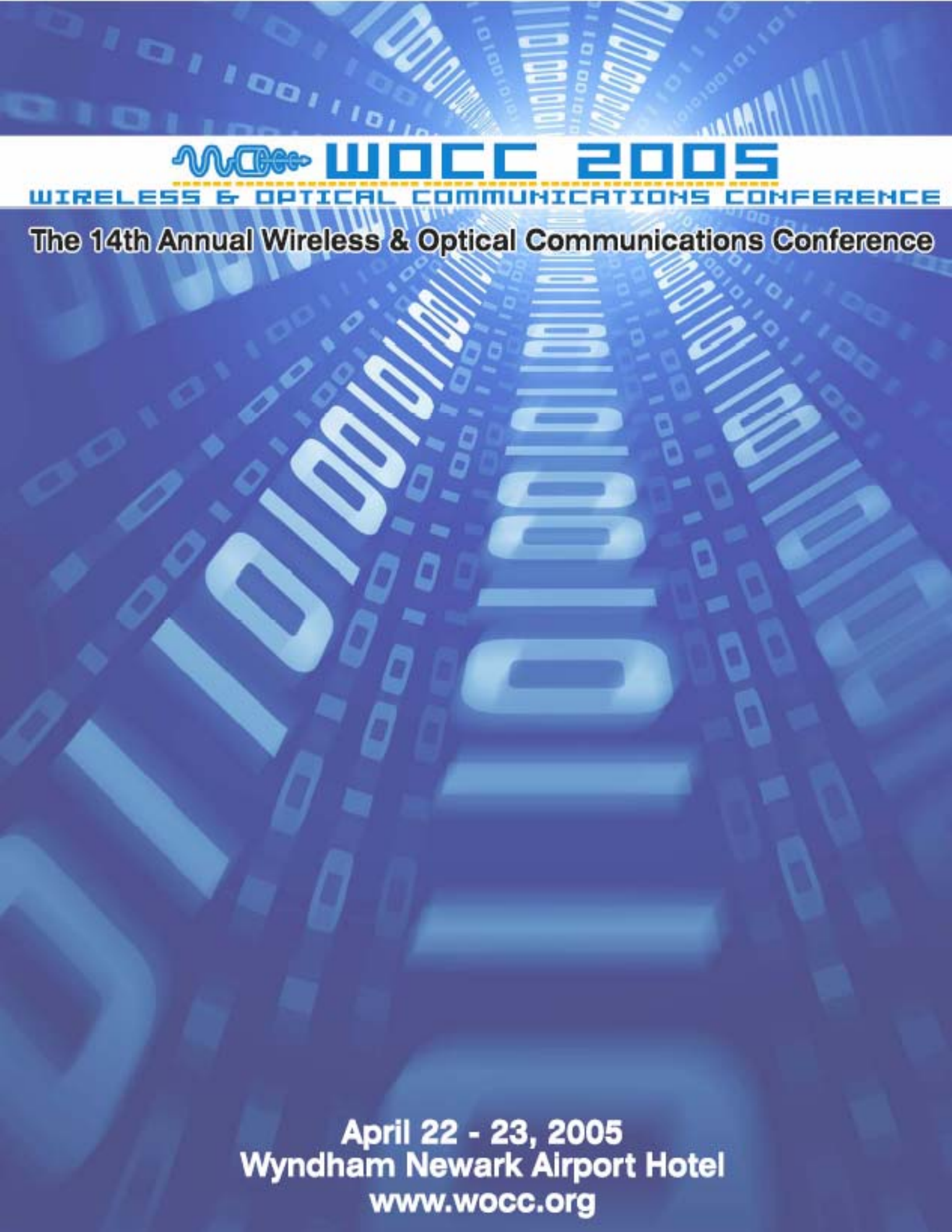

WOCC 2005
WIRELESS & OPTICAL COMMUNICATIONS CONFERENCE
The 14th Annual Wireless & Optical Communications Conference
April 22 - 23, 2005
Wyndham Newark Airport Hotel
www.wocc.org

The Fourteenth Annual Wireless and Optical Communications Conference *"Convergent Communications"*

April 22-23, 2005, Wyndham Newark Airport Hotel, New Jersey, U.S.A.

Table of Contents

Welcome Message

On behalf of the Wireless and Optical Communications Conference (WOCC) Planning Committee, I welcome you to WOCC 2005. I also thank all the sponsors for their technical and financial support; all the session chairs and speakers for their participation and contribution; and all the committee members for their team work and follow-through. WOCC 2005 is the fourteenth annual conference that has been devoted to telecommunication professionals for exchanging ideas and information. Building on the success of last year's WOCC in Taipei, this year the WOCC returns to its home base in New Jersey while the U.S. telecom industry is becoming vibrant again with massive consolidation under way.

The conference theme for WOCC 2005 is **"Convergent Communications."** The two-day program consists of a keynote speech, four plenary sessions, and 11 technical sessions and a panel discussion in three parallel tracks with eminent speakers covering a wide range of topics in wireless, optical, and multimedia aspects of the conference theme. This rich program provides all attendees with the opportunities to meet and interact with on another. I hope your experience with WOCC is a fruitful and long lasting one. With your support and participation, WOCC will continue its success for a long time.

Dr. Tien Pei Lee
Conference Chair

Conference Theme

The fourteenth Annual Wireless and Optical Communications Conference (WOCC) will bring together technical experts and business leaders from North America and the Asia Pacific region to discuss multimedia, optical, and wireless communications technologies and business opportunities. The theme of WOCC 2005 is **Convergent Communications** over public mobile wireless networks, public fixed broadband wireline networks, and private customer premises networks. The integration of these three networks is the focus of a new next-generation network (NGN) providing convergent user-centric services that are no longer associated with the types of network access or content media. Instead, these convergent user-centric services will offer seamless delivery of multimedia applications including voice, data, image, and streaming video independent of any access technologies. The transport layer protocol is converging on Internet Protocol (IP) that propelled the growth of World Wide Web (WWW). The network and service providers will need to deploy standard-compliant converged networks and offer these new value-added services to save operational cost and grow their revenue. Convergent Communications can truly be considered as the enabler for the next phase of growth for the telecommunication industry.

Conference Organizer

WOCC, Inc. <www.wocc.org>

Conference Sponsors

Applied Science and Technology Research Institute (ASTRI) <www.astri.org>
Center for Optical Technologies, Lehigh University <www.lehigh.edu/optics>
Chunghwa Telecom <www.cht.com.tw>
Computer and Communications Research Laboratories, Industrial Technology Research Institute (CCL/ITRI) <www.ccl.itri.org.tw>
Chinese American Academic and Professional Society (CAAPS)
Chinese Association for Science and Technology (CAST) <www.castusa.org>
Chinese Institute of Engineers − USA (CIE-USA) <www.cie-gnyc.org>
IEEE Communications Society <www.comsoc.org>
IEEE North Jersey Section <web.njit.edu/~ieeenj>
Lucent Technologies <www.lucent.com>
Monte Jade Science and Technology Association (MJSTA) <www.montejade.org>
Photonics Society of Chinese Americans (PSC) <www.psc-a.org>
Taiwan Institute of Economic Research (TIER) <TIE.tier.org.tw>
Telcordia Technologies <www.telcordia.com>

Conference Planning Committee

Conference Chair:

Tien Pei Lee, Telcordia Technologies (Retired)

Conference Organizer:

Kevin W. Lu, Telcordia Technologies

Program Chairs:

Qi Bi, Lucent Technologies
Deyu Zhou, Opnext
Heather Yu, Panasonic Digital Networking Laboratory

Conference Coordinator:

Xiaomei Qian, Amaranth Group

Publication:

Yongmei Dai, Lehigh University
Wei Luo, Broadcom
Zhiyuan Yan, Lehigh University

Treasurer:

Ying (Emily) Hu, Lucent Technologies

Exhibits:

Russell Sun, Lucent Technologies

Fund Raising:

T. Russell Hsing, Telcordia Technologies
Peng Yin, Thomson Inc.
Sydney Zhang, Lucent Technologies

Local Arrangement:

MengChu Zhou, New Jersey Institute of Technology

Registration:

Hongya Ge, New Jersey Institute of Technology

Web Manager:

Shuang Yu, Lucent Technologies

Public Relations:

Yi Hsuan, Lucent Technologies
Shuang Yu, Lucent Technologies
Kang Yueh, Crown Castle International

Board of Trustees:

Chair:

James Hwang

Vice Chair:

Allen Chen

Trustees:

T.C. Chiang
T. Russell Hsing
Steve Hsu
Haifeng Li
William Yeh
Kang Yueh
MengChu Zhou

Conference Program

	Friday, April 22, 2005	**Saturday, April 23, 2005**
08:00 ~ 09:00	**Registration**	**Registration**
09:00 ~ 09:10	**F1 Opening Remarks** Conference Chair: Tien Pei Lee	**S1 Opening Remarks** Conference Chair: Tien Pei Lee
09:10 ~ 16:10	**Exhibition**	**Exhibition**
09:10 ~ 10:40 (90 Minutes)	**F2 Plenary Session I** Chair: Qi Bi, Lucent Robert Yang, ASTRI Tom Koch, Lehigh University Fred Juang, Georgia Tech	**S2 Plenary Session III** Chair: Xiaomei Qian, Amaranth Xiaomang Yu, China Unicom Alice Chou, TIER
10:40 ~ 10:50	Break	Break
10:50 ~ 12:20 (90 Minutes)	**F3 Plenary Session II** Chair: Heather Yu, Panasonic Mike Schwartz, Telcordia Wuqiang Li, Consulate General of PRC Steve Socolof, New Venture Partners	**S3 Plenary Session IV** Chair: Deyu Zhou, Opnext Zhaohui Wu, Zhejiang University Ian Chiou, CCL/ITRI Shen-Chang Chao, ASTRI
12:30 ~ 14:00	**F4 Luncheon** **Keynote:** Ed Chao Director, Mobility Solutions Product Management, Lucent	**S4 Luncheon**
14:00 ~ 16:10	**Poster Session**	**Poster Session**
Parallel Sessions 14:00 ~ 15:40 (100 Minutes)	**F5 Technical Session I (Wireless)** Chair: Benjamin Tang, Lucent Co-chair: Dong Sun, Lucent *Wireless and Wireline Convergence*	**S5 Technical Session VI (Wireless)** Chair: Xiaodong Wang, Columbia Univ. Co-chair: Guosen Yue, NEC Research *Broadband Wireless and Sensory Network*
	F6 Technical Session II (Optical) Chair: Xiang Liu, Lucent Co-chair: Chongjin Xie, Lucent *Enabling Technologies for Optical Communications and Networks*	**S6 Technical Session VII (Optical)** Chair: Zhengyu Huang, RSoft *Applications of Fiber and Integrated Optical Communications*
	F7 Panel Discussion I (Multimedia) Chair: R. Chandramouli, Stevens *What's Next in Wireless Multimedia*	**S7 Technical Session VIII (Multimedia)** Chair: Peng Yin, Thomson *Emerging Multimedia Technologies*
15:40 ~ 16:10	Break	Break
Parallel Sessions 16:10 ~ 17:50 (100 Minutes)	**F8 Technical Session III (Wireless)** Chair: MengChu Zhou, NJIT *Wireless Ad Hoc Networks*	**S8 Technical Session IX (Wireless)** Chair: Shen-De Lin, Lucent Co-chair: Tau Zhang, Telcordia *Wireless Mobile Communications*
	F9 Technical Session IV (Optical) Chair: Xiang Zhou, AT&T Labs *Optical Communications and Network Systems*	**S9 Technical Session X (Optical)** Chair: Haisheng Wang, Boeing *Optoelectronics and Network Elements*
	F10 Technical Session V (Multimedia) Chair: James Lei, ASTRI *Digital Wireless Multimedia*	**S10 Technical Session XI (Multimedia)** Chair: Wen-Yi Zhao, Sarnoff *Interactive Multimedia*
18:00 ~ 20:00	**F11 Conference Reception**	**S11 Post-Conference Dinner**

DAY 1 (FRIDAY, APRIL 22, 2005)

Registration (08:00-09:00 AM)

F1 – Opening Remarks (09:00-09:10 AM)
Conference Chair: **Tien Pei Lee**, Telcordia Technologies (Retired)
Honorable Guest: **Doug Zuckerman**, VP Membership Services, IEEE Communications Society

F2 – Plenary Session I (09:10-10:40 AM)
Session Chair: **Qi Bi**, Lucent Technologies

09:10 – 09:40 AM **Robert J. Yang**, CEO, ASTRI
"ASTRI: Building the Technology Base for Hong Kong's Future"

09:40 – 10:10 AM **Tom Koch**, Director of Center for Optical Technologies, Lehigh University
"Perspectives on Photonic Integration"

10:10 – 10:40 AM **Bing-Hwang (Fred) Juang**, Motorola Foundation Chair Professor, Georgia Tech
"Convergent Communication Technologies and Services with Context Awareness"

Break (10:40-10:50 AM)

F3 – Plenary Session II (10:50 AM-12:20 PM)
Session Chair: **Heather Yu**, Panasonic Digital Networking Laboratory

10:50 – 11:20 AM **Mike Schwartz**, Executive Director and Chief Strategist, Operation Solutions, Telcordia Technologies
"Converged Services and the Telco of the Future"

11:20 – 11:50 AM **Wuqiang Li**, Consul, Consulate General of PRC in New York
"Overview of Optical and Wireless Communication R&D in the 863 Program"

11:50 – 12:20 PM **Stephen J. Socolof**, Managing Partner, New Venture Partners
"A Business Case for Mobile Broadband Data"

F4 – Luncheon (12:30-2:00 PM)
Keynote Speech: **Ed Chao**, Director, Mobility Solutions Product Management, Lucent Technologies
"Convergence of Wireless Services"

Poster Session (2:00-4:10 PM)

1. **Hanyu Li**, **Yu-Dong Yao**, and **Jin Yu**, Stevens Institute of Technology
   "Outage Probabilities of Wireless Systems with Beamforming"

2. **Ming Qu**, **Frank Y. Shih**, **Ju Jing**, and **Haimin Wang**, New Jersey Institute of Technology
   "Automated Recognition of Solar Flares in Real-Time Data"

3. **Chau Yuen** and **Yong Liang Guan**, Nanyang Technological University (NTU) and
   Tjeng Thiang Tjhung, Institute of Infocomm Research (I2R)
   "New High-Rate STBC with Good Dispersion Property"

4. **Lichuan Liu** and **Hongya Ge**, New Jersey Institute of Technology
   "Subspace Projection & Time-varying AR modeling for Anti-Jamming DS-CDMA Communications"

Parallel Technical Sessions (2:00-3:40 PM)

F5 – Technical Session I: Wireless and Wireline Convergence
Session Chair: **Benjamin Y.C. Tang**, Lucent Technologies
Session Co-chair: **Dong Sun**, Lucent Technologies

02:00 – 02:250 PM **Fuchun Joseph Lin**, Telcordia Technologies
"A Survey on Wireless/Wireline Integration"

02:25 – 02:50 PM **Benjamin Y.C. Tang**, Lucent Technologies
"Evolving to Wireless and Wireline Convergence – An Overview of IMS"

02:50 – 03:15 PM **Ming-Jye Sheng**, SysAir Inc.
"Requirements and Challenges for 3G/3.5G Mobile Terminal Tests"

03:15 – 03:40 PM **Thaddeus J.A. Kobylarz**, AT&T Wireless Services
"The Utility of Compound Wireless Services"

F6 – Technical Session II: Enabling Technologies for Optical Communications and Networks
Session Chair: **Xiang Liu**, Lucent Technologies
Session Co-chair: **Chongjin Xie**, Lucent Technologies

02:00 – 02:25 PM **Daniel C. Kilper**, *et al*., Lucent Technologies
"Optical Performance Monitoring Applications in Transparent Networks"

02:25 – 02:50 PM **Jay (Y.C.) Hsieh**, Optoplex Corporation
"Tunable Filter Based Reconfigurable Optical Network"

02:50 – 03:15 PM **Chongjin Xie**, Lucent Technologies
"Polarization Mode Dispersion and Its Mitigation Techniques in High Speed Fiber Optical Communication Systems"

03:15 – 03:40 PM **Hongbin Zhang**, *et al*., Tyco Telecommunications
"Enabling Technology for Suppressing Nonlinear Interchannel Crosstalk in DWDM Transoceanic Systems"

F7 – Panel Discussion I: What's Next in Wireless Multimedia (2:00-3:40 PM)
Moderator: **R. Chandramouli**, Stevens Institute of Technology

Panelists: **Nirwan Ansari**, Professor, Dept. of ECE, NJIT
Samir R. Das, Professor, Dept. of Computer Science, SUNY-Stony Brook
K.C. Lee, Director, Panasonic System Solutions Development Center of USA
Bruce McNair, Distinguished Service Professor, Dept. of ECE, Stevens
Sai Sankar N, Senior Member Research Staff, Philips Research

Break (3:40-4:10 PM)

Parallel Technical Sessions (4:10-5:50 PM)

F8 – Technical Session III: Wireless Ad Hoc Networks
Session Chair: **MengChu Zhou**, NJIT

04:10 – 04:35 PM **Hao Zhang** and **Zongping Jiang**, Polytechnic University
"Performance Evaluation and Improvement of Broadcasting Algorithms in Ad Hoc Networks"

04:35 – 05:00 PM **Yi Sun**, The City College of City University of New York
"Transport Capacity and Spectral Efficiency of Large Wireless CDMA Ad Hoc Networks"

05:00 – 05:25 PM **Liang Cheng**, Lehigh University
"Lightweight Service Advertisement and Discovery in Mobile Ad Hoc Networks"

05:25 – 05:50 PM **Harish Viswanathan**, *et al*., Lucent Technologies
"Hybrid Networks: Cellular-Relay Architecture"

F9 – Technical Session IV: Optical Communications and Network Systems
Session Chair: **Xiang Zhou**, AT&T Labs-Research

04:10 – 04:35 PM **Mark D. Feuer** and **Vinay Vaishampayan**, AT&T Labs-Research
"Lightpath Tracing in Photonic Networks"

04:35 – 05:00 PM **Paul Toliver** and **Shahab Etemad**, Telcordia Technologies
"Hyperfine Spectral Phase Coded Optical CDMA: Component Technologies and Networking Applications"

05:00 – 05:25 PM **Yi Cai**, Tyco Telecommunications
"Limit on Coding and Modulation Gains in Fiber-Optic Communication Systems"

05:25 – 05:50 PM **Y.-H. Kao** and **J.J. Benson**, Lucent Technologies
"DWDM Core Transport Technology"

F10 – Technical Session V: Digital Wireless Multimedia
Session Chair: **James Z. Lei**, ASTRI

04:10 – 04:35 PM **Wen Gao**, Institute of Computing Technology, Chinese Academy of Sciences
"China's New Audio-Video Standard − AVS Forum"

04:35 – 05:00 PM **Q. Peter Li** and **Wei Li**, Li Creative Technologies, Inc.
"Noise Reduction and Speech Enhancement for High-Quality Wireless Handsets"

05:00 – 05:25 PM **Tsong-Ho Wu** and **Nam Hong Cheng**, Telcordia Technologies
"Mobile Multimedia Collaboration Architecture and Applications"

F11 – Conference Reception (6:00-8:00 PM)

DAY 2 (SATURDAY, APRIL 23, 2005)

S1 – Opening Remarks (9:00-9:10 AM)
Conference Chair: **Tien Pei Lee**, Telcordia Technologies (Retired)
Honorable Guest: **Benjamin Cheng**, Chairman, ABC Digital Electronics

S2 – Plenary Session III (9:10-10:40 AM)
Session Chair: **Xiaomei Qian**, Amaranth Group

09:10 – 09:55 AM **Xiaomang Yu**, Commissioner, Development Strategy Consulting Committee, China Unicom
"Network Evolution and Wireless Services in China"

09:55 − 10:40 AM **Alice Chou**, Director, Information Services,
Taiwan Institute of Economic Research (TIER)
"The Strategy and Policy to Develop the Communication Industry in Taiwan"

Break (10:40 AM-10:50 AM)

S3 – Plenary Session IV (10:50 AM-12:20 PM)
Session Chair: **Deyu Zhou**, Opnext

10:50 – 11:20 AM **Zhaohui Wu**, Deputy Dean, College of Computer Science, Zhejiang University
"Embedded Computing and Sensor Networks"

11:20 – 11:50 AM **Ian Y. Chiou**, Director, Industrial Technology Research Institute (ITRI)
"Next Generation Broadband Communications"

11:50 − 12:20 PM **Shen-Chang Chao**, VP, ASTRI
"Multimedia Digital Home − Latest Advances and Applications"

S4 – Luncheon (12:30-2:00 PM)

Poster Session (2:00-4:10 PM)

5. **Zhigang Wang** and **MengChu Zhou**, New Jersey Institute of Technology
"Hybrid Networks: Cellular-Relay Architecture"

6. **Xuning Chen**, Princeton University
"Exploring the Design Space of Power-Aware Opto-Electronic Networked Systems"

7. **Zhen Guo** and **Mengchu Zhou**, New Jersey Institute of Technology
"Adaptive Mobility Prediction in Wireless Sensor Network"

8. **Yuecheng Zhang**, Lehigh University
"A Wireless Sensor Network for Earthquake Response Monitoring"

9. **Jin Yu** and **Yu-Dong Yao**, Stevens Institute of Technology
"Wireless Security: LPI Performance of Chaotic Signals"

10. **Qiang Zhao** and **Hongbin Li**, Stevens Institute of Technology
"Decode-Based Differential Modulation for Wireless Relay Networks"

Parallel Sessions (2:00-3:40 PM)

S5 – Technical Session VI: Broadband Wireless and Sensory Network
Session Chair: **Xiaodong Wang**, Columbia University
Session Co-chair: **Guosen Yue**, NEC Research Laboratories America

02:00 − 02:25 PM **Guosen Yue**, NEC Research Laboratories America
"Design and Analysis of LDPC for MIMO-OFDM"

02:25 − 02:50 PM **Frank Y. Shih** and **Yi-Ta Wu**, NJIT, and
Jian Liang Chen, National Dong Hwa University
"A Smart Sensor Network for Object Detection, Classification and Recognition"

02:50 − 03:15 PM **Jin Yu** and **Yu-Dong Yao**, Stevens Institute of Technology
"Secure Chaotic Spread-Spectrum Communication Systems"

03:15 − 03:40 PM **Loc Nguyen**, University of Paris XII and Paris VI
"A Model of Service Provision for Wireless Sensor Networks"

S6 – Technical Session VII: Applications of Fiber and Integrated Optical Communications
Session Chair: **Zhengyu Huang**, RSoft Design Group, Inc.

02:00 − 02:20 PM **Chee Wei Wong**, Columbia University
"Silicon Photonics"

02:20 − 02:40 PM **Minglai Kao**, Multiplex, Inc.
"Timing Jitter Control of an Add/Drop Optical Module in a Convergent Network"

02:40 − 03:00 PM **Kung-Li Deng**, GE Global Research Center
"Next Generation Fiber Optic Sensing and Its Applications"

03:00 − 03:20 PM **Ying (Emily) Hu**, Lucent Technologies
"Optical Control Planes: Status and Perspectives"

03:20 − 03:40 PM **Bing C. Wang**, University of Connecticut
"Multi-User Quantum Encryption Network"

S7 – Technical Session VIII: Emerging Multimedia Technologies
Session Chair: **Peng Yin**, Thomson Inc.

02:00 − 02:25 PM **Hong Man**, Stevens Institute of Technologies
"Directional Filterbank for Texture Image Classification"

02:25 − 02:50 PM **Xiaoan Lu**, Polytechnic University
"Minimizing Power Consumption of Source Encoding and Radio Transmission in Multiuser CDMA Systems"

02:50 − 03:15 PM **Juhua Zhu**, Princeton University
"Video Segmentation for Surveillance"

03:15 − 03:40 PM **Hang Liu**, Thomson Inc.
"Video Transmission over IEEE 802.11-based Wireless LAN"

Break (3:40-4:10 PM)

Parallel Sessions (4:10-5:50 PM)

S8 – Technical Session IX: Wireless Mobile Communications
Session Chair: **Shen-De Lin**, Lucent Technologies
Session Co-chair: **Tao Zhang**, Telcordia Technologies

04:10 − 04:35 PM **Gerard A. Brosnan**, Mitreteck Systems
"The Future of Mobile Data Services"

04:35 − 05:00 PM **Wenwu Zhu**, Intel Communicatons Technology Lab China
"Intel Communications Technology China Lab Wireless Overview"

05:00 − 05:25 PM **Michael Luddy**, Signal Processing Consultants
"Signal Processing Techniques for 3G Wireless Power Amplifier"

05:25 − 05:50 PM **Li-Chun Wang**, National Chiao Tung University
"A Network Perspective of MIMO Antenna Techniques with Multiuser Scheduler"

S9 – Technical Session X: Optoelectronics and Network Elements
Session Chair: **Haisheng Wang**, The Boeing Company

04:10 − 04:30 PM **Jian Jim Wang**, NanoOpto
"Redefine Optical Devices' Integration and Manufacturing through Nano-engineering"

04:30 − 04:50 PM **Louay Eldada**, Dupont Photonics
"Advances in Optoelectronic Technologies for ROADM Subsystems"

04:50 − 05:10 PM **Zhengyu Huang**, RSoft Design Group, Inc.
"Advanced Photonics Design Automation (PDA) Software for Integrated Optoelectronic Components and Optical Communication Systems"

05:10 − 05:30 PM **Hui Nie**, Triquint Optoelectronics
"High Performance, Low-Cost PIN, APD Receivers in Fiber Optical Networks and FTTx Applications"

05:30 − 05:50 PM **Kang-Yih (K.-Y.) Liou**, Multiplex, Inc.
"High-Speed Opto-Electronic Components for Digital and Analog RF Systems"

S10 – Technical Session XI: Interactive Multimedia
Session Chair: **Wen-Yi Zhao**, Sarnoff Corporation

04:10 − 04:35 PM **Ying Li**, IBM T.J.Watson Research Center
"Multimedia Content Analysis for E-Learning Application"

04:35 − 05:00 PM **Yingli Tian**, IBM T.J.Watson Research Center
"S3-R1: The IBM Smart Surveillance System Release 1"

05:00 − 05:25 PM **S. Kevin Zhou**, Siemens Corporate Research, Inc.
"Statistical Learning and Analysis for Unconstrained Face Recognition and Analysis"

05:25 − 05:50 PM **Dinkar Bhat**, Triveni Digital
"Opportunities for Data Broadcasting in Terrestrial Digital TV"

F1 and S1 − Opening Remarks

Conference Organizer

Kevin W. Lu
Telcordia Technologies
One Telcordia Drive, 1T-213, Piscataway, NJ 08854-4157, U.S.A.
klu@telcordia.com

BIOGRAPHY

Dr. Kevin W. Lu is Chief Scientist of Emerging Technologies and Services at Applied Research of Telcordia Technologies in Piscataway, New Jersey. He has more than 20 years of experience in wireless, optical, and multimedia communications research. He currently manages commercial projects on optoelectronics and system testing; conducts research in convergent communications; develops business for video surveillance and SIP-enabled collaboration in transportation and utility industries; and exploits RFID applications for telecommunications supply chain information systems.

Kevin received the B.S. degree in control engineering from National Chiao Tung University, Hsinchu, Taiwan, in June 1979, and the M.S. and D.Sc. degrees in systems science and mathematics from Washington University, St. Louis, Missouri, on May 22, 1981 and August 17, 1984, respectively. Working for Telcordia since August 20, 1984, he has conducted system engineering work and life-cycle economic analyses of various wireline and wireless broadband technologies and services. He has authored 58 journal or conference publications, and 46 internal technical memoranda. He received Telcordia Award of Excellence in 1987 for his substitution forecast models for timely asset depreciation based on both physical deterioration and technological obsolescence. He became Director of Broadband Access Network Engineering from September 1995 to March 1999, and Executive Director of Integrated Access and Operations from March 1999 to January 2003. His teams produced the Telcordia CEO Award recipients every year from 1998 to 2002 for their significant business impacts.

Kevin managed the Telcordia Horizons Research Program for BellSouth Science and Technology from 1997 to 2001. He also managed three government projects including Hospitals, Universities, Businesses, and Schools (HUBS) for the DARPA Next Generation Internet (NGI) Program, and Wide Bandwidth Information Infrastructure (WBII) and Wide Bandwidth Technology (WBT) for the U.S. Army Space and Missile Defense Command (SMDC). He has led demonstrable development of the Application-to-Application Virtual Private Network (AA-VPN) over enterprise networks that support DiffServ. He has recently managed the Wi-Fi-based Mobile Ad Hoc Networks (MANET) Project for the Chung-Shan Institute of Science and Technology (CSIST); the Ethernet Passive Optical Networks (EPON) and Fiber-to-the-Home (FTTH) Projects for the Computer and Communications Research Labs (CCL) of the Industrial Technology Research Institute (ITRI); and Opto-Electronics Testing Project for the ITRI Opto-Electronics and Systems (OES) Laboratories.

The highlights of Kevin's technical contributions include his IEEE JSAC paper [Vol.8, No.6, pp. 1058-1067, August 1990] concluding cost-effectiveness of Passive Optical Networks (PON) over other alternatives, his paper at the Eighth International Workshop on Optical/Hybrid Access Networks [Paper 2.3, Atlanta, Georgia, March 2-5, 1997] comparing cost-effectiveness of fiber-to-the-home and fiber-to-the-curb networks for various demands and densities, and his contribution in June 2000 to the Committee on Broadband Last Mile Technology of the National Research Council in Washington, DC [*Broadband – Bringing Home the Bits*, National Academy Press, Washington, D.C., 2002].

F1 and S1 − Opening Remarks

Conference Chair

Tien Pei Lee
Telcordia Technologies (Retired)
tplee2@juno.com

BIOGRAPHY

Dr. Tien Pei Lee retired from Bellcore (now Telcordia Technologies) in 1997 after a 34- year career in the Bell System (Bell Labs 1963-1984, Bellcore 1984-1997). From 1997 to 1999, he was appointed as the Program Director, Electrical and Communications System Division, National Science Foundation in Arlington, Virginia. From 2000 to 2003, he was a consultant in the Nanotechnolgy Laboratory, Princeton University, Princeton, NJ. He is a Fellow of IEEE, OSA, and Photonic Society of Chinese Americans. He is the recipient of Bell Labs Distinguished Member of Technical Staff award, Bellcore's President Recognition Award, the Engineering Achievement Award, Chinese Institute of Engineers, USA, and two-time winner of the R&D 100 Award.

From 1984 to 1995, Dr. Lee was the Director, Photonic Device Research, Bellcore. His group has pioneered the work on high-speed DFB lasers, strained quantum well lasers, and integrated DFB laser arrays. He was one of the task leaders in the MONET program sponsored by DARPA. From 1995 to 1997 he became the Chief Scientist, Optical Network Technology Division, Bellcore.

Dr. Lee received his BS degree from the National Taiwan University in 1957, and PhD. degree from Stanford University in 1963. He was with Bell Laboratories from 1963 to 1984 where he was engaged in the pioneering research on mm-wave varactor diodes, high power light emitting diodes, semiconductor lasers, high-speed photodetectors, and avalanche photodiodes for optical fiber communications.

Dr. Lee has published over 200 technical papers, 10 book chapters, and edited 5 books and held 8 patents in the area of microwave semiconductor devices, LEDs and semiconductor lasers, broadband optical amplifiers, and highly sensitive photodetectors.

He has received honorary professorships from many leading universities in China and Taiwan, including Peking University, Tsinghua University, The Beijing University of Post and Telecommunications, Wuhan Research Institute, Huazhong University of Science and Technology, the University of Electronic Science and Technology in Chengdu, the Shanghai Institute of Optics and Fine Mechanics, and Chiao Tong University, Hsinchu, Taiwan.

F2 − Plenary Session I

Session Chair

Qi Bi
Bell Laboratories, Lucent Technologies
Room 3D210, 67 Whippany Rd, Whippany, NJ 07981, U.S.A.
qbi@lucent.com

BIOGRAPHY

Dr. Qi Bi is a Bell Laboratories Fellow in the Mobility Solutions Unit of Lucent Technologies. He is well known in the industry as an expert in wireless mobile communications. He currently leads a team with responsibilities in analysis and design of third generation wireless digital communication systems. His present focus is on the areas of high-speed wireless data network delivering VoIP, broadcast and multicast services, push to talk, and broadband wireless communications.

Dr. Bi has 15 years of extensive experience in wireless communications. He was one of few pioneers worked on IS-95 CDMA technology since the very beginning. His early analyses of CDMA helped shaping Lucent CDMA strategy. He was among the first in Lucent to discover that forward link was the limiting link for IS-95 system when the focuses were on the reverse link. He was a key member of a small consulting team recommended not to invest in then compelling satellite opportunities such as Iridium. Most recently, he provided critical and convincing technical grounds for key service providers to converge to 1xEV-DO technology from a set of choices.

Dr. Bi received his BS and MS from Shanghai Jiao Tong University in 1978 and 1981 respectively, and later obtained his Ph.D. from the Pennsylvania State University in 1986. After joining Bell Laboratories as a Member of Technical Staff in 1988, he was awarded the Distinguished Member of Technical Staff in 1995, and became a Technical Manager in 1997.

Dr. Bi was the recipient of numerous honors including the *Advanced Technology Laboratory Award* in 1995 and 1996, the *Bell Labs President's Gold Award* in 2000 and 2002, the *Bell Labs Innovation Team Award* in 2003, the *Guest Professor of Shanghai Jiao Tong University* in 2000, the *Speaker of the Year* award from the IEEE New Jersey Coast Section in 2004 and the *Asian American Engineer of the Year* in 2005. In 2002, he was awarded the prestigious *Bell Labs Fellow* "for his pioneering contributions in analysis, design, and optimization of CDMA systems that resulted in Lucent Technologies' global success in digital wireless communications."

Dr. Bi is a recognized leader worldwide and has served as technical chair for many international conferences. He is the wireless program chair for the Wireless and Optical Communications Conference of 2005. He served as Technical Chair for the 3G Wireless Symposium from 2000 to 2003, Technical Vice Chair of the IEEE Wireless Communications and Network Conference in 2003, Technical Chair for the Wireless Symposium of IEEE Globecom from 2000 to 2002. In addition, he organized the 1st and the 2nd Lucent IS-95 and UMTS Technical Conferences in 1999 and 2000 and was Technical Chair of the Wireless Mobile ATM Conference in 1998 and 1999. His publication experience includes his current role as the guest editor for *Wireless Communications and Mobile Computing* from Wiley, experience as a Feature Editor of *IEEE Communications Magazine* in 2001, and as the Editor of the *IEEE Journal on Selected Areas in Communications* and the *IEEE Transaction on Wireless Communications*.

Dr. Bi holds more than 30 US patents, and has published many journal and conference papers. He also serves as the U.S. East Coast Chapter President of the Jiao Tong University Alumni Association. He is listed in Who's Who in America since 2002, and was featured in the November 8th issue of Shanghai Bund magazine in 2002.

F2 − Plenary Session I

ASTRI: Building the Technology Base for Hong Kong's Future

Robert J. Yang
Hong Kong Applied Science and Technology Research Institute (ASTRI)
5th Floor, 2 Science Park East Avenue, Hong Kong Science Park, Shatin, New Territories, Hong Kong
rjyang@astri.org

ABSTRACT
The Government of the Hong Kong Special Administrative Region founded the Hong Kong Applied Science and Technology Research Institute Company Limited (ASTRI) in 2001 to capture the promises of technological advances for Hong Kong through world-class applied research. In September 2004, ASTRI completed its five-year strategic plan with an objective to become Greater China's most customer-focused applied research institution by continuously producing a substantial volume of world-competitive intellectual properties, and transfer them cost-effectively to the burgeoning local technology industries of Hong Kong, Pearl River Delta and the rest of China, and in so doing, position Hong Kong as a vital driving force for technology in the region. The plan calls for ASTRI to utilize Hong Kong's unique comparative advantage as the only first-world economy in all of China to build a distinctive human resource edge in technology, and execute a totally customer-focused approach toward R&D that would produce substantial industrial impact in a predictable manner year in and year out.

As a research institution, ASTRI's R&D activities focus on four closely interrelated technological domains – IC design, wireless communications, enterprise and consumer electronics and next generation material and packaging technologies. By engaging in the pursuit of customer-focused excellence in these highly innovation- and knowledge-intensive fields, we will strive not only to execute our organization's impact-driven missions but also to provide the challenging working environment for our employees to accelerate their personal development and advance their careers in and beyond ASTRI. At ASTRI, we believe organizational achievement and individual growth are inseparable, and it is the execution of this belief that will ultimately determine the outcome of our plans.

BIOGRAPHY
Dr. Robert J. Yang is the CEO of the Hong Kong Applied Science and Technology Research Institute Company Ltd. (ASTRI), an applied research institution focused on the development and dissemination of next generation information and communications technologies for the growing technology industries of Hong Kong, Pearl River Delta and Greater China. Prior to joining ASTRI in May 2004, he was the Executive Vice President of the Industrial Technology Research Institute (ITRI) of Taiwan.

Dr. Yang is an R&D manager who is well-recognized for his exemplary track records in getting results out of research. In 2002, he spearheaded Taiwan's six-year, US$620 million Nanotechnology Program, by far the largest R&D program ever launched by Taiwan, and served as its founding Executive Director. His strategy on industry-focus resulted in the transfer of 59 technologies to Taiwan's industry per year in just the program's second year. Earlier, he planned and directed ITRI's now well-known Open Laboratory Program which incubated over a hundred new technology companies with a total capitalization of over 1.2 billion US dollars in the program's first seven years of operation. Prior to that, as the overall manager of ITRI's environmental technology programs, he led a team of researchers who developed a wide range of application-driven environmental technologies that were implemented at over 1,000 sites in Taiwan. As the Vice President and General Director of ITRI's Energy and Resources Laboratories (ERL) in the late 1980's, he built ERL from a conventional research laboratory into a market-driven technology center and grew its R&D output from zero to 43 technologies transferred to industry per year in his seven years tenure there.

Dr. Yang is an Honorary Professor of Chiao Tung University of Taiwan, and a founder of the APEC R&D Leaders Forum. He earned his Ph.D. degree at the University of Washington in the United States.

F2 − Plenary Session I

Perspectives on Photonic Integration

T. L. Koch
Lehigh University
205 Sinclair, 7 Asa Drive, Bethlehem, PA 18015, U.S.A.
tlkoch@lehigh.edu

ABSTRACT

Photonic integration can be viewed as a replacement technology from two perspectives; replacing discrete optical solutions with improvements in cost, size, and power, but also enabling the evolving replacement of network functionality that has historically been provided in the electronic domain.

This talk will explore the status of integration in the world of photonics, both from technological and market or application perspectives. The tenuous analogy with the history of electronic integration is examined to gain a better understanding of the expectations and role of photonic integration. Additionally, this talk will discuss the evolving role that photonics is playing in communications networks, and the impact of this evolution as a driver for integration.

BIOGRAPHY

Dr. Tom Koch is a joint Professor in ECE and Physics at Lehigh University, and holds the Daniel E. ’39 and Patricia M. Smith Endowed Chair of Director, Center for Optical Technologies. Prior to this Tom held Vice President positions at SDL, Lucent, and most recently at Agere Systems where he led the Technology Platforms organization.

Tom received his AB in Physics from Princeton and his Ph.D. in Applied Physics from Caltech in 1982 working under Prof. Amnon Yariv. Joining Bell Labs Research in that year, his contributions in optoelectronic technologies enabled key advances in high-capacity optical fiber communications. Tom has chaired numerous major international conferences, authored more than 275 conference and journal publications, book chapters, and books. He has received the William Streifer Award for Scientific Achievement and the Distinguished Lecturer Award from the IEEE LEOS, is a Fellow of Bell Labs, the OSA, and the IEEE.

F2 − Plenary Session I

Convergent Communication Technologies and Services with Context Awareness

Biing-Hwang (Fred) Juang
Georgia Institute of Technology
Atlanta, Georgia 30332-0250, U.S.A.
juang@ece.gatech.edu

ABSTRACT

The worlds of universal telephony and best-effort data networking, two disparate communication services in the past, are converging to one in which the user's multimedia experiences are becoming increasingly rich, personalized, spontaneous and interactive. The so-called converged network has set the stage for user-centric broadband services. For example, on-demand media is expected to encompass a multiplicity of information sources (from MP3 download and digital audio broadcast to mobile video), networks (from dialed-up to WiMax) and terminal devices (from multimedia PDA with 3G mobile to HDTV). This calls for innovations in efficient and intelligent content processing, distribution and information management. Even more fundamentally, as service personalization (in the general term of context which includes situation, location and availability) becomes the critical differentiation factor in the market, the new convergent communication may demand an architectural focus that will prove indispensable in the trustworthy support and management of context-aware services. In this talk, we articulate for such a vision and point out technical challenges that have to be harnessed in order to realize the vision of right information and right service at the right time.

BIOGRAPHY

Professor Biing-Hwang (Fred) Juang received his Ph.D. from University of California, and had worked at Speech Communications Research Laboratory (SCRL) and Signal Technology, Inc. (STI) on a number of Government-sponsored research projects from 1979 to 1982. Notable accomplishments during the period include development of vector quantization for voice applications, voice coders at extremely low bit rates, 800 bps and around 300 bps, and robust vocoders for use in satellite communications. He subsequently joined the Acoustics Research Department of Bell Laboratories, working in the area of speech enhancement, coding and recognition. Dr. Juang became Director of Acoustics and Speech Research at Bell Labs in 1996, and Director of Multimedia Technologies Research at Avaya Labs (a spin-off of Bell Labs) in 2001. His group continued the long heritage of Bell Labs in speech communication research, including, most notably, the invention of electret microphone, network echo canceller, a series of speech CODECs, and key algorithms for signal modeling and automatic speech recognition.

Prof. Juang has published over 150 papers, including the book "Fundamentals of Speech Recognition", co-authored with L.R. Rabiner, and holds about twenty patents. He has served as Editor-in-Chief of IEEE Transactions on Speech and Audio Processing (1996-2002), Chair of the Technical Committee on Neural Networks for Signal Processing (1991-93), member of the Conference Board of the IEEE Signal Processing Society (1988-93), member of a number of advisory boards, and Chair of the Fellow Committee of the IEEE Signal Processing Society. He has received numerous awards, including the Technical Achievement Award from the IEEE SP Society, the IEEE Third Millennium Medal, IEEE Fellow, Bell Labs Fellow, and Bell Labs President's Gold Award. He is currently Motorola Foundation Chair Professor and Georgia Research Alliance Eminent Scholar at the School of Electrical and Computer Engineering of Georgia Institute of Technology which he joined in 2002. Prof. Juang is a member of the National Academy of Engineering of the United States of America.

F3 − Plenary Session II

Session Chair

Heather Yu
Panasonic Digital Networking Laboratory
Two Research Way, Princeton, NJ 08540, U.S.A.
heathery@research.panasonic.com

BIOGRAPHY

Dr. Heather Yu is a Senior Scientist at Panasonic Digital Networking Laboratory. She received her B.S. degree from Peking University, her M.A. and Ph.D. degrees from Princeton University all in Electrical Engineering. In 1998, she joined Panasonic where her major focus is multimedia communications and multimedia information access R&D. Her current research interests include digital rights management and multimedia content access and distribution in consumer networks. In the multimedia security area, she holds two US patents, has many patents pending, published a variety of technical papers in prestigious conferences and journals, and has given three tutorials at IEEE multimedia, communications, and consumer electronics conferences.

Currently, Dr. Yu serves as Chair of IEEE ComSoc Multimedia Communications Technical Committee, Associate Editor for IEEE Trans. on Multimedia, Editor for ACM Computers in Entertainment, IEEE Multimedia Magazine, and Informing Science Journal, Conference Steering Committee Member of IEEE ICME and IEEE CCNC, Technical Program Co-chair of IEEE 2005 International Symposium on Multimedia (SM2005), and Technical Program Chair of IEEE 2006 Consumer Communications and Networking Conference (CCNC2006). From 1998-2004, she served as conference technical program chair, associate chair, session chair, technical committee member, best paper award committee member, keynote speaker, panelist, panel chair, and steering committee member for many conferences.

F3 − Plenary Session II

Converged Services and the Telco of the Future

Mike Schwartz
Telcordia Technologies
One Telcordia Drive, 4A-762, Piscataway, NJ 08854-4157, U.S.A.
mas85@cc.telcordia.com

ABSTRACT

Traditional fixed-line Telcos as well as newer mobile operators are facing competitive and profit-affecting challenges as broadband network access and IP services roll out to customers. Entry barriers for competitors are continually dropping, making it increasingly important to differentiate services by something other than price. This talk will review recent announcements from operators around the world and will explore the competitive challenges being faced by fixed-line operators. The promise of converging voice, data, video and mobility services under a single platform to offer market differentiation and competitive advantages will be discussed, revealing both the technical challenges and the business opportunities.

BIOGRAPHY

Mike Schwartz is the Telcordia Technologies Executive Director of Strategy and Market Analysis. He is responsible for identifying the impact of technology, regulation, and competition on Telcordia's Next Generation Software Products and Solution offerings. His work influences product and solutions investments, market plan development, competitive response, distribution and alliance strategies, and internationalization strategies.

Mr. Schwartz's career spans over 36 years in the telecommunications industry. Mr. Schwartz has led organizations responsible for the development of industry technical requirements and standards, and organizations responsible for the development and execution of conformance and interoperability test capabilities. He was responsible for the implementation of a new business within Telcordia to bring Telcordia's technical services to the telecommunications equipment supplier market place.

Mr. Schwartz received his BS (EE) from Rensselaer Polytechnic Institute in New York State, and his MSEE from the University of California-Berkeley.

Mr. Schwartz is a member of the Tau Beta Pi Engineering Honor Society, and a Senior Member of IEEE. He holds a seat on the Council of the ***World Telecommunications Congress*** and ***International Symposium on Services and Local accesS*** (ISSLS) and is a former Chairman of the ISSLS Council and its financial board.

F3 − Plenary Session II

Overview of Optical and Wireless Communication R&D in the 863 Program

Wuqiang Li
Consul, Consulate General of PRC in New York
520 12th Avenue, New York, NY 10036-1003, U.S.A.
liwuqiang@yahoo.com

ABSTRACT

The 863 Program is China's most important high-tech Research and Development Program. Communication is one of the four topics of the Information Technology Area of the program. Communication Topic includes three main important orientations:

1. New generation information network technology
2. Optical communication Technology
3. Personal communication technology

The aim of the program is, through the carrying out of its projects, to put forward some technology standard suggestions having international influence, develop some communication system with China's own intellectual property and application value; set up a high performance broadband information pilot network, and train a research team with sustainable development for communication technology area; promote the development of communication industry.

This presentation will focus on optical communication and personal communication of the 863 program.

BIOGRAPHY

Name:	**Wuqiang Li**, Consul, Consulate General of the PRC in NY
Birthday:	Jan. 05, 1947
Birthplace:	Xi'an, Shaanxi Province, China
1965-1970:	Student, Radio Engineering Dept., Xi'an Jiaotong University
1970-1980:	Engineer, Fuxian Broadcasting Station, Shaanxi
1980-1983:	Visiting scholar, Ecole Nationale Superieure de l'Electronique et de Ses Applications, France
1983-1988:	Deputy Director, Robotics Centre, Automation Institute, Ministry of Machine-Building Industry, Beijing
1988-1989:	Project officer, State Science and Technology (SSTCC)
1990-1994:	Second, then, First Secretary, Mission of the P.R. of China to the European Commission, Brussels
1994-1997:	Director, Automation Division. High Tech. Dept. SSTCC
1998:	Director, Telecommunication Division, High Tech. Dept. SSTCC
1999-2001:	Counselor, Chinese Embassy in Denmark
2001:	Director, IT Division, Dept. of High and New Technology Development and Industrialization, Ministry of S/T
2002-2004:	Deputy Director General, High and New Technology Development and Industrialization, Ministry of S/T

F3 − Plenary Session II

A Business Case for Mobile Broadband Data

Stephen J. Socolof
New Venture Partners LLC
98 Floral Avenue, Murray Hill, NJ 07974, U.S.A.
ssocolof@nvpllc.com

ABSTRACT

As a venture capitalist, we are seeing a new wave of innovation and investment opportunities occurring in the communications industry around fixed and mobile broadband access. This is a result of (1) a growing appetite for ubiquitous accessibility to the internet and all of the services it can offer, (2) infrastructure technologies maturing to the point of readiness for trial and deployment, and (3) new value-added service offerings being created to leverage the infrastructure. We'll talk about some of the companies in our portfolio, like Flarion, that are riding this wave.

BIOGRAPHY

Steve Socolof is Managing Partner of New Venture Partners (NVP). He concentrates on Optical and Semiconductor Components and Networking and Communications investment sectors. He currently works with the following NVP portfolio companies: DAFCA, Flarion, InPhase, and SyChip.

Steve joined Lucent at its inception in 1996, working in the Corporate Strategy and Business Development organization. There, he was charged with developing an internal venture capital model as an alternate approach to Lucent's business unit structure to quickly develop technology for the market. Subsequently, he became a Vice President of what emerged as the New Ventures Group.

Prior to Lucent, Steve spent eight years with the management consulting firm Booz, Allen and Hamilton. At Booz, Steve was one of the firm's leaders in helping clients improve their innovation and product development processes. He worked with R&D organizations of many companies ranging across consumer products, electronics, engineered materials, and medical products.

Steve received his Masters in Business Administration degree from the Amos Tuck School at Dartmouth College. He holds a Bachelor of Arts degree in Economics and a Bachelor of Sciences degree in Mathematical Sciences from Stanford University.

F4 – Luncheon Keynote

Convergence of Wireless Services

Ed Chao
Lucent Technologies
67 Whippany Road, Whippany, NJ 07981, U.S.A.

ABSTRACT

Today's end users want access to their communications and entertainment services from multiple places such as home or office using different devices without separate accounts. Users want to be able to share contact lists as they access and share all types of content; voice, video and data. To offer converged, blended lifestyle services, service providers are providing bundling through network IP and value over IP. This talk focuses on the importance of blended lifestyle, converged services for operators and end-users, as well as the enablers of service convergence. In this talk, several key enabling technologies including IMS, VoIP, and other Bell Labs innovations will be discussed that will greatly enhance service providers capability to offer innovative blended lifestyle applications.

BIOGRAPHY

Ed Chao is a Director of Product Management of the Mobility Solutions product unit at Lucent Technologies. He has worked in the wireless industry for over 15 years. Mr. Chao has responsibility for the CDMA products, including new product introduction for new air-interface technologies such as 3G-1X, 1xEV-DO, and future evolutions. He is also responsible for driving the convergence of CDMA with Lucent's FMS core products towards enabling capabilities for VoIP and other multimedia services. Mr. Chao holds an MBA degree from Columbia University, and a MSEE from Georgia Tech.

F5 − Technical Session I: Wireless and Wireline Convergence

Session Chair

Benjamin Y.C. Tang
Bell Laboratories, Lucent Technologies
101 Crawfords Corner Road, Holmdel, NJ 07733, U.S.A.
btang@lucent.com

BIOGRAPHY

Dr. Benjamin Y.C. Tang is a Distinguished Member of Technical Staff at Bell Labs, Lucent Technologies in Holmdel, New Jersey. He received a B.S. degree from the National Taiwan University, M.S. from the University of Florida, and Ph.D. from Purdue University, all in electrical engineering. Currently, Dr. Tang's work focuses on network architecture, design and optimization, and network evolution planning and economic analysis for next-generation packet core (MPLS), broadband access and IMS converged network solutions. Many of his works involve joint studies and development of network evolution strategy for major carriers in China, Asia Pacific and North America. Dr. Tang's areas of interest include all aspects of data and broadband networking technologies, IMS and NGN standards, and network optimization algorithms.

F5 − Technical Session I: Wireless and Wireline Convergence

Session Co-chair

Dong Sun
Bell Laboratories, Lucent Technologies
101 Crawfords Corner Road, Holmdel, NJ 07733, U.S.A.
dongsun@lucent.com

BIOGRAPHY

Dr. Dong Sun is a Member of Technical Staff in Networking Technologies and Performance Department at Bell Labs, Lucent Technologies in Holmdel, New Jersey. He holds a B.S. degree from the University of Electronic Science and Technology of China, an M.S. degree from Communications Telemetry and Telecontrol Research Institute, China, and a Ph. D. degree from Stevens Institute of Technology in Hoboken, New Jersey, all in electrical engineering. His current work focuses on network architecture, solutions and QoS etc aspects in the IMS/NGN, VoIP technology, ATM and IP/MPLS data network planning, design and optimization, and 3G wireless network architecture, modeling and cost analysis. His research interests include all aspects of wireline and wireless architecture, service and network convergence, and network design, optimization, and engineering. He is a senior member of the IEEE.

F5 − Technical Session I: Wireless and Wireline Convergence

A Survey on Wireless/Wireline Integration

Fuchun Joseph Lin
Telcordia Technologies
1 Telcordia Drive, Piscataway, NJ 08854-4157, U.S.A.
fjlin@ieee.org

ABSTRACT

Telecommunication operators started to address the issues of wireless/wireline integration since mid 1990s. Back then, the emphases were (1) how to make wireline voice features such as call waiting, call forwarding, three way calling, voice mails available to wireless subscriber, (2) how to add mobility to wireline services via calling card, prepaid service, and personal toll free number, and (3) how to merge network infrastructures such as Wireless and Wireline Intelligent Networks (WIN, CAMEL, AIN, and IN) to maximize resource sharing. While the work from mid 1990s is still continued (e.g., wireless E-911, number portability are still under deployment in many parts of the world), the wireless/wireline integration today has taken a new form due to the emergency of (1) new wireless access technologies and (2) network evolution toward a convergent IP architecture.

This talk will survey the most recent development in this area of wireless/wireline integration. We will look at the short-term wireless/wireline integration efforts by telecommunications operators such as Verizon, SBC, BellSouth, BT, and KT etc. We will also look at more exciting, long-term efforts in standards bodies such as 3GPP, ETSI TISPAN, and ATIS of using IMS (IP Multimedia Subsystem) as the core for this integration. Moreover, we believe devices and service management will play an important role in making this integration happen and will comment about their necessity in the talk.

BIOGRAPHY

Dr. Fuchun Joseph Lin is a Chief Scientist in Applied Research of Telcordia Technologies (Formerly Bellcore). He has seventeen years of experience in both Bell Labs and Telcordia Technologies. He received his Ph.D. in Computer Science from the Ohio State University in Columbus, Ohio and his BS and MS in Computer Science from National Chiao-Tung University in Hsinchu, Taiwan. He joined Applied Research of Telcordia Technologies in 1992 after four years of work experience at Bell Labs in the 5ESS Switching Division. At Telcordia, his current focus is in service integration and convergence for next generation networks. He serves as a project manager and technical director, managing Telcordia research programs in the areas of next generation wireless/wireline networks. He is a member of the IEEE Communications and Computer Societies, and also a member of the ACM. He has won two patents and published two dozens of technical papers in professional conferences and journals.

F5 − Technical Session I: Wireless and Wireline Convergence

Evolving to Wireless and Wireline Convergence – An Overview of IMS

Benjamin Y.C. Tang
Bell Laboratories, Lucent Technologies
101 Crawfords Corner Road, Holmdel, NJ 07733, U.S.A.
btang@lucent.com

ABSTRACT

Originally specified by 3GPP to support IP multimedia services for mobile users, IMS (IP Multimedia Subsystem) has become the foundation for future wireless and wireline convergence. IMS offers service providers the opportunity to build an open IP based service infrastructure that will enable an easy deployment of new rich, personalized multimedia communication services mixing telecom and data services. IMS is access agnostic so that a common IMS based service platform can be built to support various access mechanisms such as DSL, cable, wireless (CDMA, UMTS) and WiFi/WiMax. As such, IMS promises a cost-effective evolution path to future wireless and wireline convergence that meet next-generation service demands and requirements.

This talk provides an overview of IMS from market, technology and business perspectives. We first look at market drivers for next-generation services supported by IMS. The IMS functional architecture being developed in standards and solution for a wireless and wireline converged network are then examined at a high level. The talk concludes with a few key findings from IMS business cases that demonstrate the potential CapEx/OpEx savings and revenue increase made by IMS over conventional point solutions.

BIOGRAPHY

Dr. Benjamin Y.C. Tang is a Distinguished Member of Technical Staff at Bell Labs, Lucent Technologies in Holmdel, New Jersey. He received a B.S. degree from the National Taiwan University, M.S. from the University of Florida, and Ph.D. from Purdue University, all in electrical engineering. Currently, Dr. Tang's work focuses on network architecture, design and optimization, and network evolution planning and economic analysis for next-generation packet core (MPLS), broadband access and IMS converged network solutions. Many of his works involve joint studies and development of network evolution strategy for major carriers in China, Asia Pacific and North America. Dr. Tang's areas of interest include all aspects of data and broadband networking technologies, IMS and NGN standards, and network optimization algorithms.

F5 − Technical Session I: Wireless and Wireline Convergence

Requirements and Challenges for 3G/3.5G Mobile Terminal Tests

Ming-Jye Sheng
SysAir Inc.
2147 Route 27, Edison, NJ 08817, U.S.A.
mjsheng@sysair.com

ABSTRACT

As the worldwide UMTS/WCDMA 3G/3.5G network deployment scheduled for next couple of years, mobile terminal testing industry strives to supply test equipment with sufficiently good features to meet the needs. I would like to share my industry experience on the requirements and technical challenges in building mobile terminal test equipment (also known as Network Simulator). The test applications covered in this presentation will include baseband chip and protocol design, manufacturing test, conformance test, and application test.

BIOGRAPHY

Dr. Ming-Jye Sheng has broad experience in WCDMA L1/L2/L3 radio interface protocol. He is the founder and CTO of SysAir Inc. since 2002. The company had completed several WCDMA baseband and protocol design projects with Taiwan's ITRI Computer and Communication Lab, and III Network and multimedia Lab.

From 2000 to 2002, Dr. Sheng was with Wiscom Technologies, a multi-millions start-up company, designing and manufacturing WCDMA baseband chip for mobile handset manufactures in Taiwan and China. He served as director of software development for phased delivery of Mobile Terminal Protocol Software. In this capacity, he also developed technical/business partnership with Chinese Mobile Manufacturers.

From 1996 to 2000, Dr. Sheng was with Lucent Bell Labs as a Distinguished Member of Technical Staff as a lead system engineer of the WCDMA NTT DoCoMo project for the design of the 3G CDMA Radio Network Controller and Base Station. Dr. Sheng's WCDMA protocol design contribution help complete delivery of the Lucent Version 2 prototype to the NTT DoCoMo, and brought multi-million commercial contract as well as R&D funding into the Lucent DoCoMo project.

In early nineties, He also worked at AT&T Bell Labs on network provisioning project, and then co-founded start up company for internet service. His research interest included wireless system, parallel and distributed computing, and VLSI computation. Dr. Sheng received BSEE from the Cheng Kung University, Taiwan, MS from Taiwan University, Taiwan, and Ph.D. in CS from the Ohio State University.

F5 − Technical Session I: Wireless and Wireline Convergence

The Utility of Compound Wireless Services [1]

Thaddeus J.A. Kobylarz
AT&T Wireless Services
t.kobylarz@ieee.org

ABSTRACT

The wireless telecommunications industry is undergoing a veritable "roller coaster" ride. The "boom" years of the 1990's gave way to "bust" years. Currently, a "plateau" of little change is being experienced. Although hope exists for another stratospheric ascent, the much heralded investment in a data infrastructure has not had much of an influence. Staid voice communications still remains the only "killer" application, leading to excess communications capacity and little capital return from the data infrastructure investment.

This talk will provide examples within a data services class that have the potential of substantial capital returns. This class of data services is termed Compound Wireless (Mobile Communication) Services or CWS's. Compound Wireless Services are beyond 3G and are not now available. Nor are they planned for 3G wireless systems. However, they represent a natural extension beyond 3G and provide an incentive for users/subscribers to desire 3G data services. It is believed that Compound Wireless Services will make the wireless telecommunications terminal an indispensable data tool and will subjugate voice communications to a secondary service. That is, the CWS class will contain many "killer" application services.

A Compound Wireless Service is a service consisting of linked component services. When invoked, a CWS will cause the component services to be executed in a sequence prescribed by the CWS. The following CWS example is intended to assist in defining this class of services. Consider having a severe time constraint for driving a vehicle between two geographic points. This may apply to commuting between one's home and a place of employment, or for a limousine driver to arrive at an airport in time for a passenger's flight, or for a chartered bus to reach its tour destination in a timely manner, etc. The main three component services employed to achieve this need are:

1. Location service − to determine the present location of a wireless terminal in the vehicle.
2. Travel route computation − to compute the least time consuming drive between the current wireless terminal location and a designated destination (e.g., airport).
3. Traffic information retrieval − to interrogate traffic information systems available from state police and other sources for the regions of the travel route.

The user/subscriber programmed wireless service consists of continual iterations of these three services until the destination is reached. The iteration sequence can consist of the following steps:

1. Determine present location (service 1) and provide it to the wireless terminal. If the present location is the same as the destination, inform the user/subscriber and cease the iteration of services.
2. Compute the least time consuming route from the present location to the designated destination (service 2). If the route has changed, alert the user/subscriber (orally/graphically/textually) of a new route and its directions.
3. Retrieve traffic information for the route's regions (service 3) and determine if traffic delays (e.g., due to an accident) would ensue. If traffic delays exist ahead, repeat step 2 with the updated delay information. If no traffic delays exist ahead, go to step 1.

The preceding and other examples will be provided in the talk with more detail.

[1] A pending patent protects the compound wireless services concept and ideas cited in this abstract.

BIOGRAPHY

Dr. Thaddeus J.A. Kobylarz has received a BSEE from the New Jersey Institute of Technology, a MSEE from the University of Vermont, and a Ph.D. in EE and Computer Science from the North Carolina State University. The first part of his career was in academia as an Assistant Professor at Princeton University, an Associate Professor at Stevens Institute of Technology, and the EE Department Chairman at the University of Petroleum and Minerals (Dhahran, Saudi Arabia). The second part of his career encompassed over 20 years at Bell Laboratories, principally as an (hardware/software) architect. In his final five years he represented Lucent Technologies at wireless standards committees. The wireless standard IS-813 was published while he was chairman of TIA TR-45.7. After retiring from Bell Laboratories in 2001, he was a standards representative consultant for AT&T Wireless Services. As the rapporteur of the 3GPP "Charging and Billing" group, four GSM standards were published (TS32.200, TS32.205, TS32.215, and TS32.235). Besides numerous technical reports, he has published over 40 papers and co-authored a book. He has worked on various computer and communications topics, with an emphasis on wireless services.

F6 − Technical Session II: Enabling Technologies for Optical Communications and Networks

Session Chair

Xiang Liu
Bell Laboratories, Lucent Technologies
791 Holmdel-Keyport Road, Room R-113, Holmdel, NJ 07733, U.S.A.
xliu20@lucent.com

BIOGRAPHY

Dr. Xiang Liu received the B.S. degree from Beijing Normal University, China, in 1989 and the M.S. degree from the Institute of Physics, Chinese Academy of Sciences, in 1994, both in physics. He received the Ph.D. degree in applied physics from Cornell University, Ithaca, NY, in 2000. His doctoral work was on ultrafast optics and spatiotemporal solitons. He and his coworkers experimentally demonstrated the first generation of optical spatiotemporal solitons. He joined Bell Laboratories, Lucent Technologies, as a Member of Technical Staff in 2000. Since then he has been primarily working on next-generation optical fiber communications technologies, including advanced modulation formats, mitigation of nonlinear penalties in high-speed transmissions, novel dispersion managements, forward-error-correction, and mitigation of polarization-mode dispersion, through analytical modeling, numerical simulation, and experiments. He has authored or co-authored approximately 60 archival journal papers and 30 conference papers. He has received more than ten international patents. Dr. Liu is a Senior Member of the IEEE.

F6 − Technical Session II: Enabling Technologies for Optical Communications and Networks

Session Co-chair

Chongjin Xie
Bell Labs, Lucent Technologies
791 Holmdel-Keyport Road, Holmdel, NJ 07733, U.S.A.
chongjin@lucent.com

BIOGRAPHY

Dr. Chongjin Xie received his M.Sc. in 1996 and Ph. D in 1999 from Beijing University of Posts and Telecommunications, Beijing, China. From 1999 to 2001, he worked at Photonics laboratory, Chalmers University of Technology, Gothenburg, Sweden for about one and half years to conduct post-doctorate research. He joined Bell Laboratories, Lucent Technologies in Holmdel, New Jersey, USA as a Member of Technical Staff in 2001. His research interests are in fiber optical communication systems and networks, including high-speed lightwave transmission, polarization mode dispersion, polarization dependent loss, modulation formats, and all-optical networks.

F6 − Technical Session II: Enabling Technologies for Optical Communications and Networks

Optical Performance Monitoring Applications in Transparent Networks

D. C. Kilper, C. R. Giles, W. Weingartner, and **A. Azarov**
Bell Laboratories, Lucent Technologies
791 Holmdel-Keyport Rd., Holmdel, NJ 07733, U.S.A.
dkilper@lucent.com

P. Vorreau and **J. Leuthold**
High-Frequency and Quantum Electronics Laboratory, Department of Electrical Engineering and Information Technology, University of Karlsruhe, 76128 Karlsruhe, Germany

ABSTRACT

Optical performance monitoring (OPM) is an enabling technology for highly transparent and re-configurable networks. Simple OPM functions such as channel monitoring and discovery are requirements in re-configurable systems. Large transparent regions of the network either created by long transmission distances or transparent pass-through at cross-connect or add-drop nodes create new challenges in terms of both locating and diagnosing faults. OPM devices can provide greater visibility into signal health and enable remote troubleshooting. We examine advanced OPM methods and technologies with potential to enhance fault management. Clear technology requirements are determined by identifying specific applications. For example, a typical fault isolation cycle in which the OPM measurement history is reviewed in response to end terminal performance monitoring (PM) alarms. The required sensitivity for both Q-factor and optical signal to noise ratio (OSNR) monitoring is determined by the need to correlate the OPM readings with the end terminal alarms. Another potential application for OPM is Quality of Service (QoS) monitoring in systems that utilize all-optical regeneration. In this case dedicated per-channel monitoring is required and therefore integration with the regeneration device is desirable. An OPM device that is derived from an SOA-based wavelength converter and regenerator is described as a promising solution. By focusing on the application, we identify OPM technology needs for enabling new advances in transparent networks.

BIOGRAPHY

Dr. Daniel C. Kilper received the B. S. degree in electrical engineering and the B.S. degree in physics from Virginia Polytechnic Institute and State University, in 1990, and the M. S. and Ph. D. degrees in physics from The University of Michigan, Ann Arbor, in 1992 and 1996. Following his PhD work, he was a post-doctoral research scientist at the Montana State University Optical Technology Center in the department of physics. In 1997 he became an assistant professor of physics at the University of North Carolina, Charlotte. He joined the Advanced Photonics Research Department at Bell Laboratories, Lucent Technologies in 2000. His current research interests at Bell Laboratories include transparent and re-configurable optical network architectures and control systems, optical performance monitoring, and the dynamic properties of optical amplifiers.

F6 − Technical Session II: Enabling Technologies for Optical Communications and Networks

Tunable Filter Based Reconfigurable Optical Network

Jay (Y.C.) Hsieh
Optoplex Corporation
3390 Gateway Boulevard, Fremont, CA 94538, U.S.A.
jayhsieh@optoplex.com

ABSTRACT
Reconfigurable optical add/drop (ROADM) is one of the most important topics for today's optical network, for the ROADM subsystem provides the node with the highest flexibility. Flexibility is defined as the ability to change the disposition of a wavelength from add, drop, or pass-through without interrupting traffic on any other wavelength. Two major approaches have been taken: wavelength selection switch (WSS) and tunable filter based optical add/drop (TOADM).

In this talk, we report a few schemes, which provide certain degrees of recofigurabilities. Typically, the flexibility and cost are contradictory to each other. We will compare these approaches in terms of performance, cost and availability.

BIOGRAPHY
Dr. Jay Hsieh is the chief technology officer of Optoplex Corporation, Fremont, California. Dr. Hsieh joined Optoplex in 2001, responsible for developing optical components for telecommunication network. In the past four years, he has led the team to design and manufacture interleaver, TOADM (tunable optical add/drop module), OPM (optical performance monitoring module) and DLI (delay-line interferometer). Those products enable to narrower the channel spacing, higher the data transfer rate, and enhances the flexibility of the networks. Under Dr. Hsieh's supervision, in 2004, Optoplex shipped the first asymmetric optical interleaver to provide the flexibility of bandwidth allocation among the two output ports. In addition to that, in 2005, Dr. Hsieh has developed the first athermal, compact, C+L-band DPSK demodulator for 40Gbit/s optical signal.

Dr. Hsieh received his B.S and M.S. in Physics from National Tsing Hua University, Taiwan. He obtained his PhD in Optics in 1996 from Optical Science center, University of Arizona, Tucson, Arizona. At the University, Dr. Hsieh's research was focusing on the topic of optical recording, including magneto-optics and phase-change optics technologies. The research area covers recording system design and recording material characteristics.

From 1996 to 2000, Dr. Hsieh worked on data storage industry. He is a research scientist of Komag Corporation in the yeas of 1996 to 1998, focusing on the technology of optical inspection − using laser beam to inspect the defects on the storage disk. The success of this work has dramatically improved the yield of disk manufacturing. From 1998 to 2000, Dr. Hsieh joined Terastor Corporation as a recording system scientist, focusing on near field optical recording, where he is responsible for design and developing a removable recording system having 40Gbyte capacity in a five and half inches plastic disk. During this period, Dr. Hsieh applied the vector diffraction theory to model the interaction between the focused laser spot and the patterned plastic recording media. He has invented a few techniques for optical tracking and servo for near field optical recording.

In year 2000 to 2001, Dr. Hsieh worked for Blaze Network Products as a director of Optical technologies, in charge of developing compact CWDM transceiver for data-com application. At this position, Dr. Hsieh's work has been granted with 2 patents on the design of optical -assembly for the transceiver.

Dr. Hsieh has co-authored more than 20 professional journal and conference publications and holds nine patents, in the field of magnetic recording, optical recording, datacom transceivers and optical components for optical communication devices. He is currently a member of Optical Society of America.

F6 − Technical Session II: Enabling Technologies for Optical Communications and Networks

Polarization Mode Dispersion and Its Mitigation Techniques in High Speed Fiber Optical Communication Systems

Chongjin Xie
Bell Labs, Lucent Technologies
791 Holmdel-Keyport Road, Holmdel, NJ 07733, U.S.A.
chongjin@lucent.com

ABSTRACT
Polarization mode dispersion (PMD) is considered to be one of the main obstacles for deploying high-speed optical communication systems operating at 40-Gb/s per channel and higher. PMD comes from the random birefringence in optical fibers that arises from imperfections in manufacturing and external fiber stresses and bends in fields as well. PMD is a stochastic phenomenon whose value changes with time, temperature, wavelength and deployment condition. For that reason, PMD a complicated problem and it is hard to compensate.

PMD causes splitting and broadening of the transmitted pulses, which results in inter-symbol interference (ISI) in optical transmission systems, thus degrading system performance. Because of the statistical feature of PMD, system impairments caused by PMD have to be specified in a statistical manner. Outage probabilities are usually used to quantify the PMD penalties. Depending on modulation formats, an optical communication system without any PMD compensation can tolerate about 10%~20% bit period average PMD at the outage probability of 10^{-5} with 1~2 dB margin. For system with larger PMD, some PMD mitigation techniques have to be used.

PMD mitigation techniques can be divided into three main approaches: (i) passive mitigation techniques, (ii) electrical PMD compensation, and (iii) optical PMD compensation. Passive PMD mitigation techniques include use of more PMD robust modulation formats, soliton transmission, allocating more margins to PMD, forward error correction (FEC) coding and polarization scrambling. They do not require any dynamically adjusted components. Electrical equalization techniques, which can reduce the effect of ISI, are well known for applications like modems and mobile phones. These concepts have been applied to optical communications recently. As the bandwidth of optical communications is much high and close to speed limit of electronics, the most attractive electrical equalizer structure for optical communications due to simple operation principle are feed-forward equalizer (FFE) and decision-feedback equalizer (DFE). Electrical PMD compensators are much cheaper compared to the optical ones, and they are robust and can improve signal distortions due to all kind of impairments. However, since the quadratic detection drops all polarization information, they are not as effective as optical compensators, and so far demonstrations and realizations as single chip circuits have only been shown for bit rates at 10-Gb/s. Unlike electrical compensators, optical PMD compensators are designed to have a PMD characteristics reverse to that in transmission links, but due to existence of high-order PMD, this has only been achieved in first-order approximation up to now. An optical PMD compensator usually consists of three parts: a compensating element, a feedback signal generator and a control unit. The compensator element can be one or many stages, and usually more stages can achieve better performance. However, the compensator with more stages requires more complicated control signals and is more susceptible to local optima. Trial-and-error (dithering) or more efficient gradient searching algorithms can be implemented in the control unit. Many signals can be used as the feedback control for PMD compensators, such as degree of polarization (DOP), RF signals, and eye-opening (or electrical Q). Not only does the performance of the PMD compensators have a strong dependence on feedback signals, but the efficiency of some feedback signals depends on modulation formats as well.

Except the passive ones, most PMD mitigation techniques are channel based, which means that each channel in a WDM system requires a separate PMD compensator. This is very cost ineffective. Recently, some ideas of multi-channel PMD compensators were proposed, including channel switching and some PMD compensator sharing techniques.

BIOGRAPHY

Dr. Chongjin Xie received his M.Sc. in 1996 and Ph. D in 1999 from Beijing University of Posts and Telecommunications, Beijing, China. From 1999 to 2001, he worked at Photonics laboratory, Chalmers University of Technology, Gothenburg, Sweden for about one and half years to conduct post-doctorate research. He joined Bell Laboratories, Lucent Technologies in Holmdel, New Jersey, USA as a Member of Technical Staff in 2001. His research interests are in fiber optical communication systems and networks, including high-speed lightwave transmission, polarization mode dispersion, polarization dependent loss, modulation formats, and all-optical networks.

F6 − Technical Session II: Enabling Technologies for Optical Communications and Networks

Enabling Technology for Suppressing Nonlinear Interchannel Crosstalk in DWDM Transoceanic Systems

Hongbin Zhang, R. Brian Jander, Carl Davidson, Dmitriy I. Kovsh
Alexei N. Pilipetskii, Bamdad Bakhshi, and **Neal S. Bergano**
Tyco Telecommunications
250 Industrial Way West, Eatontown, NJ 07742, U.S.A.
hzhang@tycotelecom.com

ABSTRACT

Nonlinear interchannel crosstalk may result in significant performance degradation in transoceanic dense wavelength division multiplexing (DWDM) transmission systems at high bit rates. Three nonlinear mechanisms are mainly responsible for the signal distortion: self-phase modulation (SPM), cross-phase modulation (XPM) and four-wave mixing (FWM), and the latter two mechanisms cause nonlinear interchannel crosstalk. Several techniques for suppressing nonlinear interchannel crosstalk were introduced. Using large effective area fibers permits reducing the value of signal intensity for the given channel power. Dispersion management can reduce the propagation distance over which closely spaced channels overlap while ensure that the total dispersion returns to zero at the end of the system. Transmission format were also utilized to tolerant large fiber nonlinearity. The Chirped Return-to-Zero (CRZ) transmission format suppresses nonlinear interaction by broadening the spectrum of optical signal. Orthogonal polarization launch (OPL) between adjacent channels can eliminate FWM and cut XPM by one half.

Relative polarization of adjacent channels determines the strength of nonlinear interaction between them. The nonlinear crosstalk is the largest for parallel relative state of polarization (SOP) and smallest for the orthogonal relative SOP. For the orthogonal relative SOP channels FWM is negligible while XPM is only one half of the one in parallel case. Thus it is desirable to launch and keep the orthogonal relative SOP between adjacent channels through the transmission. However the OPL is difficult to realize since real transoceanic systems deploy single-mode fiber from transponders to the input of wet plant, and cannot maintain polarization state. According to our knowledge, all the above techniques except OPL have been realized in full capacity real transoceanic systems. To solve this problem, we use an active polarization controlling method, and use a polarization beam splitter after the wavelength multiplexer to generate feedback signals. Optical signals after transponders pass through a single-mode fiber, and the polarization controllers can generate appropriate birefringence such that the relative SOP between adjacent channels after the wavelength multiplexer is orthogonal. Our simulations and 6,500 Km strait line WDM transmission experiments showed about 1 dB of Q-factor improvement when employing orthogonal launch.

BIOGRAPHY

Dr. Hongbin Zhang received the B.S. degree in Electrical Engineering from ZheJiang University in 1995 and the M.S. and Ph.D. degrees in System and Industrial Engineering and Electrical and Computer Engineering from the University of Arizona in 1996, 2001, respectively.

In 2001, he joined Tyco Telecommunications as a senior member of technical staff, has been engaged in the study of transmission properties of undersea lightwave systems and dry plant terminal design.

F7 – Panel Discussion I: What's Next in Wireless Multimedia

Moderator

Rajarathnam Chandramouli ("Mouli")
Department of Electrical and Computer Engineering, Stevens Institute of Technology
207 Burchard Building, Castle Point on Hudson, Hoboken, NJ 07030, U.S.A.
mouli@stevens.edu

BIOGRAPHY

Dr. Chandramouli is currently an Assistant Professor in the Department of Electrical and Computer Engineering at Stevens Institute of Technology. His research includes low power wireless networking and security, steganography and steganalysis, and low power VLSI with support from the National Science Foundation, Air Force Research Laboratory, Stevens Wireless Security Center, and NJ Center for Wireless Telecommunications among others. He is a recipient of the NSF CAREER and IEEE Richard E. Merwin Awards. He also serves as an Associate Editor for the IEEE Transactions on Circuits and Systems for Video Technology since 2000.

F7 – Panel Discussion I: What's Next in Wireless Multimedia

Nirwan Ansari
Department of ECE, New Jersey Institute of Technology
University Heights, Newark, NJ 07102-1982, U.S.A.
nirwan.ansari@njit.edu

BIOGRAPHY

Professor Nirwan Ansari received B.S.E.E. (summa cum laude), M.S.E.E., and Ph.D. degrees from NJIT, University of Michigan, and Purdue University in 1982, 1983, and 1988, respectively.

He has been a full professor in the Department of Electrical and Computer Engineering at NJIT since 1997. He authored with E.S.H. Hou *Computational Intelligence for Optimization* (Kluwer, 1997, translated into Chinese in 2000), and edited with B. Yuhas *Neural Networks in Telecommunications* (Kluwer, 1994). He is a technical editor of the *IEEE Communications Magazine*, *Computer Communications*, the *ETRI Journal*, as well as the *Journal of Computing and Information Technology*. His current research focuses on various aspects of broadband networks and multimedia communications. His research has been supported by various federal and state agencies, and private industries. He has also contributed over 80 refereed journal articles, and numerous conference papers and book chapters.

He organized (as General Chair) the First IEEE International Conference on Information Technology: Research and Education (ITRE2003), was instrumental, while serving as its Chapter Chair, in rejuvenating the North Jersey Chapter of the IEEE Communications Society which received the 1996 Chapter of the Year Award and a 2003 Chapter Achievement Award, served as Chair of the IEEE North Jersey Section and in the IEEE Region 1 Board of Governors during 2001–2002, and currently serves in various IEEE committees including as TPC Co-chair/Vice-chair of several conferences. He was the 1998 recipient of the NJIT Excellence Teaching Award in Graduate Instruction, and a 1999 IEEE Region 1 Award. He is frequently invited to deliver keynote addresses, tutorials, and talks.

F7 – Panel Discussion I: What's Next in Wireless Multimedia

Samir R. Das
Department of Computer Science, SUNY Stony Brook
Stony Brook, NY 11794-4400, U.S.A.
samir@cs.sunysb.edu

BIOGRAPHY

Dr. Samir R. Das is currently an associate professor in the Computer Science Department in the State University of New York at Stony Brook. He received his Ph.D. in Computer Science from Georgia Institute of Technology, Atlanta, in 1994. His research interests include wireless ad hoc, mesh and sensor networking, performance evaluation and parallel discrete event simulation. He has more than fifty refereed research articles on these topics.

Samir Das has received the U.S. National Science Foundation's CAREER award in 1998. He co-chaired the program committee for the 2001 ACM Symposium on Mobile Ad Hoc Networking and Computing (MobiHoC) and 2004 ACM International Conference on Mobile computing and Networking (MobiCom). He currently serves on the editorial board of the *IEEE/ACM Transactions on Networking*, *IEEE Transactions on Mobile Computing* and the *Ad Hoc Networks* journal.

F7 – Panel Discussion I: What's Next in Wireless Multimedia

K.C. Lee
Panasonic System Solutions Development Center of USA / Panasonic R&D North America
Two Research Way, Princeton, NJ 08540, U.S.A.
kclee@psdu.panasonic.com

BIOGRAPHY

Dr. K.C. Lee received his Ph. D from Rutgers University in 1990 and MS from Ohio State University in 1883 both in Computer Engineering. His research interest is in the design and development of next generation systems. He worked for Telcordia Applied Research in the area of high performance information filtering, switching and transaction processing from 1985 to 1993. Later, he transferred to software development organization to realize a distributed database propagation system supporting fifty (50) "800 toll free number" Service Control Points in North America. The high performance distributed system is fault resilient and has been working reliably for the past 10 years. In 1998, he moved on to conduct R&D on next generation VoIP systems for Panasonic. His team developed one of the first fully integrated web contact center system prototype with wireless VoIP functions in 2001. From 2002 to 2005, he has been working on next generation intelligent IP surveillance systems for Panasonic System Solution Company. He published over 20 technical papers in conference and journals. He holds 6 US patents.

F7 – Panel Discussion I: What's Next in Wireless Multimedia

Bruce McNair
Department of ECE, Stevens Institute of Technology
206 Burchard Building, Castle Point on Hudson, Hoboken, NJ 07030, U.S.A.
bmcnair@stevens-tech.edu

BIOGRAPHY

Bruce McNair is Distinguished Service Professor of Electrical and Computer Engineering at Stevens. In addition, he is Founder and Chief Technology Officer of Novidesic Communications, LLC, a technology consulting company. Prior to starting Novidesic and joining the faculty at Stevens in 2002, he spent 24 years at AT&T Bell Laboratories (AT&T Labs - Research after the Lucent spin-off). His most recent work there was research of next generation (4G and beyond) wireless data communications systems, including high-speed, high-mobility wide area networks as well as range and speed extensions to 802.11(a&b) wireless LANs. Besides continuing the areas he investigated at AT&T Labs, his research interests at Stevens include privacy-preserving end user authentication, the application of cryptography to communications systems, rapid prototyping of hardware and software systems, real-time embedded systems, and broadband powerline (BPL) systems.

F7 – Panel Discussion I: What's Next in Wireless Multimedia

Sai Shankar N
Philips Research USA
345 Scarborough Road, Briarcliff Manor, NY 10510, U.S.A.
sai.shankar@philips.com

BIOGRAPHY

Dr. Sai Shankar N received his Ph.D. degree from the department of Electrical Communication Engineering from Indian Institute of Science, Bangalore, India in the area of ATM networks. In 1998, He was awarded the German Fellowship, DAAD, in the department of mathematics, University of Kaiserslautern, Germany to work on queuing approaches in manufacturing. In 1999, he joined Philips Research, Eindhoven, the Netherlands, where he served as Research Scientist in the department of New Media Systems and Applications. He worked on various problems involving Hybrid, Fiber, Co-axial Cable (IEEE 802.14) Networks and IP protocols and provided efficient algorithms to improve protocol and buffer efficiency. In the year 2001 he joined Philips Research USA, Briarcliff Manor, NY as "Senior Member Research Staff" and is currently working in the area of MAC protocols for Ultra Wide Band and Cooperative Communications. He is an active contributor of the wireless LAN standard and has submitted more than 15 proposals in shaping QoS (TSPEC, Admission Control and Simple Scheduler) related issues in the IEEE 802.11e Working Group that has been incorporated in IEEE 802.11e draft standard. He is also an active participant in the Ultra Wide Band (UWB) MAC working group of Multi-Band OFDM Alliance (MBOA) and is one of the prime contributor and author of the new MBOA MAC. To this end, he has been nominated by Electronic Engineering Times (EETimes) as one of the finalists for the Innovator of the Year 2004 for his findings in UWB MAC. Apart from above, he holds several fundamental disclosures on "Agile Radio MAC" that is essential for the forthcoming Agile Radios when spectrum is opened by FCC.

He is the poster session Co-Chair at IEEE INFOCOM 2005, Industry Liason Chair in IEEE WICON 2005, Sponsor Chair at IEEE/ACM Broadnets 2005, and is serving as Publicity Coordinator in Mobile Computing and Communication Review (MC2R) journal. He was TPC Co-Chair for Wireless Mobile Applications Workshop held in conjunction with IEEE/ACM Broadnets 2004.Apart from the above activities, he is in the TPC of IEEE Globecom 2005 and in the executive committee of CDD held in conjunction with IEEE Globecom. He served in the TPC member of IEEE Globecom 2004 organizing a workshop on mobile applications and also TPC member of workshop on Wireless LAN hotspots organized in conjunction with ACM Mobicom 2004. He recently edited a book on "Recent Trends in WLANs" that was published by Wiley Interscience in Dec. 2004. He was the session chair of Networks performance evaluation session in IEEE ICICS 2001, Wireless Networks session, Chair and TPC member of 2nd New York Metro Area Workshop and the TPC member of 3rd New York Metro Area workshop. He serves as Adjunct Professor in Polytechnic University, Brooklyn teaching graduate course on Wireless Protocols. Besides these, he is IEEE Standards Association member. He was recently elevated as Senior Member of IEEE. He has authored more than 35 conference and journal papers, 25 accepted standard contributions and has filed more than 30 patents.

F8 – Technical Session III: Wireless Ad Hoc Networks

Session Chair

MengChu Zhou
Department of Electrical and Computer Engineering
New Jersey Institute of Technology, Newark, NJ 07102, U.S.A.
zhou@njit.edu

BIOGRAPHY

Professor MengChu Zhou received his B.S. degree from Nanjing University of Science and Technology, Nanjing, China in 1983, M.S. degree from Beijing Institute of Technology, Beijing, China in 1986, and Ph. D. degree in Computer and Systems Engineering from Rensselaer Polytechnic Institute, Troy, NY in 1990. He joined New Jersey Institute of Technology (NJIT), Newark, NJ in 1990, and is currently a Professor of Electrical and Computer Engineering and the Director of Discrete-Event Systems Laboratory. His research interests are in computer-integrated systems, Petri nets, semiconductor manufacturing, multi-lifecycle engineering, and system security. He has over 200 publications including 5 books, over 70 journal papers, and 14 book-chapters. He co-authored with F. DiCesare *Petri Net Synthesis for Discrete Event Control of Manufacturing Systems*, Kluwer Academic, Boston, MA, 1993, edited *Petri Nets in Flexible and Agile Automation*, Kluwer Academic, 1995, co-authored with K. Venkatesh *Modeling, Simulation, and Control of Flexible Manufacturing Systems: A Petri Net Approach*, World Scientific, 1998, and co-edited with M. P. Fanti *Deadlock Resolution in Computer-Integrated Systems*, Marcel Dekker, 2005.

He was invited to lecture in Australia, Canada, China, France, Germany, Hong Kong, Italy, Japan, Korea, Mexico, Taiwan, and US. He served as Associate Editor of IEEE Transactions on Robotics and Automation from 1997 to 2000 and currently Managing Editor of IEEE Transactions on Systems, Man and Cybernetics: Part C, Associate Editor of IEEE Transactions on Automation Science and Engineering, and Editor-in-Chief of International Journal of Intelligent Control and Systems. He was General Co-Chair of 2003 IEEE International Conference on System, Man and Cybernetics, Washington DC, October 5-8, 2003 and 2004 IEEE Int. Conf. on Networking, Sensors and Control, Taipei, March 21-23, 2004. He organized and chaired over 70 technical sessions and served on program committees for many conferences. He was Program Chair of 1998 and Co-Chair of 2001 IEEE International Conference on System, Man and Cybernetics (SMC) and 1997 IEEE International Conference on Emerging Technologies and Factory Automation, and Guest Editors for IEEE Transactions on Industrial Electronics, and IEEE Transactions on Semiconductor Manufacturing. He is General Co-Chair of 2003 IEEE International Conference on System, Man and Cybernetics, Washington DC, October 5-8, 2003 and 2004 IEEE Int. Conf. on Networking, Sensors and Control, Taipei, March 21-23, 2004.

Dr. Zhou has led or participated in twenty-five research and education projects with total budget over $10M, funded by National Science Foundation, Department of Defense, Engineering Foundation, New Jersey Science and Technology Commission, and industry. He was the recipient of NSF's Research Initiation Award, CIM University-LEAD Award by Society of Manufacturing Engineers, Perlis Research Award by NJIT, Humboldt Research Award for US Senior Scientists, Leadership Award and Academic Achievement Award by Chinese Association for Science and Technology-USA, Asian American Achievement Award by Asian American Heritage Council of New Jersey, and Distinguished Lecturer of IEEE SMC Society. He was founding chair of Discrete Event Systems Technical Committee of IEEE SMC Society, and Co-Chair (founding) of Semiconductor Factory Automation Technical Committee of IEEE Robotics and Automation Society. He is a life member of Chinese Association for Science and Technology-USA and served as its President in 1999. He is Fellow of IEEE.

F8 – Technical Session III: Wireless Ad Hoc Networks

Performance Evaluation and Improvement of Broadcasting Algorithms in Ad Hoc Networks

Hao Zhang and **Zhong-Ping Jiang**
Department of Electrical and Computer Engineering, Polytechnic University
Brooklyn, NY 11201, U.S.A.
hzhang08@utopia.poly.edu, zjiang@control.poly.edu

ABSTRACT
Efficient broadcasting protocol design is an important issue in mobile ad hoc networks, because the broadcasting technique has been widely used in various applications involving route searching and message distribution. A problem with the original broadcasting protocol *flooding* is the excessive retransmissions that cause packet collisions and lead to bandwidth reduction. Various improved techniques have been proposed in the literature to alleviate this problem, while most of them are designed for networks with static topology, and their performance is often compared by means of numerical simulations. Recently, we have constructed mathematical models for several broadcasting protocols in one-dimensional and two-dimensional topology, and have proposed the close-form expressions to clearly reveal some new relationships between performance metrics and network parameters. In another recent contribution, we have also taken a preliminary step to address the mobility issue. That is, we intend to improve the existing broadcasting protocols, which do not perform very well under highly-mobile situations. Our proposed mobility-sensitive mechanisms adaptively increase broadcast redundancy when the nodal mobility is detected. Neighbor information, instead of location information, is employed in one of our algorithms, which has been shown preferable in ad hoc networks when node locations are not available.

As a third research effort we have carried out, we recently focus on the design of broadcasting protocols with a specific application: route searching. In on-demand ad hoc routing protocols, route searching is an essential part in network layer to establish a path between a pair of nodes that wish to exchange information. Based on the observation that unnecessary retransmissions can be further reduced by combining various broadcasting protocols with some specific features of route searching, we propose a method to reduce redundancy after the required route is found. The simulations have shown the efficiency of this technique on improving protocol performance in terms of the decreased number of nodes that receive the broadcasted packet.

BIOGRAPHY
Hao Zhang received the B.S. and M.S. degrees in electrical engineering from HuaZhong University of Science and Technology, Wuhan, P.R. China, in 1999 and 2001, respectively. He is now working towards a Ph.D. degree in electrical and computer engineering at the Polytechnic University, Brooklyn, NY. His research interests include network optimization, control and protocol analysis. His recent work focuses on analysis and design of wireless ad hoc broadcasting protocols and localization technology in wireless CDMA systems.

Professor Zhong-Ping Jiang received the M.Sc. degree in statistics from the Universit´e de Paris-sud, Paris, France, in 1989, and the Ph.D. degree in automatic control and mathematics from the ´Ecole des Mines de Paris, Paris, France, in 1993. After having held visiting researcher positions in various institution in France and Australia, he joined the ECE Department of Polytechnic University at Brooklyn in 1999, where he is an Associate Professor. His main research interests include stability theory, optimization, robust and adaptive nonlinear control, with special emphasis on applications to underactuated mechanical systems, communication and biological networks. He has authored or coauthored four book chapters, over 65 refereed journal papers and numerous conference papers. More detailed information can be found in the website: http://eeweb.poly.edu/faculty/jiang/. Dr. Jiang is a recipient of the prestigious Queen Elizabeth II Fellowship Award from the Australian Research Council, a CAREER Award from the U.S. National Science Foundation and the JSPS Invitation Fellowship from the Japan Society for the Promotion of Science.

F8 – Technical Session III: Wireless Ad Hoc Networks

Transport Capacity and Spectral Efficiency of Large Wireless CDMA Ad Hoc Networks

Yi Sun
Department of Electrical Engineering, The City College of City University of New York
Convent Ave. at 138th St., New York, NY 10031, U.S.A.
yisun@ee.ccny.cuny.edu

ABSTRACT

We study transport capacity and spectral efficiency of large wireless CDMA ad hoc networks. The former is defined as transported bit-meters per symbol period per node and the latter is bit-meters per Hz per second per volume meter under the joint optimization of coding and routing. The network consists of infinitely many nodes uniformly distributed in an *n*-dimensional space. Node density and spreading gain tend to infinity. The MMSE, decorrelator, or MF receiver is employed at a receive node. It is shown that the limit network at any time is composed of infinitely dense memoryless Gaussian channels each connecting a pair of send and receive nodes. Then the transport capacity, spectral efficiency and average number of hops are obtained. The network presents a "scaling law" in that the transport capacity vanishes as node density tends to infinity at a rate higher than processing gain. The "scaling law" disappears if processing gain increases as fast as node density does, which is in sharp contrast to the Gupta-Kumar network where a scaling law cannot be overcome. It is also shown that a supersaturated network where the traffic intensity defined as the number of active nodes per Hz per second per volume meter tends to infinity achieves the highest spectral efficiency but a vanishing transport capacity. On the other hand, as the traffic intensity vanishes, the spectral efficiency vanishes and the transport capacity achieves the highest. For a low-powered sensor network to achieve high spectral efficiency under the constraint of fixed total transmission power per volume meter, the node density shall be increased to the maximum and the transmission power of each node be decreased to the minimum.

BIOGRAPHY

Professor Yi Sun received the B.S. and M.S. degrees in electrical engineering from the Shanghai Jiao Tong University in 1982 and 1985, respectively, and the Ph.D. degree in electrical engineering from the University of Minnesota in 1997. He was a Post-doctoral Research Fellow at the University of Utah in 1997 and at the University of Connecticut in 1998, respectively. In September 1998, Dr. Sun joined the faculty of the Department of Electrical Engineering at the City College of City University of New York where now he is a tenured Assistant Professor. Dr. Sun's research interests are in the areas of wireless communications, CDMA multiuser detection, capacity of random access systems, and capacity of wireless ad hoc networks.

F8 – Technical Session III: Wireless Ad Hoc Networks

Lightweight Service Advertisement and Discovery in Mobile Ad Hoc Networks

Liang Cheng
Department of Computer Science and Engineering, Lehigh University
19 Memorial Drive West, Bethlehem, PA 18015, U.S.A.
cheng@cse.lehigh.edu

ABSTRACT

Service advertisement and discovery are important components for collaborative applications in mobile ad hoc networking (MANET) environment since they enable mobile communication and computing entities to provide services and associated data to peers and to be aware of and use the available services and data from peers. In this research, we design and implement a lightweight protocol for service advertisement and discovery based on a MANET multicast protocol ODMRP (On-Demand Multicast Routing Protocol). Service advertisement and discovery information is piggybacked in ODMRP routing control packets. NS-2 simulation results show that our protocol achieves the goal of service advertisement and discovery in mobile ad hoc networks with high successful data delivery ratio and low overheads.

BIOGRAPHY

Professor Liang Cheng is the Director of LONGLAB (Laboratory Of Networking Group, http://long.cse.lehigh.edu) and an Assistant Professor of Computer Science and Engineering Department at Lehigh University. His current research interests include: sensor and ad hoc networks, middleware, and network management. Currently he advises six Ph.D. students, has more than forty publications of book chapters, journal and conference/workshop papers, and holds one U.S. patent. Cheng has been the principle investigator (PI) and a Co-PI of seven projects supported by the National Science Foundation (NSF), the Defense Advanced Research Projects Agency (DARPA), Pennsylvania Department of Community and Economic Development, and Agere Systems, Inc. He has served 2005 IEEE Sarnoff Symposium on Advances in Wired and Wireless Communications as the Program Chair. Cheng is an awardee of Christian R. and Mary F. Lindback Foundation Minority Junior Faculty Award with Career Enhancement Grant.

F8 – Technical Session III: Wireless Ad Hoc Networks

Hybrid Networks: Cellular-Relay Architecture

Harish Viswanathan, Sayandev Mukherjee, and **Ram Ramjee**
Bell Labs, Lucent Technologies
Murray Hill, NJ, 07974, U.S.A.
{harishv, sayan, ramjee}@lucent.com

ABSTRACT

Peer-to-peer communication networks such as sensor networks, personal area networks and wireless local area networks are characterized by multi-hop wireless communications in which information may be routed from source to destination via multiple wireless links. On the other hand cellular networks are single-hop networks in which wireless communication is between the mobile node and the base station only. Convergence will be a main theme of future networks that provide ubiquitous high rate services seamlessly through converged technologies. Motivated by this we propose cellular network architectures with multi-hop transmission from the base station to terminals and vice versa through *relays*. Relays are network elements (fixed or mobile) or other user terminals that have significantly more intelligence than repeaters and are capable of storing and forwarding data and making scheduling and routing decisions. Relay nodes are not connected to the wireline network through a back-haul connection, but have to rely on wireless transmission to communicate to the base station. We discuss a variety of deployment scenarios involving multi-hop transmission through relays. Cellular-relay networks could be such that the relay to terminal links use different spectrum than base to terminal links. For example, the relays could communicate to the terminals through a wireless local area network using the IEEE 802.11 air interface, in which case the relays are like access points and use the unlicensed band, while the base station transmits to the relays using the licensed cellular network spectrum. In this model, mobile terminals are assumed to have both cellular and IEEE 802.11 interfaces, which is becoming increasingly common. An alternative scenario is one in which the two kinds of hops use two different carriers within the spectrum assigned to the cellular network operator. It is also possible to deploy relays in such a way that no additional carrier or spectrum is required and transmissions from base station to relays and relays to user terminals use the same spectrum. Capacity gains are achieved even in such a scenario because of the additional effective spectrum reuse that is obtained due to the spatial separation of the relays and their lower transmit power compared to that of the base station. We present a detailed description of such a system including the signaling scheme and the medium access protocol for high-speed packet data applications. Finally we discuss benefits of relay based cellular network architectures for multicast traffic In this model, the multicast throughput is not limited by the link quality of the user at the edge of the cell since transmission happens through appropriately selected relays.

BIOGRAPHY

Dr. Harish Viswanathan received the B. Tech. degree from the Department of Electrical Engineering, Indian Institute of Technology, Chennai, India in 1992 and the M.S. and Ph.D. degrees from the School of Electrical Engineering, Cornell University, Ithaca, NY in 1995 and 1997, respectively. He was a recipient of the Cornell Sage Fellowship. He is currently a distinguished member of technical staff at Lucent Technologies Bell Labs, Murray Hill, NJ. His research interests include information theory, communication theory, wireless networks and signal processing.

F9 – Technical Session IV: Optical Communications and Network Systems

Session Chair

Xiang Zhou
AT&T Labs-Research
200 Laurel Ave South, Room A5 1F-32, Middletown, NJ 07748, U.S.A.
zhoux@research.att.com

BIOGRAPHY

Dr. Xiang Zhou received the B.Sc. degree in physics from Fudan University, Shanghai, China in 1991, and the Ph. D degree in electrical engineering from Beijing University of Posts and Telecommunications in 1999. His ph. D research focused on ultra-high speed OTDM optical fiber communication system. From 1999 to 2001, he was with Nangang Technological University, Singapore, as a Research Fellow, where his research covered optical CDMA, fiber-grating based WDM add/drop multiplexer and wide-band Raman amplification. He has been a senior technical staff member in AT&T Labs-Research since October 2001, working on optical technologies for ULH optical transmission system. His current research interests are in Raman amplification, modulation format and polarization effects-related system impairment. He has authorized/co-authorized more than 40 Journal and conference publications.

F9 – Technical Session IV: Optical Communications and Network Systems

Lightpath Tracing in Photonic Networks

Mark D. Feuer [1] and **Vinay Vaishampayan** [2]
AT&T Labs-Research
[1] Middletown, NJ 07748, [2] Florham Park, NJ 07932, U.S.A.
mdfeuer@research.att.com

ABSTRACT

Deployment of photonic networks, in which wavelengths are routed optically, is now underway. As network operators reap significant cost savings by removing O-E-O conversion from many nodes, they will lose the management functions, such as performance monitoring and path trace, that the electronic equipment provides. We discuss one possible option for implementing such a path trace function in photonic networks, a new technology that we call LightLabel. LightLabel is an in-band auxiliary channel, which enables the use of ubiquitous, low-cost path trace receivers throughout the network. It is all-digital, based on a novel encoding process at the lightpath source. To assure low system cost, the path trace receivers are required (1) to operate from a low-power optical tap coupler, (2) to use only low-speed photodiodes and circuits, and (3) to operate without a wavelength filter.

For example, a photonic network has multiple lightpaths that can be carried on a single wavelength. If a reconfigurable optical add/drop module (ROADM) or photonic crossconnect (PXC) is set incorrectly or malfunctions, data streams may be sent to the wrong terminals. Lightpath tracing allows identification and localization of the fault, expediting repair. LightLabel encoding is carried out by binary electronics at the lightpath source, in a manner similar to forward error correction (FEC) coding. The encoding algorithm includes a layer of block coding with complementary constant-weight codes (CCWC), which creates weight variations detectable by a low-speed receiver. A second layer of coding, based on CDMA (code-division multiple access) techniques, is used to distinguish the LightLabel signals from multiple wavelengths *without* requiring a tunable wavelength selection filter at the path trace receiver.

System operation was emulated in the laboratory, using a preprogrammed data pattern at 10.24 Gb/s, a LightLabel chip rate of 10.0 Mchip/s, and an auxiliary channel rate of 50.0 Kb/s. This talk shows the experimentally observed error rate of a single LightLabel channel operating in the presence of ASE noise. Error rates for chip-by-chip detection and for the 10 Gb/s payload channel are also shown for comparison. The excellent noise rejection of the LightLabel signal is in close agreement with theoretical calculations. Even with the penalty expected from multiple user interference, the LightLabel error rate will remain lower than the payload error rate at all OSNR values, so LightLabel encoding will not require changes in line amplifiers or span engineering rules.

BIOGRAPHY

Dr. Mark D. Feuer is a senior researcher in the Optical Systems Research Department of AT&T Labs. His current work focuses on enabling technologies for dynamic photonic networks, comprising topics ranging from optical device physics through network design. Prior to rejoining AT&T Labs in 2002, he worked at JDS Uniphase, AT&T Labs, and Bell Labs, researching optical subsystems and the physics of high-speed electronic devices. Dr. Feuer holds B.A. and Ph.D. degrees in physics from Harvard University and Yale University, respectively. He is a member of the APS and the IEEE, and has served as chair of the Networks subcommittee for the Optical Fiber Communications conference, as well as Associate Editor for IEEE Transactions on Electron Devices.

F9 – Technical Session IV: Optical Communications and Network Systems

Hyperfine Spectral Phase Coded Optical CDMA: Component Technologies and Networking Applications

Paul Toliver and **Shahab Etemad**
Telcordia Technologies
331 Newman Springs Road, Red Bank, NJ 07724, U.S.A.
ptoliver@research.telcordia.com

ABSTRACT

Recently, there has been a renewed interest in exploring optical CDMA (OCDMA) as a next generation communications technology. Some of benefits it has the potential to offer include increased levels of security at the physical layer as well as the possibility to simplify certain networking functions, such as code translation. A variety of optical CDMA implementations have been proposed and can generally be classified as either coherent or incoherent approaches, each of which has its own set of advantages and challenges. This paper will focus on a specific coherent approach to OCDMA referred to as spectral phase coding. What is unique about this work over previous research is the fine spectral resolution at which our orthogonal phase codes are applied. Through the use of ultra-narrow spectral filtering techniques, including hyperfine DWDM filters and ring resonator technologies, our system is able to accurately tailor the spectral phase of each distinct frequency lines from a mode-locked laser operating at 5 or 10 GHz. This approach enables us to make the spectral width of the OCDMA signal, coded with an orthogonal phase mask covering 16 frequency bins, compatible with filtering and transmission components used in conventional DWDM systems aligned on a 100 or 200 GHz ITU grid. By combining coherent OCDMA with orthogonal coding and synchronous user operation, the largest overall system spectral efficiency can be achieved.

In addition to describing the system architecture and device technologies, we will also present recent experimental results on practical optical networking applications, including the transmission of OCDMA with other conventional DWDM channels (inter-band compatibility). In addition, we show it is possible to have the OCDMA signal coexist with a conventional DWDM channel within the same passband (intra-band compatibility). Finally, we demonstrate the ease at which OCDMA signals can be translated from one code to another code using completely passive optics, and discuss how this function can be exploited in a practical OCDMA networks.

BIOGRAPHY

Dr. Paul Toliver received his B.S. in Electrical Engineering from the University of Wisconsin-Madison in 1995 and his Ph.D. in Electrical Engineering from Princeton University in 2000, where his research focused on 100 Gb/s photonic packet switching networks and ultrafast all-optical interferometric switches. Since 1995, he has participated in a number of government and commercial optical networking systems research efforts. He was involved in the research and development of next generation DWDM systems and technologies within Nortel Networks Advanced Technologies Group. In October 2000, he joined the Telcordia Technologies, Applied Research as a Senior Research Scientist, where he has recently been involved in a number of government-sponsored next-generation optical networking research programs including transparent optical networks, optical label switching, optical CDMA, and quantum communications.

F9 – Technical Session IV: Optical Communications and Network Systems

Limit on Coding and Modulation Gains in Fiber-Optic Communication Systems

Yi Cai
Tyco Telecommunications
250 Industrial Way West, Room 1A-224, Eatontown, NJ 07724, U.S.A.
ycai@tycotelecom.com

ABSTRACT

In recent years the performance of fiberoptic communication systems has been dramatically improved by employing strong forward error correction (FEC) codes and more sophisticated modulation schemes. This raises a fundamental question − what is the limit on coding and modulation gains in fiberoptic communication systems? To answer this question, we need to evaluate the channel capacities of fiberoptic communication systems for different modulation and detection schemes.

Shannon proved the remarkable information capacity theorem and derived the capacity boundary for additive-white-Gaussian-noise (AWGN) channel on all modulation schemes in AWGN channels. The capacities of AWGN channels employing different modulation formats have been well studied in the literature. However, these results cannot be directly applied to fiberoptic communication systems. Unlike the cases studied by Shannon, optical signals have the additional parameter of polarization. It has been proposed and experimentally shown that multiplexing the two orthogonal polarization modes for information transmission can increase the spectral efficiency. However, as far as we know, no work has been done to evaluate the fundamental capacity limit on fiberoptic communications systems by taking into account two polarization modes.

In this paper we show that having two orthogonal polarization modes makes the fiberoptic channel have larger capacity than the AWGN channel. The fiberoptic channels studied here are channels dominated by linear amplified spontaneous emission noise (ASEN). We extend the capacity formulae for AWGN channels to ASEN channels by taking into account two polarization modes. Based on the evaluated capacities of ASEN channels, we discuss possible gains from different coding and modulation techniques.

BIOGRAPHY

Dr. Yi Cai is currently a senior member of technical staff in the system research department at Tyco Telecommunications, Eatontown, NJ. He received a B. S. degree in optical engineering from the Beijing Institute of Technology, Beijing, China, in 1992, a M. Eng. degree in information and signal processing from the Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai, China, in 1998, and a Ph. D. degree in electrical engineering from the University of Maryland Baltimore County, Baltimore, MD, in 2001. His research interests include forward error correction, line coding, adaptive signal processing, modulation formats, and their applications in fiber-optic communication systems.

F9 – Technical Session IV: Optical Communications and Network Systems

DWDM Core Transport Technology

Y.-H. Kao and **J. J. Benson**
Lucent Technologies
101 Crawfords Corner Rd., Holmdel, NJ 07733, U.S.A.
yuanhuakao@lucnet.com

ABSTRACT

Dense wavelength division multiplexing (DWDM) transmission systems have been used in commercial networks to transport massive data over long distances. The majority of the backbone DWDM systems that are deployed today are point-to-point with limited reach and capacity. To reduce the transport cost per bit and operating cost, new technologies have been developed to transport more bits per second over longer distances with intelligent network flexibility and performance monitoring features. This talk will provide an overview of evolution from today's point-to-point transport networks to next generation reconfigurable high-capacity and ultra long-haul mesh transport networks. Key elements and enabling technologies to build next generation mesh networks will also be reviewed.

BIOGRAPHY

Dr. Yuan-Hua Kao is a Member of Technical Staff at the Optical Networking Group of Lucent Technologies, Holmdel, New Jersey. Dr. Kao received her B.S. in Physics in 1992 from National Taiwan University, Taipei, Taiwan. She obtained her M.S. in Physics in 1994, M.S.E in Electrical Engineering in 1997 and Ph.D. in Physics in 1998 from University of Michigan, Ann Arbor, Michigan. Her research focus at the University of Michigan was on the topic of ultrafast optical switching in semiconductor laser amplifiers, fiber logic gates and soliton propagation for high-speed optical communication systems.

Dr. Kao joined the Optoelectronics Group of Lucent Technologies, Breinigsville, Pennsylvania in 1998, where she was responsible for the design, development, and characterization of high-speed semiconductor lasers and modulators. She transferred to the Optical Networking Group of Lucent Technologies in 2000 and was responsible for the development of high speed and tunable optical transmitters for long haul and metro DWDM transport systems. Dr. Kao's current responsibility includes optical transport system integration and development of next generation subsystems for cost-effective optical transmissions with enhanced reach and capacity.

Dr. Kao has co-authored more than 30 professional journal and conference publications and holds six patents, all in the field of high-speed optical communication devices and systems. She is currently a member of Optical Society of America.

F10 – Technical Session V: Digital Wireless Multimedia

Session Chair

James Z. Lei
Hong Kong Applied Science and Technology Research Institute (ASTRI)
5th Floor, Photonics Centre, 2 Science Park Avenue, Hong Kong Science Park, Shatin, Hong Kong
lei@astri.org

BIOGRAPHY

Dr. James Zhibin Lei received his B.S. from Beijing University, and M.S. and Ph.D. in Electrical Engineering from Brown University. He has 15 years of experience in R&D, project management and product development in the broad areas of multimedia and communications industry. He has previously worked at Bell Labs, Lucent Technologies, Panasonic Research, Walter Hunter, Fuqing Interquip Ltd, and Hengnan Electronics Equipment Co. Ltd. He has an extensive R&D background and product development experience which ranges from consumer electronics, to wireless networking, and mobile multimedia products and applications. His research and development effort has led to several startups, including a multimedia spin-off from Lucent, and an Internet multimedia software company.

He was the Meritorious Award winner of Mathematical Contest in Modeling, sponsored by SIAM, in 1989, and held a CRM-UBC Fellowship for Mathematical Biology Summer School at University of British Columbia, Vancouver, Canada, in 1993. He was awarded several patents, and had some 60+ research papers and technical publications in the broad area of multimedia computing and communications.

He was elected as the President of New Jersey Chinese Computer Professionals Society (1999-2001) and the Director of Chinese Association of Science and Technology (CAST-USA) (2000-2002).

F10 – Technical Session V: Digital Wireless Multimedia

AVS Standard – Audio Video Coding Standard Workgroup of China

Wen Gao
Institute of Computing Technology, Chinese Academy of Sciences
Beijing 100080, P.R. China
wgao@jdl.ac.cn

ABSTRACT

To meet the requirements of the digital audio and video industry and related technology development, the Audio Video Coding Standard Working Group was established with the approval of the Science and Technology Department of the China Ministry of Information Industry (MII). AVS Workgroup takes the responsibility for the formulation of technical standards related to equipment for multimedia compression, decompression, processing and presentation and products like digital audio and video systems. The working results will be submitted for review and approval by the Science and Technology Department of MII to publish such standards as industrial standards, or be submitted by the Science and Technology Department of MII directly to the State Authority of National Standardization to be ratified as National Standards of China. AVS Standard's main purpose is to compress digital audio and video data to the range from more than 1/10 to even below 1/100 of the original data. AVS standard includes four main technical standards, which are system, video, audio and digital copyright management, and some supporting standards such as consistency versification. During the seventh meeting in Beijing on 18-19th of December in 2003, the Working group has completed the Final Committee Draft of the first part (system) and the second part (video) as well as the verification software.

BIOGRAPHY

Dr. Wen Gao received the M.S. and Ph.D. degrees in computer science from Harbin Institute of Technology, Harbin, China, in 1985 and in 1988, respectively, and the Ph.D. degree in electronics engineering from the University of Tokyo, Tokyo, Japan, in 1991. He was a Research Fellow at Institute of Medical Electronics Engineering, University of Tokyo, Tokyo, Japan, in 1992, and a Visiting Professor at Robotics Institute, Carnegie Mellon University, Pittsburgh, PA, in 1993. From 1994 to 1995, he was a Visiting Professor at the MIT AI Lab, Massachusetts Institute of Technology, Cambridge. Currently, he is the Vice President of the University of Science and Technology of China, the Deputy President of Graduate School of Chinese Academy of Sciences, Professor of computer science at Harbin Institute of Technology, and the Honor Professor in computer science at City University of Hong Kong. He is the head of Chinese National Delegation to the MPEG Working Group (ISO/SC29/WG11). He has published seven books and over 200 scientific papers. His research interests are in the areas of signal processing, image and video communication, computer vision, and artificial intelligence. Dr. Gao is the Editor-in-Chief of the *Chinese Journal of Computers* and was the General Co-Chair of the IEEE International Conference on Multi-model Interface in 2002.

F10 – Technical Session V: Digital Wireless Multimedia

Noise Reduction and Speech Enhancement for High-Quality Wireless Handsets

Q. Peter Li and **Wei Li**
Li Creative Technologies, Inc.
30 A Vreeland Road, Suite 130, Florham Park, NJ 07932, U.S.A.
qili@ieee.org

ABSTRACT

In wireless communications, the noise is a more serious problem than in landline communications. To end users, the voice from a wireless handset includes various kinds of noises involved from different sources and communication stages, such as the environmental background noise, electronic device noise, coding and computation noise, communication channel noise, etc. How to reduce the noises and enhance the speech is an important research topic to high-quality wireless communications, and noise reduction is becoming a new feature and selling point to wireless handsets.

Supported by the U.S. Government research funding, we have been studying the problem for years and have developed new algorithms and chips for noise reduction and speech enhancement for commercial wireless environments. Our algorithm is based on the mathematic models of the human hearing system, and it can improve the SNR for more than 15 dB in the environments of commercial wireless applications. The chip is a low cost and low power consumption implementation. It can be inserted into wireless handsets or equipments directly. In this presentation, we will demonstrate our noise reduction algorithms with various background noises in comparison with other products on the market. Our chips with pre-loaded algorithm are ready for cell phone manufactures for new high-quality wireless handsets.

BIOGRAPHY

Dr. Qi (Peter) Li received his Ph.D. degree in electrical engineering from the University of Rhode Island, Kingston, in 1995. From 1988 to 1994, he worked at F.M. Engineering and Research, Norwood, MA, where he engaged in pattern recognition, real-time systems, and networks. In 1991, he attended Harvard University to study statistical theory and methods. From 1995 to 2002, he was with Bell Laboratories, Lucent Technologies, Murray Hill, NJ, as a Member of Technical Staff in the Multimedia Communications Research Lab, where his research was in speech and speaker recognition, biometric authentication, front-end signal processing, speech modeling, and multimedia systems; his research results were implemented in Lucent products.

In 2002, Dr. Li established Li Creative Technologies (LcT), Inc., located in Florham Park, NJ. LcT is a high-tech company in R&D for signal processing, multimedia applications, and homeland security. Since 2003, LcT has been awarded several research contracts by DARPA, NAVY, and MDA of the Department of Defense. The company is conducting research in acoustic-signal processing for handheld devices, emotion state detection, speaker recognition, new features for speech processing, data-driven prognostics, decision models and systems, etc. The company is also developing products based on its new research results, and is interested in licensing new techniques developed in the company for the industry.

Dr. Li is a senior member of IEEE. He has been active as a reviewer for several journals, including *IEEE Transactions on Speech and Audio Processing*. He has also been a Local Chair for the IEEE Workshop on Automatic Identification and a committee member for several IEEE conferences and workshops. He has received a best-paper award, an achievement award, several Bell Labs patent awards, and 2004 New Jersey Small Business Success Award. Dr. Li is listed in *Who's Who in America* (Millennium and 2001 Editions) and in *Who's Who in Executives and Professionals* (2004 Edition).

Wei Li received his M.S. degrees in Electrical Engineering and Chemical Engineering from University of Rhode Island in 2004 and 2002, respectively. From 1996 to 2000, he worked at Foxboro Co. and a steel company in real time control and data acquisition systems as an electrical engineer. From 2000 to 2004, he worked at the acoustic signal processing lab, University of Rhode Island. During that period, his research was funded by NSF and NASA. His research focused on acoustic noise reduction, digital signal processing and pattern recognition with Hidden Markov Model. He designed and implemented acoustic noise reduction package with Matlab, including auditory filter bank design, time window design, fundamental frequency estimation, correlogram computation, LPC in spectral domain. He also developed a digital cochlea by FIR Filter bank design using Simulink and Matlab. His research also included speech recognition in noisy environment by utilizing digital signal processing and psychoacoustics knowledge, speech recognizer based on Hidden Markov Model. Mr. Li is a member of IEEE.

F10 – Technical Session V: Digital Wireless Multimedia

Mobile Multimedia Collaboration Architecture and Applications

Tsong-Ho Wu and **Nam Hong Cheng**
Telcordia Technologies, Inc.
One Telcordia Drive, Piscataway, NJ 08854-4157, U.S.A.
twu@research.telcordia.com, hong@research.telcordia.com

ABSTRACT

Recent advances in the Internet enabling technologies and wide deployment of broadband optical and wireless networks in both the core and access areas have led to rapid growth of real-time multimedia communications and collaborative computing applications over the Internet anytime and anywhere. The mobile multimedia collaboration enabled applications include networked healthcare, distributed data right management for digital content distribution, telematics, and 3G/4G/wireline network convergence. These mobile multimedia collaborative networking and computing applications are recently made possible due to widely deployed broadband Internet (e.g.., IP-over-SONET) and last-mile broadband technologies (e.g., ADSL/DSL and cable modem), the maturity of a widely accepted application layer signaling protocol (Session Initiation Protocol (SIP)), and availability of high-power and smart mobile devices. These mobile multimedia collaboration enabled applications share a common core application requirement set, referred to as "5R" requirements, i.e., "*Right data sent to Right person at Right time in Right form at Right cost*". This 5R requirement set basically covers technical challenges of security, QoS, privacy protection, performance, mobility and costs from layer 1 to layer 7. In this talk, we first discuss the concept of mobile multimedia collaboration and its enabled applications as described above. We then use distributed data right management (DRM) for secure digital content distribution as an example to illustrate 5R requirements. We conclude the talk by identifying challenges of meeting the 5R requirements as well as reviewing the progress of 5R implementation under mobile broadband internet networking infrastructure.

BIOGRAPHY

Dr. Tsong-Ho Wu received his Ph.D. from the State University of New York at Stony Brook in 1983. Dr. Wu has 20+ years R&D and technology management experiences in networking, control and management, and application development areas from physical layer (SONET, WDM) to link layer (ATM,GSM,802.11) to network/session layer (IP, Web Switching) and to application layer (Security, QoS and SIP). He held technical and management positions in AT&T Labs (1999-2000), Telcordia Technologies (formerly Bellcore) (1986-1999) and Sprint Data (1983-1986) as well as CEOs of 2 high-tech start-ups (2000-2003). In addition, he served as Principal Investigator and Task Leader for various advanced government research projects funded by DARPA and US Army Research Labs during 1995-1999. He re-joined Telcordia's Applied Research Area as Chief Scientist in 2004, where he is responsible for creating and executing significant R&D programs through external funding to enable emerging applications such as networked healthcare/Health-IT, Telematics, 3G/4G/wireline network convergence, data right management for distributed digital content distribution, and distributed multimedia communications and collaborative computing.

Dr. Wu is an IEEE Fellow and received the Inventor of the Year Award from the New Jersey Inventors Hall of Fame in 1997. He has served as a Distinguished Lecturer of IEEE Communication Society from 1998-2004; and served as a Member of "Technical Advisory Board" (Telecommunications) to Taiwan Ministry of Transportation and Communications during 1993-1999. Dr. Wu published two technical pioneer books *Fiber (SONET) Network Service Survivability* (1992) [by Artech House] and *ATM Transport and Network Integrity* (1997) [by Academic Press]. He has published more than 80 refereed journal and conference papers; edited special issues of two major IEEE journals; received SAIC Chairman Publication Prize (Technical Book category) (1998); and holds 3 US patents with 3 more pending. He is listed in Who's Who in Science and Engineering (1999- now); Who's Who in Media and Communications (1998-now); International Who's Who in Information Technology (2000-now); and Who's Who in America (2003-now).

Dr. Nam Hong Cheng received his Ph.D. in Communication Engineering from the Royal Melbourne Institute of Technology (RMIT), Australia. He has held technical and management positions since joining Telcordia Technologies (formerly Bellcore) in 1998. Currently, he is a Senior Scientist in the Emerging Technologies and Services Research Department.

Dr. Cheng is a key member in developing and integrating a SIP based multimedia communication and collaboration system. He was also a key member in developing service management and network management capabilities for Telcordia VoIP product line and solutions. Dr. Cheng has managed and led a number of research and development projects in Telcordia. He has worked on policy based network management, including policy management and analysis, and policy based management for mobile ad-hoc networks. He also worked on resource management and integrated assurance for mobile networks, integrated fault and performance analysis, and content delivery infrastructure and management.

Prior to joining Telcordia, he was with Ericsson Australia as a Product Team Leader on Operation Support Systems for mobile networks, and a consultant on network management for mobile networks.

S2 − Plenary Session III

Session Chair

Xiaomei Qian
Amaranth Group
One American Lane, Greenwich, CT 06831, U.S.A.
xqian99@yahoo.com

BIOGRAPHY

Dr. Xiaomei Qian is currently working in the Quantitative Research Department of Amaranth Group, assisting the statarb strategy research and trade of equities. Prior to Amaranth, she was the embedded software technical lead in Innovance Networks (Piscataway, NJ), a startup company which built the next generation ultra long haul optical switches, focused on the GMPLS signaling protocol and resource allocation implementation. Before Innovance, she was a manager of CMTS (Cable Modem Termination System) network management system at Riverdelta Networks (acquired by Motorola in 2001, Tewksbury, MA) and responsible for the CMTS CableLab certification process. She joined Lucent Technologies as a Member of Technical Staff in 1997 working on the architecture design and software development on core ATM switches and IP routers (Holmdel, NJ). Before Lucent, She was with General Instrument (Hatsboro, PA) to develop ATM based digital set-top boxes for the Fiver-To-The-Home architecture.

Xiaomei Qian received her Ph.D. and M.S. degrees in Computer Information Engineering from Stevens Institute of Technologies, Hoboken, NJ, and graduated from Tsinghua University, Beijing, China.

S2 − Plenary Session III

Network Evolution and Wireless Services in China

Xiaomang Yu
China Unicom
Xidan Bei Da Jie Jia 133, Beijing, P.R. China 100032
yuxm@chinaunicom.com.cn

ABSTRACT

The question of overlapping infrastructure has been a hot topic since China began its review of technology to be used for the third generation or 3G wireless. That will entail huge investment requirements and operators have been looking for ways to hold the line on spending. This presentation will discuss the speaker's view on China telecommunication industry restructure and expand to two other related topics. Listed below are the three main areas of the talk:

- China telecommunication industry history, current status, and restructure trend
- Network evolution and wireless services in China
- Value added services in China

BIOGRAPHY

Xiaomang Yu is currently the Commissioner of China Unicom Development Strategy Consulting Committee, and Visiting Professor of Beijing University of Posts and Telecommunications. Xiaomang Yu has in-depth knowledge and experience in the telecommunication industry. He is the founding Executive Vice President (EVP) of China Unicom - one of the 4 major service providers in China. Xiaomang Yu is also the longest serving EVP of the company, and was a Director of China Unicom Board. Since joining China Unicom in 1994, he helped to set up and grow the company to nation's 2nd largest mobile carrier with more than 100 million subscribers (the world's 3rd largest GSM operator and the 2nd largest CDMA operator). During the past 10 years, Xiaomang Yu has been in charge of all aspects of the business including planning, finance, domestic and long distance, mobility, data, optical network construction, operation and maintenance, and interoperability, etc. He led the effort to build the China Unicom network infrastructure including the first ATM (Asynchronous Transfer Mode) network and IP phone system in China 1999.

Xiaomang Yu is also dedicated to the development of China information services. He established Unciom-Sparklice Information Ltd, an e-commence company which opened the first Internet Café in China 1996. In 1998, he led and launched ChinaBig.com (Unicom Media), the largest online directory service in China. He was the chairman of the board for both companies till year 2004.

Before joining China Unicom, Xiaomang Yu was the General Manager of China Railway Signal and Communication Corporation for almost 10 years. During his terms, he created the first joint venture in China Railway systems – CASCO Signal Ltd. in 1986.

Xiaomang Yu earned a B.S. degree in Electrical Engineering from Harbin Institute of Engineering in 1965. He began his career in research and design institutes focusing on automation and communications study for 20 years. In early 1980s, he started his management role. Xiaomang Yu received his Master of Telecommunications and Information Management from the Norwegian School of Management BI (Executive School).

Retiring from major responsibilities at Unicom in Nov. 2003 (still holds the position of Commissioner, China Unicom Development Strategy Consulting Committee), Xiaomang Yu joined China Society Data Network Alliance (CSDN) Information and Technology Co. Ltd. as the Chairman of the Board, and devoted most of his time to value added services in China telecommunication industry.

S2 − Plenary Session III

The Strategy and Policy to Develop the Communication Industry in Taiwan

Alice Chou
Taiwan Institute of Economic Research
7th Floor, 16-8, The-Huei Street, Taipei, Taiwan, R.O.C.
alice.chou@tier.org.tw

ABSTRACT

Building on the IT and Semiconductor industries' successful development, Taiwan government had planned to develop the next successful industry – communication industry − several years ago. The National Telecommunication Program since 1988 has resulted in many achievements over five years' development. For example, Taiwan made more than 80% of the WLAN cards worldwide; government issued five licenses for the 3G operators; and the communication industry production is close to NTD 600 billion. In addition, the enterprises in Taiwan also actively conduct R&D projects. The wireless communication promotion office of MoEA, the 3G Communication Leaders United Board (CLUB), and the non-profit organizations such as ITRI, III, and CSIST are all teaming together to make significant progress. This presentation will describe how the wireless communication industry could become the third trillion NTD industry in Taiwan, and what the strategy and policy the Taiwan government used.

BIOGRAPHY

Alice Chou graduated from Chung Yuang University, Taiwan in 1979, and received M.S. degree in Computer Science from College of William and Mary Virginia in 1984. She joined Taiwan Institute of Economic Research in 1987 as a system analyst in charge of the database development for the R&D projects sponsored by the government. At the same time she was also doing the government project called the "Industrial Technology Information Services." She then became the chief librarian and managed more than 50-thousand books and periodicals. Since 1997, Alice has been Director for Department of Information Services. In 1998, she created Department of Taiwan Industry and Enterprise Database to sell Taiwan's industrial analysis reports to all sectors. With many years' experience in handling the government R&D projects, Alice is currently responsible for several projects including the Wireless Communication Technology Consultant and Promotion Project, Technology Development Program Performance Evaluation Project, Industrial Technology White Book Project, Ban-Chiao Telecommunication Park Planning Project, Lung-Yuan Wireless Telecommunication Park Planning Project, Agriculture Biotechnology Industry Promotion Project, etc. Alice is also the Secretary-General of the 3G CLUB, an association for promoting the 3G and beyond 3G technology development in Taiwan.

S3 − Plenary Session IV

Session Chair

Deyu Zhou
Opnext, Inc.
1 Christopher Way, Eatontown, NJ 07724, U.S.A.
dzhou@opnext.com

BIOGRAPHY

Dr. Deyu Zhou is a senior manager of an optical engineering group at Opnext, Inc. He leads the optical group that provides solutions in transmitter and receiver optical subassemblies ranging from 2.5Gbps and below to 10Gbps in various reaches in Opnext's pluggable products. He is in charge of new transmitter and receiver design from concepts to product introduction. In addition, he manages cost reduction projects via optimization of existing design and improvement in transmitter and receiver manufacture processes. He is result-driven in managing contract manufactures, providing detailed technical guidance and schedule requirements. Prior to joining Opnext, Dr. Zhou was a senior research scientist at Telcordia Technologies, where he conducted research and development in advanced optical packet switch systems and all optical networks.

Dr. Deyu Zhou obtained his doctorate degree in the area of fiber optical communications from Department of Electrical Engineering at Princeton University. His research work at Princeton covered hybrid Optical TDM/WDM systems and its components. He published more 30 research paper in cited technical journal and conferences. He is a member of IEEE LEOS member.

S3 − Plenary Session IV

Embedded Computing and Sensor Networks

Zhaohui Wu
College of Computer Science, Zhejiang University
Room 505, East Building Cao Guangbiao, Hangzhou 310027, P.R. China
wzh@cs.zju.edu.cn

ABSTRACT

The potential applications of embedded computing and sensor networks make them very attractive domains for research. This presentation will highlight a few of the projects that have been carried out in our labs related to embedded computing and sensor networks. These projects cover a wide range including embedded operating systems, status monitoring and fault diagnosis systems, embedded middleware and smart cars. We will give an overview of these research projects, highlighting the roles that embedded computing and sensor networks play in these platforms.

BIOGRAPHY

Professor Zhaohui Wu, who was born in 1966, now is a Ph.D. supervisor and Deputy Dean of College of Computer Science at Zhejiang University (ZJU). He serves as the Chief Engineer of the Research Center of Embedded System at ZJU. He was a member of Sino-Germany jointly Ph.D. program from 1991 through 1993, and received his Ph.D. (1993) in Computer Science from ZJU. During the subsequent 10 years, much of his research and teaching focused on Distributed Artificial Intelligence, Embedded Software and System Engineering, etc. As a group leader, Prof. Wu has taken charge of more than 30 research projects, such as, National Major Technical Plan of China (Climbing S&T heights plan), National High Technology Research and Development Program of China (863 Program), National Natural Science Foundation of China (NSFC), Provincial Key Technologies R&D Program of Zhejiang, etc. All the projects have been put across and gained public appreciations.

His research achievements received many awards for scientific and technological progress on the provincial and ministerial levels. He has published two books and more than one hundred papers.

More recently, Prof. Wu has made significant accomplishments on the application of Embedded Software and System Engineering. Collaborating with the professor Feiyue Wang from the University of Arizona, he proposed a new theoretical model and computing framework for utilizing customized embedded operating system (ASOS), and made prior research on super-micro embedded operating system in China. Prof. Wu has been paying more attention to the combination of theoretical research with technical application. Under his leadership, his group has developed successfully the copyrighted scalable real-time embedded operating system named HBOS (Heaven Bird Operation System), based on which, a series of embedded digitized product equipments have come forth, including embedded hand-hold data collector for power device overhaul, Yongxin digital TV set-top-box, set-top-box for stock application, embedded IP phone, embedded speaker verification module, embedded speech driven module for vehicles, etc. These systems applications have made enormous economic and social profits.

Prof. Wu also serves at the Expert Group of both Major software program of 863 Program and Provincial Informationization of Zhejiang.

S3 − Plenary Session IV

Next Generation Broadband Communications

Ian Y. Chiou
Computer and Communications Research Laboratories, Industrial Technology Research Institute
195 Sec. 4, Chung Hsing Rd., Chutung, Hsinchu, Taiwan 310, R.O.C.
ianchiou@itri.org.tw

ABSTRACT

With proliferation of multimedia applications and broadband connectivity increasingly available and affordable, demands for more advanced broadband equipment and services have accelerated dramatically in recent years. In this presentation, worldwide communications market trends and growth areas as well as bottlenecks of existing broadband infrastructure are first highlighted. It's then followed by closer looks into various emerging technologies to support broadband communications from metropolitan areas to residential homes. Evolved from opposite ends of the technology spectrum, NG-SDH/SONET and Metro Ethernet are two prevalent solutions to efficiently carry multi-service traffic in the metropolitan area networks. In the access network, a variety of different technologies covering fiber access (e.g., FTTx/xPON), wireless (e.g., WiMax) and hybrid solutions are next discussed. At customer premises, technologies utilizing phone line, power line, wireless and Ethernet as well as industry standards to facilitate home networking are also examined. In the end, ongoing R&D work in broadband communications at CCL/ITRI is briefly mentioned.

BIOGRAPHY

Dr. Ian Y. Chiou is currently Director of Communication System Division at CCL/ITRI responsible for research programs in the areas of broadband access (EPON, xDSL, IP Security, etc.), networked video (MPEG4/H.264 Codec, Video Surveillance and Streaming, etc.), metro Ethernet (Ethernet Switching, Gigabit Switch Fabric, etc.) and open architecture based communication software. He has held various management and technical leadership positions in telecommunications industry. Previously, he was an R&D director at Bell Labs of Lucent Technologies responsible for product development of carrier-grade network and element management systems supporting various DWDM/SONET/SDH transmission equipment. He has developed in-depth knowledge in system architecture and software development methodology over the years, and has led several successful projects transforming new technology into field-proven products. Dr. Chiou received his M.S. and Ph.D. in Computer and Information Science from Ohio State University, Columbus, Ohio, and B.S. in Electrical Engineering from National Taiwan University.

S3 − Plenary Session IV

Multimedia Digital Home − Latest Advances and Applications

Shen-Chang Chao
Hong Kong Applied Science and Technology Research Institute (ASTRI)
5th Floor, Photonics Centre, 2 Science Park Avenue, Hong Kong Science Park, Shatin, Hong Kong
schao@astri.org

ABSTRACT

The talk will present the market trends, technology advances and emerging next generation wireless and multimedia consumer electronic devices, applications and services for digital home. The presentation includes an overview of related technologies and products developed by ASTRI and an introduction to the Consumer Electronics R&D Center to be launched in the Hong Kong/PRD region.

BIOGRAPHY

Dr. Shen-Chang Chao is Vice President at ASTRI responsible for research and development in innovative wireless, web service and multimedia technologies and applications. Dr. Chao has 16 years of experience in telecommunication industry in U.S. He has a successful track record in leading large software teams to develop and deliver communication software products to worldwide customers. He had extensive experience in identifying technology solution to meet business needs, product realization process and methodology, large scale multi-vendor system integration and system architecture design. Dr. Chao earned his Ph.D. degree in theoretical high-energy physics from the Columbia University at NYC.

S5 − Technical Session VI: Broadband Wireless and Sensory Network

Session Chair

Xiaodong Wang
Electrical Engineering Department, Columbia University
717 Schapiro CEPSR, 500 West 120th Street, New York, NY 10027, U.S.A.
wangx@ee.columbia.edu

BIOGRAPHY

Dr. Xiaodong Wang received the B.S. degree in Electrical Engineering and Applied Mathematics (with the highest honor) from Shanghai Jiao Tong University, Shanghai, China, in 1992; the M.S. degree in Electrical and Computer Engineering from Purdue University in 1995; and the Ph.D. degree in Electrical Engineering from Princeton University in 1998. From July 1998 to December 2001, he was on the faculty of the Department of Electrical Engineering, Texas A&M University. In January 2002, he joined the faculty of the Department of Electrical Engineering, Columbia University.

Dr. Wang's research interests fall in the general areas of computing, signal processing and communications. He has worked in the areas of digital communications, digital signal processing, parallel and distributed computing, nanoelectronics and bioinformatics, and has published extensively in these areas. Among his publications is a recent book entitled *Wireless Communication Systems: Advanced Techniques for Signal Reception*, published by Prentice Hall, Upper Saddle River, in 2003. His current research interests include wireless communications, Monte Carlo-based statistical signal processing, and genomic signal processing. Dr. Wang received the 1999 NSF CAREER Award, and the 2001 IEEE Communications Society and Information Theory Society Joint Paper Award. He currently serves as an Associate Editor for the *IEEE Transactions on Communications*, the *IEEE Transactions on Wireless Communications*, the *IEEE Transactions on Signal Processing*, and the *IEEE Transactions on Information Theory*.

S5 − Technical Session VI: Broadband Wireless and Sensory Network

Session Co-chair

Guosen Yue
NEC Research Laboratories America
Princeton, NJ 08540
yueg@nec-labs.com

BIOGRAPHY

Dr. Guosen Yue received the B.S. degree in physics and the M.S. degree in electrical engineering from Nanjing University, Nanjing, China in 1994 and 1997, and the Ph.D. degree from Texas A&M University, College Station, TX, in 2004.

Since August 2004, he has been with NEC Laboratories American, Princeton, New Jersey, conducting research on broadband wireless systems and mobile networks. His research interests are in the area of advanced modulation and channel coding techniques for wireless communications.

S5 − Technical Session VI: Broadband Wireless and Sensory Network

Design and Analysis of LDPC for MIMO-OFDM

Guosen Yue
NEC Research Laboratories America
Princeton, NJ 08540
yueg@nec-labs.com

ABSTRACT

We consider the performance analysis and design optimization of LDPC coded MIMO OFDM systems for high data rate wireless transmission. The tools of density evolution with mixture Gaussian approximations are used to optimize irregular LDPC codes and to compute minimum operational signal-to-noise ratios for ergodic MIMO OFDM channels. In particular, the optimization is done for various MIMO OFDM system configurations which include different number of antennas, different channel models and different demodulation schemes; and the optimized performance is compared to the corresponding channel capacity. It is shown that along with the optimized irregular LDPC codes, a turbo iterative receiver that consists of a soft maximum a posteriori (MAP) demodulator and a belief-propagation LDPC decoder can perform within 1 dB from the ergodic capacity of the MIMO OFDM systems under consideration.

BIOGRAPHY

Dr. Guosen Yue received the B.S. degree in physics and the M.S. degree in electrical engineering from Nanjing University, Nanjing, China in 1994 and 1997, and the Ph.D. degree from Texas A&M University, College Station, TX, in 2004.

Since August 2004, he has been with NEC Laboratories American, Princeton, New Jersey, conducting research on broadband wireless systems and mobile networks. His research interests are in the area of advanced modulation and channel coding techniques for wireless communications.

S5 − Technical Session VI: Broadband Wireless and Sensory Network

A Smart Sensor Network for Object Detection, Classification and Recognition

Frank Y. Shih [1], **Yi-Ta Wu** [1], and **Jiann-Liang Chen** [2]
[1] New Jersey Institute of Technology, [2] National Dong Hwa University
shih@njit.edu

ABSTRACT
A surveillance system is a closed-circuit television system used to maintain close observation of a person or group. It is widely used nowadays to help a guard with consecutive sensing information. However, the concurrent observation of several monitors and the long-term exhausting visualization cause the problem of decaying attention. Furthermore, two major issues in the traditional surveillance systems affect their performance. First, the object resolutions are changed due to the varying distances between the object and the camera. Therefore, it will cause the problem in object recognition since we have to adopt different sizes of the mask to properly extract object features. The other issue is that the detection of the moving object becomes difficult when the camera is not fixed. Consequently, the development of an efficient, automated surveillance system is an important task to overcome the problem for ensuring robust security.

In this presentation, a sensor-based surveillance system is developed for object detection, classification and recognition to provide a more powerful and reliable system than the traditional ones. The wireless sensors are utilized as the guarders by only utilizing limited functions to detect the coordinates of the unauthorized invasions. When there are no specific signals detected by the wireless sensors, our smart sensor network system will periodically rotate as traditional surveillance for safeguard. Once the wireless sensors detect any unauthorized invasion, the system will adjust the cameras toward the suspicious area and obtain the coarse image features for object classification. In order to reduce unnecessary processing and perform the surveillance system efficiently, a hierarchical feature extraction approach is adopted. That is, after receiving vigilant signals from wireless sensors, the cameras will extract coarse image features for object classification. Once the classification result shows that the object is a dangerous intrusion, the cameras will continuously extract fine image features for object recognition. Experimental results shows our system not only efficiently detect any unauthorized invasion, but also successfully classify and recognize the invasion.

BIOGRAPHY
Professor Frank Y Shih received the B.S. degree from National Cheng-Kung University, Taiwan, in 1980, the M.S. degree from the State University of New York at Stony Brook, in 1984, and the Ph.D. degree from Purdue University, West Lafayette, Indiana, in 1987, all in Electrical Engineering. He is presently a professor jointly appointed in the Department of Computer Science (CS) and the Department of Electrical and Computer Engineering (ECE) at New Jersey Institute of Technology, Newark, NJ. He currently serves as the Associate Chair of the CS Department and the Director of Computer Vision Laboratory. He holds the IEEE senior membership. Dr. Shih has published over 140 technical papers in well-known prestigious journals and conferences. His current research interests include image processing, sensor networks, pattern recognition, computer vision, artificial intelligence, expert systems, robotics, computer architecture, fuzzy logic, and neural networks.

Yi-Ta Wu is presently a Ph.D. candidate in Computer Science, New Jersey Institute of Technology. His interests include image/video processing, multimedia security, mathematical morphology, surveillance system, robot vision, pattern recognition, shortest path planning, and artificial intelligence. (See http://web.njit.edu/~yw23).

Professor Jiann-Liang Chen was born in Taiwan on December 15, 1963. He received the Ph.D. degree in Electrical Engineering from National Taiwan University, Taipei, Taiwan in 1989. Since August 1997, he has been with the Department of Computer Science and Information Engineering of National Dong Hwa University, where he is a professor now. His current research interests are directed at Wireless Sensor Networks, Cellular Mobility Management and Personal Communication Systems.

S5 − Technical Session VI: Broadband Wireless and Sensory Network

Secure Chaotic Spread-Spectrum Communication Systems

Jin Yu and **Yu-Dong Yao**
Wireless Information Systems Engineering Laboratory (WISELAB)
ECE Department, Stevens Institute of Technology, Hoboken, NJ 07030, U.S.A.
{jyu, yyao}@stevens.edu

ABSTRACT
In a hostile environment, a commercial or military interceptor may try to detect the presence of radio frequency (RF) energy and then to determine the location of its transmitter. Although direct-sequence (DS) spreading signals have generally good low probability of intercept (LPI) performance, there still exist some intercept detectors, such as those with likelihood ratio test technique, which are able to determine the presence of direct-sequence spread-spectrum (SS) signals. To improve the security of the DS SS systems, non-binary and non-periodic chaotic sequences are desirable for covert communications because their pseudorandom waveforms can be very useful in disguising signals as noise. Another advantage of using chaotic sequences is the large number of available spreading sequences for multiple access applications.

Several intercept receivers, including energy detectors, synchronous and asynchronous, coherent and non-coherent structures, which are typically used to detect binary DS SS signals, are examined here to detect the presence of chaotic DS SS signals. A simple detection approach using a binary correlating function to detect non-binary chaotic sequences is proposed. Comparisons between systems using chaotic and binary sequences are given in terms of the LPI performance and the performance improvement with chaotic spreading sequences is observed. Another detection scheme employing dual antennas is also explored to detect the presence of chaotic or multi-level spreading signals. The detection performance using dual antennas is compared to that using the simple binary detection method with a single antenna. Detection probability improvement is observed with the use of dual antennas due to the reduction of waveform mismatch. Detection probabilities are also examined when the effect of mutual coupling is considered due to the small antenna spacing between the dual antennas and noticeable performance degradation is observed.

BIOGRAPHY
Jin Yu received the B. Eng. degree from Wuhan University, China, in 1998, and received the M. Eng. degree from the University of Mississippi, Oxford, MS, in 2001, respectively. Currently he is studying toward his Ph.D. degree in electrical engineering at Stevens Institute of Technology. During his study at the University of Mississippi, his research work focused on the computational electromagnetics and microwave circuits. At present he is doing research in the applications of phased arrays in wireless communications at WISELAB. His research interest areas include code-division multiple access (CDMA), signal processing for wireless communications, and adaptive antennas.

Dr. Yu-Dong Yao received the B.Eng. and M.Eng. degrees from Nanjing University of Posts and Telecommunications, Nanjing, China, in 1982 and 1985, respectively, and the Ph.D. degree from Southeast University, Nanjing, in 1988, all in electrical engineering. Between 1989 and 1990, he was at Carleton University, Ottawa, as a research associate working on mobile radio communications. He was with Spar Aerospace Ltd., Montreal, between 1990 and 1994, where he was involved in research on satellite communications. He was with Qualcomm Inc., San Diego, from 1994 to 2000, where he participated in research and development in wireless CDMA systems. Dr. Yao joined Stevens Institute of Technology, Hoboken, New Jersey, in 2000. He is an associate professor in the Department of Electrical and Computer Engineering and a director of WISELAB. Dr. Yao holds one Chinese patent and nine U.S. patents. He is an associate editor of *IEEE Communications Letters* and *IEEE Transactions on Vehicular Technology*, and an editor of *IEEE Transactions on Wireless Communications*. He is a guest editor for a special issue on wireless networks for *International Journal of Communication Systems*. His research interests include wireless communications and networks, spread spectrum and CDMA, and DSP for wireless systems.

S5 − Technical Session VI: Broadband Wireless and Sensory Network

A Model of Service Provision for Wireless Sensor Networks

Loc Nguyen
Laboratory Lip6, University Paris 6
8 rue du Capitaine Scott, 75015 Paris, France
tuan-loc.nguyen@lip6.fr

ABSTRACT

This article introduces the IIS architecture (Intelligent Services for Sensor Networks), a model of service provision for Wireless Sensor Networks Service. IIS serves the role of middleware that abstracts a network of sensor as a collection of massive information. IIS supports mechanisms for self-organization, networking and energy optimization to build higher-level service structures in Wireless Sensor Networks. IIS is also a framework which simplifies the service creation for sensor network applications.

BIOGRAPHY

Professor Tuan Loc Nguyen received his Ph.D. in network and computer science from the University of Paris VI, France, in 2004 and his engineer degree in science computer from Polytechnic University of Ho Chi Minh City, Vietnam, in 1999. He is currently an assistant professor at the University of Paris XII and Paris VI. His research interests include the intelligence in networking, value-added services in networking, service provision, wireless sensor networks, and autonomic communication.

S6 – Technical Session VII: Applications of Fiber and Integrated Optical Communications

Session Chair

Zhengyu Huang
RSoft Design Group
200 Executive Blvd., Ossining, NY 10562, U.S.A.
zhengyu_huang@rsoftdesign.com

BIOGRAPHY

Dr. Zhengyu Huang is the Vice President of Sales and Business Development at RSoft Design Group, which is the worldwide market leader in providing Photonic Design Automation (PDA) software for optical communication, optoelectronics, and semiconductor manufacturing. Zhengyu has over 12 years experience in the areas of simulation, design, and fabrication of photonic integrated components. At RSoft, Zhengyu is responsible for the worldwide sales and business development for all RSoft products. Zhengyu is also in charge of the application development, consulting services and technical support for component-level PDA tools and has actively involved and managed the development and commercialization of these tools. On several US government sponsored research programs to develop next-generation PDA tools, he was or has been the principle investigator or co-PI. At Columbia University, Zhengyu developed and prototyped various novel photonic integrated devices for high-speed optical communication network. At Iowa State University, he conducted research in the area of design and fabrication of photonic crystals. Zhengyu has contributed over 20 technical papers in scientific journals and conferences.

Prior to joining RSoft, Dr. Huang was a management consultant at Boston Consulting Group (BCG), where he provided strategic consulting service for leading multinational and Chinese companies in consumer goods, telecommunication, e-commerce, and automobile industries. Zhengyu also worked for China DaTong Electronics Corporation as the assistant to the CEO.

Zhengyu received the Ph.D. in Applied Physics and Electrical Engineering from Columbia University, the M.S. in Condensed Matter Physics and Microelectronics from Iowa State University and the B.S. in Physics from Peking University.

S6 – Technical Session VII: Applications of Fiber and Integrated Optical Communications

Silicon Photonics

Chee Wei Wong
Optical Nanostructures Laboratory, Department of Mechanical Engineering, Columbia University
Room 220 Mudd Hall, 500 West 120th Street, New York, NY 10027, U.S.A.
cww2104@columbia.edu

ABSTRACT

The convergence of electronics and photonics in a monolithic silicon platform brings about unprecedented information processing capacity. Silicon photonics yields a scalable solution to the anticipated barriers of interconnection bandwidth and latency, input/output density, and electronics/photonics partitioning. This is further propelled by our theoretical understanding of optical nanostructures from first-principles and by successes in nanoscale optical device nanofabrication, from which we can now practically prescribe the properties of synthetic optical nanostructures. We will discuss a specific example of a silicon optical nanostructure, which exhibits the possibility of large-scale CMOS deployment of the resulting silicon nanophotonics technology.

BIOGRAPHY

Dr. Chee Wei Wong joined the Columbia faculty in 2004, after receiving his Sc.D. in Mechanical Engineering (Optical Nanotechnology) at the Massachusetts Institute of Technology (MIT) in 2003. He received the S.M. at MIT in 2001, the B.Sc. in Mechanical Engineering (highest honors) at the University of California at Berkeley in 1999, and B.A. in Economics (highest honors) at the University of California at Berkeley in 1999. He was a post-doctoral research associate at the MIT Microphotonics Center prior to joining Columbia. His research interests are in optical nanostructures, such as nonlinearities in nanophotonics, quantum dot interactions, high-density integrated optics, silicon electronic-photonic integration, nanoelectromechanical systems, and nanofabrication. He is the author of over 30 journal articles and patents in these areas, and a member of APS, ASME, IEEE, OSA, and Sigma Xi.

S6 – Technical Session VII: Applications of Fiber and Integrated Optical Communications

Timing Jitter Control of an Add/drop Optical Module in a Convergent Network

Minglai Kao
Multiplex, Inc.
116 Corporate Boulevard, South Plainfield, NJ 07080, U.S.A.
mlkao@multiplexinc.com

ABSTRACT

Timing jitter is the deviation of a signal from its "should be" position in time and it is one of the major sources of errors in communication networks especially for high data-rate systems. Two factors that make jitter control more important and more difficult than ever before in a convergent network are the ever-increasing data rates and the natural disparities of various applications. As the data rate increases, the timing window for data capture becomes smaller and smaller and therefore the difficulty of correctly capturing the data increases. Timing jitters further reduce the window and thereby increase the probability of data-sampling or data-recovery errors. With more and more applications are being converged to the network, the timing variations among these applications increase and therefore impose more technical challenges for recovering the clock and the data.

Sources of timing jitters in general can be categorized as random or deterministic. The former comes from the random nature of electronic components such as thermal noise and shock noise while the latter is normally attributed to the design.

Three measurements are typical for modules – jitter tolerance, jitter transfer, and jitter generation. Since jitter cannot be eliminated completely, a module should be able to tolerate the maximum amount of jitters that could possible exist in a system without making any error. The measurement of jitter tolerance of a module is to ensure this capacity. The measurement of jitter transfer is to find out how much jitter that a module adds to that of an incoming signal. The measurement of jitter generation is the measurement of the jitter that a module generates. Technology advancement has made the measurements of jitter much easier. Instruments are now available for these measurements. However, differences among the various instruments as well as accuracies of measurements are some of the major concerns.

Although jitters cannot be eliminated completely, they can be reduced or controlled by good design and proper operation. From the operational point of view, the temperature and the power supplies should be controlled to reduce noise and the module should be kept away from strong electromagnetic interference. Common practices in a good design include selection of the right components for the desired frequency and temperature ranges, proper component placement and signal routing in the physical layout of the printed circuit board, and good thermal management with proper mechanical design. This presentation will cover the basics of current jitter measurement and design techniques for an optical module.

BIOGRAPHY

Dr. Minglai Kao graduated from the National Chiao-Tung University, Hsinchu, Taiwan in 1975. He joined the Bell Labs of AT&T in 1986 after he obtained the Ph.D. degree in Electrical Engineering from the Ohio State University, Columbus, Ohio, USA. He has been in the communications industry for more than 18 years of which 12 years was in the fiber optic communications especially the design and testing of various fiber optic components and associated electronics and field trials of long haul fiber optic transmission systems and the remaining years was in the communications IC area such as IC for VoIP applications. Currently he is with Multiplex, Inc, New Jersey and he has been with this company for almost 5 years. His main responsibility is on the technical aspects of the transponder products but his interests cover many areas. He holds a patent on the automatic control of the bias of a lithium-niobate modulator for long distance transmission. He is a senior member of IEEE.

S6 – Technical Session VII: Applications of Fiber and Integrated Optical Communications

Next Generation Fiber Optic Sensing and Its Applications

Kung-Li Deng
GE Global Research Center
One Research Circle, KWC1613, Niskayuna, NY 12309, U.S.A.
deng@crd.ge.com

ABSTRACT

In the past, fiber optic sensing has made profound impact to several fields including civil, mechanical and biomedical engineering. Today, there is an increasing demand for sensors that includes homeland-security, military, industrial and infrastructure where fiber optic sensor is able to continue to play as a key enabler to meet the needs. More than usual, these fiber sensors will face harsh operating conditions with high temperatures, corrosion/erosion surroundings, high-vibration, voltage and pressure environment. The future requirements will include long operating-life, high accuracy, low field maintenance and low cost. In this talk, I will introduce a new fiber optic sensor that will be able to operate in the harsh environment (for example, ~1000C) with extended life based on a novel permanent fiber grating technique. We also develop a nano-membrane technology on the surface of the fiber where it functions as the interaction agent with the surrounding chemical and gases. Unlike the traditional catalysis, this membrane will sustain high-temperature and is re-conditionable in the field. These technologies open up opportunities to use fiber-grating sensors in power generation system (gas/steam turbine, coal-fire boilers, and aircraft engines); in oil and gas applications (down-hole sensing, sub sea station and reservoir monitoring); and in the area of bio-chemical detection.

BIOGRAPHY

Dr. Kung-Li Deng is a senior member of research staff at GE's Global Research Center in Niskayuna, New York, where he is conducting integrated photonics research. Dr. Deng has been involved with fiber optics and photonics for communication, sensing, materials research and biotechnology. His work is largely looking into non-traditional applications such as Energy, Healthcare, Transportation, and Infra-structure Sensing for fiber-optic technology. He also works on advanced optoelectronic chip-scale packaging and advanced avionic photonic networks with Lockheed Martin. Prior to GE, he worked as a research assistant professor at Polytechnic University, NY. From 2001-2002, he was the chief scientist and co-founder at BeLight Inc., a spin-off start-up company from Jedai Broadband Networks, leading the research and development efforts for next-generation intelligent optical wireless networks. While at Jedai Broadband Networks, Dr. Deng was the senior research scientist, a NJ-based start-up company for next generation optical access networks. Prior to Jedai, he was a Member of Technical Staff at Bell Laboratories, Lucent Technologies in Holmdel, NJ, working on 40, 80, 100 and 160-bits/s OTDM systems and next-generation optical Ethernet technologies.

Dr. Deng received his Ph.D. in Electrical Engineering from Princeton University in 1999, B.S. and M.S. degrees in 1991 and 1993 respectively from National Taiwan University, both in Electrical Engineering. He has published over 70 technical papers in cited journals and conferences in the field of fiber sensor, advanced packaging, optical networks and ultrafast lasers. Dr. Deng also holds multiple patents in laser ranging, ultra-fast optical system, next-generation free-space optical communications systems, photonic packaging and sensing.

S6 – Technical Session VII: Applications of Fiber and Integrated Optical Communications

Optical Control Planes: Status and Perspectives

Ying (Emily) Hu
Lucent Technologies
101 Crawfords Corner Rd. Holmdel, NJ 07733, U.S.A.
emilyhu@lucent.com

ABSTRACT

Growing competition between network operators, new characteristics of traffic as well as network survivability challenges trigger the need for a more flexible and dynamic optical infrastructure. The ASON/GMPLS concept is becoming a practical and economic reality, driven by advancements in technology. The control plane is the centerpiece of the ASON/GMPLS concept, providing the functionality to effectively and efficiently control the optical network. This entails the realization of fundamental capabilities within the network itself for state information management, decision making, and action invocation.

The talk will present the service and business applications of ASON/GMPLS optical control plane, the management aspects of optical control plane, current standards, concepts related to such an infrastructure and ways to implement it in real networks, along with challenges facing designers and system engineers.

BIOGRAPHY

Dr. Ying (Emily) Hu is a senior member of technical stuff in Bell Labs advanced optical and wireless network modeling group. She has been responsible for supporting various Lucent organizations with end-to-end architecture, traffic models, and network designs. Also she has been providing technical expertise in optical networking in support of Lucent Worldwide Service to develop new professional services, pre-sale, and delivery activities regarding SONET/SDH, C/DWDM, Optical Ethernet, and Storage Area Network.

She has a Ph.D. in electrical engineering from Stevens Institute of Technology, Hoboken, USA, and MSEE and BSEE in Beijing Institute of Technology, Beijing, China.

S6 – Technical Session VII: Applications of Fiber and Integrated Optical Communications

Multi-User Quantum Cryptography Networks

Bing C. Wang
Department of Electrical and Computer Engineering, University of Connecticut
260 Glenbrook Road U-2157, Storrs, CT 06269-2157, U.S.A.
bingwang@engr.uconn.edu

ABSTRACT

Present quantum cryptography technologies can provide ultra-secure encryption key distribution between two parties. However, any practical implementation of encryption key distribution schemes requires establishing secure quantum communications amongst multiple users. In this talk, we will briefly survey some of the latest quantum key distribution research going on in both industrial and academic research laboratories. In addition, recent efforts in deploying quantum cryptography technologies in the field will be discussed. We will also discuss some common topologies that are being considered for multi-user quantum encryption networks. The performance of the multi-user quantum key distribution systems is then compared in four common optical network topologies: the Sagnac-based fiber ring, the wavelength routed, the passive star and the bus network. Their performances are analyzed and compared using quantum bit error rate analysis

BIOGRAPHY

Professor Bing C. Wang received the B.S. degree in applied Physics from Columbia University, New York, in 1998 and the Ph.D. degree in electrical engineering from Princeton University, Princeton NJ, in 2002. While at Princeton, he worked in the Lightwave Communications Laboratory under the guidance of Professor Paul Prucnal, his research advisor.

In 2002, he joined the Electrical and Computer Engineering Department of the University of Connecticut in 2002 as an assistant professor. At the University of Connecticut, he conducted research on multi-user quantum key distribution, novel quantum cryptography protocols, optical packet switching, and all optical signal processing. He has authored or coauthored over 30 journal and conference publications, one book chapter, and holds one patent.

Professor Wang is a member of the IEEE Lasers and Electro-Optics Society and the Optical Society of America, and has served on various NSF proposal review panels.

S7 – Technical Session VIII: Emerging Multimedia Technologies

Session Chair

Peng Yin
Corporate Research, Thomson Inc.
2 Independence Way, Princeton, NJ 08540, U.S.A.
peng.yin@thomson.net

BIOGRAPHY

Dr. Peng Yin received her B.E. degree in electrical engineering from University of Science and Technology of China and the M.A. and Ph.D. degrees in electrical engineering from Princeton University, New Jersey. Dr. Yin is currently a senior member of the technical staff at Corporate Research, Thomson Inc., located at Princeton, New Jersey. Her current research interest is mainly on image and video compression. Dr. Yin received the CASS CSVT Transaction Best Paper Award in 2002.

S7 – Technical Session VIII: Emerging Multimedia Technologies

Directional Filterbank for Texture Image Classification

Hong Man
Department of Electrical and Computer Engineering, Stevens Institute of Technology
Burchard Building, Castle Point on Hudson, Hoboken, NJ 07030, U.S.A.
hman@stevens.edu

ABSTRACT

We present a rotation invariant texture classification method using a special directional filter bank (DFB) and support vector machine (SVM). This method extracts a set of coefficient vectors from directional subband domain, and models them as multivariate Gaussian densities. Eigen-analysis is then applied to the covariance metrics of these density functions to form rotation invariant feature vectors. Classification is based on SVM, which only takes non-rotated images for training and uses images at various rotation angles for testing. Experimental results have shown that this DFB is very effective in capturing directional information of texture images, and the proposed rotation invariant feature generation and SVM classification method can in fact achieve relatively consistent classification accuracy on both non-rotated and rotated images.

BIOGRAPHY

Professor Hong Man received the B.S. degree from Soochow University, China, in 1988, the M.S. degree from Gonzaga University in 1994, and the Ph.D. degree from Georgia Institute of Technology in 1999, all in Electrical Engineering. He joined Stevens Institute of Technology in 2000, and currently he is an assistant professor in the Department of Electrical and Computer Engineering. He is serving as the director for Visual Information Environment Laboratory at Stevens, the director for Computer Engineering undergraduate program in the ECE department, and the coordinator for NSA Center of Academic Excellence in Information Assurance in the School of Engineering. He is a member of the IEEE and ACM. He served as member of organizing committee for IEEE International Workshop on Multimedia and Signal Processing (MMSP) 2002 and 2005, member of technical program committee for IEEE Vehicular Technology Conference (VTC) Fall 2003, and IEEE/ACM International Conference on E-Business and Telecommunication Networks (ICETE) 2004. He is a committee member on IEEE SPS TC for Education. He was an active contributor to the ISO/ITU JPEG 2000 image coding standard.

S7 – Technical Session VIII: Emerging Multimedia Technologies

Minimizing Power Consumption of Source Encoding and Radio Transmission in Multiuser CDMA Systems

Xiaoan Lu
Polytechnic University
5 Metrotech Center, LC220, Brooklyn, NY 11201, U.S.A.
xlu@vision.poly.edu

ABSTRACT

We investigate the power consumed by multiple mobile terminals transmitting compressed source signals to a base station in a CDMA cellular system. The aim is to minimize total power consumption (the sum of power consumed by source compression and radio transmission) at the terminals by simultaneously adjusting the operating parameters of the source coder and the transmitter. We find that in general the complexity of source compression should increase with increasing distance between a terminal and the base station. However, the exact configuration of the source coder and the transmitter depends on the interaction of all N terminals. The optimum operating points of the terminals are contained in N nonlinear equations. We use the example of a transform coder processing signals from a Gauss-Markov source to explore the advantages of an adaptive system over a system with fixed operating parameters. We also argue how our analytical framework can be applied to a variety of source coders.

BIOGRAPHY

Xiaoan Lu received the B.S. and M.S. degrees in Electronic Engineering from Tsinghua University, Beijing, China, in 1997 and 2000, respectively. She is currently working toward her Ph.D. degree at Polytechnic University, Brooklyn, NY. Her general research interests are in the areas of signal/image processing, image/video compression and wireless multimedia communications, with an emphasis on the emerging topic of power efficient wireless multimedia communications.

S7 – Technical Session VIII: Emerging Multimedia Technologies

Video Segmentation for Surveillance

Juhua Zhu
Dept. of Electrical Engineering, Princeton University
Princeton, NJ 08544, U.S.A.
juhuazhu@princeton.edu

ABSTRACT

Video segmentation is usually termed as foreground (moving objects) segmentation in a fixed camera scenario, and as independent motion segmentation in a moving platform scenario. It is a fundamental step in many vision systems including video surveillance, human-machine interface, and very low-bandwidth telecommunications. Accurate foreground segmentation is a difficult task due to such factors as illumination variation, occlusion, background movements, and noise. We present a transform domain approach that employs a set of DCT-based features to exploit the spatial and temporal correlation in the video sequences. The approach is shown to be insensitive to illumination change and to noise. It also overcomes many common difficulties of segmentation such as foreground aperture, and moved background objects. The algorithm can perform in real-time. If time allows, I will briefly show some results of the moving camera case. With a moving camera, estimation of camera ego-motion is the key issue. Our approach is based on solving an optimization problem for the FOE (Focus Of Expansion). The flow field defined by FOE can be used to detect independent motions on the road.

BIOGRAPHY

Juhua Zhu received her B.S and M.S. degree in Electrical Engineering from Shanghai Jiaotong University, China, in 1998 and 2001, respectively. She is currently a Ph.D. student of Electrical Engineering Dept. in Princeton University, NJ, U.S.A. Her research interests include computer vision, statistical learning, and image /video processing.

S7 – Technical Session VIII: Emerging Multimedia Technologies

Video Transmission over IEEE 802.11-based Wireless LAN

Hang Liu
Corporate Research, Thomson Inc.
2 Independence Way, Princeton, NJ 08540, U.S.A.
juhuazhu@princeton.edu

ABSTRACT

Interest and demand for wireless multimedia applications are growing quickly. This talk will review techniques to support the QoS for video transmission over wireless networks, especially over IEEE 802.1-based wireless LAN. New IEEE 802.11e standard will be discussed, which supports traffic prioritization and advanced network resource management to ensure sufficient bandwidth for delay-sensitive applications. Error control techniques at link layer and transport/application layer are also described.

BIOGRAPHY

Dr. Hang Liu joined Thomson Inc., Corporate Research Lab, Princeton, NJ, in 2004 as a Senior Member of Technical Staff, where he work on multimedia over wireless networks. Prior to Thomson, he worked for NEC C&C Research Laboratories, Princeton, NJ, and two startup companies, Iospan Wireless, Inc., and Tellium, Inc. He has published more than 20 first-author papers in international conferences and journals. His research experience includes wireless and mobile networking, mobile computing, multimedia communication systems, Internet, optical networking, network management, and network security. He received the B.S. degree from Tianjin University, Tianjin, China, and the M.S. and Ph.D. degrees in electrical engineering from the University of Pennsylvania, Philadelphia, PA.

S8 – Technical Session IX: Wireless Mobile Communications

Session Chair

Shen-De Lin
Lucent Technologies
Room 3E-205, 67 Whippany Road, Whippany 07981, U.S.A.
shendelin@lucent.com

BIOGRAPHY

Dr. Shen-De Lin received the B.S. degree in electronics engineering from Fu Jen Catholic University, Hsinchuang, Taiwan in 1982, and the M.S. and Ph.D. degrees from State University of New York (SUNY) at Stony Brook in 1987 and 1991, respectively. His Ph.D. thesis was related to signal reception and direction-of-arrival estimation by sensor arrays.

After graduating from SUNY, he jointed AT&T Bell Laboratories and became a cellular system engineer. He received the Outstanding Achievement Award in AT&T in 1994 and the Appreciation of Excellence Award in AT&T in 1995. Since Lucent Technologies was spun off from AT&T in 1996, he has been a base station system engineer in Lucent Technologies. He was promoted to the Distinguished Member of Technical Staff in 1998 and to the Consulting Member of Technical Staff in 2000. He worked on a wide array of international cellular and Personal Communications System (PCS) technologies and standards including analog, Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Time Division Duplex (TDD) and Frequency Division Duplex (FDD). He submitted a number of contributions to the 3rd Generation Partner Project (3GPP), 3GPP2, T1P1 and China Wireless Telecommunications Standards (CWTS). He has been responsible for evaluating wireless system performance, defining mobile system requirement documents, developing 2G/3G fixed/mobile voice/data link budgets, investigating effects of inter-system interference and providing RF engineering guidelines. His current professional interests include technology co-existence study, mobile system optimization and RF planning and design.

Dr. Lin has published seven technical papers and more than 100 internal technical memoranda. He gave a talk entitled “RF Filter Needs for Wireless Applications," in IEEE Microwave Theory and Techniques Workshop in 1993. He holds one patent regarding CDMA handoff. He is the co-author of the book *Handbook of CDMA System Design, Engineering, and Optimization* published by Prentice Hall in 2000.

S8 – Technical Session IX: Wireless Mobile Communications

Session Co-chair

Tao Zhang
Telcordia Technologies
One Telcordia Drive, RRC 1A-245, Piscataway, NJ 07024, U.S.A.
tao@research.telcordia.com

BIOGRAPHY

Dr. Tao Zhang is Director of Mobile Networking Research Group at Telcordia Technologies, Piscataway, New Jersey, USA. He is leading a research group developing technologies to support the mobile Internet, collaborative networking, mobile ad-hoc networks, peer-to-peer applications, and vehicular networking. Advanced technologies developed by Dr. Zhang and his teams to support seamless, secure, and quality-of-service aware media roaming and information sharing for mobile users and devices have been used in a new commercial product developed by a client company and are being implemented on commercial WiFi-cdma2000 dual-mode mobile phones. Dr. Zhang and his research group have also been contributing to leading international standards organizations, including the Internet Engineering Task Force (ETF), the IEEE 802.21 committee, and the Alliance for Telecommunications Industry Solutions (ATIS).

Before joining Telcordia (then Bellcore) in 1995, Dr. Zhang worked at Citibank, Lehman Brothers, and Dow Jones/Telerate, leading strategic planning, design, implementation, and deployment of global real-time financial data collection and distribution software systems and networks.

Dr. Zhang co-authored the book *IP-Based Next Generation Wireless Networks* published by John Wiley and Sons in 2004. He is the founding General Chair of *CollaborateCom: International Conference on Collaborative Computing: Networking, Applications, and Worksharing*, which is co-sponsored by the IEEE, Create-Net, and ICST. He is also on the editorial board of ACM/Kluwer *Wireless Network Journal*. He holds one U.S. patent, with over 25 more pending. Dr. Zhang received the 2000 Telcordia CEO Award (for most exceptional teams and individuals who have achieved a significant business success) and SAIC's Executive Science and Technology Council Publication Prize in 2002. Dr. Zhang received his Ph.D. degree in computer engineering from the University of Massachusetts Amherst, USA in 1993, and his M.S. in computer engineering and B.S. in electrical engineering from Northern Jiaotong University, Beijing, China, in 1987 and 1984 respectively.

S8 – Technical Session IX: Wireless Mobile Communications

The Future of Mobile Data Services

Gerard A. Brosnan
Mitretek Systems
3150 Fairview Park Drive, Falls Church, VA 22042, U.S.A.
gerard.brosnan@mitretek.org

ABSTRACT

This paper identifies trends in the American mobile data services market and presents forecasts for prevailing prices − both retail and wholesale − in the 2015 timeframe. For purposes of this study, mobile data services consist of messaging and switched data services (including Internet access) offered over cellular/personal communications service networks. The paper is organized as follows. Initially, we provide information on the mobile data market as it exists today and how it is expected to develop over the next few years. Then we describe the supply side; that is, how telecommunications companies are planning to provide mobile data services and the expected pricing trends. In addition, we address the demand side − the expected consumer demand for mobile data services and projections on consumer willingness to pay. Finally, we provide conclusions and forecasts resulting from the analysis.

BIOGRAPHY

Gerard A. Brosnan is a Principal Engineer at Mitretek Systems. He is presently supporting the General Services Administration (GSA); his responsibilities include acquisition planning and requirements analysis for next generation telecommunication services. Mr. Brosnan recently supported the Department of Transportation and its Vehicle Infrastructure Integration project. Prior to joining Mitretek in 2002, Mr. Brosnan worked at Bell Laboratories for more than 10 years, where he held engineering and management positions in the switching systems business unit. He received an M.S. degree in Industrial and Operations Engineering from the University of Michigan, and a B.S. degree in Industrial Engineering from the University of Wisconsin.

S8 – Technical Session IX: Wireless Mobile Communications

Intel Communications Technology China Lab Wireless Overview

Wenwu Zhu
Intel Communicatons Technology Lab China
Raycom, ZhongguangCun, #2 Kexueyan South Rd, Beijing, China
wenwu.zhu@intel.com

ABSTRACT

In this talk, first Intel wireless vision will be presented and then Intel Corporate Communications Technology China Lab wireless research focused areas will be reviewed, which include WiMAX and Multi-Radio. WiMAX project focuses on the FPGA-based real-time 802.16e research platform prototype with MIMO OFDM PHY. Multi-radio project focuses on multi-radio co-existence research exploring interference mitigation techniques for multi-radio co-existence on mobile platforms.

BIOGRAPHY

Dr. Wenwu Zhu received the B.E. and M.E. degrees from the National University of Science and Technology, China, in 1985 and 1988, respectively, the M.S. degree from Illinois Institute of Technology, Chicago, and the Ph.D. degree from Polytechnic University, Brooklyn, New York, in 1993 and 1996, respectively, all in Electrical Engineering.

From September 2004 to present, he is Director of Intel Communication Technology China Lab. From October 1999 to August 2004, he was with Microsoft Research Asia as Research Manager of Wireless and Networking Group. During 1996-1999, he was with Bell Labs, Lucent Technologies, NJ, as a Member of Technical Staff. He has published about 200 refereed papers and patents. His current research interest includes multimedia communication and networking, and wireless communication and networking.

Dr. Zhu has been on editorial board in a couple of IEEE journals such as AE for IEEE Transactions on Mobile Computing, IEEE Transactions on Multimedia, and IEEE Transactions on Circuits and Systems for Video Technology. He received the Best Paper Award in IEEE Transactions on Circuits and Systems for Video Technology in 2001. Dr. Zhu is now the Chairman of IEEE Circuits and System Society Beijing Chapter. He serves as the Secretary of Visual Signal Processing and Communication Technical Committee. He is a senior member of IEEE.

S8 – Technical Session IX: Wireless Mobile Communications

Signal Processing Techniques for 3G Wireless Power Amplifier

Michael Luddy
Signal Processing Consultants
Allentown, NJ, U.S.A.
redwoodwest@yahoo.com

ABSTRACT

Today's 3G wireless systems require both higher linearity and high power amplifier efficiency. The high peak-to-average ratios (PARs) of the digital modulation schemes used in 3G wireless systems require that the RF power amplifier (PA) maintain high linearity over a large range while maintaining this high efficiency, these two requirements are often at odds with each other with many of the traditional amplifier architectures.

Linearity is achieved often by either reducing efficiency or by using linearization architectures such as feedforward or outphasing techniques. For class A or class AB power amplifiers, 'backing off' the input can improve linearity, but this reduces power efficiency and increases heat dissipation. This improvement in linearity results in an increase in power consumption, thus it is not a viable tradeoff.

The discussion today focuses on baseband signal processing approaches which are being used to reduce the high PARs, increase PA linearity, while also mitigating impairments in high powered PAs, thus allowing for higher efficiencies while maintaining linearity requirements.

This talk discusses PA impairments, introduces crest factor reduction (CFR) and digital predistortion (DPD) both of which are used to increase PA module efficiencies. CFR and DPD uses digital signal processing (DSP) techniques to predistort a baseband signal before modulation, up-conversion, and amplification by the PA.

BIOGRAPHY

Michael Luddy performed this work while a Systems Engineer at Agere Systems in Allentown, PA. Previously he has worked at AT&T Bell Laboratories, InterDigital and Sony TRDE. He has worked in wireless systems design and has been involved in 3G ASSP development for over 10 years in the areas of baseband signal processing and RF systems design. He obtained his BSEE from NJIT and MSEE from Brooklyn Polytechnic. He has over ten patents in CDMA processing.

S8 – Technical Session IX: Wireless Mobile Communications

A Network Perspective of MIMO Antenna Techniques with Multiuser Scheduling

Li-Chun Wang
Department of Communication Engineering
National Chiao Tung University, Hsinchu, Taiwan
lichun@cc.nctu.edu.tw

ABSTRACT

Multiple-input multiple-output (MIMO) antenna techniques can achieve huge capacity gains without requiring extra bandwidth. The primary challenges to apply the MIMO techniques lines in the implementation complexity and the possible side effect of reliability performance degradation. Many research efforts, especially the physical layer techniques, have been reported in the literature to resolve these issues. Differently, this talk provides a network perspective to implement the MIMO techniques in wireless scheduling systems.

First, we propose using the scheduling techniques to replenish the diversity-deficient spatial multiplexing MIMO system. To this end, we develop a novel strongest-weakest-normalized-subchannel-first (SWNSF) scheduling algorithm to enhance the degraded reliability performance of the MIMO system with limited feedback information. Our analysis indicates that the SWNSF scheduling can significantly increase the coverage of the multiuser MIMO system while improving system capacity. Secondly, we investigate the effect of multi-user scheduling techniques on the simple zero-forcing receiver based spatial multiplexing MIMO system. Somewhat surprisingly, we find that the zero-forcing receiver can be asymptotically optimal in the multiuser scheduling system as the number of users increase.

In summary, by full exploitation of the existing rich network resource – the inherent multiuser diversity, we show that the coverage and complexity issues of the MIMO system can be resolved with a negligible cost. More important than the results presented and also the ultimate goal of this talk, is the hope that the network perspective methodology can provide another innovative view and flexible design paradigm for MIMO wireless systems.

BIOGRAPHY

Dr. Li-Chun Wang received the B.S. degree from National Chiao Tung University, Taiwan, R.O.C. in 1986, the M.S. degree from National Taiwan University in 1988, and the Ms. Sci. and Ph.D. degrees from the Georgia Institute of Technology, Atlanta, in 1995 and 1996, respectively, all in electrical engineering. From 1990 to 1992, he was with the Telecommunications Laboratories of the Ministry of Transportations and Communications in Taiwan (currently the Telecom Labs of Chunghwa Telecom Co.). In 1995, he was affiliated with Bell Northern Research of Northern Telecom, Inc., Richardson, TX. From 1996 to 2000, he was with AT&T Laboratories, where he was a Senior Technical Staff Member in the Wireless Communications Research Department. Since August 2000, he has been an Associate Professor in the Department of Communication Engineering of National Chiao Tung University in Taiwan. His current research interests are in the areas of cellular architectures, radio network resource management, cross-layer optimization, and cooperation wireless communications networks. Dr. Wang was a co-recipient (with Gordon L. Stuer and Chin-Tau Lea) of the 1997 IEEE Jack Neubauer Best Paper Award from the IEEE Vehicular Technology Society. He is an associate editor for the IEEE Transactions on Wireless Communications and holding three US patents.

S9 – Technical Session X – Optoelectronics and Network Elements

Session Chair

Haisheng Wang
The Boeing Company
1151 Broad Street, Ste 214, Shrewsbury, NJ 07702, U.S.A.
haisheng.wang@boeing.com

BIOGRAPHY

Dr. Haisheng Wang is a project manager in Boeing's C4ISR development team for the future tactical communication network. Prior to Boeing, she joined several optical transport start-ups, where she was the product development director and principal architect in 10 Gb/s sub-systems and transport systems. She worked at Lucent and AMP-Lytel (now part of Tyco) on various products and research projects from low cost opto-electronic devices for datacom to high-speed devices for telecom, from subsystems to transport networks.

Haisheng Wang received her Ph.D. degree from CREOL, University of Central Florida, studying ultrafast phenomena in strained MQW III-V opto-electronic devices, Her post-doctoral research work was on VCSELs for optical interconnects at Cornell University/USAF Rome lab. She has about 20 research papers in technical journal and conferences. She is a member of IEEE.

S9 – Technical Session X – Optoelectronics and Network Elements

Redefine Optical Devices' Integration and Manufacturing through Nano-Engineering

Jian Jim Wang
NanoOpto Corporation
1600 Cottontail Lane, Somerset, NJ 08873, U.S.A.
jwang@nanoopto.com

ABSTRACT
Optical industries are 30-year behind semiconductor industry. Conventional optical devices such as polarizers, waveplates, beam-splitters, reflectors, filters and lenses, are all manufactured through different scattered and incompatible design and manufacturing platforms, which make the integration and miniaturization impossible.

With recent advance of nanotechnology, it becomes possible to manufacture optical nano-structures with high precision, high throughput/volume, and low cost. Based on this, we could redefine each fundamental optical device function and associated manufacturing method through nano-engineering. This will leads to a new path for optical integration.

A nano-manufacturing platform based on wafer level nano-replication with mold and nano-pattern transfer by nano-lithography is reported here. The nano-replication process, which based on imprinting a single-layer spin-coated UV curable resist, achieved excellent nano-patterning fidelity and on-wafer uniformity with high-throughput.

Nano-optic devices, such as quarter wave plates and polarizers, were manufactured with the nano-manufacturing platform. Excellent wafer level performance and yield were achieved. The developed technology is suitable for high-throughput and low cost manufacturing needs for commercializing nano-structure based optical devices and integrated optical devices. In the past three years, we have processed more than 1000 4"-in-dia wafers for nano-optic polarizers and waveplates by using the described nano-manufacturing technology. Statistically, we have achieved nano-replication wafer throughput of 20 wafers/hour. For both nano-optic polarizer and waveplate wafers, we have achieved average on-wafer optical yield of 80%, and the fabrication cost was estimated to be about $\$0.01/mm^2$ with a 4" in-dia wafer processing line. The fabrication cost is at least 2 to 10 times lower than existing technologies for making similar polarizers (e.g., Polarcor^{TM} or CuPo^{TM}) and waveplates (e.g., quartz waveplates or polymer sandwiched waveplates).Various integrated nano-optical devices were also fabricated and will be discussed.

BIOGRAPHY
Dr. Jian Jim Wang is the Chief Technical Officer and acting Vice-president engineering of NanoOpto Corporation in New Jersey. He is in charge of technology R&D work and product development and engineering in NanoOpto Corporation. Under his technical leadership, the company has successfully developed the high volume nano-replication and nano-lithography manufacturing platform and four different commercial products based on nanotechnology. As principal investigator (PI), he has also successfully got over $1.5 million SBIR/STTR phase-I and phase-II small business funding in the past. Dr. Wang has over 14 years of experience in optics, optoelectronics, and nanofabrication. He is one of the world's experts in nano-structure fabrication and commercial applications. Prior to NanoOpto, Dr. Wang co-founded Nanonex Corporation, New Jersey. He was the Vice-president technology and the first employee of Nanonex Corporation. Dr. Wang also worked as a lead design engineer at Lucent Technologies and Agere Systems. He was also part of the research staff at Princeton University. Dr. Wang holds a BS in Physics from Fudan University, Shanghai, and a Dr.rer.nat (Ph.D.) in physics from the University of Stuttgart, Germany. Dr. Wang has over 50 scientific publications and over 15 patents and patent applications.

S9 – Technical Session X – Optoelectronics and Network Elements

Advances in Optoelectronic Technologies for ROADM Subsystems

Louay Eldada
DuPont Photonics Technologies
100 Fordham Road, Wilmington, MA 01887, U.S.A.
louay.eldada@usa.dupont.com

ABSTRACT

Until recently, reconfigurable optical add/drop multiplexer (ROADM) systems did not exist, their components were unselected, and their market was unclear. Today every major system vendor has a ROADM offering, and a large number of component vendors have announced ROADM products based on a variety of technologies, some more mature than others. We review the different optoelectronic component technologies that have been developed for use in ROADM subsystems, and describe their principles of operation, designs, features, advantages, and challenges.

BIOGRAPHY

Dr. Louay Eldada is the CTO of DuPont Photonics Technologies. He holds a Ph.D. in optical networking components from Columbia University. While at Honeywell, he founded the Telecom Photonics business unit and managed its product development arm. He held the same position when this business was acquired by Corning. He later founded Telephotonics and served as its CTO until an acquisition by DuPont. He has authored 150 papers and books, has presented 90 keynote and invited talks, has organized 70 industry conferences, holds 35 patents, and is the recipient of 24 technical awards.

S9 – Technical Session X – Optoelectronics and Network Elements

Advanced Photonics Design Automation (PDA) Software for Integrated Optoelectronic Components and Optical Communication Systems

Zhengyu Huang
RSoft Design Group
200 Executive Blvd., Ossining, NY 10562, U.S.A.
zhengyu_huang@rsoftdesign.com

ABSTRACT

The talk will present the recent development in advanced photonic design automation (PDA) software for integrated optoelectronic components and optical communication systems. At first, various design challenges at component- and system-level are discussed, especially for these new applications such as photonic crystal devices, silicon photonics, VCSELs, EPICs, optical interconnects and high-speed optical links. Then the corresponding design solutions based on various numerical approaches are illustrated. In addition, advanced capabilities and future directions for PDA software including optimization, parallel computation visualization, and circuit level modeling will be presented.

BIOGRAPHY

Dr. Zhengyu Huang is the Vice President of Sales and Business Development at RSoft Design Group, which is the worldwide market leader in providing Photonic Design Automation (PDA) software for optical communication, optoelectronics, and semiconductor manufacturing. Zhengyu has over 12 years experience in the areas of simulation, design, and fabrication of photonic integrated components. At RSoft, Zhengyu is responsible for the worldwide sales and business development for all RSoft products. Zhengyu is also in charge of the application development, consulting services and technical support for component-level PDA tools and has actively involved and managed the development and commercialization of these tools. On several US government sponsored research programs to develop next-generation PDA tools, he was or has been the principle investigator or co-PI. At Columbia University, Zhengyu developed and prototyped various novel photonic integrated devices for high-speed optical communication network. At Iowa State University, he conducted research in the area of design and fabrication of photonic crystals. Zhengyu has contributed over 20 technical papers in scientific journals and conferences.

Prior to joining RSoft, Dr. Huang was a management consultant at Boston Consulting Group (BCG), where he provided strategic consulting service for leading multinational and Chinese companies in consumer goods, telecommunication, e-commerce, and automobile industries. Zhengyu also worked for China DaTong Electronics Corporation as the assistant to the CEO.

Zhengyu received the Ph.D. in Applied Physics and Electrical Engineering from Columbia University, the M.S. in Condensed Matter Physics and Microelectronics from Iowa State University and the B.S. in Physics from Peking University.

S9 – Technical Session X – Optoelectronics and Network Elements

High Performance, Low-Cost PIN, APD Receivers in Fiber Optical Networks and FTTx Applications

Hui Nie
TriQuint Optoelectronics
9999 Hamilton Blvd., Breinigsville, PA 18031, U.S.A.
hnie@tqs.com

ABSTRACT

PIN and APD Receivers are key optical components in long-haul, metro and access optical networks. Based on different optical network topologies and applications, PIN or APD receivers are selected based on different requirements and performance matrices. Inherently, PINs are simpler, lower cost compared to APDs, while APDs offer performance enhancement thus lower total systems cost.

In this paper, recent advances in detector, receiver research and industry developments will be reviewed. Some important design trade-offs of PIN and APD detectors and receivers will also be illustrated. Recently, there are many detector and receiver activities in metro and access networks, especially in FTTx applications. Low-cost PIN and APD applications and requirements in FTTx networks will be discussed.

BIOGRAPHY

Dr. Hui Nie was born in Wuxi, China. He received B.S. degree in physics from University of Science and Technology of China in 1993, M.S. and Ph.D. degrees in electrical engineering from University of Texas at Austin, in 1996 and 1998, respectively. His thesis research was focused on high performance resonant-cavity separate-absorption-multiplication (SAM) APDs.

In 1998, he joined Lucent Technologies, Murray Hill, NJ, as a Member of Technical Staff. In 2000, he relocated to Lucent Technologies Optoelectronics Center in Breinigsville, PA, where he developed 2.5G and 10G of APD products based on MOCVD technology. Currently, he is a senior engineer and program manager in TriQuint Optoelectronics, which was spun-off from Lucent Technologies in 2001 and was acquired by TriQuint Semiconductors in 2003. In TriQuint, he has led a team and developed industry leading performance 10 Gb/s small form-factor receivers. He is working on new-generation APDs and ROSA products.

He is a member of IEEE Laser and Electro-Optics Society.

S9 – Technical Session X – Optoelectronics and Network Elements

High-Speed Opto-Electronic Components for Digital and Analog RF Systems

Kang-Yih (K.-Y.) Liou
Multiplex, Inc.
5000 Hadley Road, South Plainfield, NJ 07080, U.S.A.
kyliou@multiplexinc.com

ABSTRACT

Opto-electronic devices and subsystems for optical communication systems and next generation networks are presented. The key enabling devices for today's WDM systems include quantum-well distributed feedback (DFB) lasers, wavelength tunable Bragg reflector lasers, lasers integrated with electro-absorption modulators, broadband PIN photodiodes, and high-receiver-sensitivity avalanche photodetectors. State-of-the-art optical transceivers for 80 km and 640 km fiber transmission at 10 Gb/s and 2.5 Gb/s data rates, respectively, utilize semiconductor DFB lasers with monolithically integrated modulators for low component manufacturing costs. The simplicity of using direct modulation of semiconductor laser has also been explored using optical injection locking. We present recent results of monolithic injection locked semiconductor lasers with 20 to 40 GHz modulation speed for analog RF photonic links with potential application in CATV distributions.

BIOGRAPHY

Dr. Kang-Yih (K.-Y.) Liou is Director of Laser Technology and Government Business at Multiplex, Inc. Prior to joining Multiplex in 2000, he had 20 years of experience with Bell Laboratories at Crawford Hill and Optical networking Group of Lucent Technology in Holmdel, New Jersey. He has contributed to the development of the first Trans-Atlantic optical fiber communication system (TAT-8) and has made numerous contributions to the research and development of single-frequency semiconductor lasers, photonic integrated circuits, opto-electronic integrated devices, and WDM metro and access systems. He has extensive experience in design and manufacturing of semiconductor lasers, electro-absorption modulated lasers, WDM metro and access components, semiconductor waveguide devices, high-speed lightwave transmitters, and management of government funded R&D programs. He has published over 100 papers and conference talks and holds 19 patents in the area of semiconductor lasers, photonic integrated circuits and lightwave communication systems. He has a B.S. degree from National Taiwan University and Ph.D. from University of Wisconsin – Madison.

S10 – Technical Session XI: Interactive Multimedia

Session Chair

Wen-Yi Zhao
Sarnoff Corporation
201 Washington Road, CN5300, Princeton, NJ 08543-5300, U.S.A.
wzhao@sarnoff.com

BIOGRAPHY

Dr. Wen-Yi Zhao is a member of technical staff working at Sarnoff Corporation (formerly RCA David Sarnoff Research Center). He has been working on various image processing, computer vision and pattern recognition problems at the Vision Technologies Lab. His contributions include biometrics, super-resolution and image restoration, sensor fusion, discriminant analysis, optical flow computation, alignment of 2D-2D/3D-3D/2D-3D data, and shape from shading. During 1997 to 1998, he visited LG Electronics Research Center of America, where he conducted research on video indexing and retrieval for the development of MPEG-7 standard. He is the lead author of an influential ACM survey paper on face recognition (2003). He is a recipient of the best industry related paper award at the 17th International Conference on Pattern Recognition, 2004. Wen-Yi has been giving tutorials and invited talks on the subject of his expertise. He is a senior member of the IEEE, the IEEE Computer Society and the IEEE Signal Processing Society. Wen-Yi is listed on Who'sWho in America (59th edition) and Who'sWho in Science and Engineering (8th edition).

S10 – Technical Session XI: Interactive Multimedia

Multimedia Content Analysis for E-Learning Application

Ying Li
IBM T. J. Watson Research Center
19 Skyline Dr., Hawthorne, NY 10532, U.S.A.
yingli@us.ibm.com

ABSTRACT

Web-based learning (a.k.a. on-line learning or e-learning) is rapidly emerging as an alternative to traditional classroom-based education. Many universities and industrial organizations have started offering remote education and training programs. As a result, the amount of instructional videos available on corporate intranets and the Internet is dramatically increasing. This, on one hand, opens up exciting possibilities for self-driven education with the flexibility to set one's own pace and focus; while on the other hand, it poses great challenges on the task of efficient content access, browse and retrieval.

In this talk, I will first give a general overview of e-Learning application and briefly introduce related international standards, then present some of my recent work on automatically extracting semantics from e-learning content based on the analysis of multiple media information. These extracted metadata can then be used to construct video's table-of-content and facilitate nonlinear content access, browse and retrieval. To achieve this goal, an audio classification scheme is first constructed to partition a video into homogeneous audio segments using the Support Vector Machine technique, then discussion scenes where students interact with the instructor by asking questions or making comments, are detected using statistical approaches. These discussion scenes are then further classified into either 2-speaker or multi-speaker discussions to help differentiate Q&A from classroom discussions. Meanwhile, the narration scenes where the instructor continuously lectures, are analyzed to identify scenes that contain different types of visual contents such as close-up views of the instructor, shots of presentation slides, web-pages, or blackboard/whiteboard. Various audio and visual features are exploited to achieve above tasks.

BIOGRAPHY

Dr. Ying Li received the B.S. and M.S. degrees in Computer Science and Engineering from Wuhan University, Wuhan, China and the Ph.D. degree in Electrical Engineering from the University of Southern California, Los Angeles, in 1993, 1996, and 2003, respectively.

Since March 2003, Dr. Li has been with IBM T. J. Watson Research Center as a Research Staff Member. Her research interests include digital image processing, content-based image analysis and retrieval, multimodal-based video content analysis, indexing and representation, pattern recognition, and multimedia and e-Learning applications. Dr. Li is an author of tens of conference and journal papers, as well as four book and book chapters on various multimedia related topics. She currently holds 4 US patents.

Dr. Li is a member of IEEE and SPIE. She is a guest editor for the Journal of Visual Communication and Image Representation Special Issue on Multimedia Database Management, and serves on the technical program committee of various IEEE conferences such as ICME, ICIP, ICASSP, as well as ACM Multimedia. Besides, she is on the program committee for SPIE Internet Multimedia Management Systems conference and IEEE International Workshop on Multimedia Content-based Analysis and Retrieval 2004.

S10 – Technical Session XI: Interactive Multimedia

S3-R1: The IBM Smart Surveillance System Release 1

Yingli Tian
IBM T. J. Watson Research Center
19 Skyline Drive, Hawthorne, NY 10532, U.S.A.
yltian@us.ibm.com

ABSTRACT

One of the key components of tele-presence systems is automatic awareness of the remote environment. This very same capability of automatic situation awareness is currently being developed and deployed in the context of the next generation smart surveillance systems. Smart surveillance systems use a number of automatic video analysis techniques like object detection, tracking and classification in conjunction with database and web application servers to provide users with the capability of distributed smart surveillance. The IBM smart surveillance system is one of the few advanced surveillance systems which provides not only the capability to automatically monitor a scene but also the capability to manage the surveillance data, perform event based retrieval, receive real time event alerts thru standard web infrastructure and extract long term statistical patterns of activity.

BIOGRAPHY

Dr. Yingli Tian is a Research Staff Member at the IBM T.J. Watson Research Center since 2001 after she worked at Robotics Institute of Carnegie Mellon University. Her research interests focus on motion analysis, facial expression analysis, 3D reconstruction, and video surveillance. She is the author of three book chapters and has published more than 50 papers in computer vision area. She is an IEEE Senior Member.

S10 – Technical Session XI: Interactive Multimedia

Statistical Learning and Analysis for Unconstrained Face Recognition and Analysis

S. Kevin Zhou
Siemens Corporate Research, Inc.
755 College Road East, Princeton, NJ 08540, U.S.A.
shaohua.zhou@gmail.com

ABSTRACT

Although face recognition has been actively studied during the nineties, the state-of-the-art recognition systems perform poorly when confronted with unconstrained scenarios such as illumination and pose variations, surveillance video, etc. In this talk, I address these challenges by introducing approaches to recognizing human faces under illumination and pose variations and from video sequences, using statistical learning and analysis techniques. I also talk about how to estimate age from the face image.

BIOGRAPHY

Dr. S. Kevin Zhou received his B.E. degree in Electronic Engineering from the University of Science and Technology of China, Hefei, China, in 1994 and Ph.D. degree in Electrical Engineering from the University of Maryland, College Park. He now works for Siemens Corporate Research, Inc. He has general research interests in signal/image/video processing and understanding, computer vision, pattern recognition, machine learning, and statistical inference and computing. He published over 30 journal and conference papers and book chapters in face recognition, motion analysis, illumination modeling, and machine learning based on reproducing kernel Hilbert space.

S10 – Technical Session XI: Interactive Multimedia

Opportunities for Data broadcasting in Terrestrial Digital TV

Dinkar Bhat
Triveni Digital
40 Washington Road, Princeton Junction, NJ 08550, U.S.A.
dbhat@TriveniDigital.com

ABSTRACT

Data broadcasting offers many new opportunities for terrestrial digital TV broadcasters. In this presentation, we provide an overview of the technology and the standards that have been developed within ATSC for enabling this area. In a television broadcast, audio and video occupy a significant portion of the overall bandwidth, but there is still enough bandwidth available that can be used for arbitrary data. Various kinds of data can be transmitted; for instance, software updates, multimedia files, websites, etc. Thus, very interesting and useful applications can be enabled on receivers. Different kinds of receivers can exist in the field, like set-top boxes and PC-based cards. We describe methods for classifying data broadcast applications in terms of target audience, type of data transmitted, etc.

A successful data broadcasting system must meet a number of application requirements, for instance, data bandwidth management, error recovery, etc. We present a software architecture that can meet the challenging requirements. We present field experiences with data broadcasting in several different deployments. We also discuss the future for this technology and some emerging applications.

BIOGRAPHY

Dr. Dinkar Bhat is a principal engineer at Triveni Digital, NJ, which develops software solutions for terrestrial and cable networks. He has worked on several products including digital TV stream monitoring software and data broadcasting systems. Prior to this, he did research on computer vision and image processing. He holds a PhD in Computer Science from Columbia University, NY, in the area of computer vision.

Poster Session

Outage Probabilities of Wireless Systems with Beamforming

Hanyu Li, Yu-Dong Yao, and **Jin Yu**
Wireless Information Systems Engineering Laboratory (WISELAB)
ECE Department, Stevens Institute of Technology, Hoboken, NJ 07030, U.S.A.
{hli5, yyao, jyu}@stevens.edu

ABSTRACT

Recent years, beamforming techniques have received great interests and it can achieve performance and capacity enhancement without the need for additional power or spectrum. They can be implemented through conventional beamforming, minimum variance distortionless response (MVDR) beamforming, and linear constrained minimum variance (LCMV) beamforming. In conventional beamforming, the antenna mainlobe is steered toward the desired signal. In MVDR beamforming, an antenna pattern is formed to maximize the output SNR while maintaining a constant gain in the direction of the desired signal. The LCMV beamforming is developed from MVDR beamforming with additional linear constraints to improve its robustness. While multiple interferers are considered, the LCMV beamforming can be implemented by putting nulls in the directions of interferers.

This poster investigates the outage probability of a wireless system with conventional beamforming using a uniform linear array (ULA) beamformer. A simplified beamforming model is used in deriving closed-form outage probability expressions and its accuracy is examined by simulation. Fading statistics of Rayleigh, Rician, and Nakagami are used to characterize the desired signal, whereas interferers are assumed to be subject to Rayleigh fading.

BIOGRAPHY

Hanyu Li received the B. Eng. and M. Eng. degree from Beijing University of Posts and Telecommunications, China, in 2000 and 2003, respectively. Currently he is working toward the Ph.D. degree at Stevens Institute of Technology. He was with LinkAir, Beijing, between 2001 and 2003, where he was involved in research and development of CDMA systems. Recently he is doing research in the performance analysis of beamforming techniques in wireless communications at the Wireless Information Systems Engineering Laboratory (WISELAB). His research interests include space-time coding, beamforming, and CDMA.

Jin Yu received the B. Eng. degree from Wuhan University, China, in 1998, and received the M. Eng. degree from the University of Mississippi, Oxford, MS, in 2001, respectively. Currently he is studying toward his Ph.D. degree in electrical engineering at Stevens Institute of Technology. During his study at the University of Mississippi, his research work focused on the computational electromagnetics and microwave circuits. At present he is doing research in the applications of phased arrays in wireless communications at the Wireless Information Systems Engineering Laboratory (WISELAB). His research interest areas include code-division multiple access (CDMA), signal processing for wireless communications, and adaptive antennas.

Poster Session

Automated Recognition of Solar Flares in Real-Time Data

Ming Qu, Frank Y. Shih, Ju Jing, and **Haimin Wang**
New Jersey Institute of Technology, Newark 07102, NJ, U.S.A.
qm3@njit.edu

ABSTRACT

The focus of the automatic solar flare detection is on the development of efficient feature-based classifiers. The three principal techniques used in this work are Multi-Layer Perceptron (MLP), Radial Basis Function (RBF), and Support Vector Machine (SVM) classifiers. We have experimented and compared these three methods for solar flare detection on the solar Hα (Hydrogen-Alpha) images obtained from the Big Bear Solar Observatory in California. The preprocessing step is to obtain the nine principal features of the solar flares for the classifiers. Experimental results show that by using SVM, we can obtain the best classification rate of the solar flares. Measurement of the evolution properties of solar flares through their complete cyclic development is also crucial in the studies of Solar Physics. From the analysis of solar images, we apply image segmentation techniques to compute the properties of solar flares. We also present our solution for automatically tracking the apparent separation motion of two-ribbon flares and measuring their moving direction and speed. We believe our work will lead to real-time solar flare detection and characterization.

BIOGRAPHY

Ming Qu is currently a PhD student in Computer Science, at the New Jersey Institute of Technology, Newark, New Jersey. He received his Master of Science in Computer Science, New Jersey Institute of Technology, Newark, New Jersey, 2002; his Bachelor of Science in Computer Science, Beijing Polytechnic University, Beijing, China, 1997. He was an IT consultant at Hewlett Packard Co., Beijing, China from 1997-2001. His research interests are in the area of Image Processing, Computer Vision and Pattern Recognition; expertise in Solar Image Processing and Medical Image Processing; strong knowledge on Neural Network, Support Vector Machine, Image Segmentation, Image Enhancement, Image Reconstruction, Computer Vision, Medical Imaging, Fuzzy Logic, and Artificial Intelligence. Ming Qu has published 6 Journal papers and 5 conference papers in his field of research. Papers related to this work are:

- Ming Qu, Frank Y. Shih, Ju Jing, and Haimin Wang, Automatic Solar Flare Detection Using MLP, RBF and SVM, 2003, Solar Physics, v. 217, Issue 1, pp. 157-172.
- Ming Qu, Frank Y. Shih, Ju Jing, and Haimin Wang, Automatic Solar Flare Tracking Using Image Processing Techniques, 2004, Solar Physics, v. 222, Issue 1, pp. 137-149.
- Ming Qu, Frank Y. Shih, Ju Jing, and Haimin Wang, Automatic Solar Filament Detection, 2004, Solar Physics, in press.

Poster Session

New High-Rate STBC with Good Dispersion Property

Chau Yuen [1]*, **Yong Liang Guan** [1], and **Tjeng Thiang Tjhung** [2]
[1] Nanyang Technological University (NTU), Singapore
[2] Institute of Infocomm Research (I2R), Singapore
* yuenchau@pmail.ntu.edu.sg

ABSTRACT

In this paper, several new high-rate STBCs with transmit diversity gain of two are proposed. The proposed STBCs can flexibly support either three or four transmit antennas, and a code rate of between two to four. We show that they have good symbol dispersion property that leads to better BER performance under spatially-correlated MIMO channels or when the number of transmit antennas is reduced from four to three. They also have better coding gain and lower decoding complexity than some existing high-rate STBCs at the same spectral efficiency.

BIOGRAPHY

Chau Yuen received the B. Eng and M. Phil degree from Nanyang Technological University, Singapore in 2000 and 2001 respectively. He proceeds with his research by doing Ph.D. in the same university. His research focuses are on the design, analysis and optimization of transmit diversity by using space-time block code, with emphasis on orthogonal and quasi-orthogonal space-time block code. From 2005, he is a post-doc fellow in Lucent Technologies Bell Labs, Murray Hill.

Poster Session

Subspace Projection and Time-varying AR modeling for Anti-Jamming DS-CDMA Communications

Lichuan Liu and **Hongya Ge**
Department of Electrical and Computer Engineering
New Jersey Institute of Technology, Newark, NJ 07102, U.S.A.
{ll24, ge}@njit.edu

ABSTRACT

Direct-sequence spread-spectrum (DS/SS) communication systems have certain degree of inherent immunity to intentional and/or unintentional jammers. However, in some applications, the jammer might be much stronger than the desired DS/SS signal, and the processing gain due to spreading might be insufficient to provide enough jamming resistance for decoding the useful signal reliably. In such cases, jammer suppression needs to be done prior to symbol detection. For stationary interference, many jammer mitigation techniques have been developed to remove its effect adequately. However, the nonstationary interferences cannot be adequately suppressed using a single domain mitigation algorithm due to the fact that signal's parameters are time-varying. Frequency modulated (FM) interferers are such kind of examples. Many interference suppression techniques are reported and most of the techniques use IF estimation and time-frequency analysis (TFA). The disadvantage of TFA is its large computation burden and slow convergence. To increase convergence and lower the computational complexity, this paper proposed to estimate the IF, based on time-varying autoregressive (TV-AR) modeling. One of the important IF-based interferer rejection techniques is to uses the jammer IF to construct a time-varying excision notch filter that effectively removes the interference. However, this notch filtering technique may cause significant distortion to the desired signal, resulting in poor receiver performance. Recently, subspace projection techniques based on IF estimation have been devised for FM interference excision in DS/SS communications. It is demonstrated recently that the subspace projection method can improve the output SNR significantly. In this work, we model the received data as a linear combination of FM interferences with time-varying IFs, thermal noise and the desired DS/SS CDMA signal using a time varying autoregressive (TV-AR) model. We then use the orthogonal and the oblique projection techniques to suppress the jammer based on the estimated IF from the TV-AR model. Finally, from simulation results, comparing the proposed subspace jammer suppression method with the time-varying notch filter method, the proposed method induces less distortion to the desired signal and can improve the performance of the whole system.

BIOGRAPHY

Lichuan Liu received the B. S. and M. S. degrees in electrical engineering, in 1995 and in 1998, respectively, from the Department of Electrical Engineering, University of Electrical Science Technology of China, Chengdu, China. She is currently working toward the Ph. D. degree in Department of Electrical and Computer Engineering, New Jersey Institute of Technology, Newark, NJ, USA. Her research interests include wireless communications, space-time coding, wireless networks and signal processing.

Poster Session

Hybrid Networks: Cellular-Relay Architecture

Zhigang Wang and **MengChu Zhou**
New Jersey Institute of Technology
University Heights, Newark, NJ 07102, U.S.A.
{zw3, zhou}@njit.edu

ABSTRACT

Inter-vehicle communication, an important component of Intelligent Transportation System, performs crucial functions in collision avoidance, road-hazard notification, and coordinated driving system. An inter-vehicle communication network is an instantiation of a mobile ad hoc network, which is characterized by multi-hop wireless communications among mobile nodes without any centralized control infrastructure. However, automotive ad hoc networks will behave in fundamentally different ways than the models that predominate mobile ad hoc network research. Driver behavior, constraints on mobility and high speeds create unique characteristics in such networks. They are characterized by rapid but somewhat predictable topology changes, with frequent fragmentation, a small effective network diameter, and redundancy that is limited temporally and functionally. The motivation of this research is to propose an effective approach to topology management under these constraints. Apparently flat structure is not suited to vehicular ad hoc networks since it is impossible for every node to acquire the global topology information. All participating nodes must be organized hierarchically so that only local information is required to exchange and global information is hidden for single node. Clustering is an important technique to implement hierarchical structure. Several heuristic clustering techniques have been proposed to choose cluster heads in an ad hoc network. These are lowest-ID, highest-degree and node-weight heuristics. However they cannot be deployed directly in ad hoc vehicular networks since their design objectives are not for highly mobility vehicular networks. The metrics used in these proposals will be frequently changed.

In this paper, we propose a new clustering technique, position-based hierarchical clustering, which incorporates position information into a novel hierarchical clustering technique. Each node knows its own position through a global positioning system. The cluster structure is determined by the geographic position of nodes. Each cluster has one node as the cluster head. Not only is the election of cluster heads based on nodes' position, but also the association and dissociation of clusters are determined by each node's position. The predefined maximum distance between the cluster head and its members then controls the cluster size. It enables nodes to move during cluster setup and maintenance. Furthermore, it allows asynchronous operation for cluster head election. A vehicular ad hoc network can be considered as a one-dimension network by taking the number of lanes into account. We give some mathematical analysis about the performance under some assumptions. Our simulation results show that it gains better stability of the cluster structure, and needs smaller communication overhead for maintaining the cluster structure than the existing approaches do.

BIOGRAPHY

Zhigang Wang received the B.S. and M.S. degree from the Department of Electrical Engineering, University of Electronic and Science of Technology, Chengdu, China in 1995 and he is a Ph.D. candidate of New Jersey Institute of Technology, Newark, New Jersey. He is a student member of IEEE. His current research interests include wireless networks, intelligent system, and communication theory.

Poster Session

Exploring the Design Space of Power-Aware Opto-Electronic Networked Systems

Xuning Chen
Department of Electrical Engineering, Princeton University
Princeton, NJ 08544, U.S.A.
xuningc@princeton.edu

ABSTRACT

As microprocessors become increasingly interconnected, the power consumed by the interconnection network can no longer be ignored. Moreover, with demand for link bandwidth increasing, optical links are replacing electrical links in inter-chassis and inter-board environments. As a result, the power dissipation of optical links is becoming as critical as their speed. In this paper, we first explore options for building high speed opto-electronic links and discuss the power characteristics of different link components. Then, we propose circuit and network mechanisms that can realize power-aware optical links − links whose power consumption can be tuned dynamically in response to changes in network traffic. Finally, we incorporate power-control policies along with the power characterization of link circuitry into a detailed network simulator to evaluate the performance cost and power savings of building power-aware opto-electronic networked systems. Simulation results show that more than 75% savings in power consumption can be achieved with the proposed power-aware opto-electronic network.

BIOGRAPHY

Xuning Chen is a fourth year Ph.D. student in Electrical Engineering Department, Princeton University. She received her bachelor degree from Microelectronics Department, Peking University in 2001. Currently, she is working on the low power optical transceiver front-end design. She has worked on the leakage power model which is included into "Orion", a rum-time power simulator to enable rapid power-performance tradeoffs at architecture level [1]. She also explored the design space for power-aware opto-electronics networked system [2]. Her research interests include power modeling and low power design, and optical interconnection networks.

[1] Xuning Chen and Li-Shiuan Peh, "Leakage Power Modeling and Optimization in Interconnection Networks," International Symposium on Low Power Electronic Design (ISLPED), Souel, Korea, 2003.

[2] Xuning Chen, Li-Shiuan Peh, Gu-Yeon Wei, Yue-Kai Huang, and Paul Prucnal, "Exploring the Design Space of Power-Aware Opto-Electronic Network Systems," Proceedings of the 11th International Symposium on High-Performance Computer Architecture (HPCA), San Francisco, CA, February 2005.

Poster Session

Adaptive Mobility Prediction in Wireless Sensor Network

Zhen Guo and **Mengchu Zhou**
Department of Electrical & Computer Engineering, New Jersey Institute of Technology
University Heights, Newark, NJ 07102, U.S.A.
{zg2, zhou}@njit.edu

ABSTRACT

Today's wireless networks have become highly flexible and can be configured and adapted to different environment much more rapidly. Wireless sensor networks have an important application − object tracking, which is characterized by its capability of monitoring mobile objects. Mobility prediction is in demand because wireless sensor networks are a type of peer to peer network characterized by multi-hop wireless communications in which global location information is impossible and energy resources are very limited. Prediction-based adaptive sensing method can offer a compromise between system lifetime and distortion of the prediction accuracy. The basic idea is to keep lower tracking interval and higher reporting frequency where the sensor predictions show high variation and less sensors active where the predictions show small variation. We propose an adaptive mechanism to optimize the local tracking interval in the sensor network so that enough number of sensor measurements is done depending on the region of the sensor field while minimizing the distortion. An optimal local area for the space between the sensor nodes is computed to utilize the tradeoff between minimizing the tracking energy dissipated by the active sensors in a region and the object loss rate caused by putting the sensors into passive mode. We present a detailed description of such a model including the auto-regression and adaptive prediction algorithm. Finally we discuss benefits of adaptive prediction based wireless sensor network architectures. In this model, the tracking interval could be dynamically optimized based on the adaptive mobility prediction.

BIOGRAPHY

Zhen Guo received the B. S. degree from the Department of Materials Science and Engineering, University of Science and Technology of China, Hefei, China in 1999 and the M.S. degree from Department of Computer Science, New Jersey Institute of Technology, Newark, NJ in 2001. He is currently a Ph.D. candidate of Department of Electrical & Computer Engineering at New Jersey Institute of Technology. His research interests include reliable system, communication theory, and wireless ad hoc and sensor networks.

Poster Session

A Wireless Sensor Network for Earthquake Response Monitoring

Yuecheng Zhang
Department of Electrical and Computer Engineering, Lehigh University
19 Memorial Drive West, Bethlehem, PA 18015, U.S.A.
zhy2@lehigh.edu

ABSTRACT

In this project, the wireless sensor network (WSN) technologies are applied in the Network of Earthquake Engineering Simulation (NEES) system to enhance the performance. Several optimized protocols and techniques are introduced in this poster, while some on-going research topics are listed as future directions. The proposed heterogeneous monitoring structure provides a more flexible platform to share the sensing results among different type of users. The self-nominating routing protocol is designed to increase the routing reliability in case of state-variations and failures of link/node. Except from improving the reliability, the self-nominating routing protocol also shows high energy efficiency. Other necessary techniques introduced in the poster include DPS-independent node positioning algorithm PLACE and time synchronization approach LESSAR. These advanced techniques can significantly reduce the system cost while provide necessary networking services.

BIOGRAPHY

Yuecheng Zhang is a Ph.D. candidate in the Electrical and Computer Engineering Department at Lehigh University. He has obtained his Master in Science and Bachelor degree from Electronic Engineering Department of Tsinghua University, Beijing, China in 2001 and 1998 respectively. He is in his fourth year of Ph.D. study under the advising of professor Liang Cheng in the dissertation topic of "reliable and energy efficient packet delivery in wireless sensor networks − cross-layer approach." His research interests include: (i) communication protocol design; (ii) cross-layer optimization; (iii) node positioning, and time synchronization for wireless networks; (iv) video compression, multimedia communication, and information streaming; and (v) multi-view video analysis and rendering.

Poster Session

Wireless Security: LPI Performance of Chaotic Signals

Jin Yu and **Yu-Dong Yao**
Wireless Information System Engineering Laboratory (WISELAB)
ECE Department, Stevens Institute of Technology
Hoboken, NJ 07030
{jyu, yyao}@stevens.edu

ABSTRACT

To improve the security of the DS SS systems, non-binary and non-periodic chaotic sequences are desirable for covert communications because their pseudorandom waveforms can be very useful in disguising signals as noise. Another advantage of using chaotic sequences is the large number of available spreading sequences for multiple access applications. Several intercept receivers, including energy detectors, synchronous and asynchronous, coherent and non-coherent structures, which are typically used to detect binary DS SS signals, are examined here to detect the presence of chaotic DS SS signals. A simple detection approach using a binary correlating function to detect non-binary chaotic sequences is proposed. Comparisons between systems using chaotic and binary sequences are given in terms of the LPI performance and the performance improvement with chaotic spreading sequences is observed. Another detection scheme employing dual antennas is also explored to detect the presence of chaotic or multi-level spreading signals. The detection performance using dual antennas is compared to that using the simple binary detection method with a single antenna. Detection probability improvement is observed with the use of dual antennas due to the reduction of waveform mismatch. Detection probabilities are also examined when the effect of mutual coupling is considered due to the small antenna spacing between the dual antennas and noticeable performance degradation is observed. A particle-filtering based approach is also developed to combat the uncertainty of chaotic signals and the detection performance improvement is shown through numerical results.

BIOGRAPHY

Jin Yu received the B. Eng. degree from Wuhan University, China, in 1998, and received the M. Eng. degree from the University of Mississippi, Oxford, MS, in 2001, respectively. Currently he is studying toward his Ph.D. degree in electrical engineering at Stevens Institute of Technology. During his study at the University of Mississippi, his research work focused on the computational electromagnetics and microwave circuits. At present he is doing research in the applications of phased arrays in wireless communications at the Wireless Information Systems Engineering Laboratory (WISELAB). His research interest areas include code-division multiple access (CDMA), signal processing for wireless communications, and adaptive antennas.

Dr. Yu-Dong Yao received the B.Eng. and M.Eng. degrees from Nanjing University of Posts and Telecommunications, Nanjing, China, in 1982 and 1985, respectively, and the Ph.D. degree from Southeast University, Nanjing, in 1988, all in electrical engineering. Between 1989 and 1990, he was at Carleton University, Ottawa, as a research associate working on mobile radio communications. He was with Spar Aerospace Ltd., Montreal, between 1990 and 1994, where he was involved in research on satellite communications. He was with Qualcomm Inc., San Diego, from 1994 to 2000, where he participated in research and development in wireless CDMA systems. Dr. Yao joined Stevens Institute of Technology, Hoboken, New Jersey, in 2000. He is an associate professor in the Department of Electrical and Computer Engineering and a director of Wireless Information Systems Engineering Laboratory (WISELAB). Dr. Yao holds one Chinese patent and eight U.S. patents. He is an associate editor of IEEE Communications Letters and IEEE Transactions on Vehicular Technology, and an editor of IEEE Transactions on Wireless Communications. He is a guest editor for a special issue on wireless networks for International Journal of Communication Systems. His research interests include wireless communications and networks, spread spectrum and CDMA, and DSP for wireless systems.

Poster Session

Decode-Based Differential Modulation for Wireless Relay Networks

Qiang Zhao and **Hongbin Li**
Department of Electrical and Computer Engineering, Stevens Institute of Technology
203 Burchard Building, Hoboken, NJ 07030
{qzhao,hli}@stevens.edu

ABSTRACT

In this paper, we develop a differential binary phase shift keying (BPSK) modulation scheme for wireless relay networks composed of one source, one relay and one destination node. The proposed scheme, referred to as the differential decode-and-forward (DDF), utilizes the relay to assist data transmission from the source to the destination. We derive a maximum likelihood (ML) detector and a piece-wise linear (PL) detector for the proposed DDF scheme. A closed-form bit error rate (BER) expression is presented for the proposed PL detector. Both analytical and simulation results show that the proposed DDF scheme is capable of providing diversity gain at the destination node over Rayleigh fading channels.

BIOGRAPHY

Qiang Zhao received the B.S. degree in automatic control from Beijing University of eronautics and Astronautics, Beijing, China, the M.Sc. degree in electrical engineering from the Virginia Tech, Blacksburg. He is now a Ph.D. student in the department of electrical and computer engineering, Stevens Institute of Technology. His research interests include transmitter and receiver diversity techniques for wireless fading channels, space–time coding, and performance analysis of communication systems.

Center for Optical Technologies

2005
COT Workshops & Open House

Thursday, May 19th and Friday, May 20th

LEHIGH UNIVERSITY.

PENNSTATE

Northampton Community College

Lehigh Carbon COMMUNITY COLLEGE

Ben Franklin Technology PArtners
Northeastern Pennsylvania

Please plan to attend the 4th annual Center for Optical Technologies [COT] Workshops & Open House on May 19-20, 2005 at the Rauch Business Center at Lehigh University.

The two-day COT event will begin with two Workshops on Thursday, 19 May; an Optics Workshop and Bio-Photonics Workshop. On Friday, 20 May, COT will hold an Open House that includes COT thrust leader presentations and a poster session.

For more information, please contact:
Anne Nierer, Administrative Coordinator
610-758-2600, aln3@lehigh.edu

www.lehigh.edu/optics

Research Report DB

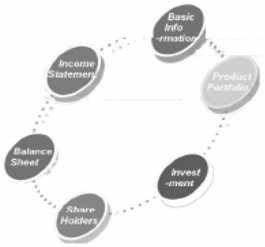
- Basic Information
- Industry Report
- Short Commentary
- Annual Report
- Monography

Industry Financial Indices DB

Balance Sheet | Income Statement | Profitability | Costs & Expenses | Per Share Information | Growth | Solvency | Management | Employee

Enterprise DB

Profitability | Growth | Solvency | Per Share Information | Costs & Expenses | Management



Import & Export DB

TREND | LIST | RANK | COMMODITY
COMMODITY-COUNTRY RANK
COUNTRY LIST | COUNTRY RANK | COUNTRY EACH
COUNTRY-COMMODITY RANK

Production,Sales,Inventroy DB

TREND | LIST
DETAIL of PRODUCT

Key References DB

TIE takes in domestic all or different resources of industrial economic.

Diagram DB

This DB extracts important charts and graphs of all industryies.

- **Macroeconomic**
- Agriculture,Forestry,Fishing and Animal Husbandry
- Mining and Quarrying
- Food,Beverage,Tobacco
- Petroleum and Petrochemicals
- Textile,Clothes,Leather
- Paper and Printing
- Non-Metallic Mineral Products
- **Metal Products**
- Machinery and Equipment
- Precision Instruments
- Electronic Parts and Components
- Computer,Communication & Consumer Electronics
- Electrical,Electronic Machinery and Equipment
- Transport Equipment and Parts
- Electricity,Gas and Water
- **Construction and Real Estate**
- **Transportation and Logistics**
- Finance and Insurance
- General Merchandise
- Cultural
- Recreational Service and Travel
- Business and Personal Services
- Sanitary and Social Walfare Services
- Public Administration

Taiwan Institute of Economic Research

Address:4Fl.,16-8Tehui St.,Taipei, Taiwan, R.O.C.

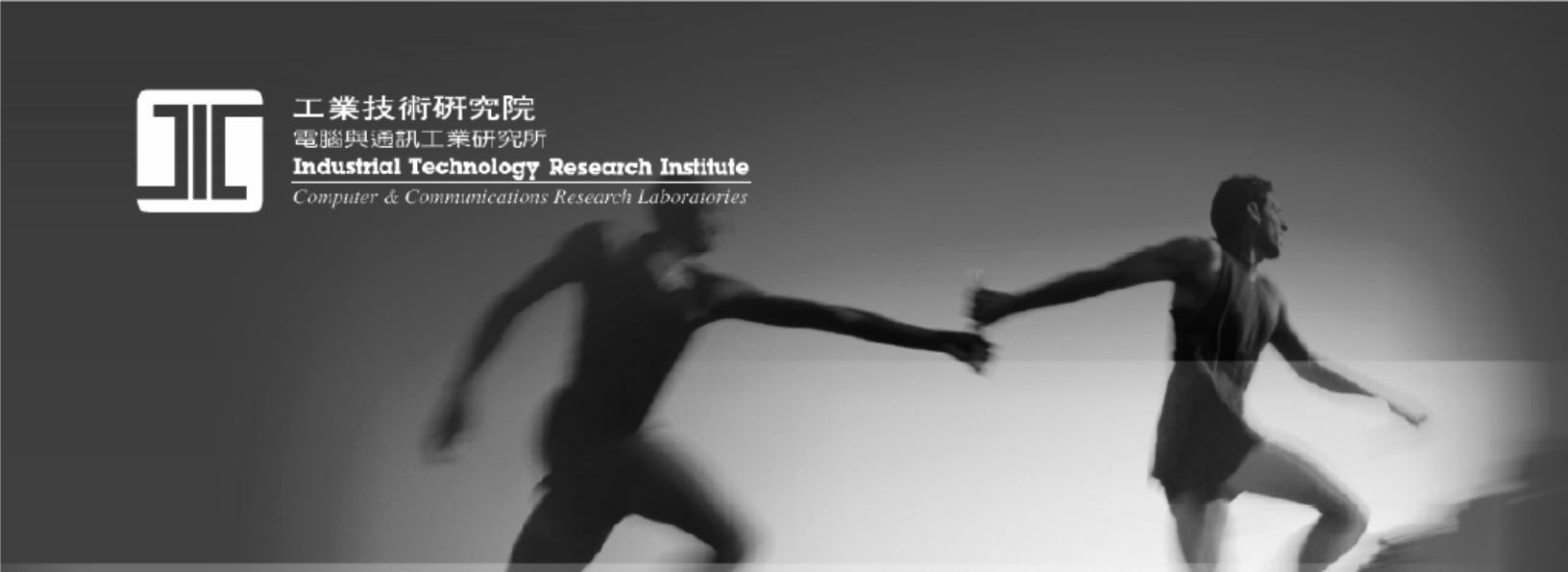
TEL:886 2 2586 5000 ext 488,466,455

Facsimile:886 2 2593 5543

Website:http://TIE.tier.org.tw

E-Mail:TIE@tier.org.tw

工業技術研究院
電腦與通訊工業研究所
Industrial Technology Research Institute
Computer & Communications Research Laboratories



Being the foremost takes teamwork

Join the crew

The mission of ITRI/CCL is to execute hi-tech R/D programs of national scale, and to enhance the global competitiveness of the domestic information, communications, and digital consumer electronics industries by leading advanced technology development. As a strategic partner for Taiwan's hi-tech industry, CCL also undertakes an important task of incubating topnotch R&D and management professionals for the industry.

Our core technology areas include: Internet, Broadband, Wireless Communications, and Digital Video with efforts ranging from hardware, software, key components to systems. We are looking for experienced and inspired professionals to join our strategic planning or R&D teams.

We have openings as follows:

- Technical Directors of R&D Divisions
- Managers of R&D Departments and Projects
- Senior Hardware/Software/System Engineers/Researchers

Advance Your Career, Join CCL Now!

www.ccl.itri.org.tw

E-MAIL: CCL_talent@itri.org.tw
TEL: +886-3-5914678
FAX: +886-3-5820236
C100, Rm.318, Bldg.51, No.195, Sec.4, Chung Hsing Rd.,
Chutung, Hsinchu, Taiwan 310, R.O.C.

CHINESE INSTITUTE OF ENGINEERS – Greater New York Chapter

2005 Annual Convention

October 15, 2005

Engineering Career Planning and Global Job Opportunities

Newark Airport Marriott Hotel
Newark, New Jersey
Contact: Dr. Yi-Kang An at yikangan@hotmail.com
http:// www.cie-gnyc.org

ASTRI™
HONG KONG APPLIED SCIENCE AND TECHNOLOGY RESEARCH INSTITUTE COMPANY LIMITED
香港應用科技研究院有限公司




Delivering world-class innovations... for customer-focused impact

The Government of the Hong Kong Special Administrative Region founded the Hong Kong Applied Science and Technology Research Institute Company Limited (ASTRI) in 2001 to capture the promises of technological advances for Hong Kong through world-class applied research, with a strategic plan to become Greater China's most customer-focused applied research institution by continuously producing a substantial volume of world-competitive intellectual properties, and transfer them cost-effectively to the burgeoning local technology industries of Hong Kong, Pearl River Delta and the rest of China, and in so doing, position Hong Kong as a vital driving force for technology in the region.

As a research institution, ASTRI's R&D activities focus on *four closely interrelated technological domains - IC design, wireless communications, enterprise and consumer electronics and next generation material and packaging technologies*. By engaging in the pursuit of customer-focused excellence in these highly innovation- and knowledge-intensive fields, we will strive not only to execute our organization's impact-driven missions but also to provide the challenging working environment for our employees to accelerate their personal development and advance their careers in and beyond ASTRI. At ASTRI, we believe organizational achievement and individual growth are inseparable, and it is the execution of this belief that will ultimately determine the outcome of our plans. We offer challenging growth opportunities with competitive compensations and benefits package, in a world-class city - Hong Kong - the gateway to China.

CAREER OPPORTUNITIES

We are actively seeking outstanding professionals with track records of research excellence and industrial applications in these technological domains to fill the following key leadership and technical positions:

- R&D Group Vice Presidents
- R&D Directors
- Senior Technical and Project Managers
- Principal Engineers

To register for onsite job interviews at WOCC 2005, please visit ***www.astri.org/en/recruitment.php****, and also bring along a hard copy of your resume.* For more information on our technology programs and other career opportunities, please visit our website at www.astri.org.

We've reduced the challenges of transformation.

We'll help you transform, manage, and grow your wireline, mobile, broadband, and IP networks. So you can see your business from a whole new point of view.

www.telcordia.com/transform

Telcordia®

"In addition to baseball, it's hard to believe that Taiwan can challenge the top of the world in marathon!" James, US marathoner.

Lin Yi-Jie is the first native Taiwanese marathoner ever to dare the death-challenging Sahara Marathon in 2002 and finally won the 12th prize. He is the best-ever marathoner in Asia and has since been running at risk of his life.

Let the world hear the voice of Taiwan…

With international Telephone Service 009
Chunghwa Telecom reaches more than 220 destinations in premium quality fulfills the outgoing communication needs of customer and makes the world hear the voice of Taiwan. Like Lin Yi-Jie
its devotion never ends, its progress never stops, its faith never surrenders…

中華電信國際電話 009 無可取代

中華電信 www.cht.com.tw 免費服務專線：0800-080-100