ISF WANTS YOU!

Projekt- und Abschlussarbeiten

Towards Taxonomy-based SPL Engineering

- **Context**
  - Software taxonomies structure software domains from an abstract specification of the functionality to concrete implementable variants by successive correctness-preserving refinements.
  - Software product line engineering (SPLE) allows developing these software systems by managed large-scale reuse
- **Objective**: Design a taxonomy-based SPLE process and evaluate it with respect to maintainability and evolvability
- **Tasks**
  - Devise guidelines for code structure of product line artifacts (with pre-processor annotations) based on taxonomy
  - Implement SPL for SPARE Time taxonomy
  - Compare code structure of SPARE Time SPL with original SPARE Time toolkit structure
- **Information**: Master's thesis
- **Contact**: Ina Schaefer (`i.schaefer@tu-bs.de`)

Identifikation von Feature-Interaktionen

- Kontext: Linux Patches werden automatisch gegen vordefinierte und zufällig erzeugte Konfigurationen getestet und Entwickler per Email auf fehlerhafte Konfigurationen hingewiesen
- Problem: Eine Konfiguration enthält irgendeine Auswahl der mehr als 10.000 Features und Entwickler müssen die interagierenden Features manuell identifizieren
- Ziel: Durch die Kombinatorik in fehlerhaften/fehlerfreien Konfigurationen und Patch sollen weitere Konfigurationen generiert werden, um potentielle Feature-Interaktionen zu isolieren
- Vorraussetzung: Software-Produktlinien
- Geplant als Masterarbeit
- Ansprechpartner: Thomas Thüm (`t.thuem@tu-bs.de`) und Sebastian Krieter (Magdeburg)

Inkrementelle Erfüllbarkeitsanfragen für SPLs

- Kontext: Feature-Modelle beschreiben die Abhängigkeiten zwischen Features einer Produktlinie und werden zur Fehlererkennung in Aussagenlogik kodiert
- Problem: Für eine einzige Produktlinie wie Linux gibt es Millionen von Erfüllbarkeitsanfragen, die zum Großteil ähnlich sind
- Ziel: Inkrementelle Verfahren von SAT und SMT-Solvern evaluieren und Entwicklung von eigenen Strategien zur effizienten Überprüfung von vielen, ähnlichen Erfüllbarkeitsanfragen
- Vorraussetzung: Software-Produktlinien
- Geplant als Masterarbeit
- Ansprechpartner: Thomas Thüm (`t.thuem@tu-bs.de`)

Binary Decision Diagrams for Large Product Lines

- Context: Feature models define valid combinations of features and are used in numerous analyses for product lines. For that purpose, feature models are often translated into propositional formulas and feed into state-of-the-art solvers (e.g., SAT, SMT, BDD).
- Problem: While BDDs are often more efficient than other solvers, their creation only scales to hundreds of features, whereas industrial product lines, such as Linux, have thousands of features.
- Goal: Create BDDs for parts of feature models based on an existing compositionality principle. Evaluate the potential of such BDDs to reduce the effort during product-line analysis.
- Requirements: Lecture on software product lines
- Master's thesis
- Advisor: Thomas Thüm (`t.thuem@tu-bs.de`) and Prof. Eric Bodden (Paderborn)

Compositional Feature Modeling

- Context: Feature models in industry contain thousands of features and are inherently non-compositional. That is, a change in one part of the model can influence any other part. While there are first ideas to achieve compositionality in feature models (i.e., feature-model interfaces), they are computationally expensive.
- Goal: A methodology to create and edit feature models in a compositional manner, such that for every change in a feature model the consequences for other parts of the model are made explicit (cf. change impact analysis). Evaluation of the costs and benefits of this methodology.
- Requirements: Lecture on software product lines
- Master's thesis
- Advisor: Thomas Thüm (`t.thuem@tu-bs.de`)

Deploying Guidance for Product Line Evolution

- **Context**: In DarwinSPL[1], we are able to model feature-model evolution. This evolution may affect configurations of the feature model. To handle this, we are able to define guidance for engineers maintaining configurations to adapt the configurations to the feature-model evolution.
- **Problem**: From the tool perspective, it is currently not possible to store this guidance and to deploy it to configuration maintainers.
- **Envisioned Solution**: Implement the guidance process in the existing tool landscape of DarwinSPL.
- **Information**: Bachelor's thesis or project work
- **Contact**: Michael Nieke (`nieke@isf.cs.tu-bs.de`)

[1] `https://gitlab.com/DarwinSPL/DarwinSPL`

Evolution Visualization of Temporal Feature Models

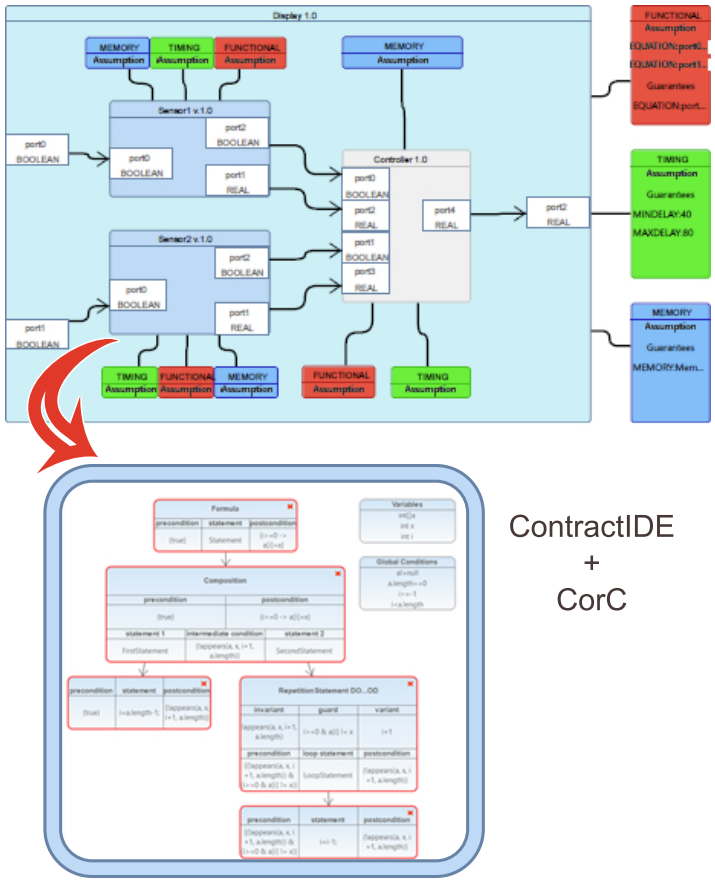
- **Context**: Temporal Feature Models allow to model integrated evolution for feature models.
- **Problem**: For long evolution histories and large feature models, engineers might lose overview on the evolution that took place.
- **Envisioned Solution**: Devise different interactive visualization concepts (e.g., an evolution Gantt diagram) to visualize the evolution of a temporal feature model in a clear way.
- **Information**: Bachelor's thesis or project work
- **Contact**: Michael Nieke (`nieke@isf.cs.tu-bs.de`)

Efficient Reuse of Satisfiability Requests

- **Context**: In several domains, properties are checked using satisfiability requests. For instance, properties of feature models can be checked. During evolution of systems, parts of satisfiability requests change and parts remain the same.
- **Problem**: Parts that are the same are checked many times again. Incremental solvers use push/pop mechanisms for parts of the requests. If the stack has a bad order, push/pop is slower than checking everything again.
- **Envisioned Solution**: Devise and implement multiple methods/strategies for reordering parts of satisfiability requests based on the evolution history.
- **Information**: Master's thesis
- **Contact**: Michael Nieke (`nieke@isf.cs.tu-bs.de`), Thomas Thüm (`t.thuem@tu-bs.de`)

Tool Support for Correct-by-Construction Component-based Systems

- **Context**: ContractIDE is a graphical editor for modeling and specifying component-based architectures. CorC is an IDE for building programs that are correct-by-construction.
- **Problem**: Both editors have potential to complement each other. ContractIDE can be used to model component-based systems and CorC can be used to model (or implement) the behavior of a single component. Currently, no connection between both tools exists.
- **Envisioned Solution**: Develop a new Eclipse plug-in that bridges the gap between both editors and allows users to model software systems with a standardized and safety-oriented process.
- **Information**: Bachelor's thesis or project work
- **Contact**: Tobias Runge (`tobias.runge@tu-bs.de`) & Alexander Knüppel (`a.knueppel@tu-bs.de`)



ContractIDE
+
CorC

Method Call Treatment in Deductive Verification

- **Context**: In design by contract, scalability of deductive verification depends to a great extent on method call treatment (i.e., whether a called method is inlined or its respective contract is used instead).
- **Goal**: We studied this parameter in the verification system KeY with respect to provability, verification effort, and specification effort, but want to extend our study to at least two other verification systems. Moreover, the goal is to introduce a new keyword to JML to explicitly mark methods that should be either inlined or whose contract should be used. An optional goal is to define a heuristic that may reason about which approach is more profitable for a given verification task.
- **Information**: Master's thesis or project work
- **Contact**: Alexander Knüppel (`a.knueppel@tu-bs.de`)

Towards Automating Interactive Proofs

- **Context**: Based on current technology in deductive verification, most proofs are constructed interactively (i.e., automation stops and the verification system asks for user interaction). Reasons are manifold: Choice of parameters, insufficient specification, time out...
- **Goal**: Study prominent interactive proofs (e.g., TimSort) and investigate how to automate all steps that were performed interactively.
- **Information**: Master's thesis or project work
- **Contact**: Alexander Knüppel (`a.knueppel@tu-bs.de`)

Information Flow im Correctness-by-Construction Editor

- Kontext: Correctness-by-Construction (CbC) ist ein Verfahren zur Softwareentwicklung. Hierbei werden Programme durch Korrektheit bewahrenden Verfeinerungen erstellt. Dieser Ansatz kann mit Information-Flow-Techniken angereichert werden, um vertrauliche Daten zu schützen.
- Problem: Vertrauliche Daten im Porgramm schützen
- Ziel: Erweiterung des Editors. Automatische Analyse des Information-Flows im CbC Editor
- Geplant als Projekt- oder Masterarbeit
- Ansprechpartner: Tobias Runge (`tobias.runge@tu-bs.de`)

Softwareproduktlinien im Correctness-by-Construction Editor

- Kontext: Correctness-by-Construction (CbC) ist ein Verfahren zur Softwareentwicklung. Hierbei werden Programme durch Korrektheit bewahrenden Verfeinerungen erstellt. Softwareproduktlinien werden verwendet um eine Menge von Programmvarianten zu verwalten.
- Problem: Der CbC Editor kann nur einzelne Varianten auf Korrektheit überprüfen
- Ziel: Erweiterung des Editors, sodass Familien bewiesen werden können
- Geplant als Masterarbeit
- Ansprechpartner: Tobias Runge (`tobias.runge@tu-bs.de`)

Reverse Engineering von Taxonomien

- Kontext: Kontext: Software Taxonomien strukturieren Software von abstrakten Spezifikationen zu konkreten Varianten. Jedoch ist die Erstellung von Taxonomien aufwendig.
- Ziel: Taxonomie aus einer vorhandenen Codebasis automatisch extrahieren.
- Vorgehen: Vorhandenen Code nach Gemeinsamkeiten und Unterschieden untersuchen und Taxonomie ableiten.
- Geplant als Bachelor-, Projekt- oder Masterarbeit
- Ansprechpartner: Tobias Runge (`tobias.runge@tu-bs.de`)

Fallstudie zu Taxonomie-basierter Softwareentwicklung

- Kontext: Software Taxonomien strukturieren Software von abstrakten Spezifikationen zu konkreten Varianten. Die Varianten werden hierbei durch Korrektheit bewahrenden Verfeinerungen erstellt (Correctness-by-Construction).
- Ziel: Fallstudie in eine Taxonomie übertragen und Funktionalität nach dem Correctness-by-Construction Prinzip implementieren.
- Geplant als Projekt- oder Masterarbeit
- Ansprechpartner: Tobias Runge (`tobias.runge@tu-bs.de`)

Praktika und Teamprojekte