# 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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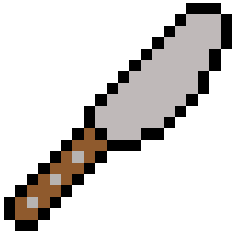
# Language Levels Tradeoff



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'}
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                    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

FeatureIDE

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?

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

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

**Conversion**
**UVLParser**

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

constraints
    (!Child2 & Child1 | !Child2 & !Child1 | Child2 & !Child1)
```

# Language Levels How to Resolve?

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    Root
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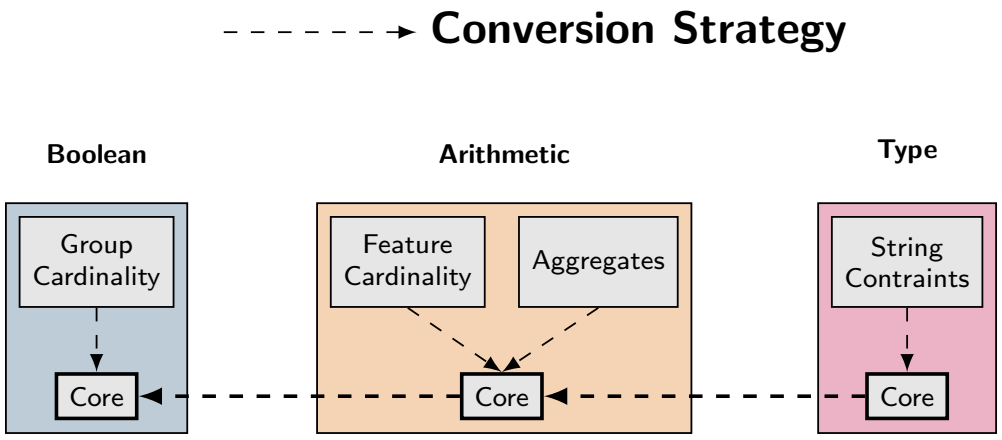


Figure: Language Levels in UVL

# What Can We Do? Parsing

**UVL-Parser**

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

Figure: UVL-Parser GitHub Repo

# What Can We Do? Editing

**UVLS**

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

Figure: UVLS GitHub Repo

**UVL-Playground**

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

Figure: UVL Playground

**FeatureIDE**

- Graphical Editing
- Limited to Boolean UVL

Figure: FeatureIDE Git Repo

# What Can We Do? Conversion

**TraVarT**

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

Figure: TraVarT GitHub Repo

**UVL Parser Conversions**

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

Figure: 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**

- Java-based
- ...
- ...

# What Can We Do? Collections

**UVL-models**

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

Figure: UVL-Models GitHub Repo

**Feature-Model Benchmark**

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

**UVLHub**

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

# 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

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

# Universal Variability Language: Current State

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