BASIC INFORMATION ON SUB-PROJECT

NAME OF PROGRAMME/FUND	Scholarship Fund - Sciex NMS[ch]
RESEARCH FIELD AND OTHER RESEARCH FIELDS INVOLVED (if applicable)	Engineering Sciences
TITLE OF THE SUB-PROJECT	Dynamic Analysis for distributed systems (DYNASTY)
REGION OF THE CZECH REPUBLIC (according to the location of the home institution)	Prague
GRANT AMOUNT SPENT	55 879,85 CHF
INTERMEDIATE BODY	Swissuniversities
HOME INSTITUTION	Charles University in Prague Faculty of Mathematics and Physics
HOST INSTITUTION	Università della Svizzera italiana (USI) Faculty of Informatics
NAME OF THE FELLOW	Lubomír Bulej

ABSTRACT OF THE SUB-PROJECT	Dynamic program analysis provides essential support for many software engineering tasks, such as profiling, debugging, and software comprehension. Prevailing dynamic analysis tools often rely on instrumentation techniques and require changes to the observed base program before it is started. However, this approach is not viable for the analysis of complex distributed systems in production, as the individual software components cannot be stopped and restarted to apply the analysis. The goal of the DYNASTY project was thus to advance the state of the art with respect to live deployment of dynamic analyses in distributed systems without disrupting their execution. Since existing dynamic analysis frameworks offer little or no support to the programmer beyond the task of instrumentation, they are unable to extract and use information regarding the architecture and composition of the dynamic analysis for live deployment. We have therefore designed and implemented a framework for analysis composition (FRANC) which supports the notion of analysis units that can be flexibly and automatically composed to produce a dynamic analysis tool. FRANC builds on DiSL, a domain-specific language for bytecode instrumentation jointly developed by the research groups of the Host Mentor and the Home Mentor. The modular nature of analyses expressed in FRANC has two main benefits. The first is that it allows capturing recurring patterns in the construction of dynamic analysis tools, specifically the maintenance of analysis state. The second is that the framework has knowledge of the architecture and of individual elements of a dynamic analysis tool, which serves as a basis for live deployment and enables optimizations to reduce runtime overhead.

MAIN RESULTS	The primary results of the project are twofold. The first is a conceptual decomposition of dynamic analyses into units with distinct and well-defined responsibilities. The second is a prototype framework for dynamic analysis composition (FRANC) that enables synthesis of dynamic analyses from such units. The resulting system allows describing dynamic analyses using a state-oriented approach, in which the analysis' requirements are decomposed in terms of structures that hold the analysis state and the semantics with which these state structures evolve. This in turn allows one to extract commonalities found in many existing analysis tools and to create a library of reusable elements for analysis composition. Dynamic analyses in FRANC are then built by using short script-style code fragments to combine generic data structures and state transformers. While the compositional approach increases runtime overhead, the performance of dynamic analysis tools built using FRANC is generally competetive with lower-level frameworks. Additional results include contributions to the evaluation of the DiSL framework (the foundation for FRANC) and its presentation to the scientific community, as well as an open-source release of the DiSL framework as a project (http://disl.ow2.org) of the OW2 consortium, an international community for open-source infrastructure software. In response to an invitation from the SPEC Research Group (platform for collaborative research efforts in the area of quantitative system evaluation and analysis), the DiSL framework has also been submitted for inclusion in a repository of tools endorsed by the group. The acceptance of DiSL as an OW2 project and its inclusion in the SPEC RG tools repository increase the potential impact of the DiSL framework and contribute to the transfer of research results to industrial practice. This is also important for the future development of FRANC, because it is based on DiSL.
DATE OF REALISATION OF THE FELLOWSHIP	1.7.2012 - 31.12.2012
MORE INFORMATION ON THE PROGRAMME	**www.sciex.ch**