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Review of the thesis

Instrumentation and Evaluation for Dynamic Program Analysis

of Lukáš Marek

The thesis contains two main contributions, the DiSL instrumentation language and framework and the analysis virtual machine ShadowVM.

DiSL allows efficient instrumentation of Java classes in an aspect oriented style. DiSL provides high-level abstractions that a non-skilled programmer can use to assemble the desired instrumentation. An experienced developer can design custom *Markers*, *Guards* and *StaticContexts* to select an arbitrary location for instrumentation and access custom context information. DiSL has the flexibility of Java bytecode transformation libraries but also provides the high-level API where only a very limited knowledge of bytecode is required. DiSL and ShadowVM is available as open source and is of practical use. Some of the presented ideas and techniques are novel.

Processing of analysis events triggered by the instrumentation can have undesired effects on the observed application. Observation problems such as missing events or shared state corruption are hard to detect even for a skilled analysis developer. ShadowVM addresses such problems by offloading the analysis out of the context of the observed application. The introduced event ordering models help to

decrease lock contention while buffering the events and increase parallelism while evaluating the events. These event ordering models and other ideas are novel.

The thesis itself is well written. The architecture of the systems are described with the necessary details. The experiments are carefully designed and executed. Common benchmark suites are used for evaluation. All relevant details of the experiments and their results are presented.

The thesis has the form of selected publications with additional connecting text. Three publications with six to nine authors are included. Lukáš Marek is the first author and declared that he largely contributed to the design of the DiSL language and he was the lead developer and one of the two main authors of the framework and substantially contributed to the text of the paper. He also prepared the demonstration of DiSL and its description. Lukáš Marek designed and implemented most of the ShadowVM framework and substantially contributed to the text of the paper. Therefore, the predominant part of the work presented in the thesis is the achievement of Lukáš Marek.

The thesis examines in detail the state of the art. The methodology used is sound and reflects current scientific practice. Lukáš Marek showed that he is able to develop new ideas and to advance the science. The thesis satisfies the conditions of a creative scientific work. Furthermore, Lukáš Marek has published 11 articles in peer reviewed conferences or journals.



Andreas Krall