

# **2018 IEEE 26th International Requirements Engineering Conference (RE 2018)**

**Banff, Alberta, Canada  
20 – 24 August 2018**



**IEEE Catalog Number: CFP18022-POD  
ISBN: 978-1-5386-7419-2**

**Copyright © 2018 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP18022-POD
ISBN (Print-On-Demand):	978-1-5386-7419-2
ISBN (Online):	978-1-5386-7418-5
ISSN:	1090-705X

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# 2018 IEEE 26th International Requirements Engineering Conference **RE 2018**

## Table of Contents

**Welcome Message from the RE18 Chairs .xiii**.....  
*Walid Maalej (University of Hamburg), Daniel Amyot (University of  
Ottawa), and Guenther Ruhe (University of Calgary)*

**Organizing Committee .xvii**.....

**Program Committee .xix**.....

**Keynote Abstracts .xxiii**.....

**Donors and Sponsors .xxvi**.....

## Keynotes

Disruptive Change in Requirements Engineering Research .1.....  
*Jane Cleland-Huang (University of Notre Dame)*

Requirements Engineering in the Age of Societal-Scale Cyber-Physical Systems: The Case of  
Automated Driving .3.....  
*Krzysztof Czarnecki (University of Waterloo)*

## Research Track

The Next Release Problem Revisited: A New Avenue for Goal Models .5.....  
*Fatma Baak Aydemir (Utrecht University), Fabiano Dalpiaz (Utrecht  
University), Sjaak Brinkkemper (Utrecht University), Paolo Giorgini  
(University of Trento), and John Mylopoulos (University of Ottawa)*

The Manager Perspective on Requirements Impact on Automotive Systems Development Speed .17..  
*S. Magnus Ågren (Chalmers | University of Gothenburg), Eric Knauss  
(Chalmers | University of Gothenburg), Rogardt Heldal (Chalmers |  
University of Gothenburg, Western Norway University of Applied  
Sciences), Patrizio Pelliccione (Chalmers | University of Gothenburg),  
Gösta Malmqvist (Knowit AB), and Jonas Bodén (Knowit AB)*

A Qualitative Study on using GuideGen to Keep Requirements and Acceptance Tests Aligned .29.....  
*Sofija Hotomski (University of Zurich) and Martin Glinz (University of  
Zurich)*

Enhancing Automated Requirements Traceability by Resolving Polysemy .40.....	
	<i>Wentao Wang (University of Cincinnati), Nan Niu (University of Cincinnati), Hui Liu (Beijing Institute of Technology), and Zhendong Niu (Beijing Institute of Technology)</i>
Vetting Automatically Generated Trace Links: What Information is Useful to Human Analysts? .52.....	
	<i>Salome Maro (Chalmers   University of Gothenburg), Jan-Philipp Steghöfer (Chalmers   University of Gothenburg), Jane Hayes (University of Kentucky), Jane Cleland-Huang (University of Notre Dame), and Miroslaw Staron (Chalmers   University of Gothenburg)</i>
Modeling User Concerns in the App Store: A Case Study on the Rise and Fall of Yik Yak .64.....	
	<i>Grant Williams (Louisiana State University) and Anas Mahmoud (Louisiana State University)</i>
Customer Rating Reactions Can Be Predicted Purely using App Features .76.....	
	<i>Federica Sarro (University College London), Mark Harman (University College London, Facebook), Yue Jia (University College London, Facebook), and Yuanyuan Zhang (University College London)</i>
Catalog of Invisibility Requirements for UbiComp and IoT Applications .88.....	
	<i>Rainara Carvalho (Federal University of Ceará), Rossana Andrade (Federal University of Ceará), Káthia Oliveira (Université Polytechnique Hauts-de-France), and Christophe Kolski (Université Polytechnique Hauts-de-France)</i>
RE and Society - A Perspective on RE in Times of Smart Cities and Smart Rural Areas .100.....	
	<i>Joerg Doerr (Fraunhofer IESE, Kaiserslautern, Germany), Anne Hess (Fraunhofer IESE, Kaiserslautern, Germany), and Matthias Koch (Fraunhofer IESE, Kaiserslautern, Germany)</i>
On Systems of Systems Engineering: A Requirements Engineering Perspective and Research Agenda .112.....	
	<i>Cornelius Ncube (The British University in Dubai) and Soo Ling Lim (University College London)</i>
Automated Extraction of Semantic Legal Metadata using Natural Language Processing .124.....	
	<i>Amin Sleimi (SnT Centre for Security, Reliability and Trust, University of Luxembourg), Nicolas Sannier (SnT Centre for Security, Reliability and Trust, University of Luxembourg), Mehrdad Sabetzadeh (SnT Centre for Security, Reliability and Trust, University of Luxembourg), Lionel Briand (SnT Centre for Security, Reliability and Trust, University of Luxembourg), and John Dann (Central Legislative Service, Ministry of State, Luxembourg)</i>
The Grace Period Has Ended: An Approach to Operationalize GDPR Requirements .136.....	
	<i>Vanessa Ayala-Rivera (University College Dublin) and Liliana Pasquale (University College Dublin)</i>
Mining Android App Descriptions for Permission Requirements Recommendation .147.....	
	<i>Xueqing Liu (University of Illinois at Urbana-Champaign), Yue Leng (University of Illinois at Urbana-Champaign), Wei Yang (University of Texas at Dallas), Chengxiang Zhai (University of Illinois at Urbana-Champaign), and Tao Xie (University of Illinois at Urbana-Champaign)</i>

Semantic Incompleteness in Privacy Policy Goals .159.....	
	<i>Jaspreet Bhatia (Carnegie Mellon University) and Travis D. Breaux (Carnegie Mellon University)</i>
App Review Analysis Via Active Learning: Reducing Supervision Effort without Compromising Classification Accuracy .170.....	
	<i>Venkatesh T. Dhinakaran (Rochester Institute of Technology), Raseshwari Pulle (Rochester Institute of Technology), Nirav Ajmeri (North Carolina State University), and Pradeep K. Murukannaiah (Rochester Institute of Technology)</i>
Learning from Mistakes: An Empirical Study of Elicitation Interviews Performed by Novices .182.....	
	<i>Muneera Bano (Swinburne University of Technology, Melbourne, Australia), Muneera Bano (University of Technology Sydney), Didar Zowghi (University of Technology Sydney, Australia), Alessio Ferrari (CNR-ISTI, Pisa), Paola Spoletini (Kennesaw State University, GA, USA), and Beatrice Donati (University of Florence)</i>
Efficiency and Effectiveness of Requirements Elicitation Techniques for Children .194.....	
	<i>Jennifer Horkoff (Chalmers and the University of Gothenburg), Jerker Ersare (Chalmers and the University of Gothenburg), Jonas Kahler (Chalmers and the University of Gothenburg), Thorsteinn D. Jörundsson (Chalmers and the University of Gothenburg), and Imed Hammouda (Mediterranean Institute of Technology, South Mediterranean University)</i>
Towards Ubiquitous RE: A Perspective on Requirements Engineering in the Era of Digital Transformation .205.....	
	<i>Karina Villela (Fraunhofer IESE), Anne Hess (Fraunhofer IESE), Matthias Koch (Fraunhofer IESE), Rodrigo Falcao (Fraunhofer IESE), Eduard C. Groen (Fraunhofer IESE), Jörg Dörr (Fraunhofer IESE), Carol Naranjo Valero (TU Kaiserslautern), and Achim Ebert (TU Kaiserslautern)</i>
FAME: Supporting Continuous Requirements Elicitation by Combining User Feedback and Monitoring .217.....	
	<i>Marc Oriol (Universitat Politècnica de Catalunya), Melanie Stade (University of Applied Sciences and Arts Northwestern Switzerland), Farnaz Fotrousi (Blekinge Institute of Technology), Sergi Nadal (Universitat Politècnica de Catalunya), Jovan Varga (Universitat Politècnica de Catalunya), Norbert Seyff (University of Applied Sciences and Arts Northwestern Switzerland), Alberto Abello (Universitat Politècnica de Catalunya), Xavier Franch (Universitat Politècnica de Catalunya), Jordi Marco (Universitat Politècnica de Catalunya), and Oleg Schmidt (SEnerCon GmbH)</i>
On the Impact of Semantic Transparency on Understanding and Reviewing Social Goal Models .228	
	<i>Mafalda Santos (NOVA LINCS, FCT-UNL), Catarina Gralha (NOVA LINCS, FCT-UNL), Miguel Goulão (NOVA LINCS, FCT-UNL), João Araújo (NOVA LINCS, FCT-UNL), and Ana Moreira (NOVA LINCS, FCT-UNL)</i>
An Experimental Comparison of Two Navigation Techniques for Requirements Modeling Tools .240.	
	<i>Parisa Ghazi (University of Zurich) and Martin Glinz (University of Zurich)</i>

Morse: Reducing the Feature Interaction Explosion Problem using Subject Matter Knowledge as Abstract Requirements .251.....  
*Laure Millet (Critical Systems Labs), Nancy A. Day (Critical Systems Labs), and Jeffrey J. Joyce (Critical Systems Labs)*

Discovering, Analyzing, and Managing Safety Stories in Agile Projects .262.....  
*Jane Cleland-Huang (University of Notre Dame) and Michael Vierhauser (University of Notre Dame)*

Understanding Challenging Situations in Agile Quality Requirements Engineering and Their Solution strategies: Insights from a Case Study .274.....  
*Wasim Alsaqaf (PhD Candidate), Maya Daneva (University of Twente Enschede), and Roel Wieringa (University of Twente Enschede)*

## Industry Innovation Track

Towards Development of Complete and Conflict-Free Requirements .286.....  
*Abha Moitra (GE Global Research), Kit Siu (GE Global Research), Andrew Crapo (GE Global Research), Harsh Chamarthi (GE Global Research), Michael Durling (GE Global Research), Meng Li (GE Global Research), Han Yu (GE Global Research), Panagiotis Manolios (Northeastern University), and Michael Meiners (GE Aviation Systems)*

Industrial Requirements Classification for Redundancy and Inconsistency Detection in SEMIOS .297.....  
*Manel Mezghani (Prometil), Juyeon Kang (Prometil), and Florence Sèdes (IRIT, University of Toulouse CNRS, INPT, UPS, UT1, UT2)*

Tailoring Requirements Negotiation to Sustainability .304.....  
*Norbert Seyff (University of Applied Sciences and Arts Northwestern Switzerland), Stefanie Betz (Furtwangen University), Leticia Duboc (La Salle - Ramon Llull University), Colin Venters (University of Huddersfield), Christoph Becker (University of Toronto), Ruzanna Chitchyan (University of Bristol), Birgit Penzenstadler (California State University Long Beach), and Markus Nöbauer (InsideAx GmbH)*

Requirements Engineering for Consensus-Oriented Technical Specifications .315.....  
*Martin Krammer (VIRTUAL VEHICLE Research Center), Nadja Marko (VIRTUAL VEHICLE Research Center), and Martin Benedikt (VIRTUAL VEHICLE Research Center)*

Supporting Diagnosis of Requirements Violations in Systems of Systems .325.....  
*Michael Vierhauser (University of Notre Dame), Jane Cleland-Huang (University of Notre Dame), Rick Rabiser (Johannes Kepler University, CDL MEVSS), Thomas Krismayer (Johannes Kepler University, CDL MEVSS), and Paul Grünbacher (Johannes Kepler University, CDL MEVSS)*

Integrating Requirements Specification and Model-Based Testing in Agile Development .336.....  
*Dalton N. Jorge (Federal University of Campina Grande), Patrícia D. L. Machado (Federal University of Campina Grande), Everton L. G. Alves (Federal University of Campina Grande), and Wilkerson L. Andrade (Federal University of Campina Grande)*

Focusing Requirements Elicitation by Using a UX Measurement Method .347.....  
*Kyoko Ohashi (Fujitsu Laboratories LTD.), Asako Katayama (Fujitsu Laboratories LTD.), Naoki Hasegawa (Fujitsu Laboratories LTD.), Hidetoshi Kurihara (Fujitsu Laboratories LTD.), Rieko Yamamoto (Fujitsu Laboratories LTD.), Joerg Doerr (Fraunhofer IESE), and Dominik Pascal Magin (Fraunhofer IESE)*

## **RE@Next!**

Assessment of Safety Processes in Requirements Engineering .358.....  
*Jéssyka Vilela (Universidade Federal do Ceará (UFC), Universidade Federal de Pernambuco (UFPE)), Jaelson Castro (Universidade Federal de Pernambuco (UFPE)), Luiz Eduardo G. Martins (Universidade Federal de São Paulo (UNIFESP)), and Tony Gorschek (Blekinge Institute of Technology (BTH))*

CaRE: A Refinement Calculus for Requirements Engineering Based on Argumentation Semantics .364  
*Yehia Elrakaiby (Lero - University of Limerick), Alessio Ferrari (CNR-ISTI), and John Mylopoulos (University of Toronto)*

Crowd-Focused Semi-Automated Requirements Engineering for Evolution Towards Sustainability.370  
*Norbert Seyff (University of Applied Sciences and Arts Northwestern Switzerland), Stefanie Betz (Furtwangen University), Iris Groher (Johannes Kepler University Linz), Melanie Stade (University of Applied Sciences and Arts Northwestern Switzerland), Ruzanna Chitchyan (University of Bristol), Letícia Duboc (La Salle-URL), Birgit Penzenstadler (California State University Long Beach), Colin Venters (University of Huddersfield), and Christoph Becker (University of Toronto)*

Reflection on Evolutionary Decision Making with Goal Modeling Via Empirical Studies .376.....  
*Alicia M. Grubb (University of Toronto)*

Software Transparency as a Key Requirement for Self-Driving Cars .382.....  
*Luiz Marcio Cysneiros (York University - School of IT), Majid Raffi (York University - School of IT), and Julio Cesar Sampaio do Prado Leite (PUC-Rio)*

Speculative Requirements: Design Fiction and RE .388.....  
*Andy Darby (Lancaster University), Emmanuel Tseklevs (Lancaster University), and Pete Sawyer (Aston University)*

The Ability of Engineers to Extract Requirements from Models .394.....  
*Ronald Giachetti (Naval Postgraduate School), Karen Holness (Naval Postgraduate School), and Mollie McGuire (Naval Postgraduate School)*

The Use of Design Thinking for Requirements Engineering: An Ongoing Case Study in the Field of Innovative Software-Intensive Systems .400.....  
*Jennifer Hehn (University of St.Gallen) and Falk Uebernickel (University of St.Gallen)*

Towards Utility-Based Prioritization of Requirements in Open Source Environments .406.....  
*Alexander Felfernig (Graz University of Technology), Martin Stettinger (Graz University of Technology), Müslüm Atas (Graz University of Technology), Ralph Samer (Graz University of Technology), Jennifer Nerlich (Vogella GmbH), Simon Scholz (Vogella GmbH), Juha Tiihonen (University of Helsinki), and Mikko Raatikainen (University of Helsinki)*

## Data Track

Automatic Glossary Term Extraction from Large-Scale Requirements Specifications .412.....  
*Tim Gemkow (Technische Universität Berlin), Miro Conzelmann (Technische Universität Berlin), Kerstin Hartig (Technische Universität Berlin), and Andreas Vogelsang (Technische Universität Berlin)*

Requirement Engineering of Software Product Lines: Extracting Variability Using NLP .418.....  
*Alessandro Fantechi (Università di Firenze, Italy), Alessio Ferrari (ISTI-CNR, Pisa, Italy), Stefania Gnesi (ISTI-CNR, Pisa, Italy), and Laura Semini (Università di Pisa, Italy)*

The REquirements TRacing On Target (RETRO).NET Dataset .424.....  
*Jane Huffman Hayes (University of Kentucky), Alex Dekhtyar (CalPoly San Luis Obispo), and Jared Payne (University of Kentucky)*

Towards a Corpus of Requirements Documents Enriched with Semantic Frame Annotations .428.....  
*Waad Alhoshan (University of Manchester), Riza Batista-Navarro (University of Manchester), and Liping Zhao (University of Manchester)*

Utilizing Product Usage Data for Requirements Evaluation .432.....  
*Ashkan Hemmati (University of Calgary), S. M. Didar Al Alam (University of Calgary), and Chris Carlson (Brightsquid Secure Communication Corp, Canada)*

## Panel Papers

RE Cares'18: First RE Cares Workshop and Event - RE Cares About Giving Back to Alberta .436.....  
*Jane Huffman Hayes (University of Kentucky), Maleknaz Nayebi (University of Toronto), Alex Dekhtyar (CalPoly University San Luis Obispo), and Barbara Paech (Heidelberg University)*

Data Driven Requirements Engineering: Implications for the Community .439.....  
*Maleknaz Nayebi (University of Toronto)*

## Doctoral Symposium

Modeling Adaptive Socio-Cyber-Physical Systems with Goals and SysML .442.....  
*Amal Anda (University of Ottawa)*

An Ontology Based Collaborative Recommender System for Security Requirements Elicitation .448..  
*Imano Williams (North Carolina A&T State University)*



Assessing Security Risk and Requirements for Systems of Systems .454.....	<i>Duncan Ki-Aries (Bournemouth University)</i>
Automated Validation of Requirement Reviews: A Machine Learning Approach .460.....	<i>Maninder Singh (North Dakota State University)</i>
Cross-Functional Teams That Grok It: The Collective Empathic Understanding of Product Requirements .466.....	<i>Rob Fuller (University of British Columbia)</i>
Decision Support for Smart Ecosystem Evolution .472.....	<i>Matthias Koch (Fraunhofer IESE)</i>
Towards a Security Requirements Management Framework for Open-Source Software .478.....	<i>Wentao Wang (University of Cincinnati)</i>
Towards Goal-Oriented Process Mining .484.....	<i>Mahdi Ghasemi (University of Ottawa)</i>

## Posters and Tool Demos

BloomingLeaf: A Formal Tool for Requirements Evolution Over Time .490.....	<i>Alicia M. Grubb (University of Toronto) and Marsha Chechik (University of Toronto)</i>
Dynamic Visual Analytics for Elicitation Meetings with ELICA .492.....	<i>Zahra Shakeri Hossein Abad (University of Calgary), Munib Rahman (University of Calgary), Abdullah Cheema (University of Calgary), Vincenzo Gervasi (University of Pisa), Didar Zowghi (University of Technology Sydney), and Ken Barker (University of Calgary)</i>
FlexiView Experimental Tool: Fair and Detailed Usability Tests for Requirements Modeling Tools .494.....	<i>Parisa Ghazi (University of Zurich) and Martin Glinz (University of Zurich)</i>
Multi-user Input in Determining Answer Sets (MIDAS) .496.....	<i>Albert Kalim (University of Kentucky), Jane Huffman Hayes (University of Kentucky), Satrio Husodo (University of Kentucky), Erin Combs (University of Kentucky), and Jared Payne (University of Kentucky)</i>
piStar Tool – A Pluggable Online Tool for Goal Modeling .498.....	<i>João Pimentel (Universidade Federal Rural de Pernambuco) and Jaelson Castro (Universidade Federal de Pernambuco)</i>
SuSoftPro: Sustainability Profiling for Software .500.....	<i>Ahmed D. Alharthi (RMIT University, Melbourne, Australia), Maria Spichkova (RMIT University, Melbourne, Australia), and Margaret Hamilton (RMIT University, Melbourne, Australia)</i>
T-Reqs: Tool Support for Managing Requirements in Large-Scale Agile System Development .502...	<i>Eric Knauss (Chalmers   University of Gothenburg), Grischa Liebel (Chalmers   University of Gothenburg), Jennifer Horkoff (Chalmers   University of Gothenburg), Rebekka Wohlrab (Chalmers   University of Gothenburg), Rashidah Kasauli (Chalmers   University of Gothenburg), Filip Lange (Ericsson), and Pierre Gildert (Ericsson)</i>

## Tutorials

DT4RE: Design Thinking for Requirements Engineering: A Tutorial on Human-Centered and Structured Requirements Elicitation .504.....	
<i>Jennifer Hehn (University of St. Gallen), Falk Uebernickel (University of St. Gallen), and Daniel Mendez Fernandez (Technical University of Munich)</i>	
Agile Requirements Engineering with User Stories .506.....	
<i>Fabiano Dalpiaz (Utrecht University) and Sjaak Brinkkemper (Utrecht University)</i>	
Reconciling Requirements and Continuous Integration in an Agile Context .508.....	
<i>Sebastien Mosser (Université Côte d'Azur, CNRS, I3S) and Jean-Michel Bruel (Université de Toulouse, CNRS, IRIT)</i>	
Software Reuse and Reusability Based on Requirements: Product Lines, Cases and Feature-Similarity Models .510.....	
<i>Hermann Kaindl (TU Wien) and Mike Mannion (Glasgow Caledonian University)</i>	
Writing Requirements for Molecular Programs .512.....	
<i>Jack Lutz (Iowa State University) and Robyn Lutz (Iowa State University)</i>	
<b>Author Index 513</b> .....	