



# ANNUAL REPORT 2019

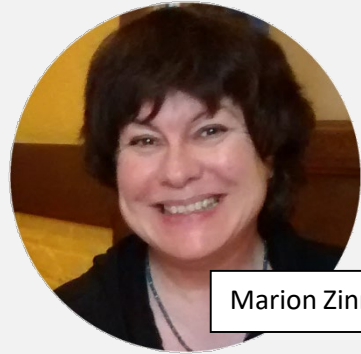
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# SWC TEAM



Horst Lichter



Marion Zinner



Christian Plewnia



Konrad Fögen



Simon Hacks



Nils Wild



Peter Alexander

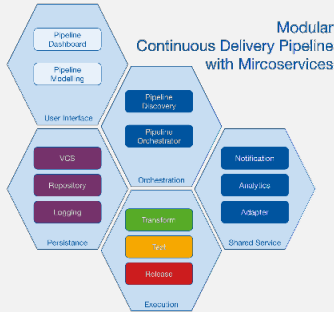


Andreas Steffens

# RESEARCH PROJECTS

## Scalable distributed data processing

Christian Plewnia



## DevOps-aware Software Engineering

Andreas Steffens

## ROBUSTA - Combinatorial Robustness Testing

Konrad Fögen



**coffee4j**



## Enterprise Architecture Roundtrip-Management

Simon Hacks

## Enterprise Architecture Debt Management

Peter Alexander / Simon Hacks



# HIGHLIGHTS

## FEBRUARY: Seminar on Software Testing, TGGG Bangkok

An industry seminar on **Concepts and Modern Approaches to Software Testing** was organized in the context of the TGGG Software Systems Engineering seminar series.



**Concepts and Modern Approaches to Software Testing**

SSE Industry Seminar  
by Prof. Dr. Horst Lichter  
(RWTH Aachen University)

Topics:

- Introduction to Software Testing
- Approaches to Black-Box Testing
- Test Automation
- Test Driven Development
- Behavior Driven Development

Thursday, 28 February 2019  
08.30 A.M. – 04.30 P.M.  
Aachen Conference Room  
3<sup>rd</sup> Floor, TGGG Building

2500 Baht per Person

## MARCH: Workshop Scrum in Industry

We organized a **Scrum Workshop** in the context of the Software Project Management lecture. There, **Frank Linden**, a professional Agile Coach from **Amadeus IT Leisure Group**, interactively taught some important aspects of the Scrum framework. Thanks, for offering this opportunity to our students!





# HIGHLIGHTS

## MARCH: 4<sup>th</sup> CSE Workshop in Hamburg

Co-located with the International Conference on Software Architecture (ICSA'19) we organized the **4<sup>th</sup> Workshop on Continuous Software Engineering**. For the first time, CSE and QUDOS joined forces to foster cross-fertilization and bootstrap an even bigger, stronger community around the urgently emerging topics they are both.

The keynote was given by **Ian Gorton**!

Thanks to **Andreas Steffens** for organizing this event.



## MAY: 137 Years of Software Engineering @ RWTH Aachen

We celebrated

- 75<sup>th</sup> birthday of **Prof M. Nagl**
- 20<sup>th</sup> anniversary of **Prof. H. Lichter**
- 10<sup>th</sup> anniversary of **Prof. B Rumpe**
- 32<sup>nd</sup> anniversary of the Chair Software Engineering



# HIGHLIGHTS

## JUNE: Final SW Lab Presentation at Amadeus

This year Amadeus supported our **Bachelor Software Lab**. Amadeus provided the tasks students had to solve in the project.  
The final presentation was given by the students at Amadeus in Würselen.

Thanks to Amadeus for offering this opportunity.

**Christian Plewnia** headed this lab.

**SWC** Software Construction | **RWTH AACHEN UNIVERSITY**

### Asynchrone Suche nach Reiseangeboten

Abschlusspräsentation Softwareprojektpraktikum 2019  
Amadeus Leisure IT Lounge | 10. Juli, 12:45 bis 14:15

**Softwareprojektpraktikum**  
Das Softwareprojektpraktikum ist eine Lehrveranstaltung für Bachelor Informatik Studenten an der RWTH Aachen. Das Ziel des Praktikums ist es, dass die Studenten Erfahrung in der Durchführung eines Softwareprojekts im Team sammeln. Hierfür trat Amadeus als Kunde auf, für den die studentischen Teams eine Aufgabe lösen sollten.

**Aufgabenstellung**  
Im Fokus stand das Szenario, in dem bei Suchanfragen nach Reisen auch die Systeme der Veranstalter direkt eingebunden werden können. Da diese externe Systeme mit variierenden Antwortzeiten sind, stellte sich die Frage, wie Benutzern von Reiseportalen erst später eintreffende Ergebnisse verständlich dargestellt werden können.

**Beispiel-Suchanfrage**

Suchanfrage → nach 0.5s → nach weiteren 7s → Ergebnisse

Reiseportal → Suche → Veranstalterssysteme

**Lösungen**  
Vier Teams mit je fünf Studenten haben sich über drei Monate hinweg mit dieser Aufgabe beschäftigt und als Antwort vier unterschiedliche Webiste-Prototypen für die Suche von Reisen entwickelt.

**Wie die Lösungen aussehen?**  
Komm am 10. Juli um 12:45 in die Lounge und schau dir die Präsentationen der Studenten an.

**Kooperation**  
Amadeus und die Forschungsgruppe Softwarekonstruktion der RWTH Aachen kooperieren in Forschung und Lehre. Dies ermöglicht zum einen die Untersuchung von praktischen Fragestellungen mit wissenschaftlichen Ansätzen. Zum anderen profitiert auch die Lehre durch einen stärkeren Praxisbezug und die Möglichkeit für Abschlussarbeiten bei Amadeus. Diese Vorteile für beide Partner sind die Motivation für die Kooperation.

**Ansprechpartner für die Kooperation**  
Amadeus Leisure IT  
Marcel Titz (marcel.titz@amadeus.com)  
Forschungsgruppe Softwarekonstruktion, RWTH Aachen  
Christian Plewnia (plewnia@swc.rwth-aachen.de, +49 241 80 1000)

Scanne den QR-Code, um den Termin in deinen Kalender zu speichern

Photo: Luc Broux auf Unsplash.com

## JULY : Industry Lecture on Quality Assurance at IVU

In the context of the **SQA lecture**, IVU introduced to the students the challenges of testing large and complex application landscapes and present some developed solutions.

As this lecture was given at the IVU building in Aachen, students were invited to explore the specific test lab of IVU.

Thanks to IVU for offering this opportunity.



# HIGHLIGHTS

## JULY: Course on Test Cloud Automation at UTM, Johor Bahru

As part of the DAAD-funded project we organized a compact course on **Testing and Cloud Automation** at Universiti Teknologi Malaysia (UTM).



### Invited Instructors:



**Prof. Dr. Horst Lichter**  
Head of Research Group  
Software Construction Research Group  
RWTH Aachen University, Germany.



**Mr. Andreas Steffens**  
Researcher  
Software Construction Research Group  
RWTH Aachen University, Germany

## SEPTEMBER: Ph.D. Defense of Simon Hacks

On September 12, **Simon Hacks** successfully passed his Ph.D. defense on **“Improving the Quality of Enterprise Architectures - Processes and Techniques”**.

Thanks to Prof. Pontus Johnson for supporting this defense!

Simon joined KHT Stockholm as Postdoc.

**Congratulations!**





# HIGHLIGHTS

## OCTOBER: SWC Trip to Worms

This year, we spontaneously visited **Worms** and the “**Wonnegau**”.



## NOVEMBER: Visit from UTM Malaysia

As part of the DAAD-funded project "Digital Lifestyle Germany - Malaysia" we welcomed a delegation of the **Universiti Teknologi Malaysia (UTM)**.

In addition to some meetings, visits to various RWTH institutes and the company partner IVU Technologies took place.

Thanks to **Andreas Steffen** for taking care of our guests.





# HIGHLIGHTS

## DECEMBER: 7<sup>th</sup> QuASoQ Workshop in Putrajaya, Malaysia

Collocated with the 26<sup>th</sup> Asia-Pacific Software Engineering Conference (APSEC 2019), we organized the **7<sup>th</sup> International Workshop “Quantitative Approaches to Software Quality” (QuASoQ)** in Putrajaya.

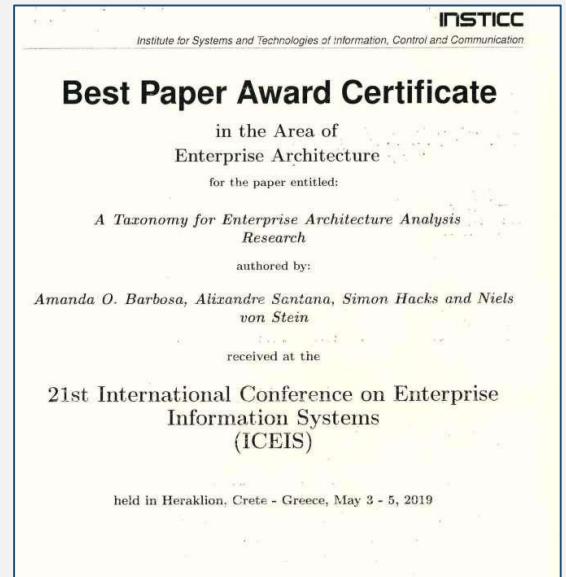
**Konrad Fögen** (once again) chaired the workshop!



# WHAT ELSE HAPPENED ...

## SIMON HACKS RECEIVED BEST PAPER AWARD @ ICEIS

The paper entitled “**A Taxonomy for Enterprise Architecture Analysis Research**” by Amanda Oliveira Barbosa, Alixandre Santana, Simon Hacks and Niels von Stein received the Best Paper Award at the **21<sup>st</sup> International Conference on Enterprise Information Systems**, May 3, 2019 - May 5, 2019, Heraklion, Crete, Greece.



## COFFEE4J FRAMEWORK PUBLISHED

coffee4j is a Java-based framework, developed by **Konrad Fögen**, for [Combinatorial Test Input Generation and Fault Characterization](#). It is based on a fast implementation of the well-known IPOG algorithm and supports constraint handling, robustness testing and fault localization.



## NEW RESEARCH PROJECT WITH IVU TECHNOLOGIES

In September, we started a new research project with **IVU Technologies Aachen**. The focus of this project is to improve **Test Automation**, including test strategy, technology and processes.

**Nils Wild**, who joined us in July, is in charge of this project.



# PUBLICATIONS

- H. Lichter, K. Fögen, T. Sunetnanta, T. Anwar (eds) (2019): **Proceedings of the 7th International Workshop on Quantitative Approaches to Software Quality (QuASoQ 2018)** co-located with APSEC 2019, Putrajaya, Malaysia, December 2. CEUR-WS.org.
- Y. C. Yeong, S. Hacks, H. Lichter (2019): **Prioritization of EA Debts Facilitating Portfolio Theory**. In 7th International Workshop on Quantitative Approaches to Software Quality (QuASoQ 2019), Putrajaya, Malaysia, December 2, CEUR-WS.org, Vol. 2511, 45-52.
- K. Fögen, H. Lichter (2019): **An Experiment to Compare Combinatorial Testing in the Presence of Invalid Values**. In 7th Int. Workshop on Quantitative Approaches to Software Quality (QuASoQ 2019), Putrajaya, Malaysia, December 2, CEUR-WS.org, Vol. 2511, 27-36.
- S. Hacks (2019): **Improving the Quality of Enterprise Architecture Models -Processes and Techniques-**. Shaker, Aachen.
- B. Bebensee, S. Hacks (2019): **Applying Dynamic Bayesian Networks for Automated Modeling in ArchiMate: A Realization Study**. In 23rd IEEE Int. Enterprise Distributed Object Computing Workshop, EDOC Workshops 2019, Paris, France, October 28-31, 2019, 17-24.
- S. Hacks, H. Höfert, J. Salentin, Y. C. Yeong, H. Lichter (2019): **Towards the Definition of Enterprise Architecture Debts**. In 23rd IEEE International Enterprise Distributed Object Computing Workshop, EDOC Workshops 2019, Paris, France, October 28-31, 2019, 9-16.
- N. Dohmen, K. Koopmann, S. Hacks (2019): **Optimizing Enterprise Architecture Considering Different Budgets**. In C. Draude, M. Lange, B. Sick (eds), INFORMATIK 2019: 50 Jahre Gesellschaft für Informatik – Informatik für Gesellschaft (Workshop-Beiträge), Gesellschaft für Informatik e.V., Bonn, 45-58.
- K. Fögen, H. Lichter (2019): **Repairing Over-Constrained Models for Combinatorial Robustness Testing**. In 2019 IEEE 19th International Conference on Software Quality, Reliability and Security Companion (QRS-C), IEEE, 177-184.
- K. Fögen, H. Lichter (2019): **Combinatorial Robustness Testing with Negative Test Cases**. 19th Int. Conference on Software Quality, Reliability and Security (QRS), IEEE, 34-45.
- S. Hacks, A. Steffens, P. Hansen, N. Rajashekar (2019): **A Continuous Delivery Pipeline for EA Model Evolution**. In I. Reinhartz-Berger, J. Zdravkovic, J. Gulden, R. Schmidt (eds), Enterprise, Business-Process and Information Systems Modeling. BPMDS 2019, EMMSAD 2019, Springer International Publishing, Cham, 141-155.
- V. Borozanov, S. Hacks, N. Silva (2019): **Using Machine Learning Techniques for Evaluating the Similarity of Enterprise Architecture Models**. In P. Giorgini, B. Weber (eds), Advanced Information Systems Engineering, Springer International Publishing, Cham, 563–578.
- A. Barbosa, A. Santana, S. Hacks, N. von Stein (2019): **A Taxonomy for Enterprise Architecture Analysis Research**. In Proceedings of the 21st International Conference on Enterprise Information Systems, SciTePress, Vol. 2, 493-504.
- S. Katsikeas, P. Johnson, S. Hacks, R. Lagerström (2019): **Probabilistic Modeling and Simulation of Vehicular Cyber Attacks: An Application of the Meta Attack Language**. In Proceedings of the 5th International Conference on Information Systems Security and Privacy – Volume 1: ICISSP, SciTePress, 175-182.
- J. Bonn, K. Fögen, H. Lichter (2019): **A Framework for Automated Combinatorial Test Generation, Execution, and Fault Characterization**. In Proceedings of the 8th International Workshop on Combinatorial Testing (IWCT 2019), IEEE, 224-233.



# PUBLICATIONS

N. Rajashekar, S. Hacks, N. Silva (2019): [A Performance Comparison of Graph Analytic Methods for Supporting Enterprise Architecture Model Maintenance](#). In Practice of Enterprise Modelling 2019 Conference Forum (to be published).

S. Hacks, A. Hacks, S. Katsikeas, B. Klaer, R. Lagerström (2019): [Creating Meta Attack Language Instances using ArchiMate: Applied to Electric Power and Energy System Cases](#). In Proceedings of the 2019 IEEE 23rd International Enterprise Distributed Object Computing Conference (to be published), IEEE.

S. Hacks, H. Lichter (2019): [Qualitative Comparison of Enterprise Architecture Model Maintenance Processes](#). In EMISA 2019 conference (to be published).

K. Fögen, H. Lichter (2019): [Semi-Automatic Repair of Over-Constrained Models for Combinatorial Robustness Testing](#). In 26th Asia-Pacific Software Engineering Conference (APSEC) (to be published).