International Conference on Software Architecture
22. – 26.03.2021, Stuttgart (held virtually)

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Foreword

The IEEE International Conference on Software Architecture is the premier gathering of practitioners and researchers interested in software architecture, component-based software engineering, and quality aspects of complex software systems. ICSA continues the tradition of a working conference, where researchers meet practitioners and where software architects can explain the problems they face in their day-to-day work and try to influence the future of the field. Interactive working sessions are the place where researchers meet practitioners to identify opportunities to create the future. The 18th IEEE International Conference on Software Architecture (ICSA 2021) continues this long history of establishing and supporting the software architecture research and practice community. This conference looks at what can be learned from our software architecture history, experience, studies, and best practices.

The year 2020 has been a very difficult year for all, including the software architecture community. The COVID-19 situation challenges systems and their software architectures in different ways: the way we are collaboratively creating software architectures without the typical in-person activities such as workshops, brainstorming sessions, reviews; the challenges facing our systems in terms of new usage patterns and business opportunities; and the impact they are having on our social and economic well being. This is why we have selected the theme “Software Architecture in the COVID-19 Reality” for ICSA 2021.

ICSA 2021 is run as a fully-virtual conference, which creates many organizational challenges, but also provides an opportunity for people from all over the world to more easily attend. Given that people did not had to travel, we have also done our small part in decreasing the carbon footprint of our conference. However, we will miss the face-to-face interaction with colleagues and the impromptu discussions that have always characterized this conference. Whether future ICSA versions will be hybrid so that we can get “the best of both worlds” is something that we will need to consider, while at the same recognizing the many challenges of running a conference in hybrid mode.

ICSA 2021 was planned to be held in Stuttgart, Germany. It is one of the
vibrant German regions shaped by large industries, such as automotive and insurance. Its picturesque landscape is surrounded by small hills, but also has significant environmental challenges to be addressed in the near future. During the virtual conference we will try to connect to the planned venue via a virtual city tour, participation of local research and industry partners, and virtual social events.

The General Chair and Technical Track Chairs would like to thank all members of the ICSA 2021 organizing committee, who made the event possible, and quickly adapted to a very challenging virtual version of the conference. We would also like to give special thanks to the Technical Track program committee members whom dedicated a large amount of time not only to reviewing their assigned papers, but also actively participating in the discussions. Their very thorough feedback was very valuable to all authors, whether the paper was accepted or rejected. We would also like to thank all our sponsors and supporters as they made the conference easy to organize, in particular our conference hosts, the IEEE Computer Society and infos e.V. Thank you!
Keynotes

Jay Gambetta
IBM Fellow, VP of Quantum Computing
Quantum circuits, and the future of quantum computing in the cloud

Birgit Penzenstadler
Chalmers University
The not-so-subtle art of taking a deep breath: Live-wiring yourself for better output and experience

Nenad Medvidovic
University of Southern California, USA
Human Archipelagos Have Been Induced by COVID, but Architectural Archipelagos Are All Our Own Doing

Vijayananda (Vijay)
Philips, India
Transforming care @ scale and speed with Philips Architecture in COVID-19 times

The abstracts and further info can be found here: https://icsa-conferences.org/2021/attending/keynotes/
Workshops

**QSA – 1st Workshop on Quantum Software Architecture**

Organizers:
- Johanna Barzen, University of Stuttgart, Germany
- Sebastian Feld, Delft University of Technology, The Netherlands
- Frank Leymann, University of Stuttgart, Germany
- Karoline Wild, University of Stuttgart, Germany

Quantum computing is becoming real: Several vendors offer quantum computers in the cloud or on premise, companies invest to become familiar with this technology and its potentials, several software companies build corresponding tools, and consulting companies offer services to build solutions. Many applications will benefit from quantum technologies because a lot of intractable problems (in the sense of complexity classes) may realize up to exponential speedups on quantum computers.

However, software to be run on a quantum computer is quite different from software for classical computers. Thus, the current state of the art is that solutions are hand-crafted in an ad-hoc manner and a solid foundation for building and integrating quantum software is missing.

The goal of the QSA workshop is to bring together researchers and practitioners from different areas of quantum computing and (classical) software architecture to strengthen the quantum software community and discuss architectural styles and best practices of quantum software as well as other aspects of the quantum software development lifecycle.

The workshop offers a platform for the presentation of novel scientific ideas as well as practical experiences and enables the exchange with experts from different areas of quantum computing.

**Mo. 22. March 2021, 08:50 – 15:00**

https://icsa-conferences.org/2021/workshops/qsa/

Workshops

**WASA – 7th International Workshop on Automotive System/Software Architectures**

Organizers:
- Stefan Kugele, Technische Hochschule Ingolstadt, Germany
- Darko Durisic, Volvo Car Corporation, Sweden
- Yanja Dajsuren, Eindhoven University of Technology, The Netherlands
- Miroslaw Staron, Chalmers | University of Gothenburg, Sweden

With the advent of software and electronics, automotive companies are enabling innovation to improve safety, security, driver experience, and driving automation. Moreover, the complexity and size of software keep growing because of future innovations, such as lane-keeping, self-learning algorithms, and automated driving, which all lead to the ultimate goal of autonomous driving. Consequently, increasing use of software over the years introduced the paradigm shift by requiring automotive companies to develop their systems using architecture and model-based techniques. Although model-based techniques using e.g. MATLAB/Simulink and Stateflow are being accepted in the automotive industry as standard languages and tooling for developing automotive control software, the techniques for system and software architecture are still far from being widely accepted. This is excluding the AUTOSAR standard (Classic and Adaptive), which defines the language for designing and configuring automotive software architectures and identifies major architectural components of automotive systems.

The goal of this workshop is to address issues related to the appropriate automotive system/software architecture and engineering techniques, which can be accepted by the automotive industry. Therefore, to bring together researchers and practitioners in the area of automotive system/software architecture and engineering, the International Workshop on Automotive System/Software Architectures (WASA) is being organized with the International Conference on Software Architecture (ICSA 2021), the premier international software architecture conference.

**Mo. 22. March 2021, 14:00 – 17:30**

https://icsa-conferences.org/2021/workshops/wasa/
Blockchain is an emerging technology that comprises a set of nodes without a pre-existing trust relationship and connected through a peer-to-peer topology. The five essential characteristics of blockchain technologies; namely, decentralization, consensus, immutability, provenance, and finality, enable new forms of distributed software architectures, where agreement on shared states can be established without trusting a central integration point. A major difficulty for architects designing applications based on blockchain is that technology has many configurations and variants. Since blockchains are at an early stage, there is little scientific evidence, product data or reliable technology evaluation available to compare different blockchain-based architectural designs.

The goal of this workshop is to shed the light on architectural issues, concerns, and solutions that emerge with the blockchains technologies.


Sponsor Talks

Thomas Eisenbarth
Axivion
Architecture Verification
Slot: Tue Mar 23, 17:00-17:20 UTC

Matthias Eschhold & Steve Walter
Novatec
Package structure of software systems
Slot: Wed Mar 24, 17:50-18:10 UTC

Ivan Greguric Ortolan
Mimacom
Event Driven Architecture on Apache Kafka
Slot: Wed Mar 24, 09:45-10:05 UTC

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Program overview

MONDAY, 22 MARCH

UTC

8:50
QSA — 1st Workshop on Quantum Software Architecture

Rolling Block 2 (EU + Asia)

13:00
BlockArch — 2nd International Workshop on Blockchain-Based Architecture

14:00
WASA — 7th International Workshop on Automotive System/Software Architectures

15:00
Early Career Researchers Forum (ECRF)

16:00

17:30

19:00

TUESDAY, 23 MARCH

UTC

0:00
Opening

0:20
Session 1: Quality Attributes and Emerging Technologies
- Quantum Computing Platforms: Assessing Impact on Quality Attributes and SDLC Activities
- Architectural Decay as Predictor of Issue- and Change-Proneness
- A Decision Model for Choosing Patterns in Blockchain-Based Applications

1:05
Break

1:15
Session 2: Infrastructure and Platforms
- Long Live The Image: Container-Native Data Persistence in Production
- Constructing a Shared Infrastructure for Software Architecture Analysis and Maintenance

2:00
Break

2:10
Keynote 1: Transforming care @ scale and speed with Philips Architecture in COVID-19 times
Vijayananda (Philips, India)

Note: All mentioned times / days are UTC (24h)
# TUESDAY, 23 MARCH

<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Event</th>
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<tbody>
<tr>
<td>8:00</td>
<td>Opening</td>
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<tr>
<td>8:20</td>
<td>Keynote 1: Transforming care @ scale and speed with Philips Architecture in COVID-19 times Vijayananda (Philips, India)</td>
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<td>9:10</td>
<td>Break</td>
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<td>9:20</td>
<td>Session 3: Architectures for Emerging Technologies</td>
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<td>Towards Resilient IoT Messaging: An Experience Report Analyzing MQTT Brokers</td>
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<td>A Decision Model for Choosing Patterns in Blockchain-Based Applications</td>
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<td>10:05</td>
<td>Break</td>
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<td>10:15</td>
<td>Session 4: Security and Privacy</td>
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<td>&amp;comp: An Architecture for Monitoring and Enforcing Security Compliance in Sensitive Health Data Environment</td>
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<td>Modeling Data Flow Constraints for Design-Time Confidentiality Analyses</td>
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<td>17:00</td>
<td>Sponsor Talk: Architecture Verification – Thomas Eisenbarth (Axivion)</td>
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<td>17:20</td>
<td>Session 7: Quality Attributes</td>
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<td>Architectural Decay as Predictor of Issue- and Change-Proneness</td>
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<td>Towards Resilient IoT Messaging: An Experience Report Analyzing MQTT Brokers</td>
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<td>Model-based Performance Analysis for Architecting Cyber-Physical Dynamic Spaces</td>
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<td>17:20</td>
<td>Session 9: Microservices 2</td>
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<td>A Process Model for Microservices Design and Identification</td>
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<td>Monolith Modularization Towards Microservices: Refactoring and Performance Trade-offs</td>
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<td>18:05</td>
<td>Break</td>
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<td>18:15</td>
<td>Session 8: Security and Maintainability</td>
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<td>&amp;comp: An Architecture for Monitoring and Enforcing Security Compliance in Sensitive Health Data Environment</td>
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<td>Practitioner Views on the Interrelation of Microservice APIs and Domain-Driver Design: A Grey Literature Study Based on Grounded Theory</td>
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<td>Modeling Data Flow Constraints for Design-Time Confidentiality Analyses</td>
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<tr>
<td>19:00</td>
<td>Break</td>
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<tr>
<td>19:10</td>
<td>Working Session: Architecture Technical Debt - Part 1</td>
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<tr>
<td>19:10</td>
<td>Working Session: Software Architecture Problems in the Next 5-10 Years - Part 1</td>
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Note: All mentioned times / days are UTC (24h)

- [Open Research Object (ORD)]
- [Research Object Reviewed (ROR)]
- [Candidate for Best Paper Award]
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### Program overview

**UTC Time** | **THURSDAY, 25 MARCH**
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**RB3**
0:00 | Working Session: Software Architecture for Machine Learning Systems - Part 2 | Working Session: Software Architecture Design Reasoning and Thinking - Part 2
8:00 | Session 15: Traceability and Decomposition 1  
InMap: Automated Interactive Code-to-Architecture Mapping Recommendations  
Automatic Class Decomposition using Clustering  
Why and How Your Traceability Should Evolve: Insights from an Automotive Supplier | Session 16: Architectural Knowledge  
Knowledge-based Adequacy assessment Approach to support AI adoption  
Exploring Web Search Engines to Capture Architectural Knowledge
8:45 | Break
8:55 | Working Session: Architecting for Sustainability - Part 2
10:40 | Social Event 3

**Note:** All mentioned times / days are UTC (24h)

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**UTC Time** | **THURSDAY, 25 MARCH**
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17:00 | Keynote 2: Human Archipelagos Have Been Induced by COVID, but Architectural Archipelagos Are All Our Own Doing  
Nenad Medvidovic (University of Southern California)
17:50 | Session 17: Traceability and Decomposition 2  
Automatic Class Decomposition using Clustering  
InMap: Automated Interactive Code-to-Architecture Mapping Recommendations  
Why and How Your Traceability Should Evolve: Insights from an Automotive Supplier  
Knowledge-based Adequacy assessment Approach to support AI adoption  
Exploring Web Search Engines to Capture Architectural Knowledge
18:35 | Break
18:45 | New and Emerging Ideas Panel: Software Architecture in the COVID-19 Reality
19:45 | Social Event 4 - Among Us

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**Note:** All mentioned times / days are UTC (24h)
Program overview

UTC TIME FRIDAY, 26 MARCH

Rolling Block 2 (EU + Asia)
8:00 Session 19: Sustainability and Evolution 1
A Framework of Software Architecture Principles for Sustainability-driven Design and Measurement
Enabling Consistency between Software Artefacts for Software Adaption and Evolution
Continuous API Evolution in Heterogenous Enterprise Software Systems
The Tao way to anti-fragile software architectures: the case of mobile applications

8:55 Awards Ceremony

9:15 Break

9:25 Most Influential Paper Presentation
PerOpteryx: automated application of tactics in multi-objective software architecture optimization. Anne Koziolek, Heiko Koziolek, Ralf H. Reussner

10:15 Closing

Rolling Block 1 (Americas + EU)
18:00 Session 20: Sustainability and Evolution 2
A Framework of Software Architecture Principles for Sustainability-driven Design and Measurement
Enabling Consistency between Software Artefacts for Software Adaption and Evolution
Continuous API Evolution in Heterogenous Enterprise Software Systems
The Tao way to anti-fragile software architectures: the case of mobile applications

18:55 Break

19:05 Most Influential Paper Presentation
PerOpteryx: automated application of tactics in multi-objective software architecture optimization. Anne Koziolek, Heiko Koziolek, Ralf H. Reussner

19:55 Awards Ceremony

20:15 Closing

Social events

Games

skribbl.io
Do you have the courage to test your drawing skills? Skribbl.io is a simple multiplayer game where you have to draw a chosen word, and others need to guess it. Your drawing skills will make you either a winner or a loser. Either way, you will have a lot of fun!
Slot: Wed Mar 24, 11:05 UTC

Codenames
Have you ever wanted to be a spy like James Bond? Codenames is a simple premise and challenging game which allows you to enter the world of spies. You can have a lot of fun guessing which cards may fit the clues given by your spymaster. But be aware not to catch the other team's cards or even the black one.
Slot: Thur Mar 25, 10:40 UTC

Among Us!
Have you ever wanted to downright lie to your colleagues or find out who the imposter in your group is? Then, Among Us is the right game for you. As a crewmate, you get a set of tasks to solve, while the ones in the role of imposters aim to sabotage the tasks and eliminate the crew. You need to install the app for playing the game, which is available for iOS and Android for free. Alternatively, you can buy the game via Steam or Epic game stores for playing it on your PC.
Slot: Thur Mar 25, 19:45 UTC

City Tour

Socializing during a virtual conference is a difficult task. We will nevertheless try to compensate for lack of personal interaction as much as possible. During all socializing slots, we will present a pre-recorded Stuttgart city tour.

Slots:
Wed Mar 24, 11:05 & 20:30 UTC
Thur Mar 25, 10:40 & 19:45 UTC
Overall information

Due to the Covid-19 pandemic, ICSA 2021 made an early, and as it turned out, wise decision to move to a full virtual conference.

Therefore, ICSA 2021 has all advantages (cheap registration, easy to attend, no travel and corresponding climate footprint, ...) and disadvantages (less interaction, harder socializing, ...) of being a virtual event.

On this page we provide some information on the conference’s organization as virtual event.

Prerecorded Talks

ICSA 2021 will not use live talks for most of the main event. Authors will be asked to provide pre-recorded, 10-minute videos of their talks. We will share the talks over YouTube and link them in the virtual conference management system. Discussion sessions during the conference will then provide summaries of submitted papers (<= 5min) and we will have Questions and Answers (Q&A) session. Discussions will be prepared upfront in the virtual conference management system.

Virtual Conference Management System

The conference will be managed and operated under the hood of the Whova conference management system. You can find ICSA's Whova page here. The ICSA agenda in Whova embeds your prerecorded YouTube videos and Zoom meetings for all live sessions. This means all information you need is centralized inside of Whova. Channels per session and for all types of socializing or networking activities will be provided in addition by Whova.

Multi-Time-Zone Mode

All discussion sessions of ICSA 2021 will be scheduled to take place twice with the objective that in each of the three major time zones (Europe, Asia, America) people can attend their preferred sessions during mostly business hours. The few live sessions, like the keynote presentations, conference opening, etc. will be played back or shared via video recording. Q&As will be done in this case in an asynchronous fashion via Whova.

Further information you can find on the following link:
https://icsa-conferences.org/2021/attending/virtual-attendance/