Sunday, 28 April, 8:30 - 12:00

T01 Wireless Broadband Networks

Roshdy Hafez, *Carleton University, Canada (Soho/Herald, 7th Fl)*

This tutorial provides a comprehensive description of existing and emerging broadband wireless networks. The tutorial classifies and surveys wireless networks, explains the differences in their technologies and applications. The presentation covers broadband fixed wireless access, MAN and WAN wireless standards and infrastructure, IEEE802.11"b" and "a", HiperLan II, Bluetooth, 3G and 2.5G wireless systems. The tutorial discusses the technological challenges that face these standards, their data rates, their mobility management models and models for their coexistence or even convergence. The talk also covers the current activities within 3GPP and 3GPP2 and their current approach to define and standardize service profiles, QoS requirements and methods for enforcing the QoS in IP-based wireless access networks.

Roshdy H.M. Hafez is a full professor at the Department of Systems and Computer Engineering, Carleton University, Canada. Dr. Hafez has many years experience in the areas of mobile communications and spectrum engineering. He has taught and lectured extensively in wireless and related areas. His current research focuses on broadband wireless systems in the context of 3G/4G personal wireless, Ah-Hoc wireless networking and Wireless over Fiber Local Access Networks. He acts as a consultant to Nortel, Industry Canada, CRC, SigproWireless and other telecommunications companies. Between 1994 and 2000 Dr. Hafez was actively involved and lead projects in federal and provincial centers of excellence: TRIO, CITR and CITO. Dr. Hafez gave several tutorials in international conferences and taught many short courses on wireless to the industry.

T02 Orthogonal Frequency Division Multiplexing for Wireless Communications

Leonard Cimini, *AT&T, USA;* Ye (Geoffery) Li, *Georgia Institute of Technology, USA (Duffy/Columbia, 7th Fl)*

Orthogonal frequency division multiplexing (OFDM) is an effective technique for combating multipath fading in wireless communications. It has been successfully used for HF radio applications and has been chosen as the standard for digital audio broadcasting and digital video broadcasting in Europe and high-speed wireless local areas networks. In this tutorial, we present the basic principles of OFDM and discuss the problems, and some of the potential solutions, in implementing an OFDM system. Techniques for peak-to-average power ratio reduction, time and frequency synchronization, and channel estimation will be discussed. We conclude with a brief overview of current application areas.

Leonard J. Cimini, Jr., received a Ph.D. degree in electrical engineering from the University of Pennsylvania in 1982. Since 1982, he has been employed at AT&T, where his research interests are in wireless communications systems. Dr. Cimini is a fellow of the IEEE and has been very active in the IEEE Communications Society. He is also an Adjunct Professor at the University of Pennsylvania.

Ye (Geoffrey) Li received the Ph.D. degree in electrical engineering in 1994 from Auburn University. From May 1996 to August 2000, he was with AT&T Labs - Research. He is currently an Associate Professor at Georgia Tech. His current research interests are in statistical signal processing and wireless communications. He has served as a guest editor for a special issue on Signal Processing for Wireless Communications for the IEEE J-SAC and is an editor for Wireless Communication Theory for the IEEE Transactions on Communications.

T03 Enabling Technologies and Open Challenges of Optical Internet

Andrea Fumagali, *University of Texas at Dallas, USA;* Javier Aracil, *Public University of Navarra, Spain (Chelsea, 7th Fl)*

In the core and metro network, climbing Internet traffic growth rates are expected to find support from optical technology. The strength of optics is in its potential bandwidth of nearly 25 Terabits per fiber. The challenge, however, is to identify how this bandwidth can be made readily available to higher layer protocols, e.g., IP, providing the high speed network support required by bandwidth-greedy Internet applications.

This tutorial provides an overview of emerging optical technologies that are likely to become essential in the design of the Next Generation Internet, covering both the IP/MPLS and optical layer perspective. Probable network architectures will be reviewed, including IP over Wavelength Division Multiplexed (WDM) optical signal. Issues and challenges of designing a cost effective high-speed network will be identified, presenting research proposals that address multiple access, protection and restoration, traffic grooming and TCP/IP internetworking. Short and long-term solutions, including testbeds from leading companies and consortia, will be reviewed, examining key components and anticipated advantages. CAD tools necessary to design the future Optical Internet will also be presented.

Dr. Andrea Fumagalli received his Ph.D. from the Politecnico di Torino, Italy, in 1992. From 1987 to 1989, he worked as a consultant for the national telephone research center in Italy, CSELT, where he was involved in the design and implementation of advanced telephone services supported over a fiber-based packet switching ring network, LION. Between 1990 and 1992, he was a visiting researcher at the University of Massachusetts, where he defined and studied the concept of switched delay lines used as a storage method for all-optical packet-switching. From 1992 to 1998, he was on the faculty of the Electrical Engineering Department at the Politecnico di Torino. In 1994 and 1995, on leave of absence from the Politecnico di Torino, he was at the University of Massachusetts where he was responsible for a number of projects sponsored by NSF and DARPA. Since 1997, he has been Associate Professor of Electrical Engineering at the University of Texas at Dallas and member of the Center for Advanced Telecommunications Systems and Services (CATSS). Dr. Fumagalli's research involves architectures of optical and wireless networks, and performance evaluation of such networks. He has worked in optical and high-speed communications since 1987, supported by several national and international funding agencies, including ESPRIT, EIT, NSF, DARPA and DoD. His publications include about eighty papers in refereed journals and conferences. Dr. Fumagalli has been involved in a number of professional activities, including guest editorship for the special issue on ATM Networks of the Journal on Communications; the Journal of High Speed Networks, as a guest editor for the special issue on Optical Networks; and the European Transactions on Telecommunications (ETT), as a guest editor for the special issue on WDM Networks. He is organizing a special issue on Protection and Survivability of Optical Networks for the SPIE/Baltzer Optical Networks Magazine.

Dr. Javier Aracil received the M.Sc. and Ph.D. degrees (Honors) from Technical University of Madrid, in 1993 and 1995, both in Telecommunications Engineering. In 1992, he joined the European Space Agency to perform research on multiple access protocols for the ESA OBP program. In 1993, he joined Telefonica Investigacion y Desarrollo where he was a researcher in the area of Intelligent Network services development. Also in 1993, he joined Technical University of Madrid where he participated in several European Union projects (PECO and RACE programs) concerning satellite communications and broadband networks. In 1995, he was awarded a Fulbright scholarship and was appointed a Postdoctoral Researcher of the Department of Electrical Engineering and Computer Sciences, University of California, Berkeley. In 1998, he was a visiting faculty at the Center for Advanced Telecommunications, Systems and Services (CATSS) of The University of Texas at Dallas and currently is a tenured Associate Professor of the Public University of Navarra, Spain, and the research director of the Networking and Distributed Systems Group since 1996. Dr. Aracil is also a member of the editorial board of SPIE/Baltzer Optical Networks Magazine. His research interests are Internet services analysis and characterization, design and performance evaluation of traffic monitoring equipment, and integration of Internet services in WDM networks.

T04 IP over WDM

Hussein Mouftah, *Queens University, Canada (Empire/Hudson, 7th Fl)*

In order to fully utilize Wavelength Division Multiplexing (WDM) Network capabilities, we have to develop new architectures and network control methods to import IP traffic into WDM highways while providing Quality of Service management in a cost effective way. The interaction of the IP layer and the optical layer is of much concern. The objective is to make the optical layer dynamically adaptive to the change of traffic pattern in the IP layer and eventually to achieve lightpaths on demand. We will discuss these issues and present the control models of IP-optical network interaction. We will also present the Generalized Multi Protocol Label Switching (GMPLS) and the role it can play in this area. Also, network survivability has been a crucial concern in WDM optical networking. We will address this issue and present different optical protection and restoration schemes within wavelength-routed WDM mesh networks.

The high cost of wavelength converters at current stage of technology has to be taken into consideration when we design node architectures for an optical network. We will discuss the efficiency of wavelength converters in a long-haul optical network at different degrees of traffic load. Also, we will describe cost-effective ways to optimally design wavelength-convertible switch so as to achieve higher network performance while still keeping the total network cost down. Also, we will describe routing and wavelength assignment (RWA) algorithms and their use in the design of WDM networks with and without wavelength converters.

Hussein Mouftah joined the ECE Department at Queen's University in 1979, where he is now a Full Professor and the Department Associate Head, after three years of industrial experience mainly at Bell Northern Research of Ottawa (now Nortel Networks). He served as Editor-in-Chief of the IEEE Communications Magazine (1995-97) and IEEE Communications Society Director of Magazines (1998-99). Dr. Mouftah is the author or co-author of two books and more than 600 technical papers and 8 patents in this area of broadband packet switching networks, mobile wireless networks and quality of service over the optical Internet. He has received numerous IEEE and Professional Engineers awards. Dr. Mouftah is a Fellow of the IEEE (1990).

Sunday, 28 April, 13:30 - 17:00

T05 Fundamentals of Performance Evaluation of Computer and Telecommunications Systems

Mohammad Obaidat, *Monmouth University, USA (Soho/Herald, 7th Fl)*

Performance evaluation of computer and telecommunication systems has become an increasingly important issue given their general pervasiveness. Evaluating of computer systems and networks is needed at every stage in the life cycle of the system, including its design, manufacturing, sale/purchase, use, upgrade, tuning, etc. A performance evaluation is required when a system designer wants to compare alternative architecture and protocols and find the optimum and most cost-effective one. Computer and telecommunications systems performance can be evaluated using measurement, analytic modeling and simulation modeling. The objective of this tutorial is to provide an up-to-date treatment of the fundamental techniques and algorithms of computer and telecommunications systems performance modeling, simulation and measurement. Special emphasis will be given to discrete event simulation. The application of these techniques will be demonstrated by case studies.

Professor Obaidat is an internationally well-known academic/scientist/engineer. He is a tenured full Professor of Computer Science at Monmouth University (MU), USA. Among his previous positions are Chair of the Computer Science Department and Director of the Graduate Program at MU and a faculty member at CUNY. He has received extensive research funding and has published over two hundred and ten (210) refereed technical articles. Professor Obaidat has served as a consultant for several corporations worldwide. Dr. Obaidat is the chief editor of the Wiley International Journal of Communication Systems. He is the area editor on telecommunications and networking of the Transactions of the Society for Computer Simulation International. He is also an associate editor/editorial board member of seven other refereed scholarly journals including three IEEE Transactions. He has guest edited many special issues of scholarly journals. He served as General Chair or Program Chair of many international conferences. Obaidat is a Fellow of the Society for Modeling and Simulation International, SCS.

T06 Satellite Communications: Issues in Transmission Techniques, Multiple Access Protocols and Performance

Erina Ferro, *National Research Council, Italy (Chelsea, 7th Fl)*

Satellite transmissions have an important role in telephone communications, television distribution, computer communications, maritime navigation, and military command and control. Moreover, due to their intrinsic nature, in many situations they constitute the only way for communicating. Recent trends in telecommunications indicate that four major growth market/service areas are: messaging and navigation services (wireless and satellite), mobility services (wireless and satellite), video delivery services (cable and satellite), and interactive multimedia services (fibre, satellite, cable). The major drawback in using geostationary satellites is the long delay that can have an important impact in the end-to-end delay user requirements. Moreover, atmospheric conditions may affect the data transmitted in a very heavy way.

The tutorial aims at giving the basic elements of telecommunications via geostationary satellite. The LEO constellations are shortly included. Currently after the disaster of the Teledesic service, these are no more a reality but in the future they will again play an important role. Aspects considered will include basic transmission and multiple access techniques, channel modeling and fade countermeasures, and their performance analysis by theoretical, experimental, and simulation tools.

Erina Ferro received her Laurea degree with distinction in Computer Science from the University of Pisa (Italy) in 1975. Since 1976 she is with CNUCE, an Institute of the Italian National Research Council (C.N.R.), where she is currently working as a senior researcher in the digital multimedia transmissions via satellite. She participated in several international and national projects where some systems designed by her team were implemented and used on the Eutelsat, Olympus and Italsat satellites. Working in the TDMA satellite access schemes field she obtained two patents, in 1989 and 1996, respectively. She has also participated to several COST actions of the European Community (currently she is involved in the Cost Action 272). Her research activity covers the fields of the access schemes for multimedia traffic over multimedia systems with guaranteed quality of service, the fade countermeasure techniques for satellite transmissions, and the performance evaluation of the transmission systems. She has served as a reviewer for a number of international journals and IEEE congresses. Dr. Ferro authored over seventy publications in the above fields, in international scientific journals and conference proceedings.

T07 Service Level Agreements (SLA)

Christian Rad, *AT&T, USA (Olmstead/Gramercy, 7th Fl)*

Performance guarantees have emerged as a means for IT managers to ensure their critical business data is delivered in a reliable and consistent manner. These performance guarantees, coupled with traditional support such as Mean Time to Repair and Mean Time Between Failures are now referred to, in the industry, as Service Level Agreements (SLA). This tutorial will review the basic elements of the broader topics of Service Level Agreements, Service Level Management and Service Level Assurance. Topics will include SLA parameters and associated definitions, description of the current direction in network architecture and its impact on SLA monitoring, challenges in data collection, survey of the industry with respect to SLA monitoring schemes, and a review of commercial tools.

Christian Rad is a Senior Consultant with AT&T Laboratories. He began his career in the telecommunication industry in 1984 after joining AT&T Bell Laboratories as a member of the technical staff. In 1998 he joined Bellcore as the Senior Scientist in applied research working on the Service Level Assurance and the dynamics of Service Level Management.

During his tenure at AT&T Bell Laboratories, Christian was a major participant in the AT&T∂s ATM/SONET Infrastructure Initiatives. His contributions have been in transport provisioning, maintenance and restoration with the development of solutions for multivendor networking and automated transport provisioning. He has made major contributions to AT&T's FASTAR, Transport Self Identification Plan, and ATM/SONET transport network deployment. His current interests include end-to-end integration planning of transport network and the management of multi-level technologies and the related services.

Christian has been a member of the American Physical Society, American Association for the Advancement of Science, T1M1.5 working group and ITU-T Question 23 on TMN. He is a senior member of IEEE and an active participant in organizing IEEE Conferences, Symposiums, Workshops and Panel Sessions. He has served as the technical program chair and vice chair of the Committee on Network Operations and Management (CNOM).

T08 CDMA2000 1xEV Concepts and Performance Overview

Eduardo Esteves, *Qualcomm, USA (Empire/Hudson, 7th Fl)*

The cdma2000 1xEV standard, also known as IS-856, is a next generation solution to high-speed wireless Internet access that was recently approved as part of the IMT-2000 specifications. This air interface provides a spectral efficient system achieving forward link rates of up to 2.4Mbps in 1.25MHz of bandwidth. In this tutorial, a detailed description of both Physical and MAC layers will be provided with special attention to advanced techniques such as adaptive modulation and coding, turbo codes and incremental redundancy, type II Hybrid-ARQ, fast channel feedback information and multiuser diversity. The tutorial will end with a comprehensive discussion on a variety of performance and capacity results.

Dr. Eduardo Esteves has over 11 years of experience in the system design and implementation of wireless communication systems, including both satellite and cellular systems. He joined Qualcomm R&D department in 1997 and since then has been working on the design, standardization and implementation of the high data rate packet data system (1xEV-DO). Dr. Esteves graduated with a Ph.D. degree in Electrical Engineering from the University of Southern California. He also holds two U.S. patents related to mobile communications.

Thursday, 2 May, 8:30 - 12:00

T09 Turbo Coding: Principles and Practice

Christian Schlegel, *University of Utah, USA;* Lance Perez, *University of Nebraska, USA (Marquis Ballroom C, 9th Fl)*

This tutorial will introduce the concept of Turbo Coding and Iterative Decoding. Turbo Coding is a novel development in the field of error control coding which has pushed the performance of codes up to the theoretical limit established by Shannon in 1948.

The two basic principles of Turbo Coding, parallel and serial concatenation, are explained. Performance theories and analysis methods, both of the turbo cliff behavior and the error floor are given. A detailed discussion of the soft-output component decoders, which form the heart of iterative decoding, is presented. Applications to coded modulation and current standards are discussed, and associated developments such as block turbo coding and low-density parity check codes are included.

Christian Schlegel received the Dipl. El. Ing. ETH degree from the Federal Institute of Technology, Zürich, in 1984, and the M.S. and Ph.D. degrees in electrical engineering from the University of Notre Dame, Notre Dame, IN, in 1986 and 1989, respectively. In 1988 he joined the Communications Group at the research center of Asea Brown Boveri, Ltd., in Baden, Switzerland, where he was involved in mobile communications research. He spent the 1991/92 academic year as Visiting Assistant Professor at the University of Hawaii at Manoa, Hawaii, before joining the Digital Communications Group at the University of South Australia in Adelaide, Australia from 1992-1994, where he supervised research in mobile communications. From 1994-1996 he was with the University of Texas at San Antonio, and in 1996 he joined the University of Utah, Salt Lake City. In 2001 he was named iCORE Professor for High-Capacity Digital Communications at the University of Alberta, Canada. His interests are in the area of digital communications and mobile radio systems, error control coding, multiple access communications, as well as analog and digital system implementations. He is the author of the research monograph "Trellis Coding" published by IEEE Press in 1997, and of "Trellis and Turbo Coding", to be published by Wiley/IEEE in 2002. He is also currently working on a new book entitled Coor-dinated Multiple User Communications'. Dr. Schlegel received an NSF 1997 Career Award in support of his research in multiuser communications, and a Canada Research Chair in 2001.

T10 VoIP and QoS

Koichi Asatani, *Kogakuin University, Japan (Wilder, 4th Fl)*

Internet Telephony market is growing very rapidly both in the international and domestic telecommunication markets. It is expected that the traffic of the global Internet telephony will exceed that of international legacy telephone traffic in around 2005. Currently, QoS of Internet telephony is not guaranteed nor even specified. The QoS guarantee assumes that QoS is specified, measured and controlled. The interconnection of Internet telephony and legacy telephony is one of the most important demands. Also for the interconnection, numbering/addressing plan for the Internet telephony is very vital. This tutorial introduces trends in services and markets, state of the art on network architecture, and QoS measurement and management technologies related to Internet telephony based on VoIP. It also touches the current status of the international standards in ITU-T, TIPHON project of ETSI and IETF.

Koichi Asatani has over 28 years of experience in telecommunications and information technologies in a variety roles of and organizations, such as NTT Executive Director on Communications QoS and management, Vice-Chair of ITU-T SG 13 on network aspects of Internet technologies. He currently leads QoS management working group in National Committee on IP telephony in Japan.

T11 Smart Antennas and Spatial Channels

Andreas Molish, *AT&T, USA;* Juha Laurila, *Nokia, Finland;* Klaus Hugl, *Technische Universität Wien, Austria;* Ernst Bonek, *Forschungszentrum Telekommunikation Wien, Austria (Wilder, 4th Fl)*

Smart antennas are one of the most promising methods for increasing capacity of mobile radio systems, both for upgrading second-generation systems and for use in third- and fourth generation systems. The tutorial will give a comprehensive overview over all relevant aspects of smart antenna systems. Measurement and modeling of the spatial propagation characteristics, which form the physical basis for any smart antenna system are discussed as well as signal processing algorithms, hardware architectures, experiences from the construction of an actual testbed, and capacity issues. Also MIMO systems (multiple antennas at base station and mobile station), the most recent, exciting development in smart antennas, are discussed.

Andreas F. Molisch received the Dipl. Ing., Dr. techn, and habilitation degrees from the Technical University Vienna in 1990, 1994, and 1999, respectively. From 1991 to 2001, he was with the Institut für Nachrichtentechnik und Hochfrequenztechnik (INTHFT) of the TU Vienna, most recently as associate professor. Since 2001, he has been with AT&T Laboratories - Research. His current research interests are MIMO systems, smart antennas, characterization of mobile radio channels, and wideband systems. He is senior member of the IEEE, and co-author of two books, five book chapters, some 45 journal papers, and numerous conference contributions.

Juha Laurila received the M.Sc. (E.E.) degree from the Helsinki University of Technology, Finland in 1995 and Dr.Tech. degree from the Vienna University of Technology, Austria in 2000. Since 2000 he has been working as a senior research engineer at Nokia Research Center (Radio Communications Laboratory) Helsinki, Finland. His current research activities are related to the utilization of multiple antenna techniques in cellular systems. J.Laurila has authored or co-authored more than 20 international reviewed journal and conference publications.

Ernst Bonek was born in Vienna, Austria, 1942. He received the Dipl. Ing. And Dr.techn. degrees from the Technische Universitœt (TU) Wien. In 1984, he was appointed Full Professor of Radio Frequency Engineering at the TU Wien. His present field of interest is mobile communications at large. Recent contributions concern the characterization of mobile radio channels, cordless telephony, and advanced antennas and receiver designs. Altogether, he authored or co-authored some 100 journal publications. He holds three patents, and seven more are pending. His current positions in scientific organizations include: chairman of the "Antennas and Propagation" working group in the European research initiative "COST 273"; Area Editor of "Wireless Personal Communications"; Chairman of URSI (Union of radio scientists) commission, Senior Member of IEEE.

Klaus Hugl was born in Austria, in 1974. He received his Dipl. Ing. with high honors from Technische Universität Wien (TU-Wien) in 1998. He∂s currently working towards his Ph.D. at Institut für Nachrichtentechnik und Hochfrequenztechnik (INTHF) of TU-Wien. His research interests are smart antennas, especially downlink beamforming and spatial channel modeling/characterization.

T12 Broadband Communications from High Altitude Platforms

David Grace, Tim Tozer, *SkyLARC Technologies, UK*
(Marquis Ballroom C, 9th Fl)

High Altitude Platforms (HAPs) are airships or planes (manned or unmanned), which will operate at an altitude of approximately 20km, to provide a cost-effective means of meeting requirements for future wireless multimedia communications, in particular broadband and 3G. From this altitude services can be offered over a wide geographical area, and there is considerable activity worldwide in the development of networks of HAPs. HAPs will be particularly good at providing a rapid rollout of new services and to fill in gaps in existing terrestrial coverage. This tutorial will provide an understanding of the principles of HAP-based communications including, system design fundamentals, tradeoffs, and analysis, with reference to current and proposed projects.

David Grace is a Director of SkyLARC Technologies Ltd, a spin-off company from the University of York that specializes in providing expertise and solutions for the delivery of broadband communications from aerial platforms. He is also currently project manager for the University of York's

contribution to the EU Framework V HeliNet project, namely the broadband communications program. He has been invited to speak at numerous HAP events and conferences including the Stratospheric Platforms System Workshop, Tokyo, Japan (2000 & 2001), and Wireless Personal Mobile Conference 2001, Aalborg, Denmark. He has published over 40 journal and conference papers in the fields of wireless communications and HAPs.

Tim Tozer is Leader of the Communications Research at the University of York, directing a number of projects in wireless communications. He is author of over 100 published articles, and has given numerous conference and seminar presentations worldwide. He also has many years experience in planning and delivering classes and lectures to both undergraduate and post-graduate educational programs. With a background in satellite communications, he is now involved with work on communications from High Altitude Platforms, including the HeliNet program. Tim is also Managing Director of SkyLARC Technologies Ltd.

Thursday, 2 May, 13:30 - 17:00

T13 Intelligent Wireless Networking; Smart Antennas and Adaptive Modulation

Lajos Hanzo, *University of Southampton, UK (Marquis Ballroom C, 9th Fl)*

Based on the Wiley monograph "Third-Generation Systems and Intelligent Wireless Networking: Smart Antennas and Adaptive Modulation∑ by Blogh and Hanzo (for sample chapters and full contents please refer to http://www-mobile.ecs.soton.ac.uk) this overview provides an insight into the effects of smart antennas, adaptive modulation and a range of other efficient networking techniques on the achievable teletraffic capacity of wireless systems. This research-oriented presentation jointly considers the benefits of both physical and network-layer performance enhancement techniques. More specifically, while conventional systems would drop a call in progress, if the communications quality falls below the target quality of service and it cannot be improved by handing over to another physical channel, intelligent reconfigurable systems of the near future are expected to simply reconfigure themselves in a more robust mode of operation without dropping the call. It will be demonstrated that the proposed beam-forming and adaptive transmission techniques may double the expected teletraffic capacity of the system, while maintaining the same AVERAGE performance as their conventional counterparts. While this overview is ambitious in terms of providing a research-oriented outlook, potential attendees require only a modest background in wireless communications. Network operators, service providers, managers and researchers embarking on the joint optimization of the physical and network layer may find the coverage of the presentation beneficial.

During his 26-year career Lajos Hanzo has held various academic and research positions in Hungary, Germany and the UK. Since 1986 he has been with the University of Southampton, where he holds the Chair of Telecommunications.

T14 Multiuser in Multicarrier Systems for Wireless Communications

Y. Bar-Ness, *New Jersey Institute of Technology, USA (Odets, 4th Fl)*

There has recently been an emphasis on using multi-carrier systems in wireless communications, as in, for example, IEEE 802.11a in the US and Hyperlan2 in Europe. OFDM modulation, the principle of data transmission for these systems, has been shown to have many advantages in the multi-path fading environments that wireless communications are regularly faced with. This is certainly not without many problems that the system designer has to cope with. Probably more than in wire-line systems, multi-user interference is an important impairment that requires cancellation. In this tutorial we will detail the principles of DAB, DVB and WLAN with emphasis on their related standards. Different multi-users-multi-carrier schemes will be presented. Methods for inter-user interference cancelation will be discussed. Some adaptive de-correlating based algorithms will be included. Inter-carrier interference is another problem wireless multi-carrier systems are faced with. We will present some ideas for handling such impurities. Finally, we will suggest and analyze different methods for multi-rate transmission in multi-carrier systems and suggest avenues for canceling interference that these schemes may cause.

Dr. Bar-Ness is a Distinguished Professor of Electrical and Computer Engineering, Foundation Chair for Communications and Signal Processing Research, and the Director of the CCSPR at NJIT. He has B.S. and M.S. degrees in Electrical Engineering from the Technion, Israel and a Ph.D. in applied mathematics from Brown University, USA. He came to NJIT in 1985 from AT&T Bell Labs. His previous employment includes universities, industries, and research and development institutions both in the USA and Israel. Between September 1993 and August 1994 he was on sabbatical with the Telecommunications and Traffic Control Systems Group, Faculty of Electrical Engineering at TU Delft, and from September 2000 to August 2001 he was on sabbatical with the department of Electrical Engineering, Stanford University. His current research interests include Adaptive Array and Interference Cancellations, Wireless Mobile and Personal Communications, Surface Acoustic Waves applications, and Data Compression. He has been a fellow of IEEE since 1989.

T15 Next-Generation Optical Communication Networks

Andrzej Jajszczyk, *AGH University of Technology, Poland (Wilder, 4th Fl)*

This tutorial addresses new networking technologies supporting multiple services. The tutorial will provide a comprehensive overview of various alternatives for carrying multiservice traffic, including IP over SONET/SDH over WDM and IP over WDM. Methods enabling IP to serve as a multiprotocol platform will be described, including such protocols as Intserv, Diffserv, and MPLS. Integrated strategies for resilience in a multi-layer transport network will be presented and discussed. Multi-layer resilient network planning approaches will be outlined. Migration scenarios towards all-optical networking will be presented. This tutorial is targeted at system architects, designers, developers and advanced network managers who want to learn about the latest developments in optical networking technologies.

Andrzej Jajszczyk is a Professor at the AGH University of Technology in Cracow, Poland. He received M.S. and Ph.D. degrees from Poznan University of Technology. He spent several years at universities in Australia and Canada as a visiting scientist. He is an IEEE Fellow, the author or co-author of six books and more than 160 scientific papers, as well as 19 patents in the areas of telecommunications switching, high-speed networking, and network management. He has been a consultant to industry, telecommunications operators, and government agencies. He was the founding editor of the IEEE Global Communications Newsletter, editor of IEEE Transactions on Communications, and editor-in-chief of IEEE Communications Magazine. He is an IEEE Communications Society Distinguished Lecturer.

T16 Telecommunications Software Patterns

Robert Hanmer, *Lucent Technologies, USA (Marquis A/B, 9th Fl)*

One way of reusing proven software development techniques and architectures is through the use of software "patterns". A pattern is a way of describing a proven solution to a design problem with enough detail that a designer can apply it to a similar problem with minimum effort. For several years software architects and designers at several major telecommunications and software companies have been documenting those solutions that they have found to work well. This tutorial presents a survey of those software patterns of greatest interest to telecommunications software developers. These patterns span the design space from correctly handling transient errors to state machines to resource overload to development processes and user interface design.

The tutorial begins with an introduction to software patterns and the telecommunications patterns community. Information about evaluating patterns to determine their usefulness will be covered. Then a tour through the published patterns will be made. The tour will describe the highlight of the different collections of patterns as well as their sources. The sources include books, conference notes and websites. The structure for a telecommunications system provides the organizing framework for this tour.

The tutorial objective is to make the participants aware of the existence of these valuable resources that can greatly simplify their design work. By reusing a proven solution to frequently occurring problems, their efforts can be focused on the truly new portions of their design.