

Advance Program

Ultra-High Data-Rate (>80 Gb/s) Transmission

Monday, 23 July 2007

ALL SESSIONS WILL BE HELD IN CHIEF POKER JIM

9:00 AM - 10:00 AM

Session ME1: INDUSTRY PERSPECTIVE OF ULTRA-HIGH DATA-RATE SYSTEMS

Session Chair: Christophe Peucheret, *Technical University of Denmark, Kgs. Lyngby, Denmark*

ME1.1 9:00 AM - 9:30 AM (Invited)

Technology Maturity at 40Gbps and Migration to 100Gbps, B. Mikkelsen, P. Mamyshev, C. J. Rasmussen, M. Givehchi, F. Liu, J. Edinberg and N. Robinson, *Mintera Corporation, Acton, MA, USA*

We discuss the current status of the 40 Gbps technology needed to implement cost-effective and easy-to-deploy 40 Gbps DWDM transport systems. We also discuss how to migrate to transport of 100 GBE.

ME1.2 9:30 AM - 10:00 AM (Invited)

Towards Robust 100GE Transmission, C. R. S. Fludger, T. Duthel, and C. Schulien, *CoreOptics GmbH, Nuremberg, Germany*

We discuss transmission requirements for commercially deployable, robust 100G Ethernet transport. Coherently equalised POLMUX-RZ-DQPSK is shown to be both compatible with 10G infrastructure and suitable for long-haul transmission.

10:00 AM – 10:30 AM

COFFEE BREAK

FIRESIDE ROOM

10:30 AM - 12:15 PM

Session MA2: JOINT SESSION ON ADSP & HIGH SPEED: 100 Gb ETHERNET

Session Chair: Maurice O'Sullivan, *Nortel Networks, Nepean, ON, Canada*

MA2.1 10:30 AM - 11:00 AM (Invited)

Ethernet Evolution: The Path to 100 Gigabit Ethernet, J. F. D'Ambrosia, *force10networks, Harrisburg, PA, USA*

At the July 2006 IEEE Plenary, the Higher Speed Study Group was formed. This group has adopted a MAC rate objective of 100 Gb/s. This session will provide an update on the state of the group's efforts.

MA2.2 11:00 AM - 11:30 AM (Invited)

100G Ethernet – A Review of Serial Transport Options, P. J. Winzer and G. Raybon, *Alcatel-Lucent, Holmdel, NJ, USA*

We review recently demonstrated options for serial transport technologies at 100 Gb/s, including binary, multi-level, and coherently detected polarization-multiplexed formats.

MA2.3 11:30 AM - 12:00 PM (Invited)

Electronic Dispersion Compensation beyond 10 Gb/s, K. Roberts, *Nortel Networks, Ottawa, ON, Canada*

Electronic dispersion compensation is displacing optical compensation at 10Gb/s. How can this be achieved at 40 Gb/s or 100 Gb/s?

MA2.4 12:00 PM - 12:15 PM

Coherent Equalization versus Direct Detection for 111-Gb/s Ethernet Transport, D. van den Borne, *Eindhoven University of Technology, Eindhoven, The Netherlands*, T. Duthel, C. R. S. Fludger, *CoreOptics GmbH, Nuremberg, Germany*, E.-D. Schmidt, T. Wuth, *Siemens Networks GmbH & Co. KG, Munich, Germany*, C. Schulien, *CoreOptics GmbH, Nuremberg, Germany*, E. Gottwald, *Siemens Networks GmbH & Co. KG, Munich, Germany*, G. Khoe and H. de Waardt, *Eindhoven University of Technology, Eindhoven, The Netherlands*

We discuss coherent equalization to realize robust 111-Gb/s transmission. For 111-Gb/s POLMUX-RZ-DQPSK we experimentally show the advantage of coherent equalization over direct detection for compensation of both chromatic dispersion and differential group delay.

12:15 PM – 1:30 PM

LUNCH BREAK

1:30 PM - 3:00 PM

Session ME3: TRANSMISSION TECHNOLOGIES

Session Chair: Peter A. Andrekson, *Chalmers University of Technology, Gothenburg, Sweden*

ME3.1 1:30 PM - 2:00 PM (Invited)

High Data Rate Submarine Transmission Systems: Getting to and Beyond 40 Gb/s, M. Nissov, Y. Cai and J.-X. Cai, *Tyco Telecommunications Laboratories, Eatontown, NJ, USA*

This talk will discuss high data rate transmission over transoceanic distance. First, we will discuss issues specific to submarine transmission systems, then look at 40G, and finally discuss the technologies that might enable even higher rates.

ME3.2 2:00 PM - 2:30 PM (Invited)

Transmission Systems beyond 100Gbit/s: Status and Technologies, R. Ludwig, C. Schmidt-Langhorst, B. Huettl, C. Schubert, *Fraunhofer-Institut, Berlin, Germany*, S. Weisser and L. Raddatz, *Alcatel-Lucent, Nuremberg, Germany*

We report on single-channel transmission systems with data rates beyond 100Gbit/s. The current status and the applied technologies are reviewed, in particular 160-Gbit/s-based systems with long transmission distances and high bit-rates using advanced modulation formats.

ME3.3 2:30 PM - 3:00 PM (Invited)

Terabit OTDM Transmission - Key Challenges, M. Nakazawa and T. Hirooka, *Tohoku University, Sendai, Miyagi, Japan*

We report recent progress and key challenges for terabit/s OTDM transmission. We focus especially on emerging ultrahigh-speed transmission technologies such as DPSK and DQPSK transmission and a distortion-free transmission scheme using time-domain optical Fourier transformation.

3:00 PM – 3:30 PM

COFFEE BREAK

3:30 PM - 5:00 PM

Session ME4: OPTICAL SIGNAL PROCESSING

Session Chair: Tetsuya Miyazaki, *National Institute of Information and Communications Technology, Koganei, Tokyo, Japan*

ME4.1 3:30 PM - 4:00 PM (Invited)

All-Optical Signal Processing for Ultra-High Speed Photonic Network, F. Futami, *Fujitsu Laboratories Ltd., Kawasaki, Kanagawa, Japan*

Ultra-high speed all-optical signal processing for photonic networks is discussed. Using a fiber-based optical switch, ultra-high speed amplitude noise suppression and all-optical format conversion of OOK to PSK are presented.

ME4.2 4:00 PM - 4:30 PM (Invited)

High Resolution Optical Waveform Sampling Techniques, P. A. Andrekson, *Chalmers University of Technology, Gothenburg, Sweden*

Techniques to analyze optical waveforms with high resolution are discussed. Emphasis is on all-optical sampling that offers high resolution with excellent sensitivity.

ME4.3 4:30 PM - 5:00 PM (Invited)

High-Speed All-Optical Signal Processing Techniques for High-Speed Optical Transmission, S. Kawanishi, *NTT Corporation, Atsugi, Kanagawa, Japan*

This paper reviews recent progress on high-speed all-optical signal processing technologies including switching and regeneration for optical transmission systems.

6:30 PM – 8:00 PM

WELCOME RECEPTION - QUEEN MARIE BALLROOM

Tuesday, 24 July 2007

9:00 AM - 10:00 AM

Session TuE1: MODELLING TECHNIQUES AND APPLICATIONS

Session Chair: Hidenori Taga, *National Sun Yat-sen University, Kaohsiung, Taiwan, R.O.C.*

TuE1.1 9:00 AM - 9:30 AM (Invited)

Pitfalls when Modeling High-Speed Optical Transmission Systems, A. Richter, I. Koltchanov and H. Louchet, *VPIsystems, Berlin, Germany*

We present methods for accurately modeling high-speed optical transmission systems with channel data rates beyond 40Gbit/s. We provide simulation guidelines and examples for investigating limitations of transmitter and receiver, fiber impairments, and estimating signal performances.

TuE1.2 9:30 AM - 9:45 AM

Novel 100Gbps Ethernet Systems for Next-Generation Metro Transport and Wide-Area Access Networks using Optical Carrier Suppression and Separation Technique, A. Chowdhury, Z. Jia, G.-K. Chang, *Georgia Institute of Technology, Atlanta, GA, USA* and R. Younce, *Tellabs Operations Inc., Naperville, IL, USA*

A novel, dispersion tolerant, spectrally efficient scheme of transmitting 100 Gbps per wavelength channel by exploiting optical carrier suppression and separation technique and optical duobinary or DQPSK modulation is proposed and evaluated through numerical simulation.

TuE1.3 9:45 AM - 10:00 AM

An Exact Analysis of RZ- vs. NRZ-DPSK Performance in ASE Noise Limited High Speed Optical Systems, Q. Zhang, *Minnesota State University, Duluth, MN, USA*

The back-to-back performance of optical RZ-DPSK and NRZ-DPSK formats was compared using KLSE method. The effect of unmatched optical bandpass filter was studied with/without the presence of the electrical low pass filter in the receiver.

10:00 AM – 10:30 AM**COFFEE BREAK****10:30 AM - 11:45 AM****Session TuE2: PMD AND COMPENSATION TECHNIQUES****Session Chair:** Jin-Xing Cai, *Tyco Telecommunications Laboratories, Eatontown, NJ, USA***TuE2.1 10:30 AM - 11:00 AM (Invited)**

Polarization-Mode-Dispersion Impairments and Mitigation in Ultra-High Speed Transmission, C. Xie, *Alcatel-Lucent, Holmdel, NJ, USA*

We review the PMD induced penalty and PMD mitigation techniques in fiber-optic transmission systems. Recent progress in PMD mitigation techniques that enables ultra-high speed fiber-optic transmission is discussed.

TuE2.2 11:00 AM - 11:30 AM (Invited)

Compensation of Chromatic and Polarization Mode Dispersion in High Speed Transport Systems, C. J. Rasmussen, B. Mikkelsen, P. Mamyshv, and F. Liu, *Mintera Corporation, Acton, MA, USA*

We review techniques for compensation of chromatic and polarization mode dispersion in high speed fiber-optic transport systems with emphasis on methods used in 40G systems being deployed today and in the near future.

TuE2.3 11:30 AM - 11:45 AM

All-Order PMD Compensation of Sub-Picosecond Optical Pulses with Arbitrary Input States of Polarization, H. Miao, A. M. Weiner, *Purdue University, West Lafayette, IN, USA*, L. Mirkin, and P. J. Miller, *CRI, Inc., Woburn, MA, USA*

We demonstrate full compensation of ~800 fs optical pulses distorted by all-order polarization mode dispersion effects to ~10 ps by applying polarization switching, wavelength-parallel polarization sensing, and ultrafast optical pulse shaping techniques.

11:45 AM – 1:30 PM**LUNCH BREAK****1:30 PM - 3:00 PM****Session TuE3: MODULATION FORMATS AND CODING****Session Chair:** Andre Richter, *VPIsystems, Berlin, Germany***TuE3.1 1:30 PM - 2:00 PM (Invited)**

LDPC-Coded Modulation for High-Speed Optical Transmission Systems, I. B. Djordjevic, *University of Arizona, Tucson, AZ, USA*

Several LDPC-coded modulation schemes enabling ≥ 100 Gb/s transmission using commercially available components operating 40 Giga symbols/s are presented: (a) coded orthogonal frequency division multiplexing (OFDM), (b) bit-interleaved coded modulation (BICM), and (c) multilevel coding (MLC).

TuE3.2 2:00 PM - 2:15 PM

80Gb/s-256QAM Format using Phase Noise Tolerant Pilot Carrier Aided Homodyne Detection, Y. Kamio, M. Nakamura, and T. Miyazaki, *National Institute of Information and Communications Technology, Koganei, Tokyo, Japan*

We investigated the phase noise-tolerance of coherent detection in a high-efficiency optical fiber transmission using 256-QAM formats at 80Gb/s by computer simulation. We confirmed that the proposed scheme has a phase noise tolerance with DGD.

TuE3.3 2:15 PM - 2:45 PM (Invited)

Advanced Modulation Format for 100Gb/s Transmission, I. Morita, *KDDI R&D Laboratories, Kamifukuoka, Saitama, Japan*

ABSTRACT NOT AVAILABLE

TuE3.4 2:45 PM - 3:00 PM

A Spectrum-Efficient 80-Gbit/s DPSK Transmitter using Phase Interleaving Technology without Optical-Time or Polarization-Division Multiplexing, G.-W. Lu, and T. Miyazaki, *National Institute of Information and Communications Technology, Koganei, Tokyo, Japan*

We experimentally demonstrate a cost-effective 80-Gbit/s DPSK transmitter using phase interleaving without optical-time/polarization-division multiplexing. Two cascaded independent 40-Gbit/s modulations are time-interleaved to generate 80-Gbit/s DPSK with high spectrum efficiency: 20-dB bandwidth of only 0.68nm.

3:00 PM – 3:30 PM

COFFEE BREAK

3:30 PM - 4:30 PM

Session TuE4: ULTRAHIGH SPEED TRANSCEIVER TECHNOLOGIES I

Session Chair: Ronald Freund, *Fraunhofer-Institut, Berlin, Germany*

TuE4.1 3:30 PM - 4:00 PM (Invited)

Generation of 100+++ Gbit/s Signals using Multilevel Modulation Formats, T. Tøkle, *Technical University of Denmark, Lyngby, Denmark*, M. Serbay, *University of Kiel, Kiel, Germany*, J. B. Jensen, *Technical University of Denmark, Lyngby, Denmark*, W. Rosenkranz, *University of Kiel, Kiel, Germany* and P. Jeppesen, *Technical University of Denmark, Lyngby, Denmark*

Multilevel modulation formats are used as the enabling technology to obtain 120 Gbit/s per channel bit rates, and 240 Gbit/s when polarisation multiplexing is added. Using OTDM, this can be extended even further.

TuE4.2 4:00 PM - 4:15 PM

Photoreceivers for 100 Gbit/s Applications, A. Umbach, G. Unterboersch, *u2t photonics AG, Berlin, Germany*, H.-G. Bach, C. Schubert, *Fraunhofer-Institut, Berlin, Germany*, R. Derksen, *Nokia Siemens Networks, Munich, Germany* and J. H. Sinsky, *Alcatel-Lucent, Holmdel, NJ, USA*

Waveguide integrated photodetectors with 100 GHz bandwidth were developed. Different transmission experiments have demonstrated their capability for 107 Gbit/s applications. Design and results for separately packaged photodiodes and co-packaged receivers with 1x2 demultiplexer are shown.

TuE4.3 4:15 PM - 4:30 PM

Performance Optimization for 80 Gb/s NRZ-DPSK Transceiver with Pre-Emphasized Electrical Signal Driving Path, Q. Zhang, *Minnesota State University, Duluth, MN, USA*

Employing a rigorous KLSE based quasi-analytical method for the BER calculation, we optimize an 80 Gb/s NRZ-DPSK transceiver by pre-emphasizing the high frequency portion of the gain shape of electrical signal driving path.

Wednesday, 25 July 2007

9:00 AM - 10:00 AM

Session WE1: ULTRA HIGH SPEED TRANSCEIVER TECHNOLOGY II

Session Chair: Tetsuya Miyazaki, *National Institute of Information and Communications Technology, Koganei, Tokyo, Japan*

WE1.1 9:00 AM - 9:30 AM (Invited)

Challenges in Test and Measurement for 100GE Serial TDM System Studies, T. W. S. Lee, *SHF Communication Technologies AG, Berlin, Germany*

This presentation seeks to address some key test and measurement issues currently facing the R&D community investigating the feasibility of serial 100Gb Ethernet as a viable next generation high speed data communication solution.

WE1.2 9:30 AM - 10:00 AM (Invited)

High-Speed InP Mach-Zehnder Modulators for ETDM Transmission Systems, H. Klein, *Fraunhofer-Institut, Berlin, Germany*

External Modulators are key components for high-speed transmission networks. This paper presents recent results of HHIs InP based MZ-modulators for ≥ 80 Gbit/s transmission using on-off keying and phase modulation formats.

END OF PROGRAM