

Tools for Software Product Lines

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[Tools

- Feature Modeling Plug-in (FMP)
- XFeature
- Pure::Variants
- SPLOT
- FeatureIDE



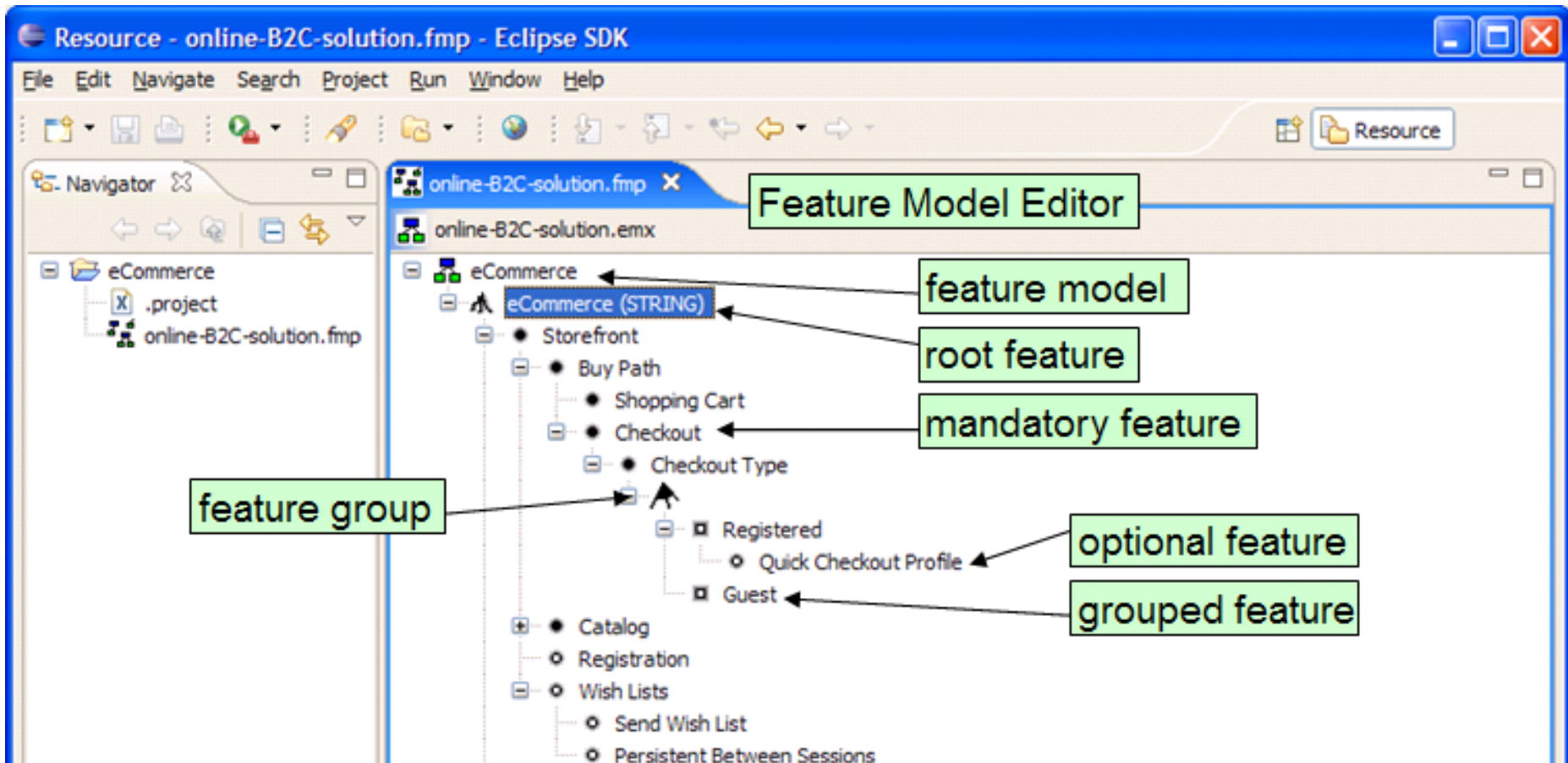
Feature Modeling Plug-in (FMP)

<http://gsd.uwaterloo.ca/fmp>

[FMP]

- It allows for editing and configuring feature models in SPL
 - Eclipse Plug-in
 - Prototype tool developed in 2005
 - No longer maintained
- Created in the University of Waterloo
 - Research leader: Krzysztof Czarnecki
 - Well known by his research on feature modelling

Feature Model Editor



Product Configuration

The screenshot displays a product configuration tool interface with several key components:

- Feature Tree (Top):** A hierarchical tree structure for "Configuration 1 of eCommerce (simpleCommerce: STRING)". It includes nodes like "Storefront", "Buy Path", "Shopping Cart", "Checkout", "Checkout Type", "Registered", "Quick Checkout Profile", "Guest", "Catalog", "Registration", "Wish Lists", "Send Wish List", "Persistent Between Sessions", "Business Management", "Order Management", and "Inventory Tracking". Checkmarks indicate selected features. Annotations include:
 - "user selected feature" pointing to "Registered".
 - "user eliminated feature" pointing to "Quick Checkout Profile".
 - "machine selected feature due to constraint propagation" pointing to "Registration".
- Modeling and Metamodeling Panes (Bottom Left):** A box labeled "modeling and metamodeling panes" pointing to the "Modeling" and "Metamodeling" tabs at the bottom of the feature tree.
- Properties View (Bottom Center):** A box labeled "Properties View" pointing to the "Properties" pane, which shows attributes like "Name", "Id", "Description", "Attribute", and "Integer", "Float", "String", "Value", "Default Value", and "Feature".
- Constraints View (Bottom Right):** A box labeled "Constraints View" pointing to the "Constraints" pane, which displays a constraint: `((/registered)->(/registration);)`. An annotation "Registered requires/implies Registration" points to this constraint.

A decorative graphic consisting of a thin gold arc at the top and bottom, with a thick black bracket on the left and a thick gold bracket on the right, framing a horizontal bar with a gold-to-white gradient.

XFeature

<http://www.pnp-software.com/XFeature/>

[XFeature]

- Prototype tool similar to FMP
 - Feature modelling
 - Eclipse Plug-in
 - Developed in 2005
 - Created at ETH Zurich in Switzerland
- Free and open software under GNU General Public License

XFeature Main Screen

Resource - IcsrControlSystem.xfm - Eclipse Platform

File Edit Navigate Search Project XFeature Run Window Help

Navigator

- IcsrControlSystemExample
 - build.xml
 - IcsrControlSystem.gcd
 - IcsrControlSystem.xdm
 - IcsrControlSystem.xfm
 - IcsrControlSystemApp.xdm
 - IcsrControlSystemApp.xfm
 - IcsrControlSystemApp.xfmm
 - build.xml
 - ICSR.xdm
 - ICSR.xfmm
 - IcsrXdmGen.xsl
 - IcsrXfmmGen.xsl


Outline

- AllCoverageTestOfIcsrSampleModel
 - SpacecraftControlSystem
 - gSensors
 - gActuators
 - Actuator
 - gActuatorOptions
 - AtitudeActuator
 - gSelfTest
 - SelfTest
 - gProcessors
 - Processor
 - gIntMem
 - InternalMemorySize

IcsrControlSystem.xdm IcsrControlSystem.xfm

Tasks Error Log Problems Properties

Property	Value
Basic	
FeatureCardinality	1..1
name / value	Processor
ComponentPropertySet	
StatusProperty	provided
TypeProperty	OR_Processor



S.P.L.O.T.

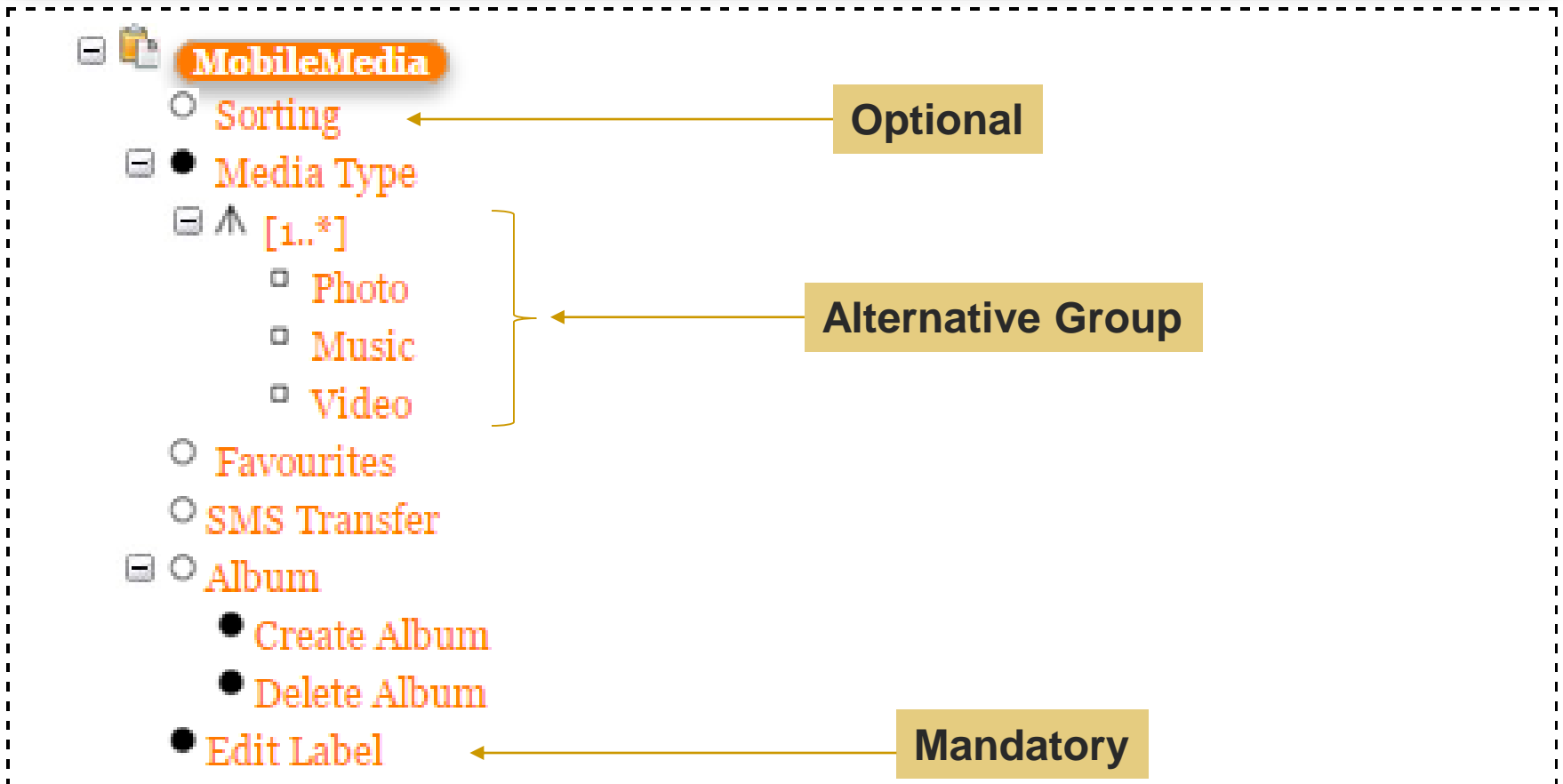
<http://www.splot-research.org/>

[SPLOT Overview]

- Released in 2009
 - University of Waterloo
 - Krzysztof Czarnecki
- Open source Web-based tool
- It allows to edit, debug, analyze, configure, and share feature models
 - Its repository includes hundreds of feature models

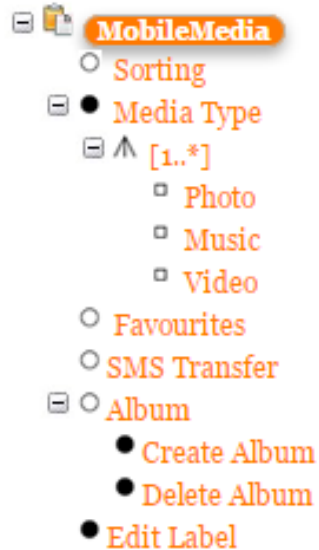
[Feature Model Editor]

Feature Diagram



Cross-Tree Constraints

Feature Diagram



It means that the SMS Transfer feature requires the Album feature (and its sub-features)

Cross-Tree Constraints

■ (SMS Transfer \vee Album)

[Click to create a constraint](#)

Automated Analysis

Feature Model Statistics

#Features	14
#Mandatory	3
#Optional	1
#XOR groups	3
#OR groups	1
#Grouped	9
#Cross-Tree Constraints (CTC)	2
CTCR (%)	0.29
#CTC distinct vars	4
CTC clause density	0.50

Feature Model Analysis

✓	Consistency	Consistent
✓	Dead Features	None
✓	Core Features	<u>4 feature(s)</u>
✓	Valid Configurations	30

Run Analysis

Product Configuration

MobileMedia (10 features)

- [-] [gear] [MobileMedia]
- ? [-] [check] [X] [radio] Sorting
- [-] [gear] [bullet] Folder
 - [-] [gear] [bullet] Create Folder
 - [-] [gear] [bullet] Delete Folder
- [-] [gear] [bullet] Media Type
 - [-] [up] [1..3]
 - ? [-] [check] [X] [radio] Photo
 - ? [-] [check] [X] [radio] Music
 - ? [-] [check] [X] [radio] Video
 - ? [-] [check] [X] [radio] Favourites

Configuration Steps [reset]					
50%					
Step	Decision	#Decisions (cumulative)	#Propagations (at step)	#SAT checks (at step)	SAT time (at step)
1	[check] MobileMedia	5 (50.0%)	4	6	1 ms
👉 Auto-completion: Less Features More Features					



Pure::Variants

<http://www.pure-systems.com/products/pure-variants-9.html>

[Pure::Variants]

- Commercial system (IDE)
 - Evaluation copy available
- Include several tools for developing and management of variability
- It integrates to Eclipse and other IDEs
 - Enterprise Architect, IBM Rational DOORS, IBM Rational Rhapsody, etc.

Screen 1: Product Configuration

The screenshot displays the Eclipse Platform Variant Management interface for a project named 'Indoor.vdm'. The interface is divided into several panes:

- Variant Projects:** Shows a tree view of the project structure, including 'Weather Station Example' and its sub-projects like 'ExampleConfigSpace', 'Runtime System.ccfm', and 'Weather Station.xfm'.
- Indoor.vdm:** The main configuration tree. It shows a hierarchy of features and components. The 'Pressure' feature is currently selected and highlighted in blue. Other visible features include 'Debug', 'Trace', 'Output', 'LCD', 'PC Data transfer', 'USB', 'Serial', 'Protocol', 'SynclGoProto', 'LDPoverSLIPProto', 'Sensors', 'Temperature', 'Wind', 'System', 'API', 'FileSystems', 'Interfaces', 'Interrupt', and 'Memory'.
- Relations:** A pane on the right showing the relationships between features. It lists 'Weather Station' and its sub-features like 'Output', 'Sensors', 'Runtime System Solutions', 'Cpu', 'I2CBitbang', 'LCDScreen', 'Machine', and 'PSIFlag'.
- Properties:** A pane at the bottom right showing the configuration details for the selected 'Pressure' feature. It includes fields for 'Unique ID', 'Unique Name', 'Visible Name', 'Class/Type', and 'Variation Type'. The 'Variation Type' is set to 'Mandatory'.
- Outline:** A pane at the bottom left showing a list of features and components, including '16x4', 'atmega103', 'avr', 'AvrModel', 'Compiler', 'Cpu', 'Devices', and 'GCC'.

The status bar at the bottom of the window shows the page number '434' and the total number of pages '2075', along with the current page number '330' and the total number of pages '3'.

Screen 2: Graphical View

The screenshot displays the Eclipse Platform interface for a project named "Weather Station.xfm". The main window shows a hierarchical feature model diagram. The root node is "Weather Station", which branches into "Sensors", "Output", and "Debug". "Sensors" further branches into "Temperature" and "Pressure". "Output" branches into "PC Data transfer", "LCD", and "Trace". "PC Data transfer" further branches into "USB", "Serial", and "Protocol". The "Pressure" node is selected, and its properties are shown in the Properties view at the bottom.

Feature Model Diagram:

```
graph TD; WS[Weather Station] --> Sensors[Sensors]; WS --> Output[Output]; WS --> Debug[Debug]; Sensors --> Temperature[Temperature]; Sensors --> Pressure[Pressure]; Output --> PCData[PC Data transfer]; Output --> LCD[LCD]; Output --> Trace[Trace]; PCData --> USB[USB]; PCData --> Serial[Serial]; PCData --> Protocol[Protocol];
```

Properties View for Pressure:

Label	Value
Unique ID	1522984850
Unique Name	AirPressureSensor
Visible Name	Pressure
Class/Type	ps:feature

Relations View:

- Parent (1): Sensors
- Prolog Script (2):
 - Has Feature (2): AirPressureSensor, ps:classalias: Pressure
 - Not Has Feature (1): ps:classalias: Pressure



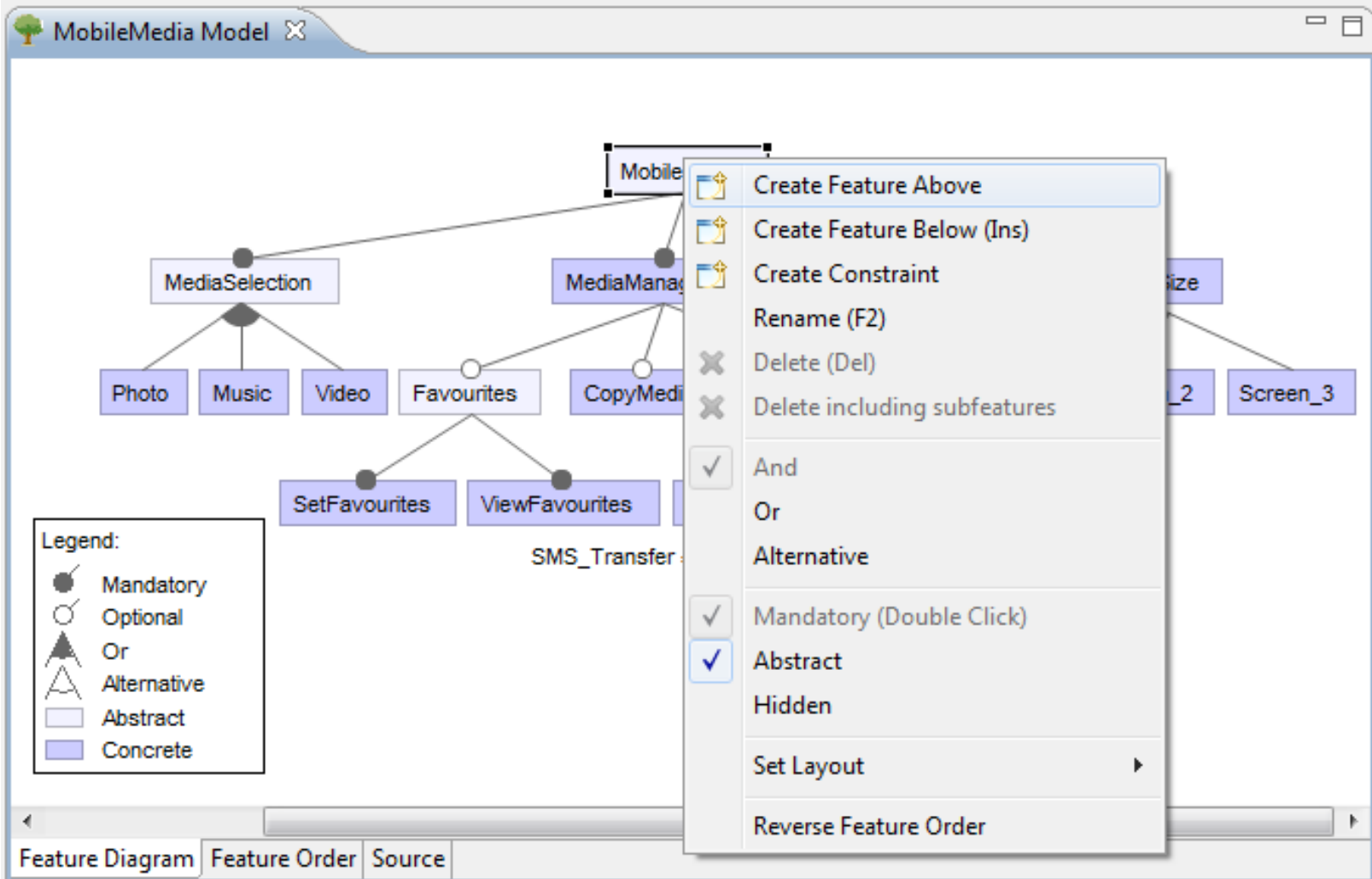
FeatureIDE

<https://featureide.github.io/>

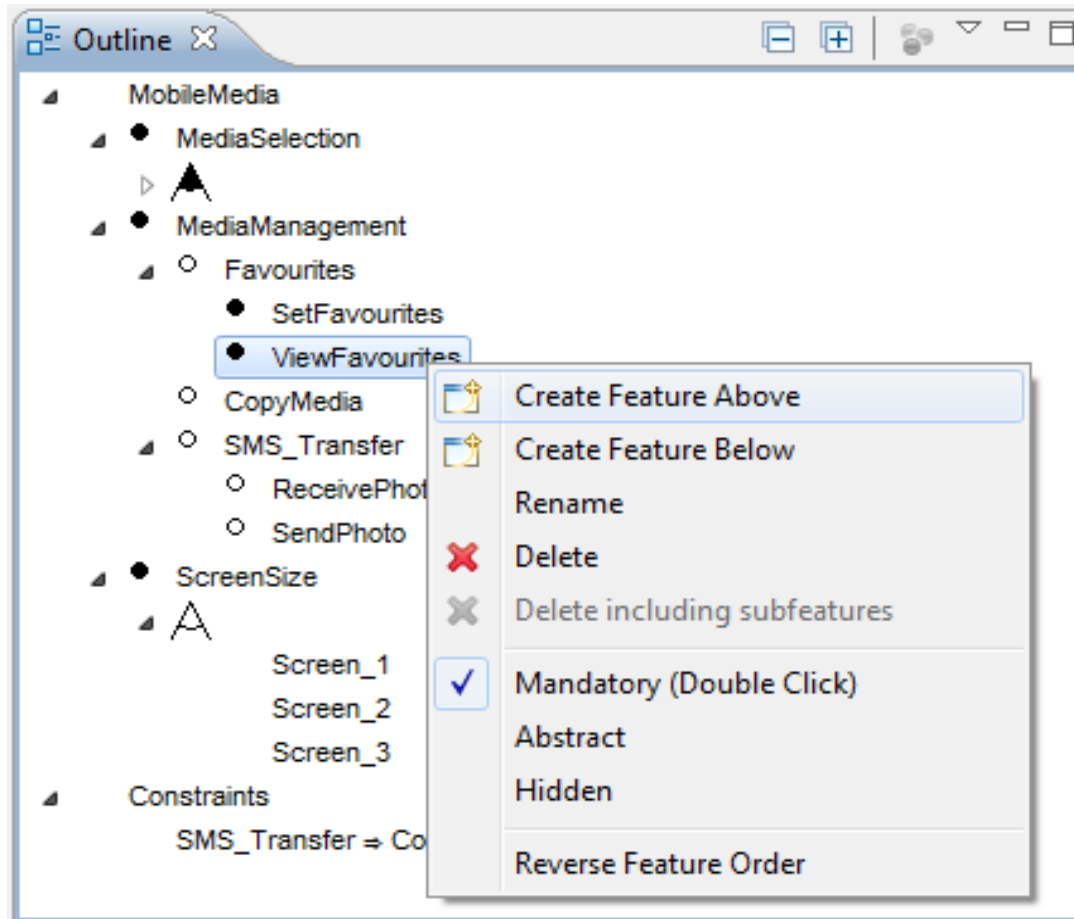
[FeatureIDE]

- It allows domain analysis implementation of SPL
 - Eclipse-based IDE
- It supports programming techniques
 - Feature-oriented programming (FOP)
 - Aspect-oriented programming (AOP)
 - Delta-oriented programming (DOP)
 - Preprocessors

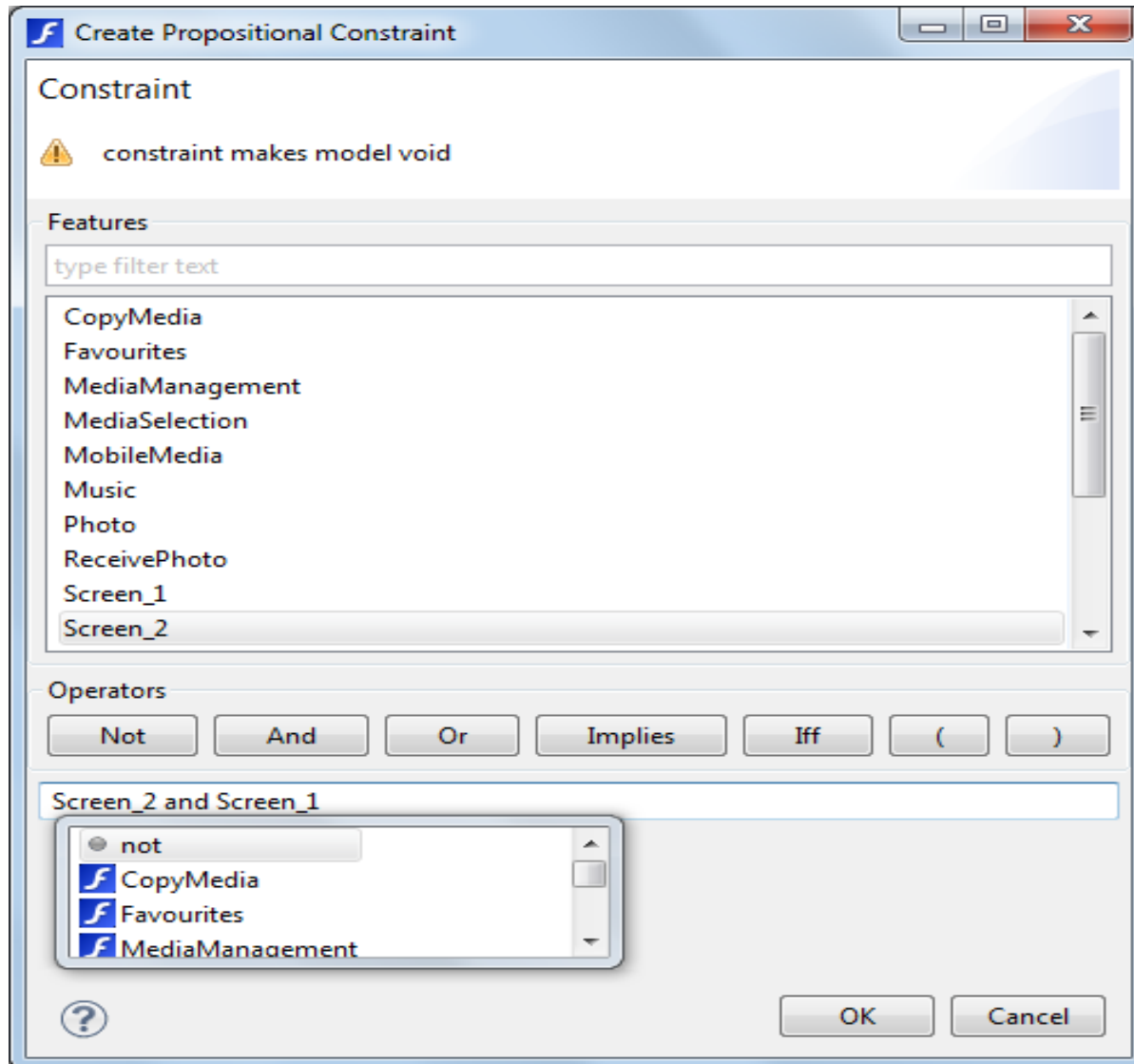
Feature Model Editor



[Alternative View]



[Cross-Tree Constraints]



Product Configuration

The image shows two windows from the Eclipse IDE. The left window is the Package Explorer, displaying the project structure for 'MobileMedia'. The right window is the configuration editor for 'MobileMedia.config', showing a tree view of configuration options with checkboxes.

Package Explorer (Left Window):

- MobileMedia
 - src
 - JRE System Library [JavaSE-1.6]
 - JRE System Library [jre7]
 - configs
 - MobileMedia_2.config
 - MobileMedia.config
 - features
 - CopyMedia
 - MediaManagement
 - Music
 - Photo
 - ReceivePhoto
 - Screen_1
 - Screen_2
 - Screen_3
 - Screen_4
 - ScreenSize
 - SendPhoto
 - SetFavourites
 - SMS_Transfer
 - Video
 - ViewFavourites
 - model.xml

MobileMedia.config (Right Window):

- MobileMedia (valid, 1 possible configurations)
 - MediaSelection
 - Photo
 - Music
 - Video
 - MediaManagement
 - Favourites
 - SetFavourites
 - ViewFavourites
 - CopyMedia
 - SMS_Transfer
 - ReceivePhoto
 - SendPhoto
 - ScreenSize
 - Screen_1
 - Screen_2
 - Screen_3

Configuration | Advanced Configuration | Source

[Bibliography]

■ Websites of the Tools

- <http://gsd.uwaterloo.ca/fmp>
- <http://www.pnp-software.com/XFeature/>
- <http://www.splot-research.org/>
- <http://www.pure-systems.com/products/pure-variants-9.html>
- <https://featureide.github.io/>