

CASCON 2017 Proceedings

Sponsored By

IBM Advanced Studies
IBM Canada Software Lab

Edited By

Jamie Featherstone - IBM Canada Ltd.
Kelly Lyons - University of Toronto
Joe Wigglesworth - IBM Canada Ltd.
Darsh Saraf - IBM Canada Ltd.

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Message from the Conference Chair

CASCON 2017

Message from the Conference Chair

Welcome to CASCON 2017!

We've got a lot to celebrate this year. It's IBM Canada's 100th Anniversary and the 50th anniversary of the IBM Canada Lab—sponsoring CASCON for 28 years!

On behalf of IBM, I would like to thank our CASCON community for the accomplishments and advocacy that earned us an IEEE Computer Society Technical Council on Software Engineering (TCSE) Synergy Award, presented at the 39th ACM/IEEE International Conference on Software Engineering (ICSE 2017) in May in Buenos Aires, Argentina. We are proud and honoured to received this prestigious award!

I would also like to thank our Program Co-chairs, Dr. Kelly Lyons from the University of Toronto, and Joe Wigglesworth, from IBM, for their outstanding work in organizing this conference. They are both former CAS Heads, and their experience and passion for CASCON is evident and appreciated.

Think of all the impressive accomplishments science has packed into such a small fraction our time on this planet. The scientific method got us from our first look at Jupiter's moons to walking on our Moon in just 400 years. It's about trial and error. Evidence and analysis. Observing, reflecting and making. Now think of all the mistakes and misunderstandings made on the journey to those accomplishments.

That's what we're doing with CASCON this year. We've challenged ourselves to experiment with new approaches. We're trying several new things—some of which may be very successful, others not so much—and we appreciate your observations, analysis and understanding. We've had to reacquaint ourselves with the uncomfortable feeling of leaving behind well-established optimizations, for a journey through the less good in search of new solutions to changing constraints. In hindsight, I've also been reacquainted with the truth of Thomas Sowell, that there are no solutions, only tradeoffs. But designing for outcomes is even more rewarding than it is challenging.

I'd like to call your attention to some of the changes.

This year, CASCON is colocated with Empirical Software Engineering International Week. ESEIW participants will be joining us for lunch and breaks. We especially appreciate the opportunity to have Dr. Vic Basili deliver a joint opening keynote on the Evolution of Empirical Software Engineering through the 70s to 2000s.

We've created more seating space with a new "gala-style" layout that more than doubles the plenary seating, and makes presentations possible over lunch. We've added additional time to lunch and breaks, so you have more networking time and don't have to instantly teleport from one session to another. Also, you won't "miss the conference" by attending workshops.

Monday's lunch features a "Future 50" strategic foresight exercise aimed at getting everyone thinking about the future implications of current trends in technology and society. We'll use this work as a launching point for Monday afternoon's "Future 50" panel. As Alan Kay has famously said, "the best way to predict the future is to invent it." What better way to mark Canada's 150th, IBM Canada's 100th, and the IBM Canada Lab's 50th anniversary?

Tuesday's lunch will be our first CASCON Sponsored Challenge. I'd like to thank Queen's University and the City of Kingston for their support for CASCON. We'll use table-based design thinking exercises to explore the opportunities and challenges of small municipalities. There are three main objectives. 1) Build awareness in the CASCON community about these issues. 2) Gain a breadth of insights from CASCON participants. 3) Connect those interested in continuing the work beyond CASCON.

Wednesday's Women in Technology Mentoring Luncheon will include 60 IBM STEM4Girls participants from local middle schools, and a dozen Shad fellows. Thanks to our CASCON volunteer chairs, Trevor Deley and Natasha Decoste, the Shads will also be helping everyone to have the best possible conference experience. They're very excited about the conference theme and the opportunity to interact with you.

The expo space has been rearranged in U-shape around the perimeter of the plenary room. Each of the 23 stations features a different exhibit on each of the three conference days. The intent of the "one-day-only" approach is to refresh the expo every day, and afford exhibitors the opportunity to attend workshops and visit other booths on their "off" days. Plus we now have two expo reception nights!

The changes needed to make these things happen have disadvantages as well as advantages. Round tables vs. theatre style seating. Larger spaces with more noise and less intimacy. Most notably, our "half-day" and "full-day" workshops are now only about two and four hours long, respectively. Are these changes worthwhile? What other changes should we consider? My team and I look forward to discussing these things with you.

See you at CASCON!



Marcellus Mindel
Head, IBM Advanced Studies
CASCON General Chair

Marcellus Mindel

Message from the Program Co-Chairs

CASCON 2017

Message from the Program Co-Chairs

Welcome to CASCON 2017, the 27th Annual International Conference on Computer Science and Software Engineering hosted by the IBM Advanced Studies (CAS)!

The theme of CASCON 2017 is The Cognitive Era: Data, Systems, and Society. This year we explore the economic and societal impacts of cognitive systems through 5 thought-provoking keynote presentations, 21 technical paper presentations, 73 poster and demo exhibits, and 27 workshops.

Our keynote presenters, Professor Emeritus Vic Basili, IBM Fellow Donna Dillenberger, Canadian Broadcaster and Writer Nora Young, Vice President, Entertainment Software Association Tanya Woods, and Professor Susan Landau will enlighten the CASCON audience on the following topics: The Evolution of Empirical Software Engineering; Cognitive Blockchain; Seeing the Forest and the Trees: Surviving and Thriving in the Coming Data Boom; Social Entrepreneurship - A practitioner's guide; and, Cybersecurity, National Security, Law and Policy. Four out of five keynote speakers at CASCON 2017 are women!

The Technology Expo provides an excellent opportunity to experience emerging research results and leading edge products and developing product areas. For the second year in a row, CASCON 2017 features very short PechaKucha style presentations to showcase the posters and exhibits to the entire CASCON audience.

The 27 workshops at CASCON 2017 are wonderful forums for presenting, discussing, and debating issues, problems, ideas, technology gaps, works-in-progress, and gaining hands-on experience with new product directions.

This year we received 66 full paper submissions and 19 position paper submissions from sixteen different countries in South America, North America, Europe, and South and East Asia. We accepted 21 full papers and 11 position papers. Acceptance rate for full papers was 33.3% and for position papers was 52.6%. Each paper was rigorously reviewed by three members of the 69-member Program Committee and seven reviewers resulting in a very high-quality program. The program is organized into the following sessions: modeling, algorithms, cognitive computing, systems management, cloud systems, machine learning, and Java performance. As in previous years, the CASCON 2017 proceedings are archived for ease of access in the ACM Digital Library.

One of the most gratifying aspects of the CASCON planning process is the selection of the Best Paper, Best Student Paper, and Most Influential Paper awards. This year, the Best Paper Award goes to authors Xiang Jiang, Erico N de Souza, Ahmad Pesaranghader, Baifan Hu, Daniel Silver and Stan Matwin for their paper, "TrajectoryNet: An Embedded GPS Trajectory Representation for Point-based Classification Using Recurrent Neural Networks." The Best Student Paper Award is given to Krystalenia Tatsi for her paper, "Assisting Developers Towards Fault Localization by Analyzing Failure Reports," co-authored with her supervisor, Kostas Kontogiannis. The Most Influential Paper from CASCON 2007 is awarded to Yuan Gan, Marsha Chechik, Shiva Nejati (all from the University of Toronto at the time) and Jon Bennett, Bill O'Farrell, and Julie Waterhouse (all from the IBM Toronto Laboratory at the time) for their paper, "Runtime Monitoring of Web Service Conversations".

We are very grateful to many people for their help and support in organizing CASCON 2017. First of all, we thank all the authors of technical papers, workshop proposals and technology expo submissions. Second, we thank all the CASCON 2017 participants, who gathered for the annual "Meeting of Minds" in Markham. We thank the hard-working members of the CASCON 2017 Program Committee for their dedication to excellence in completing the reviews and engaging in discussion of the papers. We also recognize the workshops and technology showcase committees, as well as the awards committees, for their hard work. We thank the entire CASCON 2017 organizing team: Jimmy Lo who worked his magic to make everything run smoothly, Tinny Ng and Iosif Viorel Onut who, respectively, orchestrated the workshop and technology expo selections and programs, as well as Jamie Featherstone, Darsh Saraf, Cris He, and Emily Liu who assembled the CASCON 2017 proceedings and kept the CASCON 2017 website up-to-date.

Our task as Program Co-Chairs was particularly enjoyable because we have both served as the Head of CAS Toronto in the past. We are thankful for the opportunity to reflect on and reminisce about our past as we worked together to build the 2017 CASCON Program and helped to continue the important and meaningful legacy that is CAS and CASCON!



Kelly Lyons
University of Toronto, Canada
CASCON 2017 Program Co-Chair

A handwritten signature in black ink that reads "Kelly Lyons".

Joe Wigglesworth
IBM Canada Ltd.
CASCON 2017 Program Co-Chair

A handwritten signature in black ink that reads "Joe Wigglesworth".

Message from the Most Influential Paper of 2007 Award Committee Co-Chairs

CASCON 2017

Message from the Most Influential Paper of 2007 Award Committee Co-Chairs

Since 2010, CASCON has presented a “Most Influential Paper” (MIP) Award to a paper published a decade earlier at CASCON. The MIP Award recognizes lasting contributions and impact to theory and practice.

The Most Influential Paper for 2007 was selected by the MIP Selection Committee:

- Ken Kent, University of New Brunswick
- Kelly Lyons, University of Toronto, CASCON 2017 Program Co-Chair
- Iosif Viorel Onut, IBM Canada Ltd.
- Dorina Petriu, Carleton University, CASCON 2018 Program Co-Chair
- Joe Wigglesworth, IBM Canada Ltd., CASCON 2017 Program Co-Chair

The committee followed a selection process similar to the process established in previous years. Each MIP Award Committee Member was provided with links to all of the CASCON 2007 papers and the citation and download statistics for each paper from Google Scholar and the ACM Digital Library. The committee then focused on the top five papers for each of the gathered statistics, resulting in a shortlist of nine papers. Each member was asked to review the shortlisted papers according to the following criteria adapted from the ACM SIGSoft Impact Project and from the Journal of the American Society for Information Science (JASIST) published by Wiley:

1. Impact (50%)
 - a) Contributions that have had substantial impact in industry or academia;
 - b) Results that are directly useful to IBM products, processes, methods or developers;
 - c) Usefulness to practicing information professionals (e.g., applicability, timeliness, scope, problem-solving value, product value);
 - d) Societal or scientific/technical significance of the topic or problem investigated or expounded;
 - e) Technology transition approaches that have worked well.
2. Professional Merit (50%)
 - a) Creativity and originality, as reflected in new insights, interpretations, facts, innovations, methods, applications (e.g., stimulating, informative, or enlightening)
 - b) Scientific and professional quality of the research, review, development work, methods of inquiry (e.g., competent, valid, or replicable);
 - c) Scholarship embodied in the presentation, explanations, interpretations, and discussions (e.g., researched, documented, or balanced)

On behalf of the Most Influential Paper for 2007 Selection Committee, we are very pleased to announce that the CASCON Most Influential Paper of 2007 Award is awarded to Yuan Gan, Marsha Chechik, Shiva Nejati (all from the University of Toronto at the time) and Jon Bennett, Bill O’Farrell, and Julie Waterhouse (all from IBM Toronto at the time) for their paper, "Runtime Monitoring of Web Service Conversations".

This winning paper proposes a theoretically grounded yet industrial-strength method for runtime monitoring of web service conversations. The paper shows that a subset of UML 2.0 Sequence Diagrams can be used to specify a variety of properties. An implementation of the solution is also presented. The implementation results are not only interesting but have had long-lasting applicability and direct relevance to IBM and its business process and web services products and services. The research presented is high quality scientific work and continues to be cited today.

We congratulate the authors for their outstanding contribution, and we thank the MIP Selection Committee for their reviews and deliberations.



Kelly Lyons
University of Toronto, Canada
Most Influential Paper of 2007
Award Committee Co-Chair

A handwritten signature in black ink that reads "Kelly Lyons". The signature is fluid and cursive, with "Kelly" on the first line and "Lyons" on the second line.

Joe Wigglesworth
IBM Canada Ltd.
Most Influential Paper of 2007
Award Committee Co-Chair

A handwritten signature in black ink that reads "Joe Wigglesworth". The signature is fluid and cursive, with "Joe" on the first line and "Wigglesworth" on the second line.

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CASCON 2017

Organizing Committee

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Darsh Saraf	IBM Canada Ltd.

Best Paper Awards Selection Committee

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Jeremy Bradbury	University of Ontario Institute of Technology
Allen Chan	IBM Canada Ltd.

Most Influential Paper Award Committee

Ken Kent
Kelly Lyons
Iosif Viorel Onut
Dorina Petriu
Joe Wigglesworth

University of New Brunswick
University of Toronto
IBM Canada Ltd.
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Best Exhibit Award Selection Committee

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Piotr Mierzejewski
Joanna Ng
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John Steinbacher
Ettore Tiotto
Joe Wigglesworth

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Expose RESTful Microservices Using OpenAPI, WebSphere Liberty and IBM Cloud

Chairs / Speakers

- Leo Christy Jesuraj
- Arthur De Magalhaes

Application programming interfaces (APIs) are everywhere around us today. Just think – every time you post, comment or "like" on social media or every time you complete a transaction online, you are interacting with an API. API Economy is a vast domain that covers the exposure and invocation of services from and to anywhere. Cloud computing, mobile devices and the Internet of Things (IoT) are the main catalysts behind the growth of the API Economy. At the center of the API Economy are RESTful APIs because they are, by nature, language-neutral and by far the most widely used type of API today.

The OpenAPI Specification (OAS), originally known as the Swagger Specification, is a specification for machine-readable interface files for describing, producing, consuming, and visualizing RESTful Web services. It's language-agnostic and is also extensible into new technologies and protocols beyond HTTP. The new version of OAS, OpenAPI 3.0, introduces new concepts such as Links and includes lots of improvements such as support for describing callbacks, enhanced security definitions, improved examples, and more.

WebSphere Liberty now provides the way to document and expose REST APIs using OpenAPI 3.0. It also allows to explore all APIs available on a Liberty server easily in a central place. You can also easily push your APIs into the cloud using IBM Cloud.

Node.js Native Modules

Chairs / Speakers

- Sampson Gao
- Muntasir Mallick
- Anisha Rohra
- Jaideep Bajwa

Node.js is growing in popularity and it is becoming highly likely that you will need to develop Node.js based applications as part of your future solutions. Node.js is lightweight and efficient with an event-driven and non-blocking I/O model, making it a good framework for Microservice architecture. Combining Node.js with Microservice architecture, developers can easily work on individual functional components without affecting the availability and performance of the entire application. Another striking benefit is Node.js' package ecosystem, NPM, is the largest ecosystem of open source libraries in the world, allowing developers to reuse existing modules and libraries into their own solutions.

While most code used with Node.js is written in Javascript, it is sometimes necessary to develop native add-ons in C/C++. These add-ons allow Node.js code to interact with existing libraries written in C/C++ or to interact with their environment in ways that the existing Node.js JavaScript API does not support. This workshop is to help you get started in exploiting the benefits of Node.js by teaching you how to fully leverage the power of Node.js native add-ons.

The 9th CASCON Workshop on Cloud Computing

Chairs / Speakers

- Marin Litoiu
- Joe Wigglesworth

Goals and Outcomes

The goal of the workshop was to bring together researchers and practitioners from government, industry and academia to present and share the best practices and research agendas on different aspects of hybrid clouds and containerized applications: development, deployment, runtime management, quality of services and economic models. In this workshop, we particularly focused on two aspects of cloud computing: (a) dynamic provisioning of software and hardware resources in hybrid clouds (b) the advantages and drawback of container platforms. We also explored the state of the art of the software as a service, platform as a service, privacy and security aspects of the hybrid clouds.

This half-day workshop consisted in presentations and a panel. The presentations were structured along two main themes, dynamic provisioning and container management. To encourage discussion and provide a more open discussion and perspective, we included a panel where industry and academic experts presented their visions and answered questions from the audience.

Workshop on Financial Risk Analytics

Chairs / Speakers

- Oleksandr Romanko
- Alex Kreinin

The workshop comprises four 20-minute talks by distinguished researchers from industry and academia. The speakers are:

- 8:30 - 8:55 Alex Kreinin (joint work with Yijun Jiang), "Scenario Engine - new features and new problems"
- 8:55 - 9:15 Oleksandr Romanko (joint work with Helmut Mausser), "Scenario-based financial risk optimization"
- 9:15 - 9:30 Oleksandr Romanko (joint work with Helmut Mausser), "Portfolio Optimization service on IBM Bluemix cloud demo"
- 9:35 - 9:55 Roy Kwon, "Risk parity optimization under Markov regime switching"
- 9:55 - 10:15 Aloagbaye Momodu (joint work with Chi-Guhn Lee), "Valuation of Israeli options using a projected successive over-relaxation algorithm"

Following the presentations, workshop attendees would have an opportunity to explore the research results and related topics in more detail through informal discussions with the speakers and workshop organizers.

Using Mini Studies to Gain Competitive Advantage

Chairs / Speakers

- Joe Wigglesworth
- Marcelo Martins

How to gain a competitive advantage is an important question for businesses and other organizations. But this is a very difficult question to answer. Often, large scale studies or commissions are created with the mandate to exhaustively research a topic and report back to the leadership. But these kinds of studies are expensive in terms of time and staff hours and it can happen that good opportunities are missed because these studies lack agility.

The idea behind this workshop is that mini studies can be used for similar topics, but with the difference of using smaller groups and a much shorter time frame to keep the study focused and to ensure that the study completes while the possibility of gaining a competitive advantage related to the topic still exists.

The purpose of the workshop is to discuss and brainstorm about how best to run mini studies and how best to pick good topics that are appropriate for the mini study process. For example, is it better to take ideas that come down from the senior leaders of the organization, or from practitioners in the field? What are attributes that make a good mini study topic so that those good topic ideas can be recognized? The last part of the workshop will be a discussion session for coming up with good topic ideas and analyzing them to understand what makes them attractive.