

# Refactoring

December 2021

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| candidate                  | Jakob Konrad Hansen                              |
| supervisors                | Volker Stolz and Lars Tveito                     |
| type                       | 60ECTS   |
| study program              | Informatics: Programming and System Architecture |
| planned date of completion | May 2023   |

## Short description

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The task is to implement and research refactoring for the ABS programming language<sup>[4]</sup>.

## Background and motivation

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Refactoring is the process of changing a software system in such a way that it preserves the external behavior of the code, but also improves its internal structure<sup>[3]</sup>.

The thesis will be based around implementing refactoring support and researching refactorings for the ABS programming language. We want to offer users of ABS more refactorings and a satisfactory method to apply them. To do this we will build upon an existing Xtext<sup>[2]</sup> grammar and work with the LSP protocol<sup>[6]</sup>. A proposal to extend the LSP protocol might be made if it aligns with the thesis. The temporary thesis statement and research questions will be:

- How should refactoring be implemented for ABS?
- Which refactorings can we safely implement for ABS?
- Is the resulting approach generalizable to other programming languages?

## Methodology

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The thesis will consist of both theoretical and practical work. The theoretical work will consist of reading relevant research, formalizing refactorings, and argue their correctness. The practical work will consist of implementing software which will provide these refactorings. That will be a process of specifying requirements for the software, implementing the software and then evaluating it.

## Progress plan

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### Autumn 2021

- Deliver the project plan and read relevant curriculum and papers

### Spring 2022

- Read relevant papers
- Connect previously developed refactorings from Erlend Kristiansen's master thesis<sup>[5]</sup> with ABS, using LSP
- Narrow down the scope of the thesis based on the result of this implementation
- Formulate a thesis for and write essay

### Autumn 2022

- Analyze LSP and determine if the protocol is sufficient for refactoring
- Propose alternatives/extensions to the LSP protocol
- Implement refactorings for ABS

### Spring 2023

- Evaluate refactorings and/or alternative LSP proposal
- Finish master thesis

## Relevant courses

- INF5110 - Kompilorteknikk
- IN5440 - Selected topics in static analysis
- IN4240 - Testing av programvare
- IN5320 - Development in platform ecosystems

## Relevant readings

- *Refactoring and Active Object Languages*<sub>[8]</sub>
- *Refactoring*<sub>[3]</sub>
- *Implementing Domain-Specific Languages with Xtext and Xtend*<sub>[1]</sub>
- *The Specification Language Server Protocol: A Proposal for Standardised LSP Extensions*<sub>[7]</sub>

## References

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- [1] L. Bettini. *Implementing Domain Specific Languages with Xtext and Xtend - Second Edition*. 2nd. Packt Publishing, 2016.
- [2] Eclipse. *Xtext*. <https://www.eclipse.org/Xtext/>. 2021.
- [3] M. Fowler. *Refactoring: Improving the Design of Existing Code*. Boston, MA, USA: Addison-Wesley, 1999.
- [4] E. B. Johnsen et al. “ABS: A Core Language for Abstract Behavioral Specification”. In: *Formal Methods for Components and Objects - 9th International Symposium, FMCO 2010, Graz, Austria, November 29 - December 1, 2010. Revised Papers*. Ed. by B. K. Aichernig, F. S. de Boer, and M. M. Bonsangue. Vol. 6957. Lecture Notes in Computer Science. Springer, 2010, pp. 142–164.
- [5] E. Kristiansen and V. Stolz. “Search-based composed refactorings”. In: *27th Norsk Informatikkonferanse, NIK 2014, Høgskolen i Østfold, Fredrikstad, Norway, November 17-19, 2014*. Bibsys Open Journal Systems, Norway, 2014.
- [6] Microsoft. *Language Server Protocol*. <https://microsoft.github.io/language-server-protocol/>. 2020.
- [7] J. K. Rask et al. “The Specification Language Server Protocol: A Proposal for Standardised LSP Extensions”. In: *CoRR abs/2108.02961* (2021). arXiv: 2108.02961.
- [8] V. Stolz, V. K. I. Pun, and R. Gheyi. “Refactoring and Active Object Languages”. In: *Leveraging Applications of Formal Methods, Verification and Validation: Engineering Principles - 9th International Symposium on Leveraging Applications of Formal Methods, ISoLA 2020, Rhodes, Greece, October 20-30, 2020, Proceedings, Part II*. Ed. by T. Margaria and B. Steffen. Vol. 12477. Lecture Notes in Computer Science. Springer, 2020, pp. 138–158.