



# ANNUAL REPORT 2020

(COVID-19 edition)

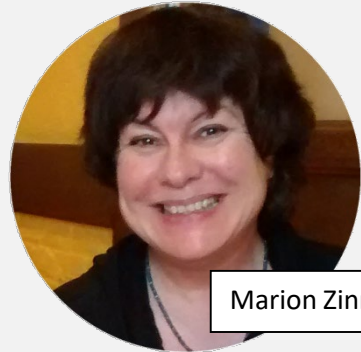
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# SWC TEAM



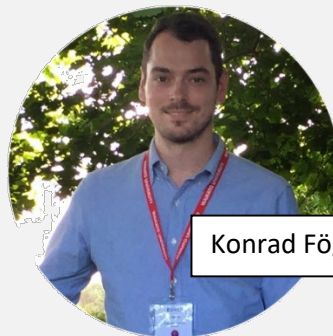
Horst Lichter



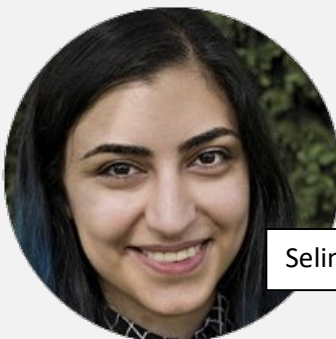
Marion Zinner



Christian Plewnia



Konrad Fögen



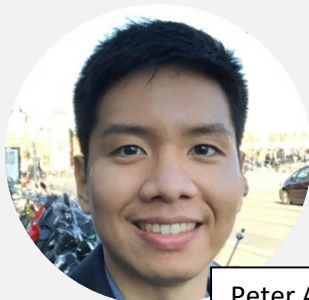
Selin Aydin



Alex Sabau



Nils Wild



Peter Alexander

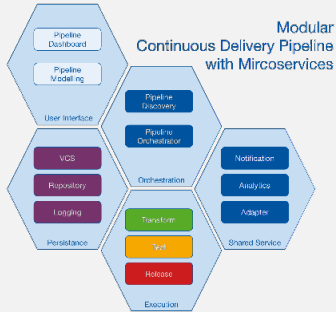


Andreas Steffens

# RESEARCH PROJECTS

## Scalable distributed Data Processing

Christian Plewnia



## DevOps-aware Software Engineering

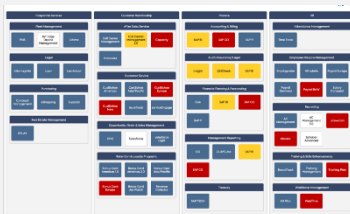
Andreas Steffens

## Combinatorial Robustness Testing

Konrad Fögen



**coffee4j**



## Test Automation for Application Landscape Frameworks

Nils Wild

## Enterprise Architecture Debt Management

Peter Alexander



# HIGHLIGHTS

## JANUARY : Industry Lecture @ OOSC

In the context of the **OOSC lecture**, Mirko Hartmann, a Senior Software Engineer from IVU Traffic Technologies AG, gave a guest lecture on **Migrating to a broker-based communication infrastructure using RabbitMQ**.

Thanks to IVU for offering this opportunity!



FOR THE MOBILITY OF TOMORROW

### FACILITATING PUBLIC TRANSPORT

The smart software solutions from IVU enable transport operators and cities to offer innovative and modern services. Well designed, intelligently implemented and adapted to customer-specific requirements, IVU software is already supporting the organisation of transport for the passengers of tomorrow.

## MARCH : Lockdown ...

To fight against the **COVID-19 pandemic**, a country-wide lockdown was needed. We did our very best, to adopt our way to work in order to teach students and to move on in our research projects.

### Some News and Infos

Currently, the SWC team is working from home. You can reach us at any time by mail, you find the information on the [team page](#).

Theses can still be **registered and supervised**. According processes are well documented and we use all tools to support you from home when you work on your thesis. So don't be afraid to request for a thesis!



# HIGHLIGHTS

## JULY: Final SW Lab Presentations

This summer term, Amadeus and IVU Technologies supported our **Bachelor Software Labs**. The following topics were elaborated by the students:

- **Many ways to travel** (together with Amadeus)
- **Daten, die uns bewegen** (together with IVU Technologies)

The final presentations were given virtually.

Thanks to both cooperation partners for offering this opportunity.

Thanks to **Christian** and **Nils** for managing the labs!



## Many ways to travel

Building a comparison portal for package tours with diverse transportation

Final presentation of the software development lab 2020  
Online presentation | 17th July, 10:00 to 11:45 (CET)

**Software development lab**  
The software development lab is a course for students enrolled to the bachelor computer science program at RWTH Aachen University. In this lab, the students gain experience in conducting a software project as a team of four to five students over a time period of three months.

**The assignment**  
Amadeus asked each student team to develop ideas for a user interface of an online travel agent's website. The teams had to implement a prototype based on data for hotels, flights, train trips, and public transportation. Each of the three teams went through an iterative process



For the third time, Amadeus has played the role of the customer in such a lab, tasking the student teams with developing a software solution for an assignment.

**The scenario**  
The focus was on packaged tours with the option for the consumer to choose between different means of transportation. For example, a consumer could choose to travel from Aachen to Berlin by going to Cologne/Bonn airport with public transportation, taking a flight from Cologne/Bonn to Berlin Tegel, and getting from there to the hotel by public transportation. Alternatively, he or she could take a train from Cologne to Berlin instead of the flight. Offering such a product as an online travel agent would require a user interface that gives the consumer a comprehensive overview of the transportation options.

of developing and sketching ideas, implementing their prototypes, and presenting the intermediate results to their customer.

**The results**  
The teams present the results of their work in the lab's final presentation. Are you curious? Join the final presentation!



**Join the presentation on July 17th 10:00 (CET)**

**Contact persons for the lab**  
Amadeus Leisure IT  
Felix Mörken (felix.moerken@amadeus.com)  
Manuel Tilo (manuel.tilo@amadeus.com)

Research Group Software Construction  
RWTH Aachen University  
Christian Plewitt (plewitt@swc.rwth-aachen.de)

**We thank the SWC and the MIB for giving the lab access to their public transportation data.**

**Image references**  
• Picture background and logo by Amadeus (published on Instagram)  
• The information is provided without any responsibility on the part of Amadeus (published on Instagram)



## Daten, die uns bewegen

Datenvisualisierung zur Verbesserung des öffentlichen Verkehrs

Abschlusspräsentation des Softwarepraktikums 2020  
Online Präsentation | 15 Juli 12:30 bis 14:00

**Softwarepraktikum**  
Das Softwarepraktikum ist Teil des Informatik Bachelorstudiums an der RWTH Aachen University. In diesem Praktikum sammeln die Studierenden praktische Erfahrung bei der Realisierung eines eigenen Softwareprojekts in Teams von 4-5 Studierenden über einen Zeitraum von ca. drei Monaten. Dabei müssen sie sich selbst organisieren und die notwendigen fachlichen Kompetenzen durch die technische Umsetzung der Anforderungen mit aktuellen Methoden, Konzepten, Werkzeugen und Technologien erlernen und vertiefen.

**Die Aufgabe**  
Die Produkte der IVU suite bieten Softwarelösungen für den öffentlichen Transportsektor an. Dabei fallen eine ganze Reihe von Daten an, die dazu genutzt werden können, den Service zu verbessern und planerische sowie operative Tätigkeiten zu erleichtern. Die Studierenden sollen ein Web-Tool zur Analyse und Visualisierung dieser Daten entwickeln. Im Fokus standen dabei die Plandaten zu Fahrwegen, Verläufen und Verbindungen sowie die KVR-Daten zur Lichtsignalanlagen-Regelung.



**Die Ergebnisse**  
Die Studierenden werden ihre Ergebnisse bei der Abschlusspräsentation des Praktikums vorstellen. Neugierig? Dann komm einfach dazu.

**15 Juli 12:30 bis 14:00**



**Kontakt**  
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RWTH Aachen University  
Nils Wilsch (nwilsch@swc.rwth-aachen.de)

**Image references**  
• Picture background, logo and icons published on Instagram

# HIGHLIGHTS

## SEPTEMBER: 5<sup>th</sup> CSE Workshop in L'Aquila (virtual)

Co-located with the 14th European Conference on Software Architecture (ECSA) we organized the **5<sup>th</sup> Workshop on Continuous Software Engineering**. For the second 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.

Thanks to **Andreas** for co-organizing this event.



## OCTOBER: SWC Research Retreat in Hürtgenwald

This year, we organized our yearly research retreat in **Hürtgenwald** under the **COVID-19** restrictions.

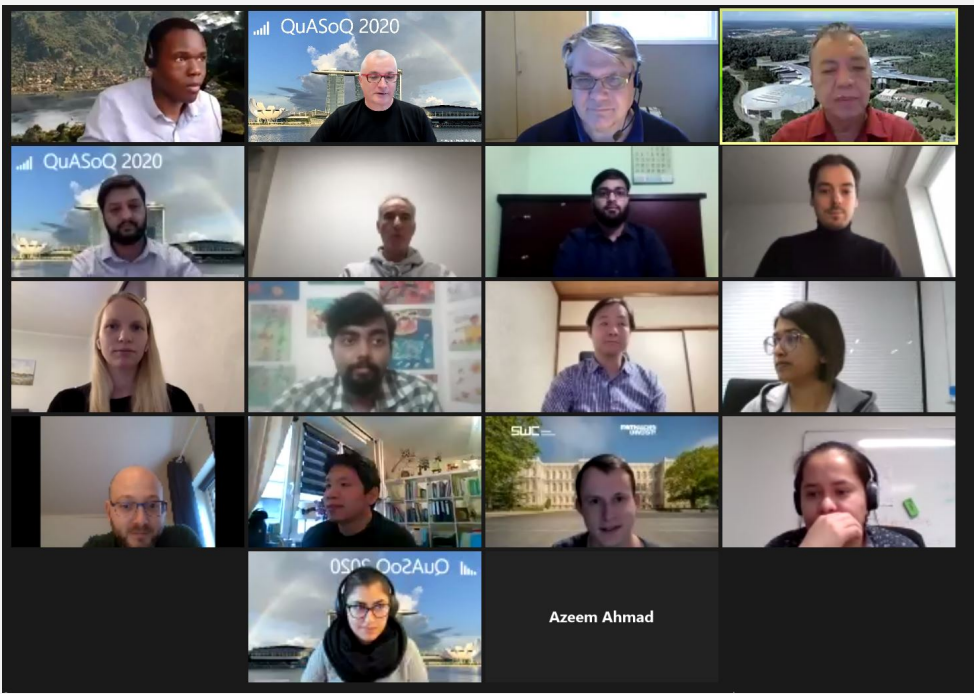


# HIGHLIGHTS

## DECEMBER: 8<sup>th</sup> QuASoQ Workshop in Singapore (virtual)

Collocated with the 27<sup>th</sup> Asia-Pacific Software Engineering Conference (APSEC 2020), we organized the **8<sup>th</sup> International Workshop “Quantitative Approaches to Software Quality” (QuASoQ)**.

This time, the workshop was conducted virtually. Ten papers were presented and 20 researchers attended the workshop.



Case Study Results

Overview

Coverage Criterion	Testing Strength	Test Suite Size	Average FDE
t-wise relevant coverage (CT)	t=5	15,023.70	0.62
t-wise valid coverage (CRT)	t=2	48.30	0.62
b-wise strong invalid coverage (CRT)	b=0	301.00	0.98
t-wise valid coverage (CRT) and b-wise strong invalid coverage (CRT)	t=1, b=0	308.00	1.00

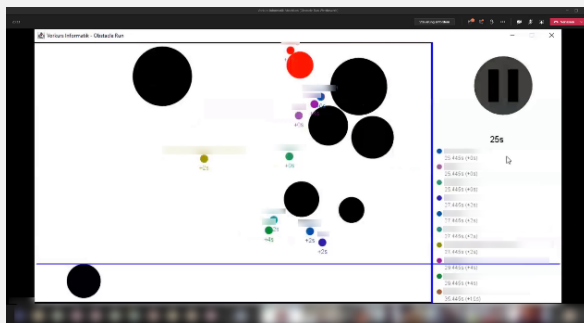
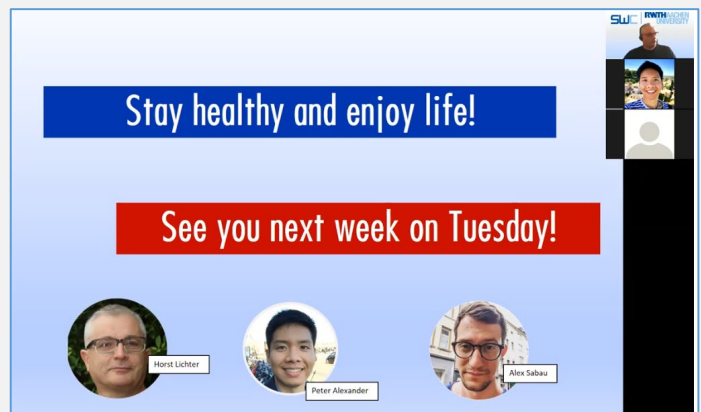
# WHAT ELSE HAPPENED ...

## DISTANCE TEACHING & RESEARCHING ...

As almost everywhere, we had to change our teaching format in Summer in Winter Term to react to the COVID-19 pandemic.

Hence, we taught the **SPM lecture**, all **Bachelor Software Project Labs** and the **2020 Bridge Course in Computer Science** virtually!

But not only the teaching format changed but also our way to work together and to collaborate with our industry cooperation partners changed dramatically!



# WHAT ELSE HAPPENED ...

## CHRISTOPHER GERDES RECEIVED ONE OF THE BACHELOR AWARDS 2020

**Christopher Gerdes** received an Industry Bachelor Award at the virtual TDI 2020 for his Bachelor Thesis entitled **“Usage-based discovery of a fragmentation for a distributed tourism search database”**.

The thesis was done in cooperation with Amadeus and was supervised by **Christian**.



## TALK IN THE UTM DISTINGUISHED LECTURE SERIES

**UTM Engineering**

**DISTINGUISHED LECTURE SERIES**

*“Software Engineering in the Age of Digitalisation - Current and Future Challenges”*

DATE: 01 SEPTEMBER 2020  
TIME: 4:00pm (Malaysia) / 10:00am CET

 Faculty of Engineering  
UTM JOHOR BAHRU

**LIVE STREAMING** 

Attendance will be recorded in UTM Smile

**Professor Horst Lichter**  
RWTH Aachen University  
Germany

 **GOALS** 

 **UTM** FACULTY OF ENGINEERING  Premier Digital Tech University  **UTM SDSN**



# WHAT ELSE HAPPENED ...

## NEW RESEARCH PROJECT WITH ITERGO DÜSSELDORF

In May, we started a new research project with **ITERGO Düsseldorf**. The topic of this project is to develop new approaches for **Enterprise Architecture Debt Management** as an integral part of Enterprise Architecture Management.

**Peter** is in charge of this project.



## NEW RESEARCH PROJECT WITH APOBANK DÜSSELDORF

In February, we started a new research project with **apoBank Düsseldorf**. There, the focus is to develop new approaches for **DevOps in regulated Software Development Environments**.

**Alex**, who joined us in January, is in charge of this project.



## NEW RESEARCH PROJECT WITH KISTERS AACHEN

In July, we started a new research project with **KISTERS Aachen**. In this project appropriate Software technologies for BidData Applications should be researched and evaluated.

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



## RESEARCH PROJECT WITH GDIS AACHEN FINISHED

In July, we successfully finished a research project with **GDIS Informatik Services** on **Test Data Generation**.

Thanks to **Konrad** for heading this project!



# PUBLICATIONS

- H. Lichter, S. Aydin, T. Sunetnanta, T. Anwar (eds) (2020): **Proceedings of the 8th International Workshop on Quantitative Approaches to Software Quality** (QuASoQ 2020), Singapore, December 1. CEUR-WS.org.
- H. Lichter, S. Aydin, T. Sunetnanta, T. Anwar (2020): **Report on the the 8th International Workshop on Quantitative Approaches to Software Quality**. In 8th International Workshop on Quantitative Approaches to Software Quality (QuASoQ 2020), Singapore, December 1, CEUR-WS.org, Vol. 2767, 1-5.
- K. Fögen, H. Lichter (2020): **An Industrial Case Study on Fault Detection Effectiveness of Combinatorial Robustness Testing**. In 8th International Workshop on Quantitative Approaches to Software Quality (QuASoQ 2020), Singapore, December 1, CEUR-WS.org, Vol. 2767, 29-36.
- B. Lehmann, P. Alexander, H. Lichter, S. Hacks (2020): **Towards the Identification of Process Anti-Patterns in Enterprise Architecture Models**. In 8th International Workshop on Quantitative Approaches to Software Quality (QuASoQ 2020), Singapore, December 1, CEUR-WS.org, Vol. 2767, 47-54.
- S. Sok, C. Plewnia, S. Tanachutiwat, H. Lichter (2020): **Optimization of Compute Costs in Hybrid Clouds with Full Rescheduling**. In 2020 IEEE International Conference on Smart Cloud (SmartCloud) (to be published), IEEE Computer Society, Los Alamitos, CA, USA.
- A. R. Sabau, S. Hacks, A. Steffens (2020): **Implementation of a continuous delivery pipeline for enterprise architecture model evolution**. In Software and systems Modeling, Springer, New York, NY.
- S. Hacks, H. Lichter (2020): **Qualitative Comparison of Enterprise Architecture Model Maintenance Processes**. In 40 Years EMISA – Proceedings of EMISA 2019, Gesellschaft für Informatik (GI), Vol. P-304, 105-118.
- P. Alexander, S. Hacks, J. Jung, U. Steffens, Ö. Uludag, H. Lichter (2020): **A Framework for Managing Enterprise Architecture Debts – Outline and Research Directions**. In EMISA 2020 conference, CEUR-WS.org.
- J. Salentin, S. Hacks (2020): **Towards a Catalog of Enterprise Architecture Smells**. In N. Gronau, M. Heine, H. Krasnova, K. Poustcchi (eds), Entwicklungen, Chancen und Herausforderungen der Digitalisierung: Proceedings der 15. Internationalen Tagung Wirtschaftsinformatik, WI 2020, Potsdam, Germany, March 9-11, 2020. Community Tracks, GITO Verlag, 276–290.
- N. Wild, H. Lichter, P. Kehren (2020): **Test Automation Challenges for Application Landscape Frameworks**. In Proceedings of 2020 IEEE International Conference on Software Testing, Verification and Validation Workshops (ICSTW), IEEE, 330-333.
- K. Fögen, H. Lichter (2020): **Generation of Invalid Test Inputs from Over-Constrained Test Models for Combinatorial Robustness Testing**. In Proceedings of 2020 IEEE International Conference on Software Testing, Verification and Validation Workshops (ICSTW), IEEE, 171-180.
- T. Friedrichs, K. Fögen, H. Lichter (2020): **A Comparison Infrastructure for Fault Characterization Algorithms**. In Proceedings of 2020 IEEE International Conference on Software Testing, Verification and Validation Workshops (ICSTW), IEEE, 201-210.
- C. Plewnia, A. Steffens, N. Wild, H. Lichter (2020): **A lightweight collaborative approach for teaching software project labs with industry partners**. In Joint Proceedings of 3rd Software Engineering Education Workshop (SEED 2020) & Workshop on NLP Advancements for Software Engineering (NLPaSE 2020 ), Singapore, December 1, CEUR-WS.org, Vol. 2799, 1-8.