Introduction to the IEEE Transactions on Cloud Computing

Rajkumar Buyya

WELCOME to the *IEEE Transactions on Cloud Computing* (*TCC*). It is my privilege and honor to serve as the inaugural Editor-in-Chief of *TCC*. I would like to thank the IEEE and the world-wide Cloud Computing community for giving me the opportunity to serve them.

Let me first share some of the open opportunities and challenges in Cloud Computing and then introduce the transactions and its progress.

1. Opportunities and Challenges

Computing is being transformed to a model consisting of services that are commoditized and delivered in a manner similar to utilities such as water, electricity, gas, and telephony. In such a model, users access services based on their requirements regardless of where the services are hosted. Several computing paradigms have promised to deliver this utility computing vision. Cloud computing is the most recent emerging paradigm promising to turn the vision of "computing utilities" into reality.

Cloud computing started with a risk-free concept: Let someone else take the ownership of setting up of IT infrastructure and let end-users tap into it, paying only for what is been used. A service offering computation resources is frequently referred to as Infrastructure as a Service (IaaS) and the applications as Software as a Service (SaaS). An environment used for construction, deployment, and management of applications is called PaaS (Platform as a Service).

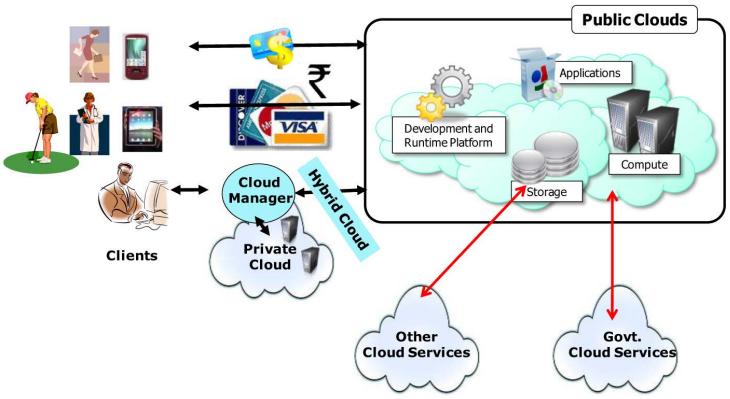


Fig. 1. A bird's eye view of Cloud computing.

Several IT vendors are promising to offer storage, computation, and application hosting services, and provide coverage on several continents, offering Service-Level Agreements (SLA) backed performance and uptime promises for their services. Cloud computing delivers infrastructure, platform, and software (application) as services, which are made available as subscription-oriented services in a pay-as-you-go model to consumers. The price that CSPs (Cloud Service Providers) charge depends on the quality of service (QoS) expectations of CSCs (Cloud Service Consumers).

Cloud computing fosters elasticity and seamless scalability of IT resources that are offered to end users as a service through the Internet. Cloud computing can help enterprises improve the creation and delivery of IT solutions by providing them with access to services in a cost-effective and flexible manner. A bird's eye view of Cloud computing is shown in Fig. 1.

Clouds can be classified into three categories, depending on their accessibility restrictions and the deployment model. They are:

- Public Cloud,
- Private Cloud, and
- Hybrid Cloud.

A public Cloud is made available in a pay-as-you-go manner to the general public users irrespective of their origin or affiliation. A private Cloud's usage is restricted to members, employees, and trusted partners of the organization. A

For information on obtaining reprints of this article, please send e-mail to: tcc@computer.org.

2168-7161/13/$31.00 © 2013 IEEE Published by the IEEE Computer Society

hybrid Cloud enables the use of private and public Cloud in a seamless manner. In a typical public Cloud scenario, a third-party vendor delivers services such as computation, storage, networks, virtualization, and applications to various customers. In a private Cloud environment, internal IT resources are used to serve their internal users and customers. Businesses are adopting public Cloud services to save capital expenditure and operational costs by leveraging Cloud's elastic scalability and market-oriented costing features. Nevertheless, public Cloud computing also raises concerns about data security, management, data transfer, performance, and level of control.

Cloud computing applications span many domains, including business, technology, government, health care, smart grids, intelligent transportation networks, life sciences, disaster management, automation, data analytics, and consumer and social networks. Various models for the creation, deployment, and delivery of these applications as Cloud services have emerged.

The business potential of Cloud computing is recognized by several market research analysts. My own guesstimate is that the worldwide spending on Cloud services will reach about a trillion dollar by 2020. To achieve this potential, several technological, business, security, and application-oriented challenges need to be addressed.

2. Open Research Challenges

Cloud computing introduces many challenges for system and application developers, engineers, system administrators, and service providers (see Fig. 2). These include:

1. How do we effectively manage the virtual machine (VM) life cycle to deliver quality expectations of consumers and at the same time reduce the cost delivery of services?
2. How do we secure the data and computation on the VMs managed by Cloud service providers?
3. How do we guarantee users' privacy and trust requirements?
4. How do we meet legal and regulatory compliance requirements about data hosting in Clouds?
5. What should the model of pricing for services be?
6. How do we manage Service Level Agreements (SLAs) and how do we guarantee quality of service (QoS) satisfaction and prevent or minimize SLA violations?
7. How do we balance the energy consumption and performance of data centers so that users can be charged at a nominal rate?
8. How do we choose data centers' locations so that data security, operation costs, and energy consumption meet the terms in the SLA signed with users?
9. Should the application logic and its scalability be handled by the application itself or be entrusted to a third party service?
10. What level of replication of data and application components is needed to guarantee reliable delivery of services?
11. How do we create Cloud applications rapidly and manage their life cycle?
12. What standards and interfaces are needed for portability and scalability of application services?

Fig. 2. Key open challenges in Cloud computing.

3. Introducing the IEEE *Transactions on Cloud Computing*

The Cloud computing paradigm is rapidly progressing, as evidenced by its adoption for the creation and delivery of innovative applications in several domains including scientific, consumer, social networks, health care, enterprises, banking, government, and big data. Several trade magazines have been actively featuring industrial development in

Cloud computing. The IEEE, as part of its "IEEE Cloud Computing Initiative," has identified the need for a respected journal for publishing research in Cloud computing. To support rapid dissemination of innovative research results (i.e., theoretical and practical models, algorithms, technologies, and solutions for Cloud computing) at a similar pace for the benefit of society, the IEEE launched the new *IEEE Transactions on Cloud Computing*. The new transactions will publish peer-reviewed articles that provide innovative research ideas and results in all areas relating to Cloud computing. Topics relating to novel theory, algorithms, performance analyses, and applications of techniques relating to all areas of Cloud computing will be considered for the transactions. For more details, please visit the *TCC* website: http://www.computer.org/tcc

The new transactions is managed by the IEEE Computer Society in partnership with other sister societies, namely, the IEEE Communications Society, the IEEE Systems Council, the IEEE Power & Energy Society, and the IEEE Consumer Electronics Society. The strategic directions of the transactions are managed by the Steering Committee chaired by Professor Jon Rokne.

4. Progress, Process, and Acknowledgements

In my role as the inaugural Editor-in-Chief (EiC) of *TCC*, one of my first tasks was to establish the Editorial Board (EB) whose members will be responsible for the technical quality of the journal. The members of the EB will serve as Associate Editors and they will be involved in the management of the peer reviews of the submitted manuscripts and selection of reviewers.

In consultation with the Steering Committee of *TCC*, I have identified leading, internationally recognized, researchers working in Cloud computing from all over the world. On approval from the Steering Committee, the IEEE Computer Society has appointed them as Associate Editors and members of the EB. A complete list of EB members is included at the end of this introduction.

Since its launch early this year, *TCC* has been accepting submission of papers that introduce original and innovative ideas. That means submission of "extended versions" of already published works (e.g., conference/workshop papers) is not encouraged unless they contain significant number of "new and original" ideas/contributions along with more than 49 percent "brand new" material.

TCC has been attracting submissions from academic researchers, industrial practitioners, policy and standards developers, and application communities from all over the world. During the last five months, we have received more than 150 submissions. In addition, we have scheduled four special issues focused on specific challenges in Cloud computing. They are also encouraging submission of revised versions of papers that are recognized as best papers from associated conferences.

Along with EB members, I have been managing the content of the transactions and the rigorous peer review process to ensure publication of original and high-quality papers. Based on the quality, focus, and scope of each submitted paper, it either gets assigned to a suitable Associate Editor or desk rejected with suitable suggestions. Each paper that advances to the full review phase is assigned to an appropriate Associate Editor, who seeks three or more review reports from peers and experts in the field and makes an appropriate recommendation. As the EiC, I have been able to make the final decision on each paper based on peer review reports and the recommendation of AE. The IEEE Computer Society is managing the manuscripts workflow from their initial submission to the final publication.

The papers accepted for the first issue of *TCC* cover hot topics in Cloud computing ranging from Cloud security to energy-efficient resource provisioning. I hope you will enjoy reading them and get inspired to innovate further.

I would like to thank the authors, reviewers, and readers for their interest in *TCC*. I acknowledge the strong support offered by all members of the Steering Committee, colleagues from the IEEE Computer Society, members of the Editorial Board, and the Cloud computing community world-wide in getting *TCC* up and running.

I request your continued support for establishing *TCC* as the premier forum for Cloud computing research and innovation. Your feedback and comments on further improving *TCC* are highly appreciated.

Rajkumar Buyya
Editor-in-Chief

Sanjeev K. Aggarwal received the MTech and PhD degrees, both from IIT Kanpur, in 1981 and 1986, respectively. For his PhD thesis, he worked on the Automatic code Generation problem and developed a framework for retargetable code generation. This work was later used in Industrial compilers. He has published extensively in international forums and has handled a large number of funded projects. He is with the Department of Computer Science and Engineering at the Birla Institute of Technology, Goa, India. He has approximately 27 years of research and teaching experience. Earlier, he was with the Department of Computer Science and Engineering at IIT Kanpur. He worked with Tata Research Development and Design Centre, Pune, from 1986 to 1990. At TRDDC, he was project leader for the CHILL compiler suite which was developed for C-DOT's digital switches. The project involved development of highly optimizing CHILL compilers and debuggers. He has hands-on experience with compiler development, testing, and project management. His areas of research interest are Cloud/Grid computing, multicore computing, compilers for high performance architectures, and application of language processing technology in tools for software engineering. He has been teaching courses on Grid/Cloud computing, compiler design, compilers for high performance architectures, and programming languages. He is the Director of BITS Pilani, Goa, and was head of Computer Centre at IIT Kanpur during 1997-2002, head of the Department of Computer Science and Engineering at IIT Kanpur during 2003-2005, and Dean of Resource Planning and Generation at IIT Kanpur during January 2008-January 2011.

Gagan Agrawal received the BS degree from IIT Kanpur and the MS and PhD degrees from the University of Maryland, College Park. He is a professor of computer science at Ohio State University. He has worked in a number of research areas, including parallel compilation and runtime support, data mining, and Grid and Cloud computing. His recent research is focused on two areas: tools and programming models for accelerator-based computing, and managing and processing large-scale data sets. He has published more than 200 papers in these areas.

Shivnath Babu is an associate professor in the Department of Computer Science at Duke University. His primary research interest is in making data-intensive computing systems easier to manage. Recent work from his research group has focused on the Hadoop MapReduce system. Check out the Starfish project (http://www.cs.duke.edu/starfish/). He is very interested in using Cloud platforms for online experimentation to aid system tuning and testing. The vision of the Flex project is to enable users—irrespective of whether they are end-users, developers, or system administrators—to have programmatic access to collect information needed for system testing and tuning through planned experiments on the Cloud. The DIADS project tackles integrated problem diagnosis for database systems running on networked storage as well as automated detection and recovery from data corruption caused by hardware faults, software bugs, or human mistakes. The work is supported by startup funds from Duke, grants from the US National Science Foundation, faculty awards from IBM, an equipment grant from IBM, and resource usage grants from Amazon Web Services.

Pavan Balaji holds appointments as a computer scientist at the Argonne National Laboratory, as an Institute Fellow of the Northwestern-Argonne Institute of Science and Engineering at Northwestern University, and as a Research Fellow of the Computation Institute at the University of Chicago. He leads the Programming Models and Runtime Systems group at Argonne. His research interests include parallel programming models and runtime systems for communication and I/O, modern system architecture (multicore, accelerators, complex memory subsystems, high-speed networks), and Cloud computing systems. He has nearly 100 publications in these areas and has delivered nearly 120 talks and tutorials at various conferences and research institutes. He is a recipient of several awards, including the US Department of Energy Early Career award in 2012, TEDxMidwest Emerging Leader award in 2013, Crain's Chicago 40 under 40 award in 2012, Los Alamos National Laboratory Director's Technical Achievement award in 2005, Ohio State University Outstanding Researcher award in 2005, five best paper awards, and various others. He serves as the worldwide chairperson for the IEEE Technical Committee on Scalable Computing (TCSC). He has also served as a chair or editor for nearly 50 journals, conferences, and workshops, and as a technical program committee member for numerous conferences and workshops. He is a senior member of the IEEE and a professional member of the ACM. More details about Dr. Balaji are available at http://www.mcs.anl.gov/~balaji.

Sorav Bansal received the BTech degree in computer science from IIT Delhi in 2001 and the PhD degree from Stanford University in 2008, where he developed a compiler optimization technique called "peephole superoptimization." He leads the systems research group in the Computer Science Department at the Indian Institute of Technology (IIT) Delhi, where his research touches many areas, including fast machine virtualization, binary translation, compiler optimizations, parallel programming, concurrency testing, and data center design. He has published in premier operating system, programming language, and networking conferences and journals including OSDI, SOSP, ASPLOS, FAST, and INFOCOM. He has received multiple research grants/faculty awards from the Government of India and private sector companies like NetApp, Freescale, IBM, among others. For his pedagogical contributions, he received the "Teaching Excellence Award" from IIT Delhi in 2012-2013.

Umesh Bellur is a professor of computer science and engineering at IIT Bombay. Prior to this, he was the founder of a startup (Collation Inc.) in the California Bay area which was subsequently acquired by IBM. He has more than 15 years of professional experience after receiving the PhD degree from Syracuse University. He was awarded the IBM Faculty award for this work in autonomic distributed computing in 2006 and the SAP Research and Innovation award for his work in QoS-based routing in event overlays in 2008. More information can be found at: http://www.cse.iitb.ac.in/~umesh.

David Bernstein is the George Mason University Foundation Professor at the George Mason University School of Law in Arlington, Virginia, where he has been teaching since 1995. He was a visiting professor at Georgetown University Law Center for the Spring 2003 semester, at the University of Michigan School of Law for the 2005-2006 academic year, and at Brooklyn Law School in Fall 2006. Professor Bernstein is a nationally recognized expert on the Daubert v. Merrell Dow Pharmaceuticals and the admissibility of expert testimony, and he is a past chairperson of the Association of American Law Schools Evidence section. Professor Bernstein is the coauthor of *The New Wigmore: Expert Evidence* (Aspen Law and Business, 2004; second edition, 2010), and coeditor of *Phantom Risk: Scientific Inference and the Law* (MIT Press, 1993). Professor Bernstein is also an expert on the "Lochner era" of American constitutional jurisprudence. He is the author of *Only One Place of Redress: African-Americans, Labor Regulations, and the Courts from Reconstruction to the New Deal* (Duke University Press, 2001), and of *Rehabilitating Lochner: Defending Individual Rights against Progressive Reform* (University of Chicago Press, 2011). Professor Bernstein is also the the author of *You Can't Say That! The Growing Threat to Civil Liberties from Antidiscrimination Laws* (Cato Institute, 2003). In addition to his books, Professor Bernstein is the author of dozens of scholarly articles, book chapters, and think tank studies, including articles and review essays in the *Yale Law Journal*, *Michigan Law Review* (2), *Northwestern University Law Review*, *Texas Law Review* (2), *Georgetown Law Journal* (2), *Vanderbilt Law Review*, *California Law Review*, *Washington University Law Review*, *North Carolina Law Review*, *Boston University Law Review*, *Law and Contemporary Problems*, *Journal of Supreme Court History* (3), *Illinois Law Review*, and *Iowa Law Review*. Professor Bernstein teaches Products Liability, Evidence, Constitutional Law I and II, and Expert and Scientific Evidence. He is a contributor to the popular Volokh Conspiracy blog.

Ricardo Bianchini received the PhD degree in computer science from the University of Rochester. He is currently a professor of computer science at Rutgers University. His research interests include Cloud computing, and power/energy/thermal management of data centers. In fact, Professor Bianchini is a pioneer in data center energy management, energy-aware storage systems, energy-aware load distribution across data centers, and leveraging renewable energy in data centers. Professor Bianchini has cochaired the program committees of several conferences and workshops, and currently serves on the editorial board of four journals. Professor Bianchini has published five award papers, and has received the CAREER award from the US National Science Foundation. He is currently an ACM Distinguished Scientist.

Irena Bojanova, PhD, is the Founding Chair of the IEEE CS Cloud Computing STC and an editorial board member of *IT Professional*. She is a professor and program director of information and technology systems at the University of Maryland University College, managed academic programs at Johns Hopkins University and PIsoft Ltd., and costarted OBS Ltd., (now CSC Bulgaria). Her current research interests include Cloud computing, Web-based systems, and educational innovations. She is a member of the IEEE and can be reached at ibojanova@umuc.edu.

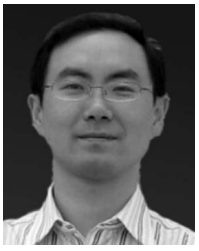
Ivona Brandic received the PhD degree in 2007 and her venia docendi for practical computer science in 2013, both from the Vienna University of Technology. She is an assistant professor in the Distributed Systems Group, Information Systems Institute, Vienna University of Technology (TU Wien). Prior to that, she was an assistant professor in the Department of Scientific Computing, Vienna University. From 2003 to 2007, she participated in the special research project AURORA—Advanced Models, Applications and Software Systems for High Performance Computing and the European Union's GEMSS—Grid-Enabled Medical Simulation Services project. She was involved in the European Union's SCube project and she led the Austrian national FoSII—Foundations of Self-governing ICT Infrastructures project funded by the Vienna Science and Technology Fund (WWTF). She is a management committee member of the European Commission's COST Action on Energy Efficient Large Scale Distributed Systems. From June to August 2008 she was a visiting researcher at the University of Melbourne, Australia. Dr. Brandic is on the editorial board of the Springer *Journal on Scalable Computing*. In 2011, she received the Distinguished Young Scientist Award from the Vienna University of Technology for her HALEY project on Holistic Energy Efficient Hybrid Clouds. Her interests comprise Service Level Agreement and Quality of Service management in large-scale distributed systems, autonomic computing, workflow management for scientific applications, and energy efficient large scale distributed systems (Cloud, Grid, Cluster, etc.). She has published more than 50 scientific journal, magazine, and conference publications and she coauthored a text book on federated and self-manageable Cloud infrastructures. She coauthored the European Union's Cloud Computing report paving future research directions of the EU. In 2010, she chaired the International Conference on Utility and Cloud Computing, held in Chennai, India. She has served on more than 50 program committees (among others, EuroPar, COMPSAC, CloudCom) and was an invited reviewer of more than 10 international journals. In 2011, she edited two special issues for *Future Generation Computer Systems* (Elsevier) and *Scientific Programming Journal* (IOS Press). She has been invited expert evaluator of the European Commission, French National Research Organization (ANR), National Science and Engineering Research Council Canada (NSERC), and Netherlands Organization for Scientific Research (NWO).

Roy Campbell – Biography not available.

Junwei Cao received the PhD degree in computer science from University of Warwick, United Kingdom, in 2001. He received the master's and bachelor's degrees from Tsinghua University in 1998 and 1996, respectively. He is currently a professor and Deputy Director of the Research Institute of Information Technology, Tsinghua University, China. He is also the Director of the Open Platform & Technology Division, Tsinghua National Laboratory for Information Science and Technology, Beijing, China. His research is focused on distributed computing technology and applications. Before joining Tsinghua in 2006, he was a research scientist at the Massachusetts Institute of Technology. Before that, he worked as a research scientist at NEC Europe Ltd., Germany. He has published more than 150 academic papers and books. He is a senior member of the IEEE Computer Society and a member of the ACM and CCF.

Beng Chin Ooi received the BSc (1st Class Honors) and PhD degrees from Monash University, Australia, in 1985 and 1989, respectively. He is a distinguished professor of computer science at the National University of Singapore (NUS). His research interests include database system architectures, performance issues, indexing techniques, and query processing, in the context of multimedia, spatio-temporal, distributed, parallel, P2P, and Cloud database systems and applications. He has served as a PC member for international conferences such as ACM SIGMOD, VLDB, IEEE ICDE, WWW, and SIGKDD, and as Vice PC Chair for ICDE '00, '04, '06, co-PC Chair for SSD '93 and DASFAA '05, PC Chair for ACM SIGMOD '07, Core DB PC chair for VLDB '08, and PC co-Chair for IEEE ICDE '12. He was an editor of the *VLDB Journal* and *IEEE Transactions on Knowledge and Data Engineering* (*TKDE*), Editor-in-Chief of *TKDE* (2009-2012), and a cochair of the ACM SIGMOD Jim Gray Best Thesis Award committee. He is serving as a trustee board member and executive of the VLDB Endowment. He is the recipient of the ACM SIGMOD 2009 Contributions award, a co-winner of the 2011 Singapore President's Science Award, the recipient of the 2012 IEEE Computer Society Kanai award, and of the 2013 NUS Outstanding Researcher Award. He is a fellow of the ACM and the IEEE.

Peter Corcoran is a graduate of Trinity College Dublin with engineering and PhD degrees in 1984 and 1987. He has been a university professor for 26 years at the National University of Ireland, Galway. He is Editor-in-Chief of the *IEEE Consumer Electronics Magazine* and was elevated to IEEE fellow in 2010 for his contributions to digital camera technology. He has more than 250 technical publications, more than 55 peer reviewed journal papers, more than 100 international conference papers and publications; is co-inventor on more than 150 granted US patents, with another 100+ patents currently pending. He is currently on sabbatical leave having completed a seven year term as Vice-Dean of Research and Graduate Studies in the College of Engineering and Informatics at NUI Galway. He has a broad interest in consumer electronics (CE) technologies. More specific research interests include 1) smart-imaging and advanced digital imaging solutions, 2) CE device connectivity and networking, 3) smart grid and associated networking issues, and, naturally, 4) Cloud computing and CE devices. He is also an entrepreneur and industry consultant.



Yong Cui received the BE and PhD degrees from Tsinghua University, China, in 1999 and 2004, respectively. He is currently a full professor at Tsinghua University, a council member of the China Communication Standards Association, and cochair of IETF IPv6 Transition WG Softwire. Having published more than 100 papers in refereed journals and conferences, he received the best paper awards from ACM ICUIMC 2011 and WASA 2010. Holding more than 40 patents, he won the National Science and Technology Progress Award of China in 2005, the Influential Invention Award of China Information Industry in both 2012 and 2004. He is one of the authors of RFC 5747 and RFC 5565 for his proposal on IPv6 transition technologies. He serves on the editorial board on the *IEEE Transactions on Parallel and Distributed Systems* and *IEEE TCC*. His major research interests include mobile wireless Internet and computer network architecture.

Cesar Augusto F. De Rose received the BSc degree in computer science from the Catholic University of Rio Grande do Sul (PUCRS, Porto Alegre, RS, Brazil, 1990), the MSc degree in computer science from the Federal University of Rio Grande do Sul (CPGCC-UFRGS, Porto Alegre, RS, Brazil, 1993), and the Doctoral degree from Karlsruhe University (KIT - Karlsruhe, Germany, 1998). He joined the PUCRS Computer Science Department as a lecturer in 1998, as a member of the Parallel and Distributed Processing Group (full professor since 2012). His research interests include resource management in parallel and distributed architectures (Cluster, Grid, and Cloud) and virtualization. In 2009, he founded and since then has been lead researcher at the PUCRS High Performance Laboratory (LAD-PUCRS).

Murat Demirbas received the PhD degree from The Ohio State University in 2004 and was a postdoctorate researcher with the Theory of Distributed Systems Group at the Massachusetts Institute of Technology (MIT) in 2005. He is an associate professor of computer science and engineering at the State University of New York at Buffalo. His research interests are in distributed and networked systems, Cloud computing, distributed algorithms, and self-stabilizing fault tolerance. He received the US National Science Foundation CAREER award in 2008, and the UB Exceptional Scholars Young Investigator Award in 2010.

David De Roure is a professor of e-Research at the University of Oxford, Director of the Oxford e-Research Centre, Co-Director of the Institute for the Future of Computing in the Oxford Martin School, and has a coordinating role in Digital Humanities at Oxford. Focused on advancing digital scholarship, he works closely with multiple disciplines, including social sciences (concentrating on *social machines* and *web observatories*), digital humanities (computational musicology), and previously bioinformatics, chemistry, environmental science, and social statistics. He is an expert in big data analytics and has an extensive background in distributed computing, Web, Linked Data, and social computing, runs the myexperiment.org social website for sharing scientific workflows, and promotes innovation in scholarly communication. He is closely involved in The Oxford Research Centre in the Humanities, is a member of the Cyber Security Centre, and collaborates in Oxford's WSTNet laboratory with the Oxford Internet Institute. He was closely involved in the UK e-Science programme and held a national role from 2009-2013 as the UK National Strategic Director for Digital Social Research. He is a UK representative on the European e-Infrastructure Reflection Group, one of the UK PIs for the Square Kilometre Array telescope, a chair of the UK e-Science Forum, and a partner in the UK Software Sustainability Institute. He is a champion for the Web Science Trust, chairs the W3C Web Observatory Community Group, and in 2011, was elected as a research fellow at the Graduate School of Library and Information Science at the University of Illinois at Urbana-Champaign. He is a fellow of the British Computer Society, a member of the Institute of Mathematics and ITS Applications, a Supernumerary fellow of Wolfson College, and a member of the Wolfson College Digital Research Cluster.

Janakiram Dharanipragada received the PhD degree from IIT, Delhi. He is currently a professor in the Department of Computer Science and Engineering, Indian Institute of Technology (IIT) Madras, India, where he heads and coordinates the research activities of the Distributed and Object Systems Lab. His current research focus is on building large scale distributed systems focusing on design pattern-based techniques, measurements, peer-peer middleware-based grid systems, etc. He is currently the SIG Chair of Distributed Computing of the Computer Society of India and is also the founder of the Forum for Promotion of Object Technology in India. He was awarded the Boyscast Fellowship in 1997. He was awarded the IBM Faculty Award in 2007 and the Yahoo Faculty Grant in 2009. He has guided 12 PhD, more than 34 MS (research), and 60 MTech students. He has more than 150 international journal/ international conferences publications. He is a Board of Studies member of JNTU, Hyderabad, JNTU, Kakinada, Andhara University, SV University, Cochin University, VIT University, and Anna University. He has authored more than 100 research papers and is the editor for six books. His books *Grid Computing* and *Building Large Scale Software Systems* have been brought out by Tata McGraw Hill Publishers. He is the principal investigator for a number of projects which include MobiTel: Mobile Telemedicine for rural India, Peer-to-peer Concept Search (Indo-Italian Collaborative project), Service Oriented Architecture for Linux Kernel (DIT), and Cloud Bursting Architecture for Document workflow (Xerox). He is also the founding chair of the ACM Chennai chapter. He is on the board of directors for a few start-up companies in developing Cloud computing-based products (Daneebo and Exa Tech).

Beniamino Di Martino received the MS degree (magna cum laude) in physics and the PhD degree in information engineering, both from the University of Naples, Italy, in 1992 and 1996, respectively. Since 2005, he has been a full professor of information systems at the Second University of Naples, Italy. In 1994, he joined the Institute for Software Technology and Parallel Systems at the University of Vienna, Austria, where he was a researcher until 1998, funded from 1996 to 1998 by the EC Marie Curie Support scheme (Marie Curie Fellow). In 1998, he moved to the Second University of Naples, Italy, where he was an assistant professor until 2002, and an associate professor of information systems until 2005. He has been a scientific consultant for IBM Italia and ENEA (Italian National Agency for New Technology, Energy, and the Environment). He is vice director of the Department of Industrial and Information Engineering. He is the author of eight international books and more than 200 publications in international journals and conferences. He is project coordinator of EU funded FP7-ICT-2010-256910 Project "mOSAIC - Open-Source API and Platform for Multiple Clouds." He has been participating to various research projects supported by national and international organizations (international projects include: EU-ICT Mosaic and EU-SMARTCITIES CoSSmiC, EU-ARTEMIS Crystal, EU-IST OntoWeb and APART, EU-Esprit HPF+ and PPPE, CEI PACT, EU-TMR, Austrian-SFB AURORA, Austrian FWF HLPS; Italian national projects include: MUR PRIN "Cloud@Home" (responsible for SUN unit), "Mosaico" and "Iside," FAR—Laboratori Pubblico-Privati—"LC3" (responsible for SUN Unit), CNR PF and Agenda 2000 (Project Responsible)). He is an editor/associate editor of three international journals and an editorial board member of many international journals. He served as general and program chairman, and a member of program committees, of several international conferences, and as guest editor for several journals' special issues. He acted as Chair of the Nomination Committee for the "2012 IEEE Award of Excellence in Scalable Computing" and as a member of the Nomination Committee for the "2009 IEEE TCSC Medal for Excellence in Scalable Computing." He was vice Chair of the Executive Board of the IEEE CS Technical Committee on Scalable Computing. He is a member of the IEEE Working Group on Cloud Interoperability. He is a member of the Cloud Standards Customer Council. He is a member of the Cloud Computing Experts' Group of European Commission - Internet of Services, Software and Virtualization Unit. He is a member of the Steering Committee of IDEM (IDEntity Management) Italian Federation. He acted as Evaluator and Reviewer of scientific projects for the European Commission (FP7 programmes ICT, ICT-PSP and eInfrastructures), for the European Research Council (ERC), for the Belgium Research Ministry, for the Luxembourg Research Ministry, for the Chile Research Ministry, for the Italian Research and Economic Development Ministries, for the Campania, Piemonte, and Calabria Regional Governments. He acted as a member of Committee for Promotion to positions of Senior Lecturer at the University of Cork, Ireland, and at the University of Lille, France. He acted as a member of Examination Committees for the degree of Doctor of Philosophy (PhD) in Computer Science for the University of Oxford, the University of Cyprus, The University of La Laguna, the University of Sidney, the University of Vienna, the University of Genova, the Calabria University, the University of Rome "Tor Vergata", the Politechnical University of Turin, and the Second University of Naples. His research interests include: knowledge discovery and management, semantic web and semantic web services, semantic-based information retrieval, Cloud computing, high performance computing and architectures, mobile and intelligent agents and mobile computing, reverse engineering, automated program analysis and transformation, algorithmic patterns recognition and program comprehension, and image analysis.

Dick Epema received the MSc and PhD degrees in mathematics from Leiden University and the MSc degree in computer science from Delft University of Technology, both in The Netherlands. He is an associate professor at TU Delft and a full professor at TU Eindhoven, and conducts research in grids, clouds, and peer-to-peer systems, with an emphasis on the design and the performance analysis of such systems. His main contribution to the area of grid computing is the design, the implementation, and the analysis of a scheduling system called KOALA for multicluster grids. His main contribution in the area of peer-to-peer systems is in mechanisms for improving download performance, for video-on-demand, and for reputations in the context of the Tribler peer-to-peer project in Delft. From 1987-1988, the fall of 1991, and the summer of 1998, he was a visiting scientist at the IBM T.J. Watson Research Center in New York. In the fall of 1992, he was a visiting professor at the Catholic University of Leuven, Belgium, and in the fall of 2009 he spent a sabbatical at the University of California, Santa Barbara. He has coauthored more than 100 papers in peer-reviewed conferences and journals, he was a general cochair of Euro-Par 2009 and IEEE P2P 2010, he was the general chair of HPDC 2012 and CCGrid 2013, and he was vice program chair of CCGrid 2010 and program co-chair of HPDC 2013. He received best-paper awards at the IEEE P2P 2006, the CCGrid 2010, and the MASCOTS 2013 conferences.

Thomas Fahringer is a professor of computer science at the University of Innsbruck. He is leading a research group in the area of distributed and parallel processing which develops the ASKALON system to support researchers worldwide in various fields of science and engineering to develop, analyze, optimize, and run parallel and distributed scientific applications. Furthermore, he leads a research team that created the Insieme parallelizing and optimizing compiler for heterogeneous multicore parallel computers. Before joining the University of Innsbruck, he worked as an assistant and associate professor at the University of Vienna, where his research focused on compiler technology and tools for high performance applications. He is a graduate of the Technical University of Vienna with a doctorate in computer science. He was involved in numerous national and international research projects, including 10 EU funded projects. He has published five books, 35 journal and magazine articles, and more than 160 reviewed conference papers, including three best/distinguished IEEE/ACM papers.

Jose Fortes received the BS degree in electrical engineering (Licenciatura em Engenharia Electrotécnica) from the Universidade de Angola in 1978, the MS degree in electrical engineering from Colorado State University, Fort Collins, in 1981, and the PhD degree in electrical engineering from the University of Southern California, Los Angeles, in 1984. He is the AT&T Eminent Scholar and Professor of Electrical and Computer Engineering and Computer Science at the University of Florida, where he founded and is the Director of both the Advanced Computing and Information Systems Laboratory and the multi-university NSF Industry-University Cooperative Research Center on Autonomic Computing. From 1984 until 2001, he was on the faculty of the School of Electrical Engineering of Purdue University in West Lafayette, Indiana. In 2001, he joined both the Department of Electrical and Computer Engineering and the Department of Computer and Information Science and Engineering of the University of Florida as a professor and Bell South Eminent Scholar. From July 1989 through July 1990, he served at the US National Science Foundation as director of the Microelectronics Systems Architecture program. From June 1993 till January 1994, he was a visiting professor in the Computer Architecture Department at the Universitat Politecnica de Catalunya in Barcelona, Spain. His research interests are in the areas of distributed computing, autonomic computing, computer architecture, parallel processing, and fault-tolerant computing. He has authored or coauthored more than 200 technical papers and has led the development and deployment of Cloud and Grid-computing software used in several cyberinfrastructures for e-Science and digital government. His research has been funded by the US Office of Naval Research, AT&T Foundation, IBM, General Electric, Intel, Northrop-Grumman, US Army Research Office, NASA, the Semiconductor Research Corporation, and the US National Science Foundation. He is a fellow of the IEEE and the American Association for the Advancement of Science (AAAS). He was a distinguished visitor of the IEEE Computer Society from 1991 until 1995. He is on the editorial boards of the the *IEEE Transactions on Services Computing*, the *International Journal on Parallel Programming*, and the *Journal of VLSI Signal Processing*. He is also a past member of the editorial boards of the *IEEE Transactions on Parallel and Distributed Systems*, the *ACM Journal on Emerging Technologies in Computing Systems*, *Cluster Computing: The Journal of Networks, Software Tools and Applications*, and the *Journal of Parallel and Distributed Computing*.

Geoffrey Fox received the PhD degree in theoretical physics from Cambridge University and is now a professor of informatics and computing and physics at Indiana University, where he is director of the Digital Science Center and Associate Dean for Research and Graduate Studies at the School of Informatics and Computing. He previously held positions at Caltech, Syracuse University, and Florida State University. He has supervised the PhD work of 61 students and published more than 600 papers in physics and computer science. He currently works in applying computer science to bioinformatics, defense, earthquake and ice-sheet science, particle physics, and chemical informatics. He is principal investigator of FutureGrid—a new facility to enable development of new approaches to computing. He is involved in several projects to enhance the capabilities of minority serving institutions.

Erol Gelenbe is a fellow of the IEEE and the ACM, and the Dennis Gabor Chair Professor in electrical and electronic engineering at Imperial College. He has introduced performance models based on diffusion approximations, invented new mathematical models such as G-networks and the Random Neural Network, and contributed to performance engineering software tools such as FLEXSIM and QNAP that are applied in industry and used in academia. His designs include the SYCOMORE multiprocessor packet switch, the fiber optics random access network XANTHOS, optimal protocols for random access communications, optimum check-points for databases, the FLEXSIM database driven simulator for manufacturing systems, and the first fully implemented Software Defined Network CPN (Cognitive Packet Network) and its adaptive routing protocol. He currently works on the interaction between Energy Consumption and Quality of Service in ICT, and on the security of Mobile Networks. His awards include the Grand Prix France Telecom of the French Academy of Sciences (1996), ACM's SIGMETRICS Life-Time Achievement Award http://www.sigmetrics.org/achievementaward-2008.shtml, the UK's IET Oliver Lodge Medal http://eandt.theiet.org/magazine/2011/01/profile-prof-gelenbe.cfm, and the Parlar Science Foundation Award (Turkey, 1994). An elected member of the French National Academy of Engineering, the Hungarian Academy of Sciences, the Polish Academy of Sciences, and the Science Academy of Istanbul, Turkey, he has received Honoris Causa doctorates from the Universities of Liege (Belgium), Roma-Tor Vergata, and Bogazici (Istanbul). His recent papers have appeared in the *Physical Review*, the *Communications of the ACM*, the *ACM/IEEE Transactions on Bioinformatics*, the *ACM Transactions on Internet Technology*, the *ACM Transactions on Autonomous and Adaptive Systems*, the *IEEE Transactions on Nano-Bio Systems*, the *Proceedings of the Royal Society*, and the *Computer Journal*. He coordinates the EU FPC ICT-8 Project NEMESYS (2012-2015) on Mobile Network Security, and his other funded research projects are EPSRCECROPS (2013-2016) on Energy Savings and Harvesting in ICT, a MoD/DSTL Project on Energy Savings in Digital Cities (2012-2016), EU FP7 PANACEA (2013-2016) on Self-Organising Cloud Computing, and the Smart Networks at the Edge project of the European Institute of Technology. A Distinguished Lecturer of the IEEE Communication Society for 2013-2014, his recent publications can be found at http://san.ee.ic.ac.uk and http://sa.ee.ic.ac.uk. Recent/future conference chairships and PCs include: General Chair IEEENCCA (3-5 December 2012) https://sites.google.com/site/ieeencca2012, co-general chair IEEE HPCC 2013 http://trust.csu.edu.cn/conference/hpcc2013/, PerNEMWorkshop co-chair since 2012 (PERCOM Conference), IEEE MASCOTS 2013 TPC Co-Chair, http://ieee-ssci.org, and ICAC 2013, 26-28 June 2013. He is an associate editor of *Acta Informatica*, *IEEE Networks*, *ACM Ubiquity*, *Performance Evaluation*, *Theory and Applications of Informatics*, *Telecommunication Systems*, and *InfoCommunications Journal*.

Phillip B. Gibbons received the PhD degree in computer science from the University of California, Berkeley, in 1989. He is a principal research scientist at Intel Labs (2001-present) and principal investigator for the Intel Science and Technology Center for Cloud Computing (2011-present). He joined Intel Labs (called Intel Research at the time) after 11 years at (AT&T and Lucent) Bell Laboratories. He is an adjunct (full) professor in the Computer Science Department at Carnegie Mellon University. His research areas include parallel computing, databases, big data, Cloud computing, sensor networks, distributed systems, and computer architecture. His publications span theory and systems, across a broad range of computer science (e.g., papers in ASPLOS, CCS, CIDR, EuroSys, JFP, PACT, PLDI, PODC, PPoPP, SIGMOD, SPAA, ToN, and VLDBJ in 2010-2012).

Masum Z. Hasan received the MMath and PhD degrees in computer science from the University of Waterloo, Canada, and combined BEng-MEng in computer engineering from Odessa National Polytechnic University in Ukraine. He is currently a technology director at the Cloud CTO office of Cisco Systems, San Jose, California. He currently leads R&D work in Cloud networking, network virtualization, and programmable networking (also known as SDN: Software-Defined Networking). His work focus also has been in the area of Grid/high-performance computing, healthcare computing and networking, network analytics, traffic engineering, application and network resource access control, and network management. His prior job experiences include Principal Investigator at Bell Labs, USA, Research Scientist at the University of Toronto, Canada, and software engineer/computer scientist positions in a number of companies/institutions in Canada and Bangladesh. He has been serving on the organizing and technical program committees of a number of IEEE/IFIP international conferences and is a coeditor of a number of journals and magazines. He also serves as the chair for the IEEE Communications Society's Committee on Cloud Communications and Networking (https://sites.google.com/site/masumzh/home).

Kai Hwang received the PhD degree in EECS from the University of California, Berkeley, in 1972. He is a world-renowned scholar in computer science, information engineering, and Internet technology. Presently, he is a professor at the University of Southern California. In his 40 year academic career, he has made outstanding contributions to the fields of computer architecture, parallel processing, distributed systems, Internet security, and Cloud computing. An IEEE fellow, he served as the founding Editor-in-Chief of the *Journal of Parallel and Distributed Computing* (*JPDC*) for 28 years. His most recent book, *Distributed and Cloud Computing*, was praised by the American Library Association as a best title published by Elsevier in 2012. He received the Lifetime Achievement Award from IEEE CloudCom in 2012.

Hai Jin received the PhD degree in computer engineering from HUST in 1994. He is a Cheung Kung Scholars Chair Professor of computer science and engineering at the Huazhong University of Science and Technology (HUST) in China. He is now Dean of the School of Computer Science and Technology at HUST. In 1996, he was awarded a German Academic Exchange Service fellowship to visit the Technical University of Chemnitz in Germany. He worked at The University of Hong Kong between 1998 and 2000, and as a visiting scholar at the University of Southern California between 1999 and 2000. He was awarded the Excellent Youth Award from the National Science Foundation of China in 2001. He is the chief scientist of ChinaGrid, the largest grid computing project in China, and the chief scientist of the National 973 Basic Research Program Project of Virtualization Technology of Computing System. He is a senior member of the IEEE and a member of the ACM. He has coauthored 15 books and published more than 400 research papers. His research interests include computer architecture, virtualization technology, cluster computing and Grid computing, peer-to-peer computing, network storage, and network security.

Rao Kotagiri received the PhD degree from Monash University. He was awarded the Alexander von Humboldt Fellowship in 1983. He has been at the University of Melbourne since 1980 and was appointed as a professor of computer science in 1989. He held several senior positions, including Head of Computer Science and Software Engineering, Head of the School of Electrical Engineering and Computer Science at the University of Melbourne, and Research Director for the Cooperative Research Centre for Intelligent Decision Systems. He served on the editorial boards of the *Computer Journal*, *Universal Computer Science*, *IEEE Transactions on Knowledge and Data Engineering*, and the *VLDB Journal*. He was the program co-chair for the VLDB, PAKDD, DASFAA, and DOOD conferences. He is a steering committee member of IEEE ICDM, PAKDD, and DASFAA. He received the distinguished contribution award for Data Mining. He is a fellow of the Institute of Engineers Australia, a fellow of the Australian Academy Technological Sciences and Engineering, and a fellow of the Australian Academy of Science. He was awarded a Distinguished Contribution Award in 2009 by the Computing Research and Education Association of Australasia. His research interests include big data analytics, data mining, and machine learning.

Chandra Krintz is a professor of computer science at the University of California, Santa Barbara (UCSB). She joined the UCSB faculty in 2001 after receiving the MS and PhD degrees in computer science from the University of California, San Diego (UCSD). She has led a number of different research projects that have advanced the state of the art in programming systems in ways that improve performance and energy consumption, and that ease development and deployment of software. Recently, her work has targeted distributed and multilanguage runtime systems and cloud platforms. She has advised more than 60 undergraduate and graduate students, has publised numerous research articles regarding the implementation of programming languages in venues that include ASPLOS, ECOOP, HotCloud, IEEE Cloud, PLDI, OOPSLA, and others, participates in efforts to broaden participation in computing, and is the progenitor of the AppScale project. Her efforts have been recognized with a US National Science Foundation CAREER award, the CRA-W Anita Borg Early Career Award (BECA), the UCSB Academic Senate Distinguished Teaching Award, and ACM and IEEE senior membership.

Ruby B. Lee received the PhD degree in electrical engineering and the MS degree in computer science, both from Stanford University, and the AB with distinction from Cornell University, where she was a College Scholar. She is the Forrest G. Hamrick Professor of Engineering and Professor of Electrical Engineering at Princeton University, with an affiliated appointment in the Computer Science Department. She is the director of the Princeton Architecture Laboratory for Multimedia and Security (PALMS). Her current research is in designing security and new media support into core computer architecture, embedded systems and global networked systems, and in architectures resistant to Distributed Denial of Service attacks and Internet-scale epidemics. She teaches courses in cyber security and processor architectures for new paradigms. She is a fellow of the ACM and the IEEE. She is Associate Editor-in-Chief of *IEEE Micro* and an editorial board member of *IEEE Security and Privacy*. Prior to joining the Princeton faculty in 1998, Dr. Lee served as chief architect at Hewlett-Packard, responsible at different times for processor architecture, multimedia architecture, and security architecture for e-commerce and extended enterprises. She was a key architect in the definition and evolution of the PA-RISC architecture used in HP servers and workstations, and also led the first CMOS PA-RISC single-chip microprocessor design. As chief architect for HP's multimedia architecture team, Dr. Lee led an interdisciplinary team focused on architecture to facilitate pervasive multimedia information processing using general-purpose computers. This resulted in the first desktop computer family with integrated, software-based, high fidelity, real-time multimedia. Dr. Lee also co-led a multimedia architecture team for IA-64. Concurrent with full-time employment at HP, Dr. Lee also served as a consulting professor of electrical engineering at Stanford University. She is an elected member of Phi Beta Kappa and Alpha Lambda Delta. She has been granted 115 US and international patents, with several patents pending.

Laurent Lefèvre received the PhD degree in computer science in January 1997 from LIP Laboratory (Laboratoire Informatique du Parallelisme) in ENS-Lyon (Ecole Normale Superieure), France. From 1997 to 2001, he was an assistant professor of computer science at Lyon 1 University and a member of the RESAM Laboratory (High Performance Networks and Multimedia Application Support Lab). Since 2001, he has been a research associate of computer science at INRIA (the French Institute for Research in Computer Science and Control). He is a member of the INRIA AVALON team (Algorithms and Software Architectures for Distributed and HPC systems) from the LIP laboratory in Lyon, France. His research interests focus on green and energy efficient computing and networking. He has organized several conferences in high performance networking and computing and he is a member of several program committees. He has coauthored more than 100 papers published in refereed journals and conference proceedings. He participates in several national, European, and international projects on energy efficiency in HPC, Clouds, and networks. For more information, visit: http://perso.ens-lyon.fr/laurent.lefevre/.

Hui Lei received the PhD degree in computer science from Columbia University. He is currently senior manager of the Cloud Platform Technologies Department at the IBM T.J. Watson Research Center, and leads IBM's worldwide research strategy in Cloud infrastructure services. His research has spanned the areas of Cloud computing, mobile computing, service-oriented computing, business process management, and event-based systems, with an emphasis on software infrastructure and data management issues. His research contributions have impacted many commercial software and service products, resulted in more than 50 issued or pending patents, been featured in numerous news media reports, and earned him multiple IBM Outstanding Technical Achievement Awards. He has served as chair of the IEEE Computer Society's Technical Committee on Business Informatics and Systems, and holds a Visiting Professor appointment at Sun Yat-sen University. More information on Dr. Lei's background is available at http://www.research.ibm.com/people/h/hlei.

Qianhui Liang received the PhD (2005) degree in computer engineering from the University of Florida, and the master's and bachelor's degrees in computer science from Zhejiang University, China. She is a senior researcher in the Cloud & Security Lab at HP Labs Singapore. She is on the editorial board of the *International Journal of Cloud Computing* (*IJCC*) and an associate editor of the upcoming *International Journal of Big Data* (*IJBD*). She has served on numerous program committees and conference organizing committees, including as program co-chair of research program for Cloud Computing Asia Conference 2013 (CloudAsia 2013), co-chair of Work-In-Progress for IEEE 2011 International Conference on Services Computing (SCC 2011), general vice chair for IEEE/ACM International Conference on Cyber, Physical and Social Computing (CPSCom 2010), and program vice-chair for the IEEE 2009 International Conference on Information Reuse and Integration (IRI '09). Her research interests span machine learning and AI, and their applications in solving emerging problems of new distributed computing paradigms, such as Cloud computing and service computing. She has more than 50 publications, including two book chapters and refereed papers at international conferences and journals. She served as the Honorary Treasurer of the Singapore Cloud Forum, officially representing HP as an exco member of the forum.

David Lie received the BS degree from the University of Toronto in 1998, and the MS and PhD degrees from Stanford University in 2001 and 2004, respectively. He is currently an associate professor in the Department of Electrical and Computer Engineering at the University of Toronto. While at Stanford, he founded and led the XOM (eXecute Only Memory) Processor Project, which supports the execution of tamper and copy-resistant software. He was the recipient of a best paper award at SOSP for this work. He is also a recipient of the MRI Early Researcher Award. He leads the software security theme of the NSERC ISSNet Strategic Network on Systems Security and is a member of its Scientific Advisor Board. He has served on various program committees including OSDI, ASPLOS, Usenix Security, and IEEE Security & Privacy. Currently, his interests are focused on securing mobile platforms, Cloud computing security, and increasing the reliability of software.

Ignacio Martín Llorente received the PhD degree in computer architecture from UCM and the executive MBA from the Instituto de Empresa. He is the director of the OpenNebula Project, a co-founder of C12G Labs, and a full professor at UCM. He is an entrepreneur and researcher in the field of cloud and distributed computing, having managed several international projects and initiatives on Cloud computing, and authored many articles in the leading journals and proceedings books. His research interests include high-performance computing, virtualization, Cloud computing, and Grid technology. He is a senior member of the IEEE (imllorente@opennebula.org).

Andrew Martin undertakes research and teaching in the area of systems security at the University of Oxford. He conceived the university's new Cyber Security Centre and helps to direct it, leading the university's successful bid to be recognized as a Centre of Excellence in Cyber Security Research. He directs the new Centre for Doctoral Training in Cyber Security, and also helps to lead courses for Software Professionals as part of Oxford University's Software Engineering Programme—the Master of Science in Software and Systems Security. His recent research focus has been on the technologies of Trusted Computing, exploring how they can be applied in Grid and Cloud computing contexts, as well as in mobile devices, in order to address their emerging security challenges. He has published extensively in this area, hosting several related international events in Oxford and speaking on the subject all over the world. He wrote a doctoral thesis on the subject "Machine-Assisted Theorem Proving for Software Engineering," in the early 1990s. He then worked as a research fellow in the Software Verification Research Centre at the University of Queensland, Australia. Returning to the UK, he was briefly a lecturer at the University of Southampton, before returning to Oxford to take up his present post in 1999. Dr. Martin is a fellow of Kellogg College, Oxford. He is presently the supervisor for seven doctoral students, and holds several research grants.

Dejan Milojicic received the BSc and MSc degrees from the University of Belgrade (1983 and 1986) and the PhD degree from the University of Kaiserslautern (1993). Prior to HP Labs, he worked at the Institute "Mihajlo Pupin," Belgrade (1983-91) and at the OSF Research Institute, Cambridge, Massachusetts (1994-98). He is the IEEE Computer Society President 2014, is a senior researcher and manager at HP Labs (1998-present). He has worked in the areas of operating systems, distributed systems, and service management for more than 30 years. Dr. Milojicic has published more than 130 papers in many journals and conferences. He was the inaugural Editor-in-Chief of *IEEE Computing Now*, a front end to IEEE Computer Society publications. He holds 12 patents and 25 patent applications. He has been engaged in standardization bodies, such as OMG and Global Grid Forum. He is an ACM distinguished engineer, IEEE fellow, and member of USENIX.

Vojislav Misic received the PhD degree in computer science from the University of Belgrade, Serbia, in 1993. He is a professor of computer science at Ryerson University in Toronto, Ontario, Canada. His previous posts include the University of Belgrade, Serbia; the Hong Kong University of Science and Technology, Hong Kong, China; and the University of Manitoba, Winnipeg, Manitoba, Canada. His research interests include systems and software engineering as well as performance evaluation of wireless networks. He has authored or coauthored six books, 20 book chapters, and more than 200 papers in archival journals and at prestigious international conferences. He is a senior member of the IEEE and a member of the ACM and AIS.

Manish Parashar is a professor of electrical and computer engineering at Rutgers University. He is the founding director of the Rutgers Discovery Informatics Institute (RDI2) and of the US National Science Foundation Cloud and Autonomic Computing Center (CAC), and is associate director of the Rutgers Center for Information Assurance (RUCIA). He received the BE degree from Bombay University, India, and the MS and PhD degrees from Syracuse University. His research interests are in the broad areas of parallel and distributed computing and computational and data-enabled science and engineering. A key focus of his research is on addressing the complexity or large-scale systems and applications through programming abstractions and systems. He serves on the editorial boards and organizing committees of a large number of journals and international conferences and workshops, and has deployed several software systems that are widely used. He has also received numerous awards and is a fellow of the AAAS, fellow of the IEEE and IEEE Computer Society, and a senior member of the ACM. For more information, please visit http://parashar.rutgers.edu/.

Siani Pearson received the MA degree from Oxford University in logic, the PhD degree in artificial intelligence from the University of Edinburgh, and was a research fellow at Cambridge University before joining HP in 1994. She is a principal research scientist in the Security and Cloud Research Lab. The focus of her research is on privacy enhancing technologies, accountability, and the Cloud. She has been editor and coauthor of books on trusted computing and on privacy and security for Cloud computing, and is an associate editor for journals on trust management and on Cloud computing. She is vice president of the UK Chapter of the Cloud Security Alliance and a member of the steering committees of CSA GRC Stack and IFIP TM; the HP Privacy and Data Protection Board; the HP security forum; numerous program committees, including being program chair of IEEE CloudCom 2013; and the advisory boards of several universities and EU projects.

Ioan Raicu received the PhD degree in computer science from the University of Chicago under the guidance of Dr. Ian Foster in March 2009. He is an assistant professor in the Department of Computer Science (CS) at the Illinois Institute of Technology (IIT), as well as a guest research faculty member in the Math and Computer Science Division (MCS) at Argonne National Laboratory (ANL). He is also the founder (2011) and director of the Data-Intensive Distributed Systems Laboratory (DataSys) at IIT. He has received the prestigious US National Science Foundation (NSF) CAREER award (2011-2015) for his innovative work on distributed file systems for exascale computing. He was an NSF/CRA Computation Innovation Fellow at Northwestern University from 2009-2010. He is a three year award winner of the GSRP Fellowship from NASA Ames Research Center. His research work and interests are in the general area of distributed systems. His work focuses on a relatively new paradigm of Many-Task Computing (MTC), which aims to bridge the gap between two predominant paradigms from distributed systems, High-Throughput Computing (HTC) and High-Performance Computing (HPC). His work has focused on defining and exploring both the theory and practical aspects of realizing MTC across a wide range of large-scale distributed systems. He is particularly interested in resource management in large scale distributed systems with a focus on many-task computing, data intensive computing, cloud computing, grid computing, and many-core computing. Over the past decade, he has coauthored 90 peer reviewed articles, book chapters, books, theses, and dissertations, which received more than 3,500 citations, with a H-index of 22. His work has been funded by the NASA Ames Research Center, DOE Office of Advanced Scientific Computing Research, the US NSF/CRA CIFellows program, and the US NSF CAREER program. He has also founded and chaired several workshops, such as the ACM Workshop on Many-Task Computing on Grids and Supercomputers (MTAGS), the IEEE International Workshop on Data-Intensive Computing in the Clouds (DataCloud), and the ACM Workshop on Scientific Cloud Computing (ScienceCloud). He is on the editorial boards of the *Springer Journal of Cloud Computing Advances, Systems and Applications* (*JoCCASA*), as well as a guest editor for the *IEEE Transactions on Parallel and Distributed Systems* (*TPDS*), the *Scientific Programming Journal* (*SPJ*), and the *Journal of Grid Computing* (*JoGC*). He has been in leadership roles for several high profile conferences, such as HPDC, CCGrid, Grid, eScience, and ICAC. He is a member of the IEEE and the ACM. More information can be found at http://www.cs.iit.edu/~iraicu/, http://datasys.cs.iit.edu/, and http://www.linkedin.com/in/ioanraicu.

Omer Rana received the PhD degree in neural computing and parallel architectures from Imperial College (LondonUniversity, UK), and the MSc degree in microelectronics systems design from the University of Southampton, UK and the BEng degree in informatics systems engineering from Imperial College (London University, UK). He is a professor of performance engineering at Cardiff University's School of Computer Science and Informatics. Prior to joining Cardiff University, he worked as a software engineer with Marshall BioTech Limited in London.

Chunming Rong is head of the Center for IP-based Service Innovation (CIPSI) at the University of Stavanger (UiS) in Norway. The CIPSI has the mission to promote cross-fertilization between several research fields to facilitate design and delivery of large-scale and complex IP-based services required by many application areas. He is also a visiting chair professor at Tsinghua University and also served as an adjunct professor at the University of Oslo 2005-2009. He spent one sabbatical year as a visiting professor at Stanford University 2009-2010. His research interests include Cloud computing, big data analysis, security and privacy. He is co-founder and chairman of the Cloud Computing Association (CloudCom.org) and its associated conference and workshop series. He is a member of the IEEE Study Group on Cloud Standard and co-chairs the IEEE Technical Area of Cloud Computing in TCSC (Technical Committee on Scalable Computing). He is the co-Editor-in-Chief of the *Journal of Cloud Computing* by Springer. He received the Editor's Choice Award in Discrete Mathematics in 1999. He coauthored a book titled *Security in Wireless Ad Hoc and Sensor Networks* (John Wiley and Sons, 2009). Professor Rong has extensive experience in managing research and development projects funded by both industry and funding agencies, such as the Norwegian Research Council and the EU Framework Programs.

Pierangela Samarati is a professor in the Computer Science Department, Università degli Studi di Milano, Italy. Her main research interests are in data protection, access control, and information privacy and security. She has published more than 200 papers in journals, conference proceedings, and books. She has received several awards. She has been named an ACM Distinguished Scientist (2009) and IEEE fellow (2012).

Thamarai Selvi is working as a professor in the Department of Computer Technology, MIT Campus of Anna University, Chennai. She has more than 30 years of teaching experience and 20 years of research experience, with her areas of interest spanning Grid computing, Cloud computing, and E-learning. She has established the Centre for Advanced Research and Education (CARE) and has successfully completed 12 research projects funded by the Government of India and Tamil Nadu State Government. She has one patent attributed to her name and has filed three more patents in her research area. She has published more than 110 papers in reputable national and international conferences and more than 45 papers in reputable international journals. She has also authored five books, the latest book being *Mastering Cloud Computing* (Morgan Kauffman, 2013). She has given keynote speeches at many international conferences/workshops in the field of Cloud computing and has organized many workshops and conferences in the same area, the latest workshop being the International Workshop on Cloud Computing in collaboration with the University of Melbourne and Manjrasoft held on 20 August 2013 in the Department of Computer Technology, MIT Campus of Anna University, Chennai.

Shubhashis Sengupta is a senior manager and head of research at Accenture Technology Lab, Bangalore. His area of specialization is around large scale distributed systems, Cloud computing, grid and high performance computing, software engineering, service-oriented architecture, etc. He is a fellow of the Indian Institute of Management. He is a senior member of the IEEE and a senior member of the ACM. Dr. Sengupta has several journal and conference papers, granted patents, and filed patent applications to his credit.

Ramesh Sitaraman received the BTech degree in electrical engineering from the Indian Institute of Technology, Madras and the PhD degree in computer science from Princeton University. He is currently in the School of Computer Science at the University of Massachusetts at Amherst. His research focuses on all aspects of Internet-scale distributed systems, including algorithms, architectures, performance, energy efficiency, user behavior, and economics. As a principal architect, he helped create the Akamai network and is an Akamai fellow. He is best known for helping pioneer the first large delivery networks, such as CDNs, that currently deliver much of the world's web content, streaming videos, and online applications. Professor Sitaraman is a recipient of the US National Science Foundation CAREER Award and a Lilly Fellowship. He has served on numerous program committees and editorial boards of major conferences and journals.

Ivan Stojmenovic is the Editor-in-Chief of the *IEEE Transactions on Parallel and Distributed Systems* (2010-2013), and founder of three journals. He is an editor for *IEEE Network*, *IEEE Transactions on Computers*, and *ACM Wireless Networks*, and a steering committee member of the *IEEE Transactions on Emerging Topics in Computing*. He is one of about 250 computer science researchers with h-index > 50, has top h-index in Canada for mathematics and statistics, and has > 14,000 citations. He has received five best paper awards and the Fast Breaking Paper for October 2003 by Thomson ISI ESI. He is a fellow of the IEEE, the Canadian Academy of Engineering, and Academia Europaea.

Ruppa Thulasiram is an associate professor with the Department of Computer Science, University of Manitoba, Winnipeg, Manitoba, Canada. He received the PhD degree from the Indian Institute of Science, Bangalore, India, and spent years at Concordia University, Montreal, Canada; the Georgia Institute of Technology, Atlanta; and the University of Delaware as a post-doc, research staff member, and research faculty member before taking up a position with University of Manitoba. His current research includes scientific computing, computational finance, and Grid/Cloud computing. His research has been funded by the Natural Sciences and Engineering Research Council (NSERC) of Canada. He has published many papers in the areas of high temperature physics, gas dynamics, combustion, computational finance, and Grid/Cloud computing and has graduated many students with MSc and PhD degrees. He has has developed a curriculum for a cross-disciplinary computational finance course at the University of Manitoba for both the graduate and senior undergraduate levels.

Vijaya Varadharajan received the PhD degree in computer and communication security (1981-1984) from Plymouth and Exeter Universities in the UK, which was sponsored by BT Research Labs. He received the electronic engineering degree from Sussex University, UK (1978-1981). He is currently a professor and Microsoft Chair in Innovation in Computing at Macquarie University (2001-to date). He is also the Director of Information and Networked System Security (INSS) Research. Before this, he was chairman of the School of Computing and IT at the University of Western Sydney (1996-2000). Previously, he headed Security Research at HP Labs Bristol, UK (1988-1995). During his tenure at HP Labs., under his leadership some six different security technologies were transferred into successful HP products in divisions. He also headed the Technical Security Strategy Initiative at HP under the Senior Vice President. Before this, he was a research manager at British Telecom Research Labs. UK (1987-1988). From 1985 until 1987, he was a research fellow and lecturer in computer science at Plymouth and Reading Universities. He was awarded the 1981 Prize of the Institution of Electrical Engineers, IEE, for outstanding performance at Sussex University and the Committee of Vice Chancellors and Principals Award (UK). He has published more than 320 papers in international journals and conferences, has coauthored and edited eight books on information technology, security, networks, and distributed systems, and holds two patents. His research work over the years has contributed to the development of several successful secure commercial systems in the areas of secure distributed applications, secure network systems, security tools, secure mobile systems, as well as cryptographic and smart card-based systems and secure financial, telecom, and medical solutions. His current areas of research interest include web services security, secure distributed applications, trusted computing, security policies and management in distributed systems, Internet security, secure mobile agents, security in mobile networks, wireless security, secure e-commerce, security policies, models and architectures, and protocols. He has successfully supervised many PhD research students in the UK and Australia (more than 40). He has given 20 keynote speeches at international conferences, and has given more than 200 invited speeches in various acadmic and industrial workshops and forums. He has been a program committee member/chair for more than 200 international conferences all over the world. He is an editorial board member of several journals, including the prestigious *ACM Transactions on Information System Security*, the *Journal of Information Security*, *Computer and Communication Security Reviews*, as well as the *IEEE Transactions on Dependable and Secure Computing* (*TDSC*) and *IEEE Security and Privacy*. His research work has been supported by industry such as Microsoft, Hewlett-Packard, British Telecom, and Fujitsu, as well as government agencies such as the Australian Research Council (ARC), UK Research Council (EPSRC), Australian Defense (DSD), Department of Prime Minister and Cabinet Australia, and the European Union (COST, EUREKA, ESPRIT, RACE, INFOSEC). He is a fellow of the British Computer Society (FBCS), a fellow of the IEE, UK (FIEE), a fellow of the Institute of Mathematics and Applications, UK (FIMA), a fellow of the Australian Institute of Engineers (FIEAust), and a fellow of the Australian Computer Society (FACS).

Carlos Varela received the BS degree with honors, and MS and PhD degrees in computer science from the University of Illinois at Urbana-Champaign. Dr. Varela is an associate editor and information director of the *ACM Computing Surveys* journal, and has served as a guest editor of the *Scientific Programming* journal. He is the recipient of several research grants including the US National Science Foundation (NSF) CAREER award, two IBM SUR awards, and two IBM Innovation awards. His current research interests include web-based and Internet-based computing, middleware for adaptive distributed systems, concurrent programming models and languages, and software development environments and tools. For more information on his group's research, please visit the Worldwide Computing Lab Home Page (http://wcl.cs.rpi.edu/).

Bharadwaj Veeravalli is a senior member of the IEEE and the IEEE Computer Society, and is currently with the Department of Electrical and Computer Engineering at The National University of Singapore (NUS), Singapore, as a tenured associate professor. He is a recipient of Gold Medal awards for his outstanding PhD thesis (1994, IISc, Bangalore, India) and for his Bachelor's Degree (physics, 1987, MKU, India). His mainstream research interests include Cloud/Grid/Cluster Computing, scheduling in parallel and distributed systems, bioinformatics, high-performance computing, and multimedia computing. He is one of the earliest researchers in the field of Divisible Load Theory (DLT). He has successfully secured several externally funded projects and published more than 80 papers in high-quality peer-reviewed international journals and more than 75 papers in international conferences. He has coauthored three research monographs in the areas of PDS, distributed databases (competitive algorithms), and networked multimedia systems in the years 1996, 2003, and 2005, respectively. He served on the editorial boards of the *IEEE Transactions on Computers* and the *IEEE Transactions on SMC-A* until 2011 and is currently serving on the editorial boards of *Multimedia Tools & Applications* (*MTAP*) and *Cluster Computing*, as an associate editor. He was a visiting professor with HUST, Wuhan, China, from June 2007-May 2009. He had served (and is serving) as a program committee member and is currently serving as a general cochair for IEEE ICON 2013. In September 2010, he delivered a keynote speech at the Fifth IEEE International Conference on Bio-Inspired Computing: Theory and Applications (BIC-TA), held in Changsha, P.R. China. His academic profile, professional activities, main stream and peripheral research interests, research projects and collaborations, and most recent list of publications can be found at http://cnl-ece.nus.edu.sg/elebv/.

Cho-Li Wang received the BS degree in computer science and information engineering from National Taiwan University in 1985 and the PhD degree in computer engineering from the University of Southern California in 1995. He is currently a professor in the Department of Computer Science at The University of Hong Kong. His research is broadly in the areas of distributed systems and high performance computing, with particular interests in the design and development of system software for Cloud computing, including I/O virtualization and virtual machine migration techniques, operating systems on manycore architectures, and runtime support for parallel programming on GPGPU and cluster environments. Dr. Wang has published more than 140 papers in various peer reviewed journals and conference proceedings. He serves or has served on the editorial boards of at least eight international journals, including the *IEEE Transactions on Computers* (2006-2010). He is a member of the IEEE.

Christof Weinhardt received the PhD degree in microeconomics from the University of Karlsruhe in 1989 after receiving the Diploma in business engineering in 1986. He is the Dean of the Faculty of Economics and Business Engineering at Karlsruhe Institute of Technology. He is also director of the Karlsruhe Service Research Institute (KSRI), the FZI Research Center for Information Technology, and has his Chair at the Institute of Information Systems and Marketing. He has published more than 200 peer reviewed journals and papers as well as (co)authored 20 books in the domains of economics, information systems, and computer science in areas related to market engineering, such as Cloud and corporate services, smart grids and telecommunications, financial, retail, as well as energy markets.

Adam Wierman received the PhD, MSc, and BSc degrees in computer science from Carnegie Mellon University in 2007, 2004, and 2001, respectively. He is a professor in the Department of Computing and Mathematical Sciences at the California Institute of Technology, where he is a member of the Rigorous Systems Research Group (RSRG). His research interests center around resource allocation and scheduling decisions in computer systems and services. More specifically, his work focuses both on developing analytic techniques in stochastic modeling, queuing theory, scheduling theory, and game theory, and applying these techniques to application domains such as energy-efficient computing, data centers, social networks, and electricity markets. He received the 2011 ACM SIGMETRICS Rising Star award, and has been coauthor on papers that received of best paper awards at ACM SIGMETRICS, IEEE INFOCOM, IFIP Performance, IEEE Green Computing Conference, IEEE Power & Energy Society General Meeting, and ACM GREENMETRICS. He was named a Seibel Scholar, received an Okawa Foundation grant, and received a US National Science Foundation (NSF) CAREER grant. Additionally, his dissertation received the CMU School of Computer Science Distinguished Dissertation Award and he has received multiple teaching awards, including the Associated Students of the California Institute of Technology (ASCIT) Teaching Award.

Cheng-Zhong Xu received the BS and MS degrees from Nanjing University in 1986 and 1989, respectively, and the PhD degree in computer science from the University of Hong Kong in 1993. He is currently a professor and the interim chair of the Department of Electrical and Computer Engineering at Wayne State University. He is also an adjunct professor of the Shenzhen Institute of Advanced Technology of Chinese Academy of Sciences, China, and the founding Director of the Center for Cloud Computing. His research interest is mainly in scalable distributed and parallel systems and wireless embedded computing devices, with an emphasis on resource and system management for performance, availability, reliability, energy efficiency, and security. He has published more than 200 articles in peer-reviewed journals and conferences in these areas. He is the author of the book *Scalable and Secure Internet Services and Architecture* (Chapman & Hall/CRC Press, 2005) and a coauthor of the book *Load Balancing in Parallel Computers: Theory and Practice* (Kluwer Academic/Springer Verlag, 1997). He has served on the editorial boards of a number of journals, including the *IEEE Transactions on Parallel and Distributed Systems*, the *IEEE Transactions on Computers*, the *Journal of Parallel and Distributed Computing*, and *Science China*. He was a recipient of the Faculty Research Award, the President's Award for Excellence in Teaching, and the Career Development Chair Award of Wayne State University, and the Outstanding Overseas Scholar award of the National Science Foundation of China. He is a senior member of the IEEE.

Xiaofang Zhou received the BSc and MSc degrees in computer science from Nanjing University, China, and the PhD degree in computer science from the University of Queensland, Australia (UQ). He is a professor of computer science at the University of Queensland, and head of the Data and Knowledge Engineering (DKE) Group. Before joining UQ in 1999, he worked as a researcher for the Commonwealth Scientific and Industrial Research Organisation (CSIRO), leading its Spatial Information Systems group. His research focus is to find effective and efficient solutions for managing, integrating, and analyzing very large amounts of complex data for business, scientific, and personal applications. He has been working in the area of spatial and multimedia databases, data quality management, in-memory databases, high performance query processing, Web information systems, data mining, and bioinformatics, coauthored more than 260 research papers with many published in top journals and conferences such as SIGMOD, VLDB, ICDE, *ACM Multimedia*, *The VLDB Journal*, ACM Transactions, and IEEE Transactions. He has been on the program committees of numerous leading international conferences, including SIGMOD, VLDB, ICDE, WWW, and ACM Multimedia. He is also an associate editor of *The VLDB Journal and World Wide Web Journal*, and was an associate editor of the *IEEE Transactions of Knowledge* and *Data Engineering* (2009-2013). Currently, he is a member of IEEE Technical Committee on Data Engineering (TCDE) Executive Committee, IEEE TCDE Award Committee, and the Steering Committees of the DASFAA, WISE, APWeb, and Australasian Database Conferences. He is a specially appointed Adjunct Professor under the Chinese National Qianren Scheme hosted by Renmin University of China (2010-2013) and by Soochow University since July 2013.

Albert Zomaya is currently the Chair Professor of High Performance Computing & Networking and Australian Research Council Professorial Fellow in the School of Information Technologies, The University of Sydney. He is also the Director of the Centre for Distributed and High Performance Computing, which was established in late 2009. Professor Zomaya held the CISCO Systems Chair Professor of Internetworking during the period 2002–2007 and also was Head of school for 2006–2007 in the same school. Prior to his current appointment, he was a full professor in the Electrical and Electronic Engineering Department at the University of Western Australia, where he also led the Parallel Computing Research Laboratory during the period of 1990–2002. He served as Associate, Deputy, and Acting–Head in the same department, and held numerous visiting positions and has extensive industry involvement. He is the author/coauthor of seven books, more than 450 publications in technical journals and conferences, and the editor of 14 books and 19 conference volumes. He is currently the Editor-in-Chief of the *IEEE Transactions on Computers* and serves as an associate editor for 20 other journals. He is the founding editor of the *Wiley Book Series on Parallel and Distributed Computing* and the coeditor of the *Wiley Book Series on Bioinformatics* and the *Wiley Book Series on Nature Inspired Computing*. He is the Editor-in-Chief of the *Parallel and Distributed Computing Handbook* (McGraw-Hill, 1996). Professor Zomaya was the chair the IEEE Technical Committee on Parallel Processing (1999-2003) and currently serves on its executive committee. He also serves on the advisory board of the IEEE Technical Committee on Scalable Computing, the advisory board of the Machine Intelligence Research Labs, is a scientific council member of the Institute for Computer Sciences, Social–Informatics, and Telecommunications Engineering (in Brussels) and a member of the board of the IEEE Systems, Man, and Cybernetics Society Technical Committee on Self-Organized Distributed and Pervasive Systems. He has delivered more than 130 keynote addresses, invited seminars, and media briefings and has been actively involved, in a variety of capacities, in the organization of more than 600 national and international conferences. He is a fellow of the IEEE, a fellow of the American Association for the Advancement of Science, a fellow of the Institution of Engineering and Technology (UK), a Distinguished Engineer of the ACM, and a Chartered Engineer (CEng). He received the 1997 Edgeworth David Medal from the Royal Society of New South Wales for outstanding contributions to Australian Science. He is also the recipient of the IEEE Computer Society's Meritorious Service Award and Golden Core Recognition in 2000 and 2006, respectively. Also, he received the IEEE TCPP Outstanding Service Award and the IEEE TCSC Medal for Excellence in Scalable Computing, both in 2011. His research interests are in the areas of parallel and distributed computing and complex systems. More information can be found at http://rp-www.cs.usyd.edu.au/~zomaya/.