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# pure::variants - Connector for EMF Feature Mapping Manual

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## 1. Introduction

The pure::variants Connector for EMF Feature Mapping enables pure::variants to flexibly create multiple differing variants from a single EMF master model. This provides a boost in development efficiency since instead of having to merge changes in slight variations of the base project, the change is applied once to the master project and then all relevant variants are automatically generated by pure::variants.

The Connector supports EMF-based models. It is tool independent and can be used with any standard compliant EMF tool chain. To simplify management of variability information in EMF it contains an optional standalone user interface for handling variability information in ecore files.

### 1.1. Software Requirements

The pure::variants Connector for EMF Feature Mapping is an extension for pure::variants and is available on all supported platforms.

In order to use the user interface integration the installation of the EMF and GMF framework is required:

EMF: EMF - Eclipse Modeling Framework SDK since Version 2.5.0. See <http://www.eclipse.org/modeling/emf/>.

GMF: GMF - Graphical Modeling Framework since Version 1.2.1. See <http://www.eclipse.org/modeling/gmp/>.

### 1.2. Installation

Please consult section "Additional pure::variants Plug-ins" in the pure::variants User's Guide for detailed information on how to install the connector (menu **Help** -> **Help Contents** and then **pure::variants User's Guide** -> **Additional pure::variants Extensions**).

## 1.3. About this Manual

The reader is expected to have basic knowledge about and experiences with pure::variants. The pure::variants manual is available in online help as well as in [printable PDF format](#).

## 2. Using the pure::variants Connector for EMF Feature Mapping

### 2.1. Starting pure::variants

Depending on the installation method used either start the pure::variants-enabled Eclipse or under Windows select the **pure::variants** item from the **program** menu.

If the **Variant Management** perspective is not already activated, do so by selecting it from **Open Perspective -> Other...** in the **Window** menu.

### 2.2. How the pure::variants Connector for EMF Feature Mapping Works

The pure::variants Connector for EMF Feature Mapping works for EMF-based files. Ecore and ecorediag resources are supported out of the box. For other EMF-based resources an additional pure::variants Connector may be necessary, such as the pure::variants Connector for Papyrus, Capella or IBM Rational Software Architect.


The pure::variants Connector for EMF Feature Mapping uses an EMF runtime master model to derive multiple variants from it. Each of the variants is derived from the master runtime model by removing EMF elements not relevant in the respective variant. Removal of elements is controlled by pure::variants conditions. Conditions can be added to EMF elements by the master model author(s). The conditions are evaluated by pure::variants based on a variant model which captures the variant-specific feature selection. Elements having conditions which evaluate to 'false' are removed.

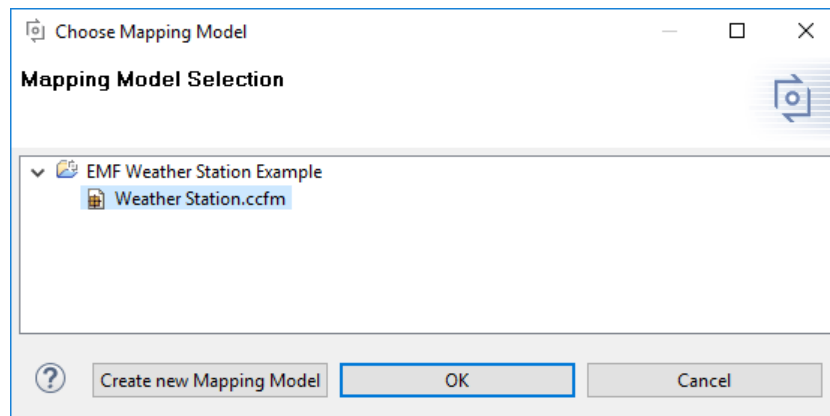
Apart from conditions, it is also possible to add a pure::variants calculation to an attribute of an EMF element. Like conditions, calculations are evaluated based on a variant model. However, instead of removing the attribute, its value is set to the evaluation result of the calculation.

## 3. Tasks

### 3.1. Creating Variability Information

#### Selecting a Mapping Model

To be able to add a condition or calculation to an EMF element, it is required to select a *mapping model*. The mapping model is a pure::variants Family Model that stores which EMF elements are mapped to which condition or calculation. To this end, open the **Mappings** view via **Window->Show View** and press **Select Mapping Model** ()

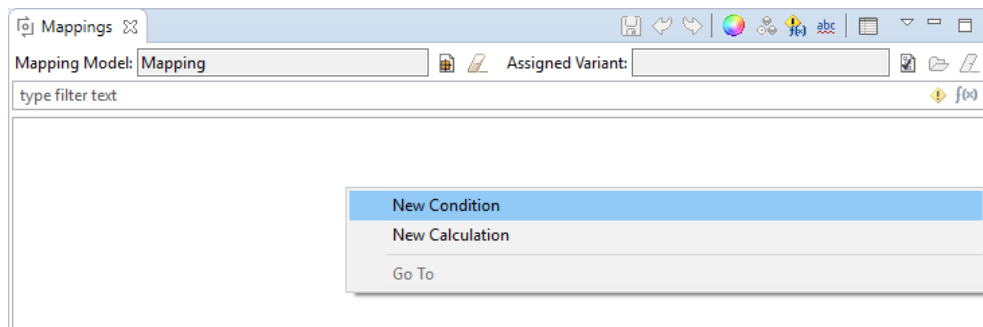
**Figure 1. Select Family Model used as Mapping Model**

## Creating a Condition on an EMF Element

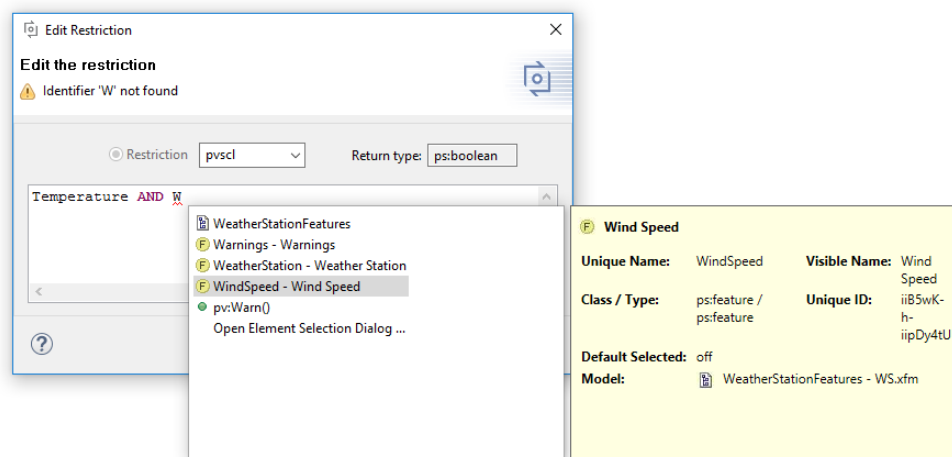
There are multiple ways how to add an element to a condition: via the **Mappings** view context menu, via drag & drop onto a condition, or via the context-menu of an EMF element.

## Using Context Menu in Mappings View

At first a condition must be added in **Mappings** view using the **New Condition** context menu.

**Figure 2. Create Condition by Context Menu**

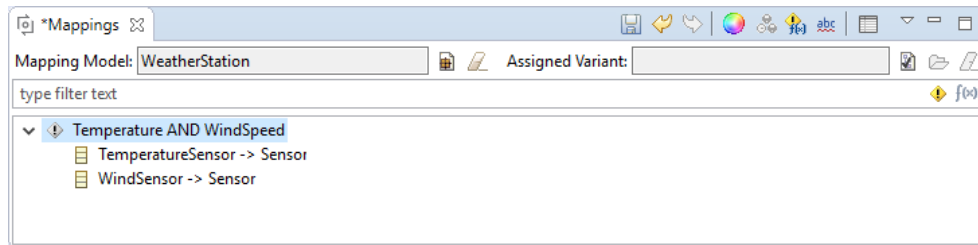
The menu opens the condition editor. The editor supports writing conditions with auto completion. To use the auto completion press **Ctrl+Space**.

**Figure 3. Condition Editor Showing the Auto Completion**

Pressing **OK** will store the new or changed condition into the loaded mapping model. To add an EMF element to the newly created condition, select the element in the opened EMF model, right-click on the condition and select **Add ....**

Alternatively, you can also drag & drop EMF elements on the condition.

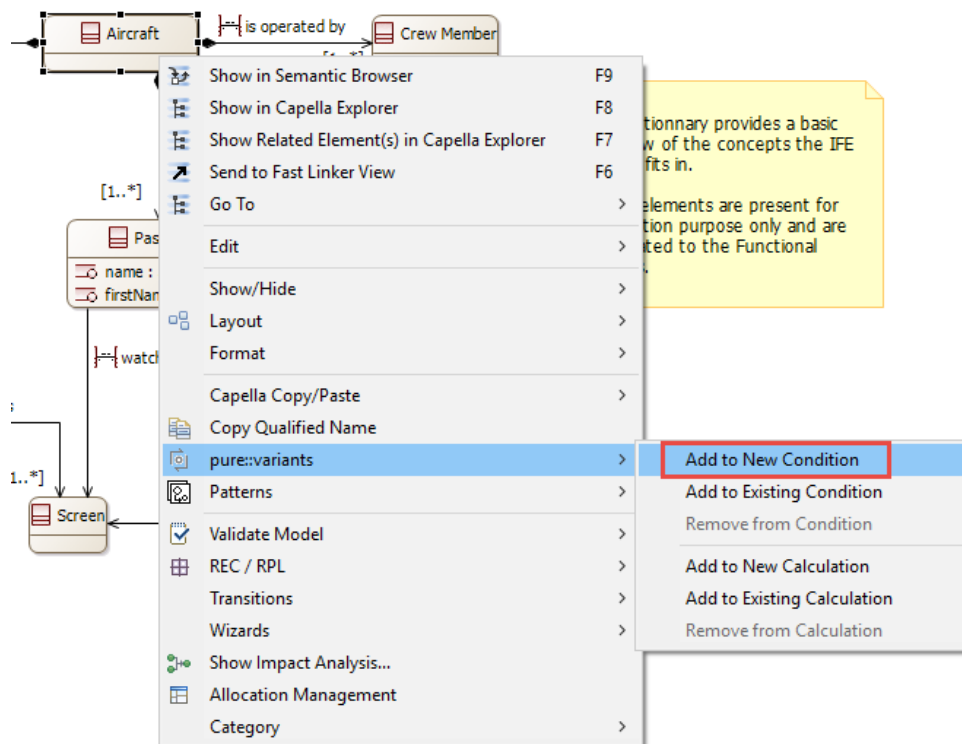
**Figure 4. Restricted EMF elements in Mapping view**



## Using Context Menu in EMF model

Another way to add a condition to one or more EMF elements, is to right-click on the selected element(s) in the EMF model (e.g., in diagram or browser) and select **pure::variants->Add to New Condition**. This will open the condition editor to create a new condition and then add the selected element(s) to it.

**Figure 5. Adding EMF Element to New Condition**



Alternatively, you can select **pure::variants->Add to Existing Condition**. This will open a dialog to select an existing condition to which the selected element(s) will be added.

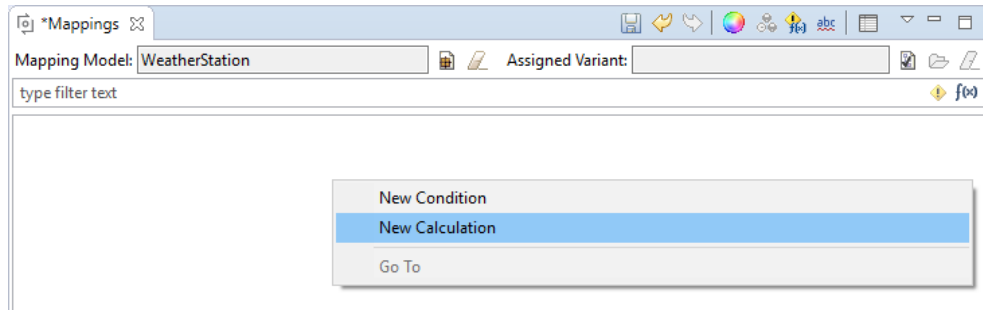
## Creating a Calculation on an attribute of an EMF Element

EMF element attributes can be added to a calculation in similar ways as conditions: via the **Mappings** view context menu, via drag & drop onto a calculation, or via the context-menu of an EMF element.

## Using Context Menu in Mappings View

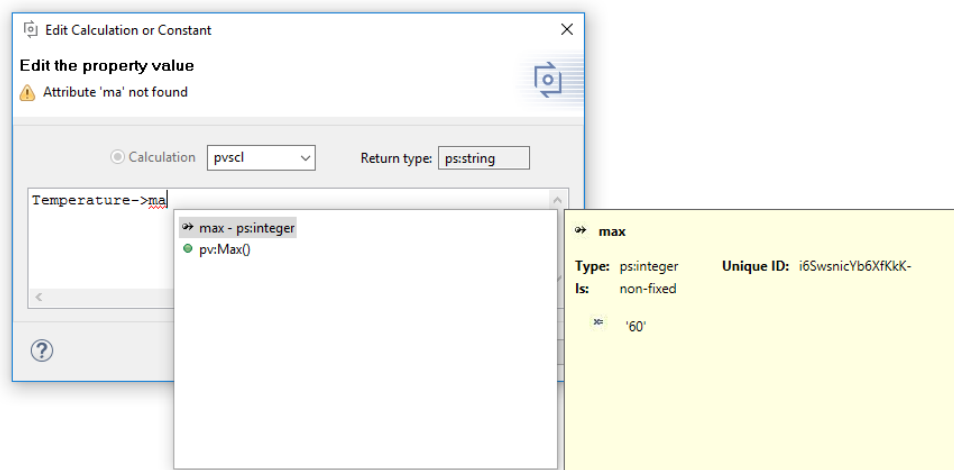
First a calculation needs to be created in the **Mappings** view using the **New Calculation** context menu.

**Figure 6. Create Calculation by Context Menu in Mappings View**



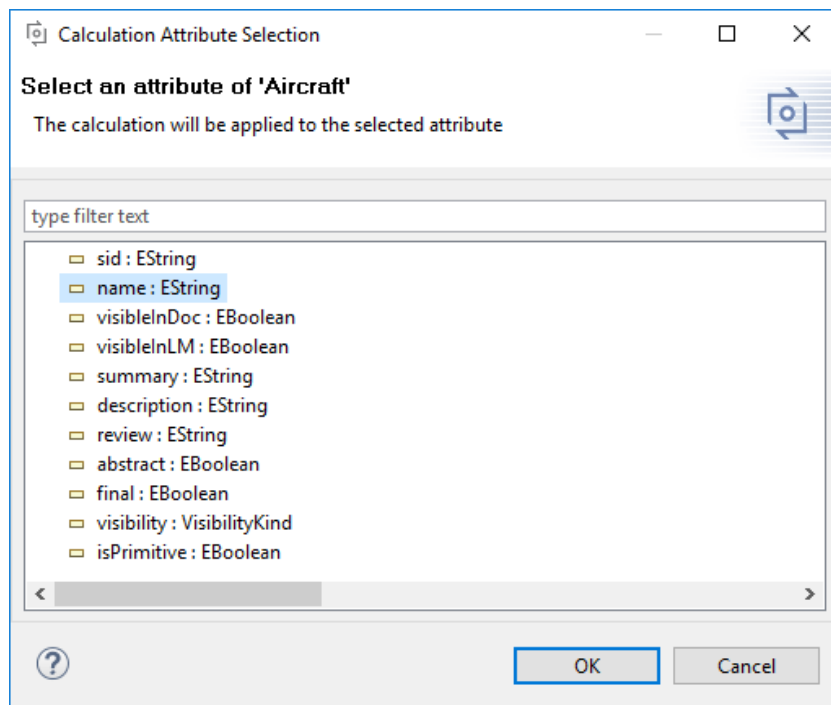
The menu opens the calculation editor, which works in the same way as the condition editor.

**Figure 7. Calculation Editor Showing the Auto Completion**

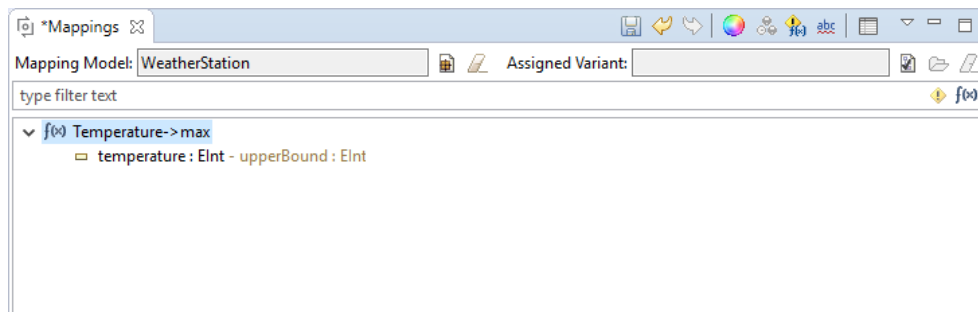


Pressing **OK** will store the new or changed calculation into the loaded mapping model. To add the attribute of an EMF element to the newly created calculation, select the element in the opened EMF model, right-click on the calculation and select **Add ...**.

Now, a dialog opens that allows to select the attribute on which the calculation should be applied. All attributes of the current element are listed here. However, only attributes which are based on type *String*, *Boolean*, or a basic number type, such as *Integer*, *Float* or *Double* are currently selectable.

**Figure 8. Attribute Selection Dialog**

Similar to conditions, you can also drag & drop an EMF element onto the calculation. This will also open the attribute selection dialog.

**Figure 9. Restricted EMF elements in Mapping view**

## Using Context Menu in EMF model

Another way to add a calculation to an attribute of an EMF element, is to right-click on the selected element in the EMF model (e.g., in diagram or browser) and select **pure::variants->Add to New Calculation**. This opens the attribute selection dialog and after pressing **OK**, opens the calculation editor to create a new calculation and then adds the selected attribute to it.

Alternatively, you can select **pure::variants->Add to Existing Calculation**. This also opens the attribute selection dialog and after pressing **OK** opens a dialog to select an existing calculation to which the selected attribute will be added.

## 3.2. Preview Variable Elements and Variant Results

### Identify Variable Elements in EMF Models

To find out whether an element is mapped to a pure::variants condition or calculation, activate the **Decoration** mode (🔍) in the **Mappings** view. When decoration mode is enabled EMF elements are marked as follows in EMF diagrams:






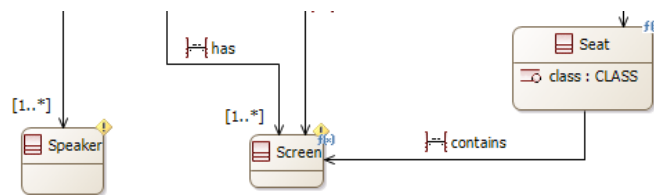
Decoration Icon	Shown when
	an EMF element is mapped to a condition
	an EMF element is indirectly mapped to a condition, either because one of its parents is mapped, or due to propagation (see <a href="#">the section called “Enable Propagation Rules”</a> )
	an attribute of this EMF element is mapped to a calculation
	mapped to both a calculation and a condition
	mapped to both a calculation and an indirect condition

Figure 10. Decoration Mode in Diagram



When hovering over the decoration icon, more information is shown. For conditions, the effective pvSCL condition is shown. This means that all conditions that apply to this element are concatenated with operator AND. For calculations, the pvSCL calculation that applies to this element is shown, and the attribute which is mapped to the calculation.

To add this text information to the diagram, select **Decoration Mode: Show Labels in Diagrams** from the drop-down menu of the **Mappings** view.

In EMF explorer, no icons are shown in decoration mode. However, the same text as in diagrams is added to elements.

## Color Elements


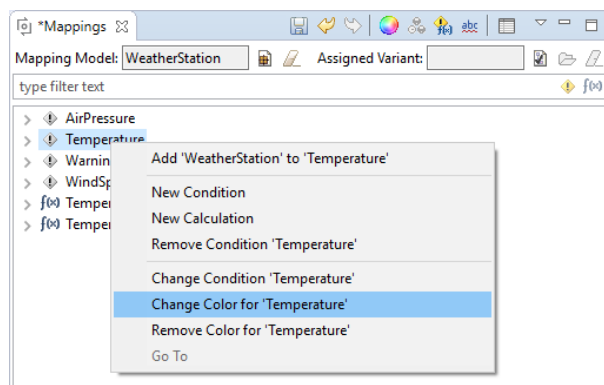
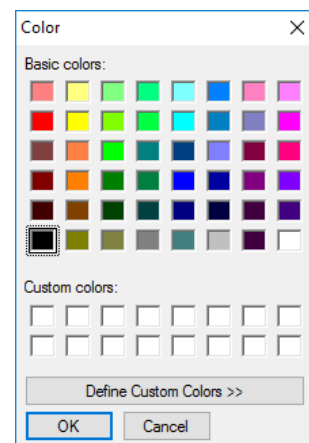
After activating the **Colorize**  mode in the **Mappings** view all views and editors showing the EMF model are updated to colorize elements which have a condition or calculation and this has set a color. To set a color, select a condition or calculation and press the **Change Color** context menu in **Mappings** view.

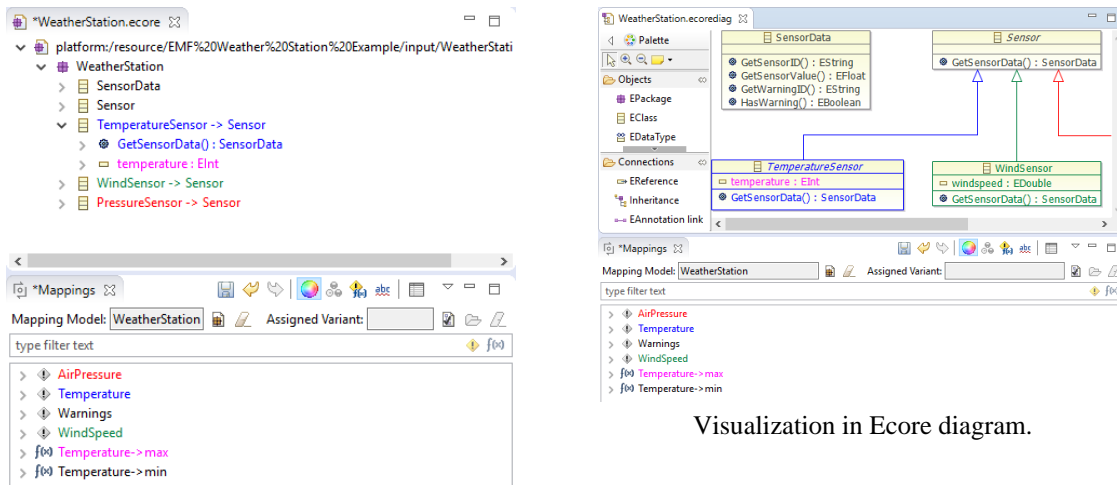
Figure 11. Set Color of Condition



Use context menu to change color.




Choose the color.

**Figure 12. Preview Variant: Colorize Elements**

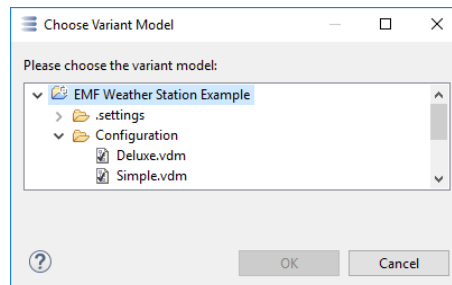
Visualization in Ecore tree.

Visualization in Ecore diagram.



## Preview a Variant

To enable the preview of variants a variant description model needs to be selected. To do this, open the **Mappings** view and press the **Assign Variant** () button.

This opens a file selection dialog. Please select the model and press **OK**.

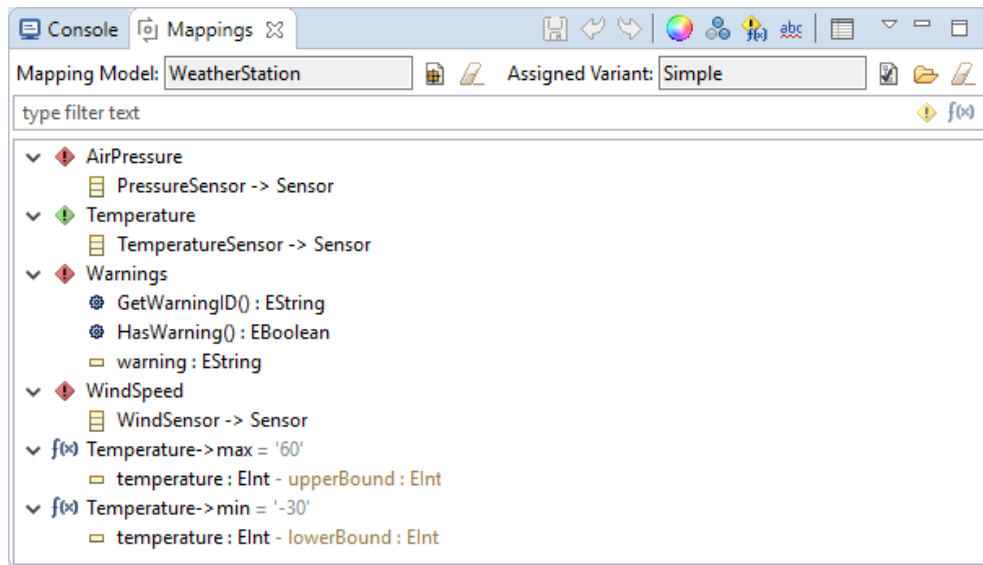
**Figure 13. Select Variant Description Model**

The variant description model is loaded and evaluated. The **Mappings** view changes the images in front of conditions. Before a variant is assigned the images are gray. After loading a variant the images are:

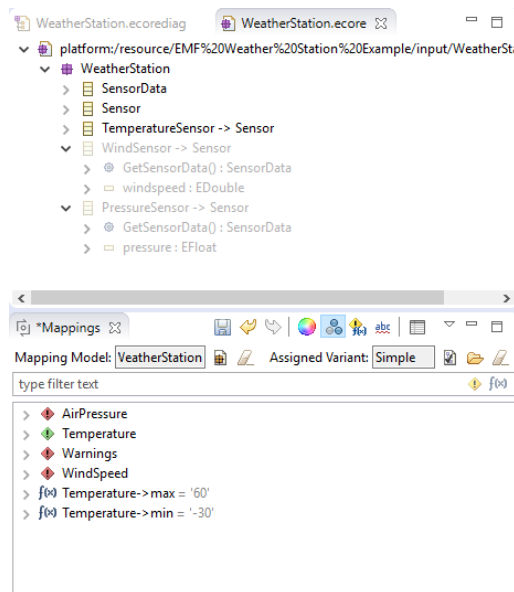
Result Icon	Description
	green if the condition evaluates to <i>true</i>
	red if the condition evaluates to <i>false</i>

Furthermore, the evaluated value of the current variant is shown behind each calculation.

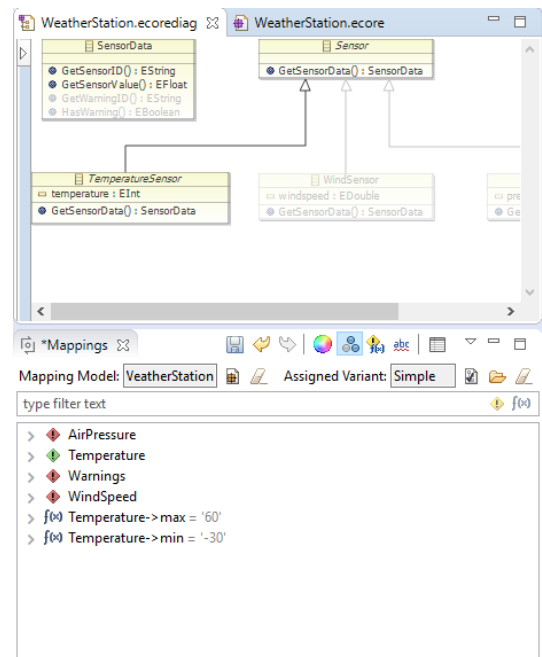


**Figure 14. Mappings View with Loaded Variant**

The preview mode is also enabled. To start the visualization in the EMF model, activate the **Variant** (🔗) mode. All elements which are not part of a variant are grayed out. Alternatively, you can hide all elements that are not in a variant, by selecting the other variant mode button (🔗).

**Figure 15. Preview Variant: Grayed-out Elements**

Elements not in Variant are grayed-out in tree.



Elements not in Variant are grayed-out in diagram.

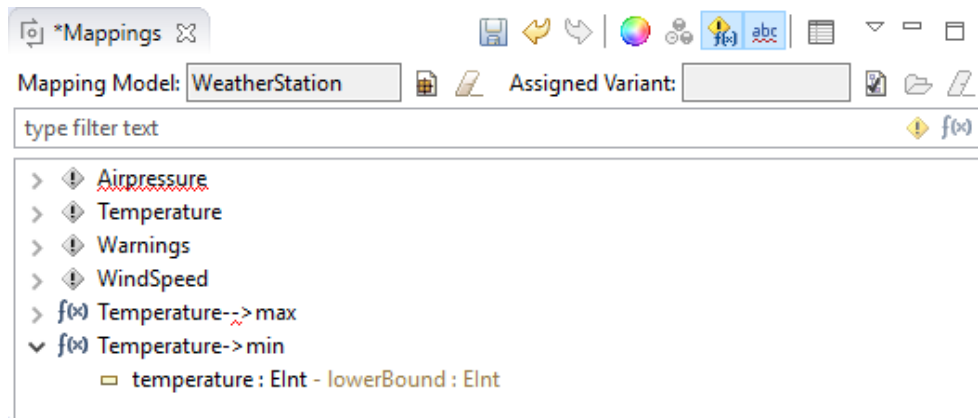
## Highlight Condition of EMF Element

After selecting an EMF element, the condition that it is mapped to is shown in bold letters in the **Mappings** view. Also all conditions that are propagated to this element are highlighted in bold letters (for details on propagation, see [the section called “Enable Propagation Rules”](#)).

## Find Errors in Conditions or Calculations

Errors in conditions or calculations can be highlighted via button **Show Errors** (abc). For example, feature `Air\Pressure` is misspelled in the first shown condition. Therefore it is underlined. Hover over the faulty condition or calculation to see the error message.

**Figure 16. Underlining Errors in Conditions or Calculations**

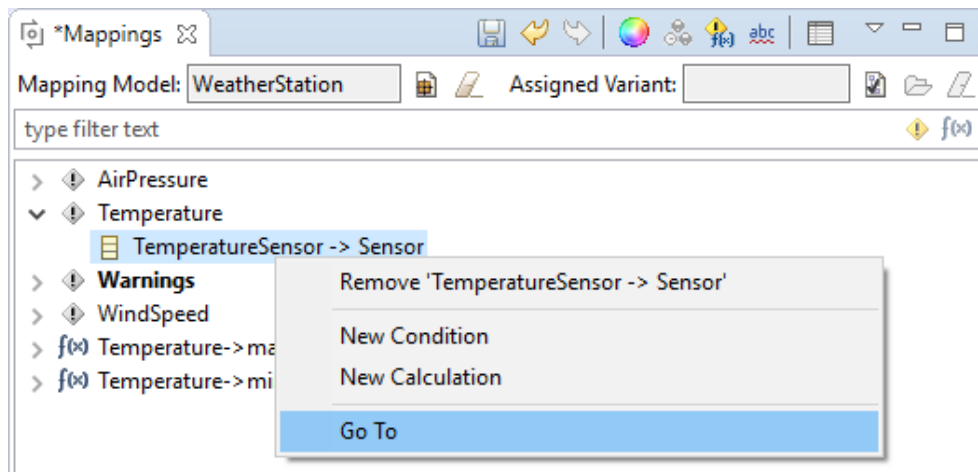


## 3.3. Useful when working with the Mappings View

### Navigate to an EMF Element

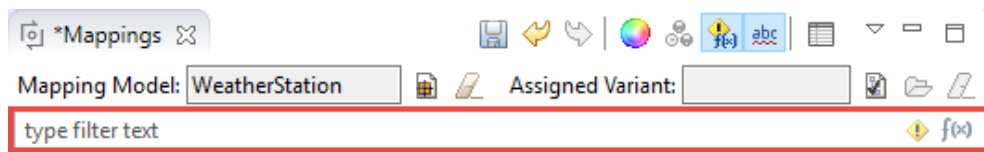
You can navigate to any EMF element shown in the **Mappings** view by using the **Go To** context menu. Wherever the element is selectable, it will be shown and selected.



**Figure 17. Navigate to EMF Element by Context Menu**



### Filter Conditions or Calculations


Conditions and calculations shown in the **Mappings** view can be filtered. To filter all elements shown in the mapping view by text, type part of their text in the marked text box (can be either part of the pvSCL expression, or the name of an EMF element). Only the matching elements will be shown in the view.

**Figure 18. Underlining Errors in Conditions or Calculations**

To show only conditions and hide all calculations, use button  at the end of the text box. For showing only calculations, press .

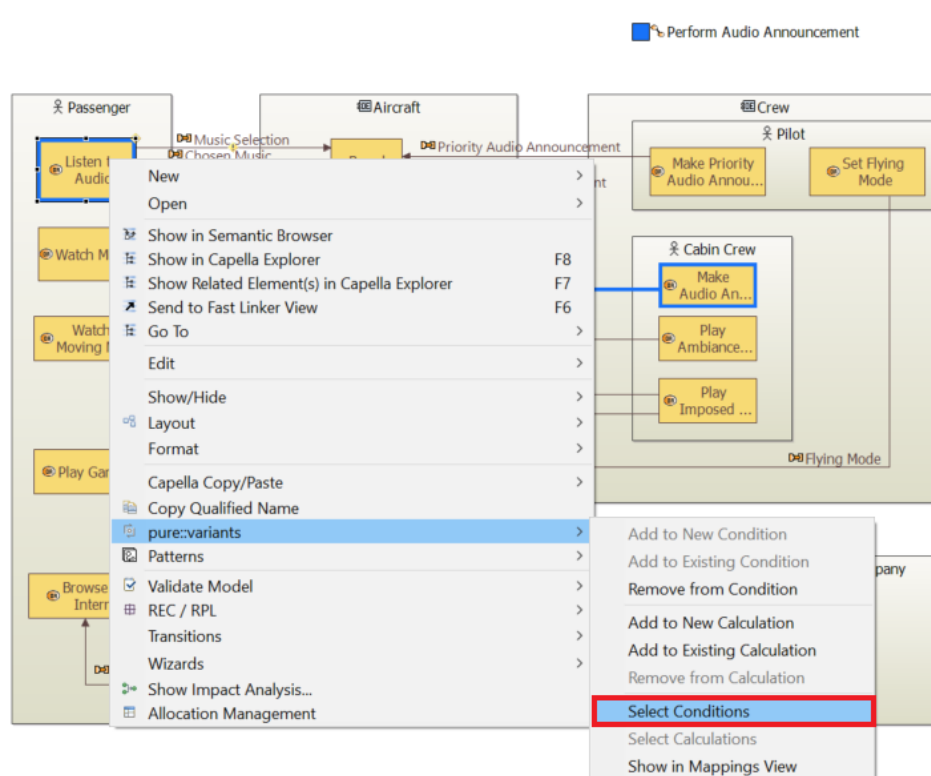
## Enable Propagation Rules

For some EMF tools a tool-specific Connector provides propagation rules. Basically a propagation rule ensures that if Element A is removed during transformation, also Elements B, C, and D are removed. This influences also visualizations and decorations.

If propagation rules are supported for the used EMF tool, you can enable or disable propagation rules by using the **Propagation settings** button () of the **Mappings** view. For more details on propagation, see the respective EMF tool connector manual.

## Select Calculations / Conditions

If an element is mapped to a condition or a calculation, it can be selected using the context menu in the EMF model. Also, all conditions and calculations that are propagated to this element are selected. To select the conditions or calculations, right-click on the selected element(s) in the EMF model (e.g., in diagram or browser) and select **pure::variants** → **Select Conditions** or **Select Calculations**. This will select the respective conditions or the calculations in the **Mappings** view.

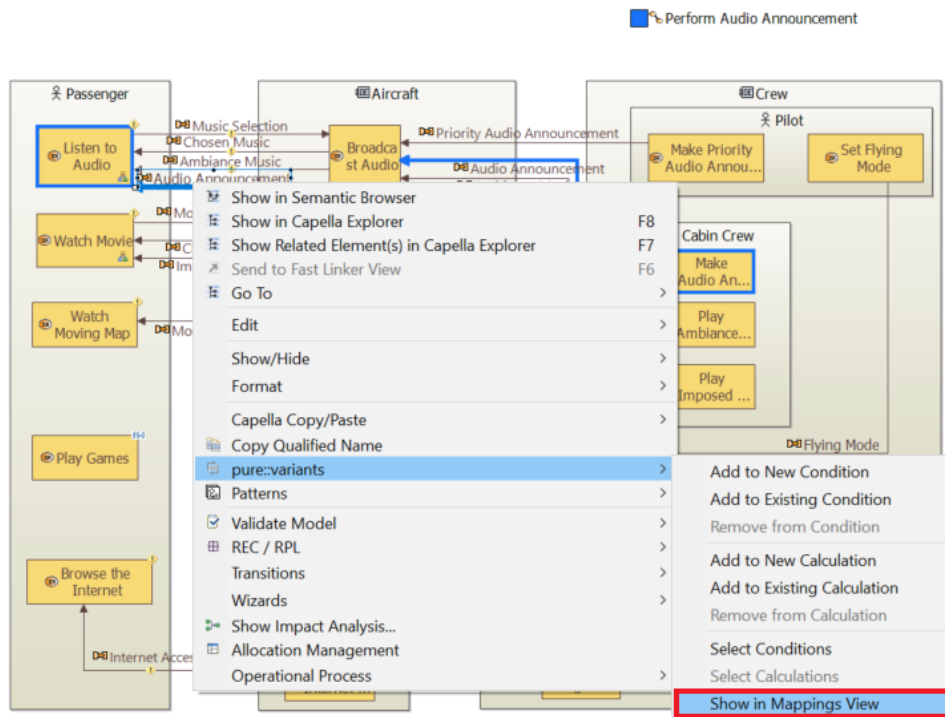
**Figure 19. Select Conditions on EMF element**

Alternatively, you can also right-click on the elements in the Capella Project Explorer to select the conditions and calculations.

## Show in Mappings View

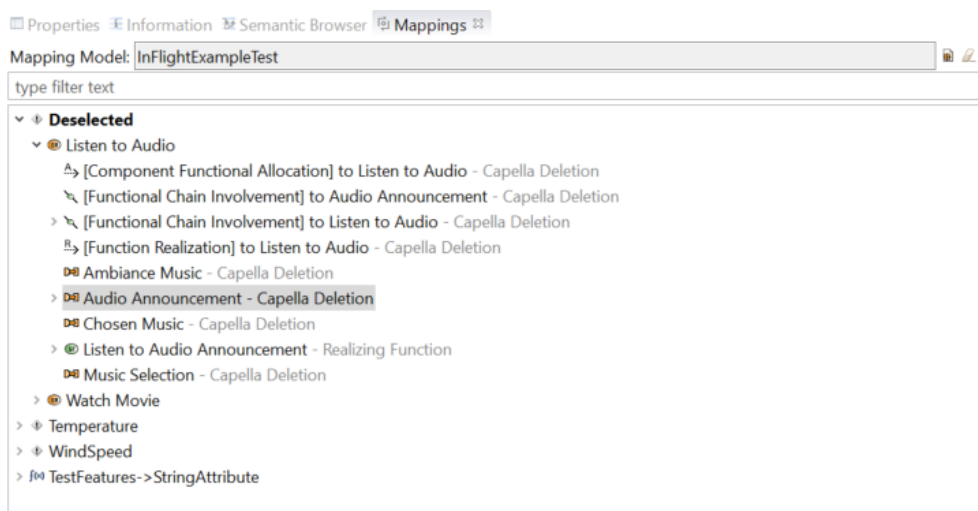
The elements mapped to the conditions or calculations can be selected in the **Mappings** view. The elements are selected under all the conditions and calculations that are propagated to this element. To select the element, right-click on the selected element(s) in the EMF model (e.g., in diagram or browser) and select **pure::variants** → **Show in Mappings View**.

**Figure 20. Show in Mappings View on EMF element**



Alternatively, you can also right-click on the elements in the Capella Project Explorer to select the elements in the mapping view.

**Figure 21. Selected element shown in the Mappings view.**

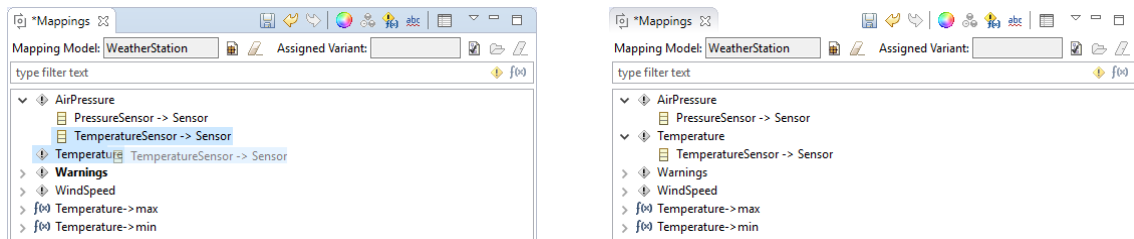


### 3.4. Changing Variability Information

#### Change a Condition for a Single Element

Changing the condition on a single element can be done by dragging the mapped element from one condition to another. For this, a new condition can be created via the context menu (see [the section called “Using Context Menu in Mappings View”](#)) or an existing condition can be used.

**Figure 22. Changing Condition by Drag and Drop**



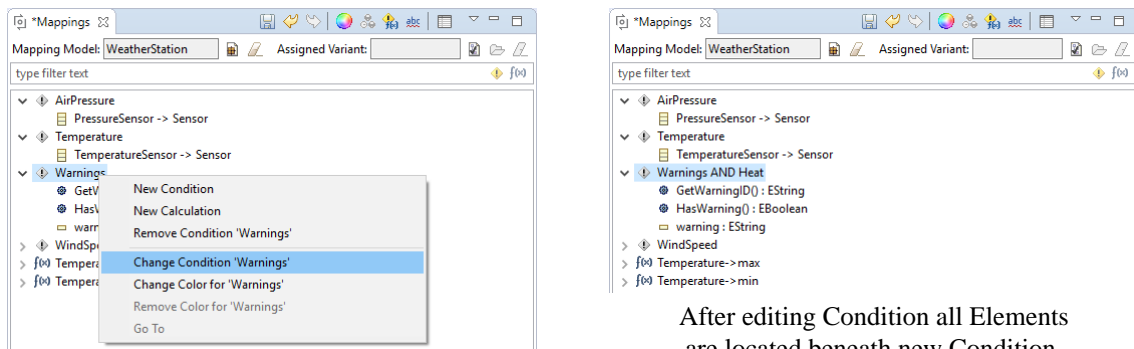
Drag Element from a Condition and to new Condition

Drop Element on new Condition.

#### Change a Condition for all Elements

Select the condition in the **Mappings** view and double-click the condition or select the **Change Condition** context menu. The condition editor with the current condition comes up. Edit the condition and press **OK**. The condition will be updated on all elements.

**Figure 23. Changing Condition via Editor**



Open Context Menu on Condition  
and Select 'Change Condition ...'

After editing Condition all Elements  
are located beneath new Condition.

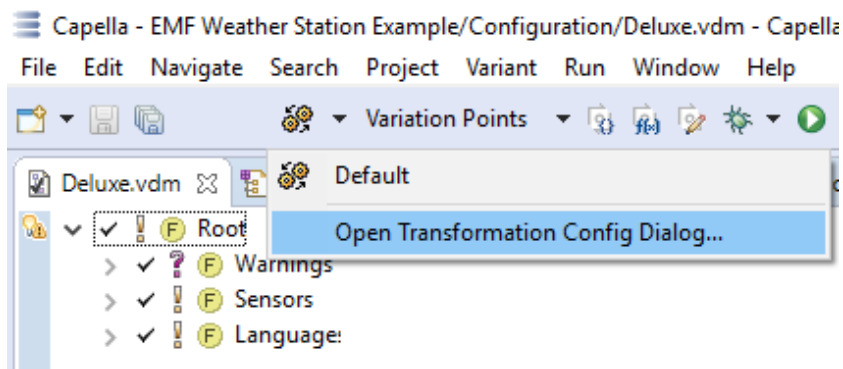
#### Changing a Calculation

Calculations can be changed in the same way as conditions. You can either drag & drop the mapped attribute from one calculation to another, or you can change the calculation itself via its **Change Calculation** context menu.

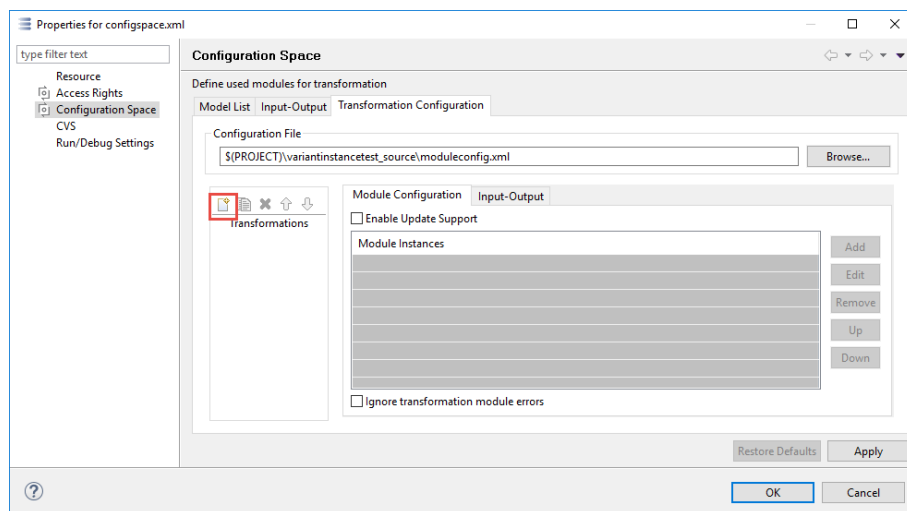
### 3.5. Creating EMF Model Variants

Variants of an EMF model will be created by opening the variant description model and creating a valid feature configuration. A variant is then generated by performing a transformation of the variant.

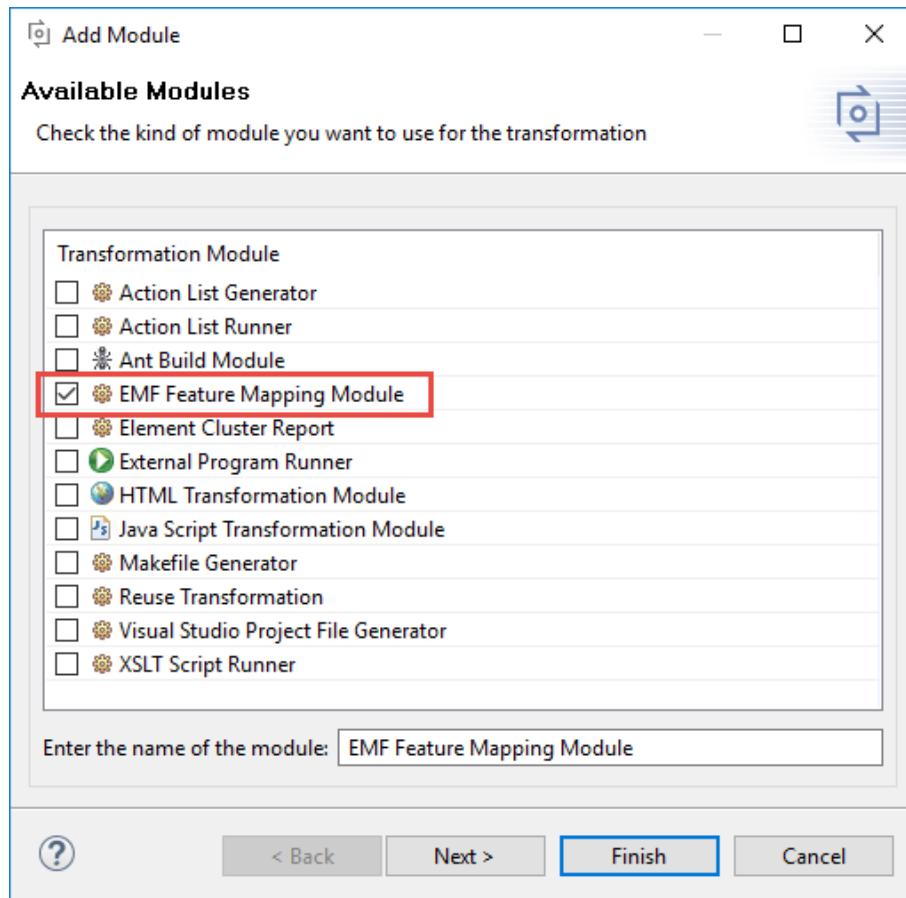
To remove elements from the EMF file, please ensure that the transformation module configuration contains the **EMF Feature Mapping Module**. Open the transformation configuration by expanding the **Transform** button and select **Open Transformation Config Dialog ...**

**Figure 24. Open Transformation Configuration Dialog**

Add a new module configuration for the transformation module.

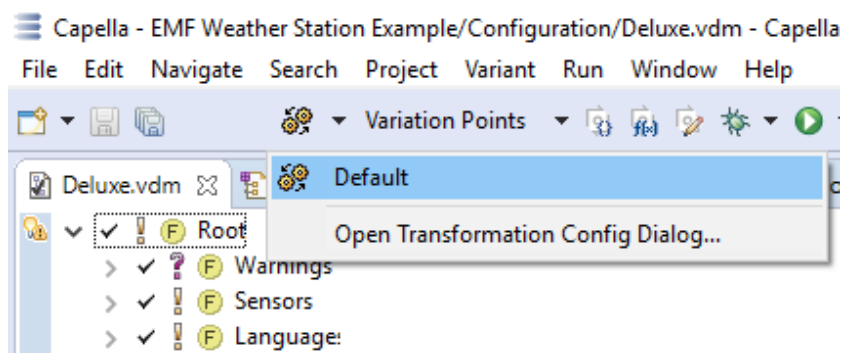
**Figure 25. Add new module configuration**

Open one of the listed modules by double-clicking or add a new module by pressing **Add**. The **Available Modules** are shown.

**Figure 26. Select EMF Feature Mapping Module**

Ensure **EMF Feature Mapping Module** is checked and press **Finish**.

To start the transformation choose the configuration (standard name: **Default**) from the drop-down menu of the transformation button.

**Figure 27. Start Transformation**

In the output folder (as defined in the transformation configuration, for standard projects the name is output) a sub folder with name of the VDM is created. The generated variant of the EMF model can be found in that output directory after the transformation finished.

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