

Extreme Refactoring: Integrating Refactorings into Software Configuration Management

- Project Report -

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1. Why we asked for funding

Starting with the beginning of this year, we have been building a Software Configuration Management (SCM) tool that is aware of refactoring operations and can semantically merge the changes that multiple programmers introduced to the same program entities when refactoring or editing. This project combines the refactoring expertise at University of Illinois with the SCM expertise at Iowa State University. The \$2000 fund generously provided by Agile Alliance supported the travel and accommodation expenses that Danny Dig inquired during the working visits at Iowa in the first stage of the project.

2. Outcomes of our work

In the following section we present the results of our work using the well known paradigm of an automated unit testing framework. First we present what we hoped to be the expected outcome (copied from the initial project funding proposal) followed by the actual outcome. It is up to the committee members to check whether the actual results match the expected ones and to let us know whether the bar is “green”.

Test #1: Tool goals

Expected: “Our research will produce a plugin for Eclipse that integrates the refactoring actions performed with the Eclipse's refactoring engine into the Molhado versioning system as the back-end.”

Actual: We developed MolhadoRef, a refactoring-aware Eclipse plugin that works for Java. MolhadoRef has several important advantages over a traditional text-based SCM:

1. *Better merging.* MolhadoRef automatically resolves more conflicts (even changes to the same lines of code). Because it takes into account the semantics of refactorings, the merging is also more reliable: there are no compile errors after merging and the semantics of the two versions to be merged are preserved with respect to the refactoring operations.
2. *Better preservation of program history.* MolhadoRef tracks the history of refactored program elements even when they are renamed or moved to different files (e.g., when moving a method to a different class).
3. *Better understanding of program evolution.* Some refactoring operations (like renaming a popular public method) may cause thousands of changes (e.g., updating all call sites) scattered throughout the code. By displaying the evolution of code in terms of higher-level operations (e.g., refactorings), MolhadoRef hides the complexity caused by the sheer amount of low-level changes corresponding to refactorings.

MolhadoRef's webpage: <https://netfiles.uiuc.edu/dig/MolhadoRef>

Test #2: Inspiration for others

Expected: “We plan to release the plugin under an open-source license so that software developers can start using it right away while the source code can serve as an inspiration for others who want to emulate our approach.”

Actual: While we are still working toward the public release, MolhadoRef is good enough for performing experiments on real source code. We are presenting MolhadoRef in premiere at OOPSLA'06 tool demo booths and FSE'06 poster presentation. We are in close contact with the Eclipse developers for potential inclusion of parts of MolhadoRef into the official Eclipse.

Test #3: Fill a need in the research literature

Expected: “Our research will cover the gap in the research literature on semantical SCM tools and refactoring operations. We plan to submit papers for publication to both agile and software engineering conferences.”

Actual: two technical reports, two extended abstracts papers, one workshop paper, one conference submission under review, one master thesis

[1] *Refactoring-aware Software Configuration Management*. UIUC technical report ([Report No. UIUCDCS-R-2006-2710](#)) April'06 describing the SCM infrastructure of MolhadoRef

[2] *Refactoring-aware Configuration Management System for Object-Oriented Programs*. UIUC technical report ([Report No. UIUCDCS-R-2006-2770](#)) September'06 describing the merging algorithm at the core of MolhadoRef

[3] *MolhadoRef: A Refactoring-aware Software Configuration Management tool*. To appear in OOPSLA'06 Companion Proceedings, section Tools Demo

[4] *Refactoring-aware Software Merging and Configuration Management*. To appear in FSE'06 companion proceedings, section Posters

[5] MolhadoRef: a Refactoring-aware Infrastructure for Versioning OO Programs. Eclipse Technology Exchange (ETX'06) to be held at OOPSLA'06

[6] *Refactoring-aware Configuration Management System for Object-Oriented Programs*. Submitted and under review at ICSE'07

[7] Exact title TBA – master thesis in Computer Science, UIUC, Kashif Manzoor
We are looking forward to presenting our work in the agile conferences too.

3. Concluding remarks

We are grateful to Agile Alliance for the travel grant that was crucial for funding the inception of a collaboration between two universities. This initial collaboration set the groundwork for our current and future research. We are grateful to our other sponsors, IBM for an Eclipse Innovation Grant and UIUC CS department for an Outstanding Mentoring fellowship.