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On the Move to Meaningful Internet Systems

OTM 2017 Workshops

Confederated International Workshops
EI2N, FBM, ICSP, Meta4eS, OTMA 2017
and ODBASE Posters 2017
Rhodes, Greece, October 23–28, 2017
Revised Selected Papers

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General Co-chairs and Editors' Message
for OnTheMove 2017

The OnTheMove 2017 event held October 23–27 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, to Rome in 2012, Graz in 2013, Amantea, Italy, in 2014 and lastly to Rhodes in 2015 and 2016 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 even increasing need to address the implied software, system, and enterprise issues 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 nor even sufficient for effective and efficient scientific exchange.

The OnTheMove (OTM) International Federated Conference series has been created precisely 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 2017 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, 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 2017, 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, further gained momentum and visibility in its seventh 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 so create and exploit a visible cross-pollination with CoopIS.

We were very happy to see that in 2017 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 2017 edition was organized and managed by a dedicated team of collaborators and faculty, Peter Spyns, Maria-Esther Vidal, 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 2017, 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 2017, 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 2017, 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 quite proud to list for this year:

– Stephen Mellor, Industrial Internet Consortium, Needham, USA
– Markus Lanthaler, Google, Switzerland

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 180 submissions for the three main conferences and 40 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 have 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 three submitted, 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 thus allow workshop authors to eventually improve their peer-reviewed papers based on critiques by the Program Committees and on live interaction 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 worthwhile to emphasize 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 the financial risk in the uncertain economic and funding climate of 2017 that is entailed by the organization of an event like OTM. Apart from the persons in the aforementioned roles, we therefore wish to thank in particular explicitly our main conference PC chairs:

– CoopIS 2017: Mike Papazoglou, Walid Gaaloul, andLiang Zhang
– ODBASE 2017: Declan O'Sullivan, Joseph Davis and Satya Sahoo
– C&TC 2017: Adrian Paschke, Hans Weigand, and Nick Bassiliades

And similarly we thank the Program Committee (co-)chairs of the 2017 ICSP, OTMA, and Workshops (in their order of appearance on the website): Peter Spyns, Maria-Esther Vidal, Mario Lezoche, Wided Guédria, Qing Li, Georg Weichhart, Peter Bollen, Hans Mulder, Maurice Nijssen, Anna Fensel, and Ioana Ciuciu. Together with their many PC 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 admin staff in Guadalajara and Dublin, respectively, Daniel Meersman and Christophe Debruyne.

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 2017   Robert Meersman
                                                                   Hervé Panetto
                                                              Christophe Debruyne

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 2017 Federated conferences, consisting of CoopIS 2017 (Cooperative Information Systems), C&TC 2017 (Cloud and Trusted Computing), and ODBASE 2017 (Ontologies, Databases, and Applications of Semantics).

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OnTheMove 2017 Keynotes

Pragmatic Semantics at Web Scale

Markus Lanthaler

Google, Switzerland

Short Bio

Dr. Markus Lanthaler is a software engineer and tech lead at Google where he currently works on YouTube. He received his Ph.D. in Computer Science from the Graz University of Technology in 2014 for his research on Web APIs and Linked Data. Dr. Lanthaler is one of the core designers of JSON-LD and the inventor of Hydra. He has published several scientific articles, is a frequent speaker at conferences, and chairs the Hydra W3C Community Group.

Talk

Despite huge investments, the traditional Semantic Web stack failed to gain widespread adoption and deliver on its promises. The proposed solutions focused almost exclusively on theoretical purity at the expense of their usability. Both academia and industry ignored for a long time the fact that the Web is more a social creation than a technical one. After a long period of disillusionment, we see a renewed interest in the problems the Semantic Web set out to solve and first practical approaches delivering promising results. More than 30% of all websites contain structured information now. Initiatives such as Schema.org allow, e.g., search engines to extract and understand such data, integrate it, and create knowledge graphs to improve their services.

This talk analyzes the problems that hindered the adoption of the Semantic Web, present new, promising technologies and shows how they might be used to build the foundation of the longstanding vision of a Semantic Web of Services.

Evolution of the Industrial Internet of Things: Preparing for Change

Stephen Mellor

Industrial Internet Consortium, Needham, MA 02492, USA

Short Bio

Stephen Mellor is the Chief Technical Officer for the Industrial Internet Consortium, where he directs the standards requirements and technology & security priorities for the Industrial Internet. In that role, he coordinates the activities of the several engineering, architecture, security and testbed working groups and teams. He also co-chairs both the Definitions, Taxonomy and Reference Architecture workgroup and the Use Cases workgroup for the NIST CPS PWG (National Institute for Standards and Technology Cyberphysical System Public Working Group).

He is a well-known technology consultant on methods for the construction of real-time and embedded systems, a signatory to the Agile Manifesto, and adjunct professor at the Australian National University in Canberra, ACT, Australia. Stephen is the author of Structured Development for Real-Time Systems, Object Lifecycles, Executable UML, and MDA Distilled.

Until recently, he was Chief Scientist of the Embedded Software Division at Mentor Graphics, and founder and past president of Project Technology, Inc., before its acquisition. He participated in multiple UML/modeling-related activities at the Object Management Group (OMG), and was a member of the OMG Architecture Board, which is the final technical gateway for all OMG standards. Stephen was the Chairman of the Advisory Board to IEEE Software for ten years and a two-time Guest Editor of the magazine, most recently for an issue on Model-Driven Development.

Talk

The fundamental technological trends presently are more connectivity and more capability to analyze large quantities of data cheaply. But no one knows where those technological trends will take us, so we need to prepare for change.

Prediction is difficult, especially about the future, as several people are reputed to have said. But this keynote will peer ahead into several areas that we can see need attention, such as:

– Security for everything.
– Innovation and funding
– Learning, deployment and competitiveness

We need strategies to prepare for evolution in these areas, and we also need to understand longer term trends. Already we see improvements in operational efficiency, and changes in the economy from pay-per-asset to pay-per-use. More changes are likely, towards pay-per-outcome and direct consumer access to "pull" products autonomously.

These changes will fundamentally change the economy and drive technological innovation. The industrial internet is only at the beginning of perhaps forty more years of change.

On Data, the World's Most Valuable Resource, and Data Science

Michael Brodie

MIT, Cambridge, MA 02139, USA

Short Bio

Dr. Michael L. Brodie is a research scientist in the Computer Science and Artificial Intelligence Lab at MIT. As Chief Scientist of Verizon, the 2nd largest Telco in the world, for 25 years, he has a keen interest in advanced technology and its applications in the real world. His responsibility on the Scientific Advisory Board of two of the world's 60+ Data Science Research Institutes [Insight Center for Data Analytics, Ireland, (2015-), and Swinburne Data Science Research Institute (2017-)] is to understand the opportunities, state of the art, and research challenges for the emerging discipline of Data Science. This lecture presents the Big Picture of Big Data and of Data Science and the consequent revolutions in science and industry.

Talk

Data is being conceived as having potential for transforming all human endeavors for which adequate data is available. While data analytics has been used since before Pharaonic Egypt, it is now becoming a powerful force in discovery and prediction, notwithstanding domain expertise, e.g., in economics, that economic trends are inherently unpredictable. On the other hand, data science has led to accelerating discovery in many domains, e.g., cancer cures, exoplanets, paleontology, FinTech, and retail optimization. Equally powerful threats abound, e.g., influencing the 2016 US election.

Seven of the world's largest ten enterprises are data-driven companies, mere startups two decades ago. To compete, corporations are transforming themselves to be data-driven. Based on Big Data and Data Science, science, engineering, and the humanities are entering the 5th paradigm of discovery. Every major university has developed a Data Science Research Institute (DSRI) most within the last two years. Yet, Data Science is in its infancy without adequate principles to distinguish correlation from causation.

This keynote explores the emergence of Big Data and Data Science by looking at the state of the art, industrial use cases, and research conducted in DSRIs.

Semiotics and BREXIT

Ronald Stamper

Short Bio

– 1953 Army – modelled short career on the Good Soldier Svejk
– 1955 University College, Oxford – mathematics (and opera).
– 1958 NHS-Statistician at Oxford Regional Hospitals working on organisational problems;
– 1961 UK Steel industry – Operational Research; then, at the staff college, he created the first courses on information systems analysis and design outside the computer industry. Discovered semiotics and, as a result, and wrote his book "Information in Business and Administrative Systems"
– 1968 his syllabus became the basis for the UK's national programme for which he wrote a book of case studies and moved to the London School of Economics to teach and research.
– 1970s Principal Investigator on LEGOL-MEASUR programme funded by IBM, Digital two UK Research Councils (physical and social sciences).
– 1979 Semantics paper at IFIP DB Architecture conference: chair said "too philosophical".
– 1988 Prof. of Information Management at U. Twente, research continued.
– 1999 'Retired' (joke) continued the research and attempted to transfer the technology to industry against the evident wishes of the UK's Department of Business, Innovation and Skills, which presides over the worst productivity in the OECD. As our Semantic Normal Form makes huge improvements in productivity, the DBIS's record was threatened.

Talk

"When did you stop beating your wife/husband?" Answer with 'Yes' or 'No'…

Semiotics: Called by John Locke (1690) the "doctrine of signs", dates back to ancient Greek philosophy. Signs stand for other things; Stamper reviewed their properties: three technical ones are handled by hardware, telecoms and software industries, but those central to business and this meeting (semantic, pragmatic and social properties) have been neglected until recently.

Port Clearance Rules in PSOA RuleML: From Controlled-English Regulation to Object-Relational Logic (Tutorial)

Gen Zou and Harold Boley

University of New Brunswick, Canada

Short Bios

Gen Zou is a PhD candidate at the Faculty of Computer Science at the University of New Brunswick, Canada. His research interests include the overlapping areas of data & knowledge modeling, graph-relational interoperation, rule-based querying, as well as machine learning. His recent work is the foundation, implementation, and evaluation of the translation and execution framework PSOATransRun for Positional-Slotted Object-Applicative (PSOA) RuleML. In PSOA RuleML, knowledge bases integrate relational data as positional facts, graph data as object-centered attribute-value facts, and object-classification facts, as well as class subsumptions and rules for query-subquery reduction to facts. The instantiations of his PSOATransRun framework translate a PSOA knowledge base to intermediate languages, TPTP and ISO Prolog, executed via translated queries. The translators designed and implemented by him consist of transformation modules reusable across all instantiations and a conversion module specific to the targeted execution environment such as Prolog. He also evaluated PSOATransRun with a test suite and use cases including PortClearanceRules.

Dr. Harold Boley is adjunct professor at the Faculty of Computer Science, University of New Brunswick, Canada, and chair of RuleML Inc. His work on Declarative Specification, Programming, and AI includes leading the development of the RuleML 1.02 system of families of languages. RuleML has been combined with OWL to SWRL, has become the main input to the W3C Recommendation RIF, and has provided the foundation for OASIS LegalRuleML Core Specification Version 1.0. Two of his projects in data-plus-knowledge representation are the object-relational PSOA RuleML and the visualization framework Grailog. He recently contributed to related efforts at the Stanford Logic Group, CSLI, and SRI.

Tutorial

The Decision Management (DM) Community Challenge of March 2016 consisted of creating decision models from ten English Port Clearance Rules inspired by the

International Ship and Port Facility Security Code. Based on an analysis of the moderately controlled English rules and current online solutions, we formalized the rules in Positional-Slotted, Object-Applicative (PSOA) RuleML. This resulted in: (1) a reordering, subgrouping, and explanation of the original rules on the specialized decision-model expressiveness level of (deontically contextualized) near-Datalog, non-recursive, near-deterministic, ground-queried, and non-subpredicating rules; (2) an object-relational PSOA RuleML rulebase which was complemented by facts to form a knowledge base queried in PSOATransRun for decision-making. Thus, the DM and logical formalizations get connected, which leads to generalized decision models with Hornlog, recursive, non-deterministic, non-ground-queried, and subpredicating rules.

The tutorial will:

– Bridge between the Decision Management, RuleML, and OTM Communities
– Explain rules for a harbor security use case, leading to Cyber Physical Systems
– Exemplify the Pragmatic Semantic Web by prohibiting certain ship types to enter a harbor
– Provide a hands-on demo with audience-driven queries of the Object-Relational Decision Model
– Recommend models using generalized rule (and ontology) expressivity in PSOA RuleML

Contents

International Workshop on Fact Based Modeling (FBM) 2017

Industry Case Studies Program (ICSP) 2017

OnTheMove Academy (OTMA) 2017

**International Conference on Ontologies, DataBases,
and Applications of Semantics (ODBASE) 2017 – Posters**