ER 2024

Companion Proceedings of the 43rd International Conference on Conceptual Modeling: ER Forum, Special Topics, Posters and Demos

Pittsburgh, Pennsylvania, USA, October 28-31, 2024

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https://resources.sei.cmu.edu/news-events/events/er2024/

Preface

Conceptual modeling is the process of building models that abstract aspects of the real world with the purpose of promoting communication and a common understanding of a domain of interest. Frequently, conceptual modeling precedes the development of information systems designed to manage information about the domain of interest.

The 43rd International Conference on Conceptual Modeling (ER 2024) is the main international forum for discussing the state of the art, emerging issues, and future challenges in research and practice on conceptual modeling. Topics of interest span the entire spectrum of conceptual modeling, including research and practice in areas such as theories of concepts and ontologies, techniques for transforming conceptual models into effective implementations, and methods and tools for developing and communicating conceptual models. The Companion Proceedings of the 43rd International Conference on Conceptual Modeling brings together the works presented in the following tracks of the conference: Forum, Special Topics, Posters and Demos.

Our gratitude goes to all the people who contributed to making this another successful edition of the ER conference series possible. We especially thank the authors who took the time to carefully write up the results of their research efforts and submit papers for consideration. We thank all the members of the program committees of the ER 2024 tracks here compiled, for their valuable reviews and discussions about the submissions. Finally, we would like to thank all members of the Organizing Committee of the ER 2024 for their support and cooperation, as well as the local organization team at the Software Engineering Institute (SEI) at Carnegie Mellon University for graciously hosting ER 2024 for the work put into making this event possible.

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ER Forum

The ER Forum is a vibrant and interactive platform for presenting and discussing novel and diverse research reports and artifacts on the full range of conceptual modeling topics. It supplements the main ER track with papers and presentations that report on new and promising research results, novel applications, experience reports, proposed research endeavors still in early stages, and updates from earlier work. The focus is on innovation and exciting new ideas and emerging new research topics that have not yet reached full maturity. The main goal of the event is to facilitate the interaction, discussion, and exchange of ideas among presenters and participants.

The 2024 offering of the ER Forum invited three types of submissions. The first where regular *forum papers* (long and short), which present novel and innovative research in conceptual modeling that is not necessarily mature or fully evaluated but includes interesting early results or carries promise for relevant future impact. Forum papers may also present novel applications of conceptual modeling in industrial contexts, or vision statements describing new and innovative research endeavors that are still in the conceptualization, design, or exploratory stage. Furthermore, *vision papers* have a particular focus on the future of conceptual modeling and/or discuss new challenges and opportunities. Finally, *follow-up notes* report new experiences about previously published papers in the ER conference or elsewhere.

A total of sixteen (16) papers were submitted. Four (4) of these papers were initially submitted to the main ER 2024 track and, having not been accepted there, were transferred for consideration in the ER Forum program, following the authors' decision. The remaining twelve (12) papers were submitted directly to the ER Forum. All papers underwent review by a program committee composed of twenty-one members. Ten (10) papers were found to be of sufficient quality to be included in the ER Forum program in accordance with the ER Forum goals and principles. In total, nine (9) full papers and one (1) vision paper were presented. The topics of the submitted work ranged widely from tool and analysis techniques to contributions on specific kinds of models and purposes. The presentations were hence thematically organized into three (3) sections titled: *IoT and Genomics*, *AI and Robots*, *Ontologies and Analytics*.

The ER Forum 2024 Chairs would like to extend their sincere gratitude to the authors, reviewers, participants, and ER 2024 Chairs for their invaluable contributions to the success of the event. We hope that it was a rewarding and constructive experience for everyone involved.

ER Forum Chairs

Sotirios Liaskos	York University, Canada
Patrick Marcel	University of Orléans, France

Program Committee

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Special Topics

The ER 2024 Special Topics track provides the opportunity for presenters to disseminate the intermediate results of their projects, and to get feedback for ready-to-start or ongoing projects, or even before submitting a project proposal. Thus, to participants, it offers a moment to get an updated view of innovative ongoing research, best practices, and networking with potential research partners and industry practitioners

We have considered innovative projects such as Cybersecurity, Digital Twins, Software Engineering, and AI Engineering that tackled relevant conceptual modeling challenges or used conceptual modeling techniques, and intended to address a challenge posed by an organization or a funding entity. We accepted five out of six project exhibitions' submissions that covered a variety of topics (Quantum Computing, Crisis Management, Context-Aware Data Analytics, AI, Conceptual Modeling for Data-Intensive Domains, and Process Factories), resulting in a rich program for this track.

Speakers were invited from industry and government agencies. We had 3 sessions as listed below;

- **Topic**: Analysis Contracts for AADL Models **Presenters**: Aaron Greenhouse and Dionisio de Niz **Abstract**: This tutorial introduces a new technique for assuring AADL models called "Analysis Contracts." Analysis contracts are supported by the OSATE AADL tool and are backed by a novel analysis process called "symbolic assurance refinement." Symbolic assurance refinement is described with an emphasis on how it addresses current difficulties with assuring models of cyber-physical systems. OSATE tool support for assurance contracts is demonstrated using a case study drawn from a real-world avionics scenario.
- **Topic**: Bootstrapping Secure Pipelines with Development Containers **Presenters**: David Shepard and Jeff Hamed **Abstract**: In today's world of fast-paced software development, security is critical, but the tools and resources needed to build a robust DevSecOps pipeline often seem out of reach for smaller teams and open-source projects. However, building a secure, scalable, and repeatable pipeline doesn't have to be expensive or complicated. This talk will show you how. We'll start by exploring the challenges faced by many teams when trying to integrate security into their development and deployment processes. From there, we'll demonstrate how to bootstrap a full DevSecOps pipeline using containers and free, open-source tools—enabling you to secure your project from day one without breaking the bank. As your project grows, so does the complexity. You'll need to maintain consistent environments, manage dependencies, and ensure that builds and deployments are reproducible across systems. Here's where we take it a step further: using the Nix package manager, we'll show how to create development and production containers that solve these problems at scale. Nix provides a declarative, reproducible approach that locks down dependencies, integrates static analysis, and builds hardened, production-ready containers with ease. By the end of the talk, you'll see how these two approaches—bootstrapping a DevSecOps pipeline with free tools and scaling it using Nix—come together to create a secure, reliable, and cost-effective development lifecycle that grows with your project. Whether you're just starting out or managing a complex

system, you'll walk away with practical steps to implement a DevSecOps pipeline that works for your team.

- **Topic**: Workshop: AI Engineering for Context-Driven AI System Design **Presenters**: Cole Frank and Nick Winski **Abstract**: This 90-minute workshop, adapted from the Software Engineering Institute's AI Division's Introduction to AI Engineering course, explores the critical role of context in AI system design. Led by Cole Frank and Nick Winski, the workshop emphasizes how problem-specific contexts, operational settings, and end-user considerations shape effective AI solutions, with a focus on conceptual modeling in AI engineering. The workshop is structured around three main sections: an introduction to AI Engineering, context-driven planning for AI solutions, and architecting context-aware AI systems. Participants will gain insights into key AI Engineering concepts, learn methods for developing context for AI use cases, and understand how to compose AI system architectures with context in mind. The session includes coverage of common AI components, their implementation, and typical functional and non-functional requirements of AI systems. Designed for researchers and practitioners in conceptual modeling and AI engineering, this workshop aligns closely with the themes of the International Conference on Conceptual Modeling. It explores how contextual factors influence the conceptual models underlying AI systems, bridging the gap between raw data and contextualized AI solutions. By the end of the workshop, participants will have a deeper understanding of how context shapes AI system design and practical insights for incorporating contextual factors in their AI projects.

We want to thank the track chairs who provided valuable feedback to the authors, and also the authors for submitting their sessions and making this track possible.

Special Topics Chairs

Hasan Yasar	Carnegie Mellon University, USA
Peter Chen	Carnegie Mellon University, USA

Posters and Demos

As part of the 43rd International Conference on Conceptual Modeling, the ER 2024 Posters and Demos track is aimed at showcasing emerging research ideas and work-in-progress as well as demonstrating novel methods and tools in any area related to conceptual modeling.

We received eight submissions. Each submission was reviewed by three members of the program committee. Based on the reviews received, six papers were accepted for presentation at the conference. The papers cover a range of topics that are both timely and relevant to the field of conceptual modeling. Each paper addresses emerging problems or explores traditional themes in novel ways. The posters and demos accepted for this track help to understand the future research directions in conceptual modeling as well as discuss the practical applications of tools and prototypes.

Themes that emerge from the accepted papers include large language models, ontological modeling, model-driven engineering, and human-robot collaboration.

The Posters and Demos track required the significant efforts of many people. We would like to thank the authors of all submitted papers, program committee members, reviewers, the ER 2024 general chairs, program chairs, and the local organizing committee.

Posters and Demos Chairs

Program Committee