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On the Move to Meaningful Internet Systems: OTM 2016 Workshops

Confederated International Workshops:
EI2N, FBM, ICSP, Meta4eS, and OTMA 2016
Rhodes, Greece, October 24–28, 2016
Revised Selected Papers

Springer

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General Co-chairs' Message for OnTheMove 2016

The OnTheMove 2016 event held October 24–28 in Rhodes, Greece, further consolidated the importance of the series of annual conferences that was started in 2002 in Irvine, California. It then moved to Catania, Sicily, in 2003, to Cyprus in 2004 and 2005, Montpellier in 2006, Vilamoura in 2007 and 2009, in 2008 to Monterrey, Mexico, to Heraklion, Crete, in 2010 and 2011, Rome in 2012, Graz in 2013, Amantea, Italy, in 2014, and to Rhodes in 2015 as well.

This prime event continues to attract a diverse and relevant selection of today's research worldwide on the scientific concepts underlying new computing paradigms, which of necessity must be distributed, heterogeneous, and supporting an environment of resources that are autonomous yet must meaningfully cooperate. Indeed, as such large, complex, and networked intelligent information systems become the focus and norm for computing, there continues to be an acute and increasing need to address the software, system, and enterprise issues involved and discuss them face to face in an integrated forum that covers methodological, semantic, theoretical, and application issues too. As we all realize, e-mail, the Internet, and even video conferences are not by themselves optimal or even sufficient for effective and efficient scientific exchange.

The OnTheMove (OTM) International Federated Conference series was created to cover the scientific exchange needs of the communities that work in the broad yet closely connected fundamental technological spectrum of Web-based distributed computing. The OTM program every year covers data and Web semantics, distributed objects, Web services, databases, information systems, enterprise workflow and collaboration, ubiquity, interoperability, mobility, as well as grid and high-performance computing.

OnTheMove is proud to give meaning to the "federated" aspect in its full title: It aspires to be a primary scientific meeting place where all aspects of research and development of Internet- and intranet-based systems in organizations and for e-business are discussed in a scientifically motivated way, in a forum of interconnected workshops and conferences. This year's 15th edition of the OTM Federated Conferences event therefore once more provided an opportunity for researchers and practitioners to understand, discuss, and publish these developments within the broader context of distributed, ubiquitous computing. To further promote synergy and coherence, the main conferences of OTM 2016 were conceived against a background of their three interlocking global themes:

– Trusted Cloud Computing Infrastructures Emphasizing Security and Privacy
– Technology and Methodology for Data and Knowledge Resources on the (Semantic) Web
– Deployment of Collaborative and Social Computing for and in an Enterprise Context

Originally the federative structure of OTM was formed by the co-location of three related, complementary, and successful main conference series: DOA (Distributed Objects and Applications, held since 1999), covering the relevant infrastructure-enabling technologies, ODBASE (Ontologies, Databases and Applications of Semantics, since 2002) covering Web semantics, XML databases, and ontologies, and of course CoopIS (Cooperative Information Systems, held since 1993), which studies the application of these technologies in an enterprise context through, e.g., workflow systems and knowledge management. In the 2011 edition issues of security aspects, originally started as topics of the IS workshop in OTM 2006, became the focus of DOA as secure virtual infrastructures, further broadened to cover aspects of trust and privacy in so-called cloud-based systems. As this latter aspect came to dominate agendas in this and overlapping research communities, we decided in 2014 to rename the event as the Cloud and Trusted Computing (C&TC) Conference, and originally launched it in a workshop format.

These three main conferences specifically seek high-quality contributions of a more mature nature and encourage researchers to treat their respective topics within a framework that simultaneously incorporates (a) theory, (b) conceptual design and development, (c) methodology and pragmatics, and (d) application in particular case studies and industrial solutions.

As in previous years we again solicited and selected additional quality workshop proposals to complement the more mature and "archival" nature of the main conferences. Our workshops are intended to serve as "incubators" for emergent research results in selected areas related, or becoming related, to the general domain of Web-based distributed computing. This year this difficult and time-consuming job of selecting and coordinating the workshops was brought to a successful end by Ioana Ciuciu, and we were very glad to see that our earlier successful workshops (EI2N, Meta4eS, FBM) re-appeared in 2016, in some cases in alliance with other older or newly emerging workshops. The Fact-Based Modeling (FBM) Workshop in 2015 succeeded and expanded the scope of the successful earlier ORM Workshop. The Industry Case Studies Program, started in 2011 under the leadership of Hervé Panetto and OMG's Richard Mark Soley, gained further momentum and visibility in its sixth edition this year.

The OTM registration format ("one workshop or conference buys all workshops or conferences") actively intends to promote synergy between related areas in the field of distributed computing and to stimulate workshop audiences to productively mingle with each other and, optionally, with those of the main conferences. In particular EI2N continues to create and exploit a visible cross-pollination with CoopIS.

We were very happy to see that in 2016 the number of quality submissions for the OnTheMove Academy (OTMA) noticeably increased. OTMA implements our unique, actively coached and therefore very time- and effort-intensive formula to bring PhD students together, and aims to carry our "vision for the future" in research in the areas covered by OTM. Its 2016 edition was organized and managed by a dedicated team of collaborators and faculty, Peter Spyns, Maria-Esther Vidal, and Anja Metzner, inspired as always by the OTMA Dean, Erich Neuhold.

In the OTM Academy, PhD research proposals are submitted by students for peer review; selected submissions and their approaches are to be presented by the students in front of a wider audience at the conference, and are independently and extensively

analyzed and discussed in front of this audience by a panel of senior professors. One may readily appreciate the time, effort, and funds invested in this by OnTheMove and especially by the OTMA faculty.

As the three main conferences and the associated workshops all share the distributed aspects of modern computing systems, they experience the application pull created by the Internet and by the so-called Semantic Web, in particular the developments of big data, the increased importance of security issues, and the globalization of mobile-based technologies. For ODBASE 2016, the focus somewhat shifted from knowledge bases and methods required for enabling the use of formal semantics in Web-based databases and information systems to applications, especially those within IT-driven communities. For CoopIS 2016, the focus as before was on the interaction of such technologies and methods with business process issues, such as occur in networked organizations and enterprises. These subject areas overlap in a scientifically natural and fascinating fashion and many submissions in fact also covered and exploited the mutual impact among them. For our event C&TC 2016, the primary emphasis was again squarely put on the virtual and security aspects of Web-based computing in the broadest sense. As with the earlier OnTheMove editions, the organizers wanted to stimulate this cross-pollination by a program of engaging keynote speakers from academia and industry and shared by all OTM component events. We are proud to list for this year:

– François Vernadat, LGIPM and EU Institutions, Luxemburg
– Giancarlo Fontino, University of Calabria, Italy
– Patrick McLaughlin, ORACLE, Ireland
– Sotiris Ioannidis, Foundation for Research and Technology Hellas, Greece

The general downturn in submissions observed in recent years for almost all conferences in computer science and IT has also affected OnTheMove, but this year the harvest again stabilized at a total of 133 submissions for the three main conferences and 58 submissions in total for the workshops. Not only may we indeed again claim success in attracting a representative volume of scientific papers, many from the USA and Asia, but these numbers of course allowed the respective Program Committees to again compose a high-quality cross-section of current research in the areas covered by OTM. Acceptance rates vary but the aim was to stay consistently at about one accepted full paper for two to three submitted (nearly one in three for CoopIS), yet as always these rates are subject to professional peer assessment of proper scientific quality.

As usual we separated the proceedings into two volumes with their own titles, one for the main conferences and one for the workshops and posters. But in a different approach to previous years, we decided the latter should appear after the event and thereby allow workshop authors to improve their peer-reviewed papers based on critiques by the Program Committees and on interactions at OTM. The resulting additional complexity and effort of editing the proceedings were professionally shouldered by our leading editor, Christophe Debruyne – with the general chairs for the conference volume, and with Ioana Ciuciu and Hervé Panetto for the workshop volume. We are again most grateful to the Springer LNCS team in Heidelberg for their professional support, suggestions, and meticulous collaboration in producing the files and indexes ready for downloading on the USB sticks. It is a pleasure to work with staff that so

deeply understands the scientific context at large, and the specific logistics of conference proceedings publication.

The reviewing process by the respective OTM Program Committees was performed to professional quality standards: Each paper review in the main conferences was assigned to at least three referees, with arbitrated e-mail discussions in the case of strongly diverging evaluations. It may be worth emphasizing once more that it is an explicit OnTheMove policy that all conference Program Committees and chairs make their selections in a completely sovereign manner, autonomous and independent from any OTM organizational considerations. As in recent years, proceedings in paper form are now only available to be ordered separately.

The general chairs are once more especially grateful to the many people directly or indirectly involved in the set-up of these federated conferences. Not everyone realizes the large number of qualified persons that need to be involved and the huge amount of work, commitment, and financial risk in the uncertain economic and funding climate of 2016 that are entailed by the organization of an event like OTM. Apart from the persons in their roles mentioned earlier, we therefore wish to thank in particular explicitly our main conference Program Committee chairs:

- CoopIS 2016: Eva Kühn, Frank Leymann, and Willem-Jan van den Heuvel
- ODBASE 2016: Declan O'Sullivan, Joseph Davis, and Satya Sahoo
- C&TC 2016: Claudio Ardagna and Nils Gruschka

And similarly we thank the Program Committee (co-)chairs of the 2016 ICSP, OTMA, and Workshops (in their order of appearance on the website): Peter Spyns, Maria-Esther Vidal, Mario Lezoche, Ovidiu Noran, Eduardo Portela, Georg Weichhart, Peter Bollen, Hans Mulder, Maurice Nijssen, Anna Fensel, Ioana Ciuciu.

Together with their many Program Committee members, they performed a superb and professional job in managing the difficult yet existential process of peer review and selection of the best papers from the harvest of submissions. We all also owe a serious debt of gratitude to our supremely competent and experienced conference secretariat and technical administration staff in Guadalajara and Dublin, respectively, Daniel Meersman and Christophe Debruyne, with the occasional valuable support by Jan Demey while passing through Fiumicino, Zaventem, and Schiphol airports.

The general conference and workshop co-chairs also thankfully acknowledge the academic freedom, logistic support, and facilities they enjoy from their respective institutions—Technical University of Graz, Austria; Université de Lorraine, Nancy, France; Latrobe University, Melbourne, Australia; and Babes-Bolyai University, Cluj, Romania—and without which such a project quite simply would not be feasible. Reader, we do hope that the results of this federated scientific enterprise contribute to your research and your place in the scientific network… and we hope to welcome you at next year's event!

September 2016   Robert Meersman
                                                                           Hervé Panetto
                                                                           Ioana Ciuciu

Organization

OTM (On The Move) is a federated event involving a series of major international conferences and workshops. These proceedings contain the papers presented at the OTM 2016 Federated Conferences, consisting of CoopIS 2016 (Cooperative Information Systems), C&TC 2016 (Cloud and Trusted Computing), and ODBASE 2016 (Ontologies, Databases, and Applications of Semantics).

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Keynotes

Challenges and Trends for Next Generation Enterprise Information Systems

François Vernadat[1,2]

[1] LGIPM, University of Lorraine, Nancy, France
[2] European Institutions, Luxembourg, Luxembourg

Short Bio

Dr François Vernadat has been a research officer, first at the National Research Council of Canada (NRCC), Ottawa, in the 80's and then at the Institut National de Recherche en Informatique et Automatique (INRIA), France, in the 90's. Since 1995 he has been a professor at the University of Metz in France in automatic control and industrial engineering. At the end of 2001, he joined the European Commission, DG Eurostat in Luxemburg, as project manager in the IT Directorate and then DG Informatics (DIGIT). In 2008 he moved to the European Court of Auditors in Luxemburg, another European institution, where he is currently the head of the Information Systems and Methods (ISM) unit. His research work has been dealing with enterprise architectures, enterprise modelling and integration, information systems design and analysis, CIM and various aspects of industrial engineering (facility layout, performance evaluation, cost estimation, competency modelling and value-risk management). He has lectured in many countries in Europe, North, Latin and South America, China and North Africa. He has consulted several large and medium-sized companies in France and Canada (automotive industry, aeronautics industry, and software houses). He is the author of over 285 scientific papers in journals, conferences, and edited books. He is the author of the textbook "Enterprise Modeling and Integration: Principles and Applications", co-author of the book "Practice of Petri nets in Manufacturing" and co-editor of the book "Integrated Manufacturing Systems Engineering", all published by Chapman & Hall. He is adviser for International Journal of Computer Integrated Manufacturing, associate editor for Computers in Industry, International Journal of Production Research, Enterprise Information Systems, and is on the editorial board of Computers and Industrial Engineering. He served as vice-chairman several technical committees of the IFAC, has been a member of IEEE and ACM and he has been chairman or vice-chairman of several international conferences on industrial engineering.

Talk

Since year 2000, nearly all corporate software vendor packages, many international research projects and a growing number of practical implementations have shown considerable progress in the area of Enterprise Information Systems, but such advances have also come with new challenges for the scientific community, especially regarding Information and Communication Technologies (ICTs), which are at the core of new developments and digital megatrends.

Indeed, SOA and Internet technologies, Enterprise Architecture Frameworks, Enterprise Modelling frameworks and tools as well as Enterprise Integration, Interoperability and Networking approaches and now Cloud Computing solutions have been continuously and rapidly evolving. The main driver has been to cope with emerging collaborative organizations in the industry and society, from the intra-organizational level to the inter-organizational level and up to the global landscape. In addition, future developments of Enterprise Information Systems in different emerging domains and application environments require the identification well in advance of challenges and trends to establish timely research roadmaps for researchers and a sound business vision for top managers and leading practitioners to enable the development of efficient EIS solutions in practice.

The next generation of Enterprise Information Systems will continue emphasizing the need for scalable, reliable, extensible, flexible, highly available and maintainable system architectures with new technologies, models and solutions. The aim is to provide ubiquitous, plug-and-play and secure integration, interoperability and networking solutions to realize collaborative systems, platforms and ICT infrastructures for all entities operating in a common business ecosystem.

The talk will present a synthesis of future trends and emerging key research challenges identified in the preparation of a Special Issue on Next Generation Enterprise Information Systems recently published in Computers in Industry.

Towards Multi-layer Interoperability of IoT Platforms: The INTER-IoT Approach

Giancarlo Fortino

University of Calabria, Rende, Italy

Short Bio

Giancarlo Fortino (SM'12) received the Laurea (B.S and M.S) and Ph.D in computer engineering from the University of Calabria, Italy, in 1995 and 2000, respectively. He is currently an Associate Professor of Computer Engineering (since 2006) with the Department of Informatics, Modeling, Electronics and Systems (DIMES), University of Calabria. He holds the Scientific Italian Habilitation for Full Professor and he is also Adjunct Full Professor of Computer Engineering at Wuhan University of Technology in the framework of High-End Foreign Experts in China and adjunct senior researcher at Italian National Research Council. He authored about 300 publications in journals, conferences, and books. He is currently the Scientific and Technical Project Manager of the EU-funded H2020 INTER-IoT project on heterogeneous IoT platform interoperability. His research interests include distributed computing, wireless sensor networks, body area networks, software agents, IoT technology, cloud computing. He is an associate editor of IEEE Trans. on Affective Computing, IEEE Trans. on Human-Machine Systems, Information Fusion, Engineering Application of Artificial Intelligence, Journal of Network and Computer Applications. He is founding co-chair of SMC TC on Interactive and Wearable Computing and Devices and is the Chair of the Italian Chapter of the IEEE SMC Society. He is co-founder and CEO of SenSysCal S.r.l., a spin-off of University of Calabria, engaged in advanced applied research and development of IoT systems.

Talk

While still in his infancy, the IoT domain already lists a number of solutions implemented, ranging from simple devices to full-fledged platforms. However, the heterogeneity at all levels (device, networking, middleware, services, data and semantics) of those solutions is preventing different systems to interoperate effectively, despite significant efforts in the development of a unique reference standard for IoT systems technology. The situation is likely to worsen in the near future, as lack of interoperability will cause major technological and business-oriented issues such as impossibility to plug non-interoperable IoT devices into heterogeneous IoT platforms, impossibility to develop IoT applications exploiting multiple platforms in homogeneous and/or cross

domains, slowness of IoT technology introduction at large-scale, discouragement in adopting IoT technology, increase of costs, scarce reusability of technical solutions, and user dissatisfaction. This keynote will aim at analyzing such lack of interoperability in the IoT realm by proposing, as effective solution, the INTER-IoT approach that is being developed in our EU-funded H2020 project. In particular, first the keynote will provide the state-of-the-art of research- and standard-oriented approaches (including AIOTI and IEEE P2413); then, it will focus on the current status of the "products" of INTER-IoT granting multi-layer interoperability and IoT platform integration: INTER-LAYER, INTER-FW, and INTER-METH. Finally, we present two case studies in which our solutions will be tested: INTER-Health (interoperability among e-Health platforms) and INTER-LogP (interoperability in port logistics).

Data Processing in the Cloud:
Current Solutions and Future Challenges –
An Industry Perspective

Patrick McLaughlin

Oracle, Galway, Ireland

Short Bio

Patrick McLaughlin is an Oracle Fellow specialising in Information Security for Oracle across EMEA. He has over fifteen years experience in IT security. He is responsible for promoting Oracle's security offerings and enterprise solutions architecture, internally across the Oracle pre-sales, sales and consulting, and externally with major customers and partners across EMEA. Most recently he has been working on security of Cloud, Mobile and Big data.

Prior to this role Patrick was CTO at Baltimore Technologies, where he was product architect for Baltimore's PKI product and cryptographic toolkits. He also had responsibility for company R&D, technology partnering and working with lead customers in government and finance. Patrick has worked as an independent consultant for several years and has extensive experience in the distributed systems and telecoms management areas, having worked for Broadcom Éireann Research and Ericsson for ten years.

Talk

There is no doubt that significant amounts of data processing are moving from on-premise data-centers to using public cloud services. This is especially true for new "digital" applications that aim to deliver a great and compelling customer experience. At the same time we are living in an era of mega-databreaches and increasing regulations coming from industries and from government organisations.

This presentation will talk about what Oracle's experience is in relation to cloud in general and cloud security specifically outlining how we secure IAAS and PAAS, including the split of responsibilities with our customers. The talk will conclude by setting some challenges for the research community in relation to data technology in general and discuss the Nirvana for cyber-security in particular.

Security Applications of GPUs

Sotiris Ioannidis

Institute of Computer Science,
Foundation for Research and Technology – Hellas, Crete, Greece

Short Bio

Dr. Sotiris Ioannidis received a BSc degree in Mathematics and an MSc degree in Computer Science from the University of Crete in 1994 and 1996 respectively. In 1998 he received an MSc degree in Computer Science from the University of Rochester and in 2005 he received his PhD from the University of Pennsylvania. Ioannidis held a Research Scholar position at the Stevens Institute of Technology until 2007 and since then he is a Principal Researcher at the Institute of Computer Science of the Foundation for Research and Technology - Hellas. His research interests are in the area of systems and network security, security policy, privacy and high-speed networks. Ioannidis has authored more than 100 publications in international conferences and journals, as well as book chapters, and has both chaired and served in numerous program committees in prestigious conferences, such as ACM CCS, IEEE S&P, etc. Ioannidis is a Marie-Curie Fellow and has participated in numerous international and European projects. He has coordinated several European and National projects (e.g. PASS, EU-INCOOP, GAN-DALF, etc.), and is currently the coordinator of SHARCS, a H2020 European project.

Talk

Modern graphics processors have been traditionally used for gaming, but in the last few years they have been used more and more in the area of high performance computing. In this talk we will explore alternate uses of graphics processors, in the area of security. We will discuss how a defender can use graphics hardware to bolster system defenses, and how miscreants can exploit them to build better and stealthier malware.

Contents

Fact Based Modeling (FBM) 2016

Industry Case Studies Program (ICSP) 2016

**International Workshop on Methods, Evaluation, Tools and Applications
for the Creation and Consumption of Structured Data for the e-Society
(Meta4eS) 2016**

OnTheMove Academy (OTMA) 2016