



Editorial

Guest editorial to the Special Issue on Component-Based Software Engineering and Software Architecture



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H I G H L I G H T S

- Introduces the Special Issue on CBSE and Software Architecture.
- Presents the CompArch'12 event and its constituent conferences CBSE, QoSA, ISARCS.
- Introduces the papers included in this Special Issue (best papers from CompArch'12).

A R T I C L E I N F O

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This paper introduces the Special Issue on Component-Based Software Engineering and Software Architecture, which contains extended versions of a selection of the best papers presented at the CompArch 2012 conference, held in June 2012, in Bertinoro, Italy.

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1. Introduction

Component-Based Software Engineering and Software Architecture are two essential disciplines for the effective, predictable and affordable development of industrial software systems. Component-Based Software Engineering (CBSE) mainly focuses on the rapid assembly of flexible software systems, using well-defined, already tested and reusable parts. CBSE combines elements of software requirements engineering, architecture, design, verification, testing, configuration and deployment. Software Architecture, in turn, focuses on the high level structures of a software system, which comprise the software elements, the relations between them, and the properties of both elements and relations. These are essential elements to design the software system and to reason about it.

Although they have their own challenges and research topics, and deserve separate technological and conceptual domains, they are in fact complementary disciplines and therefore their full capabilities and benefits are truly leveraged when combined together.

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With the goal of bringing together the communities working on these two disciplines, *CompArch* (<http://www.comparch-events.org/>) is the annual federated conference series which gathers researchers and practitioners from Component-Based Software Engineering and Software Architecture. Formally held for the first time in 2007, it started as an umbrella conference for the Quality of Software Architectures (QoSA), then in its third edition, and the International ACM SigSoft Symposium on Component Based Software Engineering (CBSE), in its tenth edition. Each year *CompArch* seeks to join with collocated events of similar interests, let they be workshops, symposia, or stand-alone conferences.

CompArch 2012 was held in June 25–28, 2012, in Bertinoro, Italy, with three main conferences (CBSE, QoSA and ISARCS), one doctoral Symposium (WCOP), and one workshop (ROSS).

In the first place, *CompArch* featured the *15th ACM SigSoft International Symposium on Component-Based Software Engineering* (CBSE 2012), chaired by Nenad Medvidovic (USC, USA) and Magnus Larsson (ABB, India). CBSE has emerged as the flagship research event for the component community. It has an established track record of bringing together researchers and practitioners from a variety of disciplines to promote a better understanding of CBSE from diverse perspectives, and to engage in active discussion and debate. CBSE encompasses research (both theoretical and applied) that extends the state-of-the-art in component specification, composition, analysis, testing, and verification, and included experience reports, empirical studies and presentation of component-based benchmarks and case studies are also within scope.

In addition to commonplace software components, CBSE also covers new trends in global services, distributed systems architectures, dynamically adaptable systems, and large-scale software systems, which often cross organizational boundaries and push the limits of established component-based methods, tools and platforms. Innovative solutions from diverse paradigms (e.g., service-, aspect-, and agent-oriented) are needed to address these emerging trends.

Every year CBSE features a special theme, and in 2012 it was “Components for Achieving Long-Lived Systems”. Many industrial systems have very strict requirements for uninterrupted operation. There are examples of systems that have aimed to provide continuous operation for more than 15 years. Such requirements place significant demands on the underlying architecture, mandating that the architecture be very well understood and carefully designed. In turn, the architecture—if implemented correctly—forms a foundation for achieving critical quality attributes such as dependability, robustness, usability, and flexibility. The principles of component-based software engineering offer a promise for achieving effective architectures for long-lived systems. This is especially so since this approach natively provides the ability to add, remove, replace, and/or modify components during operation. A related class of approaches deals with self-management in component-based systems in order to ensure continuous operation. Under these circumstances, the conference especially solicited research and experience that highlights the applicability and value of CBSE for achieving long-lived systems.

CompArch also included the *8th ACM SigSoft International Conference on Quality of Software Architecture* (QoSA 2012), chaired by Barbora Bůhnová (Masaryk University, Czech Republic) and Antonio Vallecillo (University of Málaga, Spain). The goal of QoSA (Quality of Software Architectures) is to address the quality aspects of software architecture, focusing broadly on its quality characteristics and how these relate to the design of software architectures. Specific issues of interest are defining and modeling quality measures, evaluating and managing architecture quality, linking architecture to requirements and implementation, and preserving architecture quality throughout the system lifetime.

QoSA has become the premier forum for the presentation of new results in the area of software architecture quality. It brings together researchers, practitioners and students who are concerned with software architecture quality in a holistic way. As a working conference QoSA has a strong practical bias, encompassing research papers, industrial reports and invited talks from renowned speakers.

One of the main motivations for explicitly modelling software architectures is to enable reasoning on software quality. From a software engineering perspective, a software architecture not only depicts the coarse-grained structure of a program, but also includes additional information such as the program’s dynamics (i.e., the flows of control through the system) and the mapping of its components and connections to execution environments (such as hardware processors, virtual machines, network connections, and the like). In this area, QoSA is concerned with research and experiences that investigate the influence a specific software architecture has on software quality aspects. Additionally, the development of methods to evaluate software architectures with respect to these quality attributes is considered to be an important topic. The quality attributes of interest include external properties, such as reliability and efficiency, as well as internal properties, such as maintainability.

The main theme of QoSA 2012 was “Evolving Architectures”. Papers addressing both novel research results advancing the state-of-the-art of the field and experience learned from industrial case studies are welcome. Reflecting the practical emphasis of QoSA, papers showcasing applications along with a sound conceptual contribution are particularly welcome. In addition to mature research papers this year we also welcome position papers presenting ground-breaking and more risky innovative research ideas, methods, and proposals that address unexplored areas of research and challenge current thinking and/or practices.

The third main conference under the *CompArch* umbrella was the *Third ACM SigSoft International Symposium on Architecting Critical Systems* (ISARCS 2012), chaired by Javier López (University of Málaga, Spain) and Jorge Cuellar (Siemens CT, Germany). The ISARCS symposium was born as the union of the previous Workshop on Architecting Dependable Systems (WADS), the Workshop on the Role of Software Architecture for Testing and Analysis (ROSATEA), and the Workshop on Views On Designing Complex Architectures (VODCA).

Modern software systems increasingly run in and interact with an open environment. This characteristic pushes forward the boundaries of critical system beyond the traditional class of critical applications. Architecting critical systems is then

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