IEEE COMMUNICATIONS EXPO

IEEE GLOBECOM 2006 EXPO

ADVANCE PROGRAM
28-30 November 2006
San Francisco, California USA

NEW PROGRAM!

New EXPO for Designers and Developers featuring industry exhibits and a comprehensive technical program that is geared for engineers and their management. This program includes:

- NEW ✔ ***Access '06 Business Forum*** *(20 Sessions)*
- ✔ ***Design & Developers Forum*** *(15 Seminars)*
- ✔ ***Tutorials*** *(23)* ***and Workshops*** *(4)*

ATTENDEES REGISTER TODAY!

FOR PROSPECTIVE EXHIBITORS
see page 4 for more detailed information

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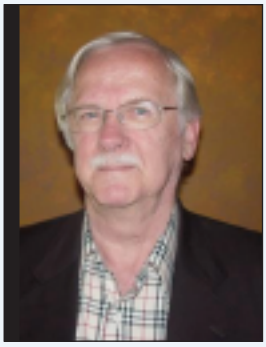
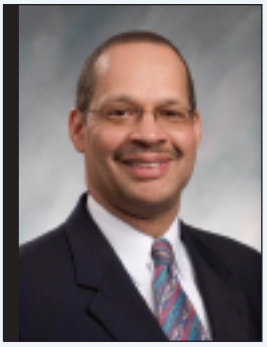
Message from the IEEE Communications EXPO Chairs



Terry Kero,
President, Myanni, Inc.
IEEE GLOBECOM/EXPO 2006
General Chair



Anthony Neal Graves,
General Manager, Digital Enterprise Group, Intel Corp.
IEEE Communications EXPO Chair

On behalf of the executive committee, we are pleased to invite you to the annual IEEE Communications EXPO, to be held on November 28-30, 2006 along with IEEE's 49th annual GLOBECOM 2006 conference in San Francisco, California. This new IEEE Communications EXPO is geared for "designers and developers" and will feature exhibits and a comprehensive technical program focused on education and information for industry engineers and their management. The EXPO technical program includes a Design & Developer Forum with 15 seminars, 23 tutorials, 4 workshops, and a brand new ACCESS'06 Business Forum.

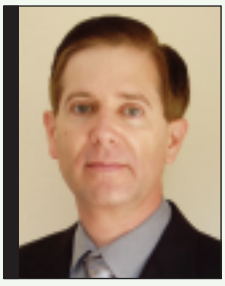
The ACCESS'06 Forum is a key component of Communications EXPO. It is a multi-disciplinary executive forum focused on the "Last Mile" access technologies. The forum covers broadband and wireless access technologies currently pursued by service providers, municipalities, and other user communities. Topics include technology and business issues surrounding the introduction of FTTH, xDSL, cable, broadband over power line, WiFi, WiMax, 3G and beyond in broadband access networks.

Highlights of forum include keynote addresses by senior Government and industry executives, executive panels, and 20 sessions covering the technology, architecture, economics, management, and applications aspects of the last mile networks. San Francisco is the ideal location for this forum because of the plethora of broadband wireless projects proposed for the city and in the neighboring Silicon Valley.

We have invited 20,000 communications designers and developers looking to meet manufacturers and suppliers of products and services related to components, subsystems, and systems including hardware, middleware, and software.

To review the complete program of the IEEE Communications EXPO and the IEEE GLOBECOM 2006 international conference, visit http://www.ieee-globecom.org/2006/ If you are interested in exhibiting, please contact Connie Shaw, Exhibit Sales Account Manager at (703) 631-6200 or Toll Free (800) 564-4220.

We look forward to a great conference and to your participation.



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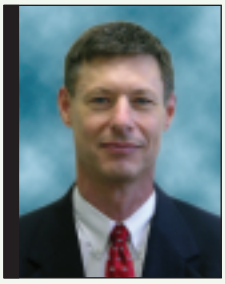
Hammerhead Systems
EXPO Technical Chair

Dilip Krishnaswamy,
Intel Corporation
EXPO Technical Chair

Adam Drobot,
President, Advanced Technology Solutions
Telcordia Technologies
ACCESS'06 Chair



Dave Waring ,
Chief Scientist
Telcordia Technologies
ACCESS'06 Vice Chair

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PROGRAM AT A AGLANCE

Monday, 27 November

9:00 - 5:00	3 Full Day Tutorials, 1 Full Day Workshop
9:00 - 12:00	5 Half Day Tutorials, 1 Half Day Workshop
12:30 - 2:00	LUNCH BREAK (on your own)
2:00 - 5:00	6 Half Day Tutorials

Tuesday, 28 November

8:00 - 9:15	Keynote Session
9:15 - 9:45	COFFEE BREAK
9:45 - 12:15	4 D&D Forums / 4 ACCESS'06 Executive Forum
10:00 - 11:45	Symposia Technical Sessions & Poster Session
12:30 - 1:45	AWARDS LUNCHEON
2:00 - 3:45	4 D&D Forums, 4 ACCESS'06 Executive Forums
2:00 - 3:45	Symposia Technical Sessions
3:45 - 4:15	COFFEE BREAK
4:15 - 6:00	Symposia Technical Sessions
4:15 - 6:00	4 D&D Forums, 4 ACCESS'06 Executive Forums
6:30 - 9:00	Welcome Reception - Communications EXPO Opens

Wednesday, 29 November

8:00 - 9:15	Keynote Session
9:00 - 4:30	GLOBECOM 2006 Communications EXPO- OPEN
9:15 - 9:45	COFFEE BREAK in the Expo Hall*
9:45 - 12:15	4 D&D Forums, 4 ACCESS'06 Executive Forums
10:00 - 11:45	Symposia Technical Sessions & Poster Session
12:15 - 1:45	ACCESS '06 Executive Panel
12:15 - 2:00	LUNCH BREAK (on your own)
2:00 - 3:45	4 D&D Forums, 4 ACCESS'06 Executive Forums
2:00 - 3:45	Symposia Technical Sessions/Poster Session
3:45 - 4:15	COFFEE BREAK in the Expo Hall*
4:15 - 6:00	4 D&D Forums, 4 ACCESS'06 Executive Forums
4:15 - 6:00	Symposium Technical Sessions/Poster Session
7:00 - 10:00	CONFERENCE DINNER SHOW

Thursday, 30 November

8:00 - 9:15	Keynote Session
9:00 - 4:30	GLOBECOM 2006 Communications EXPO- OPEN
9:15 - 9:45	COFFEE BREAK in the Expo Hall*
9:45 - 12:15	3 D&D Forums, 5 ACCESS'06 Executive Forums
10:00 - 11:45	Symposia Technical Sessions & Poster Session
12:15 - 2:00	LUNCH BREAK (on your own)
2:00 - 3:45	Symposia Technical Sessions/1 Poster Session
2:00 - 3:45	3 D&D Forums
3:45 - 4:15	COFFEE BREAK in the EXPO Hall*
4:15 - 6:00	Symposia Technical Sessions
4:15 - 6:00	3 D&D Forums
7:00 - 10:00	CONFERENCE DINNER SHOW

Visit the EXPO Floor/ Grand Ballroom Level/ Fairmont Hotel
Don't miss your opportunity to visit with Exhibitors -
Network - Win prizes during the coffee break!

Friday, 1 December

9:00 - 5:00	3 Full Day Tutorials, 2 Full Day Workshops
9:00 - 12:00	3 Half Day Tutorials
12:30 - 2:00	LUNCH BREAK (on your own)
2:00 - 5:00	3 Half Day Tutorials

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For further details on how to exhibit at IEEE GLOBECOM 2006 Expo, please contact Connie Shaw at J. Spargo at 703-631-6200

Dr. Adam Drobot, President Advanced Technology Solutions and CTO, Telcordia Technologies will chair each of the following keynote addresses.

Bill Smith

Tuesday 28 November • 8:00am

Bill Smith, CTO, BellSouth

Bill Smith is Chief Technology Officer for BellSouth Corporation. In this role, he is responsible for setting the technology direction of BellSouth's core infrastructure. His department includes network and operations technology, Internet protocol (IP) applications, next generation strategy as well as BellSouth Entertainment, LLC.

A native of Asheville, North Carolina, he attended North Carolina State University at Raleigh, where he graduated with honors in 1979. Bill began his career with BellSouth in 1979 and moved through a variety of job responsibilities over the next several years. He has been involved in BellSouth's advanced technology efforts since returning from an assignment at Bell Communications Research in New Jersey in 1987. He has held a number of assignments dealing with a variety of issues including technology, operations, marketing, and public policy. Bill was also an active participant in National and International Telecommunications Standards. Most recently Bill was responsible for BellSouth's DSL, Internet and wholesale business units.

Ki Tae Lee

Wednesday 29 November • 8:00am

Ki Tae Lee, President, Samsung Telecommunications Network Business

Mr. Ki Tae Lee heads Samsung Electronics' Telecommunication Network Business. He became the Company's President in January 2001, following years of distinguished service.

Joining Samsung in 1973, Mr. Lee has held a number of positions during his career. From 2000 to 2001, he served as Executive Vice President of Information and Communications Business. In February 1999, he was named Executive Vice President and General Manager of Wireless Terminal Division. Previously, he also managed Fax Business, Video Business and Sound Facilities.

Among his many accomplishments are the launch of Samsung's very first mobile phone and commercialization of the first CDMA handset. His strong and consistent drive for technology innovation and market leadership has helped Samsung become the third largest handset provider in the world only in ten years.

Mr Lee has won numerous outstanding awards and industry recognition, including IMI Grand Prize for Best Management from the Federation of Korean Industries (FKI) in December 2005 and IEEE Distinguished Industry Leader Award in May 2005.

Mr. Lee is Honorary Chairman of the Korean Society of Quality Management (KSQM). He has served as Chair of the Korea Association of Information and Telecommunication (KAIT), and of the Korea Association of Photonics Industry Development (KAPID). He is amember of the National Academy of Engineering of Korea (NAEK). Mr. Lee received a bachelor's degree in Electrical Engineering from InHa University in 1972.

Chris Rice

Wednesday 29 November • 8:00am

Christopher Rice, Executive Vice President, Network Planning and Engineering, AT&T Services

As Executive Vice President, Chris Rice oversees the Network Planning and Engineering Group for the new AT&T Inc. His responsibilities also include overseeing the development and deployment of advanced access, switching, and routing technologies for the company. Prior to being appointed to his current position in March 2004, he was responsible for SBC Communications' enterprise-wide technology direction, new technology introduction, platform development and network regulatory.

Previously, Mr. Rice served as Vice President-Network Engineering, where he was responsible for all current planning and engineering for SBC Southwest and SBC SNET. Prior to that, he was Vice President-Network Planning and engineering for SBC Internet Services, where he was responsible for all network planning, engineering, systems and operations. Since joining the company he has also held a variety of other management positions in network operations, network engineering, network planning, project management and outside plant operations.

Mr. Rice began his career in 1980 with Southwestern Bell Telephone in toll switching systems network operations. In 1986 he joined Bell Communications Research ("Bellcore"), where he had responsibility for the support and systems analysis of operational support systems. In 1994 he held the position of Vice President-Network Planning and Engineering for Southwestern Bell Messaging Inc., where he was responsible for network operations, network planning and engineering, and information systems.
In 1989 he received the Texas Synergy Award for the Interdepartmental Showcase. In 1990 he received the Texas Synergy Award for Addison 1 AESS to DMS-100 Conversion. Mr. Rice received a B.S. in Engineering Technology in 1980 from Texas A&M University in College Station, Texas.

KEYNOTE SESSIONS

Jean Walrand

Thursday 30 November • 8:00am

Prof. Jean Walrand, University of California Berkeley

Jean Walrand received the Ph.D. degree from the Department of Electrical Engineering and Computer Sciences of the University of California at Berkeley where he is now Professor. His research interests include decision theory, stochastic processes, and communication networks. He is the author of An Introduction to Queueing Networks (Prentice Hall, 1988) and of Communication Networks: A First Course (2nd ed. McGraw-Hill,1998) and co-author of High-Performance Communication Networks (2nd ed, Morgan Kaufman, 2000).Prof. Walrand is a Fellow of the Belgian American Education Foundation and of the IEEE and a recipient of the Lanchester Prize and of the Stephen O. Rice Prize.

Chris Vein

Thursday 30 November • 8:00am

Chris Vein, Chief Information Officer, City and County of San Francisco

Chris Vein is San Francisco's Chief Information Officer and Executive Director, Department of Telecommunications and Information Services. In these capacities, Mr. Vein provides policy guidance on the City's technology vision, provides telecommunications and information technology services to city departments, as well as guiding technology and cable television franchise policies.

Prior to his employment in San Francisco, Mr. Vein was an AVP for Operations at Science Applications International Corporation (SAIC). Mr. Vein began his career in Washington, DC working in the Executive Office of the President. As a high ranking non-political appointment, Mr. Vein was Director of Administrative and Financial Services for the White House, serving the Clinton, Bush, and Reagan Presidencies.

Graham Richard

Thursday 30 November • 8:00am

Graham Richard, Mayor of Fort Wayne, Indiana

Graham Richard was elected mayor of Fort Wayne, Indiana's second largest city, in 1999 and again in 2003. Since taking office on January 1, 2000, Mayor Richard has worked to gain and retain jobs, make Fort Wayne the safest city of its size and build excellent services.

Mayor Richard is a technology leader. In October 2005, Mayor Richard won the 2005 Star Award from the Fiber-to-the-Home Council for being a leader in broadband technology. In March 2005, Mayor Richard was selected by "Government Technology" magazine as one of the top 25 Doers, Dreamers and Drivers in the nation who have made significant contributions to the digital government movement. Author Michael George in his book "Lean Six Sigma for Service" recognizes Fort Wayne for using business practices such as Lean Six Sigma to protect taxpayers, reduce costs and provide additional services with fewer employees. The city has saved more than $10 million by using Six Sigma.

Under his leadership, the city has grown from a population of 185,000 to 252,000. Since Mayor Richard took office, more than $200 million has been invested in infrastructure improvements. More than 16,000 jobs have been retained and 4,000 gained. Fort Wayne has the lowest crime rate in 20 years.

Mayor Richard serves on the executive committees of the Indiana Association of Cities and Towns and the Indiana Metropolitan Mayors Alliance. Mayor Richard is past President of the Metropolitan Mayors Alliance, a group of mayors from Indiana's 20 largest cities, which lobbies the state legislature on behalf of those cities. He is a member of the US Conference of Mayors, the National League of Cities and the Democratic Leadership Council.

Mayor Richard is a lifelong resident of Fort Wayne. He is a graduate of North Side High School and the Woodrow Wilson School of Public and International Affairs at Princeton University. He has been an active board member in many community organizations.

TUESDAY, 28 NOVEMBER

Fiber Access Systems

Tuesday 28 November • 9:45am
Chair: **Thomas Pfeiffer**, Alcatel SEL AG

Fiber access systems are moving beyond trials, with GPON, EPON and active Ethernet systems all beginning volume deployment. This session will provide an up-to-date industry status of fiber access networks addressing both market and business aspects as well as design considerations and technological evolutions. Leading system suppliers give insights into their fiber access business.

Invited speakers:
Gao Wei – Ocean Broadband Networks
David Cleary – Calix
Mark Klimek – Alcatel
David Meis – Corning
Thomas Pfeiffer – Alcatel

Broadband Operations

Tuesday 28 November • 9:45am
Chair: **Dr. Douglas Zuckerman**, Telcordia Technologies

Customer demand for a diverse range of broadband services, such as IPTV, is on the rise. Existing operations infrastructures were designed mainly for services tightly coupled to specific network technology. The real challenge comes from IP – and the decoupling of services from the underlying network it enables. Until recently, Network Management and Service Management were largely indistinguishable. Today, they are becoming quite separate disciplines, presenting a stress on older systems, and a challenge for the designers of new systems and operations architectures.The existing OSS environment has been hard pressed to economically provision, maintain and even bill the new services. Providing a high Quality of Service and difficulties in scalability have also been at issue.This panel provides carrier and vendor views on the main issues - and potential solutions - for successful operations of broadband networks and services.

Invited Speakers:
Daniel Martin – IBM
Masayoshi Ejiri – Fujitsu
David Stephenson – Alcatel
Roberto Saracco – Telecom Italia
Laurie Spiegel – Telcordia Technologies

3G Planning and Optimization

Tuesday 28 November • 9:45am
Chairs: **Dr. C. Skianis**, NCSR
Dr. Jie Zhang, University of Bedfordshire

The history of modern communication commences with analog cellular systems (1st generation), passes to the digital era with the GSM, PDC, cdmaOne and US-TDMA (2nd generation) systems, enabling mainly voice communications, text messages and light access to data networks. The need for enhanced services in every day communications, such as multimedia communications (video messaging, images, audio), demands higher data rates and QoS. This need drives towards the deployment of third generation systems (3G networks). Those systems will coexist in the same environment with earlier 2nd generation systems as well as alternative wireless technologies. Key elements in such a coexistence include proper planning and optimization of deployed networks in terms of cost, coverage, capacity and quality constraints. This new setting creates new challenges in the field of planning and optimization for a number of sectors, such as regulatory bodies, telecom operators, equipment vendors, and companies producing related tools (planning and optimization).

Invited Speakers:
Jie Zhang – University of Bedfordshire
Costas Vlahodimitropoulos – Cosmote
Chris Brunner, Qualcomm
Dimitris Dernikas – Aircom
Spyros Denazis – Hitachi Europe & University of Patras

Consumer Electronics in Access Networks

Tuesday 28 November • 9:45am
Chair: **Dr. Robert Fish**, Panasonic Research Labs

Network architects need to be cognizant of terminal equipment, and this increasingly means the world of consumer electronics. The proliferation of digital devices and local networking technologies provides a rich but challenging set of opportunities for network and service providers to leverage. This session addresses the latest trends in consumer devices and in consumer device networking.

Invited speakers:
James Stoffel – Kodak
Dr. YongCheol Oh – Samsung, Korea
Jack (Norikazu) Endo – Toyota IT Center US

Optical Access Networks

Tuesday 28 November, 2006 • 2:00pm
Chair: **Dr. Tetsuya Yokotani**, Mitsubishi Electric

As optical access systems emerge, standardization, applications support and evolution to NGN are key systems issues. This session addresses the broader context of optical access system deployment, including harmonization with network evolution trends and emerging home network technologies.

Invited Speakers:
Shoichi Hanatani – Hitachi and President, Fiber-To-The-Home Council, Asia Pacific
Armin Schulz – AMCC
Chris Clarke – Bookham
Reuven Segev – Iamba Networks
Dr. Tetsuya Yokotani – Mitsubishi Electric

Regional and Community Networks

Tuesday 28 November, 2006 • 2:00pm
Chair: **Dr. Richard Wolff**, Gilhousen Chair, Montana State University

As network technology options mature, it becomes increasingly realistic for organizations and coalitions to consider building their own infrastructures. Often this approach can meet the needs of constituencies that might not otherwise be served. This session discusses some of the latest trends and examples, including

- Should a municipality be a service provider?
- What are the incentives for a franchise holder?
- What is the business model?
- Will unlicensed spectrum really work (interference issues)?
- Will these networks provide adequate capacity and scalability?
- What can we expect in future technologies (WiMAX replaces WiFi, for example)?

Invited Speakers:
Dr. Richard Wolff – Montana State University
Tim Ryan – City College San Francisco
Todd Graetz – CEO, TransAria
Cyrus Behroozi – Tropos Networks
Larry Alder, Google
Michael Kress – College of Staten Island

Wireless Option for the Last Mile

Tuesday 28 November • 2:00pm
Chair: **Norman Thiel**, Thiel Consulting

Broadband wireless technologies are rapidly emerging from research and development labs. Will broadband wireless emerge to displace wired equivalents in the same way cellular telephony has dominated? This session brings renowned experts together to discuss industry status.

Invited speakers:
Ali Tabassi –Sprint Nextel
David Reeder –Airspan
Dr. J.S. Shieh – Z-Com
Dr. David A. Whelan – Boeing

The Business of Broadband

Tuesday 28 November • 2:00pm
Chair: **Bart Stuck**, Signal Lake Venture Fund

Broadband access represents amake-or-break investment for the operator franchise. What is the business case for broadband deployment, and what will broadband mean for the health of the telecommunications industry? Join the experts in this session to hear the answers to these and other critical questions.

Invited Speakers:
Dr. Bharat P. Dave, Aliphion
Mike Weingarten – Signal Lake
Chi-Kuo Mao – Dean Management College National Chiao Tung University, former Chairman Chunghwa Telecom, Taiwan
Sammy Thomas – Telcordia Technologies
Frank Galuppo – Amedia Networks
Frank Petkovich, SOMA Networks

WEDNESDAY, 29 NOVEMBER

Supporting Triple Play Services

Wednesday 29 November • 9:45am
Chairs: **Oren Marmur**, CTO FlexLight Networks

A major motivator for deploying fiber access is to support video services. Optical access systems must be crafted to deliver currently envisioned video services, as well as new services that perhaps we cannot even predict at present. This session will examine optical access networks with an eye toward supporting triple play services and beyond.

Invited Speakers:
Ralph Ballart – Alcatel
Takeo Hamada – Fujitsu Labs America
Ezra Mizrahi – Teledata Networks

Global Broadband Deployments

Wednesday 29 November • 9:45a.m
Chair: **Bruno Orth**, Deutsche Telekom

Operators around the world are making significant investments in new fiber access systems. Broadband is a critical component of the public network evolution and this investment could determine the future of the wireline business. This session will provide an industry snapshot of fiber broadband deployments worldwide, with insights from leading global operators.

Invited speakers:
Dr. Hitomi Murakami – KDDI
Dr. Sanghoon Lee – Korea Telecom
Dr. Liang Wu – PCCW /Hong Kong Telecom
Vincent O'Byrne – Verizon

Broadband Power Line

Wednesday 29 November • 9:45am
Chair: **Dr. Stefano Galli**, Panasonic Research Lab

The news has been full of announcements of breakthroughs in power line carrier systems. Will broadband power line (BPL) become a contender and bring broadband to your home over the same lines that power your PC? This session brings together industry leaders to provide status and insight on BPL technology.

Invited speakers:
Michael Stelts – Panasonic, President CEPCA
Oleg Logvinov – CEO, Arkados, Chairman HomePlug
Jim Mollenkoft –Current Technologies
Chano Gomez – DS2

What's Next in DSL Technology

Wednesday 29 November • 9:45am
Chair: **Dr. John Cioffi**, Stanford University

Over 200 million paying DSL subscribers worldwide successfully use copper transmission facilities to enjoy data, video, and voice services. As this number grows to a half billion and beyond in the next few years, intense pressure on very fast DSL speeds mounts. This session investigates the operational, technical, and business aspects of realization of 100 Mbps plus speed DSLs. Talks by some of the worlds leading DSL experts will illustrate various important technological elements to such DSL progress and adoption into the mainstream of the information age.

Invited speakers:
Dr. John Cioffi – Stanford University
Dr. Kenneth Kerpez – Telcordia Technologies
Dr. George Ginis – ASSIA Inc.
Paul Spruyt – Alcatel
Dr. Mikael Isaksson – UpZide

Wednesday Lunch Time Executive Panel

Wednesday 29 November • 12:00 to 2:00 pm

The second day of ACCESS '06 will be highlighted by a panel session with keynote presentations from key policy makers and industry leaders who will predict the future of broadband.

Chairs and Panelists: TBA

EPON Deployments - Technology and Business Lessons From Around the Globe

Wednesday 29 November • 2:00pm
Chair: **Dr. Niel Ransom**, Teknovus and former CTO of Alcatel

This session will bring together carriers, system vendors and their component suppliers who have experience with putting EPON systems together.
The carriers will discuss current and future requirements for the access networks as they gear up for triple-play deployments and the customer and technical challenges that come along with it. This session will also see system vendors and component suppliers discussing the technical requirements and challenges of designing a System-on-a-Chip (SoC) to meet OEM and Telco requirements. The international experts will provide an international view on current and future PON deployments.

Invited speakers:
Dr. Yanming Liu, Salira
Ed Boyd, – Teknovus
Atikem Haile-Mariam – Finisar
Dr. Takao Naito – Fujitsu Labs America

Metropolitan Wireless Access Networks

Wednesday 29 November • 2:00pm
Chair: **Dr. Bill Kaminsky**, TechSolve

Wireless public access started over 20 years ago with the launch of cellular service. For the past 5 years we have had WiFi hotspots and private WiFi networks. Metropolitan WiFi networks are beginning to launch, WiMax is emerging, PANs are developing, cellular is completing launch of its 3 rd generation and other wireless technologies are under development. This session will focus on the various technologies and business issues that are evolving to provide access for Metropolitan Wireless Networks including:

- Radio access technologies (i.e. WiFi, WiMax, Cellular, others)
- Technical challenges
- Customer advantages
- Business models and drivers
- Security

Invited speakers: (TBA)

Last Mile Wireless Technologies and the World Wide Research Forum (WWRF)

Wednesday 29 November • 2:00pm
Chair: **Dr. Pieter van Rooyen**, Broadcom, Vice Chairman Americas of the WWRF

The World Wide Research Forum (WWRF) is a global organization founded in August 2001. Members of the WWRF are typically manufacturers, network operators/service providers, R&D centers, universities and small and medium enterprises. The WWRF identify and scope research issues relevant to future mobile and wireless communications, including pre-regulatory impact assessments and invite world-wide participation. As such, the Forum provides a global platform for discussion of results and exchange of views to initiate global cooperation towards systems beyond 3G. Current research topics within the WWRF include Smart antennas, ad-hoc networks, reconfigurability and business in the future wireless world. This session will provide an overview of the goals of the WWRF and present some of the research conducted to address wireless "Last Mile" solutions.

Invited speakers:
Dr. Chih-lin I, Applied Science and Technology Research Institute, Hong Kong
Dr. Nambi Seshadri – Broadcom
Dr. Jon Agre – Fujitsu Labs America

Ensuring QoS and Securing Converged Services

Wednesday 29 November • 2:00pm
Chair: **Scotty Poretsky**, Reef Point Systems

While converged fixed-mobile convergence (FMC), available through the 3GPP IP Multimedia Subsystem (IMS) and Unlicensed Mobile Access (UMA), promises to transform communications for consumers and enterprise customers, it also opens the mobile packet core and user devices to the public Internet — making them more vulnerable to attacks and attractive to hackers than ever before. This session will discuss the vulnerabilities of FMC networks, referencing the elements that make up the IMS and UMA architectures and identifying how and where the IMS and UMA standards specify security functions. Other important issues to be covered include: the limits of the standards' security specifications; additional security measures required to protect service provider core infrastructure and applications; quantifying FMC network dimensions (e.g., users, devices, bandwidth and sessions) for adequately deploying security solutions and planning for scalability; and the state of security technology for FMC from the control and media plane viewpoints.

Invited speakers:
Roland Thies – Alcatel
Vijay Gurbani – Lucent
Chi-Ming Chen – AT&T
Mike Todd – British Telecom
Steve Shaw – Kineto
Carol Davids – Illinois Institute of Technology

THURSDAY, 29 NOVEMBER

Fiber to the Home – The New Empowerment

Thursday 30 November • 9:45am
Chair: **Paul Green**

This session describes the technical details of current and future FTTH systems, current deployment status, and the economic and social significance of this major revolution in upgrading communications infrastructures worldwide. Presentations on the architectures and the opto-electronic and deployment technologies are followed by data on deployments to date, concluding with one view of the directions that FTTH system architecture might take beyond the passive optical networks of today.

Invited speakers:
Paul Green
Graham Richard – Mayor of Fort Wayne, Indiana
Bob Campbell – Ditchwitch
Michael Render – Render Vanderslice
Linc Hoewing – Verizon
Bob Whitman – Corning
Fred Leonberger and Rajeev Ram – MIT

Metro Ethernet Optical Networks

Thursday 30 November • 9:45am
Chair: **Winston Way**, Founder and CTO, OpVista Inc.

This session will cover various aspects of metro Ethernet optical networks, including market overview, high-speed Ethernet switch/router, MSO/Enterprise optical network architectures and standards activities.

Invited speakers: (TBA)

Universal Wireless Networks In The Bay Area

Thursday 30 November • 9:45am
Chair: **Chris Vein**, CIO, City and County of San Francisco

This session reviews the status of major citywide universal and affordable broadband wireless projects recently announced for the City of San Francisco and the neighboring cities in the Silicon Valley. The panelists will discuss a wide range of architecture, technology, economics, and social issues confronting these ambitious projects. Such universal wireless networks are expected to cover 1500 square miles in the Bay Area.

Invited speakers: (TBA)

Integrated Fiber and Wireless for Access and Metro Networks

Thursday 30 November • 9:45 am
Chairs: **Chunming Qiao**, SUNY at Buffalo
Dr. Ting Wang, NEC Labs of America

This discussion, by a panel of distinguished managers at major companies, addresses topics related to the integration of optical and wireless technologies and networks. The topics include but are not limited to FMC (Fixed-Mobile Convergence), integrating the metropolitan optical network with diverse broadband wireless access systems, IMS (IP multimedia subsystems), wireless systems combined with PON (passive optical network), new ways of utilizing WiMax and WiFi, and the range of challenges and opportunities these technologies present. The presentations, which will be light technical and/or business oriented, will discuss architectures, visions, trends, enabling technologies, and services and applications.

Invited speakers: (TBA)

WIMax Technology and Standards

Thursday 30 November • 9:45am
Chair and invited speakers: (TBA)

WiMax is a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to wired broadband technologies like cable and DSL. This session provides an update of the architecture and technologies of the IEEE 802.16 family of WiMax standards. The group of WiMax panelists will review the current status of the technology platform, compliance, equipment suppliers, and system deployment. Issues on architecture and applications will also be discussed.

TUESDAY, 28 NOVEMBER

D8: Emerging Wireless Communication Standards and Technologies

Topic: **Networks**
Duration: 9:45am - 6:00pm
Chair: **Dr. Dilip Krishnaswamy**, Intel

This session will cover emerging wireless communication standards and technologies. Experts involved in the creation of new standards will speak for each standard. The session will cover 802.11n MIMO, 802.11s mesh networks, the WiMAX 802.16.e standard, and the UWB standard. The session will also discusss future emerging technologies for 4G cellular Long Term Evolution, and discuss advanced topics for future communication technologies such as co-operative diversity, multi-protocol communications processing, and multi-tiered mesh networks.

Invited Presenters:
- Introduction/Motivation: **Dr. Dilip Krishnaswamy**, Intel
- Emerging Comm Technologies and Architectures: **Alan Crouch**, Director and GM, Communication Technology Labs, Intel
- UWB Wireless Technology: **Dr. David Leeper**, Intel
- 802.11s WLAN mesh networking standard: **Steve Conner**, Intel
- MIMO WLAN 802.11n standard: **Robert Stacey**, Intel
- WiMAX 802.16e standard: **Jose Puthenkulam**, Intel
- LTE Long Term Evolution: **Dr. Shilpa Talwar**, Intel
- Future Wireless Communication Technologies: **Dr. Sumeet Sandhu**, Intel
- P2P Wireless Networking: **Dr. Andreas Heiner**, Nokia

D14: Netflow, IPFIX, and Beyond: Integrated Routing, Traffic Analysis, and Modeling for highly Accurate Network Engineering

Topic: **Control and Management of High Performance Networks**
Duration: 9:45am - 12:15pm
Chair: **Dr. Cengiz Alaettinoglu**, Packet Design Inc.

Network management has traditionally been carried out using SNMP polling, sometimes augmented by codebook-based correlation. More recently, flow-based analysis has provided further insight into the application and traffic dynamics of IP networks. But periodic polling cannot capture the complex and dynamic layer 3 operations of IP networks, and flow-based analysis is typically viewed on a link-by-link basis. These techniques do little to help network engineers explain the often unpredictable and intermittent behaviors caused by the routing dynamics of IP networks. They are forced to make educated guesses about the global state of the network to infer root causes from symptoms and plan changes effectively.

This seminar examines the use and limitations of flow-analysis tools such as Netflow and the upcoming IPFIX standard, and how an emerging technology called route analytics works with traffic-flow analysis to provide network-wide understanding of traffic for better troubleshooting and planning. We will show "route-flow fusion" can be used to increase the reliability and predictability of IP networks for more sensitive and demanding converged applications.

D6: Seamless Mobility

Topic: **Networks**
Duration: 2:00pm - 6:00pm
Chair: **Rana P. Sircar**, Wipro Technologies

The access of the network has a rich plethora of technologies. With the evolution of the broadband wireless technologies, different broadband access technologies are starting to co-existing with each other. The consumer today demands seamless and hassle-free Value-Add services across the networks. Thus, the consumer is migrating from being user of Triple Play to that of Quadruple Play. While some of these services are still being rolled out, this seminar will focus on the various network evolution strategies being developed to provide seamless Mobility. The Seminar will also discuss the challenges and the solutions being evaluated.

D10: Modeling and Simulation Tools for Network Designers and Developers

Topic: **Simulation Systems**
Duration: 9:45am - 6:00pm
Chairs: **Jack L. Burbank**, JHU/APL
William Kasch, Johns Hopkins University/APL
Jon Ward, JHU/APL

The proposed full-day technical session aims to provide an overview of modeling and simulation (M&S) tools and techniques available to assist network designers and developers. This session would be an expanded version of the half-day session on the same topic in the 2005 D&D Forum by the authors. M&S is a critical element in the design, development, and test and evaluation (T&E) of any network product or solution. In many cases, M&S provides the only method to gain insight into the performance of the eventual product or solution in a large-scale environment, and allows for more informed design trade studies. The goal of this technical session is to provide attendees an overview of many of the M&S tools and techniques that are available to assist them in their projects. In particular, the session would nominally consist of five areas of focus relevant to M&S:

1. Network M&S Tools - This presentation would provide an overview of existing network M&S tools, such as OPNET, NS2, QualNet, and GloMoSim, contrasting the strengths and weaknesses.
2. Hardware-in-the-loop M&S - This presentation would provide an overview of hardware-in-the-loop (HITL) M&S methods, describing the appropriate applications of HITL applications, and providing novel examples of HITL techniques.
3. Distributed simulation - This presentation would provide an overview of distributed computing methods, and discuss the application of network M&S tools in a distributed environment in order to achieve high-powered M&S capabilities.
4. Waveform M&S Tools - This presentation would compare and contrast existing waveform M&S tools, such as MATLAB, SimuLink, and SPW.
5. Propagation M&S Tools - This presentation would compare and contrast existing propagation M&S tools, such as Wireless Insite.

Invited Presenters:
- OPNET: representative, OPNET Technologies
- QualNet: representative, Scalable Network Technologies
- Signal Processing Workshop: representative, CoWare
- Agilent M&S Tools: representative, Agilent Technologies
- National Instruments M&S Tools: representative, National Instruments

D1: IPTV Interoperability, from Buzzword to Reality

Topic: **IPTV**
Duration: 9:45am - 6:00pm
Chair: **Richard Brand**, Nortel

The ATIS IPTV Interoperability Forum (IIF) has been established by ATIS in Sept. 2005 to develop ATIS standards and related technical activities that enable the interoperability, interconnection and implementation of IPTV systems and services, including video on demand and interactive TV services. IIF's initial focus will be the creation of an industry overall reference architecture for IPTV; content delivery (quality of experience); digital rights management (DRM); interoperability standards and testing requirements for components; reliability and robustness of service components; and the establishing of user expectations. Therefore the first component of the session would provide the IIF definition of what IPTV is, detail how the IIF came into existence based on service provider needs and explore the investigation of what was required of the industry to make IPTV a marketable product. Today the IIF has over 40 member companies actively participating in the development of documents that will enable the IIF to ensure to the industry that the various components of any IPTV end to end solution will interoperate based on quantifiable specifications.

As a second session component Verizon, AT&T, Bell So. and Qwest are all active participants in the IIF and executives from some of these companies involved in their planned IPTV deployment, can speak on the challenges

facing them with IPTV deployment, why they are actively participating and what the IIF deliverables mean to their business. On the product side, IPTV product solution providers such as Accenture, Alcatel, Lucent, Nortel, Cisco, Intel, Microsoft and many others are also active and representatives from some of these IIF members would describe their views on the on the IIF and the technical challenges facing them with IPTV.
A third component would be a detailed description of the newly completed IIF Architecture and Digital Rights Management specifications, as well as the Quality of Service Metrics document which will be completed by the November GlobeCom date.

The fourth component would describe how the IIF will take these new IPTV specification documents and charter credible validation testing which can bring affordable IPTV into the homes of peoples in North America and the rest of the world.

WEDNESDAY, 29 NOVEMBER

D4: Challenges and Opportunities in Software Outsourcing to China

Topic: **Outsourcing**
Duration: 9:45am - 12:15pm
Chairs: **Dr. Stanley Chum**, Bitek Communications Inc.
Dr. Jason Cheng, Beijing ZGC Software Association

In the past decade, a significant portion of software development work had been outsourced from American companies to other countries such as India and Ireland, taking the advantages of the low labor cost of local software engineers. In 2004, about 0.6 billion dollars software projects were outsourced to China (or 1.5% of the total outsourced volume). Recently, China governments, software institutions and enterprises are working together to formulate strategies and plans in an effort to attract a larger share of this software outsourcing market. While there are opportunities, attraction and advantages to outsource projects to China, there also exist obstacles and challenges for the American companies to successfully outsource their critical development projects to China. This seminar will revisit recent experiences of selected outsourced projects to China, and will discuss the related critical success factors. Some successful cases will also be illustrated. This seminar will also highlight China government strategies and sponsoring programs which help making the China software outsourcing industry more competitive.

D11: BT Case Study - BT's 21st Century Next Generation Networks and Systems

Topic: **Next Generation Networks and Systems**
Duration: 2:00pm - 6:00pm
Chair: **John P. Wittgreffe**, BT Group PLC

This session will take a fascinating and stimulating look at how one of the World's largest ICT service providers, BT, is architecting its networks and systems to address the challenges and opportunities presented by NGN. The session has invited presentations from lead architects and designers from BT's 21st Century Networks and Global Services arms, with a refreshing emphasis on the challenges for services to corporate customers.

The session will open with a look at BT's 21st CENTURY NETWORK- the largest investment in NGN in the industry. This will be led by Murray Cook, BT's Chief Business Architect.

"SECURING THE NGN" will then explore the security architecture BT has put in place to meet the security challenges that 21C will face both now and in the future. This part will be led by Robert Temple, BT's Chief Security Architect.

Invited Presenters:
- 21C Architecture: **Murray Cook**, Chief Business Architect
- NGN Security: **Robert Temple**, Chief Securty Architect
- NGN systems for corporate customers: **Mark Dames**, Head of Network Architecture, Global Services
- MDA in NGN systems: **Nektarios Georgalas**, Head of MDA Research
- SOA and Distributed IT: **Mike Fisher**, Head of Distributed Computing Research

D7: Emerging Communications/Networking Technologies and Services in India

Topic: **Networks**
Duration: 9:45am - 12:15pm
Chair: **Dr. Dilip Krishnaswamy**, Intel

This session will address emerging communications/networking technology initiatives in India. It will discuss Gigabit capable Passive Optical Networks (GPON) and WiMAX development initiatives undertaken by the Centre for Development of Telematics (C-DoT) in India. Service provisioning for next-generation networks (NGNs) using technologies such as IMS (IP-Multimedia Subsystem) will also be discussed.

Invited Presenters:
- GPON & WiMAX Initiatives in India: **Dr. Anand Srivastava**, Director C-DoT India
- IMS for NGNs: **Shweta Singh & Ajit Katankot**, WIPRO India

D9: NSF and Industry Support for Convergence Curriculum Development

Topic: **Affordable Technical Education Programs**
Duration: 2:00pm - 6:00pm
Chairs: **Tim Ryan**, City College of San Francisco
Pierre Thiry, City College of San Francisco
James Jones, Photisis Consulting

This seminar presents unique aspects of collaboration between government, education, private industry and community to benefit the San Francisco Bay Area through high-quality, affordable technical education and training programs.

City College of San Francisco (CCSF) has received a $750,000 grant from the National Science Foundation Advanced Technological Education (ATE) program to develop new courses, certificates and degrees in communications convergence technologies. The award was granted by demonstrating cooperation between the internal Information Technology Services organization (ITS) and the academic Computer Networking and Information Technology Department (CNIT) which utilizes the production ITS infrastructure as part of the academic learning environment. There are two key components of this infrastructure which have recently been installed and are appropriate for accomplishing the program goals. The first is a fiber-based Metro Area Network built in partnership with the City and County of San Francisco consisting of a 30-mile ring connecting 9 City College campuses and a telecommunications co-location facility. It is utilized as a hands-on laboratory for Last Mile technologies such as fiber-optic architecture and Metro Area Ethernet and is available to all IEEE members as a research platform. The second key component is a voice-over-IP telephone system which was purchased from Alcatel and includes 10 subsystems and approximately 2,000 telephone sets. It is used to provide experience in the operation and support of an enterprise-level telephone system and also serves as a model for designing a distributed VoIP system.

A panel of more than 30 business and industry members is actively involved in assisting City College in identifying the knowledge areas and skills that should be present in a revised curriculum to effectively prepare students for future employment. Some of the members are involved to a greater degree by participating in job fairs, internship programs and donation of equipment for hands-on learning. Industry organizations with a significant involvement in the program include Alcatel, at&t, Cisco, HP, Juniper and Verizon. Each is participating in a unique fashion which best suits their assets and the needs of the City College academic program.

A new academic program was started this summer, the "Communications Convergence Workshop". It is a six-week series of introductory presentations including hands-on participation of the latest technologies: e.g. Fiber-

Optic Technology, Metro/Wide Area Ethernet, Voice over IP, Video Networking, Juniper Routers and Wireless Technology. This workshop targeted High School teachers, City College students and the broader San Francisco community and involved several of our Industry partners who assisted in the presentation and showcase of their products.

The programs described above will be presented in detail and with an emphasis on the benefits achieved through a cooperative model of curriculum development. Questions from the audience will be encouraged in order to ensure effective dissemination of information.

D2: Beyond the Hype: the Theory, Practice, and Real World Application of Quantum Cryptography

Topic: **Quantum Cryptography**
Duration: 9:45am - 12:15pm
Chairs: **Dr. Audrius Berzanskis**, MagiQ Technologies
Andrew Hammond, MagiQ Technologies

The impacts of quantum engineering and quantum information processing (QIP) are just beginning to reverberate throughout the technology industry. As the space begins to mature, many of the technologies are ripe for commercialization. In the case of quantum cryptography, they are already being brought to market.

The speaker will describe the evolution of quantum information processing; the potential impacts of such technologies in the 21st century; and will explain how MagiQ's quantum cryptography solution operates (Quantum Private Network.)

The presentation will also describe other approaches, current market feedback from companies deploying quantum cryptography, and discuss the role that service providers can play in delivering this solution to the marketplace.

This presentation will address:
- The history of quantum information processing
- What near and longer term potential exists for commercial applications of QIP
- Historical value and analysis of previous cryptographic methods
- The security threats to today's networks
- The technical aspects of quantum key distribution
- In depth architecture of quantum key distribution
- Physical layer
- Photonics layer
- Software protocols
- Interfaces to classical cryptography
- Why quantum key distribution is needed
- Sample deployments and configurations of MagiQ's quantum key distri bution product, the Quantum Private Network (QPN) 7505
- Market readiness
- Extensive demo of a live QPN 7505 system

Speakers:
- **Dr. Audrius Berzanskis**, VP Security Engineering
- **Andrew Hammond**, Vice President of Marketing and Business Development

D13: Nanotechnology in Communications

Topic: **Nanotechnology**
Duration: 2:00pm - 6:00pm
Chair: **Dr. Amr S. Helmy**, University of Toronto

This seminar aims at presenting some of the most promising and novel nano-scale technologies that greatly influence communication technologies. As the chair of the nanotechnology subcommittee in the IEEE ComSoc, I aim to use this seminar as the corner stone of a growing effort to link industrial and academic professionals in the domains of communications and nanotechnology. This will be the first in a series of sessions which will provide overviews for numerous, promising and relevant technologies for the communications community.

The seminar in its proposed setting aims at providing overview through invited speakers from industry, world leading academic institutions, and pioneering figures in the field. Hence the number of speakers is limited to approximately 6-8 depending on the time available. Talks of approximately 30 minutes are planned. The speakers will present topics ranging form novel materials which manipulate EM waves in fashions that are not available in nature (negative refraction metamaterials) to nano-structuring techniques to harness EM radiation in Antennae, nano-scale waveguides, Si circuits for VLSI interconnects and optical fibers. There will also be an overview from Michael Lebby who is the CEO of the Optoelectronics Industry Development Association (OIDA), which will provide invaluable insight in the markets in which nanotechnologies are proliferating.

The work on photonic bandgap control as well as negative index metamaterials directly affects efficiency and size of Antennae throughout the full EM spectrum. Negative refractive index metamaterials have also demonstrated tremendous promise in revolutionizing the performance and size of microwave and mm-wave components as we know them, hence enabling unprecedented levels of functionality and integration. On the other hand work on nanophotonic waveguides using plasmonic structures enables more efficient use of optics as interconnects in Si VLSI circuits. Research on nanoparticles and their integration on Si substrates is viewed as one of the most promising route to enable the realization of light sources on Si chips, which is an enabling technology for using photonics as an on chip communication mechanism. Nano-structured optical fibers will also be likely to play a role in next generation optical links where they mitigate many of the shortcomings of conventional optical fibers. In addition they enable novel functionality of fiber-based photonic components, which can be readily integrated in the optical links deploying such nano-structured fibers.

Invited Presenters:
- Nanophotonics circuits: **S. Fan**, Stanford University.
- Photonic bandgap antennas: **I. G. Thayne**, Glasgow University.
- Nanostructured meta-materials: **G. Eleftheriadis**, U of Toronto.
- Nano-structured fibers: **P. Russell**, U of Erlangen-Nuremberg.
- Nanotechnology for Si photonic devices: **L. Kimerling**, MIT.
- Emerging Nanotechnology Markets: **M. Lebby**, OIDA.

D5: Photonic Design Automation of Optical Communication Systems

Topic: **Design Techniques**
Duration: 9:45am - 6:00pm
Chairs: **Dr. Andre Richter**, VPIsystems
Dr. James D. Farina, VPIsystems
Invited Presenters: (**TBA**)

It is a complex and tedious task to define the types of components required in fiber-optic transmission systems, and then determine the optimums for numerous component parameters. To reduce cost and time, laboratory prototypes of new network architectures should only be built in the final steps of a design process. Thus, Photonic Design Automation (PDA) plays an essential part in modern design processes. PDA describes the design methodologies, software tools and services used to engineer complex photonic networks and products. It can be seen as common language for innovation, offering software integration along the signal path from transmitter to receiver, across the value chain from component and systems manufacturer to network operator. Sophisticated computer modeling allows to reduce number of costly and time consuming lab experiments and field trials investigating new system architectures and characterizing optical components.

Advantages of professional PDA tools include:
- Low cost of virtual laboratory and experiments
- Flexible and easy change of system configurations
- Low maintenance effort
- Investigation of novel and innovative designs possible
- Capability of switching on and off various physical effects to provide insights

- Easy communication and documentation of software simulation setups and results

This seminar discusses various modeling aspects along the optical propagation channel:
- The concept of multiple optical signal representations is introduced, which allows distinguishing between data signals, optical noise, distortions and crosstalk throughout the fiber transmission.
- Recent trends of modeling optical transmitters, fibers, amplifiers, and receivers are outlined.
- The problem of estimating with good confidence the bit-error rate is discussed.
- The link between computer modeling and real-world measurement is discussed on an exemplary basis.

The seminar will be given in form of technical lectures on various topics of computer modeling and physical background, which are accompanied by live demonstrations of application examples.

It is intended to cover the following topics via invited presentations:
- Component characterization to input into systems simulations,
- Experimental validation of computer models using laboratory test beds,
- Modeling requirements for the development of commercial components and systems,
- The help of optical simulation tools in university teaching.

Invited Presenters:
- Designing Active Photonic Circuits: **Arthur Lowery**, Monash University.
- Experimental validation with WDM loop testbed: **Ronald Freund**, Fraunhofer-Institut for Telecommunications Heinrich-Hertz-Institut.
- Testbed for all-optical networks: **Alex Vucovic**, Communications Research Centre Canada.
- TBA: Boh Ruffin, Corning.
- TBA: Nan Froberg, Photonic Systems Inc.

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D3: Emerging Wireless/Networking/Communication Technologies in China

Topic: **Networks**
Duration: 9:45am - 6:00pm
Chair: **Dr. Kai Miao**, Intel Corp

The communications market and industry in China have been developing at an astonishing speed. Driven by huge market forces and enabled by the large available pool of resources, technology capacity in China no doubt will continue to develop and make China a leading technology player in the world.

In this session, we will invite several key technology experts from China, who have intimate knowledge of the Chinese technology landscape, understand the unique market factors in China, and are well familiar with the "home-grown" technologies and unique solutions. These experts will not only provide information on China's current technology development status but will also give the audience insights about how the country will evolve and discuss what will be the key issues in China regarding technology development.

More specific topics will include Chinese wireless and multimedia media standards (such as TD-SCDMA), Chinese national technology initiatives (such as 973, 863, and FUTURE programs, etc.), Chinese 3G and B3G roadmaps, and technology usage models in China.

Invited Presenters:
- Opening TBD: **Kai Miao**, Intel IT Research
- Technology Trends and Research Collaborations in China: **Zhisheng Niu**, Dean College of Information Sciences Tsinghua University China
- WiMAX WiFi and 3G in China: **G. S. Kuo**, Chair professor College of Communications Beijing University of Post and Telecommunications (BUPT)
- The Future of Wireless Technology and Market in China: **TBA**
- Wireless Technology Standards A Chinese Perspective: **Jing Wang**, Professor Tsinghua University Director Chinese National 863 Project
- FUTURE Program a National Technology Agenda in China: **Ping Zhang**, Professor BUP Director China Wireless FUTUE Program

D12: Ubiquitous Human to Human Telecommunication Systems Design, Development and Standardization

Topic: **Networks**
Duration: 9:45am - 6:00pm
Chair: **Dr. Ryoichi Komiya**, National Institute of Information and Communications Technology, Japan

The specific service application of the ubiquitous networks seems to have been various types of RFID approach. The application has been convenient in the field of supply chain management.

In the IEEE Communication Society, we have to propose some new ideas for ubiquitous networks to enhance the human to human communications. In business communications, they believe that telephone and networked personal computer are sufficient to proceed business transactions. Because in business transactions, contract documents arrangements are everything. In order to process these jobs, business people are using telephone/mobile phone and networked personal computer skillfully and efficiently.

However, when it comes to exchanging more straight human emotional information, these two gears are not sufficient to replace face to face conversation. According to information statistics in daily face to face conversation, human beings are getting information from voice text (20%) from voice tonal changes (10%), and remaining 70% of information has been obtained from gestures, postures, facial expressions, accessories, clothes. The remaining information is referred to as non-verbal messages.

At the beginning of 1970, for the purpose of verbal and non-verbal message transmission, video phone R&D projects had been promoted in the U.S. Japan and some European countries. However, the results of the video phone R&D projects are obvious.

In this forum, we are going to discuss how the ubiquitous technologies can contribute to enhance human to human telecommunication much better than the existing telecommunication systems in terms of verbal and non-verbal message transmission.

Everybody believes that ubiquitous networks might be a solution for the next generation telecommunication networks. However, there are no attractive killer applications of ubiquitous devices other than RFID. Therefore, the forum aims at enhanced human to human telecommunication systems design and development and necessity of international standardization.

The topics to be covered by this forum are as below.
(1) Analysis of human verbal and non-verbal message to identify the essential information to fall in love
(2) Sensors to capture the human essential information
(3) Actuators to regenerate the human essential information at a remote site
(4) Communication bit rate study when it comes to transmitting the human essential information over the network
(5) Design and development of human to human telecommunication systems exchanging the human essential information using ubiquitous sensors and actuators
(6) Field trials of the ubiquitous human to human telecommunication systems in Japan, US and European countries
(7) International standardization for the wireless interfaces between distributed ubiquitous sensors/actuators and network terminating equipment

Invited Presenters:
- Overview: **Ryoichi Komiya**, National Institute of Information and Communications Technology, Japan

• Network: **Stan Moyer**, Telcordia
• Service applications: **Hitomi Murakami**, KDDI
• Telecommunication systems: **Masashi Shimizu**, NTT
• Network configurations and interfaces: **Mick Wilson**, Fujitsu Laboratories of Europe Ltd.
• Devices: **EPeter Yan**, Erlang Technologies
• Wireless technologies: **John Vincente**, Intel

D15: Session Initiation Protocol (SIP): A technology for enabling next generation networks and services

Topic: **Next Generation Networks and Systems**
Duration: 9:45am - 6:00pm
Chairs: **Dr. Arup Acharya**, IBM TJ Watson Research Center
Dr. Archan Misra, IBM T J Watson Research Center
Avshalom Houri, IBM Software Group

This seminar will describe the transformation of circuit-switched communication networks being brought abut by SIP (Session Initiation Protocol) and SIMPLE (SIP extensions for Instant Messaging and Presence). This transformation is underway in a global scale and across multiple sectors: cable providers, ISPs, cellular providers and enterprise networks. The most visible effects of this transformation is in the rapid adoption and deployment of network-based applications such as Voice-over-IP (VoIP), Instant Messaging (IM) and Presence, using servers and software as the building blocks, instead of a switching infrastructure. Telecom is now being redefined, for example, with Yahoo and Google offering telephony services through VoIP. SIP clients are now ubiquitous in client platforms (such as Microsoft Windows and cell phones), in the form of Softphones and IM clients on desktops and Push-to-talk on cell-phones. IP Multimedia Subsystem (IMS), which is an integral part of 3G networks and is now being considered actively for wireline networks as a framework for new communication services, is based on SIP/SIMPLE. All these advances are, in effect, creating new "convergence layer" realized through an overlay network of SIP servers and clients, which is being used to deploy new applications and services, representing the next phase in internet-based communication and services.
This seminar will cover the fundamental aspects of SIP/SIMPLE as the core technology to create converged network architecture and applications, specifically protocol-level description of SIP, programming interfaces to create SIP-based network services, overview of IMS and role of SIP in 3G wireless networks, new applications that leverage SIP, current standardization efforts, open-source projects and emerging advances such as peer-to-peer SIP.

IEEE GLOBECOM 2006 PATRONS as of August, 2006

MONDAY - FULL DAY TUTORIALS (9:00am - 5:00pm)

T3: MPLS - the Importance of Offering the Right Solution at the Right Moment. Timeliness, Benefits, and Deployment from the Origins, to ATM, to Optical Networks

Topic: MPLS

Instructor: Dr. Mario Baldi, Politecnico di Torino

This tutorial provides an overview of MPLS from its inspiring principles to its various fields of application. By retracing the evolution of MPLS, the tutorial discusses how it became the next technology promising to satisfy present and future networking needs.

After a presenting the basic mechanisms and operating principles of MPLS, the tutorial discusses the two feature of MPLS that make it a particularly important technology today. The first one, which the tutorial gives particular emphasis to, is related to enabling traffic engineering. First, the limitations of IP with respect to the realization and operation of large backbones are analyzed. Then, traffic engineering features that enable MPLS to overcome such limitations are illustrated together with their underlying mechanisms and protocols.

The second important feature is related to the control plane of MPLS that, on the one hand, is well integrated with the control plane of IP, on the other hand is suitable for deployment on connection oriented networks. For this reason the control plane of MPLS has become a unifying solution for various network technologies. The tutorial first explains the relation between MPLS and different infrastructure technologies, such as Ethernet, PPP, ATM and FR, DWDM, and circuit switching. Then the control plane of MPLS is described discussing how MPLS signaling protocols are used for set-up and restoration of MPLS Label Switched Paths (LSPs), possibly generalized in terms of circuits, optical channels, and sub-lambda channels.

The participants are expected to have basic knowledge on packet switching and the Internet Protocol Suite.

T14: IEEE802.11n: Throughput, Robustness, and Reliability Enhancements to WLANs

Topic: Wireless Communications

Instructors: Dr. Eldad Perahia, Intel Corporation
Robert Stacey, Intel Corporation

This tutorial provides a comprehensive overview of the technology in the p802.11n draft standard.

We begin with an overview of the applications, environments, channel models, use cases, and usage models developed by the study group and task group which provided the framework for proposal development. We continue with a history of the various coalitions that ultimately led to the final joint proposal adopted as the draft standard.

The technical description of the draft standard starts with a detailed discussion of the key throughput enhancing features: multiple-input, multiple-output (MIMO) / space division multiplexing (SDM) in the PHY and packet aggregation in the MAC. Further throughput enhancements in the PHY include 40 MHz channelization, reduced guard interval, tone filling, high rate coding, and efficient (greenfield) preambles. In the MAC this includes enhancements to the block acknowledgement (BA) protocol, such as a compressed BA frame format, implicit BA request, partial state operation, and no ACK delayed BA protocol. The reverse direction data protocol, which provides throughput enhancements for certain types of traffic patterns, is also discussed.

Additional topics include PHY interoperability techniques and MAC techniques and reduced inter-frame space (RIFS) operation, 20/40MHz phase coexistence operation, and channel width management.

T21: Almost Sixty Years of Error-Correction Coding: How we Reached the Shannon Limit

Topic: Communication Theory

Instructor: Dr. Bernard Sklar, Communications Engineering Services

Block codes, convolutional codes, and trellis-coded modulation represent the core techniques for obtaining coding gain. We review these fundamentals by addressing: how to generate codes, how to decode them, the advantage of non-binary codes (such as Reed-Solomon) in bursty noise, the benefits of soft-decisions, and how they are implemented with Viterbi decoding of convolutional codes. Owing to recent developments, soft-decision decoding has now become very important for block codes - which leads us to the main thrust of this tutorial - examining the remarkable coding strides accomplished in this decade. These advances, which are bringing digital system performance extremely close to the theoretical limitation of what is possible, entail the use of iterative decoding techniques which we examine by using turbo-code and low-density parity-check (LDPC) code examples. We focus on the astounding performance of LDPC, and demonstrate the workings of the message-passing algorithm used with such iterative decoding methods.

MONDAY – MORNING HALF DAY TUTORIALS (9:00am - 12:00noon)

T2: Mutiple Antenna Systems-From Optimum Combining to MIMO: an approach based on random matrix theory

Topic: Wireless Communications

Instructors: Dr. Marco Chiani, Univ. of Bologna
Dr. Moe Win, LIDS MIT

This tutorial provides the basic principles and applications of multiple antenna systems, including MIMO and distributed MIMO, and their analysis based on random matrix theory. We discuss recent results on the effect of space and time correlation on the capacity of MIMO systems. Then we present practical solutions for MIMO systems, and their performance analysis. Finally, we illustrate some applications of multiple antenna systems and MIMO in cellular systems, wireless LAN, and cooperative diversity for energy constrained wireless sensor networks.

T4: WiMAX: An Advanced Broadband Wireless System

Topic: Wireless Communications

Instructor: Dr. Doru Calin, Bell Labs, Lucent Technologies

The tutorial is primarily addressing the emerging broadband wireless solutions as specified by the IEEE 802.16 standards, often referred to as WiMAX (Worldwide Interoperability for Microwave Access) technology. WiMAX is an Orthogonal Frequency Division Multiplexing (OFDM) based system which offers promising high spectral efficiency, scalable carrier bandwidth options (e.g. from 1.25MHz to 20MHz), flexible spectrum options (e.g. 2-6GHz), multiple duplexing options (Time Division Duplexing & Frequency Division Duplexing), various subchannelization options and users mobility thanks to its 802,16e variant. Technologies such as Hybrid Automatic Repeat Request (H-ARQ), Space Time Coding (STC), Advanced Antenna Systems (AAS), Multiple Input Multiple Output (MIMO) and Space Division Multiple Access (SDMA) have been enhanced to support mobile environments and to improve the broadband access speed.

T1: Broadband Fiber Access

Topic: Advanced Technologies & Protocols for Optical Networks

Instructor: Dr. Leonid G. Kazovsky, Stanford University

This tutorial will include results of some six years of research conducted by my group, Photonics and Networking Research Laboratory at Stanford University. The research was conducted with a generous support of vari-

ous industrial companies (including both service providers and equipment manufacturers) and government agencies (such as NSF).

T7: Traffic Analysis for Network Security

Topic: Computer & Network Security Systems

Instructor: Dr. Thomas Chen, Southern Methodist University

This half-day tutorial will give an overview of how traffic data is collected and analyzed for security applications. The tutorial is organized into four major parts. The first part presents an introduction to various network-based security threats including scans, viruses, worms, spyware, and denial of service attacks. This part is essential background to understanding how these attacks typically generate specific patterns of traffic that is different and distinguishable from legitimate traffic. The success of traffic analysis depends on the observation that malicious traffic behaves in a uniquely identifiable way.

The second part of the tutorial describes how traffic data is monitored and collected from various points in the network, such as sniffers, routers, firewalls, intrusion detection systems, and honeypots. Descriptions will include illustrations with examples of open-source and proprietary software tools.

The third part of the tutorial shows methods to analyze traffic data at the packet, flow, and session levels. The processing of protocol header information in packets at the IP, TCP, and other protocol layers is described. The necessity of parsing and filtering the (usually voluminous) raw traffic data is motivated, with examples of relevant software tools.

The last part of the tutorial describes interpretation of traffic data to detect intrusions based on known signatures or behavior anomalies. Examples of manifestations of scans, backdoors, viruses, worms, and other types of attacks are shown. Finally, the tutorial will be concluded with a summary of current difficulties and limitations of traffic analysis for security.

T11: Mobile DTV

Topic: Multimedia Communications

Instructor: Dr. Ernest Tsui, Intel Corporation

The purpose of this tutorial is to provide mobile platform OEMs, DTV card vendors, DTV component manufacturers, and broadcast TV infrastructure providers guidance in the design and development of systems that would provide satisfactory DTV broadcast reception to notebook computers and handheld devices under the constraints of reasonable size, complexity, and power. The areas covered will be client and infrastructure architectures, required performance with emphasis on mobile environments, thermals, power dissipation, and co-existence with other wireless transmitters on the notebook. We concentrate on the PHY layer and network and transport layers that are associated with the PHY layer in regards to SNR and interference. Other aspects such as transport, digital rights management, conditional access, etc. are not within the scope of this tutorial.
The tutorial is intended for the following audiences and purposes:
• Development of detailed DTV product specifications and DTV infrastructure requirements
• Architects and designers of DTV clients on notebook computers

MONDAY – AFTERNOON HALF DAY TUTORIALS (2:00PM - 5:00PM)

T16: MIMO Detection: Theory and Practice

Topic: Communication Theory

Instructor: Dr. John R. Barry, Georgia Tech

This tutorial presents the basic principles of MIMO detection. We describe the fundamental problem, and present an overview of MIMO techniques that are used in practice. These include linear detection techniques, such as the zero-forcing and mibomnimum-MSE detectors. We will provide several views of the decision-feedback detector, including the nulling-and-cancelling view, the matrix view, the Gram-Schmidt view, the whitened-matched filter view, and the linear-prediction view. We will compare the ZF and MMSE versions of these detectors. We will also describe multistage detectors and tree-based detectors like the sphere detector and its variations, as well as lattice-aided detectors. The impact of ordering on performance and complexity will be described.
This tutorial will provide an overview of MIMO detection as currently practiced, and it will identify emerging trends and current research in this area.

T6: Unraveling QoS in 802.16 Wireless Broadband Access Networks: The Role of MAC, Cross-Layer Design, and Scheduling

Topic: Wireless Communications

Instructors: Dr. Vishal Sharma, Metanoia, Inc./IIT Bombay
Dr. Abhay Karandikar, IIT Bombay

The main theme of this workshop/tutorial will be to elucidate medium access control (MAC) layer operation and cross-layer design techniques for providing quality-of-service (QoS) in wireless broadband networks. We will use the recently approved IEEE 802.16 standard as an example, for two important reasons:
The rich feature-set it presents, and the flexibility it provides the system/network designer in choosing various schemes for scheduling traffic, while accounting for interactions between an advanced PHY (physical layer) and the corresponding MAC (data link).
Growing interest from operators worldwide in this emerging technology, due to the prospects of using it in a variety of applications, such as wireless data backhaul or in regions of the world where there is little or no wired infrastructure.
The IEEE 802.16 standard for fixed and mobile wireless broadband access systems is a complex standard with many features to enable data services over BWA links. These include, for instance, longer range (of 10s of miles), advanced coding and modulation schemes (OFDM, OFDMA) and power control at the physical layer, and the definition of traffic classes and advanced automatic-repeat request (ARQ) schemes at the MAC layer, to name a few.
From a traffic scheduling perspective, one must understand the key features of the standard that relate to QoS at the MAC layer, and develop a range of alternative QoS architectures that can provide the required performance. It also requires developing insights into the role/functions of the principal components of these architectures. For example, base-station (BS) or subscriber-station (SS) schedulers, traffic request classifiers, contention estimators, and so on.

T19: Sensor Networks - Protocols, Technologies and Applications

Topic: Networking the Globe

Instructor: Dr. Anura P. Jayasumana, Colorado State University

This tutorial will provide a review of sensor networks, and look at the fundamental issues in designing and analyzing sensor networks. Emerging and potential applications will be considered together with the associated sensors. Localization and tracking will be used as examples to expose the scalability constraints in these sensor networks. Network architectures, protocols, and standards will be covered, including sensor hardware, networking, OS support, algorithms, and scalability. Also covered will be querying, routing, and network self-organization.

T10: Service Delivery Platforms - Driving Enablers for NGN Service Revenue

Topic: Next Generation Networks

Instructors: Dr. Anett Schuelke, NEC Network Laboratories
Dr. Daniele Abbadessa, NEC Network Laboratories

This tutorial starts with an identification of the challenges for creating, provisioning and enabling services in NGN. The need to create a large service portfolio and introduce it quickly to market requires operators to move away from the traditional silo-approach for service developments, as

already recognized by fixed and mobile operators. They are starting to invest in IP-based networks and new service platforms. SIP Application Servers IMS and Service Delivery Platforms (SDP) are the services areas that will attract most of the investments. Operators will adopt different strategies for the introduction of SIP Application Server, IMS and SDP, however, markets trends shows that the initial IMS and SDP deployments will speed-up in the next 12 to 24 months, whilst full deployment are expected to follow at later dates.

When it comes to SDP, it is important to stress the fact that there is no comprehensive definition for it, because SDP functionalities do not reside on a single platform, but rather comprise of an integrated set of software modules. These modules collectively enable carriers to launch and manage potentially thousands of services to their customers. We will attempt to introduce and explain the current standardization activities and their technical enablers together with their achievements discussed in alignment with the current market trends. We will provide an extensive overview of the Service Oriented Architecture (SOA) approach evolving from the IT world and provide the connection o the Telecom's service oriented architecture approach. This is followed by an in-depth overview of Telecom Standardizations, their SDP evaluation and the roadmaps of next-generation service creation and provisioning solutions. The tutorial concludes with a discussion of the issues and challenges to deploy NGN service platforms and building user-centric services.

T9: IPTV Technologies and Deployment Challenges

Topic: Multimedia Communications

Instructors: Anurag Srivastava, Bell Laboratories
Dr. Swarup Acharya, Bell Labs, Lucent Technologies

In this tutorial, we will provide an overview of the network architectures and technologies that comprise an end-to-end IPTV system. As appropriate, we will highlight the various tradeoffs (e.g., channel change latency vis-à-vis compression technology) and compare it with the CATV approach. We will focus on hardware and software technologies from the service provider core to the home --- multicast transport, DSL technologies, MPEG standards and home-networking requirements such as the IPTV set-top box. We will also review the regulatory issues faced by Telcos relating to unbundling of their access infrastructure and statewide franchisee agreements. Since IPTV may not only be limited to Fiber/DSL, we briefly highlight competitive threats from emerging technologies such as Broadband over Power Lines. Finally, we describe the various lifestyle services such as "CallerId-on-TV" and converged voice-video applications that provides IPTV its cutting-edge differentiation.

T23: Concluding the Packet-TDM Controversy

Topic: Packet and Circuit Switching

Instructor: Tom Minnis, Strategic Advisory Group

The purpose of this tutorial is to provide a balanced knowledge of both packet switching and circuit switch technologies - two basic switching methodologies for building networks. The tutorials will provide the design concepts and principles underlying circuit-switching and packet-switching systems. These tutorials will help bridge the conceptual and language barriers that exists between the packet and circuit camps. Becoming fluent in both packet and circuit switching technologies will enable engineers to design systems that take advantage of both technologies, while not stumbling over the limitations of either.

FRIDAY – FULL DAY TUTORIALS (9:00am - 5:00pm)

T12: Wireless Mesh Networking

Topic: Wireless Communications

Instructors: Dr. Prasant Mohapatra, University of California
Dr. Samir Das, SUNY at Stony Brook
Steven Conner, Intel Corporation

Wireless mesh networks are multihop networks of wireless router platforms. A mesh network can provide multihop communication paths between wireless clients – serving as a community network or as a broadband access network for the Internet. Wireless mesh networks are considered cost-effective alternatives to wireless LANs, as there is no necessity to deploy any wired infrastructure to support a mesh network. There are several technical challenges that must be addressed for mesh networking to be as effective as any other form of broadband networking. Much of these challenges relate to multihop wireless communication and limited capacity. This tutorial is designed to introduce essential mesh networking concepts, lay down the technological challenges and describe how the research community is addressing them. We will explore the issues associated to each layer of the protocol stack as well as various cross-layer approaches. We will also discuss the experiences and lessons learnt from various experimental testbeds - academic and industrial. Techniques to build simple mesh network platforms will be explained. We will also discuss about the ongoing standardization efforts (IEEE 802.11s) and commercial advances in the area.

T15: System-level MIMO: Theory and Applications

Topic: Wireless Communications

Instructors: Dr. Howard C. Huang, Bell Labs, Lucent Technologies
Dr. Constantinos B. Papadias, Athens Information Technology

The purpose of this tutorial is to explore the performance tradeoffs of MIMO in wireless systems consisting of multiple simultaneous MIMO links found in emerging next-generation wireless networks. The tutorial would be based on our most up-to-date understanding of the theoretical system-level traits of MIMO systems as applied to different types of wireless networks. Beyond providing a system-level perspective of MIMO, this tutorial also addresses system simulation methodologies for MIMO networks and shows how the discussed principles are already penetrating the design and analysis of next-generation wireless standards.

T17: Generalized MultiProtocol Label Switched (GMPLS) Networks

Topic: Advanced Technologies & Protocols for Optical Networks

Instructor: Dr. Malathi Veeraraghavan, University of Virginia

This tutorial will first describe the GMPLS architecture and protocols. This includes a quick review of data-plane technologies, such as SONET, WDM and Ethernet 802.1q VLANs, followed by a more-detailed treatment of the three GMPLS control-plane protocols, RSVP-TE, OSPF-TE and LMP. We will then describe different applications of GMPLS networks, including both commercial, such as fast restoration and rapid provisioning for OPEX savings, as well as research/educational, such as Grid computing, support of eScience projects, etc. Recently, several GMPLS testbeds such as CHEETAH, Dragon, HOPI, UltraScience Net, Ultralight, OMNInet, CA*net4, UKlight, SURFnet, etc. have been created to support science applications. We will describe the goals and accomplishments of these testbed projects. Finally, we will cover some advanced topics such as multi-region networks in which different types of GMPLS networks are interconnected. Security and billing are important issues in today's Internet. We will describe proposed solutions for control-plane security and billing in GMPLS networks.

FRIDAY – MORNING HALF DAY TUTORIALS (9:00am - 12:00noon)

T18: Fixed Mobile Convergence: Architectures, Solutions, Services

Topic: Wireless Communications

Instructor: Joseph Ghetie, Telcordia Technologies Consultant

The wireless networking coverage includes fixed Wireless Local Area Networks (WLAN), Wireless Access (WiMAX), Wireless PAN (WPAN) and

GSM/CDMA mobile cellular radio networks. Current and emerging networking solutions are evaluated for their approach, functionality and management abilities. 802.11a/b/g WLANs, 802.16 WiMAX, GSM/GPRS cellular radio, and the standardization effort in IEEE, Wi-Fi Alliance, 3GGP Release 6, Unlicensed Mobile Access (UMA), IP Multimedia Subsystem (IMS), and IETF Session Initiation Protocol (SIP) are analyzed. The tutorial also evaluates the Quality of Services of various solutions targeting the use of a common handsets and unique telephone numbers across wireless networks.

T20: Adaptive MIMO Techniques and Performance

Topic: Wireless Communications

Instructors: Dr. Iain B. Collings, CSIRO
Dr. Robert W. Heath Jr, University of Texas at Austin
Matthew R. McKay, University of Sydney
Antonio Forenza, University of Texas at Austin

This tutorial will present an introduction to general MIMO systems, with a particular focus on practical correlated transmission environments. We will discuss a number of low complexity transmission architectures suitable for practical coded MIMO implementations, including the IEEE802.11n and IEEE802.16 standards. The focus of the tutorial will be on examining the potential advantages that can be gained by adapting and switching between different coded MIMO transmission schemes, depending on the quality and correlation in the MIMO channel. A summary of the main analysis techniques will be presented, as well as simulation studies which examine the various system design tradeoffs.

T22: Roadmap to Cross-Layer and Cross-System Optimization for B3G

Topic: Wireless Communications

Instructors: Dr. C. SKIANIS, NCSR 'Demokritos'
Dr. George Kormentzas, University of Aegean

The key objectives of this tutorial are in part motivated by the importance of cross-layer interactions, in order to efficiently use the radio resource space in wireless networks, and in part by the vision of the integration of heterogeneous wireless technologies providing new wideband services running over flexible QoS-enabled IP based access and core networks. This tutorial brings into the foreground a broad range of research results on cross-system and cross-layer optimization algorithms taking into account issues related to usage behavior, mobility patterns, traffic profiling, QoS issues, security, network selection and relevant horizontal/vertical handovers. Specifically, the tutorial will firstly address the importance of cross-layer interactions, in order to efficiently use the radio resources in wireless networks. Afterwards, heterogeneous platform management algorithms will be presented and advanced resource management policies, including the potential for load balancing across different systems/networks, will be discussed. Subsequently, studies concerning both cross-layer and cross-system optimization in B3G environment will be presented. Finally, specific solutions/cases deployed in the context of various EU-funded projects will be analyzed in accordance with current efforts of various forums such as 3GPP, IEEE, IETF, ETSI and WWRF.

FRIDAY – AFTERNOON HALF DAY TUTORIALS (2:00pm - 5:00pm)

T8: Technologies for All-IP Wireless Networks from 3G to 4G

Topic: Next Generation Networks

Instructors: Dr. Prathima Agrawal, Auburn University
Dr. Jyh-Cheng Chen, National Tsing Hua University

This tutorial is intended to address state-of-the art technologies necessary for building a practical all-IP wireless network. The tutorial will focus on IP layer and upwards. Evolution of technologies from 2G, 2.5G, 3G to 4G will be discussed. Challenges in realizing applications like mobile IP telephony and streaming multimedia over wireless IP networks will be elaborated. The tutorial will also cover various mature and on-going IETF protocols including signaling, registration, configuration, dynamic address-binding, location management, AAA, quality of service, broadcasting streaming content, and integration with legacy cellular systems for both IPv4 and IPv6 based networks. Practical experience of the presenters in building a prototyping indoor-outdoor testbed emulating mobile wireless Internet in conformance with 3GPP and 3GPP2 architecture will be shared.

T13: Reconfigurable Technology for MIMO-OFDM Systems with a focus on 802.16/802.16e

Topic: Wireless Communications

Instructors: Dr. Raghu M. Rao, Xilinx Inc.
Dr. Chris H. Dick, Xilinx Inc

In this tutorial we will start off by discussing the wireless propagation environment and study the characteristics of the wireless environment in the presence of scattering and mobility. We will introduce the audience to the key concepts of OFDM and MIMO-OFDM systems, relating aspects of information theory that led to the development of MIMO-OFDM systems. We will then consider the practical issues related to OFDM system and receiver algorithms, including the impact of RF and analog impairments on OFDM and MIMO-OFDM systems. The 802.16/802.16e physical layer will be discussed and will be used to exemplify the various aspects of OFDM and MIMO-OFDM technology.
In addition we will discuss some architectural aspects of FPGAs that make them a popular choice for developing wireless communication systems at the basestation, given their configurability and time to market advantages. Newer generation FPGAs also have dedicated fabric for efficient implementation of DSP and communication systems. Newer, higher level design methodologies, further improve this time to market advantage of FPGAs. We will briefly discuss these methodologies and also introduce some of the DSP and communication centric features of popular FPGAs.

T5: Advancements in Converged WDM Network Architectures: Extending from the Multi-service Metro to an IP-over-WDM Core

Topic: Advanced Technologies & Protocols for Optical Networks

Instructor: Dr. Loukas Paraschis, Cisco Systems

This tutorial reviews the evolution and the advancements of converged WDM architectures, initially in the multi-service metro networks, and currently into an IP-over-WDM core. We analyze the functionality, characteristics, and challenges of these networks. We also discuss the key applications that motivated these networks to scale levering WDM transport. The tutorial then focus on the emerging intelligent WDM converged transport layer which improves significantly the network capital and operational cost. We evaluate the interplay among the network architectures, and the enabling technologies, most notably including OADM and switching, optical amplification and dispersion compensation, electronic processing (FEC, EDC) etc. Unlike traditional WDM transport where the main design objective has been to maximize the capacity and reach of networks with typically well-defined (often simple point-to-point) topologies, converged WDM networks call for cost-sensitive, “open” architectures that allow for service flexibility. We discuss in detail the innovation in WDM system design, and the most important performance characteristics of the current and emerging optical technologies that enable high performance metro-optimized fiber transmission digital systems, that cost-effectively scale to multiple 10 Gb/s wavelengths and more than 1000 km, meeting the diverse needs of current and future enterprise and residential applications. We further review the future evolution in metro networks, along with the important related research topics. We then review the currently emerging converged IP-over-WDM core network architectures, and identify the related promise in CapEx and OpEx efficiencies. For these core networks, flexibility remains the primary motivation but scalable 40 Gb/s WDM transport for thousands of km becomes also important. We review the future evolution in these networks, along with the important related research topics.

All workshops will have notes. The notes are included with the workshop registration fee. Copies can be purchased with conference registration advance or on-site.

Monday 27 November, 9:00am – 12:00pm

W1: The Seventh International Workshop on Optical Networking Technologies: Examining the Case for Optical Burst Switching

Chair: Dr. Tarek El-Bawab, Jackson State University

Optical Burst Switching (OBS) introduces a new method of switching at the granularity of optical data bursts. This is a granularity between optical circuits, which are whole-sale large-bandwidth lightpaths, and optical packets, which are small data units that are difficult to buffer, process, and route using today's optical technologies. As such, OBS has the potential to enhance bandwidth efficiency and cost effectiveness in transport networks, and can circumvent some technological barriers facing optical packet switching. OBS has attracted a lot of interest among several research groups and become a popular topic of study worldwide. Several equipment vendors have also looked at OBS thoroughly. Many in the optical networking community consider this technology enthusiastically, and have adopted the case for OBS.

A lot of OBS research efforts however are confined to network simulations, and assume green-field or hypothetical scenarios. In practice, several architectural, technological, and economic issues are involved in the OBS proposal. OBS requires dynamic capability to rapidly allocate optical wavelengths to data bursts, and to rapidly release them after burst transmission. It requires advanced burst assembly strategies, scheduling algorithms, signaling, and control schemes. Progress in some optical component technologies is desirable, and may be required. Many professionals see difficulties in designing high-performance OBS networks that can satisfy all these requirements while achieving robustness, reliability, simplicity, and economics. Some are concerned about how a new OBS-based transport layer would fit into existing network architectures, and how it would work with IP/TCP, SONET/SDH, and other existing layers.

Monday 27 November, 9:00am - 5:00pm

W2: 1st IEEE International Workshop on Bandwidth on Demand

Chairs: Dr. Takeo Hamada, Fujitsu Laboratories of America
Dr. Burkhard Stiller, University of Zürich and ETH Zürich
Dr. Richard Rabbat, Fujitsu Laboratories of America
Dr. David Hausheer, University of Zurich

Electronic marketplaces for trading bandwidth have emerged since the late 1990's, but were seriously hit by the economic downturn in 2001. The promise of instant bandwidth availability had led to the development of market mechanisms that companies used to trade bandwidth just as other commodities. However, those trading markets all but disappeared with the bursting of the telecom bubble. Driven by the recent technical advances in telecommunications and the new potentials of emerging peer-to-peer (P2P) and next generation networks (NGN), the goal of this workshop is to take a fresh and innovative look at the concept of bandwidth on demand (BOD).

Recent advances in the Internet-based communications domain, in which the support of Quality-of-Service and diverse application services become possible, require in many cases short-termed bandwidth assignments for, e.g., large sporting events or cultural open air activities. In addition, the support of bandwidth trading in a fully decentralized and secured manner, e.g., based on P2P schemes, shows further advantages in terms of reliability and scalability for large-scale systems.

The area of bandwidth trading is receiving new interest with the changing nature of competition in the telecom industry. Competition is not along the traditional lines of providing phone service to the same customer and tagging along some data offerings, but is a cutthroat competition for the ownership of the customer's experience with phone, video, Internet and wireless service. These competing firms need to provision their network very efficiently and cost-effectively, and are adopting technologies such as an automated control plane and data-friendly transport technologies to enable a reduction in their operational expense. It is the aim of the workshop to understand how these aspects are going to change the telecom industry, what new services will be enabled and how ultimately the customer experience will change. With respect to the disappearance of centralized structures due to scalability concerns, the use of decentralized and trusted technology approaches in a fully distributed system, such as with P2P approaches, gains momentum. Avoiding single point of failures and providing secure solutions for fully distributed bandwidth trading infrastructures will result in feasible and open bandwidth on demand solutions.

Friday 1 December, 9:00am - 5:00pm

W3: MobiArch 2006 -- First IEEE/ACM Workshop on Mobility in the Evolving Internet Architecture

Chairs: Dr. Xiaoming Fu, University of Goettingen
Dr. Katherine Guo, Bell Labs
Dr. Jon Crowcroft, University of Cambridge

With the development of wireless access technologies and mobile devices, mobility has become an indispensable component of today's Internet vision. Yet, issues like efficient mobility management, locator-identifier split, multi-homing, security and operational concerns are still in their early stages of development. Moreover, the Internet architecture, its end-to-end principles and business models will require rethinking due to the massive penetration of mobility into the Internet.

Invited Presenters:
Mobile Networking and the IETF: **Charles Perkins**, Nokia
EU B3G Cluster Activities: **Ivano Guardini**, Telecom Italia Lab
Panel Session: **Hannes Tschofenig**, Siemens
TBD: **Taieb Znati**, Uuniversity. Pittsburg/NSF

Friday 1 December, 9:00am - 5:00pm

W4: Workshop on Automotive Networking and Applications

Chairs: Wai Chen, Telcordia Technologies
Onur Altintas, Toyota Info Technology Center, Japan

This workshop intends to bring together researchers, professionals, and practitioners to address recent developments and challenges in deploying vehicle-to-vehicle and vehicle-with-infrastructure networking technologies, and their applications including safety-assistance and driver-convenience. Sensors, radars, cameras, navigation systems, and microprocessors are technologies already in-use in vehicles to support applications such as parking-assistance, lane-keeping, and adaptive cruise-control. These technologies have greatly improved the levels of safety and comfort to drivers. Recently significant efforts have been made to enhance and integrate the latest wireless communications technologies into the vehicle and transportation systems to enable safety and information applications. For example, significant industrial and governmental efforts are underway to push from "passive-safety" to "active-safety" by employing advanced networking functions in vehicles and highway infrastructure.

When such communications and networking capabilities are installed, the vehicle itself can interact intelligently with other vehicles and the highway system, achieving a much higher degree of vehicular safety. Such capabilities can also support many exciting new applications, such as traffic management, vehicle diagnostics and mobile commerce. The increasing importance of vehicle and infrastructure communications is recognized by governments, highway authorities, automobile manufacturers and the academic community.

Submission Instructions
Authors are invited to submit full papers of up to 20 double-spaced pages, including references, figures and tables. All submissions should be submitted electronically in Postscript or Adobe PDF format to both of the workshop co-chairs at:
http://autonet2006.research.telcordia.com/myreview/

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HOTEL INFORMATION

The conference hotels for IEEE GLOBECOM 2006 are the Fairmont Hotel, *Mark Hopkins and *Stanford Court Hotels.
To make a reservation please visit the respective websites. Reservations must be received by **3 November, 2006**.

Fairmont Hotel San Francisco (Headquarters Hotel)
Single/Double Main Building $199.00 + sales tax
For online reservations
http://www.fairmont.com/sanfrancisco/
On-Line Pass Code:GRIEE1

Mark Hopkins InterContinental San Francisco
Single/Double $199.00 + sales tax
For online reservations
http://www.ichotelsgroup.com/h/d/ic/1/en/cwshome/DPRD-6RFTWF/SFOHA

The Stanford Court, A Renaissance Hotel
Single/Double $199.00 + sales tax
For Superior Rooms @ $199
http://marriott.com/property/propertypage/sfosc?groupCode=iceicea&app=resvlink

SOCIAL EVENTS

IEEE Communications Society Awards Luncheon - Tuesday 28 November 2006, 12:30pm
Celebrate with your colleagues at this biannual event honoring the achievements of the IEEE and IEEE Communications Society members. This event is included with the full conference registration. Tickets can be purchased for $60.00 per person.

IEEE GLOBCOM 2006 Welcome Reception - Tuesday, 28 November 2006, 6:30pm
The entire IEEE GLOBECOM 2006 Executive Committee welcomes you to San Francisco! Join us as we kick off the IEEE GLOBECOM 2006 Expo. This event is included with the conference registration fee. Accompany guests are welcome to attend.

Conference Dinner Show- Wednesday 29 November 2006 • Thursday 30 November 2006, 7:00pm
This year you will have the option to choose either to attend the Conference Banquet on either Wednesday 29 or Thursday 30 November. The banquet will feature live entertainment and promises to be a fun filled and exciting event. Please select your option dates when registering. This event is included with full conference registration. Tickets can be purchased for $125.00 for other conference registration categories and accompanying guests.

TOURS Guest Tours in and around San Francisco

The deadline for the tours is Friday, 3 November. Tours will be cancelled by 3 November if the minimum number of participants is not met.

San Francisco Highlights

(Approximately 4 hours)
Monday, 27 November, 2006, 1:00-5:00pm, $40
The forty nine square miles of San Francisco are a colorful tapestry of steep hills, picturesque houses, clanging cable cars, fishing boats, summer fog, Chinese pagodas, cosmopolitan cafés and breathtaking views. Five continents and three centuries blend together on forty-three hills, waiting to be discovered. Today you will see some of the legendary landmarks of “Everybody’s Favorite City.”

Magical Marin: Majestic Muir Woods & Sparkling Sausalito

Tuesday, 28 November, 2006, 9:00-1:00pm, $45
One of the first parks ever set aside for the coastal redwoods, this national park was named for the renowned conservationist, John Muir. The redwoods located here have a biological ancestry dating back well over a million years. Fossils of virtually identical trees appear in the record from some 160 to 170 million years ago, preceding the Jurassic Age of dinosaurs. These fossils are found across the Northern Hemisphere, in Manchuria, France, Alaska, Greenland and even on Arctic islands. Redwoods have no aging mechanisms, are extremely resistant to disease, and have few natural enemies. Thus individual redwoods can live to be thousands of years old. Your guests will have time to wander among these ancient trees. They will come away with a sense of the immense grandeur and spans of time encompassed by this noble forest.

Next your guests will visit sparkling Sausalito, a Riviera like bayside village with its winding wooded streets, eclectic houseboats, unique boutiques and art galleries. There will be ample time to explore the shops and galleries, or simply stroll along the waterfront and view the San Francisco skyline and Bay.

Emphasis on Art

Wednesday, 29 November, 9:30-1:30pm, $72

Guest will visit The California Palace of the Legion of Honor and San Francisco’s newest museum, the de Young, was founded in Golden Gate Park during the California Midwinter International Exposition of 1894.

Chinatown Discovery - A Walking Excursion

(Approximately 3 hours)
Wednesday, 29 November, 2:00 - 5:00pm, $50
Discover exotic Chinatown on foot! In downtown San Francisco, the present has been built over the remnants of the past. This is especially true of Chinatown. From the towering steel and concrete of San Francisco’s Financial District, you will pass the historic Lion Gates and be transported into the "city-within-the-City", which recalls the days of early Chinese immigration. The first Chinese settled these streets during the Gold Rush and were swiftly followed by thousands of others. Today, San Francisco's Chinese population is one of the largest outside of Asia.

The Best of the California Wine Country

(Approximately 8 hours)
Thursday, 30 November, 9:00 - 5:00pm, $115
Guests will explore the finest wine-producing region in the nation: California’s Napa and Sonoma Valleys.

SIGN UP FOR THESE TOURS EARLY SPACE IS LIMITED AND WE DON’T WANT YOU TO MISS OUT!

IEEE GLOBECOM 2006 EXPO

CONFERENCE REGISTRATION FORM

IEEE

27 November - 1 December
San Francisco, California, USA

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Please Print or Type

Name: _____
Prof./Dr./Mr./Ms./Mrs. Last Name First Name

Preferred Name on Badge/Nickname: _____

Company/Organization: _____

Title/Position: _____ Email: _____
(required for confirmation)

Mailing Address: _____
Street/PO Box

_____
City Province/State Country Postal/Zip

Telephone: ( ) _____ Fax: ( ) _____

Accompanying Guest : _____
Last Name First Name Badge/Nickname
(for name badge only)

Members of IEEE and the following ComSoc Sister Societies may register at the MEMBER rate:
Please enter your membership number in the space provided. If you are a member of an IEEE sister society, please check off below.
❒AEIT ❒CCIS ❒CIC ❒CIE ❒CIEE ❒EZS ❒HTE ❒IEICE ❒IETE ❒KICS ❒LITKA ❒POPOV ❒REV ❒SEE ❒SBrT ❒SR ❒VDE
Membership Number _____
I am registering as (check all that apply): ❒ A Technical Paper Presenter ❒ A Technical Paper Author ❒ A Workshop Paper Author/Presenter ❒ A Technical Session Chair ❒ A Design & Developers/ Speaker/Organizer ❒ IEEE GLOBECOM EXPO Only ❒ A Tutorial Presenter
❒ ACCESS '06 Executive Business Forum participant

- My primary interest is (check one) ❒ IEEE Globecom 2006 ❒ Design & Developers Forum ❒ ACCESS '06 Executive Business Forum ❒ EXPO Only
- How did you hear about IEEE GLOBECOM 2006? (check one) ❒ Advance Program ❒ Web Site ❒ Colleague ❒ E-Mail ❒ Other _____
- I have special needs (please check & attach description): ❒ access ❒ audio ❒ visual ❒ vegetarian ❒ Other _____
- Organizational Status: ❒ Industry ❒ Academia ❒ Government ❒ Other _____

Full registration (RG-01, RG-02, RG-05, RG-06, RG-09, RG-10, RG-17, RG-18) includes:
Welcome Reception, Plenary, Technical Sessions, Access'06 Executive Business Forum, D & D Forum, entrance to exhibits, Awards Luncheon, Conference Banquet and CD-ROM Record

Limited Registration RG-03, RG-04, RG-07, RG-08, RG-11, RG-12, RG-19, RG-20 includes:
Welcome Reception, Plenary, Technical Sessions, Access'06 Executive Business Forum, D&D Forum, entrance to exhibits and CD-Rom Record

Accompanying Guest Includes:
Welcome Reception, Guest Hospitality Suite and ability to purchase Tour and Social Event Tickets

Tutorial/Workshop Only Includes:
Welcome Reception, entrance to the Tutorial/Workshop(s) registered for and the notes or proceedings for those sessions

All Other Registration Includes:
Welcome Reception, Plenary, Technical Sessions, Access'06 Executive Business Forum, D & D Business Forum, Telecom Business Forum, Access to Expo floor and CD-ROM.

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REGISTRATION FEES - All attendees must be registered. Select one of RG01-RG023.

	On/By 30 October	
RG-01 – PRESENTER – Full IEEE ComSoc Member	$775	$_____
RG-02 – PRESENTER – Full IEEE Member Only	$815	$_____
(includes complimentary Full year IEEE ComSoc membership)		
❒ Check here if you do not wish a complimentary IEEE ComSoc Membership		
RG-03 – PRESENTER – Limited IEEE ComSoc Member	$580	$_____
RG-04 – PRESENTER – Limited IEEE Member Only	$620	$_____
(includes complimentary Full year IEEE ComSoc membership)		
❒ Check here if you do not wish a complimentary IEEE ComSoc Membership		
RG-05 – PRESENTER – Full Non Member	$1025	$_____
RG-06 – PRESENTER – Full Non Member	$1125	$_____
(includes 2007 IEEE ComSoc Affiliate Membership)*		
RG-07 – PRESENTER – Limited Non-Member	$830	$_____
RG-08 – PRESENTER – Limited Non Member	$930	$_____
(includes 2007 IEEE ComSoc Affiliate Membership)*		

(see next page)

Required info:
Name: _____ E-mail address: _____

ATTENDEE MEMBER REGISTRATIONS

	On/By 30 October	After 30 October	
RG-09 - FULL IEEE ComSoc MEMBER	$775	$885	$_____
RG-10 – FULL IEEE MEMBER Only	$815	$925	$_____
(includes complimentary Full year IEEE ComSoc membership)			
❒ Check here if you do not wish a complimentary IEEE ComSoc Membership			
RG-11 - LIMITED IEEE ComSoc MEMBER	$580	$690	$_____
RG-12 – LIMITED IEEE MEMBER Only	$620	$730	$_____
(includes complimentary Full year IEEE ComSoc membership)			
❒ Check here if you do not wish a complimentary IEEE ComSoc Membership			
RG-13 - 1 DAY IEEE COMSOC MEMBER (TUE WED THU CIRCLE DAY)	$360	$445	$_____
RG-14 - 1 DAY IEEE MEMBER (TUE WED THU CIRCLE DAY)	$400	$485	$_____
RG-15 - LIFE MEMBER	$50	$50	$_____
RG-16 - STUDENT MEMBER	$250	$300	$_____

ATTENDEE NON-MEMBER REGISTRATIONS

RG-17 FULL NON-MEMBER	$1025	$1190	$_____
RG-18 FULL NON-MEMBER	$1125	$1290	
(includes 2007 IEEE ComSoc Affiliate Membership)*			$_____
RG-19 LIMITED NON-MEMBER	$830	$995	$_____
RG-20 LIMITED NON-MEMBER	$930	$1095	
(includes 2007 IEEE ComSoc Affiliate Membership)*			$_____
RG-21 1-DAY NON-MEMBER (TUE WED THU CIRCLE DAY)	$585	$700	$_____
RG-22 1-DAY NON-MEMBER (TUE WED THU CIRCLE DAY)	$685	$800	$_____
(includes 2007 IEEE ComSoc Affiliate Membership)*			
RG-23 Tutorials/Workshop Only	NA	NA	$ NA

Note: The Conference Dinner Show is included with all full registrations. If you selected a full registration, please make sure to specify on your registration if you would like to attend the banquet on Wednesday Night or on Thursday Night. If you do not select an option from below, you will not be given a Conference Dinner Show Ticket.
Please choose a night: ___ Wednesday night ____ Thursday night

*IEEE ComSoc Affilitate Membership = membership to only IEEE Communications Society

TOTAL REGISTRATION: $_____

3 TUTORIALS & WORKSHOPS

Tutorials and Workshops will be held if there is a sufficient number of registered participants. If a Tutorial or Workshop is cancelled, liability of IEEE GLOBECOM 2006 is limited to the registration fee itself. Liability due to the cancellation of a Tutorial or Workshop is limited to the Tutorial or Workshop registration fee. Please select all Tutorials & Workshops that you plan to attend. Select only one for each time slot

TUTORIALS

MONDAY - FULL DAY TUTORIAL
- ❒ T3: MPLS - The Importance of Offering the Right Solution at the Right Moment: Timeliness, Benefits, and Deployment from the Origins, to ATM, to Optical Networks
- ❒ T14 IEEE802.11n: Throughput, Robustness, and Reliability Enhancements to WLANs
- ❒ T21 Almost Sixty Years of Error-Correction Coding: How we Reached the Shannon Limit

MONDAY – MORNING HALF DAY TUTORIALS
- ❒ T2: Multiple Antenna Systems-From Optimum Combining to MIMO: An Approach Based on Random Matrix Theory
- ❒ T4: WiMAX: An Advanced Broadband Wireless System
- ❒ T1: Broadband Fiber Access
- ❒ T7: Traffic Analysis for Network Security
- ❒ T11: Mobile DTV

MONDAY – AFTERNOON HALF DAY TUTORIALS
- ❒ T16: MIMO Detection: Theory and Practice
- ❒ T6: Unraveling QoS in 802.16 Wireless Broadband Access Networks: The Role of MAC, Cross-Layer Design, and Scheduling
- ❒ T19: Sensor Networks - Protocols, Technologies and Applications
- ❒ T10: Service Delivery Platforms – Driving Enablers for NGN Service Revenue
- ❒ T9: IPTV Technologies and Deployment Challenges
- ❒ T23: Concluding the Packet-TDM Controversy

FRIDAY – FULL DAY TUTORIALS
- ❒ T12: Wireless Mesh Networking
- ❒ T15: System-level MIMO: Theory and Applications
- ❒ T17: Generalized MultiProtocol Label Switched (GMPLS) Networks

FRIDAY – MORNING HALF DAY TUTORIALS
- ❒ T18: Fixed Mobile Convergence: Architectures, Solutions, Services
- ❒ T20: Adaptive MIMO Techniques and Performance
- ❒ T22: Roadmap to Cross-Layer and Cross-System Optimization for B3G

FRIDAY – AFTERNOON HALF DAY TUTORIALS
- ❒ T8: Technologies for All-IP Wireless Networks from 3G to 4G
- ❒ T13: Reconfigurable Technology for MIMO-OFDM Systems with a Focus on 802.16/802.16e
- ❒ T5: Advancements in Converged WDM Network Architectures: Extending from the Multi-service Metro to an IP-over-WDM Core

(see next page)

Required info:
Name: _____ E-mail address: _____

WORKSHOP REGISTRATION (includes notes)

MONDAY – MORNING WORKSHOP

❒ W1: The Seventh International Workshop on Optical Networking Technologies: Examining the Case for Optical Burst Switching

MONDAY – FULL DAY WORKSHOP

❒ W2: 1st International Workshop on Bandwidth on Demand

FRIDAY – FULL DAY WORKSHOPPS

❒ W3: MobiArch 2006 -- First IEEE/ACM Workshop on Mobility in the Evolving Internet Architecture Workshop

❒ W4: Automotive Networking and Applications Workshop

TUTORIAL REGISTRATION (includes Notes)		**On/By 30 October**	**After 30 October**		
TU-FD	FULL DAY	$350	$400	_____	$_____
TU-HD	HALF DAY	$250	$300	_____	$_____
WORKSHOP REGISTRATION (includes Notes)		**On/By 30 October**	**After 30 October**		
WK-FD	FULL DAY	$350	$400	_____	$_____
WK-HD	HALF DAY	$250	$300	_____	$_____

TOTAL TUTORIALS & WORKSHOPS: $_____

4 EXTRA ITEMS

		Per Person	QTY	
EX-01	Awards Luncheon	$60	_____	$_____
EX-02	*Conference Dinner Show (❒ Wednesday ❒ Thursday)	$125	_____	$_____
	*Conference Dinner Show will be offered on both nights. Please indicate preferred night.			
EX-03	Additional Conference Record – CD-ROM	$50	_____	$_____
EX-04	Overlength Page Charge (if you paper is 6 pages you need to submit payment)	$100		$_____

TOTAL EXTRA ITEMS: $_____

5 OPTIONAL TOURS

		Per Person	QTY	
OT-01	San Francisco Highlights (Monday 27 November)	$40	_____	$_____
OT-02	Magical Marin: Muir Woods & Sausalito (Tuesday 28 November)	$45	_____	$_____
OT-03	Emphasis on Art [2 museums] (Wednesday 29 November)	$72	_____	$_____
OT-04	Chinatown Discovery [walking tour] (Wednesday 29 November)	$50	_____	$_____
OT-05	Best of the California Wine Country (Thursday 30 November)	$115	_____	$_____

TOTAL OPTIONAL TOURS: $_____

PAYMENT (in U.S.Dollars)

2 Registration Fees $_____ 3 Tutorials & Workshops $_____ 4 Extra Items $_____ 5 Optional Tours $_____

(Wire Transfer Info: Please E-mail globecom2006@ieee.org for wire transfer information.)

TOTAL REMITTANCE: $_____

PAYMENT METHOD Please Check One ❒ Visa ❒ Mastercard ❒ American Express ❒ Discover ❒ Check, Bank Draft or Money Order (make payable to IEEE Globecom 2006)

Card Number _____ Expiration Date _____

Name of Cardholder _____ Signature _____

I authorize IEEE/GLOBECOM 2006 to charge my credit card for the full amount in total remittance in U.S. Dollars, converted to my country's currency

QUESTIONS: IEEE GLOBECOM 2006 Conference Management Services - 445 Hoes Lane, Piscataway, NJ 08854, Fax: +1 (732) 465-6447, E-mail: Globecom06reg@ieee.org, Phone: +1 (800) 810-4333 (in the US or Canada only) or +1 (732) 981-3414 (outside US or Canada) Registrations will not be taken by phone.

IMPORTANT: Cancellations on or prior to 30 October, 2006 will incur a $100.00 administrative fee. Please submit cancellation requests in writing to IEEE GLOBECOM 2006 to the address below. No refund will be issued after 30 October, 2006.

IEEE GLOBECOM 2006 EXPO

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