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Keynote Lecture 1

Multihop Cellular Networks: Integration, Cooperation, Standardization, Research Challenges

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Abstract: Cellular networks have been developed for voice telephone service using circuit switched technology.They are usually complex and large in terms of their network scale and operational features,high speed mobility,low data rate, and wide area coverge..The aim of the process of cellular networks evolution is to have an all IP network architecture to provide high bit rate multimedia services including voice,audio, video and data. Multimedia services require multiple sessions over one physical channel which could be provided by packet switched networks. The common protocol is IP.The Internet and cellular systems have been designed and implemented by people with different backgrounds in computers and communications, respectively.Their integration can be considered a first step toward next generation networks, where heterogeneous nettworks must work together in order to provide differential services to users in seamless and transparent manner. Next generation cellular networks are expected to provide richer and more diverse multimedia services. However,the current cellular network architecture may not be economically feasible to cater to the requirements of future mobile communication services.As an alternative to cellular communications, ad hoc networking is a wireless communication technology distinguished
by communicating via multihop transmissions. The multihop cellular network(MCN) which combines the characteristics of ad hoc networking with these of a cellular network,has been drawing a lot of attention. Namely, MCN incorporates the flexibility of ad hoc networking,while preserving the benefits of using an infrastructure.The advantage of using MCN includes capacity enhancement,coverage extension,network scalability, and power reduction.The main motivation for integrating multihop transmission in cellular networks is to enhance coverage and network capacity. Relaying can be used to assist communications to and from mobile hosts (MHS) at the cell edge or MHs experiencing deep fading in their home base station (BS). This presentation starts with the background of the problem.Next,integration of cellular and internet services including a cooperation in multihop cellular networks will be analyzed.Some examples will be included,too. Finally, 4G cellular standards,together with research challenges conclude the lecture. It is pointed that there are still a number of open research issues that need to be solved in order to provide an efficient and effective multihop transmissions in cellular networks in the future.

Brief Biography of the Speaker:
Prof. Dr. Zoran Bojkovic (http://www.zoranbojkovic.com) is a full professor of Electrical Engineering at the University of Belgrade,Serbia and a permanent visiting professor at the University of Texas at Arlington, TX, USA, EE Department, Multimedia System Lab. He was a visiting professor in more than 20 Universities worldwide and has taught a number of courses in Electrical Technology, Telecommunication Systems and Networks, Speach, Image and Video Processing, Multimedia Wire/Wireless Communication Systems, Computer Networks. Prof. Bojkovic is the co-author of 6 international books/monographies (Publishers: Prentice-Hall, Wiley, CRC Press, WSEAS) Also, some of these books have been published and translated in Canada, China, Singapore and India. He is co-editor in 62 International Books and Conference Proceedings. He has published more than 420 papers in peer-reviewed journals, conference proceedings and publications.He has conducted keynote/plenary lectures, workshops/tutorials as well as seminars , and participated in more than 70 scientific and industrial projects all over the world.He has been a consultant to industry research institutes and academia. His activities included serving as Editor- in- Chief in 2 International Journals and as Associate Editor in 3 International Journals. Prof. Zoran Bojkovic is an active researcher in wire/wireless multimedia communications. He is a Senior Member of IEEE and WSEAS, member of EURASIP, full member of Engineering Academy of Serbia as well as a member of Serbian Scientific Society.

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Keynote Lecture 2

Program Analysis and Optimization for Multi-core Computing

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Abstract: As multi-core architectures become ubiquitous in modern computing, large scale scientific applications have to be redesigned to efficiently use the multiple cores and deliver higher performance. One major approach is the automatic detection of parallelism, in which existing conventional sequential programs are translated into parallel programs by optimizing compilers, in order to take advantage of the multiple processors. Optimizing compilers rely upon program analysis techniques to detect data dependences between program statements, perform optimizations, and identify code fragments that can be executed in parallel. In this work we study various program analysis and optimization techniques for multi-core computing and measure their impact in practice. We perform an experimental evaluation of several data dependence tests and program analysis techniques and we compare them in terms of data dependence accuracy, compilation efficiency, effectiveness in parallelization and program execution performance. We run various experiments using the Perfect Club Benchmarks, the SPEC benchmarks, and the scientific library Lapack. We present the measured accuracy of each data dependence test and explain the reasons for inaccuracies. We compare these tests in terms of efficiency and we analyze the tradeoffs between accuracy and efficiency. We also determine the impact of each data dependence test on the total compilation time. Finally, we measure the number of loops parallelized by each test and we compare the execution performance of each benchmark on a multi-core architecture.

Brief Biography of the Speaker:
Kleanthis Psarris is Professor and Chair of the Department of Computer Science at the University of Texas at San Antonio. He received his B.S. degree in Mathematics from the National University of Athens, Greece in 1984. He received his M.S. degree in Computer Science in 1987, his M.Eng. degree in Electrical Engineering in 1989 and his Ph.D. degree in Computer Science in 1991, all from Stevens Institute of Technology in Hoboken, New Jersey. His research interests are in the areas of Parallel and Distributed Systems, Programming Languages and Compilers, and High Performance Computing. He has designed and implemented state of the art program analysis and compiler optimization techniques and he developed compiler tools to increase program parallelization and improve execution performance on advanced computer architectures. He has published extensively in top journals and conferences in the field and his research has been funded by the National Science Foundation and Department of Defense agencies. He is an Editor of the Parallel Computing journal. He has served on the Program Committees of several international conferences including the ACM International Conference on Supercomputing (ICS) in 1995, 2000, 2006 and 2008, the IEEE International Conference on High Performance Computing and Communications (HPCC) in 2008, 2009, and 2010, and the ACM Symposium on Applied Computing (SAC) in 2003, 2004, 2005 and 2006.

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Keynote Lecture 3

Biomimetic Human Modeling, Simulation and Control

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Abstract: For use in the entertainment industry, computer graphics/animation has made significant strides over the past two decades through advances in physics-based simulation and control. In this context, one of the most difficult open challenges going forward is the biomimetic simulation and control of the human body. This talk will present our progress toward a comprehensive simulator that confronts the combined challenge of biomechanically modeling and neuromuscularly controlling more or less all of the relevant articular bones and muscles in the body, as well as simulating the physics-based deformations of the soft tissues. A significant component of our model is the neck-head-face complex, which addresses the important role that the neck plays in synthesizing the head movements that are essential to so many aspects of human behavior. Our anatomically consistent biomechanical model confronts us with many challenging motor control problems, even for the relatively simple task of balancing the mass of the head in gravity atop the cervical spine. I will present a neuromuscular control model that emulates the relevant biological motor control mechanisms. Employing machine learning techniques, the neural networks within our controllers may be trained offline to efficiently generate the pose and stiffness control signals needed to synthesize a variety of autonomous human movements. The talk will be richly illustrated with images and videos.

Brief Biography of the Speaker:
Demetri Terzopoulos (PhD '84 MIT) is the Chancellor's Professor of Computer Science at the University of California, Los Angeles. He is a Guggenheim Fellow, a Fellow of the ACM, IEEE and Royal Society of Canada, and a Member of the European Academy of Sciences. Among his many honors are an Academy Award for Technical Achievement from the Academy of Motion Picture Arts and Sciences for his pioneering work on physics-based computer animation, and the inaugural Computer Vision Significant Researcher Award from the IEEE for his pioneering and sustained research on deformable models and their applications. One of the most highly cited authors in engineering and computer science according to ISI and other indexes, his publications include more than 300 research papers and several volumes, primarily in computer graphics, computer vision, medical imaging, computer-aided design, and artificial intelligence/life. He has given over 400 talks internationally on these topics, among them about 100 distinguished, keynote, and plenary addresses. Before joining UCLA in 2005, Dr. Terzopoulos held the Lucy and Henry Moses Endowed Professorship in Science at New York University and was Professor of Computer Science and Mathematics at NYU's Courant Institute of Mathematical Sciences. Previously, he was Professor of Computer Science and Professor of Electrical and Computer Engineering at the University of Toronto, where he continues to hold status-only faculty appointments.

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Plenary Lecture 1

Communicating at the Nanoscale

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Abstract: Today, it is difficult not to have come across the term nanotechnology because the term has spread into popular culture. In reality, what is entailed is the utilisation of very small devices (at the nanometre scale) to perform socially useful tasks such as targeted medical treatments and gathering data for climate change monitoring. To date, the design and manipulation of entities at the nanoscale has captured the headlines. However, the full impact of this technology will not be realised unless such devices are able to communicate with each other. Thus a new field is emerging that entails nanocommunications and nanonetworking – the interconnection of nanoscale devices to perform useful functions. As would be expected for such a novel and recent topic, there is a only a small quantity of published results on communications between very small devices. The time is thus opportune for this issue to be addressed to enable progress to be made on applications such as those mentioned above. This talk will begin with a brief review of the methods currently under consideration for nanocommunications, such as molecular diffusion and nanotube radio. The technologies will be illustrated by means of predictions of their likely performance. Following this, recent work in the area of optimised transmission, network coding and cooperation will be presented. The final section will consider the future prospects for and challenges of nanoscale communications. In particular, there will be consideration of the areas of channel characterisation, system modelling, the encoding of information and the types of communication protocols needed.

Brief Biography of the Speaker:
Mark S. Leeson received the degrees of B.Sc. and B.Eng. with First Class Honors in Electrical and Electronic Engineering from the University of Nottingham, UK, in 1986. He then obtained a PhD in Engineering from the University of Cambridge, UK, in 1990. From 1990 to 1992 he worked as a Network Analyst for National Westminster Bank in London. After holding academic posts in London and Manchester, in 2000 he joined the School of Engineering at Warwick, where he is now an Associate Professor and also holds the post of Director of Graduate Studies. His major research interests are coding, modulation, ad hoc networking, nanoscale communications, optical communication systems, network security and evolutionary optimization. To date Dr Leeson has over 180 publications and has supervised nine successful research students. He is a Senior Member of the IEEE, a Chartered Member of the UK Institute of Physics and a Fellow of the UK Higher Education Academy. During the academic year 2010-11 he has been a Royal Academy of Engineering Leverhulme Senior Research Fellow studying Information Theory at the Nanoscale.

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Plenary Lecture 2

Applications of Chaotic and Random Sequences for Secure Communication Systems and Networks

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Abstract: The development of direct sequence spread spectrum systems allowed design of code division multiple access systems (CDMA), which are based on the application of orthogonal sequences to multiplex users' information. Initially the design of these systems was based on application of spreading sequences like short and long pseudo-random sequences, Walsh functions or wavelets. In recent years, the non-binary sequences have been applied in these systems, primarily chaotic sequences produced by chaotic maps or random sequences produced by the random number generators. This lecture presentsresults of research conducted in recent years related to the theoretical analysis, simulation and practical design of systems that use non-binary spreading sequences.In particular the characteristics of chaos based systems for a single and multiple users in the presence of noise and fadingarepresented.Due to the random nature of sequences generated, the synchronization of these systems is a particular problem that attracted significant attention in communication community. The lecture will present the latest findings related to the methods of efficient synchronisation of these systems. Due to the random nature of orthogonal sequences, which are used to spread the message signal, these systems can be used for secure signal transmission and protect the information content from jamming and interception. It will be shown, using example designs in DSP technology, that the theoretical analysis of these systems is demanding, but the design and implementation of the simulators and devices based on this theory are possible. In addition, the possible applications of these systems in wireless sensor networks will be addressed.

Brief Biography of the Speaker:
Dr. Stevan M. Berber was born in Stanisic, Serbia, former Yugoslavia. He completed his undergraduate studies in electrical engineering in Zagreb, master studies in Belgrade, and PhD studies in Auckland, New Zealand. Currently Stevan is with the Department of Electrical and Computer Engineering at Auckland University, New Zealand. He was appointed Visiting Professor at the University of Novi Sad in 2004 and Visiting Scholar at the University of Sydney in 2008. His teaching interests are in communication systems, information and coding theory, discrete stochastic signal processing and wireless sensor and computer networks.His research interests are in the fields of digital communication systems and signal processing with the emphasis on applications in CDMA systems and wireless computer, communication and sensor networks. He is the author of more than 80 refereed journal and conference papers, 8 books and 3 book chapters. Hi filed three patent applications. Dr Berber is a referee for papers in leading journals and conferences in his research area. He has been leading or working on a large number of research and industry projects. Dr Berber is a senior member of IEEE, a member of New Zealand Scientists, and an accredited NAATI translator for English language.

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