
# Automation of Refactoring for TTCN-3 Test Specifications

## Metrics, Smell Detection, Refactoring and Refactoring Suggestions

## TTCN-3
Testing and Test Control Notation v3

- Test specification and implementation language
- Standardised by ETSI (European Telecommunications Standards Institute)
- Widely used for testing in the telecommunication and datacommunication domain (SIP, IPv6, WiMAX/HiperMAN, ...)
- Textual syntax (633 EBNF rules)
- Test-specific language concepts (test data templates, test verdicts, test configurations, ...)

## Typical Problems Found in TTCN-3 Test Suites
Bad smells that can be removed by refactoring

- Huge test suites with single source files >20.000 lines of code
- Badly structured test data templates

## TTCN-3 Smell and Refactoring Catalogues
Structured presentation of problems and possible resolutions

- 17 language independent code smells
- 21 code smells using TTCN-3 specific concepts
- 28 language independent refactorings (based on Fowler)
- 23 refactorings using TTCN-3 specific concepts

## The TRex Tool
TTCN-3 Metrics, smell detection, and refactoring automation

- Calculation of common software metrics
- Detection of 11 code smells
- Automation of 11 refactorings
- Automatic refactoring suggestions
- Enhanced editing functionality
- Open source (Eclipse Public License)

## Software Metrics
Quality assessment and refactoring suggestions

- Size metrics (number of references, ...)
- Complexity metrics (Cyclomatic Complexity, ...)

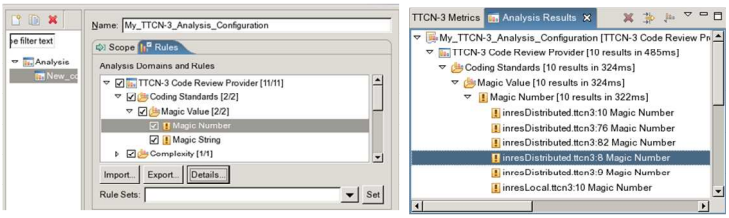
## Code Smell Detection
Quality assessment and refactoring suggestions

- Fully-Parameterised Template
- Duplicate Template Fields
- Unused Definitions
- Magic Values
- and more ...

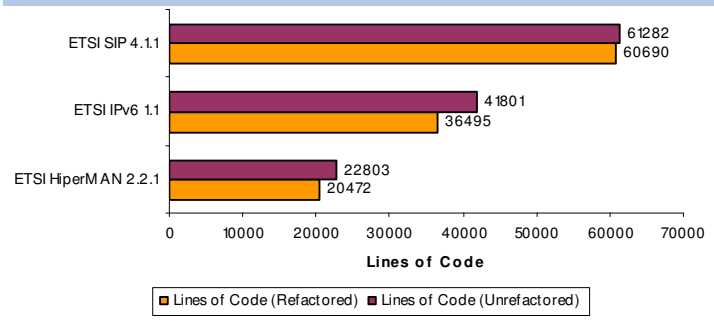
## Automated Refactoring
Code smell removal

- Replace Template with Modified Template
- Parameterise Template
- Decompose Template
- Extract Template
- Inline Template
- and more ...

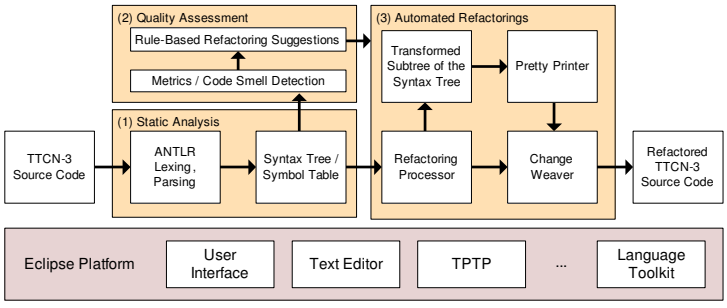
## Screenshots
Smell detection configuration and analysis results




## Application
Size reductions in ETSI test suites after refactoring




## Implementation
Toolchain for the analysis and refactoring infrastructure




## Future Work

- Exhaustive simulation to validate behaviour preservation
- XML-based description of bad smell patterns
- Problem detection using dynamic analysis
- Further refactoring implementations

## Contact

Software Engineering for Distributed Systems Group
Institute for Computer Science, University of Göttingen
Lotzestraße 16-18
37083 Göttingen
Germany
http://www.swe.informatik.uni-goettingen.de

**http://www.trex.informatik.uni-goettingen.de**