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Postconference Edition

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Alexander A. Sawchuk

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8:30am–11:00am
Plenary Session and Awards Ceremony

This session includes presentations of the John Tyndall Award and OSA, IEEE/LEOS and IEEE/ComSoc fellowships as well as an address from the general chairs of the meeting and keynote talks by two distinguished speakers.

Tatsuo Izawa
NTT Electronics Corporation, Japan

14th John Tyndall Award Presentation

14th John Tyndall Award will be presented at the OFC® 2001 Plenary Session. The Award is named for the 19th century British scientist who was the first to demonstrate a phenomenon of internal reflection. First presented in 1987, the Tyndall Award recognizes an individual who has made pioneering, highly significant, or continuing technical or leadership contributions to fiber optics technology

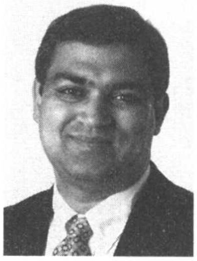
Corning endows the award, a glass sculpture that represents the concept of total internal reflection. Recipients of the John Tyndall Award receive a certificate and a cash prize of $3,100.

The winner of the 2001 John Tyndall Award is Tatsuo Izawa. Tatsuo Izawa is President, CEO of NTT Electronics Corporation which manufactures opto-electronic devices and components for DWDM network systems.

> *"For contributions to vapor-phase axial deposition for optical-fiber fabrication and pioneer work of silica-based planar lightwave."*

Keynote Speakers

Adel A.M. Saleh and Kenneth L Walker, General Chairs of OFC, 2001, are pleased to announce the two plenary speakers for the conference – Mr. Vab Goel, Norwest Venture Partners and Mr. Robert W. Lucky, Telcordia Technologies.



Vab Goel
Venture Partner, Norwest Venture Partners, USA

New Network and Service Paradigms

Mr. Goel will speak on the emerging opportunities within the networking industry from his unique perspective as a network technologist and venture capitalist.

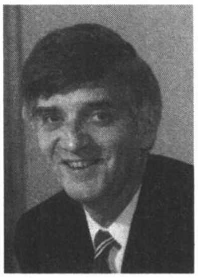
Mr. Goel is a Venture Partner at Norwest Venture Partners where he focuses on emerging communications systems, communications services and Internet services companies. Mr. Goel's investments include Virtela Communications, Winphoria Networks, and C2C Pte., Ltd.

Previously, Goel served as vice president of emerging technologies at Qwest, a group he founded within the company. In that position, he was responsible for identifying new and emerging technologies to drive state-of-the-art solutions for network evolution and new network applications. He also fostered the strategic relationships and potential investments with start-up companies such as: Qters Corporation, Corvis Corporation, Redback Networks, Siara Systems, Juniper Networks, and Extreme Networks. Prior, as Vice President of IP Network Engineering and Advanced Technology, he created and implemented the Qwest IP Network & Data Center Strategy.

Prior to joining Qwest, Goel was a principal architect responsible for architecting the Sprint Internet backbone. He created the optical Network Strategy which drove the worlds first IP over SONET and the first IP over DWDM network.

Interactive Week named Vab Goel one of the "Top 25 Unsung Hero's on the Net". He speaks both nationally and internationally and presents strategy on both the future of the Internet and technical issues. He is also active in promoting the Internet in developing nations.

Mr. Goel earned a Bachelor of Science Degree in Electrical Engineering from George Mason University, Fairfax, VA.



Robert W. Lucky
Corporate Vice President Applied Research, Telcordia Technologies, USA

Trends and Uncertainties in the Future of Telecom

The shape of things to come – the changes in networking technologies and their impact on our networks, our companies, our economy are the focus of Robert Lucky's keynote address.

Robert W. Lucky was born in Pittsburgh, Pa., and attended Purdue University, where he received a B.S. degree in electrical engineering in 1957, and M.S. and Ph.D.- degrees in 1959 and 1961. After graduation he joined AT&T Bell Laboratories in Holmdel, NJ, where he was initially involved in studying ways of sending digital information over telephone lines. The best-known outcome of this work was his invention of the adaptive equalizer - a technique for correcting distortion in telephone signals, which is used in all high-speed data transmission today. The textbook on data communications which he co-authored became the most cited reference in the communications field over the period of a decade.

At Bell Labs he moved through a number of levels to become Executive Director of the Communications Sciences Research Division in 1982, where he was responsible for research on the methods and technologies for future communication systems. In 1992 he left Bell Labs to assume his present position at Telcordia Technologies.

He has been active in professional activities, and has served as President of the Communications Society of the IEEE (Institute of Electrical and Electronics Engineers), and as Vice President and Executive Vice President of the parent IEEE itself. He has been editor of several technical journals, including the Proceedings of the IEEE, and since 1982 he has written the bimonthly "Reflections" column of personalized observations about the engineering profession in Spectrum magazine. In 1993 these "Reflections" columns were collected in the IEEE Press book Lucky Strikes ... Again.

Dr. Lucky is a Fellow of the IEEE and a member of the National Academy of Engineering. He is also a consulting editor for a series of books on communications through Plenum Press. He has been on the advisory boards or committees of many universities and government organizations, and was Chairman of the Scientific Advisory Board of the United States Air Force from 1986-1989. He was the 1987 recipient of the prestigious Marconi Prize for his contributions to data communications, and has been awarded honorary doctorates from Purdue University and the New Jersey Institute of Technology. He has also been awarded the Edison Medal of the IEEE and the Exceptional Civilian Contributions Medal of the U.S. Air Force.

Dr. Lucky is a frequent speaker before both scientific and general audiences. He has been an invited lecturer at about one hundred different universities, and has been the guest on a number of network television shows, including Bill Moyers' "A World of Ideas," where he has discussed the impacts of future technological advances. He is the author of the popular book Silicon Dreams, which is a semi-technical and philosophical discussion of the ways in which both humans and computers deal with information.

Ballroom C

2:00pm–4:00pm
MA • Raman Amplifiers 1 (Cat. A)
Alan F. Evans, Corning Inc., USA, Presider

2:00pm
MA1 (Invited) • Advances in Raman amplifier fibers, *E.M. Dianov, Fiber Optics Res. Ctr., Russia.* Raman fiber lasers and amplifiers will play an increasing role in future optical fiber communication systems. Recent progress in the development of special Raman fibers will be described. We particulary focus on high Δn germanosilicate and phosphosilicate fibers.

2:30pm
MA2 • Spectral broadening of double Rayleigh backscattering in a distributed Raman amplifier, *Stuart Gray, Michael Vasilyev, Kim Jepsen, Corning Inc., USA.* We observe broadening of the double Rayleigh backscattering (DRBS) spectrum in a Raman amplifier. This effect is caused by pump intensity fluctuations combined with proper fiber dispersion and can significantly reduce DRBS multipath interference crosstalk.

Ballroom D

2:00pm–4:00pm
MB • SOA Based Components (Cat. C)
Bart Verbeek, JDS Uniphase, The Netherlands, Presider

2:00pm
MB1 (Invited) • Ultra high-speed wavelength conversion and regeneration using semiconductor optical amplifiers, *A.E. Kelly, Kamelian Ltd., Scotland.* Techniques for all optical wavelength conversion and regeneration using semiconductor optical amplifiers are reviewed.

2:30pm
MB2 • 40 GHz all-optical XOR with UNI gate, *G. Theophilopoulos, K. Yiannopoulos, M. Kalyvas, C. Bintjas, G. Kalogerakis, H. Avramopoulos, Natl. Technical Univ. of Athens, Greece; L. Occhi, L. Schares, G. Guekos, Swiss Federal Inst. of Tech., Switzerland; S. Hansmann, R. Dall'Ara, Opto Speed SA, Switzerland.* 40 GHz Boolean XOR is demonstrated using an Ultrafast Nonlinear Interferometer gate. The gate operates with low switching energy and signals from the same source. It may be used in networking applications without wavelength conversion.

Ballroom E

2:00pm–3:45pm
MC • Fiber Gratings & Poling (Cat. B)
Simon Fleming, Sydney Univ., Australia, Presider

2:00pm
MC1 (Invited) • Dispersion-free fibre Bragg gratings, *Morten Ibsen, Periklis Petropoulos, Univ. of Southampton, UK; Michalis N. Zervas, Southampton Photonics Ltd., UK; Ricardo Feced, Nortel Networks, UK.* Fibre Bragg gratings with reduced/eliminated in-band dispersion are presented. When tested in add-drop configurations at 10Gbit/s both 25GHz and 50GHz bandwidth gratings are shown to exhibit superior performance with no dispersion-induced penalties in the stopband. Furthermore, the demonstrated linear-phase Bragg gratings have >70% channel filling factor values and reflectivities in excess of 99.9%.

2:30pm
MC2 • Large bandwidth, highly efficient mode coupling using long-period gratings in dispersion tailored fibers, *Siddharth Ramachandran, Man Yan, Lawrence Cowsar, Anthony Carra, Patrick Wisk, Richard Huff, Bell Labs., Lucent Tech., USA; David Peckham, Lucent Tech., USA.* We report the demonstration of strong (>20 dB) coupling in long-period fiber-gratings over bandwidths as large as 43 nm. These novel spectra are obtained by suitably tailoring the dispersion properties of a fiber. The polarization dependent coupling for the mode-converters varies by less than 0.004% over the entire spectrum.

Room 204 A-D

2:00pm–3:00pm
MD • Impact of PMD in Transmission Systems (Cat. D)

2:00pm
MD1 (Tutorial) • Polarization mode dispersion in optical communication systems, *Dipak Chowdhury, Corning Inc., USA.* PMD is a major impairment for high-bit-rate optical system. The objective of this course is threefold: (1) understand the physical phenomena of PMD, (2) review the current status of understanding of the impact of PMD on optical systems, and (3) PMD mitigation approaches. In this course we will introduce the concept of PMD and its various mathematical description briefly with emphasis on visualizing and comparing different ways of describing PMD. Then, very briefly, we will concentrate on some measurement aspects of PMD in systems. Current understanding of PMD impact on systems will be summarized next. System impact of PMD will be reviewed in three stages: (1) Impact of fiber PMD, 1st and higher order, in high-bit-rate systems in presence of chromatic dispersion; (2) Impact of fiber and discrete component PMD on optical systems; and finally (3) Impact of fiber and component PMD on optical systems in presence of polarization dependent loss. Finally, PMD mitigation approaches will be discussed.

Dipak Chowdhury received his B.Sc. degree in Electrical Engineering in 1986 from Bangladesh University of Engineering and Technology. He received his M.S. and Ph.D. degrees in Electrical Engineering from Clarkson University in 1989 and 1991 respectively. From 1991 to 1993 he had a joint appointment as a research associate at Yale University in the Applied physics department and at New Mexico State University in the Electrical Engineering department. For his graduate and post-graduate work he performed numerical modeling of and experimentation on

Room 207 A-D

2:00pm–4:00pm
MF • System Optimization and Modeling (Cat. D)
Alexei N. Pilipetskii, TyCom Labs., USA, Presider

2:00pm
MF1 • Performance optimization of chirped return-to-zero format in 10-Gb/s terrestrial transmission systems, *L.S. Yan, Y. Xie, Q. Yu, A.E. Willner, Univ. of Southern California–Los Angeles, USA; D. Starodubov, D-Star Tech., USA; J. Feinberg, Univ. of Southern California—Los Angeles and D-Star Tech., USA.* The performance of the chirped return-to-zero format significantly varies with slight changes in the link dispersion. Penalty reduction from more than 8 dB to 3 dB has been demonstrated by either adjusting the chirp or using tunable dispersion compensation.

2:15pm
MF2 • Semi-analytical modeling and design tool for WDM RZ systems. Validation results, *Sergey Burtsev, Jason Hurley, Shiva Kumar, David Lambert, Greg Luther, Corning Inc., USA; Rafic Abramov, Rensselaer Poytechnic Inst., USA.* We have developed semi-analytical tools to model and design long-haul dispersion-managed WDM RZ systems. Our approach provides a drastic speed-up of system budgeting compared to conventional modeling based on split-step methods. We have validated our analytical models experimentally and numerically.

2:30pm
MF3 • Accurate calculation of eye diagrams and error rates in long-haul transmission systems, *Ronald Holzlöhner, Vladimir S. Grigoryan, UMBC, USA; Curtis R. Menyuk, UMBC and USARL, USA; William L. Kath, Northwestern Univ. and UMBC, USA.* We found the distribution of phase and timing jitter in a DMS system to be Gaussian-distributed. After their removal, the residual noise Fourier components obey a multivariate-Gaussian distribution, allowing us to accurately calculate eye diagrams and error rates.

Room 303 A-D

2:00pm–4:00pm
MG • Optical Regeneration and Clock Recovery (Cat. E)
Gen Ribakovs, Nortel Networks, Canada, Presider

2:00pm
MG1 • Optical signal processing for very high speed (>40 Gbit/s) ETDM binary NRZ clock recovery, *Bernd Franz, Alcatel CRC, Germany.* Simulations and experiments show the application of optical signal processing instead of electrical nonlinear signal processing for the clock recovery in high bitrate(>40 Gbit/s) digital NRZ transmission systems. An electrical clock signal with high spectral purity can be obtained.

2:15pm
MG2 • Optical sampling measurement with all-optical clock recovery using mode-locked diode lasers, *M. Shirane, Y. Hashimoto, H. Kurita, H. Yamada, H. Yokoyama, NEC Corp., Japan.* Optical sampling measurement of 160-Gbps signals incorporating all-optical clock recovery has been demonstrated. External-cavity mode-locked semiconductor laser modules, which directly generate coherent 2-ps optical pulses, were used for optical clock recovery and as an optical sampling pulse source. We accomplished the real-time observation of waveform distortion in 160-Gbps optical data signals due to nonlinear optical effect in the transmission fiber.

2:30pm
MG3 • Ultrafast wavelength and polarization insensitive all-optical clock recovery, *Weiming Mao, Guifang Li, Univ. of Central Florida, USA.* Wavelength and polarization insensitive all-optical clock recovery based on a two-section gain-coupled DFB laser and cross gain conversion has been demonstrated. The lockup time of clock recovery is less than 1 ns.

Room 304 A-D

2:00pm–3:45pm
MH • Provisioning & Restoration 1 (Cat. F)
Krishna Bala, Tellium, Inc., USA, Presider

2:00pm
MH1 (Invited) • Signaling and control in optical networks, *Sid Chaudhuri, Tellium, USA.* Core-network provisioning and restoration structures are currently under siege. With the floodgates of broadband access about to open wide, this siege is about to intensify. Despite recent enthusiasm for terabit routers as a means of addressing this need, it has become apparent that in fact a core circuit-switching layer that interconnects WDM systems with data-networking devices is, for economic and scaling reasons, the clear architecture of choice. However, traditional circuit-switching approaches lack the signaling and control features that are essential for delivering real-time network services. We discuss the rich emerging arsenal of techniques by which IP-centric signaling and control mechanisms, together with sophisticated routing algorithms, can be harnessed to supply the critical signaling and control features needed in evolving optical core networks.

2:30pm
MH2 • Centralized vs. distributed on-demand bandwidth reservation mechanisms in WDM ring, *James Cai, Nortel Networks/Qtera Corp., USA; Andrea Fumagalli, Chi Guan, Univ. of Texas–Dallas.* A bandwidth efficient way to cope with the highly bursty traffic of the Internet is to resort to on-demand fast reservation of optical circuits (or lightpaths). Taking into consideration the data burst size, signaling dynamics and network latency, the paper compares performance of centralized versus distributed reservation mechanisms for WDM ring.

Commercial Technology Program

Room 210 C

8:00am–12:00pm
Fiber Optic Splicing – Hands-on Practices

Room 204 A-D

11:00am–1:00pm
Business and Management Topics

Room 210 C

1:00pm–5:00pm
Fiber Optic Splicing – Hands-on Practices

Ballroom C

MA • Raman Amplifiers 1 (Cat. A)—Continued

2:45pm

MA3 • Broadband discrete fiber Raman amplifier with high differential gain operating over the 1650nm-band, *Tetsufumi Tsuzaki, Motoki Kakui, Masaaki Hirano, Masashi Onishi, Yoshiharu Nakai, Masayuki Nishimura, Sumitomo Electric Industries, Ltd., Japan.* A high differential-gain (0.08dB/mW), low-noise (<5.0dB), broadband (30nm) and flat-gain (< ± 1dB) fiber Raman amplifier operating over the 1650nm-band has been demonstrated employing a low-loss highly nonlinear fiber and a broadened pump light source.

3:00pm

MA4 • Impact of nonlinear pump interactions on broadband distributed Raman amplification, *R.E. Neuhauser, P.M. Krummrich, H. Bock, C. Glingener, Siemens AG, Germany.* Broadband distributed Raman amplification is helpful in multi-terabit transmission experiments requiring high and flat gains over a wide spectral window. We show that nonlinear pump interactions can severely degrade amplifier performance at high pump powers.

3:15pm

MA5 • Fundamental noise limits in broadband Raman amplifiers, *C.R.S. Fludger, V. Handerek, N. Jolley, Nortel Networks, UK; R.J. Mears, Cambridge Univ., UK.* We show that broadband discrete Raman amplifiers based on silica-germania will have a noise figure significantly greater than the quantum limit. We also present temperature measurements on a broadband distributed Raman amplifier using asymmetrically-spaced pumps.

Ballroom D

MB • SOA Based Components (Cat. C)—Continued

2:45pm

MB3 • 40 GHz all-optical shift register with semiconductor optical amplifiers for switching and feedback, *R.J. Manning, A.J. Poustie, Corning Res. Ctr., UK.* We report for the first time the operation of an all-optical digital processing circuit based entirely on semiconductor optical amplifiers (SOAs). SOAs are used both for the nonlinear element in an interferometer and for the feedback amplifier.

3:00pm

MB4 • Optimised 2-R all-optical regenerator with low polarisation sensitivity penalty (<1dB) for optical networking applications, *J.-Y. Emery, M. Picq, F. Poingt, F. Gaborit, R. Brenot, M. Renaud, OPTO+, France; B. Lavigne, A. Dupas, Alcatel CIT, France.* 2R experiments at 10Gbit/s have been performed using a low polarisation sensitive SOA-Mach-Zehnder interferometer. Excess penalty below 1dB due to polarisation sensitivity has been measured over 15 and 25nm input wavelength range with respectively 21 and 25dB/0.1nm input OSNR.

3:15pm

MB5 • Comparison of switching windows of an all-optical 160Gbit/s demultiplexer with base data rates of 10Gbit/s and 40Gbit/s, *G. Toptchiyski, S. Randel, K. Petermann, Technical Univ. Berlin, Germany; C. Schubert, J. Berger, H.G. Weber, Heinrich-Hertz Inst., Germany.* We compare theoretical and experimental switching windows of an all-optical switch designed for demultiplexing of 160Gbit/s to 10Gbit/s and 40Gbit/s. Demultiplexing to 40Gbit/s reduces the transmittance of the switch but improves the cross-talk performance.

Ballroom E

MC • Fiber Gratings & Poling (Cat. B)—Continued

2:45pm

MC3 • Spiral fiber gratings for mode coupling, *Kyung S. Lee, Dae S. Moon, Sung Kyun Kwan Univ., Korea; T. Edrogan, Univ. of Rochester, USA.* We present some coupling properties of spiral fiber gratings. LP_{01} mode in spiral fiber gratings were demonstrated and analyzed to couple efficiently to both LP_{11} even and odd modes.

3:00pm

MC4 • A widely tunable fiber Bragg grating with a wavelength tunability over 40 nm, *S.Y. Set, B. Dabarsyah, C.S. Goh, K. Katoh, Y. Takushima, K. Kikuchi, Y. Okabe, N. Takeda, Univ. of Tokyo, Japan.* We have fabricated and demonstrated a 40nm widely tunable fiber Bragg grating designed for operation over Erbium band. This device is simple, low-cost and will have great potential for applications in optical communication and sensing.

3:15pm

MC5 • Tunable wavelength filter with a single-mode grating fiber thinned by plasma etching, *Hironori Kumazaki, Yoshihisa Yamada, Hidetoshi Nakamura, Seiki Inaba, Natl. Col. of Tech., Japan; Toshiyuki Kasajima, Mimaki Electronic Component Co. Ltd., Japan; Kazuhiro Hane, Tohoku Univ., Japan.* We studied a tunable wavelength filter using a single-mode Bragg grating fiber with a cladding thinned by reactive plasma etching. The reflection wavelength shifts were demonstrated by controlling the effective refractive index or the period of the grating.

Room 204 A-D

MD • Impact of PMD in Transmission Systems (Cat. D)—Continued

optical scattering from nonlinear micro-cavities. He joined Corning's research and development facility in 1993. Since he joined Corning, he focused his research effort in various aspects of optical communication systems. Currently he is managing modeling and simulation research in fiber-optic communication systems and optical devices. His research interests include: linear and nonlinear devices, impairments in fiber optic systems and networks, e.g., nonlinearities, cross-talk, chromatic dispersion, and polarization mode dispersion, and efficient algorithms for simulating fiber optic systems.

3:00pm–4:00pm
ME • WDM Subsystems (Cat. E)

Monique Renaud, Alcatel CRC, France, Presider

3:00pm

ME1 • Single to multi wavelength conversion using amplified spontaneous emission of semiconductor optical amplifier, *Yunfeng Shen, Jun Hong Ng, Chao Lu, T.H. Cheng, M.K. Rao, Nanyang Technical Univ., Singapore; Deming Liu, Huazhong Univ. of Science & Tech., China.* A wavelength conversion technique which can convert an input signal to many wavelengths simultaneously without any probe laser is proposed. 622Mb/s one-to-six wavelength conversion and multicast in a bus network are demonstrated.

3:15pm

ME2 • A high SNR, 150 ch supercontinuum CW optical source with precise 25 GHz spacing for 10 Gbit/s DWDM systems, *E. Yamada, H. Takara, T. Ohara, K. Sato, T. Morioka, NTT Network Innovation Labs., Japan; K. Jinguji, M. Itoh, M. Ishii, NTT Photonics Labs., Japan.* A 150 channel multi-wavelength CW optical source with precise 25 GHz spacing is successfully realized by longitudinal mode slicing a supercontinuum spectrum. We confirm SNR and Q-factor are sufficient for 10 Gbit/s multi-span DWDM transmission.

Room 207 A-D

MF • System Optimization and Modeling (Cat. D)—Continued

2:45pm
MF4 • Influence of the dispersion map on limitations due to cross-phase modulation in WDM multispan transmission systems, *C. Fürst, C. Scheerer, G. Mohs, J.-P. Elbers, C. Glingener, Siemens AG, Germany.* We determine system limitations due to cross-phase modulation (XPM) for non-zero dispersion shifted fiber by experiments and simulations. For the worst case of full dispersion compensation in each span we find a maximum power law whereas for appropriate undercompensation XPM can be efficiently suppressed.

3:00pm
MF5 • Limitations of 40 Gbit/s based dispersion managed WDM transmission: Solitons versus quasi-linear propagation regime, *Lee J. Richardson, Vladimir K. Mezentsev, Sergei K. Turytsin, Aston Univ., UK.* We investigate the transmission performance covering the whole spectrum of dispersion managed propagation regimes from soliton to quasi-linear RZ propagation detailing the limiting factors and optimal performance conditions.

3:15pm
MF6 • All-optical passive regeneration of 40 Gbit/s soliton data stream using dispersion management and in-line nonlinear optical loop mirrors, *Sonia Boscolo, Sergei K. Turytsin, Keith J. Blow, Aston Univ., UK.* We numerically demonstrate for the first time that dispersion management and in-line nonlinear optical loop mirrors can achieve all-optical passive regeneration and distance-unlimited transmission of a soliton data stream at 40 Gbit/s over standard fibre.

Room 303 A-D

MG • Optical Regeneration and Clock Recovery (Cat. E)—Continued

2:45pm
MG4 • Simultaneous 3R regeneration and wavelength conversion using a fiber-parametric limiting amplifier, *Yikai Su, Lijun Wang, Anjali Agarwal, Prem Kumar, Northwestern Univ., USA.* We present a 3R regenerator with simultaneous functionality of wavelength conversion. It consists of a fiber limiting amplifier and a phase-locked loop in a novel configuration. The 10Gbit/s regenerator effectively reduces input signal noise and jitter.

3:00pm
MG5 • Penalty-free error-free all-optical data pulse regeneration at 84 Gbps with Symmetric-Mach-Zehnder-type regenerator, *Yoshiyasu Ueno, Shigeru Nakamura, Kazuhito Tajima, NEC Corp., Japan.* We have achieved penalty-free data pulse regeneration at 84 Gbps down to an error rate level of 10^{-11} with a pseudorandom data pattern length of 2^{31}-1. An all-optical interferometric semiconductor regenerator was used.

3:15pm
MG6 • Optical 3R regenerator based on Q-switched laser, *O. Brox, S. Bauer, C. Bornholdt, D. Hoffmann, M. Möhrle, G. Sahin, B. Sartorius, Heinrich-Hertz Inst., Germany.* A polarization and wavelength insensitive Q-switched laser is applied in a 3R regenerator experiment. The optical regenerator shows a negative power penalty of -2dB at a data rate of 10Gb/s RZ.

Room 304 A-D

MH • Provisioning & Restoration 1 (Cat. F)—Continued

2:45pm
MH3 • Distributed provisioning of wavelength channels in multi-service WDM networks, *Admela Jukan, Gerald Franzl, Vienna Univ. of Tech., Austria.* We propose a distributed protocol for wavelength channel provisioning in WDM networks, where the network state information, related to transmission quality, reliability, manageability and traffic conditions, is based on an autonomous and service-differentiated characterisation of optical network elements.

3:00pm
MH4 • Comparison of centralized and distributed provisioning of lightpaths in optical networks, *Ramu Ramamurthy, Sudipta Sengupta, Sid Chaudhuri, Tellium Inc., USA.* This paper compares centralized and distributed online provisioning approaches in optical networks. In the centralized approach, complete network state is available for path computation. In the distributed approach, summarized information is available for path computation.

3:15pm
MH5 • IP control of optical networks: Design and experimentation, *Jennifer Yates, Panagiotis Sebos, Cristina Cannon, Albert Greenberg, AT&T Labs. Res., USA; Graham Smith, Pablo Arias, Jordan Rice, Bell Labs., Lucent Tech., USA.* This paper describes an experimental demonstration of IP control of optical resources, highlighting key design and implementation choices for topology discovery, IP-based signaling, OXC control and rapid restoration.

Ballroom C

MA • Raman Amplifiers 1 (Cat. A)—Continued

3:30pm
MA6 • Dual-wavelength cascaded Raman fiber laser, *Do Il Chang, Dong Sung Lim, Min Yong Jeon, Kyong Hon Kim, Electronics and Telecommunications Res. Inst., Korea.* We have demonstrated a stable and tunable dual-wavelength Raman fiber laser which can be used as a pump source for hybrid type and gain controlled C- and L- band distributed Raman and lumped erbium doped fiber amplifiers. A long period grating is used to suppress the gain competition between the two wavelength laser modes and prevent the high order Stokes oscillation. Intensity and wavelength tuning of the two lasing modes at 1480 nm and 1500 nm are achieved by tuning one and both of the fiber grating used in the laser cavity, respectively.

3:45pm
MA7 • Distributed amplification: How Raman gain impacts other fiber nonlinearities, *Alan F. Evans, Jim Grochocinski, Ashiqur Rahman, Corey Reynolds, Michael Vasilyev, Corning Inc., USA.* The gain and noise figure of distributed amplifiers can be integrated and lumped at the end of each fiber span. This paper investigates whether this convenient simplification is valid in the presence of fiber nonlinearities.

Ballroom D

MB • SOA Based Components (Cat. C)—Continued

3:30pm
MB6 • A nonsymmetrical Mach-Zehnder interferometer for suppressing pattern effect in SOAs, *Qianfan Xu, Yi Dong, Minyu Yao, Wenshan Cai, Jianfeng Zhang, Tsinghua Univ., China.* A novel idea of using change in index of refraction to suppress the pattern effect caused by gain variation in saturated SOAs with Mach-Zehnder interferometers is demonstrated. The principle and the experimental verification are presented.

3:45pm
MB7 • Novel all-optical 10 Gbp/s RZ-to-NRZ conversion using SOA-loop-mirror, *Hyuek Jae Lee, S.J. Ben Yoo, Univ. of California–Davis, USA; Chang Soo Park, KJIST, Korea.* The authors propose and demonstrate a novel all-optical return-to-zero (RZ) to non-return-to-zero (NRZ) data format conversion using a semiconductor optical amplifier (SOA) loop mirror. Error free transmission up to 78 km for the NRZ format converted data at 10 Gb/s is achieved. Also, the proposed method shows better transmission performance than the conventional Mach-Zehnder modulation method.

Ballroom E

MC • Fiber Gratings & Poling (Cat. B)—Continued

3:30pm
MC6 • Large second-harmonic generation in thermally poled silica waveguides, *Jesper Arentoft, Martin Kristensen, Peixiong Shi, Technical Univ. of Denmark, Denmark; Kjeld Pedersen, Sergey Bozhevolnyi, Aalborg Univ., Denmark.* We report the observation of very large second-harmonic signals from thermally poled silica waveguide samples. Secondary Ion Mass Spectrometry measurements show that significant amounts of silver ions are injected from the top electrode during poling.

Room 204 A-D

ME • WDM Subsystems (Cat. E)—Continued

3:30pm
ME3 • From 40 to 80*10Gbit/s DWDM transmission for ultra long-haul terrestrial transmission above 3000km, *Jean-Francois Marcerou, Fabrice Pitel, Ghislaine Vareille, Omar Ait Sab, Dominique Lesterlin, Jose Chesnoy, Alcatel, France.* We report transmission results of 40 to 80 channels at 10Gbit/s over terrestrial SMF fiber map with above 80km spans. From 3000 to 4000km can be reached while leaving about 4dB system margin.

3:45pm
ME4 • 60Gbit/s WDM-OTDM transmultiplexing using an electro-absorption modulator, *Hideaki Tanaka, Michiaki Hayashi, Tomonori Otani, Kazuho Ohara, Masatoshi Suzuki, KDD R&D Labs. Inc., Japan.* We propose WDM-OTDM transmultiplexing technique to generate a stable high speed OTDM signal with adjustable pulse width by using an electro-absorption modulator and demonstrate 60Gbit/s signal generation from three 20Gbit/s WDM signals.

4:00pm–4:30pm COFFEE BREAK, Exhibit Hall

Room 207 A-D

MF • System Optimization and Modeling (Cat. D)—Continued

3:30pm
MF7 • Dispersion-managed solitons for 160 Gbit/s transmission, *Jonas Martensson, Anders Berntson, Ericsson Telecom, Sweden.* The use of dispersion-managed (DM) solitons for 160 Gbit/s data transmission over 1000 km in fiber lines where the period of dispersion-management is much shorter than the amplifier spacing is investigated through numerical simulations.

3:45pm
MF8 • Role of power jitter induced by interchannel interaction in dispersion-managed lines, *Hiroto Sugahara, Aston Univ., UK.* Collision induced power jitter is examined in dispersion-managed wavelength-division-multiplexed transmission systems. The power jitter causes a serious problem for a single-periodic dispersion managed line having almost zero average dispersion, which can be reduced by applying a double-periodic dispersion management.

Room 303 A-D

MG • Optical Regeneration and Clock Recovery (Cat. E)—Continued

3:30pm
MG7 (Invited) • All-optical clock recovery for 3R optical regeneration, *Bernd Sartorius, Heinrich-Hertz Inst., Germany.* Scalable all-optical networks need 3R regeneration. Clock recovery is a key function. Bit-rate flexibility and ultrafast locking are important in future asynchronous IP networks. The performance of regenerators is demonstrated in loop experiments.

Room 304 A-D

MH • Provisioning & Restoration 1 (Cat. F)—Continued

3:30pm
MH7 • Reliable quality of transport monitoring in optical transparent paths of all-optical DWDM-networks, *Tim Welsch, Klaus Jobmann, Univ. of Hannover, Germany.* A method for monitoring the quality of optical transport services is introduced. Using spread spectrum technology leads to least interferring to payload. The method's performance and laboratory measurements are presented in this paper.

4:00pm–4:30pm COFFEE BREAK, Exhibit Hall

Ballroom C

4:30pm–5:45pm
MI • Raman Amplifiers 2 (Cat. A)
Evgeny M. Dianov, Russian Acad. of Science, Russia, Presider

4:30pm
MI1 • Inline loopbacks for improved OSNR and reduced double Rayleigh scattering in distributed Raman amplifiers, *C.R.S. Fludger, V. Handerek, N. Jolley Nortel Networks, UK; R.J. Mears, Cambridge Univ., UK.* We present a novel transmission system configuration, using passive components in a loopback topology, to improve counter-pumped distributed Raman amplification. This improves system performance, reduces double Rayleigh scattering and increases the efficiency of pump usage.

4:45pm
MI2 • Polarisation dependence and gain tilt of Raman amplifiers for WDM systems, *Anders Berntson, Sergei Popov, Evgeny Vanin, Gunnar Jacobsen, Jörgen Karlsson, Ericsson Telecom, Sweden.* We investigate the polarisation dependence and gain tilt of Raman amplifiers for WDM systems. We find no polarisation dependence of the gain for backward propagating pumps. Results from experiments on commercial 32 -channel WDM system are presented, highlighting the effect of gain tilt and pump depletion.

5:00pm
MI3 • Bandwidth limitations of broadband distributed Raman fiber amplifiers for WDM systems, *P.M. Krummrich, R.E. Neuhauser, C. Glingener, Siemens AG, Germany.* Pump interactions have been identified as a limiting factor for the gain bandwidth product of broadband distributed Raman fiber amplifiers. With respect to distributed Raman gain, it is more advantageous to add WDM channels at wavelengths above C+L band rather than below.

Ballroom D

4:30pm–6:00pm
MJ • Modulators (Cat. C)
Karl Martin Kissa, JDS Uniphase, USA, Presider

4:30pm
MJ1 (Invited) • Recent advances in low voltage, high frequency polymer electro-optic modulators, *W.H. Steier, M-C. Oh, H. Zhang, A. Szep, L.R. Dalton, C. Zhang, Univ. of Southern California and Univ. of Washington, USA; H.R. Fetterman, D.H. Chang, Univ. of California–Los Angeles, USA; H. Erlig, B. Tsap, Pacific Wave Industries, USA.* Advances in electro-optic polymers and in modulator fabrictaion techniques have resulted in modulators with V(sub pi)(dc)=1.2 V @ 1310 nm and V(sub pi)(dc)=1.8 V @ 1550 nm with 3dB(optical) bandwidths on ~40 GHz. Recent results on the thermal stability, optical power limits, and bias stability will be presented.

5:00pm
MJ2 • Highly reliable 40Gb/s electroabsorption modulator grown on InP:Fe substrate, *K. Takagi, H. Tada, E. Ishimura, T. Aoyagi, T. Nishimura, E. Omura, Mitsubishi Electric Corp., Japan.* The electroabsorption modulator with the unburied ridge waveguide has been fabricated on InP:Fe substrate. The cut-off frequency was 40GHz and the extinction ratio was 15dB. The estimated lifetime at 25℃ was over 1.7×10^7 hours.

Ballroom E

4:30pm–6:00pm
MK • Micro-optic Devices (Cat. B)
Robert B. Sargent, OCLI—JDS Uniphase, USA, Presider

4:30pm
MK1 • Anamorphic and aspheric microlenses and microlens arrays for telecommunication applications, *Daniel H. Raguin, Geoffrey Gretton, Don Mauer, Emil Piscani, Eric Prince, Tasso R.M. Sales, Don Schertler, Corning Rochester Photonics, USA.* A wafer-based fabrication process used to manufacture surface-relief microlenses for telecommunication applications is presented. Anamorphic and aspheric collimating lens profiles can be achieved, and have been experimentally verified to achieve insertion losses less than 0.2 dB/pair.

4:45pm
MK2 • Laser ablative shaping of collimator lens for single mode fiber, *Takahisa Jitsuno, Osaka Univ., Japan; Keiu Tokumura, Nalux Co., Ltd., Japan; Hisashi Tamamura, Sony/Tektronix Co., Japan.* Laser ablative shaping of collimator lens for single mode optical fiber and laser diode have been developed. The wavefront distortion can be compensated including the position error of fiber to the lens using laser ablation.

5:00pm
MK3 • Polarization insensitive adaptive gain profile equalizer using variable Faraday rotators and walk-off crystals, *Taichi Kogure, Kuniaki Motoshima, Kumio Kasahara, Mitsubishi Electric Corp., Japan.* We propose novel adaptive gain profile equalizer using variable Faraday rotators and walk-off crystal. Gain flatness of EDFA employing it with simple configuration is maintained less than 1.2dB over an input dynamic range of 10dB.

Room 204 A-D

4:30pm–6:00pm
ML • Longhaul DWDM Applications (Cat. G)
Andrew Lord, British Telecom Res. Labs., UK, Presider

4:30pm
ML1 (Invited) • Multi-terabit/s DWDM: Technologies and perspectives, *Katsumi Emura, NEC Corp., Japan.* The current research status for DWDM systems are summarized here in the light of 3.2 Tb/s and 6.4 Tb/s transmission experiments, and future directions are discussed with respect to the practical use of multi-Terabit/s system and to technical advances required for further increases in capacity.

5:00pm
ML2 • Field trial over a 750 km long transparent WDM link using an adaptive 10 Gb/s receiver with non-intrusive monitoring capability, *S. Herbst, H. Söhnle, M. Fregolent, B. Wedding, Alcatel SEL AG, Germany; R.P. Braun, A. Ehrhardt, Deutsche Telekom Innovationsgesellschaft, Germany.* An adaptive optical receiver was successfully tested over a 750 km long transparent WDM link. The excellent agreement of estimated and measured bit error ratio demonstrates non-intrusive monitoring in a transparent optical network.

Room 207 A-D

4:30pm–6:00pm
MM • Transmission Formats 1 (Cat. D)
Maurice S. O'Sullivan, Nortel Networks, Canada, Presider

4:30pm
MM1 • Limits on the spectral efficiency of intensity modulated direct detection systems with optical amplifiers, *Mark Shtaif, Antonio Mecozzi, AT&T Labs., USA.* We study the information capacity and the spectral efficiency of communication systems with optical amplifiers, in the direct detection intensity modulation case. With OSNR~20dB multilevel signaling can increase the spectral efficiency by no more than 3.5 relative to binary modulation. The highest spectral efficiency is obtained with a symmetric optical spectrum, and it cannot be improved by removing one sideband as in the single sideband modulation case.

4:45pm
MM2 • A quantum-limited optically-matched communication link, *D.O. Caplan, MIT, USA; W.A. Atia, Axsun Tech., USA.* We propose and demonstrate a nearly optimum all-optically matched communication link with unsurpassed receiver sensitivities better than 0.5dB from quantum-limited performance at 5 Gbps using an approach that can be extended to higher data rates.

5:00pm
MM3 • Vestigial side band demultiplexing for ultra high capacity (0.64 bit/s/Hz) transmission of 128x40 Gb/s channels, *W. Idler, B. Franz, G. Veith, Alcatel CRC, Germany; S. Bigo, Y. Frignac, Alcatel CRC, France.* Vestigial sideband filtering with high crosstalk suppression is demonstrated as optical demux of densely packed 40 Gb/s channels with high spectral efficiency of 0.64 bit/s/Hz. Narrow band optical filters have been applied for separation of 128x40 Gbit/s channels with alternating spacings of 50 and 75 GHz.

Room 303 A-D

4:30pm–6:00pm
MN • IP Over WDM (Cat. F)
Mari W. Maeda, Defense Advanced Res. Projects Agency/TTO, USA, Presider

4:30pm
MN1 (Invited) • Scalability of IP routers, *Nick McKeown, Stanford Univ., USA.* We will explore how far electronic IP routers can be scaled, what limits their performance, and how optical technology can be best applied to improve router performance.

5:00pm
MN2 • A flow-routing approach for optical IP networks, *Jenny J. He, Dimitra Simeonidou, Univ. of Essex, UK.* A novel flow-routing approach with the feature of retaining packet sequence is proposed for optical IP networks. Analytical results demonstrate its effectiveness in increasing the good-throughput of the router especially during the congestion period.

Room 304 A-D

4:30pm–6:00pm
MO • PMD Mitigation 1 (Cat. E)
X. Steve Yao, Jet Propulsion Lab., USA, Presider

4:30pm
MO1 • Higher order polarization mode dispersion compensator with three degrees of freedom, *Magnus Karlsson, Chongjin Xie, Henrik Sunnerud, Chalmers Univ. of Tech., Sweden; Peter A. Andrekson, Chalmers Univ. of Tech., Sweden and CENIX Inc., USA.* We compare several PMD compensation methods and find that the simple approach with a variable polarization controller and a variable time delay line can compensate for not only first, but also higher order PMD.

4:45pm
MO2 • Comparison of optical PMD compensation using a variable and fixed differential group delays, *Q. Yu, A.E. Willner, Univ. of Southern California—Los Angeles, USA.* Polarization mode dispersion compensation with dynamic tracking is investigated by modeling. An optical compensator using a variable differential group delay can alleviate the local minimum problem and provide superior performance compared to a fixed-delay compensator.

5:00pm
MO3 • Statistical dependence between first and second-order PMD, *G. Shtengel, E. Ibragimov, M. Rivera, S. Suh, YAFO Networks, USA.* We measure the first and the second-order PMD in high-PMD fiber, and determine correlation between the first and second-order PMD. Theory and measurements are in a good agreement.

Commercial Technology Program

Room 210 A/B

4:30pm–6:00pm
E-Commerce and Business Methodology–A New Ballgame for Protection

Ballroom C

MI • Raman Amplifiers 2 (Cat. A)—Continued

5:15pm
MI4 • Performance prediction method for distributed Raman amplification in installed fiber systems based on OTDR data, *Takeshi Hoshida, Fujitsu Network Comm., Inc., USA; Takafumi Terahara, Hiroshi Onaka, Fujitsu Labs. Ltd., Japan.* Novel characterization method of the loss profiles in transmission paths for distributed Raman amplification is proposed, which accurately predicts the gain and noise figure from conventional optical time domain reflectometry data.

5:30pm
MI5 • Optimum span configuration of Raman-amplified dispersion-managed fibers, *R. Hainberger, J. Kumasako, K. Nakamura, T. Terhara, H. Onaka, Fujitsu Labs., Japan; T. Hoshida, Fujitsu Network Comm., Inc., USA.* We analyze the influence of the span structure on the performance of Raman-amplified dispersion-managed fibers. Our calculations show that a configuration with the dispersion compensating fiber placed in the span center achieves the best trade-off between optical signal-to-noise ratio and nonlinear effects.

Ballroom D

MJ • Modulators (Cat. C)—Continued

5:15pm
MJ3 (Invited) • Over-40-GHz modulation bandwidth of EAM-integrated EAM-integrated DFB laser modules, *Hidekazu Kawanishi, Yoshinori Yamauchi, Naoyuki Mineo, Yoshiki Shibuya, Hitoshi Murai, Koji Yamada, Hiroshi Wada, Oki Electric Industry Co., Ltd., Japan.* EAM-DFB modules with record high bandwidth of 41 GHz have been developed. 40 Gb/s NRZ operation with 12 dB extinction ratio and 40 GHz short pulse trains with 6 ps pulse width have been successfully achieved.

5:45pm
MJ4 • Increasing line rate by combining ETDM and OTDM in a semiconductor Mach-Zehnder modulator, *Fenghai Liu, Xueyan Zheng, Palle Jeppesen, Technical Univ. of Denmark, Denmark; Rune J.S. Pedersen, Tellabs Denmark A/S, Denmark; Jim Fraser, John D. Bainbridge, Mike Cox, Nortel Networks, UK.* Line rate is doubled by combining ETDM and OTDM techniques in a semiconductor Mach-Zehnder modulator. 20Gb/s optical signal is successfully generated using a 10GHz commercial module to multiplex two 10 Gb/s signals.

Ballroom E

MK • Micro-optic Devices (Cat. B)—Continued

5:15pm
MK4 • Group delay of a micro-optic dynamic gain-flattening filter, *Jeremy A. Bolger, Dmitri Abakoumov, Steven Frisken, Nortel Networks, Australia; Paul Johnson, Nortel Networks, UK.* We investigate the group delay spectrum of a novel micro-optic dynamic gain-flattening filter. We show theoretical delay of less than 1ps over the operating range and compare with direct experimental measurements.

5:30pm
MK5 • 4-port interleavers and fully-circulating bi-directional circulators, *Kuochou Tai, Qingdong Guo, Kok Wai Chang, Jyehong Chen, Min Xu, JDS Uniphase, USA.* A low-loss 4-port interleaver was demonstrated. The device becomes a 4-port fully-circulating wavelength-interleaving bi-directional circulator with the addition of a non-reciprocal element. This new device technology opens up a range of possibilities for bi-directional fiber devices.

5:45pm
MK6 • Fiber dependence and coupling efficiency limitation for a lensed fiber integrated with a long period fiber grating, *L.A. Wang, W.T. Chen, Natl. Taiwan Univ., Taiwan.* We analyze the fiber dependence and the efficiency limitation for optical coupling using a lensed fiber integrated with a long period fiber grating.

Room 204 A-D

ML • Longhaul DWDM Applications (Cat. G)—Continued

5:15pm
ML3 • Germany-wide DWDM field trial: Transparent connection of a long haul link and a multiclient metro network, *A. Richter, H. Bock, W. Fischler, P. Leisching, P.M. Krummrich, A. Mayer, R.E. Neuhauser, J.P. Elbers, C. Glingener, Siemens AG, Germany.* We report on error-free multiclient transmission over a Germany-wide all-optical, configurable DWDM system. The performance of the transparent connection of a metropolitan area network and a bi-directional long haul system is investigated under real-world conditions.

5:30pm
ML4 • Value proposition for configurable optical network elements, *Leo Nederlof, Jeffrey R. Jacobs, B. Roe Hemenway, Mark J. Soulliere, Mark D. Vaughn, Eric L. Buckland, R.E. Wagner, David Charlton, Corning Inc., USA.* The value of configurable optical network elements for the fast provisioning of wavelength services is assessed against manual provisioning. Results are presented that were obtained by evaluating the long haul wavelength circuit provisioning process.

5:45pm
ML5 • Traffic grooming methods for undersea trunk and branch architectures, *Ramesh Nagarajan, M. Akber Qureshi, Bell Labs., Lucent Tech., USA.* Undersea cable systems generally span many sovereign countries with variety of bandwidth needs. Trunk and branch arrangement provides a secure and cost-effective way ofconnecting these countries with a single cable system. However the cost per bandwidth mile of undersea cable systems is very high which makes efficient traffic grooming necessary. In this paper, we propose three grooming schemes in context of a trunk and branch network that deploys SDH ring transport to provide SDH pipes to carry PDH signals. The proposed methods are generaland extend to other arrangements such as mesh-type transport and other signal levels.

6:30pm–8:00pm CONFERENCE RECEPTION, Pacific and California Ballrooms, Anaheim Hilton

Room 207 A-D

MM • Transmission Formats 1 (Cat. D)—Continued

5:15pm

MM4 • 10Gb/s SCM system using optical signal side-band modulation, *R. Hui, B. Zhu, R. Huang, C. Allen, K. Demarest, Univ. of Kansas, USA; D. Richards, Sprint, USA.* A 10Gb/s SCM long-haul optical system is reported. 4 x 2.5Gb/s data streams are combined into one wavelength, which occupies a 20GHz optical bandwidth. Optical SSB is used to increase bandwidth efficiency and reduce dispersion penalty.

5:30pm

MM5 • Performance comparison between DSB and VSB signals in 20Gbit/s-based ultra-long-haul WDM systems, *Takehiro Tsuritani, Akira Agata, Itsuro Morita, Keiji Tanaka, Noboru Edagawa, KDD R&D Labs. Inc., Japan.* Transmission performance of DSB and VSB signals was compared for the first time in 20Gbit/s-based ultra-long-haul WDM transmission systems. Impact of channel spacing, repeater output power variation and terminal dispersion compensation error was investigated.

5:45pm

MM6 • Impact of self-phase modulation on bandwidth efficient modulation formats, *T. Wuth, W. Kaiser, W. Rosenkranz, Christian-Albrechts Univ., Germany.* We present the influence of self-phase modulation on duobinary and single sideband modulation. Additionally we determine and compare the receiver sensitivity for a bit error ratio of 10^{-9} varying fiber length and input power.

Room 303 A-D

MN • IP Over WDM (Cat. F)—Continued

5:15pm

MN3 • A smart layer two protocol for IP over WDM, *Mathias Bischoff, Siemens, Germany.* A layer two protocol for IP over WDM transport is presented. It supports operation and maintenance of wide area networks by means of dedicated messages. Its state machine for robust synchronization is described.

5:30pm

MN4 • Analysis of reconfiguration in IP over WDM access networks, *Aradhana Narula-Tam, Steven G. Finn, Muriel Medard, MIT, USA.* The benefit/cost tradeoff of reconfiguration in IP/WDM networks is evaluated as the resulting reduction in average packet delay. We compare, analytically and through simulations, the performance of several reconfiguration policies to fixed topology systems.

5:45pm

MN5 • Joint IP/optical layer restoration after a router failure, *Angela L. Chiu, John Strand, AT&T Labs. Res., USA.* The Optical Layer can provide an IP client rapid, efficient restoration after a link failure; however its inability to protect against router failure erodes its attractiveness. Here, we propose a joint IP/Optical restoration mechanism addressing this problem.

Room 304 A-D

MO • PMD Mitigation 1 (Cat. E)—Continued

5:15pm

MO4 • Analysis of polarization-mode dispersion compensators using importance sampling, *Ivan T. Lima, Jr., UMBC, USA; G. Biondini, W.L. Kath, Northwestern Univ., USA; B. Marks, UMBC and Northwestern Univ., USA; C. R. Menyuk, UMBC and USARL, USA.* We use importance sampling to analyze polarization-mode dispersion (PMD) compensators that consist of a single differential-group delay (DGD) element. Using this technique we show that while these compensators improve the average penalty due to PMD, they may degrade the outage probability.

5:30pm

MO5 • Statistics of PMD-induced power fading for double sideband and single sideband subcarrier-multiplexed signals, *O.H. Adamczyk, A.B. Sahin, Q. Yu, S. Lee, A.E. Willner, Univ. of Southern California–Los Angeles, USA.* We experimentally and numerically compare the statistics of power fading for DSB and SSB subcarrier-multiplexed signals under high PMD conditions (average DGD ~40 ps) with and without dynamic first-order PMD compensation. We find that both SSB-SCM and DSB-SCM signals exhibit similar sensitivity to PMD-induced power fading. First-order compensation reduces the worst case fading penalty by ~20 dB.

5:45pm

MO6 • Chromatic and polarization mode dispersion measurement technique using phase-sensitive sideband detection, *C.K. Madsen, Bell Labs., Lucent Tech., USA.* A new technique for measuring chromatic dispersion and PMD is presented that does not require a tunable laser. To demonstrate the technique, measurements on a fiber Bragg grating are compared to the modulation phase-shift method.

6:30pm–8:00pm CONFERENCE RECEPTION, Pacific and California Ballrooms, Anaheim Hilton

Ballroom C

8:30am–10:30am
TuA • Broad Band Amplifier (Cat. A)
Felton A. Flood, Centerpoint Broadband Tech., USA, Presider

8:30am
TuA1 (Invited) • **Broadband fiber optic amplifiers,** *Susumu Kinoshita, Fujitsu Network Comm., USA.* Broadband fiber optic amplifiers are key elements of DWDM systems and enablers for optical network systems. New amplifier technologies for extending gain-bandwidth and equalizing the power deviation among WDM signals are discussed toward the next generation of ultra-high-capacity DWDM systems.

9:00am
TuA2 • **Extending the L-band to 1620 nm using MCS fiber,** *A.J.G. Ellison, D.E. Goforth, B.N. Samson, J.D. Minelly, J.P. Trentelman, D.J. McEnroe, B.P. Tyndell, Corning Inc., USA.* Compositional modifications to the base MCS (antimony silicate) glass composition permit extension of useable L-band gain from 1615 to 1620 nm. This is achieved by shifting the signal excited state absorption band to longer wavelengths.

Ballroom D

8:30am–10:30am
TuB • WDM Source 1 (Cat. C)
Larry A. Coldren, Univ. of California–Santa Barbara, USA, Presider

8:30am
TuB1 (Invited) • **Monolithic, widely-tunable, DBR lasers,** *Gregory Fish, Agility Comm., Inc., USA.* Tunable lasers are poised to dominate most applications areas within the next few years. Widely-tunable monolithic DBR lasers have the capability to satisfy the requirements of nearly every application area. This presentation will describe the activities to realize this goal.

9:00am
TuB2 • **A sampled or superstructure grating tunable twin-guide laser for wide tunability with 2 tuning currents,** *Geert Morthier, Bart Moeyersoon, Roel Baets, Ghent Univ.-IMEC, Belgium.* A new widely tunable laser structure is proposed, a TTG laser with 2 different sampled or superstructure gratings. This widely tunable laser only requires 2 instead of 3 tuning currents and has a much shorter cavity length than existing widely tunable laser diodes.

Ballroom E

8:30am–10:30am
TuC • Periodic Waveguides (Cat. A)
Laura Ann Weller-Brophy, Corning, Inc., USA, Presider

8:30am
TuC1 (Invited) • **Photonic crystal fiber modelling and applications,** *A. Bjarklev, J. Broeng, S.E. Barkou Libori, E. Knudsen, H.R. Simonsen, Technical Univ. of Denmark, Denmark.* Photonic crystal fibers having a microstructured air-silica cross section offer new optical properties compared to conventional fibers for telecommunication, sensor, and other applications. Recent advances within research and development of these fibers will be presented.

9:00am
TuC2 • **Adiabatic coupling in tapered air-silica microstructured optical fiber,** *J.K. Chandalia, B.J. Eggleton, R.S. Windeler, S.G. Kosinski, X. Liu, C. Xu, Lucent Tech., USA.* We study adiabatic mode propagation in tapered air-silica microstructured optical fibers and demonstrate efficient coupling into a robust high-delta microstructured optical fiber. As an application of this device, we exploit the widely flattened dispersion and enhanced peak intensity in the waist of the tapered microstructured fiber to generate tunable self-frequency shifting Raman solitons over the communications window from 1.3 μm to 1.65 μm.

Room 204 A-D

8:30am–9:30am
TuD • Fiber Issues for System Deployment (Cat. A)

8:30am
TuD1 (Tutorial) • **Fiber issues for system deployment,** *Jon Nagel, TerraWorx, USA.* Abstract not available.

Room 207 A-D

8:30am–10:30am
TuF • Performance Improvement—FEC & Raman Amplification (Cat. D)
Harald Geiger, Siemens AG, Germany, Presider

8:30am
TuF1 (Invited) • FEC techniques in submarine transmission systems, *Omar Ait Sab, Alcatel, France.* This paper describes different concatenated coding schemes for submarine transmission system. Simulation results demonstrate a net coding gain up to 10 dB. The impact of the fec coding gain in a transoceanic submarine system is discussed.

9:00am
TuF2 • Performance limit of forward error correction codes in optical fiber communications, *N. Ramanujam, G. Lenner, A.B. Puc, A. Pilipetskii, TyCom Labs., USA; Y. Cai, T. Adali, J.M. Morris, UMBC, USA.* We investigate performance limits of forward error correction codes in optically- amplified fiber channels with asymmetric channel statistics. We show that the binary symmetric channel approximation underestimates the maximum coding gain achievable in fiber communications.

Room 303 A-D

8:30am–10:30am
TuG • Network Design (Cat. F)
Jane M. Simmons, Corvis Corp., USA, Presider

8:30am
TuG1 • Wavelength usage efficiency versus recovery time in path-protected DWDM mesh networks, *Eric Bouillet, Krishnan Kumaran, Gang Liu, Iraj Saniee, Lucent Tech., USA.* We describe novel lightpath routing and protection schemes and demonstrate an inverse relationship between efficiency of wavelength usage and restoration time. The methodology is used in the selection of grade of protection in all-optical networks.

8:45am
TuG2 • Bi-criteria studies of mesh network restoration path-length versus capacity tradeoffs, *John Doucette, Wayne D. Grover, TRLabs., USA; Thuthuy Bach, Nortel Networks, Canada.* Mesh-restorable networks are of interest as an alternative to rings for DWDM-based optical networks. We study the capacity design of mesh networks using a bi-criteria formulation to explore the optimal trade-off between restoration capacity and restoration path-lengths.

9:00am
TuG3 • Impact of intermediate traffic grouping on the dimensioning of multi-granularity optical networks, *Ludovic Noirie, Martin Vigoureux, Emmanuel Dotaro, Alcatel CRC, France.* We demonstrate the interest of multi-granularity optical networks to decrease the number of ports for the optical switching matrices by grouping some wavelengths into bands and some bands into fibers at some intermediate nodes.

Room 304 A-D

8:30am–10:30am
TuH • Dispersion Compensation (Cat. A)
Paul Williams, NIST, USA, Presider

8:30am
TuH1 (Invited) • Broadband dispersion and dispersion slope compensation in high bit rate and ultra long haul systems, *V. Srikant, Corning Inc., USA.* This presentation reviews the essentials of dispersion compensating technology for non-zero dispersion shifted fibers. The implications of using the various existing technologies are discussed.

9:00am
TuH2 • Chromatic and polarization mode dispersion compensation using spectral holography, *Ken E. Anderson, Kelvin H. Wagner, Univ. of Colorado–Boulder, USA.* A new adaptive method for accomplishing both chromatic and polarization mode dispersion compensation on parallel DWDM fibers is proposed based on the third order nonlinear technique of coherent transient spectral holography.

Commercial Technology Program

Room 210 C

8:00am–12:00pm
Fiber Optic Splicing – Hands-on Practices

Room 210 A/B

8:30am–10:30am
Technology Trends – Insights into the Market

Ballroom C | Ballroom D | Ballroom E | Room 204 A-D

TuA • Broad Band Amplifier (Cat. A)—Continued

9:15am

TuA3 • Comparison between different configurations of Hybrid/Raman/Erbium-Doped Fiber Amplifiers, *Andrea Carena, Vittorio Curri, Politecnico di Torino, Italy and Artis Softaware Corp., USA; Pierluigi Poggiolini, Politecnico di Torino, Italy.* A comprehensive theoretical study on the optimal configuration of Hybrid Fiber Amplifiers is carried out yielding a closed form analysis. The maximum reachable distance is plotted against the span length and non-linear weight, given a target OSNR.

9:30am

TuA4 (Invited) • Dynamically flattened optical amplifiers, *Simon Parry, Nortel Networks, Canada.* Fixed gain flattening filters will be unable to meet the future requirements for amplifiers in high capacity systems. The range of possible designs and devices are reviewed, and the operational issues are examined.

TuB • WDM Source 1 (Cat. C)—Continued

9:15am

TuB3 • 10 Gb/s transmission using an electroabsorption-modulated distributed Bragg reflector laser with integrated semiconductor optical amplifier, *J.E. Johnson, L. J.-P. Ketelsen, J.M. Geary, F.S. Walters, J.M. Freund, M.S. Hybertsen, K.G. Glogovsky, C.W. Lentz, W.A. Asous, P. Parayanthal, T.L. Koch, R.L. Hartman, Lucent Tech., USA.* We demonstrate for the first time a 10 Gb/s EA-modulated wavelength-selectable DBR laser module with an integrated semiconductor optical amplifier. Transmission over 82 km of standard fiber with -3 dBm average power on 20 channels spaced by 50 GHz is achieved.

9:30am

TuB4 (Invited) • Wavelength-selectable microarray light sources simultaneously fabricated on a wafer covering the entire C-band, *K. Kudo, K. Yashiki, T. Morimoto, Y. Hisanaga, S. Sudo, Y. Muroya, T. Tamanuki, H. Hatakeyama, K. Mori, T. Sasaki, NEC Corp., Japan.* We developed multi-range wavelength-selectable light sources (WSLs) with an all-selective MOVPE (ASM) grown microarray planar-buried-hetero (MPBH) structure. We simultaneously fabricated five WSLs, each with a unique 8-nm tuning range, to cover forty 100-GHz-spaced channels (the entire C-band). Uniform characteristics, such as an Ith of 8.3 ± 1.2 mA, an SMSR of over 45 dB, and a fiber-coupled power up to 15 mW, were obtained.

TuC • Periodic Waveguides (Cat. A)—Continued

9:15am

TuC3 • A highly nonlinear holey fiber and its application in a regenerative optical switch, *P. Petropoulos, T.M. Monro, W. Belardi, K. Furusawa, J.H. Lee, D.J. Richardson, Univ. of Southampton, UK.* We report the fabrication of a highly nonlinear, polarization-maintaining, silica holey fiber with an effective area of ~2.5μm^2 at 1550nm. Nonlinear switching is demonstrated in a 3.3m long regenerative switch based on SPM with appropriate bandpass filtering.

9:30am

TuC4 • The fabrication and modelling of non-silica microstructured optical fibres, *D.W. Hewak, Y.D. West, N.G.R. Broderick, T.M. Monro, D.J. Richardson, Univ. of Southampton, UK.* We present for the first time a non-silica mircostructured optical fibre designed to guide light at 5microns using gallium lanthium suphide glass. We present the results of optical modelling of the structure as well as a discussion on possible applications.

9:45am

TuC5 • Observation of fundamental mode cut-off at short wavelength in a holey optical fiber, *K.W. Park, J.C. Kim, Y.G. Seo, U.-C. Paek, D.Y. Kim, K-JIST.* We have observed that fundamental mode is cut-off at short wavelengths in a standard holy optical fiber(HOF) while the same fiber guides light at long wavelengths. This can be an another evidence that guiding mechanism in a holy optical fiber is mostly due to average index effect rather than photonic bandgap effect. This strange property of a HOF can be potentially useful for device applications.

TuD • Fiber Issues for System Deployment (Cat. A)—Continued

9:30am–10:30am
TuE • Photonic Lightwave Circuits (Cat. B)

9:30am

TuE1 (Tutorial) • Photonic lightwave circuits, *Christopher Doerr, Bell Labs., Lucent Tech., USA.* Photonic lightwave circuits are optical devices comprised of waveguides and sometimes active devices, such as phase shifters, amplifiers, or modulators. This field is immense, including devices from electroabsorption modulated lasers to acoustooptic wavelength add-drops. Because of the limited time, we have chosen to focus on arrayed-waveguide-based and a few other interferometer-based devices. This will include multi/demultiplexers, dynamic gain equalization filters, wavelength add-drops, dispersion compensators, switches, and optical regenerators. It has been claimed for a long time now that photonic lightwave circuits should be cheaper to build in large quantities than their bulk counterparts and thus capture the marketplace. We will also discuss cases where this has and has not happened.