Welcome to Newport Beach and the 2009 IEEE/Photonics Society Summer Topicals!

The Topical Meeting Series of the Photonics Society is the premier conference for exciting new areas in photonic science, device technologies, and applications. The conferences which are held in summer and winter create the opportunity to learn about emerging topics and to interact with the research and technology leaders in an intimate environment. A unique aspect of this conference series is that the Photonics Society membership suggest and organize these meetings.

The 2009 Summer Topical Meetings are focussed on “New Frontiers in Optical Communications.” There will be four meetings that will discuss the future of optical networks. Over the 3 days of the Topical Meetings, the following 4 areas will be considered:

- Optical Code Division Multiple Access: Application and Devices
- Radio-Over Fiber Access Networks: Technologies and Architectures
- Signal Processing in Optical Networks
- The Future Global Network

I would like to personally thank each of the Topical Chairs and the Program Committee Members who have volunteered and invested their time putting together these conferences. I also want to thank the tutorial and invited speakers for giving us their perspectives on the challenges of future optical networks. The combined efforts of the organizers and speakers is why this conference series has achieved its esteemed reputation. Finally I would like to thank the previous Topical Chair, Dominik Rabus, as well as express my sincere appreciation to the Photonics Society staff for their professional organization and arrangements for the conference.

"The IEEE/Photonics Society Topicals Series serves as a breeding ground, where experts launch the conferences of tomorrow!"

Have a great time!

Kent D. Choquette
Photonics Society Topical Meetings General Chair
Verizon Communications Inc., headquartered in New York, is a global leader in delivering broadband and other wireless and wireline communications services to mass market, business, government and wholesale customers. Verizon Wireless operates America's most reliable wireless network, serving more than 86 million customers nationwide. Verizon's Wireline operations provide converged communications, information and entertainment services over the nation's most advanced fiber-optic network. Wireline also includes Verizon Business, which delivers innovative and seamless business solutions to customers around the world. A Dow 30 company, Verizon employs a diverse workforce of more than 237,000 and last year generated consolidated operating revenues of more than $97 billion.

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Final Program

Optical Code Division Multiple Access: Applications & Devices

Monday, 20 July 2009

ALL SESSIONS WILL BE HELD IN SALON 3

3:30 PM - 5:00 PM
Session MA1: OCDMA SYSTEMS I
Session Chair: Gabriella Cincotti, Università degli Studi Roma Tre, Rome, Italy

MA1.1 3:30 PM - 4:00 PM  (Invited)
Full-Duplex, 10Gbps OCDMA System, N. Kataoka, National Institute of Information and Communications Technology, Tokyo, Japan
We review a full-duplex, 10Gbps DPSK-OCMDA system including OCDMA/WDM system configuration, hybrid multi-port and SSFBG encoding/decoding devices, OCDMA prototype, and demonstrations.

MA1.2 4:00 PM - 4:30 PM  (Invited)
Performance of Asynchronous Time-Spreading and Spectrally-Coded OCDMA Systems, S.-G. Park, Hanyang University, Seoul, Korea and A. M. Weiner, Purdue University, West Lafayette, IN, USA
The performance of asynchronous coherent time-spreading OCDMA systems is evaluated semi-analytically and the results are compared with those of spectral coding OCDMA systems using ultra-short pulses. The fundamental multi-access interference limited performances are predicted to be identical.

MA1.3 4:30 PM - 4:45 PM
10G-PON Over OCDMA Uplink using Hybrid SSFBG Encoder/Multi-port Decoder and 10 Gbps Burst-mode Receiver, S. Yoshiba, Mitsubishi Electric Corporation, Kanagawa, Japan, N. Nakagawa, Osaka University, Osaka, Japan, N. Suzuki, M. Noda, M. Nogami, N. Nakagawa, Mitsubishi Electric Corporation, Kanagawa, Japan and K.-I. Kitayama, Osaka University, Osaka, Japan
We propose and experimentally demonstrate a novel 10G-PON over OCDMA uplink burst transmission by using hybrid SSFBG encoder/multi-port decoder and 10 Gbps burst-mode receiver, which can achieve four times larger capacity than conventional 10G-PON.

MA1.4 4:45 PM - 5:00 PM
On the Capacity of SOA-assisted SAC-OCDMA Systems: A Numerical Approach using Multicanonical Monte Carlo, A. Ghazisaeidi, and L. A. Rusch, Université Laval, Québec City, QC, Canada
We propose an accurate, computationally efficient numerical model for noise mitigation in SAC-OCDMA. We validate our results with previously reported experimental results, and probe via simulation the limits of this noise suppression technique.

Tuesday, 21 July 2009

9:00 AM - 10:00 AM
Session TuA1: OCDMA SERVICE
Session Chair: Xu Wang, Heriot-Watt University, Edinburgh, Scotland, UK

TuA1.1 9:00 AM - 9:30 AM  (Invited)
Truly-Asynchronous, Scalable and Survivable Optical CDMA Networks with Heterogeneous QoS, P. R. Prucnal, M. P. Fok, K. S. Kravtsov, Z. Wang and Y. Deng, Princeton University, Princeton, NJ, USA
All-optical processing technologies, including all-optical thresholding, noise suppression, and autocorrelation peak detection, are shown to enhance the performance of incoherent optical CDMA networks. A truly-asynchronous optical network with flexible quality-of-service and self-healing capability is demonstrated.

TuA1.2 9:30 AM - 10:00 AM  (Invited)
Transmission Approaches for Services of Variable-Bit-Rate and Differential QoS using OCDMA, H. Yin, Dalian University of Technology, Dalian, China and W. Liang, OEwaves, Inc., Pasadena, CA, USA
We discuss the transmission approaches for services with different bit-rate and diverse QoS in photonic CDMA networks. The proposed two-dimensional variable-length and variable-weight optical orthogonal codes can support variable bit-rate and differentiated QoS.

10:00 AM – 10:30 AM
COFFEE BREAK

10:30 AM - 11:45 AM

**Session TuA2: OCDMA SECURITY**
**Session Chair:** Ken-ichi Kitayama, Osaka University, Osaka, Japan

TuA2.1 10:30 AM - 11:00 AM (Invited)
**Multiple Secure Virtual Private Networks over Passive Optical Networks using Electronic CDMA**, T. Nirmalathas, University of Melbourne, Victoria, Australia, N. Nadarajah, National ICT Australia, Melbourne, VIC, Australia and E. Wong, University of Melbourne, Melbourne, VIC, Australia

In this paper, we present the experimental investigation of the use of electronic code division multiple access technique to achieve multiple secure virtual private networks over passive optical network architecture. We also discuss the scalability of this technique using analytical modelling.

TuA2.2 11:00 AM - 11:15 AM
**On the security of spectrally encoded quantum-encryption protocols**, G. Cincotti, Università degli Studi Roma Tre, Rome, Italy

The confidentiality of the spectral implementation of the Y00 quantum encryption protocol is investigated, against ciphertext only and known plaintext attacks. A generic framework is proposed for developing a secure encryption scheme based on a single multiport encoder/decoder.

TuA2.3 11:15 AM - 11:30 AM

Monte-Carlo simulations of the effectiveness of key-search attacks on OCDM-based encryption reveal that proper code scrambling can result in codes that obscure one another and are resilient against iteratively improving an attacker's key guesses.

TuA2.4 11:30 AM - 11:45 AM
**A Scrambling Technique to Enhance OCDMA Network Confidentiality**, V. Sacchieri, University of Rome 3, Rome, Italy, P. Teixeira, A. L. J. Teixeira, University of Aveiro, Aveiro, Portugal and G. Cincotti, Università degli Studi Roma Tre, Rome, Italy

An all-optical method to enhance confidentiality in optical networks is presented. Security of a P2P OCDMA transmission is analyzed, where data are scrambled by a cascade of encoders, so that the decryption difficulty is increased.

12:00 PM – 1:30 PM
LUNCH BREAK

1:30 PM - 3:00 PM

**Session TuA3: OCDMA DEVICES & TECHNIQUES**
**Session Chair:** Shahab Etemad, Telcordia Technologies, Inc., Red Bank, NJ, USA

TuA3.1 1:30 PM - 1:45 PM
**Demonstration of Time-Domain Spectral Phase Encoding/DPSK Data Modulation using Single Phase Modulator**, X. Wang, Z. Gao, Heriot-Watt University, Edinburgh, Scotland, UK, N. Kataoka and N. Wada, National Institute of Information and Communications Technology, Tokyo, Japan

We proposed and experimentally demonstrated time-domain spectral phase encoding scheme using single phase modulator for 8-chip, 20GHz/chip optical code generation and 2.5 Gbps DPSK data modulation, and successfully transmitted and decoded the data with BER<10^-9.

TuA3.2 1:45 PM - 2:15 PM (Invited)

We show that optical wireless CDMA can successfully be applied for visible light communication with power LEDs. We detail how it meets the requirements of multiple access communication, particularly for positioning and illumination sensing.

TuA3.3 2:15 PM - 2:30 PM
**Experimental Demonstration of Electronic GVD Compensation in Optical CDMA Networks**, M. N. Pimenta and I. Darwazeh, University College London, London, UK
We experimentally demonstrate an electronic GVD compensator for multi-wavelength Optical CDMA systems. The compensator uses a distributed transversal filter proposed in the context of Optical Communications. Results show improvement in the ability to detect the autocorrelation peak in presence of Multi-Access Interference.

TuA3.4 2:30 PM - 2:45 PM
Asynchronous Detection with Clock and Data Recovery in Optical CDMA Networks Using Dispersion-Imbalanced Loop Mirror, Y. Deng, Princeton University, Princeton, NJ, USA
We experimentally demonstrate asynchronous detection of optical CDMA signals with a dispersion-imbalanced loop mirror, which makes the signals compatible with off-the-shelf CDR unit by removing multiple-access interference and interferometric noise.

TuA3.5 2:45 PM - 3:00 PM
Impact of Four Wave Mixing on 2-D Optical Code-Division Multiplexing Systems, N. T. Dang and A. T. Pham, University of Aizu, Aizuwakamatsu, Fukushima, Japan
This paper theoretically analyzed the impact of FWM on 2-D OCDM system performance considering various noises, interferences, and system's parameters. Specifically, the impact on the operational power range, power penalty is quantitatively analyzed and discussed.

3:00 PM – 3:30 PM COFFEE BREAK

3:30 PM - 4:45 PM
Session TuA4: OCDMA SYSTEMS II
Session Chair: Naoya Wada, National Institute of Information and Communications Technology, Tokyo, Japan

TuA4.1 3:30 PM - 3:45 PM
Code/Pulse Position Swapping (C/PPS) for Multiple-Bits/Symbol and Reconfigurable Multiple Access Communications, A. J. Mendez, Mendez R&D Associates, El Segundo, CA, USA, V. J. Hernandez, Lawrence Livermore National Laboratory, Livermore, CA, USA, R. M. Gagliardi, University of Southern California, Los Angeles, CA, USA and C. V. Bennett, Lawrence Livermore National Laboratory, Livermore, CA, USA
An architecture for code/pulse position swapping (C/PPS) is described, whereby code modulation replaces traditional pulse position modulation (PPM). The architecture supports M-ary signaling, multiple accessing, throughput vs. QoS trade-offs, and granular data rates.

TuA4.2 3:45 PM - 4:15 PM (Invited)
We present two gigabit/s spectral-amplitude-coding O-CDMA techniques that use coherent multi-frequency light. The techniques achieve high beat-noise tolerance by either employing multi-frequency self-homodyne detection or using spectral M-ary ASK based on electrical-domain spatial-code spreading.

TuA4.3 4:15 PM - 4:45 PM (Invited)
We review recent developments in coherent, spectral phase coded optical code-division multiplexed (OCDM) systems employing integrated ring-resonator based coding technologies. We describe progress in advanced modulation formats for improved spectral efficiency and long distance transmission.

END OF PROGRAM
Final Program
Radio-over-Fiber Access Networks: Technologies & Architectures

Monday, 20 July 2009

**ALL SESSION WILL BE HELD IN SALON 4**

**10:30 AM - 11:45 AM**
**Session MB1:** RoF ARCHITECTURES I
**Session Chair:** Nikos Pleros, Aristotle University of Thessaloniki, Thessaloniki, Macedonia, Greece

**MB1.1** 10:30 AM - 11:00 AM (Invited)
Architectures and Technologies for Very High Throughput In-Building Wireless Services using Radio-over-Fiber Networks, G.-K. Chang, A. Chowdhury, H.-C. Chien, Georgia Institute of Technology, Atlanta, GA, USA and G. Ellinas, University of Cyprus, Nicosia, Cyprus

We discuss and demonstrate system architectures and enabling technologies for wireless services at 10-Gb/s data rate over 60-GHz millimeter wave radio-over-fiber access system suitable for in-building and on-campus fiber networks.

**MB1.2** 11:00 AM - 11:30 AM (Invited)

With the Optical Frequency Multiplying technique, high-capacity radio-over-multimode fiber networks can be realized for in-building applications. Dynamic wavelength routing provides extra network flexibility for e.g. delivering capacity-on-demand, and can be realized with optical wavelength conversion.

**MB1.3** 11:30 AM - 11:45 AM

We designed and experimentally demonstrated coherent subcarrier modulation, transmitting 10-Gb/s baseband and 2.5-Gb/s wireless data over single 60GHz radio-over-fiber channel simultaneously and BER performance at 10^{-10} after 25-km SMF were measured with <1dB power penalty.

**12:00 PM – 1:30 PM**
**LUNCH BREAK**

**1:30 PM - 2:45 PM**
**Session MB2:** DYNAMIC RoF ARCHITECTURES
**Session Chair:** Thas Nirmalathas, University of Melbourne, Victoria, Australia

**MB2.1** 1:30 PM - 2:00 PM (Invited)

An overview of the FUTON project is presented, with emphasis on the optical link design for radio-over-fiber communication and virtual-MIMO functionalities between multiple remote antenna units and a centralized processing site.

**MB2.2** 2:00 PM - 2:30 PM (Invited)
Dynamically Reconfigurable WDM Millimeter-Wave Radio-over-Fiber and Digital Optical Access Networks, J. J. Vegas Olmos, Osaka University, Osaka, Japan, T. Kuri, National Institute of Information and Communications Technology, Tokyo, Japan and K.-I. Kitayama, Osaka University, Osaka, Japan

We will describe the enabling technologies for future WDM optical access networks in which 60-GHz millimeter-wave-band and digital signals can co-exist. Our system concept includes active path allocating to provide bandwidth-on-demand to the capillaries of the network.

**MB2.3** 2:30 PM - 2:45 PM
A Radio-Over-Fiber Network with MAC Protocol that Provides Intelligent and Dynamic Resource Allocation, G. Kalfas, P. Nikolaidis, N. Pleros and G. Papadimitriou, Aristotle University of Thessaloniki, Thessaloniki, Macedonia, Greece
We demonstrate a Radio-Over-Fiber network equipped with an intelligent Medium Transparent Access Control protocol for dynamic wavelength assignment to Remote Access Units.

### 3:00 PM – 3:30 PM

**COFFEE BREAK**

### 3:30 PM - 4:15 PM

**Session MB3:** Fixed-Mobile Convergence  
**Session Chair:** Ken-ichi Kitayama, Osaka University, Osaka, Japan

**MB3.1  3:30 PM - 4:00 PM  (Invited)**  
Radio-Over-Fibre and FTTx: New Opportunities and Challenges, M. Popov, ACREO AB, Kista, Sweden  
Sharing the FTTx infrastructure between the Internet and mobile traffic using either Radio-over-fibre or femto-nodes is a natural way to reduce capital investments and increase traffic revenues. Both solutions are the subject of the European project ALPHA.

**MB3.2  4:00 PM - 4:15 PM**  
BPSK vs. QPSK Comparison in OFDM-UWB Signal Distribution over FTTH Networks, T. F. Alves and A. V. T. Cartaxo, Instituto de Telecomunicações, Lisbon, Portugal  
The performance of OFDM-UWB radio signals distribution over FTTH networks using BPSK and QPSK symbol mappings is assessed. It is shown that the QPSK mapping requires an OSNR 4 dB higher than BPSK mapping.

### Tuesday, 21 July 2009

#### 10:30 AM - 11:45 AM

**Session TuB1:** RoF Technologies I  
**Session Chair:** Nikos Pleros, Aristotle University of Thessaloniki, Thessaloniki, Macedonia, Greece

**TuB1.1  10:30 AM - 11:00 AM  (Invited)**  
In this paper we present some of the latest technologies for radio over fibre systems developed in the authors’ own laboratory and by other international groups.

**TuB1.2  11:00 AM - 11:30 AM  (Invited)**  
Silicon Photonics Toolbox for Radio-over-Fiber Applications, D. Guckenberger, Luxtera, Inc., Carlsbad, CA, USA  
A library of photonic components integrated in a silicon CMOS technology is presented as an enabling technology platform for radio-over-fiber systems, allowing increased levels of integration to be achieved, and thereby reducing size and cost.

**TuB1.3  11:30 AM - 11:45 AM**  
Arbitrary RF-Waveform Generator with Rapid Switching Capabilities using the Temporal Lau Effect, V. Torres-Company and L. R. Chen, McGill University, Montréal, QC, Canada  
We propose an arbitrary radio-frequency waveform generator with high-speed switching capabilities. As a proof-of-principle demonstration, we design a two-tap filter with Gb/s transitions between triangle and square waveforms with ~12 GHz bandwidth content.

#### 12:00 PM – 1:30 PM  
**LUNCH BREAK**

#### 1:30 PM - 2:45 PM

**Session TuB2:** RoF Architectures II  
**Session Chair:** Arshad Chowdhury, Georgia Institute of Technology, Atlanta, GA, USA

**TuB2.1  1:30 PM - 2:00 PM  (Invited)**  
Seamless Communication in Picocellular 60GHz Radio-over-Fiber Networks, K. Tsagkaris, University of Piraeus, Piraeus, Greece, K. Vyrsokinos, N. Pleros, Aristotle University of Thessaloniki, Thessaloniki, Macedonia, Greece and N. D. Tselikas, University of Peloponnese, Tripolis, Greece  
This paper demonstrates the concept and the associated physical layer network architecture of a novel handover scheme which aims at enabling seamless broadband wireless communication with high end-user mobility in picocellular 60 GHz Radio-over-Fiber networks.
TuB2.2  2:00 PM - 2:30 PM  (Invited)

High Performance Radio-over-Fiber Links, C. Lim, T. Nirmalathas, P. P. Gamage, Y. Yang, University of Melbourne, Parkville, Victoria, Australia, D. Novak and R. B. Waterhouse, Pharad, LLC, Glen Burnie, USA

Radio-over-fiber (RoF) networks with centralized control have been actively pursued to provide future broadband services. This paper explores different strategies to improve the performance of RoF links.

TuB2.3  2:30 PM - 2:45 PM


We demonstrate a broadly tunable and highly efficient resonant electro-optical modulator based on a whispering gallery mode resonator made with an electro optic crystal. This device is used to engineer a tunable opto-electronic oscillator.

3:00 PM – 3:30 PM  COFFEE BREAK

3:30 PM - 4:15 PM

Session TuB3:  RoF TECHNOLOGIES II
Session Chair:  Ampalavanapillai Nirmalathas, University of Melbourne, Parkville, VIC, Australia

TuB3.1  3:30 PM - 4:00 PM  (Invited)

UWB Over Fiber Technologies, J. Yao, University of Ottawa, Ottawa, Canada

Ultra-wideband over fiber technologies are discussed, with an emphasis on the generation and encoding of UWB signals in the optical domain.

TuB3.2  4:00 PM - 4:15 PM

A Hybrid Mode Locked Laser As Millimetre Wave Modulated Data Source for Radio-Over-Fiber Systems, B. A. Khawaja and M. J. Cryan, University of Bristol, Bristol, UK

The paper presents a characterisation of a hybrid mode locked laser under external injection locking. It shows how such a system can be used to transmit baseband data without the requirement of an external modulator.

END OF PROGRAM
Final Program
Signal Processing in Optical Communications

Monday, 20 July 2009

ALL SESSIONS WILL BE HELD IN SALON 5

9:00 AM - 10:00 AM
Session MC1: OFDM
Session Chair: John C. Cartledge, Queen's University, Kingston, ON, Canada

MC1.1  9:00 AM - 10:00 AM   (Tutorial)
OFDM, F. Buchali, Alcatel-Lucent, Stuttgart, Germany
ABSTRACT NOT AVAILABLE

10:00 AM – 10:30 AM    COFFEE BREAK

10:30 AM - 12:00 PM
Session MC2: OPTICAL SIGNAL PROCESSING I
Session Chair: Fred Buchali, Alcatel-Lucent, Stuttgart, Germany

MC2.1  10:30 AM - 11:00 AM   (Invited)
Simulation and experimental results on compensating fiber transmission impairments including inter and intra-channel nonlinearity using digital backward propagation will be presented for WDM systems and polarization-division multiplexed WDM systems.

MC2.2  11:00 AM - 11:15 AM
Impact of Non-Uniform Span Length Distribution on Coherent 100G PM-QPSK Transmission, X. Pan, Opnext, Inc., Los Gatos, CA, USA
We investigate the effect of non-uniform span length and dispersion compensation on the performance of 100 G coherent PM-QPSK DWDM links. Optimal pre-compensation values are shown to vary greatly for the span length distributions studied.

MC2.3  11:15 AM - 11:30 AM
Polarization-Insensitive Wideband Wavelength Conversion for DSPK Signal by Dual-Pump Four-Wave Mixing in a Photonic Crystal Fiber, Y. Dai and C. Shu, Chinese University of Hong Kong, Shatin, NT, Hong Kong
Nondegenerate four-wave mixing is used in high- nonlinearity photonic crystal fiber with residual birefringence to achieve polarization-insensitive wideband wavelength conversion. The output power variation is below 0.2 dB and the conversion bandwidth is over 22 nm

MC2.4  11:30 AM - 12:00 PM   (Invited)
Ultrafast Transmission Technology using Time-Domain Optical Fourier Transformation Technique, T. Hirooka and M. Nakazawa, Tohoku University, Sendai, Miyagi, Japan
Ultrafast transmission using time-domain optical Fourier transformation (OFT) is described. 320 Gbit/s-525 km transmission and 160 Gbit/s-200 km field transmission over an installed fiber link were successfully demonstrated with improved PMD tolerance using OFT.

12:00 PM – 1:30 PM    LUNCH BREAK
MC3.1 1:30 PM - 2:00 PM  (Invited)
Network Implications of Optical Compensation and Digital Signal Processing for Coherent and Non-Coherent Receiver Design, M. Frankel, Ciena Corporation, Linthicum, MD, USA
Fiber-optic industry is increasingly using CMOS DSPs to satisfy WDM channel rate increases. CMOS works best in high volume applications for dynamic impairment compensation. Optical approaches may be more appropriate for dealing with static impairments.

MC3.2 2:00 PM - 2:30 PM  (Invited)
Algorithms for Optical QAM Detection, T. Pfau and R. Noé, University of Paderborn, Paderborn, Germany
This paper presents a linewidth-tolerant carrier phase estimation algorithm for synchronous optical QAM transmission systems. The 2-stage structure of the algorithm allows a flexible and hardware-efficient implementation for arbitrary QAM constellations.

MC3.3 2:30 PM - 2:45 PM
The options to implement a coherent optical system employing a phase estimation algorithm combined with adaptive linear equalization are investigated. Several carrier phase estimator strategies are discussed, in terms of parallelization, performance and implementation complexity.

3:00 PM – 3:30 PM  COFFEE BREAK

MC4.1 3:30 PM - 4:00 PM  (Invited)
Comparison of High Order Modulation Formats for 40Gb/s and 100Gb/s, K.-T. Wu, H. Sun, Nortel Networks, Ottawa, ON, Canada, C. Laporte, Nortel Networks, Nepean, ON, Canada, A. Borowiec, Nortel Networks, Ottawa, ON, Canada, D. J. Krause, Nortel Networks, Nepean, ON, Canada, K. Roberts, Nortel Networks, Ottawa, ON, Canada and M. O’Sullivan, Nortel Networks, Nepean, ON, Canada
Modulation formats for 40 and 100 Gb/s transmission are compared based on OSNR tolerance. Implementation considerations are highlighted. Propagation penalty as a function of optical dispersion compensation is studied for 112 Gb/s DP-QPSK.

MC4.2 4:00 PM - 4:30 PM  (Invited)
Nonlinear Limits for High Bit-Rate O-OFDM Systems, F. Buchali, Alcatel-Lucent, Stuttgart, Germany
Optical OFDM’s high PAPR values limit the systems nonlinear tolerance (NLT). A 2.6-dB improvement in NLT has been found by peak clipping. Towards higher bit rates above 50 Gb/s, we observe an additional NLT increase of 8 dB per 10x increase in signal bit rate.

MC4.3 4:30 PM - 5:00 PM  (Invited)
Adaptive Weighted Channel Equalizer for Direct-Detection Optical OFDM Transmission Systems, M. E. Mousa Pasandi, J. Haghighat, and D. V. Plant, McGill University, Montréal, QC, Canada
We study the performance of an adaptive weighted channel equalizer for non-compensated OFDM transmission systems and show that it improves the BER and can reduce the overhead and sensitivity to drifts in the optical channel.
Tuesday, 21 July 2009

9:00 AM - 10:00 AM
Session TuC1: NETWORK EVOLUTION
Session Chair: Fred Buchali, Alcatel-Lucent, Stuttgart, Germany

TuC1.1  9:00 AM - 10:00 AM (Tutorial)
Network Evolution, L. Paraschis, Cisco Systems, Inc., San Jose, CA, USA
ABSTRACT NOT AVAILABLE

10:00 AM – 10:30 AM  COFFEE BREAK

10:30 AM - 12:00 PM
Session TuC2: SIGNAL CONVERTERS AND EQUALIZERS
Session Chair: John C. Cartledge, Queen’s University, Kingston, ON, Canada

TuC2.1  10:30 AM - 11:00 AM  (Invited)
CMOS ADC and DAC for 100G and Beyond, I. Dedic, Fujitsu Microelectronics Europe GmbH, Langen, Germany

100G coherent systems need high speed low power ADC and DAC, especially if these are used for serial interfaces like CEI-28G. How can we achieve these performance levels, with future scaling to 400G and beyond?

CANCELLED

TuC2.2  11:00 AM - 11:15 AM
Application of MLSE Technology in Optical Communication Systems and Performance Evaluation in 10Gbit/s Field Trials, D. Fritzschke, Dresden University Of Technology, Dresden, Germany, D. Breuer, Deutsche Telekom AG, Berlin, Germany, L. Schuerer, A. Ehrhardt, Deutsche Telekom Netzproduktion Gmbh, Berlin, Germany, H. Oeruen, CoreOptics GmbH, Nuremberg, Germany and C. G. Schaeffer, Dresden University Of Technology, Dresden, Germany

In this paper we analyze the effort of realizing advanced MLSE digital equalizer technology in optical 10Gbit/s systems and evaluate its performance for ISI compensation in field applications by comparing 4-state vs. 16-state Viterbi decoders.

TuC2.3  11:15 AM - 11:45 AM  (Invited)
Comparison of Electronic Pre-Compensation and Post-Compensation for Cascaded Optical Filtering of 10 Gb/s NRZ-OOK Signals, Y. Jiang, Queen’s University, Kingston, Canada

Using a recirculating loop, the performance improvement for cascaded optical filtering by using pre-compensation at the transmitter and post-compensation at the receiver is compared.

TuC2.4  11:45 AM - 12:00 PM
Electronic Equalization with Dual VSB Filtering for RZ-OOK and DB Signals, M. Li, F. Zhang, Peking University, Beijing, China, Z. Chen, Shanghai Jiao Tong University, Beijing, China and A. Xu, Peking University, Beijing, China

We show by simulation that for chromatic dispersion compensation of RZ-OOK and DB signals, the performance of electronic equalization can be significantly enhanced with dual-vestigial-sideband filtering and joint equalization.

12:00 PM – 1:30 PM  LUNCH BREAK

1:30 PM - 3:00 PM
Session TuC3: DIGITAL SIGNAL PROCESSING II
Session Chair: Yannick K. Lize, Opnext, Inc., Los Gatos, CA, USA

TuC3.1  1:30 PM - 2:00 PM  (Invited)
How Will Coherent Receivers Change the Network Design of DWDM Transmission Systems?, P. Magill, AT&T, Middletown, NJ, USA
ABSTRACT NOT AVAILABLE

TuC3.2  2:00 PM - 2:30 PM  (Invited)
We present Optical Performance Monitoring from the equalizer filter setting of an FPGA-based Realtime 43Gb/s Polarization Diverse Coherent Receiver. Chromatic Dispersion and Polarization Mode Dispersion are independently estimated from the blindly adapted equalizer filter. The accuracy of the estimates is demonstrated based on measurements.

TuC3.3  2:30 PM - 3:00 PM  (Invited)
Differential Phase Compensated Constant Modulus Algorithm for Phase Noise Tolerant Coherent Optical Transmission, M. El-Darawy, T. Pfau, S. Hoffmann and R. Noe, University of Paderborn, Paderborn, Germany
We extend a non-data-aided constant modulus algorithm (CMA) by a differential phase compensation (DPC-CMA) and simulate its polarization demultiplexing performance in a digital coherent QPSK receiver against that of the standard CMA.

3:00 PM – 3:30 PM  
COFFEE BREAK

3:30 PM - 5:00 PM
Session TuC4:  REGENERATION
Session Chair:  Lawrence R. Chen, McGill University, Montréal, QC, Canada

TuC4.1  3:30 PM - 4:00 PM  (Invited)
Multi-Wavelength All-Optical Regeneration Techniques, F. Parmagiani, University of Southampton, Southampton, UK
We review the progress on the various existing fibre-based solutions proposed to extend all-optical 2R regeneration to multi-channel operation. Our emphasis is on a bi-directional architecture based on offset filtering of an SPM-broadened spectrum.

TuC4.2  4:00 PM - 4:15 PM
40 Gb/s Wavelength Preserving Polarization Insensitive All-Optical 3R Regenerator Utilizing Raman Amplification, Cross- and Self-Phase Modulation, and Offset Filtering, S. H. Chung, X. Tang and J. C. Cartledge, Queen’s University, Kingston, ON, Canada
All-optical 3R regeneration is demonstrated at 40 Gb/s that is wavelength-preserving and insensitive to the state of polarization of the input signal. The regenerator consists of retiming and reshaping stages that must be carefully co-designed.

TuC4.3  4:15 PM - 4:30 PM
Experiment of DPSK Signal Regeneration using Fiber Nonlinearity, M. Matsumoto and Y. Morioka, Osaka University, Osaka, Japan
All-optical regeneration of DPSK signals using fiber nonlinearity is reported. BER measurements for a two-span system where the regenerator is inserted in between shows that the regenerator is effective in suppressing phase-noise accumulation.

TuC4.4  4:30 PM - 4:45 PM
All-Optical Regeneration of Time-Interleaved Multi-Wavelength Signals based on Higher-Order Four-Wave Mixing, N. S. Mohd Shah and M. Matsumoto, Osaka University, Osaka, Japan
Dual-channel all-optical 2R regeneration based on higher-order four-wave mixing in a nonlinear fiber is presented. A single fiber and a pump are shared by the time-interleaved two wavelength channels.

TuC4.5  4:45 PM - 5:00 PM
Small-Signal Analysis of SOA-MZI and Applications in Nonlinear Signal Processing, N. Pleros, Aristotle University of Thessaloniki, Thessaloniki, Macedonia, Greece
For the first time, we derive the frequency-domain transfer function of SOA-based MZI configurations based on small-signal gain analysis using simplified analytical expressions for the SOAs response, providing qualitative insight for various non-linear optical applications.

Wednesday, 22 July 2009

9:00 AM - 10:00 AM
Session WC1:  CODING
Session Chair:  Fred Buchali, Alcatel-Lucent, Stuttgart, Germany

WC1.1  9:00 AM - 9:30 AM  (Invited)
Soft-Decision FEC for 100 Gb/s DSP based Transmission, T. Mizuochi, Mitsubishi Electric Corporation, Kamakura, Japan
Recent progress in soft-decision based FECs for 100 Gb/s class optical communications is reviewed. High speed 2-bit soft-decision LSI made with SiGe BiCMOS technology is introduced. The implementation of soft-decision based 100 Gb/s FEC is discussed.
WC1.2  9:30 AM - 9:45 AM
Adaptive LDPC-Coded Multilevel Modulation with Coherent Detection for High-Speed Optical Transmission, I. B. Djordjevic, University of Arizona, Tucson, AZ, USA
We propose an adaptive LDPC-coded multilevel-modulation scheme, suitable for use in future 100Gb/s and 1Tb/s Ethernet technologies. In proposed scheme, codeword length and column-weight of a parity-check matrix H are kept constant while code-rate adaptation is performed by varying column-weight and permutation-block size of H.

WC1.3  9:45 AM - 10:00 AM
We propose a multi-dimensional LDPC-coded modulation scheme to achieve high transmission rates of 320 Gb/s and beyond. This scheme utilizes currently available commercial components operating at 40 Giga symbols/s, and can reach 400 Gb/s aggregate rate with a coding gain of 10.75 dB.

10:00 AM – 10:30 AM    COFFEE BREAK

10:30 AM - 12:00 PM
Session WC2: OPTICAL SIGNAL PROCESSING II
Session Chair: Lawrence R. Chen, McGill University, Montréal, QC, Canada

WC2.1  10:30 AM - 11:00 AM   (Invited)
OTDM/WDM using Optical Signal Processing, H. Sotobayashi, Aoyama Gakuin University, Sagamihara, Japan, K. Akahane and N. Yamamoto, National Institute of Information and Communications Technology, Koganei, Tokyo, Japan
Hierarchical OTDM/WDM system based on a waveband concept is demonstrated by use of an optical signal processing. Demonstrated key technologies are C- and L-waveband generation, waveband conversion, and 1-um waveband transport for a new wavelength resource.

WC2.2  11:00 AM - 11:15 AM
All-Optical Demultiplexing of Quaternary Amplitude Signals with Fiber-Based Optical Gates, E. A. de Mello Fagotto and M. L. Francisco Abbade, Pontifical Catholic University of Campinas, Campinas, Brazil
We propose an all-optical demultiplexing scheme for quaternary amplitude signals which employs fiber-based optical gates and we test it by simulations. Results suggest this scheme is suitable to be applied in metropolitan area networks.

WC2.3  11:15 AM - 11:30 AM
Secure Sensor Data Transmission Channel Overlay on Passive Optical Networks, Z. Wang, Princeton University, Princeton, NJ, USA
An independent channel is overlaid on a gigabit passive optical network to carry data collected from sensor networks. The GPON experiences minimal performance degradation due to the channel overlay, indicating the feasibility of this approach.

WC2.4  11:30 AM - 11:45 AM
In-Service Monitoring of PMD Induced Optical Signal Degradation using SOP Vector Trajectory on the Poincare Sphere, H. Takeshita, K. Fukuchi, S. Shioiri and E. L. T. de Gabory, NEC Corporation, Kawasaki, Kanagawa, Japan
The performance of signal monitoring was studied to estimate signal degradation by processing data obtained from SOP measurement. Good correlation between measured Q-value and estimation from SOP data was observed under the existence of SOPMD.

WC2.5  11:45 AM - 12:00 PM
Full PMD Vector Measured Directly from Modulated Data Using Linear Optical Sampling, P. A. Williams and T. Dennis, National Institute of Standards and Technology, Boulder, CO, USA
We demonstrate a new technique to monitor the polarization-mode dispersion in a fiber communication channel by analyzing the modulated data at the fiber output measured with Polarization-Sensitive Linear Optical Sampling (PS-LOS).

END OF PROGRAM
Final Program
Future Global Networks

Monday, 20 July 2009

ALL SESSION WILL BE HELD IN CARDIFF

9:00 AM - 10:00 AM
Session MD1: FUTURE GLOBAL NETWORK VISIONS
Session Chair: Paul A. Morton, National Science Foundation, Arlington, VA, USA

MD1.1 9:00 AM - 9:30 AM (Invited)
Future Global Network Visions, T. Znati, National Science Foundation, Arlington, VA, USA
ABSTRACT NOT AVAILABLE

MD1.2 9:30 AM - 10:00 AM (Invited)
Design Concept for Future Carrier Networks, H. Hadama, A. Tsutsui, N. Takahashi and A. Takahara, NTT Corporation, Yokosuka, Kanagawa, Japan
We propose a design concept for future networks from the network carrier’s view point. Key problems and R&D challenges are discussed. We categorize network services into three typical models, and present novel network operation ideas.

10:00 AM – 10:30 AM       COFFEE BREAK

10:30 AM - 11:45 AM
Session MD2: OPTICAL / IP NETWORKING ARCHITECTURES
Session Chair: Guru Parulkar, Stanford University, Stanford, CA, USA

MD2.1 10:30 AM - 11:00 AM (Invited)
Higher-Layer Network Requirements for Optical Innovation: CORONET and GENI, K. A. Rauschenbach, BBN Technologies, Cambridge, MA, USA
We describe GENI, the Global Environment for Network Innovations, a suite of experimental network research infrastructure being planned and prototyped in work sponsored by the National Science foundation that contemplates evolving layer structuring in future network architectures. We also consider how innovations being developed under the DARPA CORONET program drive network evolution.

MD2.2 11:00 AM - 11:30 AM (Invited)
The Future Optical Network, K.-I. Sato, Nagoya University, Nagoya, Japan
Inefficiencies of current IP technologies will become pressing problems in creation of future video-centric networks. Extension of optical layer technologies and coordination with new transport protocols will be critical.

MD2.3 11:30 AM - 11:45 AM
Burstiness as Traffic Metric in Next-Generation Optical Core Networks, T. Wolf, W. Gong and Y. Cai, University of Massachusetts Amherst, Amherst, MA, USA
Next-generation all-optical packet-switched core networks use very small packet buffers. We argue that it is essential to focus on burstiness rather than bandwidth when conditioning traffic for effective network operation.

12:00 PM – 1:30 PM       LUNCH BREAK
1:30 PM - 2:45 PM
Session MD3: IMPACTS OF APPLICATIONS AND CLOUD COMPUTING ON FUTURE GLOBAL NETWORK
Session Chair: Osamu Ishida, NTT Corporation, Yokosuka, Kanagawa, Japan

MD3.1  1:30 PM - 2:00 PM (Invited)
The Impact of Mega-Scale Data Centers on Internet Architecture, A. Vahdat, University of California - San Diego, La Jolla, CA, USA
We are moving toward a world where global computation and storage will increasingly be delivered by a relatively small number of mega-scale data centers spread across the planet. We explore challenges revolving around networking within and between these data centers.

MD3.2  2:00 PM - 2:30 PM (Invited)
Network Evolution from a Web Company Point of View, D. C. Lee, Facebook, Palo Alto, CA, USA
Internet usage has accelerated in past months. As a web company, we must scale cost-effectively amidst drivers like clustered computing, video, and social events. To continue growth and richness of the web, new approaches must be devised.

MD3.3  2:30 PM - 2:45 PM
Achieving Large Bandwidth by Leveraging Parallelism in End-Hosts and Networks, H. Takahashi, M. Takizawa, S. Kobayashi, O. Kamatani, O. Ishida, NTT Corporation, Yokosuka, Kanagawa, Japan, V. Vishwanath, S. Nam, L. Renambot and J. Leigh, University of Illinois at Chicago, Chicago,
This paper describes the first experiment on MultiRail and MultiLane technologies using global networks. These technologies leverage end-host and network parallel resources, e.g., processor cores and lambda paths, to achieve large bandwidths.

3:00 PM – 3:30 PM
COFFEE BREAK

3:30 PM - 4:30 PM
Session MD4: PHOTONIC INTEGRATION AND IMPACTS ON THE FUTURE GLOBAL NETWORK
Session Chair: Lars Dittmann, Technical University of Denmark, Lyngby, Denmark

MD4.1  3:30 PM - 4:00 PM (Invited)
Photonic Integration and Impacts on the Future Global Network, D. J. Blumenthal, University of California - Santa Barbara, Santa Barbara, CA, USA
ABSTRACT NOT AVAILABLE

MD4.2  4:00 PM - 4:30 PM (Invited)
Silicon Photonics - Changing the Economic of Optical Communications, T. L. Koch, Lehigh University, Bethlehem, PA, USA
ABSTRACT NOT AVAILABLE

7:00 PM - 9:00 PM
Session PANEL I: ENERGY USAGE AND "GREEN" NETWORKING
Session Chair: Alan E. Willner, University of Southern California, Los Angeles, CA, USA
Donal E. O’ Mahony, Trinity College of Dublin, Dublin, Ireland

Bruce Nordman
Energy Efficiency/Green Networking, B. Nordman, Lawrence Berkeley National Laboratory, Berkeley, CA, USA
ABSTRACT NOT AVAILABLE

S. J. Ben Yoo
Green Networking, S. J. B. Yoo, University of California – Davis, Davis, CA, USA
ABSTRACT NOT AVAILABLE

Jan Soderstrom
Efficiency and Power Consumption, J. Soderstrom, Ericsson, Inc., San Jose, CA, USA
ABSTRACT NOT AVAILABLE
TuD1.1  9:00 AM - 9:30 AM   (Invited)
Network Virtualization,  A. Nakao, University of Tokyo/National Institute of Information and Communications Technology, Tokyo, Japan
ABSTRACT NOT AVAILABLE

TuD1.2  9:30 AM - 10:00 AM   (Invited)
Optical Network Control Challenges,  S. Araki, I. Nishioka, S. Ishida, Y. Iizawa and M. Nakama, NEC Corporation, Kawasaki, Kanagawa, Japan
This paper discusses two challenges, failure recovery enhancement and scalability enhancement, on optical network control plane. These challenges enable us to provide optical networks with high reliability and lower operational cost.

10:00 AM – 10:30 AM    COFFEE BREAK

TuD2.1  10:30 AM - 11:00 AM   (Invited)
The Future Internet - A Service Provider’s Long Term View,  S. Elby, Verizon, Basking Ridge, NJ, USA
This paper presents several key inefficiencies of the current Internet backbone and proposes some mid-term and long-term solutions that are shaping Verizon’s backbone network evolution plans.

TuD2.2  11:00 AM - 11:30 AM   (Invited)
Current and Future Internet Architecture Trends - Role of Optical and Electronic Technologies,  F. Bonomi, Cisco Systems, Inc., San Jose, CA, USA
ABSTRACT NOT AVAILABLE

12:00 PM – 1:30 PM    LUNCH BREAK

TuD3.1  1:30 PM - 2:00 PM   (Invited)
Optical Transport Networks Evolution,  P. J. Winzer, Alcatel-Lucent, Holmdel, NJ, USA
We discuss scalability aspects of optical transport networks in terms of their supported capacity, reach, and flexibility. We also review scalable data network architectures that avoid multiple through-traffic packet processing and lend themselves to efficient optical routing.

TuD3.2  2:00 PM - 2:30 PM   (Invited)
In this presentation we will discuss recent advances in adaptive modulation schemes for ultra high bit capacity optical networks. This paper focuses on optimising the sub-carrier spacing for such high capacity networks.
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TuD3.3  2:30 PM - 2:45 PM
Adaptive Modulation and Coding for Communication over the Atmospheric Turbulence Channels, I. B. Djordjevic, University of Arizona, Tucson, AZ, USA

We propose an adaptive coding scheme that provides robust and spectrally-efficient transmission over strong atmospheric turbulence channels. We demonstrate that deep fades in the order of 35 dB and above can be tolerated with proposed scheme.

3:00 PM – 3:30 PM  COFFEE BREAK

3:30 PM - 4:45 PM  Session TuD4:  CROSS-LAYER-RESEARCH
Session Chair:  S.J. Ben Yoo, University of California - Davis, Davis, CA, USA

TuD4.1  3:30 PM - 4:00 PM  (Invited)
OpenFlow; Unifying Abstraction Across Circuit & Packet / Electronic & Optical, G. Parulkar, Stanford University, Stanford, CA, USA

ABSTRACT NOT AVAILABLE

TuD4.2  4:00 PM - 4:30 PM  (Invited)
Unique Optical Networking Facilities and Cross-Layer Networking, I. Baldine, Renaissance Computing Institute, Chapel Hill, NC, USA

The future global network will have a number of characteristics, enabled by novel optical technologies, that make it distinct from today's network: optical domain will likely become part of the convergence layer and service provisioning will involve explicit cross-layer interactions and flexible optical spectrum management. These will be tied together by intelligent cross-layer protocol software. In order to enable this transition, we need a new networking protocol architecture and network facilities that allow experimentation across all networking layers at scale.

TuD4.3  4:30 PM - 4:45 PM
Simple Unified Control for Packet and Circuit Networks, S. Das, G. Parulkar and N. W. McKeown, Stanford University, Stanford, CA, USA

OpenFlow is proposed as an architectural platform and a unified control plane for packet and circuit networks, with the main goal of simplifying network control and management while fostering innovative change in them.

7:00 PM - 9:00 PM  Session PANEL II:  WHEN WILL COMMERCIAL OPTICAL PACKET SWITCHING HAPPEN?
Session Chair:  Keren Bergman, Columbia University, New York, NY, USA
               Stuart Elby, Verizon, Basking Ridge, NJ, USA

Rod Tucker
Constraints due to Optical Buffers, R. Tucker, University of Melbourne, Melbourne, Australia

ABSTRACT NOT AVAILABLE

Masataka Ohta
Optical Packet based Networks, M. Ohta, Tokyo Institute of Technology/National Institute of Information and Communications Technology, Tokyo, Japan

ABSTRACT NOT AVAILABLE

Keren Bergman
Optical Packet Switching for High Performance Computing, K. Bergman, Columbia University, New York, NY, USA

ABSTRACT NOT AVAILABLE

Loukas Paraschis
A Commercial Perspective on Optical Packet Switching, L. Paraschis, Cisco Systems, Inc., San Jose, CA, USA

ABSTRACT NOT AVAILABLE
Wednesday, 22 July 2009

9:00 AM - 10:00 AM
Session WD1: **TIME CRITICAL NETWORKING AND APPLICATIONS**
Session Chair: Hiroaki Harai, National Institute of Information and Communications Technology, Tokyo, Japan

WD1.1 9:00 AM - 9:30 AM (Invited)
Time Critical Networking, E. A. Lee, University of California - Berkeley, Berkeley, CA, USA
ABSTRACT NOT AVAILABLE

WD1.2 9:30 AM - 10:00 AM (Invited)
The OptIPuter and Its Applications, L. Smarr, University of California - San Diego, La Jolla, CA, USA
The NSF-funded OptIPuter project enables user-controlled 10Gbps dedicated lightpaths to provide direct access to global data repositories, scientific instruments, and computational resources from "OptIPortals," PC clusters which provide scalable visualization in user's campus laboratories. I will describe applications from several disciplines of this global "OptIPlatform".

10:00 AM – 10:30 AM  COFFEE BREAK

10:30 AM - 11:30 AM
Session WD2: **GLOBAL RESEARCH INITIATIVES AND TEST-BEDS**
Session Chair: Peter A. Andrekson, Chalmers University of Technology, Gothenburg, Sweden

WD2.1 10:30 AM - 11:00 AM (Invited)
Advanced Optical Networking Test-Beds, D. Simeonidou, University of Essex, Colchester, UK
ABSTRACT NOT AVAILABLE

WD2.2 11:00 AM - 11:30 AM (Invited)
AKARI Architecture Design for New Generation Network, H. Harai, National Institute of Information and Communications Technology, Tokyo, Japan
We address new generation network architecture design. We show design principles consisting of crystal synthesis, reality connection, and sustainable & evolutiounal principles. We also describe principle-oriented component technologies such as optical packet/path integrated network.

END OF PROGRAM