Universal Variability Language: Current State

MODEVAR'25 | Contributions by many great people, Talk by Sebastian Krieter | 03.02.2024

Universal Variability Language

- Community Effort within MODEVAR initiative
- Textual format for variability models
- Simplify exchange

```
features
    Pizza
        mandatory
            Dough {Calories 10, Type 'Wheat'}
            Cheese {Calories 5}
            Sauce
                alternative
                    Tomato {Calories 2}
                    Pesto {Calories 4}
        optional
            Mushrooms {Calories 1}
            Ham {Calories 7}
            Pineapple {Calories 2}
            "Greetings on box"

constraints
    Pineapple => Ham
```

Universal Variability Language

- Community Effort within MODEVAR initiative
- Textual format for variability models
- Simplify exchange
- Simple core language
  - Boolean constraints & features
- Extensions for complex expressions

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- **Let's take a look!**

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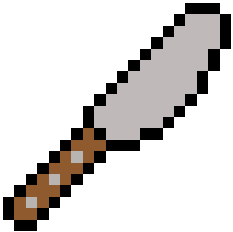
Language Levels Tradeoff



VS

+ Simple
+ Easy to understand
– Limited applicability

+ Covers more use cases
– Complex
– Harder to understand

Language Levels Overview

Boolean

- Boolean constraints & features
- Feature attributes for information

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Arithmetic

- Numeric constraints over feature attributes
- Expressions such as ==

```
include
    Arithmetic.*

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constraints
    Pineapple => Ham
    sum(Calories) < 28
```

Type

- Feature types
- Constraints over typed features

```
include
    Arithmetic.*
    Type.*

features
    Pizza
        mandatory
            Dough {Calories 10, Type 'Wheat'}
            Integer Cheese {Calories 5, Unit 'g'}
            Sauce
                alternative
                    Tomato {Calories 2}
                    Pesto {Calories 4}
        optional
            Mushrooms {Calories 1}
            Ham {Calories 7}
            Pineapple {Calories 2}
            String "Greetings on box"

constraints
    Pineapple => Ham
    sum(Calories) < 28
    Cheese < 300
    len("Greetings on box") < 100
```

Language Levels The Pain

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FaMa Tool Suite

IDE Feature

FAMiliAR

Language Levels How to Resolve?

```
features
    Root
        optional
            Child1 {Weight 3}
            Child2 {Weight 2}

constraints
    Child1.Weight + Child2.Weight < 4
```

Invalid Input

Language Levels How to Resolve?

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features
    Root
        optional
            Child1 {Weight 3}
            Child2 {Weight 2}

constraints
    Child1.Weight + Child2.Weight < 4
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Conversion
UVLParser

```
features
    Root
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            Child1 {Weight 3}
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constraints
    (!Child2 & Child1 | !Child2 & !Child1 | Child2 & !Child1)
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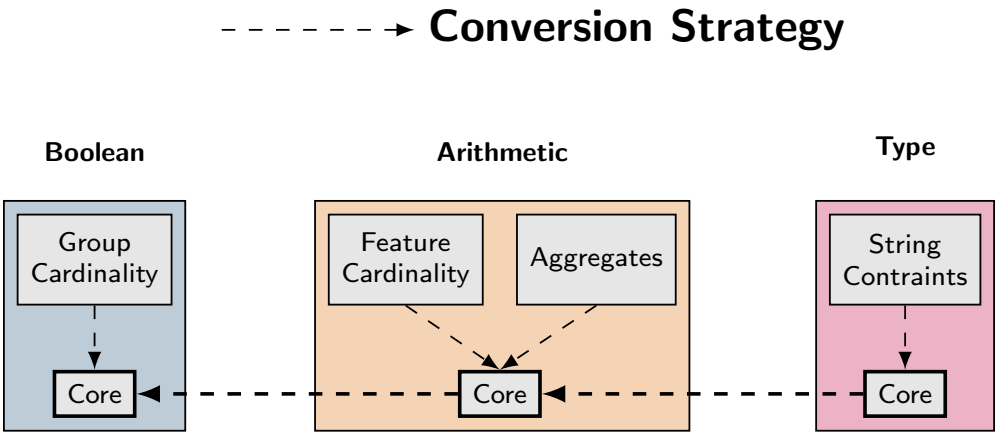

Language Levels in UVL

What Can We Do? Parsing

UVL-Parser

- ANTLR-based
  - Parser generator for many languages
- Currently supported: Java, Python, **JavaScript**

UVL-Parser GitHub Repo

What Can We Do? Editing

UVLS

- Textual editing
- Language Server for UVL
- Extension VSCode
- Support for full language

UVLS GitHub Repo

UVL-Playground

- Web-based
- Internally uses UVLS
- Includes small UVL tutorial

UVL Playground

FeatureIDE

- Graphical Editing
- Limited to Boolean UVL

FeatureIDE Git Repo

What Can We Do? Conversion

TraVarT

- Convert between variability languages
  - Feature models
  - Decision models
  - OVM

TraVarT GitHub Repo

UVL Parser Conversions

- Convert between language levels
- Included in Java Parser (Meta Model)

Meta Model GitHub Repo

What Can We Do? Analysis

FLAMA

- Python-based
- Common analyses: SAT, counting
- Reasoning engines: SAT, SMT, BDDs

FLAMA GitHub Repo

FeatJar

- FeatureIDE Lib successor
- Java-based CLI Tool
- Reasoning engines: SAT, #SAT, DDNNFs

FeatJar GitHub Repo

What Can We Do? Collections

UVL-models

- Small collection
- Translated from various variability languages
- Limited to boolean

UVL-Models GitHub Repo

Feature-Model Benchmark

- GitHub Repository
- $> 2,500$ models with at least 100 features
- UVL, DIMACS

Benchmark GitHub Repo

UVLHub

- Share UVL models
- Automated analysis for each upload
- $> 1,500$ models available

UVLHub GitHub Repo

Universal Variability Language: Current State

- Language as community effort
- Extensible language design
- Language Features
  - Language levels
  - Conversion strategies
  - Import mechanism
- Available tool support:
  - Parsing
  - Editing
  - Conversion
  - Analysis
  - Collections
- **What do we need?**

https://universal-variability-language.github.io

Universal Variability Language: Current State

1. Universal Variability Language
2. Language Levels
3. What Can We Do?