

# Smarter Merge Tool for Structured Java Code

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## 1 Abstract

Software merging is a necessity for large-scale software development and while there are many code version systems to help with this, many of them don’t take the structure of the code into account. We propose to develop a merge tool that will utilise the PDStore<sup>1</sup> database to maintain and analyse the structure of the data.

The aim of the tool is to utilise information related to the structure of a file stored in PDStore and highlight the conflicts that arise in merging. The proposal highlights the requirements, milestones and possible evaluation methods for the research project.

## 2 Motivation

Developing a merge tool that maintains information in a structured form gives scope to improve the way conflicts and changes are shown. This motivated us to explore the effectiveness and usability of such merge tools and how they compare to existing merge tools.

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<sup>1</sup>PDStore is a Triplestore database developed at the University of Auckland

## 3 Related Work

[1] describes a tool called “Semantic diff” and techniques used in that tool to show the effect of modifications. The tool aims at providing the user with a summarised report of semantic changes between two versions of a procedure, and focuses on minimising any spurious differences such as renaming local variables. While the tool provides knowledge of variable dependencies within a procedure, it is not very helpful when considering an entire program because the tool does not maintain any relationship between method invocation and method definition.

In [2] a technique for performing a 3 way structured XML merge is described. The technique involves defining merge rules derived from common use cases of XML editing. While there are similar problems, a few differences exist. By the nature of XML, the local structure is important. The rules made in [2] become invalid for flexible structured data such as code. We will utilise PDStore and abstract the tool in such a way that it can be used to assist in merging a variety of structured documents.

The system described in [3] utilises fine-grained revision control functionality to keep track of program modifications and support merging. The merge tool of this system defines rules using the user’s past revisions to suggest a

merged result to the user and also allows the user to make changes to the temporary result. While the tool automatically generates a merged result, the basis of these rules are related to user configuration rather than the merge tool defining the rules.

[4] describes the problems associated with common textual based merging. It proposes a solution that can be applied to software artefacts of different types. The solution involves representing information with extra information such as namespaces appended with UIDs. Once the data is represented in this special structure, the job of analysing two structures should be made easier.

## 4 Requirements

A successful execution of the research endeavour should meet the following requirements:

1. Visually show the changes between two transactions with the use of tree views
2. Allow the user to specify what should exist in the new state after merge. Merge in this case is combining two states of a store to produce a third state
3. Offers the ability to perform a three way merge
4. Integrate into PDStore application
5. Evaluate the usability of the tool comparing with existing merge tools

## 5 Design and Implementation

The underlying technology used in the proposed method involves using PDStore to form a structured view of the code. The merging logic will be

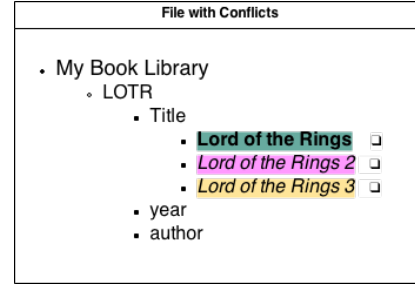


Figure 1: Proposed GUI for merge tool

written in Scala, while the GUI will be designed in Swing.

Figure 1 is an example that illustrates a possible GUI for three way merging involving PD Tree Views. The title string belonging to the LOTR book in the My book library database has differing values in each of the three existing versions (Base, Version A and Version B). We hope to colour code information such as modified items and/or items in conflict to help better inform the user of the types of changes. The user can select items from different versions to be included in the merged representation by clicking on the checkbox beside the items.

## 6 Evaluation

This evaluation will consist of usability testing and comparative analysis with existing merge tools.

As part of the usability testing, paper prototypes will be used to evaluate the feasibility of the design of the User Interface of our tool. This study will reveal both fundamental and minor flaws in the UI that would need to be fixed before the final milestone. Specific scenarios will be constructed outlining various use cases that will then be run through by the participants on mul-

multiple different UI designs. The participants will be asked to think out loud, so that their thought process can be observed and evaluated. Feedback will then be collected from the participants at the end through the use of a questionnaire which will then be used to measure the usefulness of each design.

Any identified flaws will then be corrected and the test will then be undertaken again so as to verify that the flaws are indeed fixed.

The comparative analysis will consist of test cases outlining major scenarios that will be laid out at the start of the project and will later be run against existing merge tools and our developed merge tool. The outcome of these test scenarios will help determine the effectiveness of the tools under different scenarios

## 7 Project Plan

Listed below are the three milestones for this project

**Milestone One:** Visually show the effect of a transaction

Visually show the changes before and after a transaction. Changes should be displayed in terms of roles and relations.

**Due Date:** 15th April 2014

**Milestone Two:** Able to perform Three-way merge

This involves creating a UI such that the user can select the links/relations that will exist the merged version.

**Due Date:** 30th April 2014

**Milestone Three:** Integrate the functionality into PDHistoryViewer application

Integrating the added functionality will allow us to conduct our evaluation on users. This will be key in determining the usefulness and effectiveness of the changes.

**Due Date:** 12th May 2014

## References

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- [4] Albert Zündorf, Jörg Wadsack, and Ingo Rockel. Merging graph-like object structures. In *Proc. of 10th International Workshop on Software Configuration Management, Toronto, Canada, 2001*.