OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

INF

FAKULTÄT FÜR INFORMATIK

How to Use FeatureIDE

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July 15, 2010

Content

- What is Feature-Oriented Software Development?
- What functionality does FeatureIDE provide?
- How to start working with FeatureIDE?

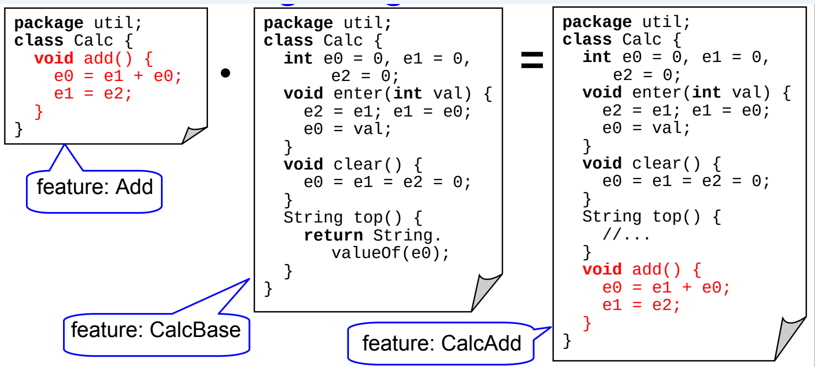
Content

- What is Feature-Oriented Software Development?
  - Feature-Oriented Programming + Example
  - Configurations
  - Feature Model
  - Composition Engines
- What functionality does FeatureIDE provide?
- How to start working with FeatureIDE?

Feature-Oriented Programming (FOP)

- Introduced 1997 by Christian Prehofer
- Based on Object-Oriented Programming
- Features realize functionalities
- Features are cross-cutting to objects
- Features modularize fragments from certain classes
- Fragment contains some methods/fields of a class belonging to one functionality
- Goals: code traceability, software customization

FOP Example



```
package util;
class Calc {
  void add() {
    e0 = e1 + e0;
    e1 = e2;
  }
}
```

feature: Add

•

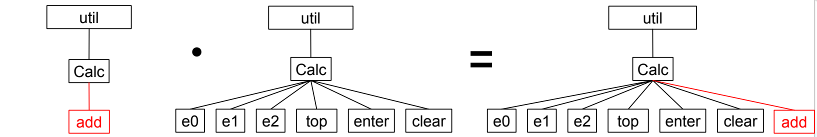
```
package util;
class Calc {
  int e0 = 0, e1 = 0,
      e2 = 0;
  void enter(int val) {
    e2 = e1; e1 = e0;
    e0 = val;
  }
  void clear() {
    e0 = e1 = e2 = 0;
  }
  String top() {
    return String.
      valueOf(e0);
  }
}
```

feature: CalcBase

=

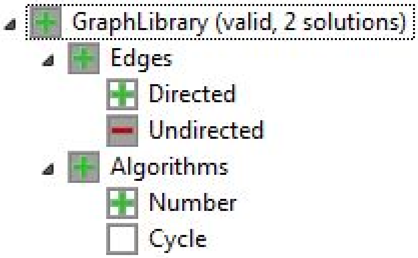
```
package util;
class Calc {
  int e0 = 0, e1 = 0,
    e2 = 0;
  void enter(int val) {
    e2 = e1; e1 = e0;
    e0 = val;
  }
  void clear() {
    e0 = e1 = e2 = 0;
  }
  String top() {
    //...
  }
  void add() {
    e0 = e1 + e0;
    e1 = e2;
  }
}
```

feature: CalcAdd



http://wwwiti.cs.uni-magdeburg.de/iti_db/lehre/epmd/2009/slides/06_FOP.pdf

Configuration

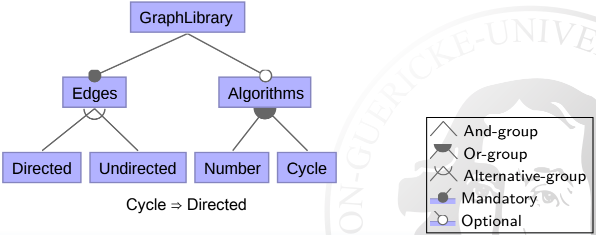


- ☑ GraphLibrary (valid, 2 solutions)
  - ☑ Edges
    - ☑ Directed
    - ☒ Undirected
  - ☑ Algorithms
    - ☑ Number
    - □ Cycle

- Selection of features
- Composition of features results in a program variant
- Not all combinations are useful

Feature Model

- Specifies valid combinations of features
- Graphically represented by a feature diagram
- Created for a particular domain
- Describes a software product line (SPL)



Cycle ⇒ Directed

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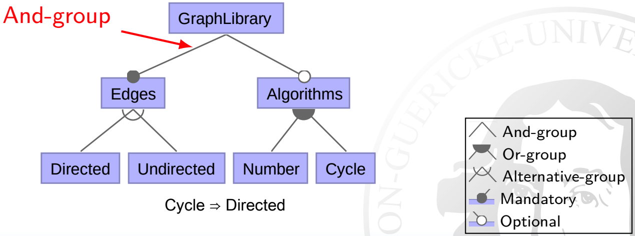

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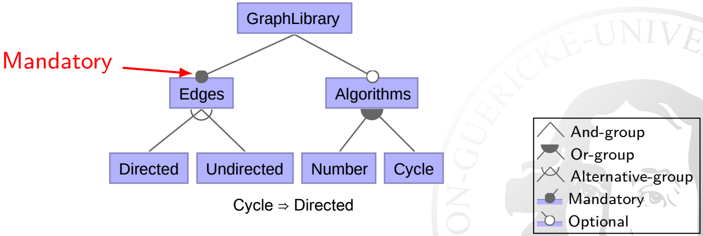

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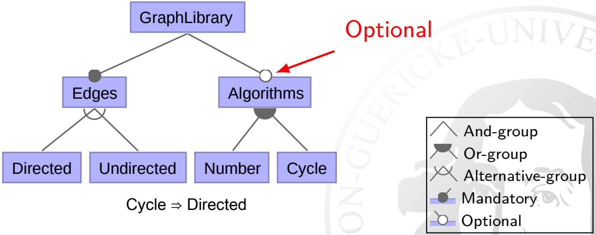

GraphLibrary

Edges

Algorithms

Directed

Undirected

Number

Cycle

Cycle ⇒ Directed

Optional

And-group

Or-group

Alternative-group

Mandatory

Optional

Feature Model

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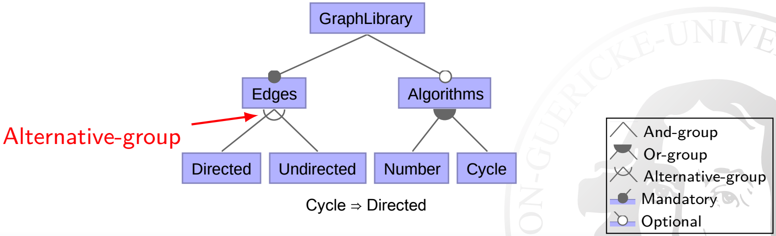

GraphLibrary

Edges

Algorithms

Alternative-group

Directed

Undirected

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Cycle

Cycle ⇒ Directed

And-group

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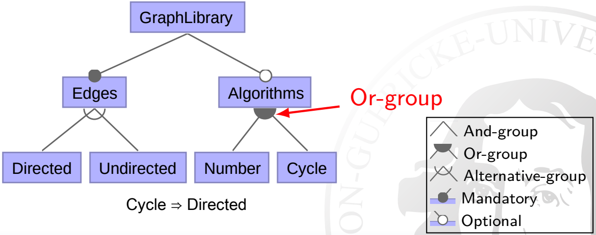

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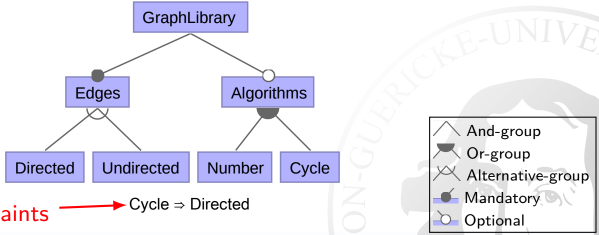

Cross-tree constraints

Feature Model

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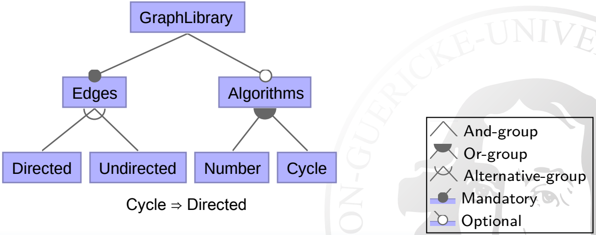
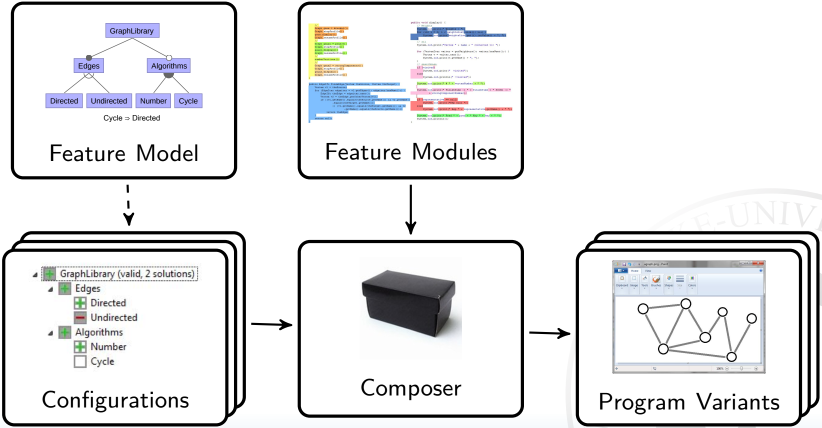


Composition Engines

Command-line tools used to compose files within FeatureIDE:

- AHEAD (jampack): .jak (Java 1.4)
  `http://userweb.cs.utexas.edu/~schwartz/ATS.html`
- FeatureC++: .cpp (C++)
  `http://www.fosd.de/fcpp`
- FeatureHouse: .java (Java 1.5), .cs (C#), .c/.h (C), .hs (Haskell), .jj (JavaCC), .als (Alloy), .xmi (UML)
  `http://www.fosd.de/fh`

Feature-Oriented Software Development



- GraphLibrary (valid, 2 solutions)
  - Edges
    - Directed
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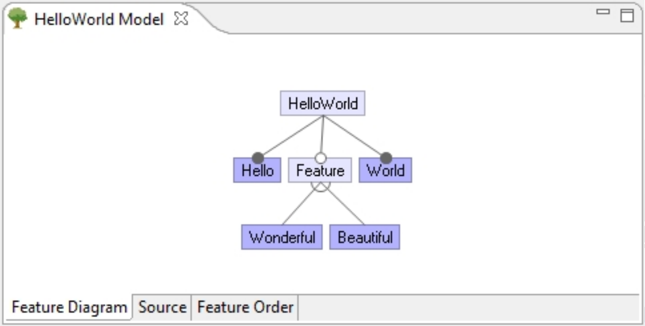
Configurations

Content

- What is Feature-Oriented Software Development?
- What functionality does FeatureIDE provide?
  - Feature Model Editor + Edit View
  - Configuration Editor
  - Jak Editor
  - Collaboration Diagram
  - Feature Project Builder
  - Run Configurations
  - Creation Wizards
- How to start working with FeatureIDE?

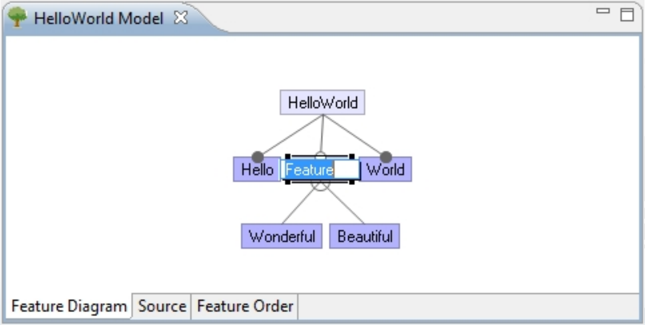
Feature Model Editor: Feature Diagram

- Double click to change connections and mandatory property



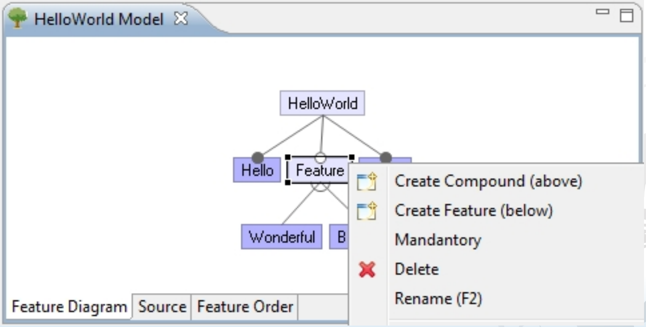
Feature Model Editor: Feature Diagram

- Double click to change connections and mandatory property
- Single click to rename features



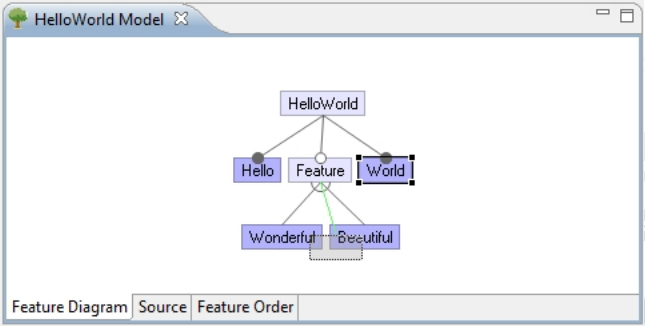
Feature Model Editor: Feature Diagram

- Double click to change connections and mandatory property
- Single click to rename features
- Right click to open context menu for features/connections



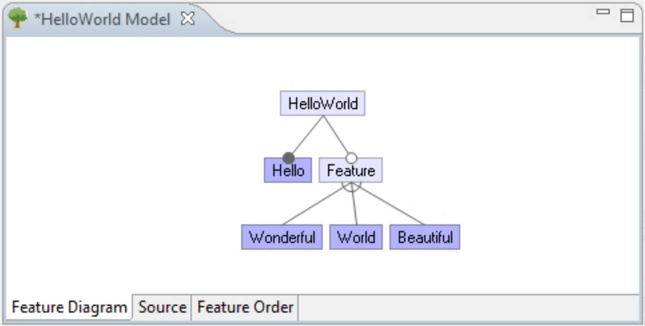
Feature Model Editor: Feature Diagram

- Double click to change connections and mandatory property
- Single click to rename features
- Right click to open context menu for features/connections
- Drag



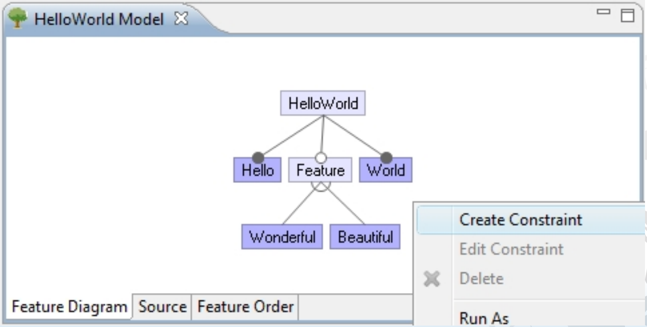
Feature Model Editor: Feature Diagram

- Double click to change connections and mandatory property
- Single click to rename features
- Right click to open context menu for features/connections
- Drag and drop features



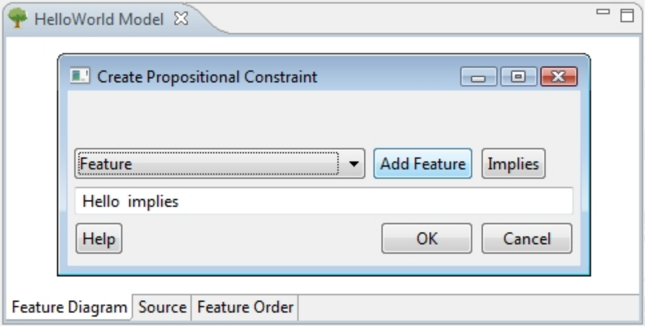
Feature Model Editor: Feature Diagram

- Double click to change connections and mandatory property
- Single click to rename features
- Right click to open context menu for features/connections
- Drag and drop features
- Context menu



Feature Model Editor: Feature Diagram

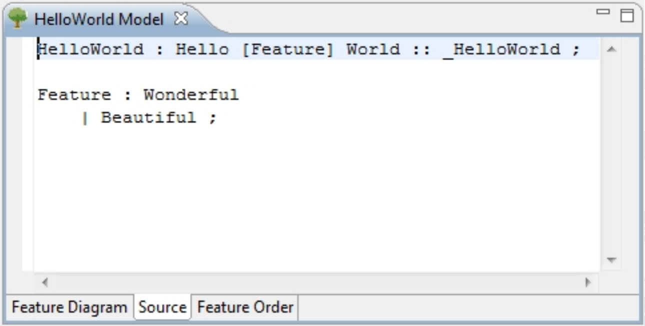
- Double click to change connections and mandatory property
- Single click to rename features
- Right click to open context menu for features/connections
- Drag and drop features
- Context menu to open Constraint Editor



Hello implies

Feature Model Editor - Grammar

- Source tab contains the GUIDSL grammar representation
- [] - optional feature
- | - Or-group -or- Alternative-group depending on parent
- + - mandatory feature and Or-group below
- ∗ - optional feature and Or-group below

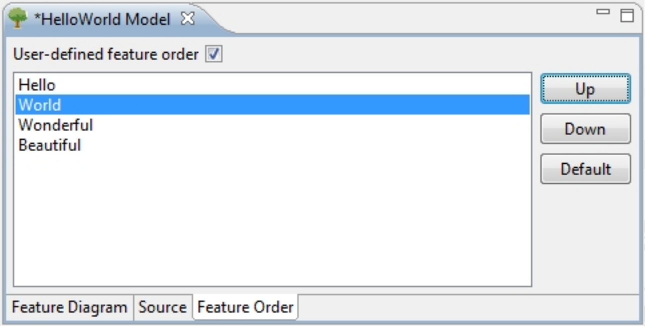


```
HelloWorld : Hello [Feature] World :: _HelloWorld ;

Feature : Wonderful
    | Beautiful ;
```

Feature Model Editor - Feature Order

- Order of features matters: can influence program behavior
- Default order: pre-order traversal of the feature diagram
- User-defined order possible
- Applies to all configurations



*HelloWorld Model

User-defined feature order ☑

Hello
World
Wonderful
Beautiful

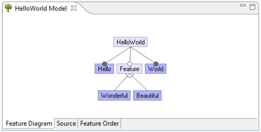
Feature Model Editor - Synchronization

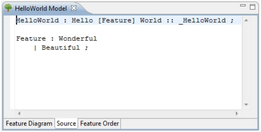
Before saving:

- When switching tab, changes are propagated

When saving:

- Feature folders are created, removed, and renamed
- Updating order of features in configurations
- Checking which configurations are valid/invalid
- Current content of Configuration Editor updated





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Feature : Wonderful
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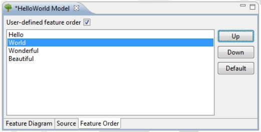


User-defined feature order ☑

Hello
World
Wonderful
Beautiful

Feature Model Edit View

- ...
- ...
- ...

Configuration Editor

- . . .
- . . .
- . . .

Jak Editor

- ...
- ...
- ...

Collaboration Diagram

- ...
- ...
- ...

Feature Project Builder

- . . .
- . . .
- . . .

Run Configurations

- . . .
- . . .
- . . .

Creation Wizards

- ...
- ...
- ...

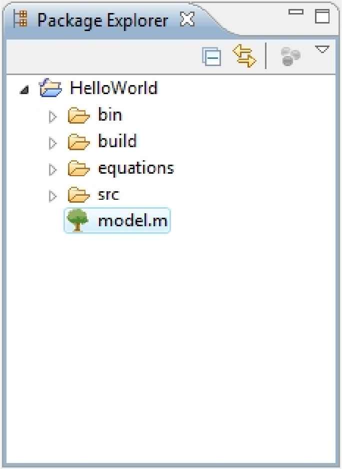
Content

- What is Feature-Oriented Software Development?
- What functionality does FeatureIDE provide?
- How to start working with FeatureIDE?
  - FeatureIDE installation
  - FeatureIDE project structure
  - Cheat Sheet

Installation of FeatureIDE

- . . .
- . . .
- . . .

FeatureIDE Project Structure

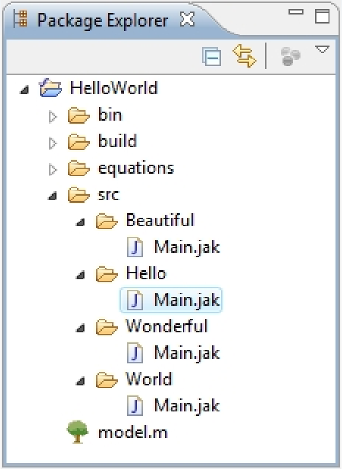


Package Explorer

HelloWorld
- bin
- build
- equations
- src
- model.m

- Feature model file in the GUIDSL-format

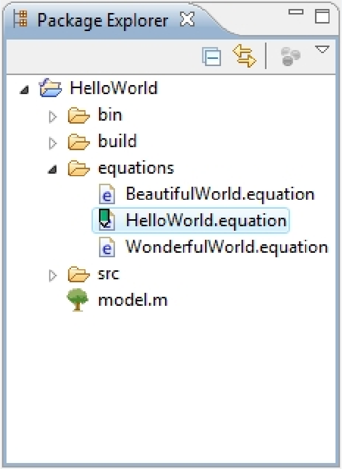
FeatureIDE Project Structure


Package Explorer

HelloWorld
- bin
- build
- equations
- src
  - Beautiful
    - Main.jak
  - Hello
    - Main.jak
  - Wonderful
    - Main.jak
  - World
    - Main.jak
- model.m

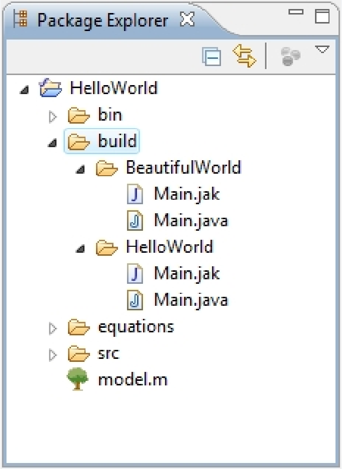
- Feature model file in the GUIDSL-format
- Source folder containing a folder for every feature including files to compose

FeatureIDE Project Structure



- Feature model file in the GUIDSL-format
- Source folder containing a folder for every feature including files to compose
- Configurations containing selected features from the feature model

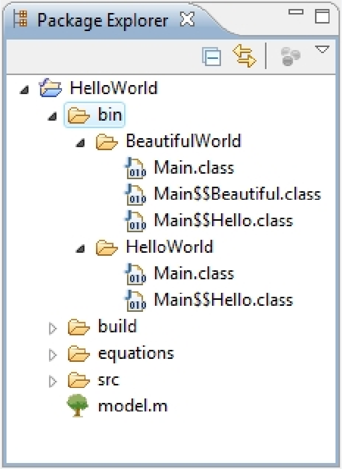
FeatureIDE Project Structure



- HelloWorld
  - bin
  - build
    - BeautifulWorld
      - Main.jak
      - Main.java
    - HelloWorld
      - Main.jak
      - Main.java
  - equations
  - src
  - model.m

- Feature model file in the GUIDSL-format
- Source folder containing a folder for every feature including files to compose
- Configurations containing selected features from the feature model
- Composed source files for several configurations (might be helpful when debugging)

FeatureIDE Project Structure



```
HelloWorld
  bin
    BeautifulWorld
      Main.class
      Main$$Beautiful.class
      Main$$Hello.class
    HelloWorld
      Main.class
      Main$$Hello.class
  build
  equations
  src
  model.m
```

- Feature model file in the GUIDSL-format
- Source folder containing a folder for every feature including files to compose
- Configurations containing selected features from the feature model
- Composed source files for several configurations (might be helpful when debugging)
- Binary files for several configurations

Cheat Sheet

- ...
- ...
- ...