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Editorial

Guest Editorial for Special Section from Component-based Software Engineering (CBSE) 2011

This section collects a selection of extended articles from the 14th ACM SIGSOFT Symposium on Component-Based Software Engineering (CBSE) – 2011.

CBSE emerged in the late 1990s as a novel development paradigm promoting the rapid and cost-effective assembly of pre-existing software components into complex systems, which is a long-standing dream of software engineers. No surprise thus that CBSE founding principles have continued since to attract great attention and interest from both academy and industry.

The CBSE Symposium, encompassing research in component specification, composition, analysis, testing and verification, has solidly established itself in the years as the flagship research event for the component community.

In view of the increasing need to fulfill changing requirements, while facing heterogeneous and rapidly evolving technological solutions, the special theme of the CBSE 2011 Call for Papers was "Components In and For Dynamic Environments". CBSE researchers have been prompted to investigate if and how the component-based approach could help address currently hot-most challenges in software system development, including: how can systems adapt to changes which are unpredictable and outside the application control? Can critical non-stop applications evolve, and to what extent? How can applications be made context-aware? How can non-functional properties be guaranteed and verified?

The special theme triggered many relevant submissions, and as a result the CBSE 2011 offered a high-quality scientific program. Of the original 17 papers in the CBSE proceedings, here we include a selection of three papers that have been extended and have successfully passed the regular IST review process. These three papers present novel results on research problems related to effectively testing, composing, and dynamically deploying evolving component-based systems.

Effectively testing large scale, complex software developed using components is a challenging problem, in particular when considering the software as an evolving system. Individual components need to be built, or re-built, correctly for all the intended configurations; these configurations change over time. The results presented in the paper "Testing Component Compatibility in Evolving Configurations" by Ilchul Yoon, Alan Sussman, Atif Memon, and Adam Porter provide a novel approach to support both incremental and prioritized component testing. The research extends their approach, Rachet, which offers a distributed, cache-aware mechanism to support large-scale compatibility testing of software with a fixed set of component versions. The new results provide an effective alternative to a "re-test all" approach; testers can identify, for example, high priority configurations with new or modified components to focus the testing effort on. The algorithms have been realized in a prototype; its performance has been evaluated with simulations for 20 builds of a component built over a five year span in academia.

The evolution of large scale, complex software developed using packages, for example Free and Open Source Software, relies on package managers. These provide capabilities to support changing the composition of packages, which includes solving package dependencies, user interaction for fine-tuning of the choice of packages, and the actual deployment of upgrades by removing and adding packages in the right order. The development of these package managers has been challenging, involving specialized, monolithic solutions each re-implementing a dependency solver. The results presented in "A Modular Package Manager Architecture" by Pietro Abate, Roberto Di Cosmo, Ralf Treinen and Stefano Zacchiroli provide a modular, flexible design solution alternative. It allows the re-use of dependency solvers in package managers and supports multi-criteria decision making to accomplish users' goals. The approach relies on the authors' formally defined Common Upgradeability Description Format (CUDF) language. A package manager for Debian-based systems has been prototyped using the design; its performance has been cross-evaluated with four state-of-the-art package managers.

The dynamic (runtime) adaptation of distributed, real-time, embedded, component-based software is an active research area. Examples of adaptations include replacing individual component instances, modifying connection configurations, or altering quality of service properties. To meet the response time requirements of these systems, the deployment adaptations need to have short, bounded latencies. The results presented in "Efficient and Deterministic Application Deployment in Component-based Enterprise Distributed Real-time and Embedded Systems" by William R. Otte, Aniruddha Gokhale, and Douglas C. Schmidt provide a standards based solution called the Locality-Enhanced Deployment and Configuration Engine. The new approach builds on their previous work, the Deployment and Configuration Engine. Performance bottlenecks are identified in the previous work and overcome with new design optimizations. A prototype has been developed; its performance has been evaluated using five experiments in two distinct simulation environments.

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We hope you will enjoy the resulting special section. If so, the greatest merit goes to all CBSE contributing authors and to the CBSE Program Committee members that helped us to select the symposium program and to identify within it the short list of best papers invited to this section. Finally, we would like to thank the reviewers, including both CBSE PC members and external experts, and the IST Editor-in-chief Claes Wohlin for hosting this section and for his constant guidance along the process.

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