



SYSML PLUGIN

18.1

user guide

No Magic, Inc.
2015

All material contained herein is considered proprietary information owned by No Magic, Inc. and is not to be shared, copied, or reproduced by any means. All information copyright 2006-2015 by No Magic, Inc. All Rights Reserved.

1	GETTING STARTED	7
	System Engineer Perspective	7
1	SYSML DIAGRAMS	9
	SysML Diagrams	9
	SysML Block Definition Diagram (BDD)	9
	SysML Internal Block Diagram (IBD)	10
	SysML Package Diagram	12
	SysML Parametric Diagram	12
	Requirements Diagram	13
	SysML Activity Diagram	15
	SysML Use Case Diagram	16
	Views and Viewpoints Diagram	17
	SysML Sequence Diagram	18
	SysML State Machine Diagram	18
1	SUPPORTIVE DIAGRAMS	19
	Requirements Table	19
	Dependency Matrix	27
	SysML Editable Matrices	27
	SysML Allocation Matrix	27
	Satisfy Requirement Matrix	28
	Verify Requirement Matrix	29
	Refine Requirement Matrix	30
	Derive Requirement Matrix	31
	Creating Editable Matrices	32
	Building Matrices	33
	Editing Matrix	33
	Predefined Relation Maps	35
1	SYSML ELEMENTS	36
	SysML Block Definition Diagram Elements	36
	Block	36
	Domain	37
	External	37
	System	37
	Subsystem	38
	System Context	38
	Constraint Block	38
	Interface Block	39
	Flow Specification	39
	Value Type	40
	Quantity Kind	40
	Unit	41
	SysML Internal Block Diagram Elements	41
	Part Property	41
	Shared Property	42

Reference Property	42
Value Property	42
Constraint Property	42
Distributed Property	43
Flow Port	43
Full Port	43
Proxy Port	44
Directed Feature	44
Views and Viewpoints Diagram Elements	44
View	44
Viewpoint	45
Conform	45
SysML Parametric Diagram Elements	46
Moe	46
Objective Function	46
Binding Connector	46
SysML Requirements Diagram Elements	47
Requirement	47
Extended Requirement	47
Functional Requirement	47
Interface Requirement	48
Performance Requirement	48
Physical Requirement	48
Design Constraint	48
Business Requirement	48
Usability Requirement	48
Test Case	48
Satisfy	49
Verify	49
Derive	49
Copy	49
SysML Activity Diagram Elements	49
Accept Change Structural Feature Event Action	49
Change Structural Feature Event	49
Invocation on Nested Port Action	50
Trigger on Nested Port	50
SysML Use Case Diagram Elements	50
External System	50
Sensor	50
Boundary System	50
User System	50
Actuator	51
Environmental Effect	51
1 USING SYSML PLUGIN	52
Generic Procedures	52
Creating SysML Projects	52
Creating SysML Projects From Templates	53

Using OMG SysML Style	54
Using QUDV Model Library	56
Using Quick Search Dialog	57
Using Structure Browser	57
Specific display options	58
Generating SysML reports	59
Context-Specific Value Compartments	60
Progressive Reconfiguration	60
Deep Reconfiguration	61
Context-Specific Value Compartments	62
Feature-based Compartments	67
Expanding and Suppressing Feature-based Compartments	68
Displaying Options in Feature-based Compartments	68
NEW! Managing Element Groups	69
NEW! Displaying Rake icon on symbol	70
Transferring mathematical expressions from MATLAB source code into the model	71
Diagram Specific Procedures	74
SysML Block Definition Diagram Procedures	74
Inserting a new SysML property	75
Inserting a new SysML diagram	76
Using SysML-Style compartments	76
Creating an association block	77
Creating a SysML Internal Block Diagram	78
Representing association roles as block properties	78
Creating instances of blocks with complex structure	78
SysML callout box	86
NEW! Managing Interfaces of the Block	89
NEW! Managing Block properties	90
SysML Internal Block Diagram Procedures	92
Creating Ports	92
Displaying Parts	93
Displaying Ports	94
NEW! Displaying Direction Prefixes of Proxy and Full Ports	95
NEW! Displaying Combined Direction on Proxy Port	96
NEW! Displaying Direction Prefixes of Flow Property	97
Using Edit Compartment	97
Show Default Value and Show Slot Type	98
Provided/Required Interfaces	99
NEW! Managing Interfaces of the Proxy Port	104
Create Directed Features and Specify Feature Directions	105
Displaying Structures of Blocks in Compartments and IBDs	105
Converting nested parts to dot notation	108
Extracting structure	109
Creating a flow port	112
SysML Package Diagram Procedures	116
Using package element	116
SysML Parametric Diagram Procedures	117
Displaying parameters	117
Creating automatic constraint parameters	118
Creating a binding connector	121

Requirements Diagram Procedures	122
Changing requirement type	122
Creating Requirements Diagram for sub-requirements	122
Numbering requirement IDs	123
Using requirement element	129
SysML Activity Diagram Procedures	131
Select Operation	131
Dynamic Centerlines	131
Decomposing activities	133
SysML Use Case Diagram Procedures	137
Numbering Use Cases	138
SysML Sequence Diagram Procedures	138
1 APPENDIX I. QUDV	140
Model Library for Quantities, Units, Dimensions, and Values (QUDV)	140
QUDV Model Library	140
QUDV	140
SI Definitions	140
SI Specializations	140
SI Value Type Library	140
1 APPENDIX II. VALIDATION	143
Validation	143
Active Validation	147
Active Validation Options	150
SysML Constraints	151
1 APPENDIX III. OPEN API	158
Stereotype Usage	158
SysML Profile	158
MD Customization for SysML Profile	158
SysML Profile API Changes	159
SysML classes for open API	160

1 GETTING STARTED

Systems Modeling Language (SysML) is designed to unify the diverse modeling languages currently used by system engineers, the same way Unified Modeling Language (UML) is used in the software industry to unify the modeling languages used by software engineers.

SysML supports the specifications, analysis, designs, verifications, and validations of a broad range of complex systems.

In addition to supporting all SysML diagrams (Block Definition, Internal Block, Package, Parametric, Requirements, Activity, and Use Case diagrams), SysML Plugin also makes it possible for MagicDraw to support additional specifications, analysis, designs, and validations on a broader range of systems and system integrations.

The SysML sample projects are available in the `<md.install.dir>/samples/SysML` directory.

1.1 System Engineer Perspective



The SysML plugin is available in MagicDraw Standard and higher editions for an additional fee.

In keeping with SysML unifying purpose, the System Engineer perspective was created to unify the diverse modeling languages currently used by system engineers. All the features dedicated to SysML are accessible. You can switch among perspectives at any time.

To switch to the System Engineer perspective

1. On the main menu, click **Options > Perspectives > Perspectives**.
2. In the Select Perspectives dialog, select **System Engineer**.
3. Click the **Apply** button.

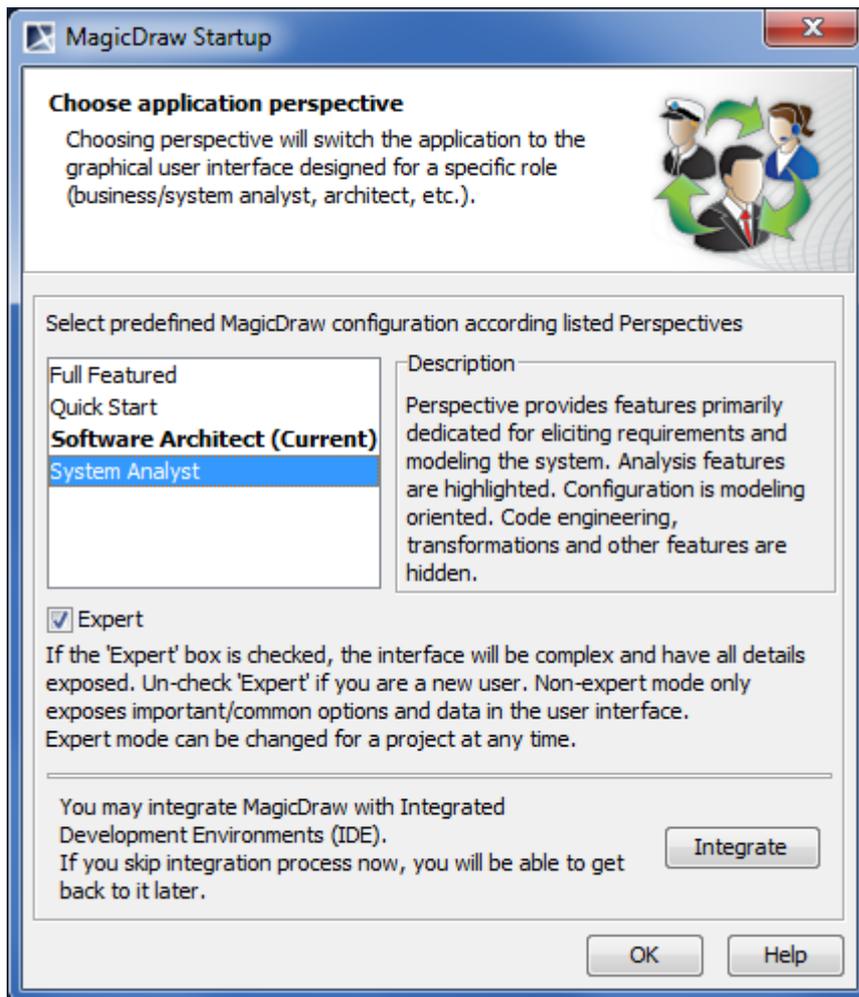


Figure 1 -- Select Perspectives dialog



For more information about how to work with perspectives, see *Perspectives Selection and Customization* in the Getting Started section in the *MagicDraw User Manual.pdf*.

1 SYSML DIAGRAMS

2.1 SysML Diagrams

All diagrams are described in the following sections:

[SysML Block Definition Diagram \(BDD\)](#)

[SysML Internal Block Diagram \(IBD\)](#)

[SysML Package Diagram](#)

[SysML Parametric Diagram](#)

[Requirements Diagram](#)

[SysML Activity Diagram](#)

[SysML Use Case Diagram](#)

[Views and Viewpoints Diagram](#)

[SysML Sequence Diagram](#)

[SysML State Machine Diagram](#)

2.1.1 SysML Block Definition Diagram (BDD)

Description

A Block Definition Diagram defines the features of a block and any relationships between blocks such as associations, generalizations, and dependencies, in terms of properties, operations, and relationships (for example, a system hierarchy or a system classification tree).

Block Definition Diagrams are based on UML class diagrams and include restrictions and extensions as defined by SysML. They are generally used to display systems of blocks or show a system dictionary and/or extensions.

Sample

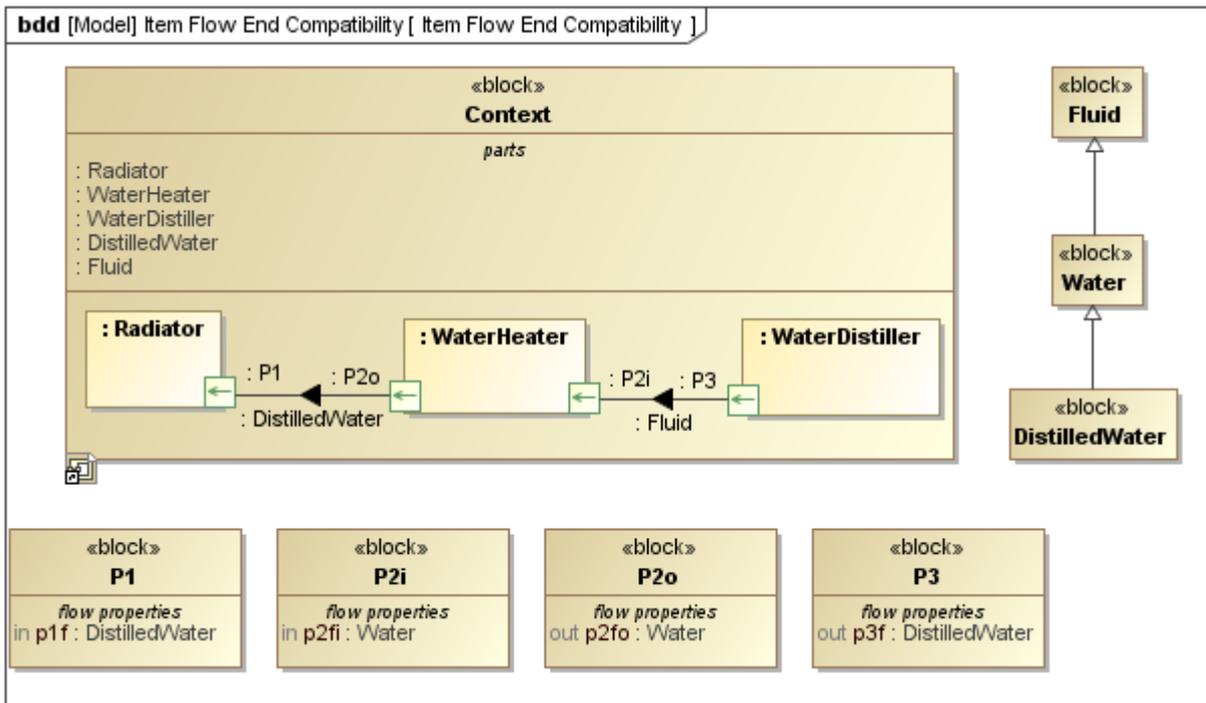


Figure 1 -- SysML Block definition diagram

Related elements

- [Block](#)
- [Domain](#)
- [External](#)
- [System](#)
- [Subsystem](#)
- [System Context](#)
- [Constraint Block](#)
- [Interface Block](#)
- [Flow Specification](#)
- [Value Type](#)
- [Quantity Kind](#)
- [Unit](#)

Related procedures

- [SysML Block Definition Diagram Procedures](#)
- [Transferring mathematical expressions from MATLAB source code into the model](#)

2.1.2 SysML Internal Block Diagram (IBD)

Description

Internal Block Diagrams are based on UML composite structure diagrams and include restrictions and extensions as defined by SysML. An Internal Block Diagram captures the internal structure of a Block in terms of properties and connections among properties. A Block includes properties so that its values, parts, and references to other blocks can be specified. However, whereas an Internal Block Diagram created for a Block (as an inner element)

will only display the inner elements of a classifier (parts, ports, and connectors), an Internal Block Diagram created for a package will display additional elements (shapes, notes, and comments).

All properties and connectors that appear inside an Internal Block Diagram belong to (are owned by) a Block whose name is written in the diagram heading. That particular Block is the context of the diagram. SysML allows any property (part) to be shown in an Internal Block Diagram to display compartments within the property (or part) symbol.

Sample

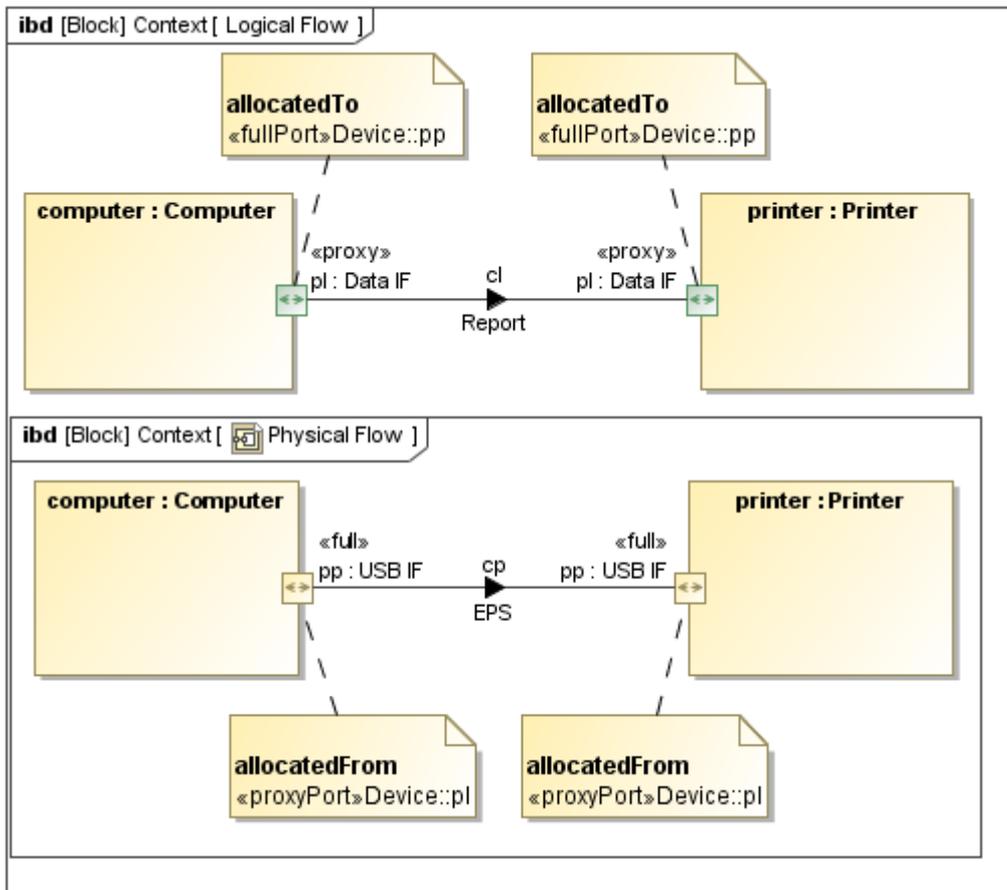


Figure 2 -- SysML Internal block diagram

Related elements

- [Part Property](#)
- [Shared Property](#)
- [Reference Property](#)
- [Value Property](#)
- [Constraint Property](#)
- [Distributed Property](#)
- [Flow Port](#)
- [Full Port](#)
- [Proxy Port](#)
- [Directed Feature](#)

Related procedures

- [SysML Internal Block Diagram Procedures](#)
- [Transferring mathematical expressions from MATLAB source code into the model](#)

2.1.3 SysML Package Diagram

Description

Package diagrams typically enable you to organize models by partitioning model elements into packageable elements and establishing dependencies between packages and/or model elements within these packages. Since Package diagrams are used to organize models in packages and views, they can include a wide array of packageable elements.

A package is a construct that enables you to organize model elements, such as use cases or classes, into groups. Packages define namespaces for packageable elements. Model elements from one package can be imported and/or accessed by another package. This organizational principle is intended to help establish unique naming of the model elements and avoid overloading a particular model element's name. Packages can also be shown on Block Definition diagrams or Requirements diagrams.

Sample

NA

Related procedures

[SysML Package Diagram Procedures](#)

2.1.4 SysML Parametric Diagram

Description

Parametric diagrams can be defined as restricted forms of IBDs. They are similar to IBDs except that the only connectors allowed are binding connectors, each having at least one end connected to a constraint parameter.

A Parametric diagram includes the usage of a constraint block to constrain the properties of another block. It contains constraint properties and constraint parameters as well as other properties from within that internal block context. All properties displayed, other than the constraints themselves, must either be bound directly to a constraint parameter or contain a property that is bound to a constraint parameter (through any number of containment levels). A constraint block generally contain many constraints, each of them containing many constraint parameters.

Constrained properties typically have simple value types that can also carry units, quantity kinds, and probability distributions. This allows for a value property that may be deeply nested within a containing hierarchy to be referenced at the outer containing level. The context for the usages of constraint blocks must also be specified in a parametric diagram to maintain the proper namespaces for the nested properties.

The state of the system can be specified in terms of the values of some of its properties. A change in state will result in a different set of constraint equations to be recalculated. This can be accommodated by specifying constraints that are conditioned on the value of the property with state. Parametric diagrams can be used to support trade-off analysis. A constraint block can define an objective function to compare alternative solutions.

Sample

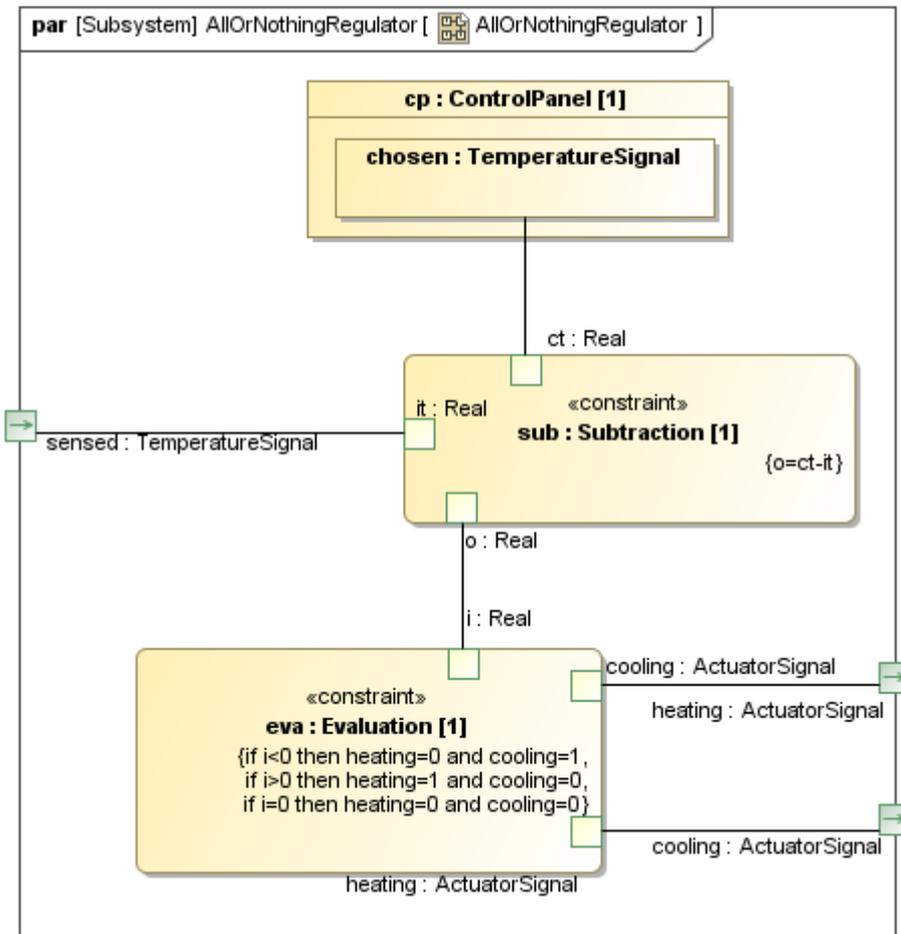


Figure 3 -- SysML Parametric diagram

Related elements

- [Moe](#)
- [Objective Function](#)
- [Binding Connector](#)

Related procedures

- [SysML Parametric Diagram Procedures](#)
- [Transferring mathematical expressions from MATLAB source code into the model](#)

2.1.5 Requirements Diagram

Description

Requirements Diagrams provide modeling constructs to represent text-based requirements and relate them to other modeling elements. These requirement modeling constructs are intended to provide a bridge between traditional requirement management tools and other SysML models.

Requirements diagrams display requirements, packages, other classifiers, test cases, rationales, and relationships. Possible relationships available for Requirements diagrams are containments, deriveReq and requirement dependencies ('Copy', 'Refine', 'Satisfy', 'Trace', and 'Verify'). The callout notation can also be used to reflect the relationships of other models.

Requirements can also be shown on other diagrams to illustrate their relationships to other modeling elements.

Sample

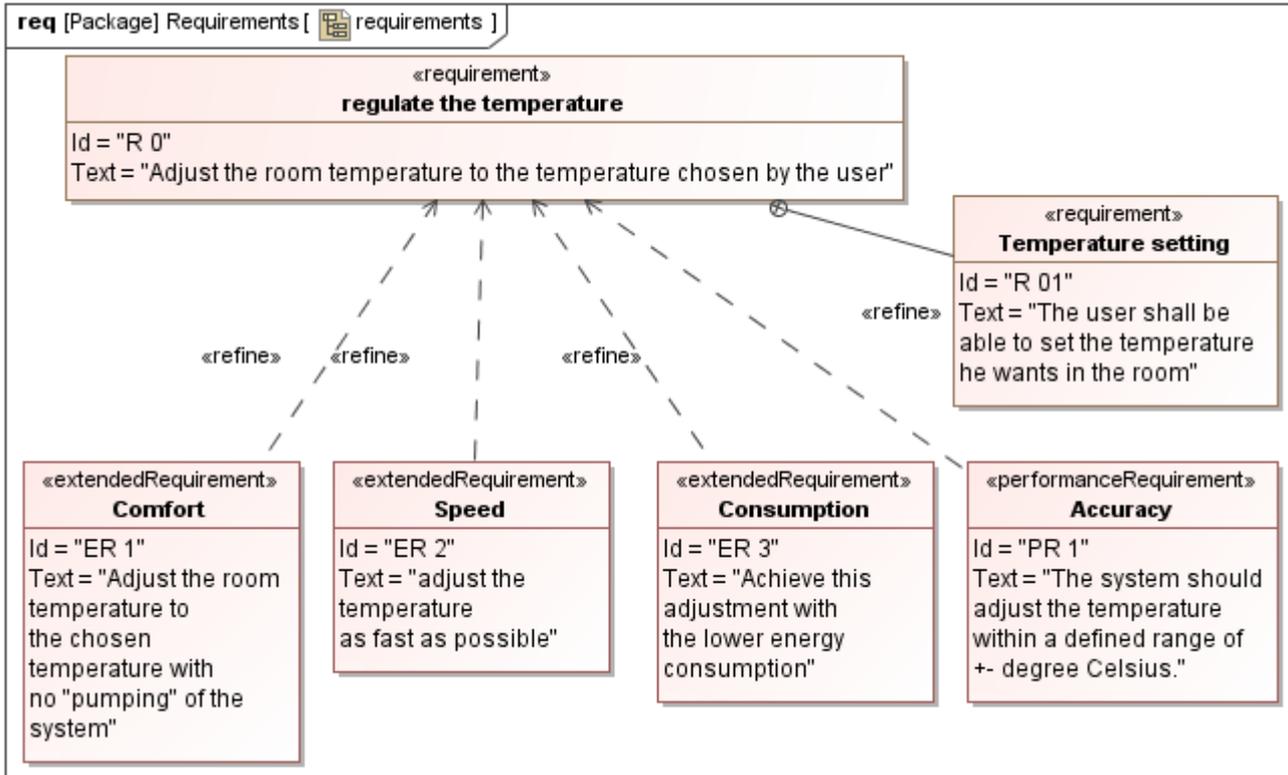


Figure 4 -- Requirements diagram

Related elements

- [Requirement](#)
- [Extended Requirement](#)
- [Functional Requirement](#)
- [Interface Requirement](#)
- [Performance Requirement](#)
- [Physical Requirement](#)
- [Design Constraint](#)
- [Business Requirement](#)
- [Usability Requirement](#)
- [Test Case](#)
- [Satisfy](#)
- [Verify](#)
- [Derive](#)
- [Copy](#)

Related procedures

- [Requirements Diagram Procedures](#)

2.1.6 SysML Activity Diagram

Description

Activity diagrams describe control, input, and output flows among actions. They represent the system business and operational work flows. They capture actions and display their results. They are typically used for business process modeling and used in situations where all or most of the events represent the completion of internally-generated actions.

Though Activity diagrams are often classified alongside interaction diagrams, they actually focus on the flows driven by internal processes (as opposed to external events).

SysML extends control in Activity diagrams and provides extensions that might be very loosely grouped under the term “continuous”, but are generally applicable to any distributed flow of information and physical items through a system. It also introduces probability concepts to activities.

Sample

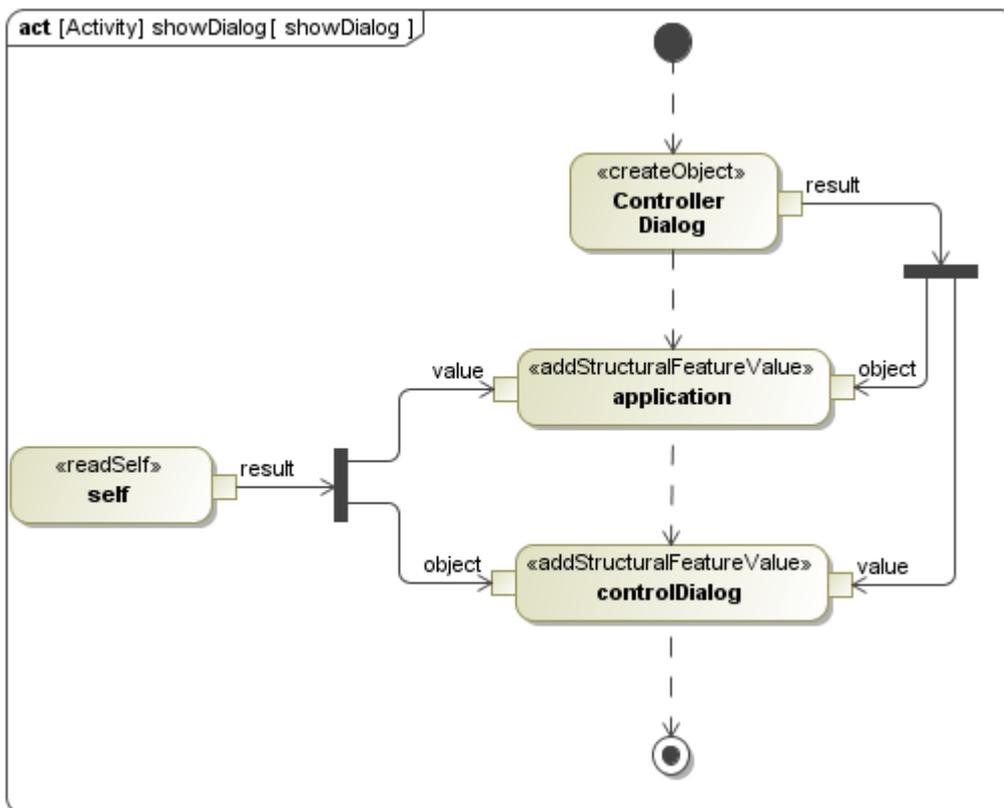


Figure 5 -- SysML Activity diagram

Related elements

- [Accept Change Structural Feature Event Action](#)
- [Change Structural Feature Event](#)
- [Invocation on Nested Port Action](#)
- [Trigger on Nested Port](#)

Related procedures

- [SysML Activity Diagram Procedures](#)
- [Transferring mathematical expressions from MATLAB source code into the model](#)

2.1.7 SysML Use Case Diagram

Description

The purpose of a Use Case Diagram is to give a graphical overview of the functionalities provided by a system in terms of actors, their goals (represented as use cases), and any dependencies among those use cases.

A Use Case Diagram describes the usage of a system. The associations between actors and use cases represent the communications that occur between the actors and the subjects to accomplish the functionalities associated with the use cases. The subject of a use case can be represented through a system boundary. The use cases enclosed in the system boundary represent the functionalities performed by behaviors (activity diagrams, sequence diagrams, and state machine diagrams).

Actors may interact either directly or indirectly with the system. They are often specialized so as to represent a taxonomy of user types or external systems. The only relationship allowed between actors in a use case diagram is generalization. This is useful in defining overlapping roles between actors. Actors are connected to use cases through communication paths, each represented by a relationship. There are four use case relationships:

- communication
- include
- extend
- generalization

Communication

A *communication* path represents an association between two Deployment Targets. It connects actors to use cases.

Include

An *include* relationship provides a mechanism for factoring out a common functionality that is shared among multiple use cases and is always performed as part of the base use case.

Extend

An *extend* relationship provides an optional functionality, which extends the base use case at defined extension points under specified conditions.

Generalization

A *generalization* relationship provides a mechanism to specify variants of the base use case.

Use cases are often organized into packages with the corresponding dependencies among the use cases included in the packages.

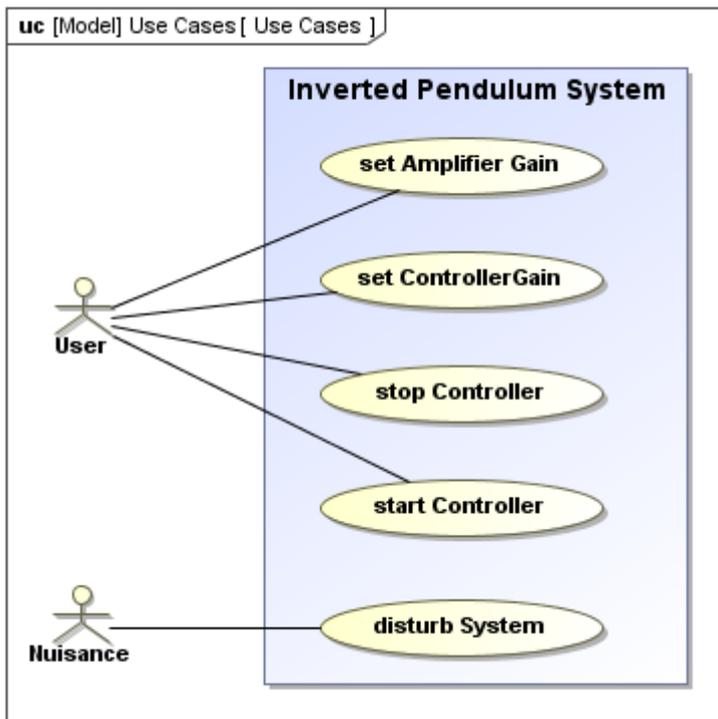


Figure 6 -- SysML Use Case diagram

Related elements

[External System](#)

[Sensor](#)

[Boundary System](#)

[User System](#)

[Actuator](#)

[Environmental Effect](#)

Related procedures

[SysML Use Case Diagram Procedures](#)

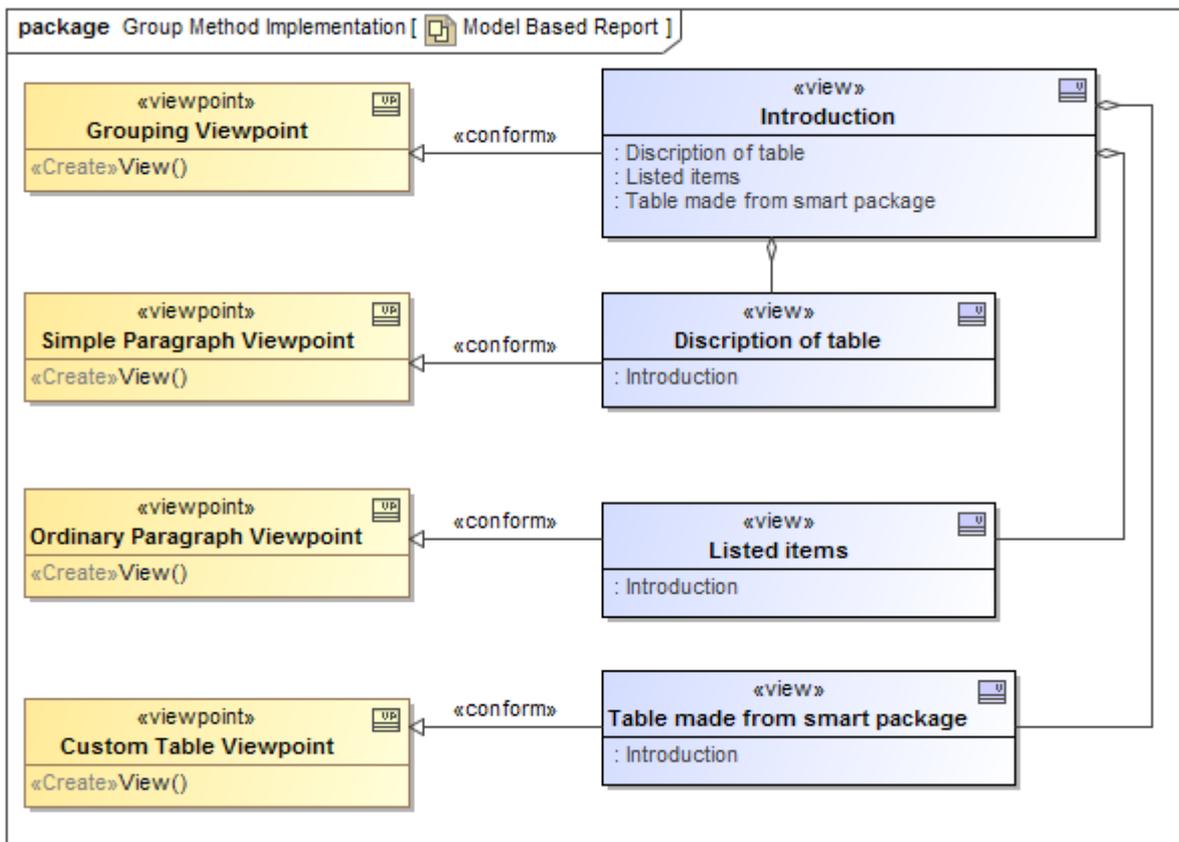
2.1.8 Views and Viewpoints Diagram

Description

The concept of View and Viewpoint reflects perspectives of different stakeholders. The views are constructed from a subset of the model that addresses their concerns.

The new technology interprets Views and Viewpoints models to construct XML document conforming with DocBook standard. A combination of diagrams, tables, model queries and simple text fragments can be presented in a built-in preview window or exported to PDF or HTML documents.

Sample



Related elements

- [View](#)
- [Viewpoint](#)
- [Conform](#)

2.1.9 SysML Sequence Diagram

This diagram is similar to UML Sequence Diagram.

2.1.10 SysML State Machine Diagram

This diagram is similar to UML State Machine Diagram.

1 SUPPORTIVE DIAGRAMS

The supportive diagrams are:

- [Requirements Table](#)
- [Dependency Matrix](#)
- [Predefined Relation Maps](#)

3.1 Requirements Table

All requirements are text-based. With Requirements Table, you can easily type your requirements into a spreadsheet-like table instead of the limited-size boxes in a diagram. This table is consistent with OMG SysML specifications. The Requirements Table has been refactored to be based on the MagicDraw Generic Table component.

Requirements Table contains requirements. Each row in the table represents a requirement. A new table consists of three columns by default. However, you can add more columns to represent the properties of each requirement in the table. Table below lists the name and description of some of the columns. With this table, you can:

- Create new requirements directly in the table, or import existing ones from your model to the table.
- Directly edit the properties of requirements in the table.
- Directly generate requirements reports, renumber requirements' IDs, or export the table into a CSV or HTML format, or into a Microsoft Excel (.xlsx) spreadsheet.
- Quickly search and filter requirements.
- Easily access custom requirement's properties.

Column Name	Visible by Default	Description
#	Y	A row number.
ID	Y	A requirement's ID.
Name	Y	A requirement's name.
Text	Y	A requirement text.
Requirement Type	N	A requirement's type, for example, business requirement or design constraint.
Owner	N	A Requirement's owner.
Source	N	(For extendedRequirement and its subtypes only) The source of a requirement.
Risk	N	(For extendedRequirement and its subtypes only) The risk level of a requirement.
Verify Method	N	(For extendedRequirement and its subtypes only) The method to verify a requirement.

#	Name	Id	Text	Satisfied By	Verified By
1	Power	d.4		PowerSubsystem	
2	Range	d.2			
3	RegenerativeBraking	d.1			
4	FuelCapacity	4.2			
5	CargoCapacity	4.1			

Figure 1 -- Requirements table

Creating A Requirements Table

You can create a Requirements Table using the main toolbar, main menu, or Containment tree.

To create a Requirements Table

1. In the Containment tree or on the diagram pane, select an element that can be the owner of the requirement table.
2. Do one of the following:
 - From the main menu, select **Diagrams > Create Diagram**. Type “reqT” and press **Enter**.
 - On the main toolbars, click the **Create Diagram** button. Type “reqT” and press **Enter**.
 - Press **Ctrl+N**. Type “reqT” and press **Enter**.
 - Right-click the element and from the shortcut menu select **Create Diagram > Requirement Diagrams > Requirement Table**.

The newly created requirement table opens on the right side of the application window.

3. Type a table name.
4. Specify a scope for table or simply drag desired requirements from the Containment tree to the table.

SysML Requirements Table Toolbar

The SysML Requirements table toolbar is located on the main toolbar. There are 13 Requirements table icons on the Requirements table toolbar: Add New, Add Nested, Add Existing, Delete From Table, Delete, Up, Down, Unnest Requirement, Nest Requirement, Report, Show Columns, Show Full Paths, and Export.

Icon	Name	Keyboard Shortcut
	Add New	Insert Ctrl + I (on MAC)

SUPPORTIVE DIAGRAMS

Requirements Table

Icon	Name	Keyboard Shortcut
	Add Nested	Alt + Insert Alt + I (on MAC)
	Add Existing	Ctrl + Insert Ctrl + E (on MAC)
	Delete From Table	Delete
	Delete	Ctrl + D
	Up	Ctrl + Up
	Down	Ctrl + Down
	Unnest Requirement	n/a
	Nest Requirement	n/a
	Report	n/a
	Show Columns	n/a
	Show Full Paths	n/a
	Export	n/a

Add New

You can either click the **Add New** icon on the table toolbar or press **Insert** to add a new requirement which will then be automatically added to the table.

If you click the icon, the available requirement types will be listed in the drop-down menu. If you have created your own custom requirement types, they will appear under the **Custom Requirements** group in the menu, for example, “myRequirement” in the following figure. Then, select a requirement type that you want to create from the drop-down menu. A requirement of the selected type will then be created and added to the table.



- The owner of the newly-created requirement will be similar to the owner of the table.
- To select a different owner, hold **Shift** and then select a requirement type from the drop-down menu. The **Select Owner** dialog will then open, enabling you to choose a different owner.
- If a table row is selected, the requirement in that row will be selected in the **Select Owner** dialog automatically.

If the selected owner is a requirement, then you are creating a new nested requirement.

If you click the buttons, a requirement will be created promptly. You can then change the type of the newly-created requirement directly in the table.

Add Nested

When a requirement is highlighted in the table, you can either click the **Add Nested** icon on the table toolbar or press **Alt + Insert** to add a new nested requirement, owned by the highlighted requirement, to the table.

Like **Add New**, if you click the icon, the available requirement types will be listed in the drop-down menu. Then, select a requirement type that you want to create from the drop-down menu. A nested requirement of the selected type will then be created, being owned by the requirement highlighted in the table.

Add Existing

To add requirement(s) already existed in your model to a SysML Requirements Table

1. Click the **Add Existing** icon on the table toolbar or press **Ctrl + Insert**. The **Select Requirement** dialog will open.

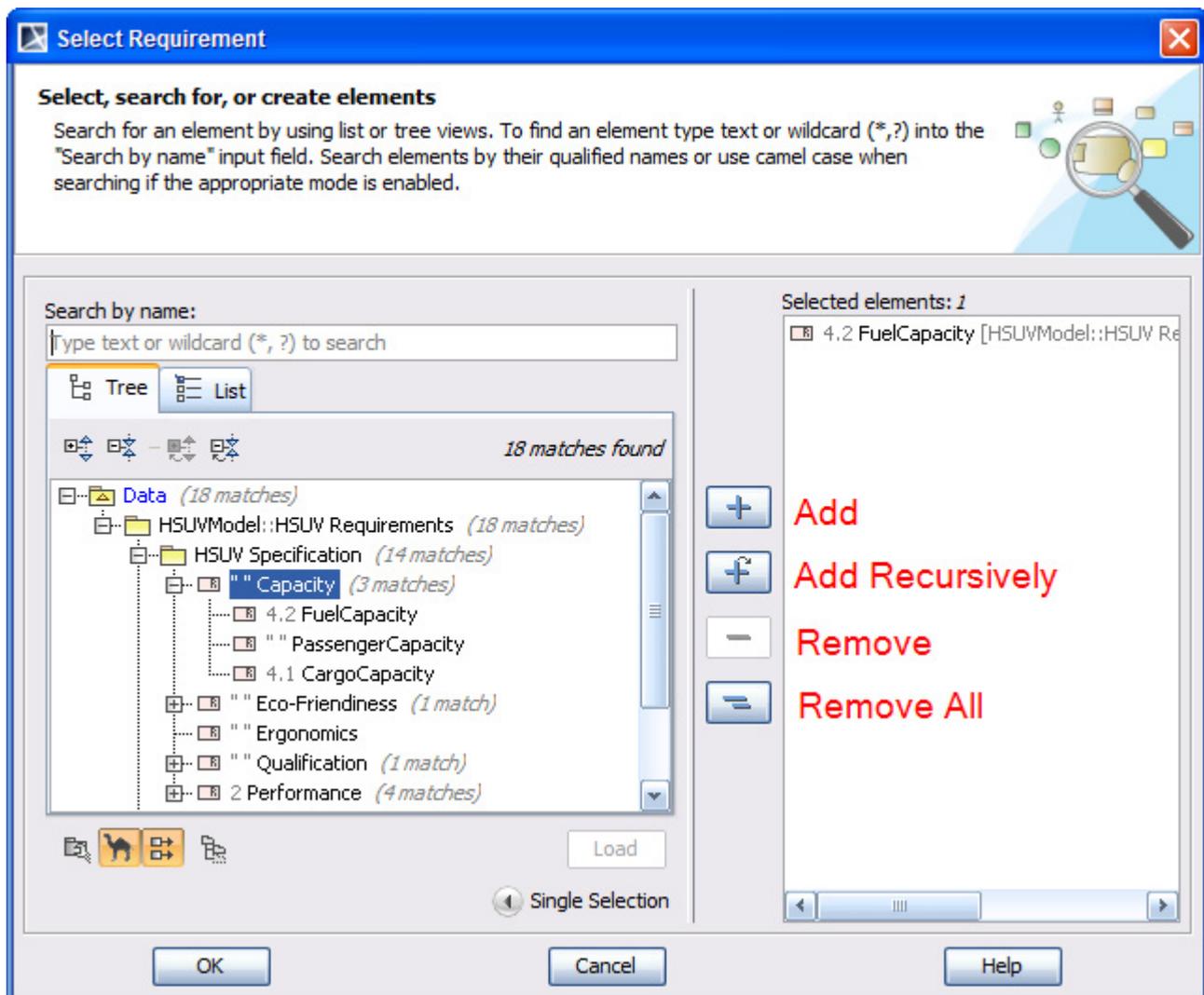


Figure 2 -- Select Requirement Dialog - Add existing requirements to table

2. Select the requirement element(s) which you want to add to the table.
 - Use the **Add** button to add a requirement selected in the element tree to the **Selected elements:** pane.
 - Use the **Add Recursively** button to add all requirements listed under the requirement selected in the element tree and the selected requirement itself to the **Selected elements:** pane.
 - Use the **Remove** button to remove the selected requirement from the **Selected elements:** pane.
 - Use the **Remove All** button to remove all requirements from the **Selected elements:** pane.
3. In the **Select Requirement** dialog, click
 - **OK** to add all requirements in the **Selected elements:** pane to the table, or
 - **Cancel** to cancel the operation.

Delete From Table

To remove requirement(s) from a SysML Requirements Table

1. Select the row(s) of the requirement(s) you want to remove.

2. Click the **Delete From Table** icon on the table toolbar or press **Delete**.
3. The selected requirement(s) will then be removed from the table.

Delete

To remove a requirement(s) from your model

1. Select the row(s) of requirement(s) you want to remove.
2. Click the **Delete** icon on the table toolbar or press **Ctrl + D**.
3. The selected requirement(s) will then be removed from the table and from your project.

Up

To move the selected row of requirement up, either click the **Up** icon on the table toolbar or press **Ctrl + Up**.

Down

To move the selected row of requirement down, either click the **Down** icon on the table toolbar or press **Ctrl + Down**.

Unnest Requirement

When a nested requirement is selected in the Requirements Table, you can click the **Unnest Requirement** to move the selected requirement to be owned by the owner of the current one. The requirement's id will be changed accordingly. **Unnest Requirement** also supports for the multiple selection of the nested requirements which are owned by the same owner.

Nest Requirement

You can select a requirement in the Requirements Table and then click on the **Nest Requirement** to move the selected requirement to be owned by the requirement in the previous row. Nest Requirement also support for the multiple selection of the requirements.

Report

The SysML Requirements Table allows you to generate a requirements report directly from the table. The default report template used is **Requirements Table (Type A)**.

To generate a report, click the **Report** icon on the table toolbar. The template drop-down menu will then open.

Select the report template you would like to use. The **Generate Report** dialog will then open. Choose the report output filename and then click **Generate** to instantly generate the report.



- All requirements in the table will be used as the scope of the generated report.
- To change the scope of the report, activate **Report Wizard** by clicking the **Wizard** button in the **Generate Report** dialog. Click the **Next** button in the **Report Wizard** twice to proceed to the **Select Element Scope** pane. You can then change the report scope using this pane.

The **Built-in** report data (in the **Select Report Data** pane of **Report Wizard**) must be selected, in order to generate a report from this table.

See Section [Appendix III. Open API](#) for more information on report generation.

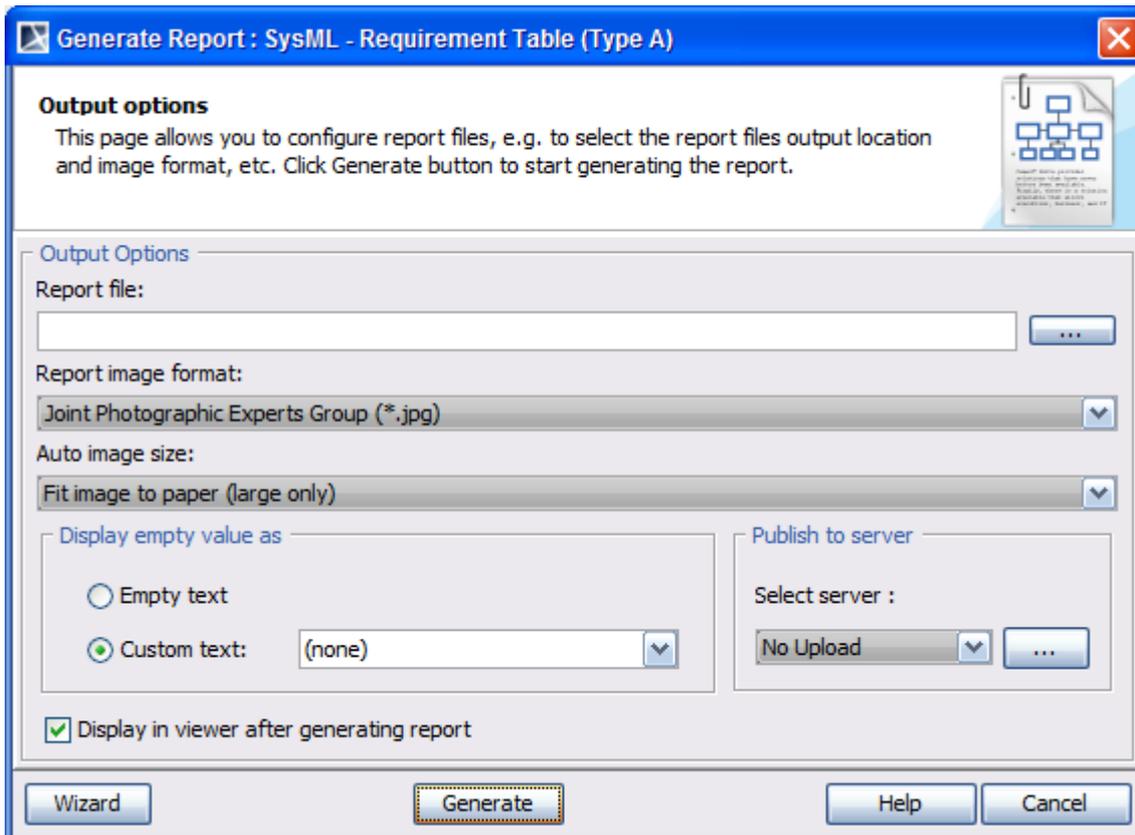


Figure 3 -- Generate Report dialog - SysML Requirements Table

Show Columns

To show or hide columns in the table, click the **Show Columns** icon on the table toolbar. The **Table Column** drop-down menu will then display.

Select a column name to display that column on the table (or deselect a column name to hide it). To customize displayed columns, select **Customize Column**. The **Select Custom Requirement Columns** dialog will then display.

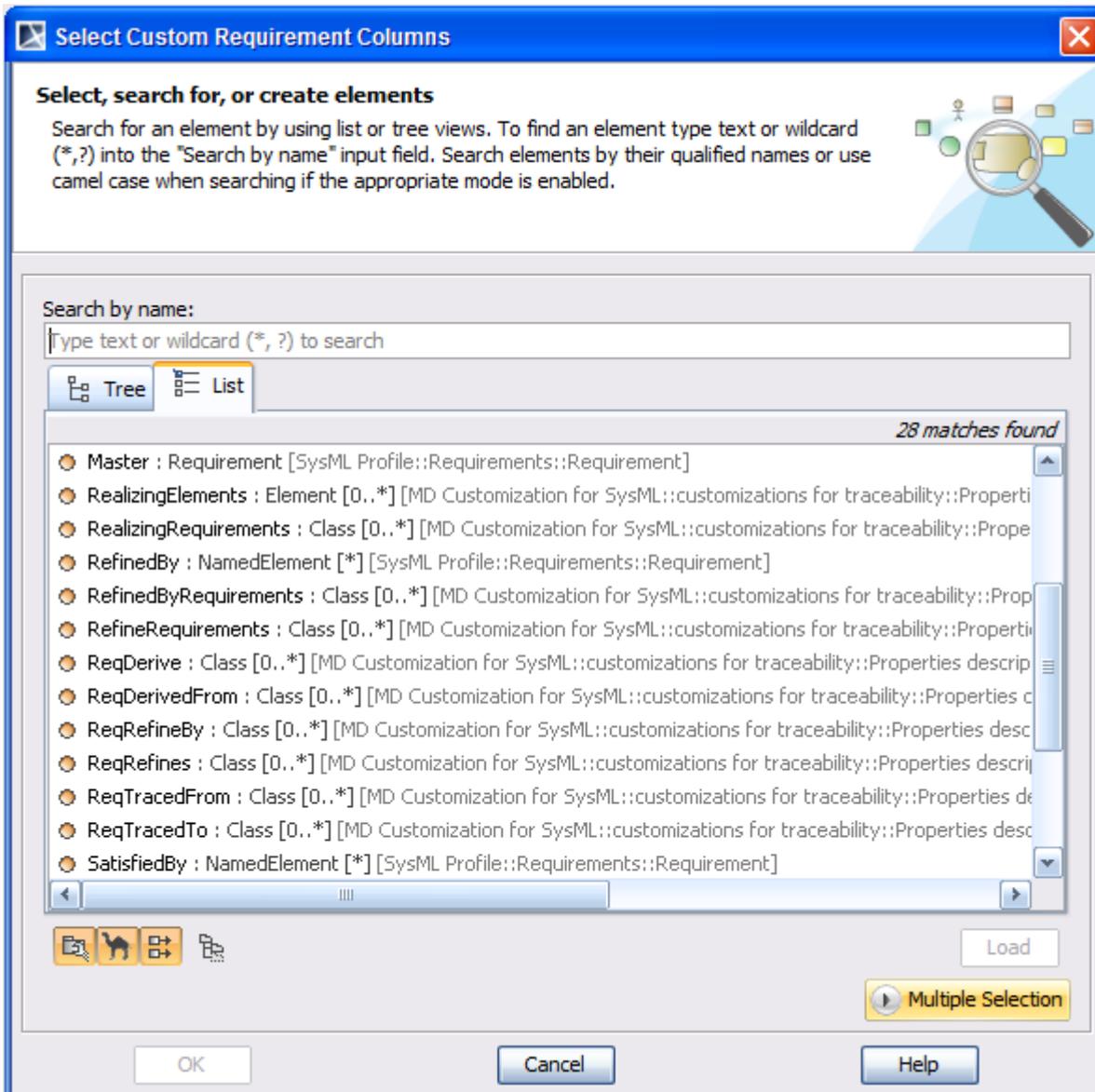


Figure 4 -- Select Custom Requirement Columns dialog

Select a property / tag to be displayed as a new column of the Requirements Table, and then click **OK**. The new column will then display on the table. To be able to select multiple properties / tags to be displayed, use the **Multiple Selection** button.

Show Full Paths

If you select an element in the table and click this icon, the full path of the element will show.

Export

You can also export a SysML Requirements Table to HTML, CSV, or Microsoft Excel (.xlsx) spreadsheet by clicking the **Export** icon on the table toolbar. All requirements in the table will be exported to a selected file format.

3.2 Dependency Matrix

Dependency Matrix enables you to visualize and represent your particular model in a tabular form, depending on the scopes and dependency criteria you have selected.

- **Scope.** There are two types of scope: row scope and column scope. You can select diagrams, UML elements, and/or SysML elements as a scope.
- **Dependency criteria:** include UML relationships, SysML relationships, semantic dependencies (dependency through property), and relationships through tags.

Cells in a dependency matrix show where the elements in the selected scope are associated with or related to one another. A dependency matrix allows you to visualize the many-to-many traceability of elements from different diagrams, particularly for elements interconnected in a large system.

A dependency matrix helps you:

- Quickly visualize dependency criteria.
- Compactly visualize the relationships of a large system, which cannot be easily represented by a diagram on a single sheet of paper because of the diagram complexity.
- Visualize domain-specific relationships through your own matrix templates for such domains.
- Understand relationships from a particular scope by filtering the unimportant kinds of model elements.
- Display relationships that cannot be represented in diagrams, such as representations (classes by lifeline), behavior representations in other diagrams, operation representations by Call Behavior Actions, etc.

For more information on the Dependency Matrix feature, see the *Model Analysis* in the 'Dependency Matrix' section in the MagicDraw User Manual.

3.2.1 SysML Editable Matrices

You can edit three SysML matrix templates. Not only can you display dependencies between elements, but you can also add or delete dependency(ies) directly in the editable matrices. The three editable matrices are:

- [SysML Allocation Matrix](#)
- [Satisfy Requirement Matrix](#)
- [Verify Requirement Matrix](#).
- [Refine Requirement Matrix](#)
- [Derive Requirement Matrix](#)

3.2.1.1 SysML Allocation Matrix

The SysML Allocation Matrix consists of:

- Row: a named element that can be the client element of the Allocate dependency.
- Column: a named element that can be the supplier element of the Allocate dependency.

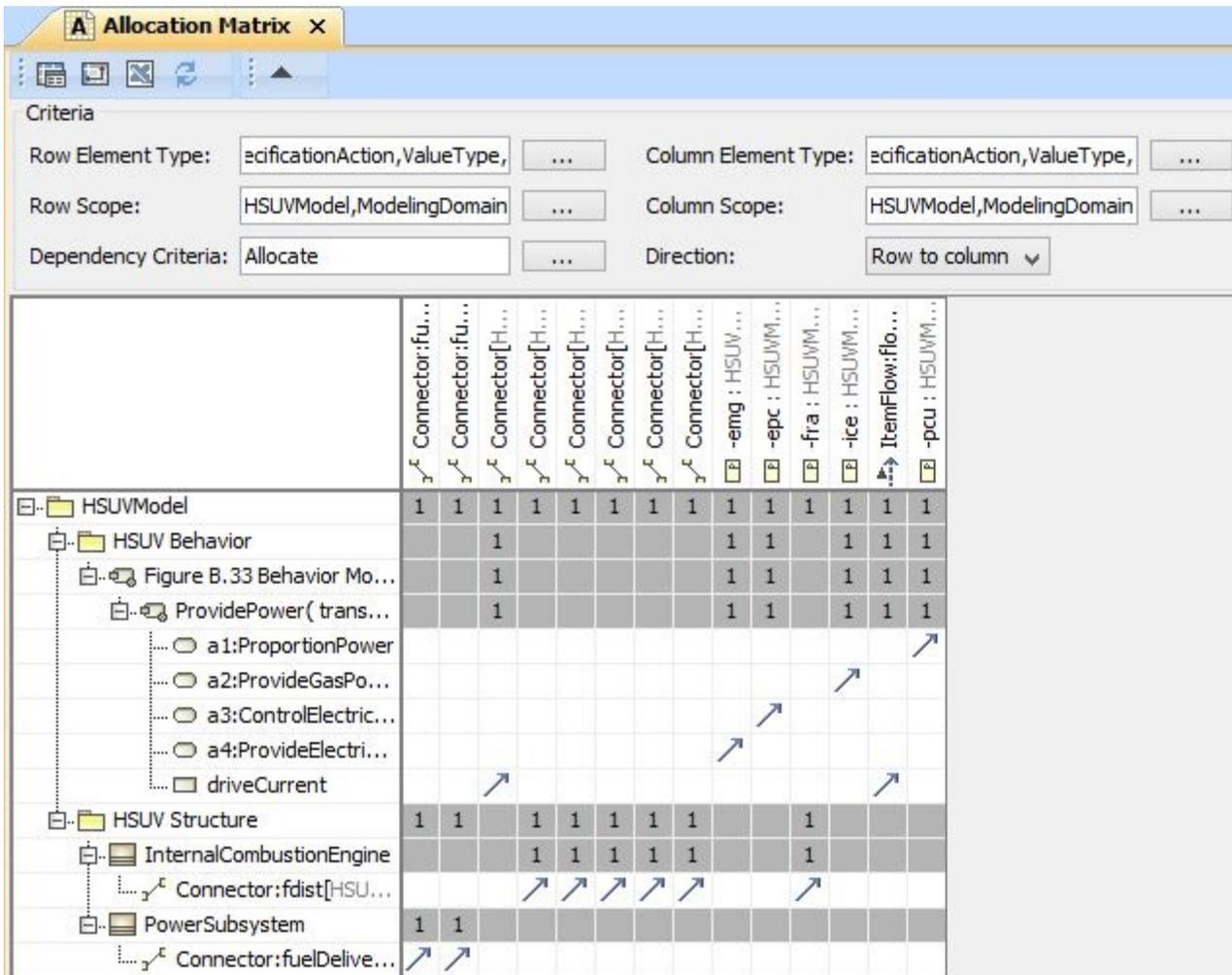


Figure 5 -- SysML Allocation matrix

3.2.1.2 Satisfy Requirement Matrix

Satisfy Requirement Matrix consists of:

- Row: a named element that can be the client element of the Satisfy dependency.
- Column: a Requirement Element that can be the supplier element of the Satisfy dependency.

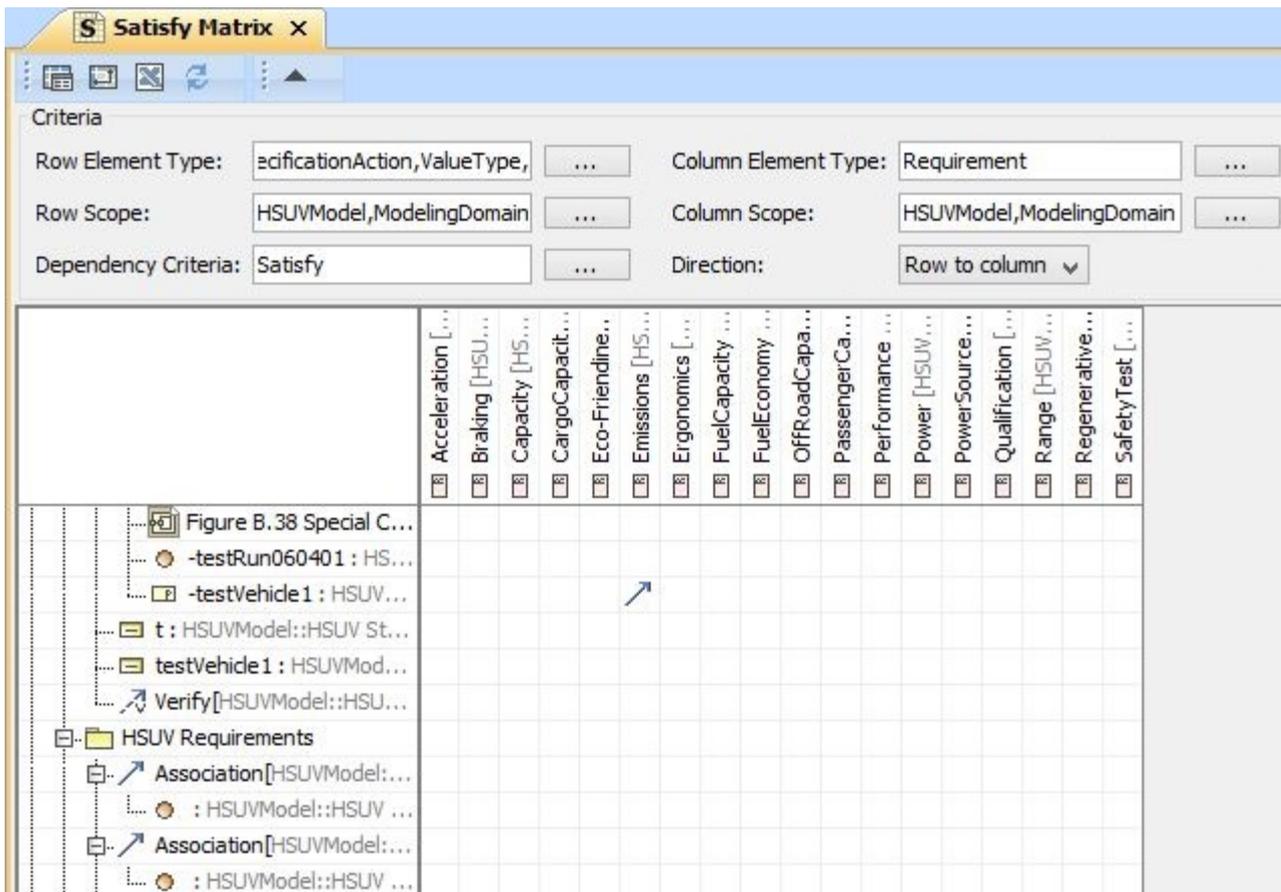


Figure 6 -- Satisfy Requirement matrix

3.2.1.3 Verify Requirement Matrix

The Verify Requirement matrix consists of:

- Row: Named element which can be the client element of Verify dependency.
- Column: Requirement Element which can be the supplier element of Verify dependency.

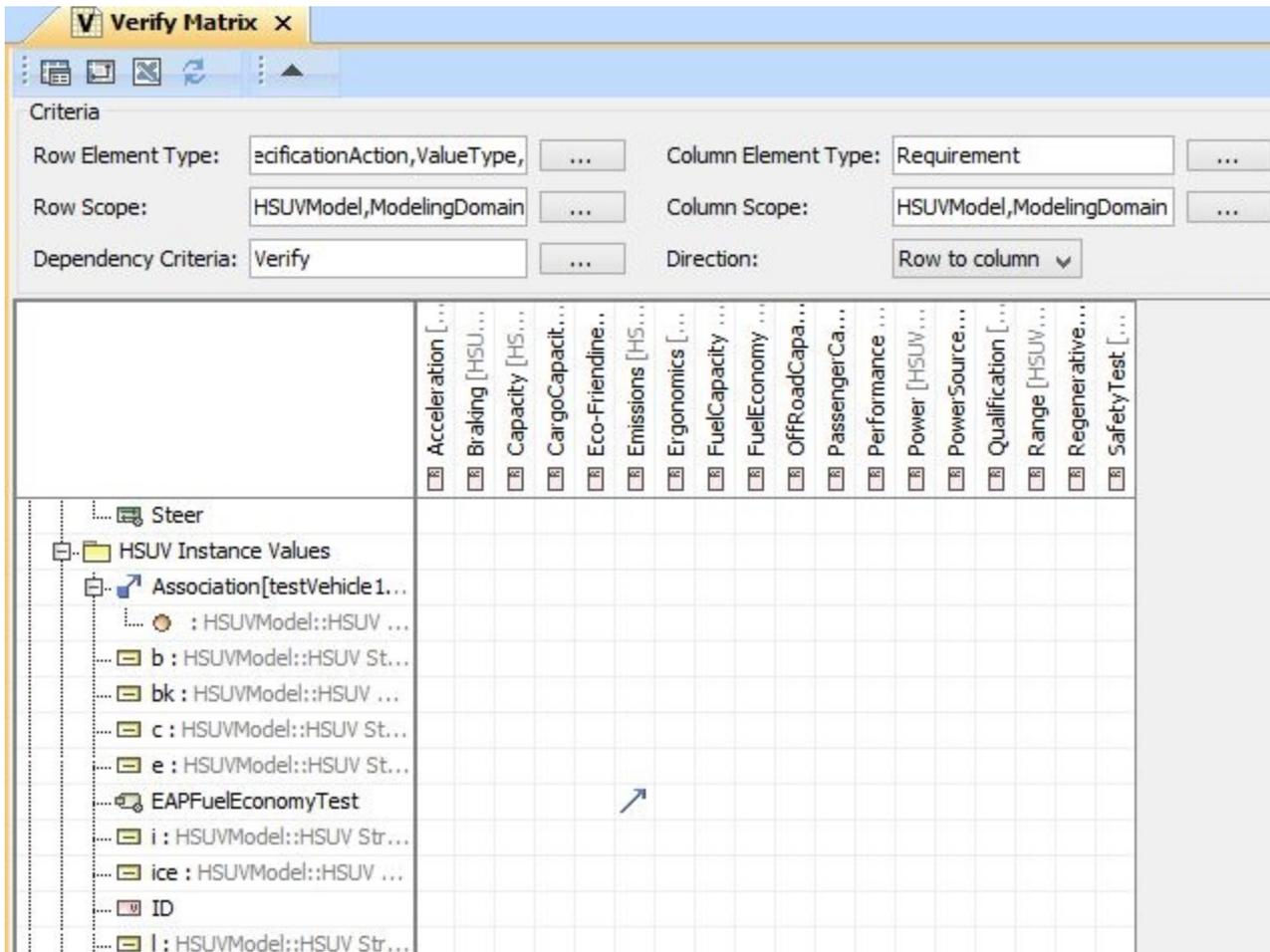


Figure 7 -- Verify Requirement matrix

3.2.1.4 Refine Requirement Matrix

The Refine Requirement matrix consists of:

- Row: Named element which can be the client element of Refine dependency.
- Column: Requirement Element which can be the supplier element of Refine dependency.

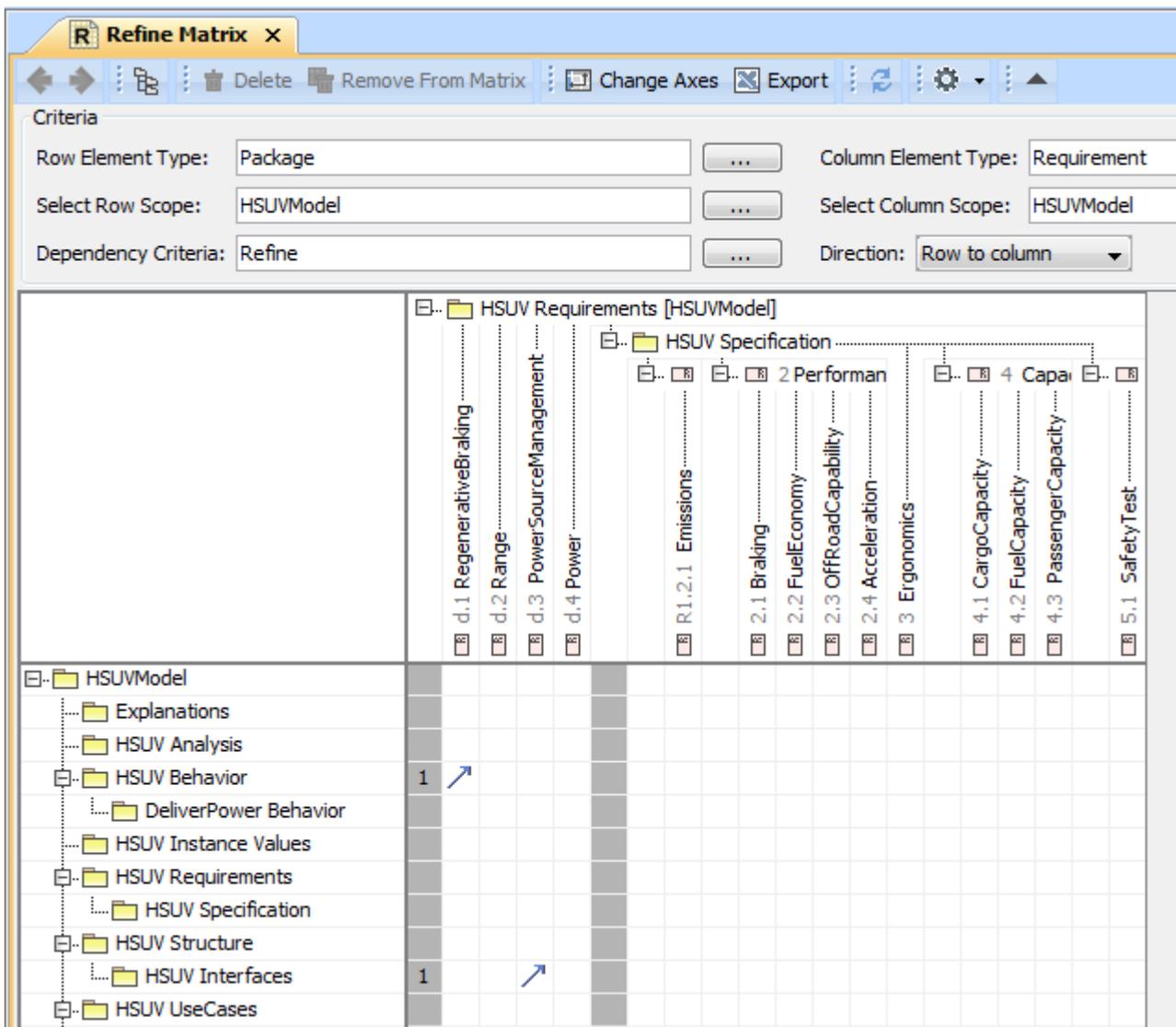


Figure 8 -- Refine Requirements matrix

3.2.1.5 Derive Requirement Matrix

The Derive Requirement matrix consists of:

- Row: Named element which can be the client element of Derive dependency.
- Column: Requirement Element which can be the supplier element of Derive dependency.

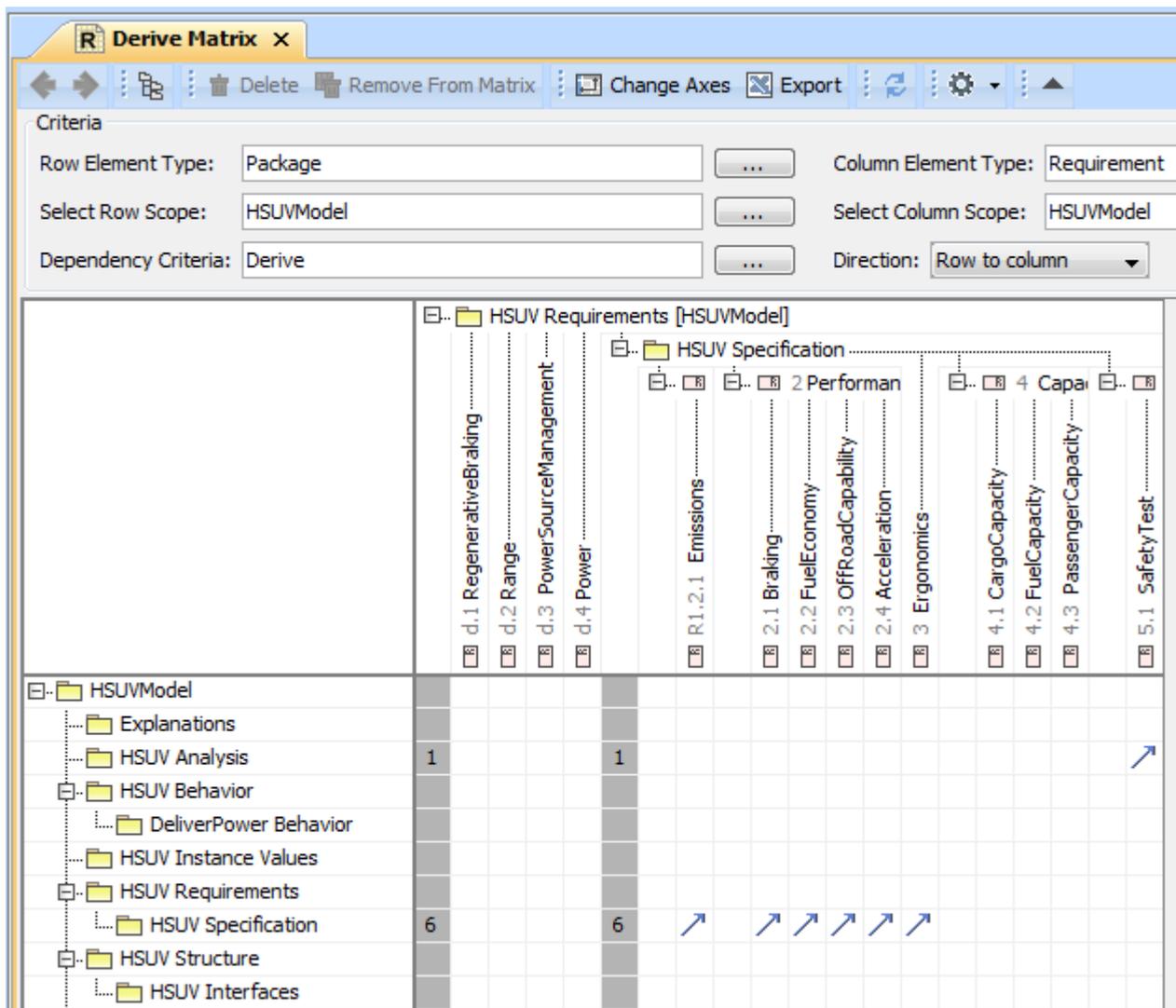


Figure 9 -- Derive Requirement matrix

3.2.1.6 Creating Editable Matrices

You can create matrices by using either the main toolbar, main menu, or Containment tree.

To create a matrix

1. In the Containment tree or on the diagram pane, select an element that can be the owner of the matrix.
2. Do one of the following:
 - From the main menu, select **Diagrams > Create Diagram**. In the opened **Create Diagram** dialog, select a matrix type and press **Enter**.
 - On the main toolbars, click the **Create Diagram** button. In the opened **Create Diagram** dialog, select a matrix type and press **Enter**.
 - Press **Ctrl+N**. In the opened **Create Diagram** dialog, select a matrix type and press **Enter**.
 - Right-click the element and from the shortcut menu select **Create Diagram > Requirement Diagrams** or **SysML Matrices** and click a desired matrix type.

The newly created matrix opens on the right side of the application window.

3. Type a matrix name.
4. Select criteria and a scope to be represented in the matrix or simply drag desired elements from the Containment tree.

3.2.1.7 Building Matrices

The matrices you have created in Section 3.2.1.6 (Creating Editable Matrices) are empty matrices. To build a complete matrix, you must also provide the row and column scopes of the matrix. All valid elements in the selected scope will be used to build the matrix.

To select the row and column scopes of a matrix:

1. Click the ... button next to the **Row Scope** in the matrix pane. The **Scope** dialog opens.
2. Select the check box(es) in front of the packages, models, or profiles that will be the row scope.
3. Click **OK** to close the **Scope** dialog.
4. Click the ... button next to the **Column Scope** in the matrix pane. The **Scope** dialog will open.
5. Select the check box(es) in front of the packages, models, or profiles that will be the column scope.
6. Click **OK** to close the **Scope** dialog.
7. Click the **Refresh** button.

3.2.1.8 Editing Matrix

You can create or remove dependencies directly in an editable matrix. Double-click an empty rectangle in the matrix to create a new dependency, or double-click an existing dependency in the matrix to remove it.

Creating New Dependencies

You can create a corresponding dependency of each matrix directly in the matrix by double-clicking on the intersection of the row and column elements. The row and column elements will become the client and supplier elements of the created dependency respectively.

Another way to create a dependency is by right-clicking on the intersection of the row and column elements. Then, select **New Relation > Outgoing**, and select the dependency you would like to create.

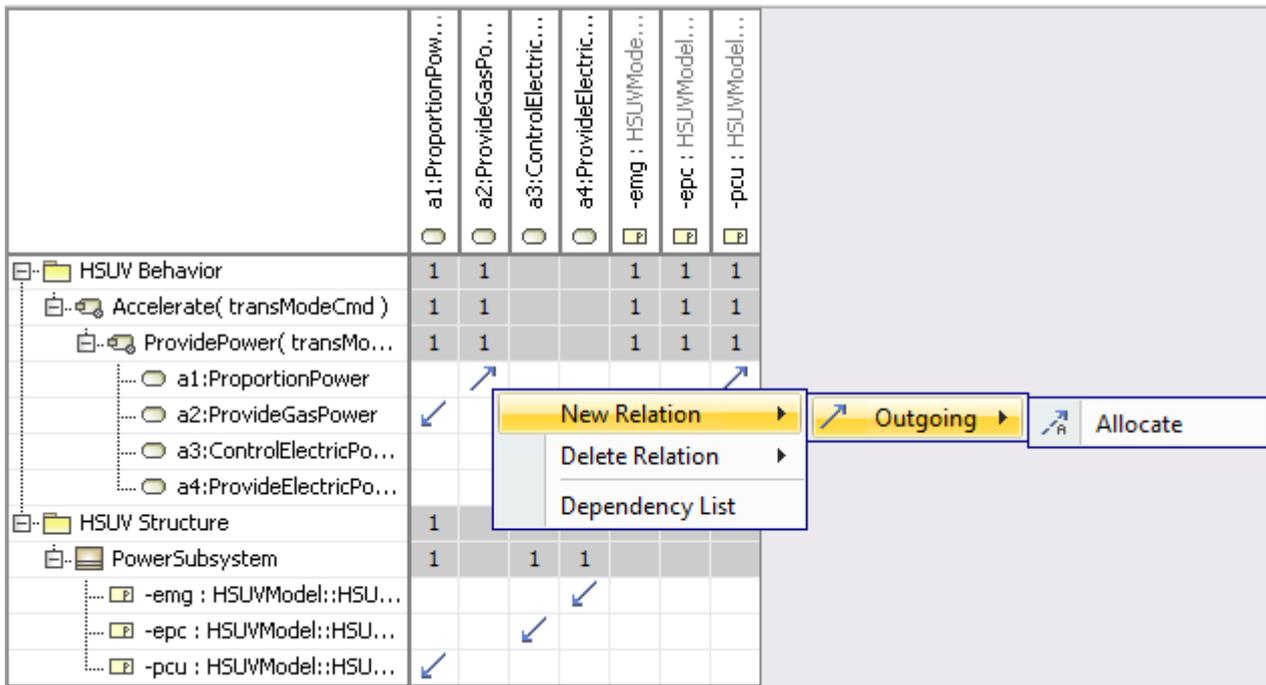


Figure 10 -- Editable Matrix context menu

Removing Existing Dependencies

You can also remove an existing dependency of each matrix by double-clicking on that particular dependency that you want to remove.

Another way to remove a dependency is by right-clicking on the intersection of the row and column elements. Then, select **Delete Relation**, and select the dependency you would like to delete.

Dependency List

You can view a list of dependencies associated with a cell in an editable matrix by right-clicking on the cell, and then select **Dependency List** from the context menu. The **Dependency List** dialog will then display.

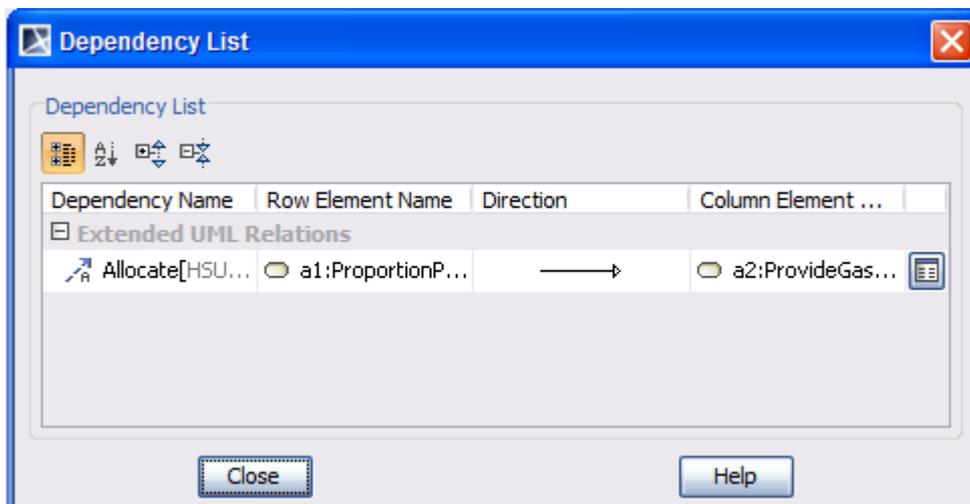


Figure 11 -- Dependency List dialog

3.3 Predefined Relation Maps

The SysML plugin introduces a predefined set of Relation maps to increase traceability of system requirements and design elements.

There are three predefined relation maps:

- Structure Decomposition Map
- Activity Decomposition Map
- Instance Map

The Relation map is a special kind of diagram that automatically updates and renders an elements dependency tree according to predefined dependency criteria.



For more information about selecting and creating elements, see section “Manipulations in Relation Map” in “MagicDraw UserManual.pdf”.

1 SYSML ELEMENTS

4.1 SysML Block Definition Diagram Elements

4.1.1 Block

Description

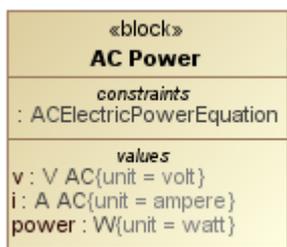
Blocks provide a general purpose capability to describe the architecture of a system, and represent the system hierarchy in terms of systems and subsystems. Blocks describe not only the connectivity relationships within / between a system and its subsystems, but also quantitative values as well as other information about that system (for example, documentation).

You can use SysML blocks throughout all phases of system specification and design, and apply them to many different kinds of systems. These include modeling either the logical or physical decomposition of a system, and the specification of software, hardware, or human elements.

A Block is a modular unit that describes the structure of a system or an element. It may include both structural and behavioral features, such as properties and operations, that represent the state of the system and behavior that the system may exhibit. Some of these properties may hold parts of a system, which can also be described by blocks. A block may include a structure of connectors between its properties to indicate how its parts or other properties relate to one another.

Any reusable form of description that may be applied to a system or a set of system characteristics can be described by a block. Such reusable descriptions, for example, may be applied to purely conceptual aspects of a system design, such as relationships that hold between parts or properties of a system. Parts (properties) in these systems can interact by many different means, such as software operations, discrete state transitions, flows of inputs and outputs, or continuous interactions. Connectors owned by SysML blocks can be used to define relationships between parts or other properties of the same containing block.

Sample



Related procedures

[NEW! Displaying Direction Prefixes of Proxy and Full Ports](#)

[NEW! Managing Interfaces of the Block](#)

[NEW! Managing Block properties](#)

4.1.2 Domain

Description

A Domain block represents an entity, a concept, a location, or a person from the real-world domain. A domain block is part of the system knowledge [1].

Sample

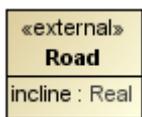


4.1.3 External

Description

An External block is a block that represents an actor. It facilitates a more detailed modeling of actors like ports or internal structures [1].

Sample

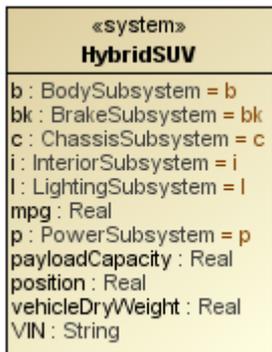


4.1.4 System

Description

A System is an artificial artifact consisting of blocks that pursue a common goal which cannot be achieved by the system's individual elements. A block can be a software, hardware, a person, or an arbitrary unit [1].

Sample

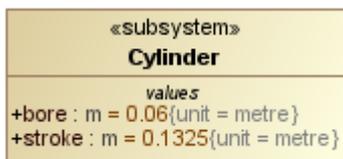


4.1.5 Subsystem

Description

A Subsystem is a typically large, encapsulated block within a larger system [1].

Sample

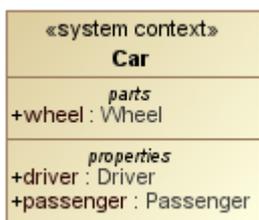


4.1.6 System Context

Description

A System context element is a virtual container that includes the entire system and its actors [1].

Sample



4.1.7 Constraint Block

Description

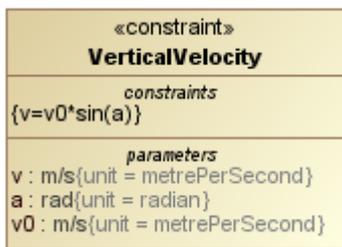
Constraint blocks provide a mechanism for integrating engineering analysis such as performance and reliability models with other SysML models. Constraint blocks can be used to specify a network of constraints that represent mathematical expressions such as $\{F=m*a\}$ and $\{a=dv/dt\}$, which constrain the physical properties of a system. Such constraints can also be used to identify critical performance parameters and their relationships to other parameters, which can be tracked throughout the system life cycle. A constraint block includes constraints (such

as $\{F=m*a\}$) and their parameters (such as F , m , and a). Constraint blocks define generic forms of constraints that can be used in multiple contexts.

Reusable constraint definitions can be specified on Block Definition Diagrams and packaged into general-purpose or domain-specific model libraries. Such constraints can be arbitrarily complex mathematical or logical expressions. The constraints can be nested to enable a constraint to be defined in terms of more basic constraints such as primitive mathematical operators.

In general, you should define constraints in constraint blocks in a Block Definition Diagram first, and then use a Parametric Diagram to bind constraint parameters to properties.

Sample



4.1.8 Interface Block

Description

An Interface Block is a special kind of block for typing proxy ports. It has no behaviors or internal parts. Normally, it contains a set of flow properties which can be shown in the “flow properties” compartment. An interface block is introduced in OMG SysML 1.3 specification to replace the use of flow specifications which have been deprecated.

Sample



Related procedures

[NEW! Managing Interfaces of the Block](#)

[NEW! Managing Interfaces of the Proxy Port](#)

4.1.9 Flow Specification

Description

A Flow Specification specifies inputs and outputs as a set of flow properties. It has a “flowProperties” compartment that lists the flow properties. A flow specification is used to type Flow Ports, in order to specify items which can flow via the ports.

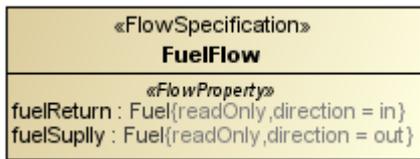


The only valid attribute of a Flow Specification element is a Flow Property.



For more information on the flow port and the flow properties, please refer to the "[SysML Internal Block Diagram Procedures](#)" chapter.

Sample



4.1.10 Value Type

Description

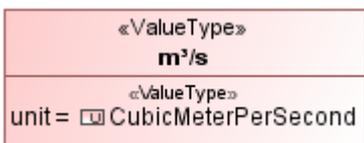
A Value Type is defined as a stereotype of UML Data Type to establish a more neutral term for system values that may never be given a concrete data representation. A Value Type adds an ability to carry a unit of measure of a quantity kind associated with the value. If these additional characteristics are not required, then UML Data Type may be used (it is, however, not recommended by SysML 1.3 specification).

In general, define quantity kinds first, followed by units and their quantity kinds. After that, define value types and their units (and quantity kinds). However, users often forget to enter the corresponding quantity kind of a value type with unit. An existing active validation constraint for filling the correct quantity kind to a value type with unspecified quantity kind, by selecting the **Apply valid quantity kind to the Value Type** option. For more information, see the "[Validation](#)" chapter.



You can select value types from the model library that holds more than 80 units and quantity kinds of SI system.

Sample



4.1.11 Quantity Kind

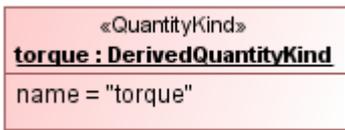
Description

A Quantity Kind (in SysML 1.0 and 1.1, called 'Dimension') is a kind of quantity that can be measured using defined and unrestricted units of measurement. For example, length, a quantity kind, may be measured by meter, kilometer, or foot units.



The only valid use of a Quantity Kind instance is to be referenced by the "quantity kind" property of a Value Type or Unit stereotype.

Sample



4.1.12 Unit

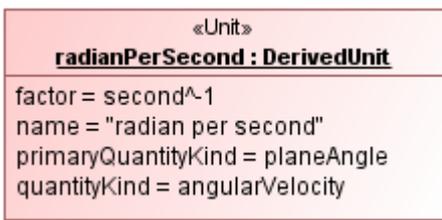
Description

A Unit is a particular value that can be used to specify a quantity of a dimension. A unit often relies on precise and reproducible measuring techniques. For example, a unit of length such as meter may be specified as a multiple of a particular wavelength of light. A unit can also use less stable or precise ways to express some values, such as costs expressed in some currencies, or a severity rating measured by a numerical scale.



The only valid use of a Unit instance is to be referenced by the “unit” property of a Value Type stereotype.

Sample



4.2 SysML Internal Block Diagram Elements

4.2.1 Part Property

Description

A Part Property is a property that specifies a part with strong ownership and coincidental lifetime of its containing Block. It describes a local usage or a role of the typing Block in the context of the containing Block. Every Part Property has ‘**composite**’ **AggregationKind** and is typed by a Block. Part Properties are displayed in the ‘parts’ compartment.

Sample



Related Procedures

[NEW! Displaying Direction Prefixes of Flow Property](#)

4.2.2 Shared Property

Description

A Shared Property is a property that specifies a shared part of its containing block. Every Shared Property has '**shared**' **AggregationKind** and is typed by a block. Shared Properties are displayed in the 'references' compartment.

Sample

A SysML diagram element representing a shared property. It consists of a yellow rectangular box with a black border. Inside the box, the text "dcMotor : DC Motor" is written in black. The box is slightly offset from the left and right edges of the page.

4.2.3 Reference Property

Description

A Reference Property is a property that specifies a reference of its containing Block to another Block. Every Reference Property has '**none**' **AggregationKind** and is typed by a block. Reference Properties are displayed in the 'references' compartment.

Sample

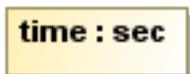
A SysML diagram element representing a reference property. It consists of a yellow rectangular box with a black border. Inside the box, the text "counterCard : A/D Counter Card" is written in black. The box is slightly offset from the left and right edges of the page.

4.2.4 Value Property

Description

A Value Property is a property that specifies the quantitative property of its containing Block. Every Value Property has '**composite**' **AggregationKind** and is typed by a SysML Value Type. Value Properties are displayed in the 'values' compartment.

Sample

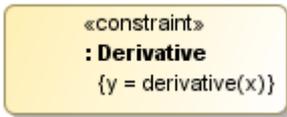
A SysML diagram element representing a value property. It consists of a yellow rectangular box with a black border. Inside the box, the text "time : sec" is written in black. The box is slightly offset from the left and right edges of the page.

4.2.5 Constraint Property

Description

A Constraint Property is a property that specifies the constraints of other properties in its containing Block. Every Constraint Property has '**composite**' **AggregationKind** and is typed by a Constraint Block. Constraint Properties are displayed in the 'constraints' compartment.

Sample



4.2.6 Distributed Property

Description

A Distributed Property is a property of a Block or a Value Type, used to apply a probability distribution to the values of the property. Specific distributions can be defined by applying a subclass of the DistributedProperty stereotype to the property.

Sample

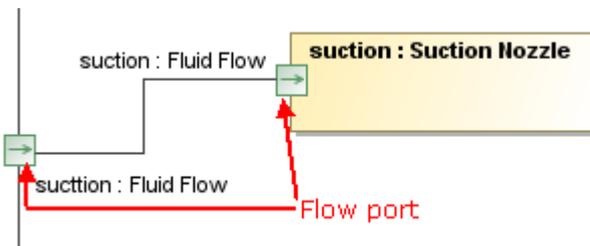


4.2.7 Flow Port

Description

A Flow Port is a port that specifies the input and output items that can flow between a Block and its environment. Flow Ports are interactions points through which data, material, or energy “can” enter or leave the owning Block. The specification of what can flow is achieved by typing the Flow Port with a specification of things that flow. This can include typing an atomic Flow Port with a single type (Block, Value Type, or Signal) representing the items that flow in or out, or typing a non-atomic Flow Port with a Flow Specification which lists multiple items that can flow. In general, Flow Ports are intended to be used for asynchronous, broadcast, or send-and-forget interactions. Note that only non-atomic Flow Ports can be conjugated. Once conjugated, all the directions of the typing Flow Specification's items are negated.

Sample

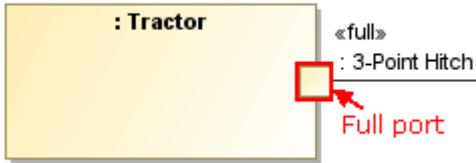


4.2.8 Full Port

Description

A Full Port is a port which is considered as a separated element of owning blocks. It may have internal parts or behaviors that support interactions with owning blocks.

Sample



4.2.9 Proxy Port

Description

A Proxy Port is a port that specifies features of owning blocks or internal parts that are available to external blocks through external connectors to the ports. It does not specify separated elements of the owning blocks or the internal parts. It can only be typed by Interface Block.

Sample



Related procedures

[NEW! Displaying Direction Prefixes of Proxy and Full Ports](#)

[NEW! Displaying Combined Direction on Proxy Port](#)

[NEW! Managing Interfaces of the Proxy Port](#)

4.2.10 Directed Feature

Description

A directed feature is a feature which applies the `«DirectedFeature»` stereotype. It specifies that the feature is provided, required, or both required and provided by an owning block.

Sample



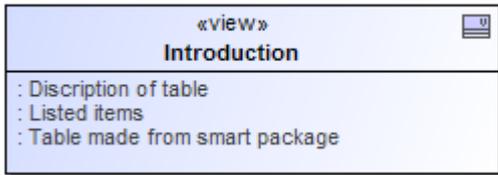
4.3 Views and Viewpoints Diagram Elements

4.3.1 View

Description

A view is a representation of a whole system from the perspective of a single viewpoint. A view can only own element import, package import, comment, and constraint elements.

Sample



4.3.2 Viewpoint

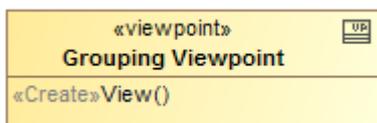
Description

A viewpoint is a specification of the conventions and rules for constructing and using a view for the purpose of addressing a set of stakeholder concerns. The languages and methods for specifying a view can reference methods and languages in another viewpoint. They specify the elements expected to be represented in the view that may be formally or informally defined.



A viewpoint cannot own any operation nor attribute.

Sample



4.3.3 Conform

Description

A Conform relationship is a dependency between a view and a viewpoint. The view conforms to the rules and conventions specified in the viewpoint.

Sample



4.4 SysML Parametric Diagram Elements

4.4.1 Moe

Description

moe (measure of effectiveness) represents a parameter whose value is critical for achieving the desired cost effectiveness mission.

Sample

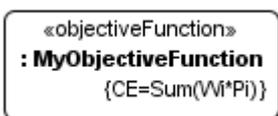


4.4.2 Objective Function

Description

An Objective Function (also known as 'optimization' or 'cost function') is used for determining the overall value of an alternative in terms of weighted criteria and/or moe's.

Sample



4.4.3 Binding Connector

Description

A Binding Connector is a connector which specifies that the properties at both ends of the connector have equal values. If the properties at both ends of a binding connector are typed by DataTypes or ValueTypes, it means that the instances of the properties at both ends must hold equal values, recursively through any nested properties within the connected properties. If the properties at both ends of a binding connector are typed by Blocks, it means that the instances of the properties must refer to the same block instance. As with any connector owned by a SysML Block, each end of a binding connector may be nested within a multi-level path of properties accessible from the owning Block. The NestedConnectorEnd stereotype is used to represent such nested ends, just as for nested ends of other SysML connectors.

Constraint blocks can only be defined on a BDD or a package diagram. A constraint block typically contains one or more constraint parameters, which are bound to properties of other blocks in a surrounding context where the constraint is used.

All properties of a constraint block are constraint parameters, with the exception of constraint properties that hold the internally-nested usages of other constraint blocks. Constraints are specified only in an informal language, but a more formal language such as OCL or MathML could also be used.

Sample



4.5 SysML Requirements Diagram Elements

4.5.1 Requirement

Description

A Requirement specifies a capability or a condition that must (or should) be satisfied. Requirements are used to establish a contract between the customer (or other stakeholders) and those responsible for designing and implementing the system. A requirement can also appear on other diagrams to show its relationship to other modeling elements.

When a requirement nests other requirements, all the nested requirements apply as part of the container requirement (the requirement that contains all the nested requirements). Deleting the container requirement will thus delete all the nested requirements it contains; a functionality inherited from UML.

4.5.2 Extended Requirement

Description

A SysML Extended Requirement is a standard Requirement subtype, which adds some properties to a requirement element. These properties such as source, risk and verify method are important for requirement management. Specific projects should add their own properties.

All these properties are now available in the standard Requirement Specification window and Requirements Table. If any of these property values is specified, a requirement is automatically converted to ExtendedRequirement.

4.5.3 Functional Requirement

Description

A Functional Requirement is a requirement that specifies a behavior that a system or part of a system must perform.

4.5.4 Interface Requirement

Description

An Interface Requirement is a requirement that specifies the ports for connecting systems and parts of a system. Optionally, it may include the items that flow across the connector and/or the Interface constraints.

4.5.5 Performance Requirement

Description

A Performance Requirement refers to a requirement that quantitatively measures the extent to which a system or a system part satisfy a required capability or condition.

4.5.6 Physical Requirement

Description

A Physical Requirement specifies the physical characteristics and/or physical constraints of a system, or a system part.

4.5.7 Design Constraint

Description

A Design Constraint is a requirement that specifies a constraint on the implementation of a system or on part of it.

4.5.8 Business Requirement

Description

A Business Requirement is a requirement that specifies characteristics of the business process that must be satisfied by the system.

4.5.9 Usability Requirement

Description

A Usability Requirement specifies the fitness for use of a system for its users and other actors.

4.5.10 Test Case

Description

A test case (Activity / StateMachine / Interaction) is a method for verifying a requirement.

4.5.11 Satisfy

Description

A 'Satisfy' relationship is a dependency between a requirement and a model element that fulfills that requirement. As with other dependencies, the arrow direction points from the satisfying (client) model element to the (supplier) requirement that is satisfied.

4.5.12 Verify

Description

A 'Verify' relationship is a dependency between a requirement and a test case or a model element that can determine whether the system fulfills the requirement. As with other dependencies, the arrow direction points from the (client) test case to the (supplier) requirement.

4.5.13 Derive

Description

A 'Derive' relationship is a dependency between two requirements (a derived requirement and a source requirement), where the derived requirement is generated or inferred from the source requirement.

4.5.14 Copy

Description

A 'Copy' relationship is a dependency between a supplier requirement (master) and a client requirement (slave), specifying that the client requirement text is a read-only copy of the supplier requirement text.

4.6 SysML Activity Diagram Elements

4.6.1 Accept Change Structural Feature Event Action

Description

An Accept Change Structural Feature Event Action is an action that waits for the occurrence of a Change Structural Feature Event.

4.6.2 Change Structural Feature Event

Description

A Change Structural Feature Event is an event which is used to model changes in values of structural features.

4.6.3 Invocation on Nested Port Action

Description

An Invocation on Nested Port Action is an invocation action that applies the «InvocationOnNestedPortAction» stereotype which extends the UML's onPort property to support nested ports.

4.6.4 Trigger on Nested Port

Description

A Trigger on Nested Port is a trigger that applies the «TriggerOnNestedPort» stereotype extending the UML's Port property of the trigger to support nested ports.

4.7 SysML Use Case Diagram Elements

4.7.1 External System

Description

An External System is a system that interacts with the system under development. For example, **Information server** or **Monitoring system** [1].

4.7.2 Sensor

Description

A Sensor is a special external system that forwards information from the environment to the system under development. For example, **Temperature sensor** [1].

4.7.3 Boundary System

Description

A Boundary System is a special external system that serves as medium between another system and the system under development without having its own interests in the communication. For example, **Bus system** or **Communication system** [1].

4.7.4 User System

Description

An User System is a special external system that serves as medium between a user and the system without having its own interests in the communication. For example, **Input Device** or **Display** [1].

4.7.5 Actuator

Description

An Actuator is a special external system that influences the environment of the system under development. For example, **Heater assembly** or **Central locking system** of a car [1].

4.7.6 Environmental Effect

Description

An Environmental Effect is an influence on the system from the environment without communicating with it directly. For example, **Temperature** or **Humidity** [1].

1 USING SYSML PLUGIN

You can find out the useful information about working with SysML plugin while studying:

- [Generic Procedures](#)
- [Diagram Specific Procedures](#)

5.1 Generic Procedures

Depending on whether you want to:

- [Creating SysML Projects](#)
- [Creating SysML Projects From Templates](#)
- [Using OMG SysML Style](#)
- [Using QUDV Model Library](#)
- [Using Quick Search Dialog](#)
- [Using Structure Browser](#)
- [Generating SysML reports](#)
- [Context-Specific Value Compartments](#)
- [Feature-based Compartments](#)
- [NEW! Managing Element Groups](#)
- [NEW! Displaying Rake icon on symbol](#)
- [Transferring mathematical expressions from MATLAB source code into the model](#)

5.1.1 Creating SysML Projects

To create a new workspace for a new project

1. Do one of the following:
 - Click **File > New Project** on the main menu.
 - Click the **New Project** button on the main toolbar.
 - Press **CTRL+N**.

The **New Project** dialog will open.

2. Click the **SysML Project** icon on the left-hand side.
3. Enter a filename in the **Name** box.
4. Click the “...” button to select a location for your new project.
5. Click **OK**.

If the current perspective is not the System Engineer perspective, the **Open Associated Perspective** dialog will open. Select **Yes** to change it to the System Engineer perspective.

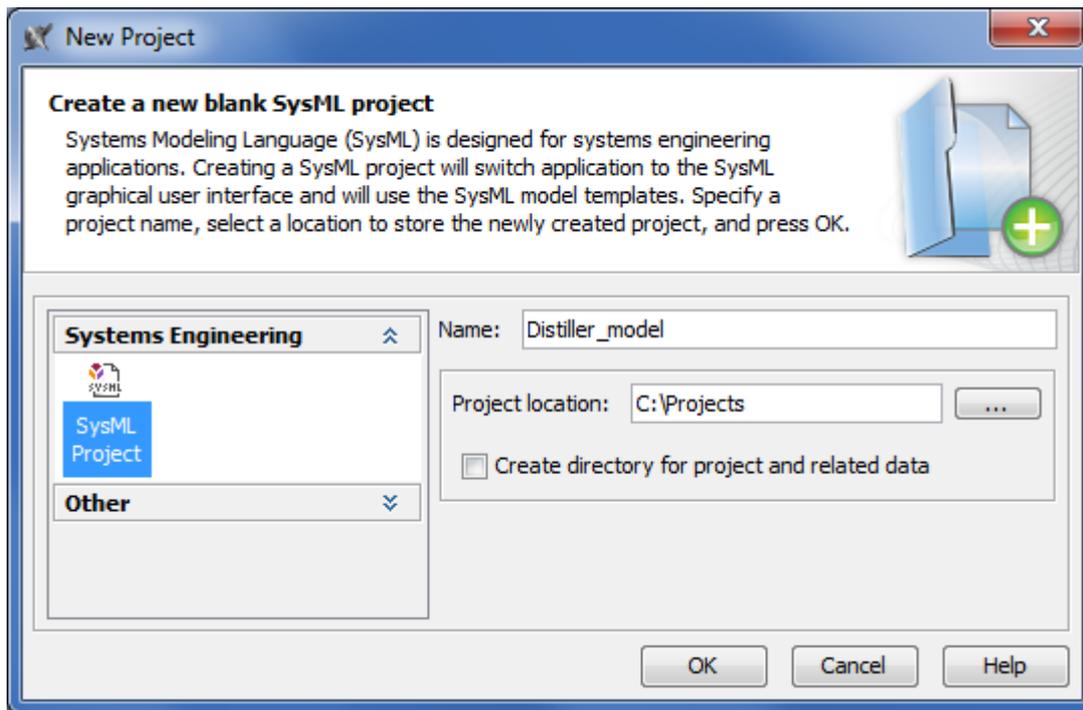


Figure 1 -- New Project dialog

5.1.2 Creating SysML Projects From Templates

To create a SysML project from a template

1. Do one of the following:
 - Click **File > New Project** on the main menu.
 - Click the **New Project** button on the main toolbar.
 - Press **CTRL+ N**.

The **New Project** dialog opens.

2. Click the **Project from Template** icon.
3. Enter a filename in the **Name** box.
4. Click the “...” button to select a location for your new project.
5. Select the **SysML** template from the **Select template** tree and click **OK**.

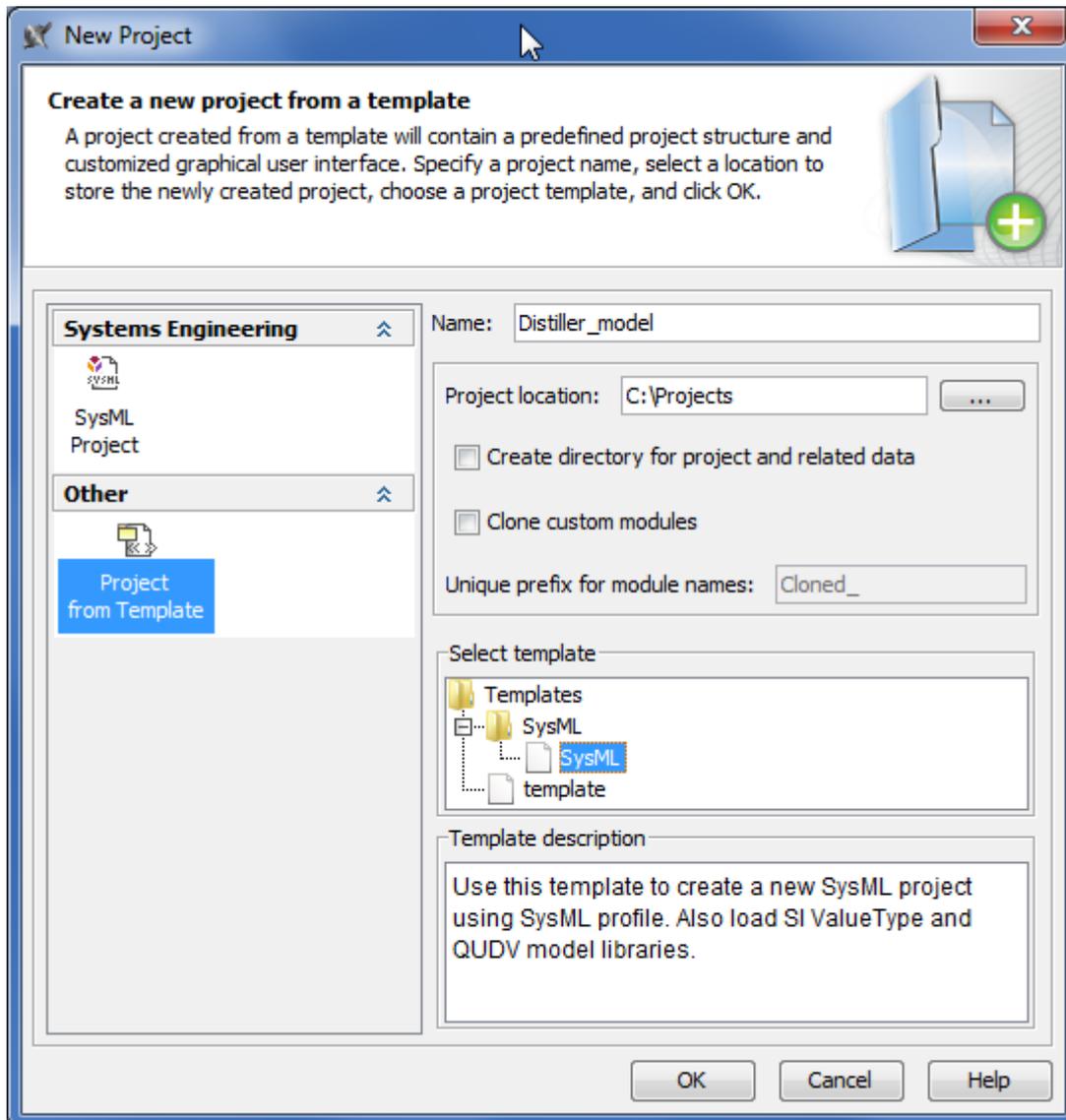


Figure 2 -- Selecting SysML template



For more information on how to work with a new project, see the Working with Projects section in the *MagicDraw UserManual.pdf*.

5.1.3 Using OMG SysML Style

SysML plugin provides the visual style of OMG SysML Specifications (OMG SysML style) that you can use with your SysML model. Such style is available with every new SysML project created by SysML 16.8 or later.

To use OMG SysML style in a new SysML project

1. Create a SysML project (see "[Creating SysML Projects](#)" or "[Creating SysML Projects From Templates](#)").
2. In the main menu, select **Options > Project**.
3. The **Project Options** dialog will open.
4. Select the **Symbols properties styles** node (on the left-hand side), and then select **OMG SysML style** in the **Symbols properties styles** panel.
5. Click the **Make Default** button.

- Click **OK**. Your SysML project will use OMG SysML style as a default style.

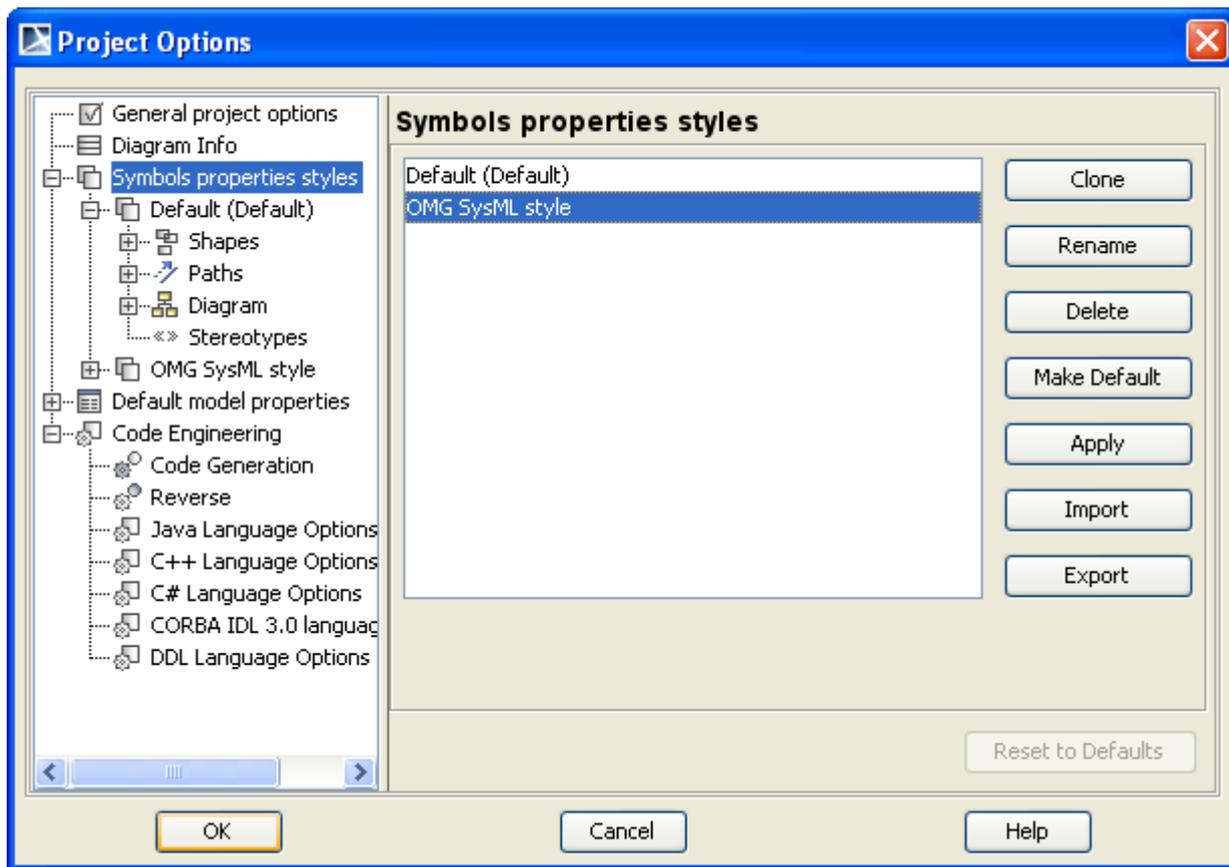


Figure 3 -- Setting symbol properties style

To apply OMG SysML style to an existing SysML project

1. Open a SysML project.
2. On the main menu, click **Options > Project**.
3. The **Project Options** dialog will open.
4. Select the **Symbols properties styles** node (on the left-hand).
5. Select **OMG SysML style**, click **Make Default > OK**. (Skip steps 6 to 10.)
6. If you do not see the **OMG SysML style** option in the **Symbols properties styles** panel, click the **Import** button. The **Open** dialog opens.
7. Open the `<md.install.dir>/templates/SysML` directory and select **OMG SysML style.stl**.
8. Click **Open**.
9. The **OMG SysML style** option will appear in the **Symbols properties styles** panel.
10. Select it, click **Make Default > OK**.

The OMG SysML style is now a default style in your SysML project. However, you can apply such style only to a SysML diagram. The following steps show you how to apply the style to a SysML diagram.

To apply OMG SysML style on a SysML diagram

1. Open the **Project Options** dialog.
2. Select **OMG SysML style** in the **Symbols properties styles** panel.
3. Click the **Apply** button. The **Select Diagrams** dialog opens.
4. Select a SysML diagram (you can select more than one diagram) and click **OK**.

- Click the **OK** button in In the **Project Options** dialog.



Applying OMG SysML style to existing SysML diagrams might distort the diagrams. Use the **Layout** feature on the main menu of MagicDraw to change how diagram looks.

5.1.4 Using QUDV Model Library

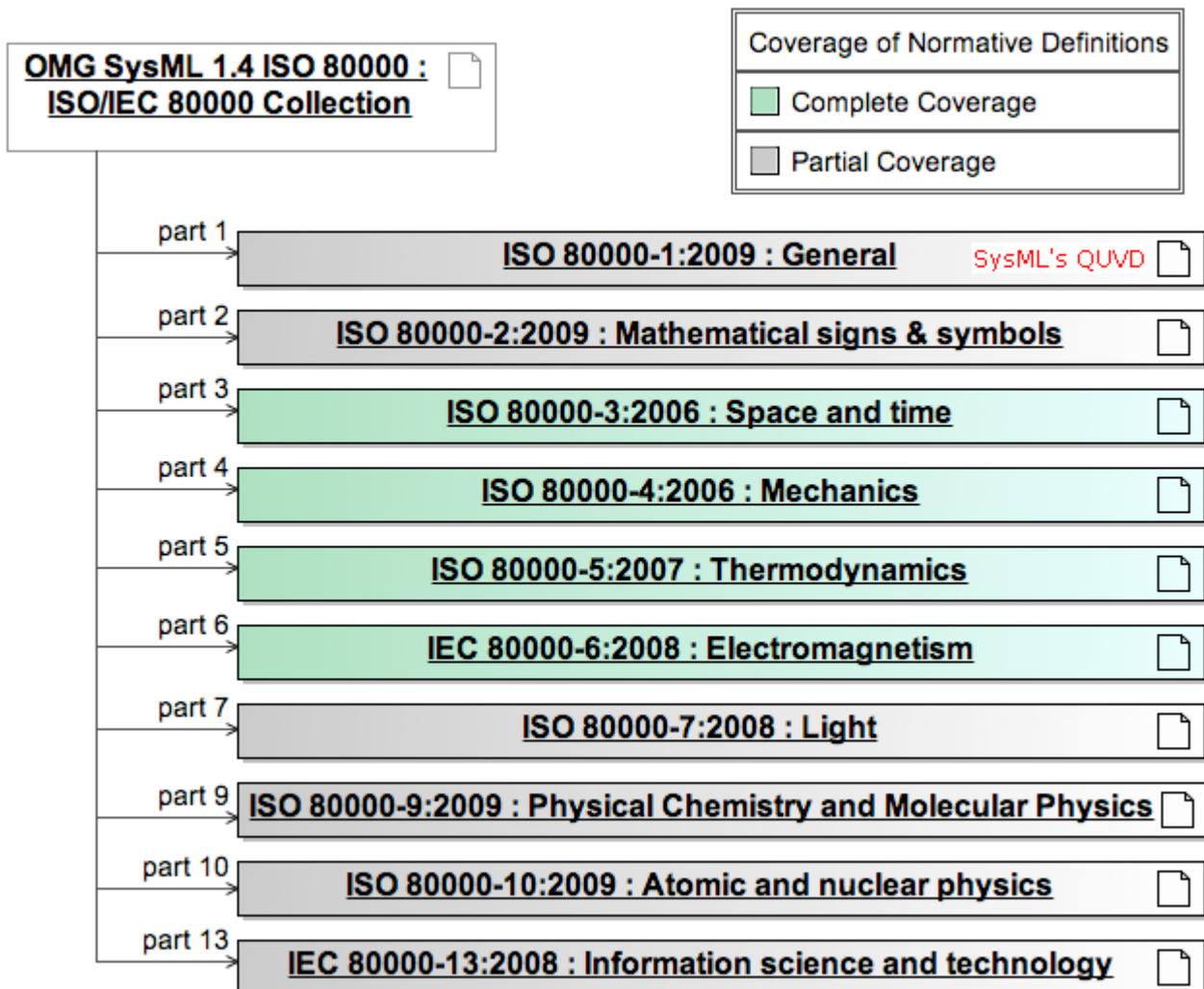
QUDV Model Library is introduced in Annex C: Non-normative Extensions to OMG SysML Specifications 1.3. This model library is designed in such a way that extensions to ISQ and SI can be represented, as well as any alternative systems of quantities and units.

For more information, see "[Model Library for Quantities, Units, Dimensions, and Values \(QUDV\)](#)".

The SysML 1.4 QUDV library was improved to

- comply with International vocabulary of metrology (VIM 3rd edition)
- encode ISO/IEC 80000 definitions of base quantities and units to provide semantics for computer-based dimensional analysis.

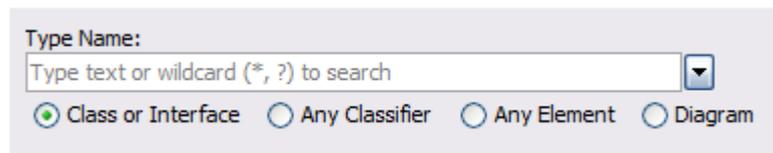
The ISO/IEC 80000 library, which is a collection of 14 standards, is available to use in new projects on demand (from the shortcut menu, select **Modules** > **Load Module**).



5.1.5 Using Quick Search Dialog

To open the Quick Search dialog

1. Press **Ctrl + Alt + F** to open the **Quick Search** dialog.



2. Do one of the following:
 - Enter the name of the element or diagram sought.
 - Select the element or diagram from the drop down list box.

The diagram or the corresponding element opens in the Containment tree.

5.1.6 Using Structure Browser

The Structure browser allows you to browse for deep nested structures of the structure classifier in your model. The property nodes, which are shown inside the property node (the parent property node), are the properties of the classifier that type the parent property node. In the following figure, the node: **diameter:m** represents the property: **diameter:m** of the classifier: **Cylinder Liner** and also the property: **cylinderLiner : Cylinder Liner** is the property of the classifier: **Engine**.

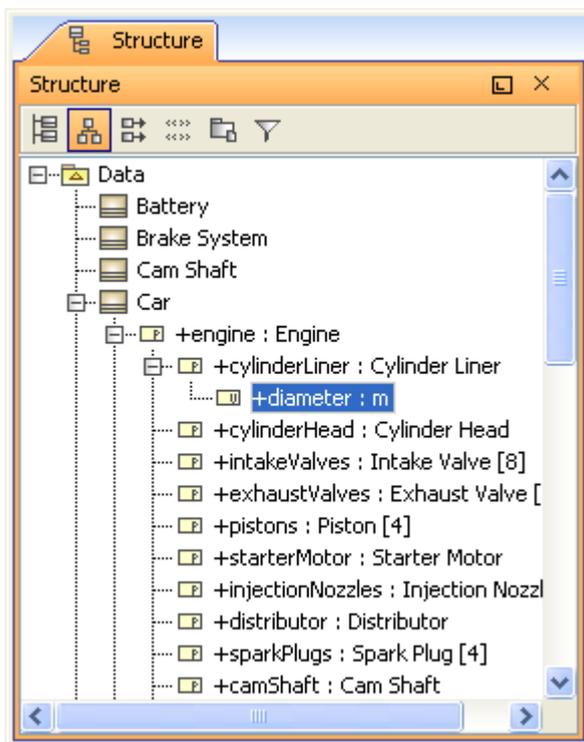


Figure 4 -- Structure browser

To open the Structure browser

- From the main menu, select **Window >Structure**.

5.1.6.1 Specific display options

There are two specific display options:

- [Display as Plain List](#)
- [Show Inherited Structure](#)

Display as Plain List

The classifiers of structure in your model will be normally displayed in a Package, Model, or Profile hierarchy. Use the **Display as Plain List** option to show all classifiers of the structure in the model in the same level without consideration of their owner. When you select the Display in Plain List option, the classifiers will be sorted by their name.

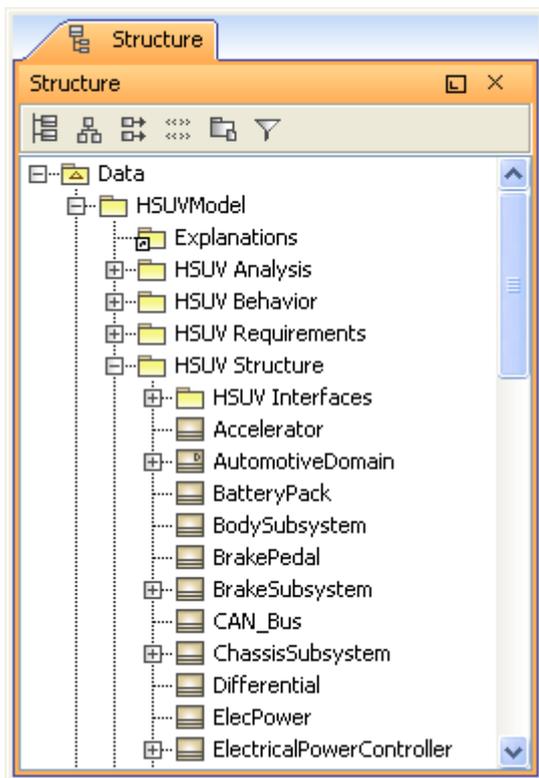


Figure 5 -- Structure standard normal display

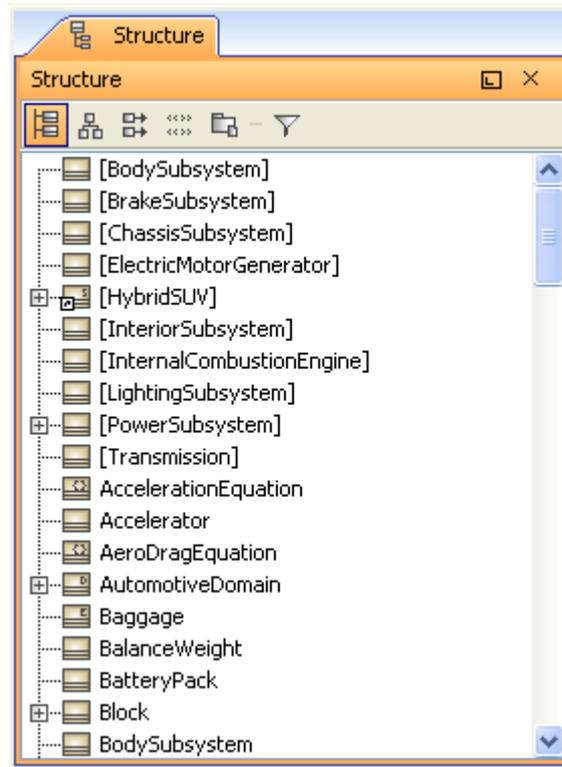


Figure 6 -- Structure Browser plain list display

Show Inherited Structure

The Structure browser can show the properties that are inherited from the generalization classifier.

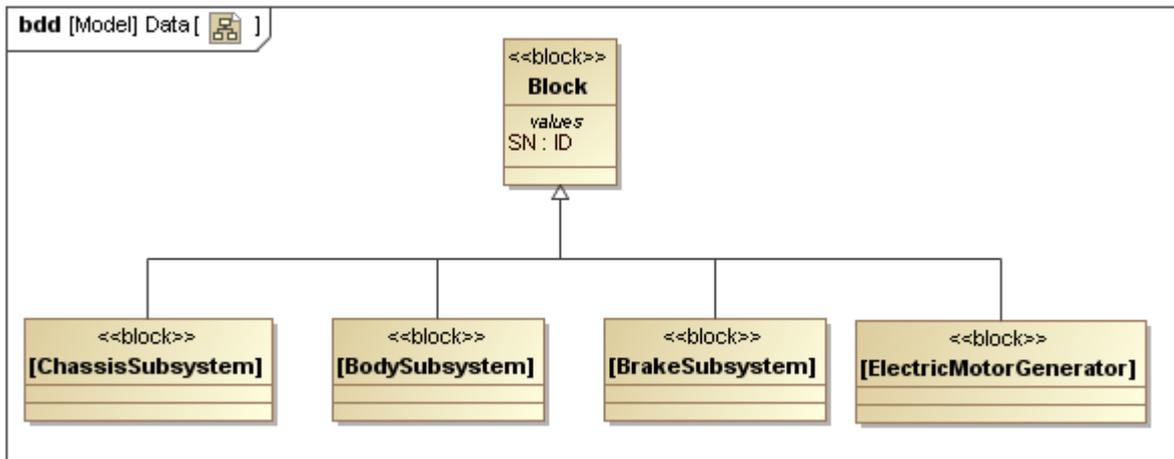


Figure 7 -- Four specialization classifiers of blocks

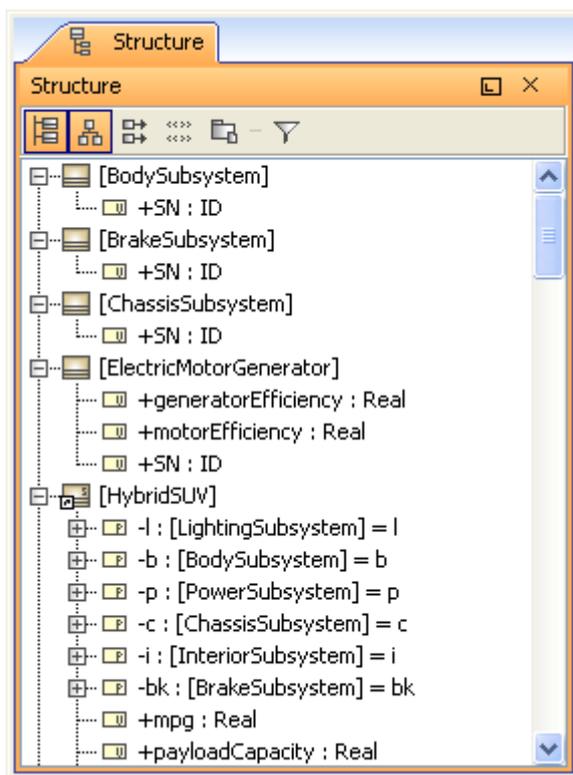


Figure 8 -- Inherited Structures of blocks

5.1.7 Generating SysML reports

This section contains only introductory information about the Report Wizard and SysML report templates. For detailed information on how to use the Report Wizard engine, see the MagicDraw Report Wizard user guide.

To create a report using a SysML report template

1. Select a report template and click **Next** in the **Report Wizard** dialog. The **Select Report Data** pane will open. You can then select a predefined report data for the selected template (default = Built-in).
2. You can modify the introductory information of a report, i.e. **Variables** (formerly called “User Defined Fields”), by clicking the **Variable** button on the **Select Report Data** pane. The **Variables** dialog will then display. You can then add/modify the variable of the report to be generated, such as author, company name, company address, report purpose, report scope, etc. This information will appear in the report generated.
3. Click **OK** to return to the **Select Report Data** pane. In the **Select Report Data** pane, click **Next**. The **Select Element Scope** pane will then display.
4. In the **Select Element Scope** pane:
 - Use the **Add** button to add an element selected in the element tree to the **Selected objects** pane.
 - Use the **Add All** button to add all elements directly owned by the element selected in the element tree to the **Selected objects** pane.
 - Use the **Add Recursively** button in to add all elements listed under the element selected in the element tree to the **Selected objects** pane.
 - Use the **Remove** button in to remove the selected element from the **Selected objects** pane.
 - Use the **Remove All** button in to remove all selected elements from the **Selected objects** pane.
5. After the scope of the report is defined, click **Next** to proceed to the **Output Options** pane.
6. Specify the report file name, report file format, and image file format. It is recommended to use RTF as the report file format.
7. Click **Generate** to create the report. Your report will be generated and automatically open in the default document editor.



TIP!

For more information about working with the Report Wizard, see the *MagicDraw ReportWizard UserGuide.pdf*

5.1.8 Context-Specific Value Compartments

Context-Specific Value Compartments allows for

- creating different configurations for the same structure and display them directly in IBD diagram(s)
- having different values for the same part in different contexts
- assigning a different initial value to an inherited property

5.1.8.1 Progressive Reconfiguration

Progressive Reconfiguration enables SysML to handle a wide range of systems engineering configuration tasks. Progressive Reconfiguration continuously applies the following values:

- Static class-level default values.
- Inherited Property-specific initial values.
- Redefined Property-specific initial values.
- Property-specific initial values.

Property-specific initial values are specific to the usage of a Block as a Part Property in a higher context (i.e. another structured block or “assembly”). If there are many Part Properties of the same type, these Part Properties may have different property-specific default values and will then be initialized differently.

Property-specific initial values are managed by the higher-context structured block, which owns the Part Properties that initialize or configure their (possibly different) values on instantiation. For example, the generic capacity of a **FuelTank** (not any particular one) is 40 liters (class-level default value). For a vehicle, however, the generic capacity of its **FuelTank** is 46 liters. An abstract **Vehicle** block will thus configure its **tank:FuelTank** part property by initializing it with a new capacity value. This can be done with Progressive Reconfiguration that will assign the instance specification **tank:FuelTank** to the property **tank:FuelTank** of the **Vehicle** block.

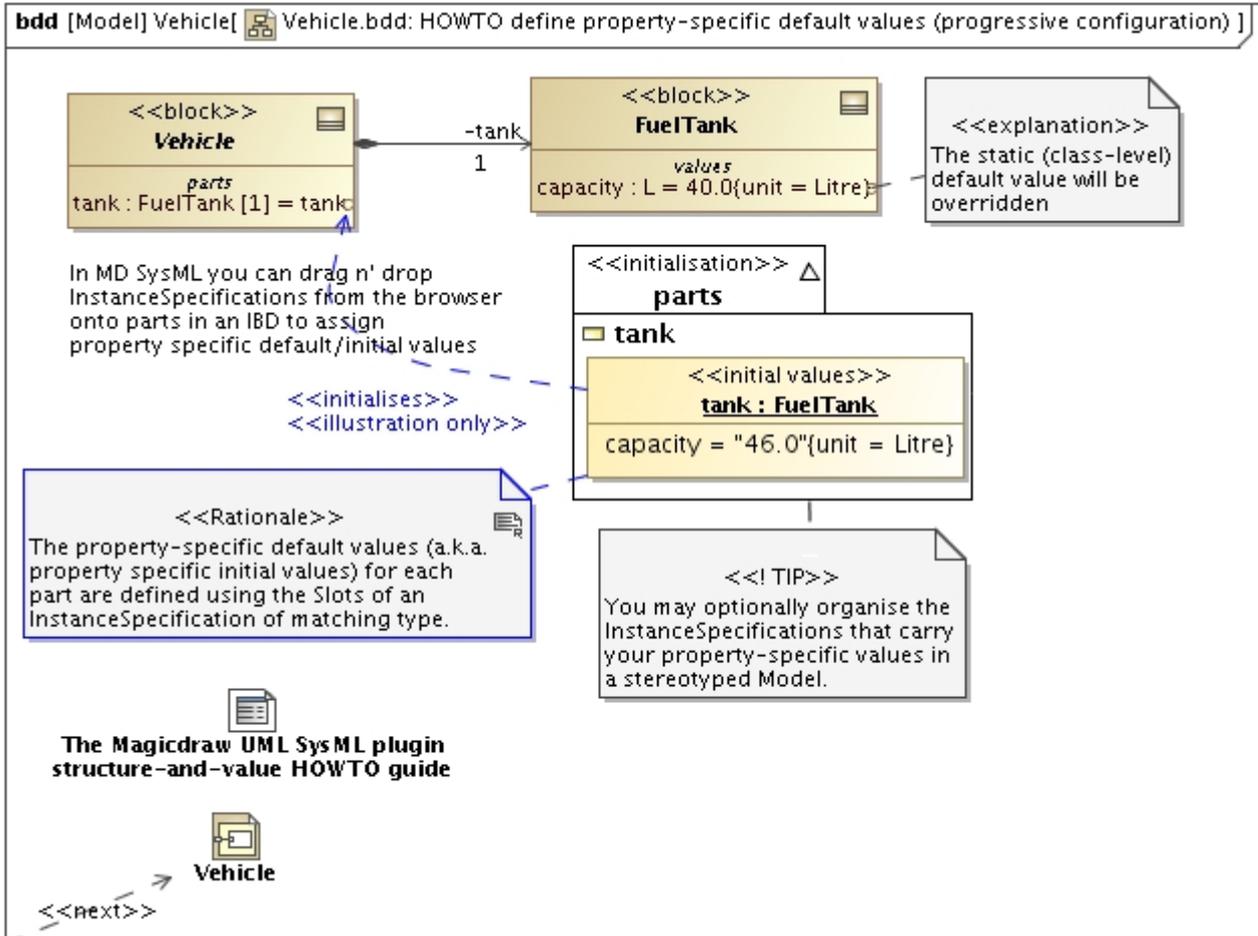


Figure 9 -- Progressive reconfiguration



For more information about Progressive Reconfiguration, see <http://training.nomagic.com>.

5.1.8.2 Deep Reconfiguration

Deep Reconfiguration enables you to configure deep-nested part(s) with context-specific value(s). Consider, for example, the case of a truck reusing a complex **WheelHubAssembly** for three pairs of wheels, each with different characteristics. Although the basic **WheelHubAssembly** might be suitable for a range of vehicles (a car, touring car, and minivan), it is not nearly suitable for a large truck. Some of the **WheelHubAssembly** parts and subparts required for a truck are larger and must be stronger to handle heavy loads. They include:

- the diameter of the **Tire**, **TireBead**, and **Rim** will be larger.
- the **inflationPressure** value of the **WheelAssembly** will be higher.
- the **LugBoltJoint** will be subject to greater **torque** and **boltTension**.
- the **LugBoltThreadedHole** will have larger **lugBoltSize** and **threadSize**.

In this case, Progressive Reconfiguration will fail because the new configuration requirements “cascade” throughout the entire complex **WheelHubAssembly** from the outermost context to the deepest part. Since no

Progressive Reconfiguration approach can handle this deep reconfiguration of complex assemblies, you need to use Deep Reconfiguration.

You can start with a completely new **TruckWheelHubAssembly** that configures a completely new **TruckWheelAssembly**, right down to a **TruckLugBoltJoint**.

However, you could use, instead, SysML PropertySpecificType strategy, which is a set of “on-the-fly” extensions (subtypes) of each Block used in a complex assembly hierarchy, to afford a point of redefinition of the Part Properties and their Value Properties as required. See the ‘PropertySpecificType’ section in OMG SysML specifications.



For more information about Deep Reconfiguration, see <http://training.nomagic.com>.

5.1.8.3 Context-Specific Value Compartments

The purpose of Context-specific Value Compartments is to show various values as a result of a reconfigured selected context. In the **FuelTank** example (see "[Progressive Reconfiguration](#)"), the capacity of a **FuelTank** in a **Vehicle** context is reconfigured to 46 litres. In the **WheelHubAssembly** example, (see "[Deep Reconfiguration](#)"), the diameter of the **Tire**, **Tire Bead** and **Rim**, the **inflationPressure** of the **WheelAssembly**, etc., in a **Truck** context will be reconfigured to suit the truck.

This section contains the following subsections:

- [Using Context-Specific Value Compartments](#)
- [Displaying Context-Specific Value Compartments](#)
- [Selecting the Context of Context-Specific Value Compartments](#)
- [Customizing Context-Specific Value Compartment Display](#)
- [Value Propagation](#)



You can see an example of a Deep Reconfiguration project by opening **context specific values.mdzip** in the `<md.install.dir>/samples/SysML` directory.

Using Context-Specific Value Compartments

A Context-Specific Value Compartment is a part symbol compartment. Only part symbols can have Context-Specific Value compartments. A Context-Specific Value compartment displays the values of the properties (parts) reconfigured in a selected context (Progressive or Deep Reconfiguration).

An example of **Progressive Reconfiguration** is when the values of *y* and *z* of a **Location** are reconfigured to 1 in the **Thing** context. Thus, the “values (Thing)” compartment in the **I:Location** part (in the **Thing** package) will display 1 as the values of *y* and *z*.

An example of **Deep Reconfiguration** is when the value of *x* of a **Location** in the **UniverseContext** package is reconfigured to 3 in the **UniverseContext** context. Thus, the “values (UniverseContext)” compartment in the **I:Location** part (in the **t1:Thing** part in the **UniverseContext** package) will display 3 as the value of *x*. If **UniverseContext** is selected, the value of *z*, instead of *x*, will be reconfigured to 2.

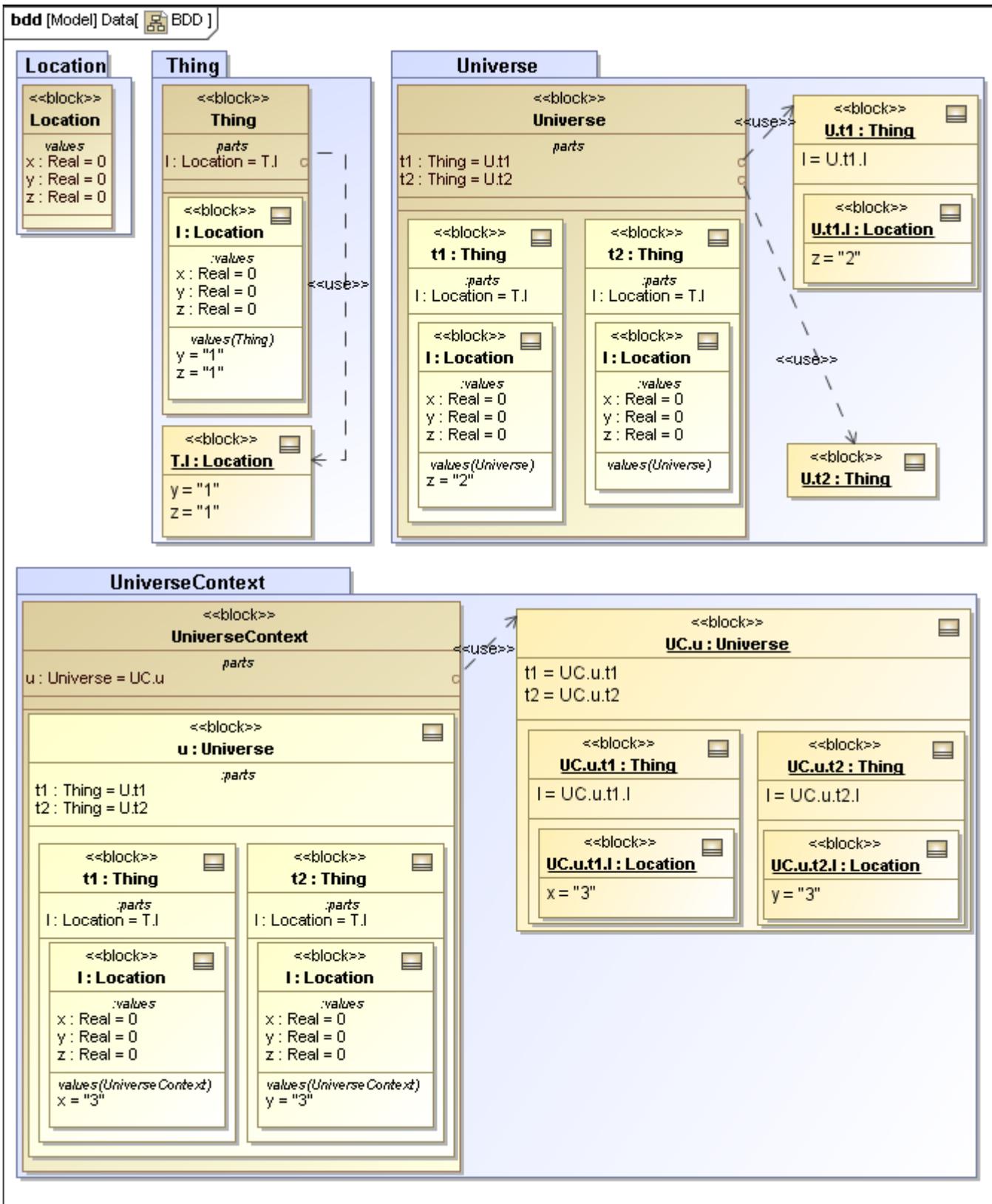


Figure 10 -- Block Definition Diagram

Displaying Context-Specific Value Compartments

You can display (or suppress) the Context-Specific Value Compartment of a part using either the **Symbol Properties** dialog or the part shortcut menu.

To display a compartment using the Symbol Properties dialog

- In the **Symbol(s) Properties** dialog, set the value of the **Suppress Context Specific Values** symbol property under the **Context Specific Values** group to **false** by clearing the check box.

To suppress a compartment using the Symbol Properties dialog

- In the **Symbol(s) Properties** dialog, set the value of the **Suppress Context Specific Values** symbol property under the **Context Specific Values** group to **true** by selecting the check box.

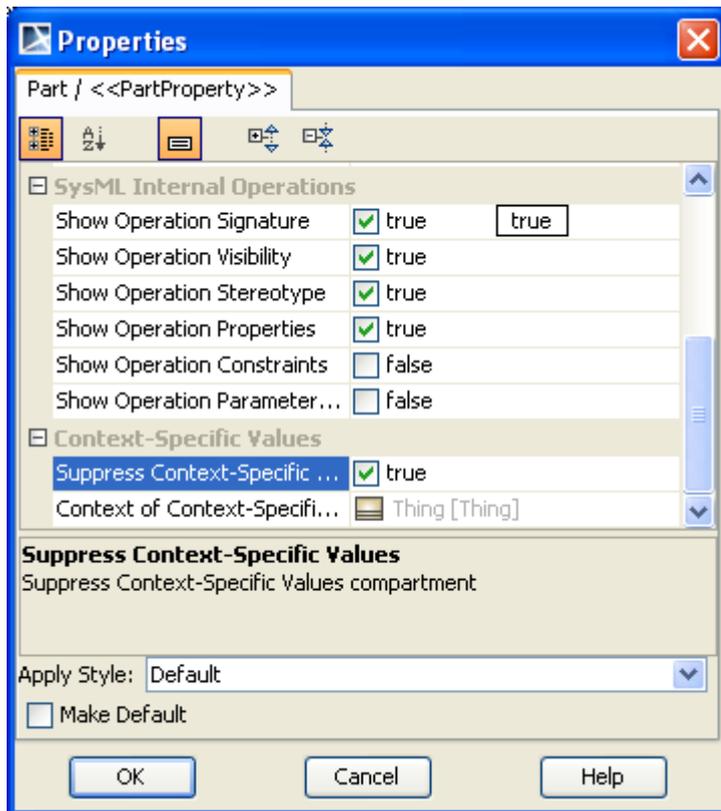


Figure 11 -- Symbol Properties dialog - Suppress Context Specific Values

To display a compartment using the part shortcut menu

- On the shortcut menu, clear the **Suppress Context Specific Values** option under the **Context Specific Values** group.

To suppress a compartment using the part shortcut menu

- On the shortcut menu, select the **Suppress Context Specific Values** option under the **Context Specific Values** group.

Selecting the Context of Context-Specific Value Compartments

The properties' values shown in the Context-Specific Value Compartment of a part and the compartment label will change according to the selected context. For example, if the selected context is **A** then the compartment label will be **values (A)**.

To select a context using the shortcut menu

- From the selected part's shortcut menu, select **Context Specific Values > Context**.

Customizing Context-Specific Value Compartment Display

You can display or hide the elements types in the Context-Specific Value Compartment of a part using either the **Symbol(s) Properties** dialog or the part shortcut menu.

To display or hide element type using the Symbol(s) Properties dialog

1. Right-click the part and select the **Symbol(s) Properties** option.
2. Three display modes are available in the **Symbol(s) Properties** dialog:
 - **None**: to hide types
 - **Name**: to display the names of the element types
 - **Qualified Name**: to display the qualified names of the element types

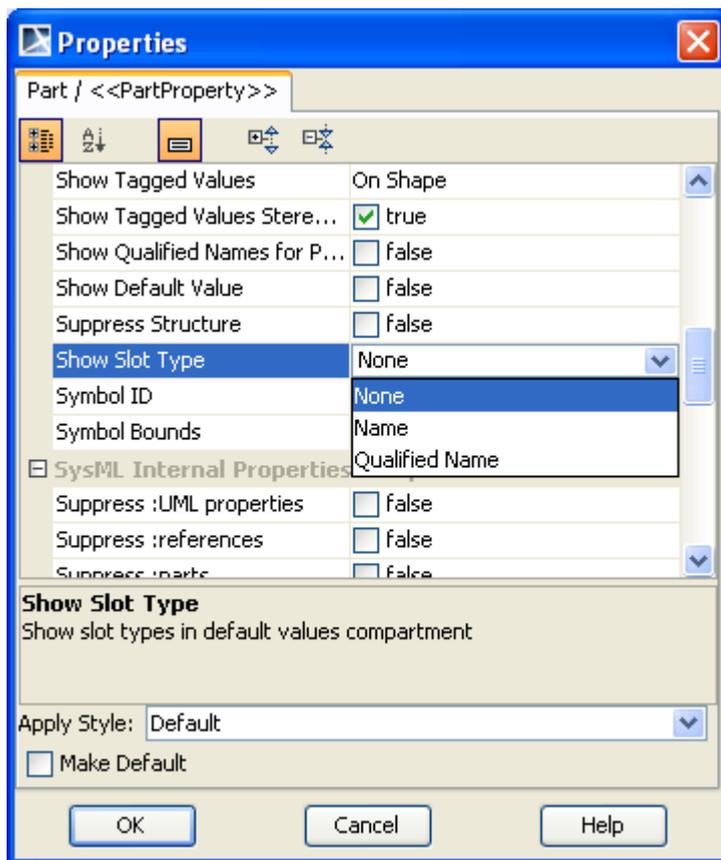


Figure 12 -- Symbol Properties dialog - Show Slot Type

To display or hide element type using the part shortcut menu

- From the selected part's shortcut menu, select **Show Slot Type**, and then select a display mode.

Value Propagation

The Value Propagation mechanism enables values that are not overridden by the values from the selected context in a Context-Specific Value Compartment to be displayed.

Assuming the property and the Value Propagation options are enabled, the value available in the next context will be used to reconfigure the property if there is no value in the selected context to reconfigure the property. However, if there is no value available in any context, the class-level default value will be displayed in the Context-Specific Value Compartment, indicating that the property is not reconfigured at all.

See the following figure for an example of the Context-specific Values Compartments having the Value Propagation enabled.

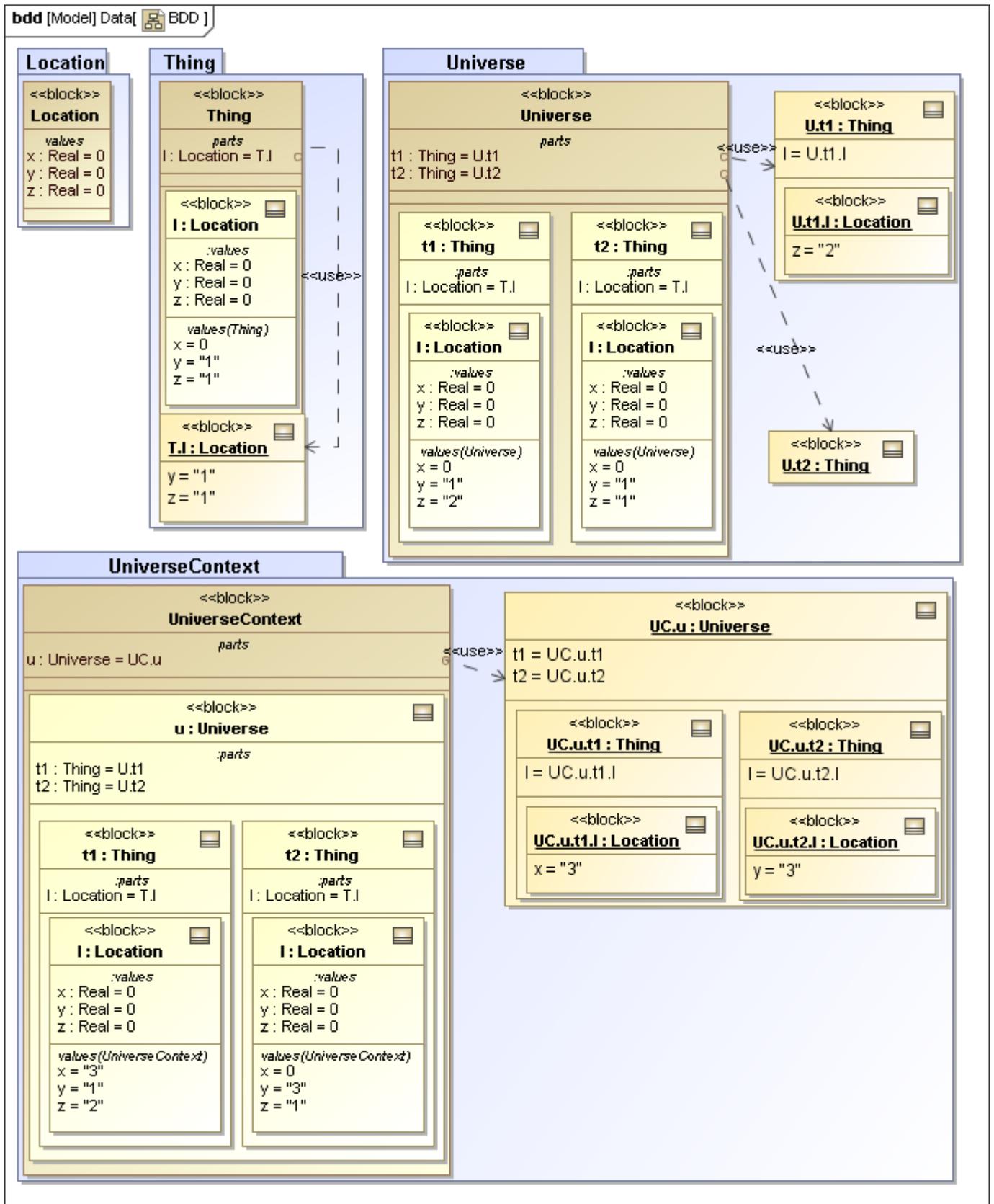


Figure 13 -- BDD value propagate

In the **UniverseContext** package, only the value of `x` of a **Location** is reconfigured to 3 in the **UniverseContext** context. The values of `y` and `z` are not set by the selected context. Since the value propagation is enabled, the next

context, **Universe**, is considered. In the **Universe** context, the value of *z* is set to 2. However, the value of *y* is still missing; therefore, the next context, **Thing**, is considered.

In the **Thing** context, the value of *y* is set to 1. Now, all attributes of the **Location** are set as follows:

- *x* = 3
- *y* = 1
- *z* = 2



For more information about Value Propagation, see <http://training.nomagic.com>.

To enable the value propagation mechanism

1. Click **Options > Project** on the main menu to open the **Project Options** dialog.
2. Select **General project options > SysML**.
3. Select the **Propagate SysML Values** check box and click **OK**.



Clear the **Propagate SysML Values** check box to disable the Value Propagation mechanism.

5.1.9 Feature-based Compartments

SysML Plugin feature-based compartments allow you to display additional compartments in internal properties. There are six feature-based compartments:

- `:values`
- `:parts`
- `:references`
- `:constraints`
- `:properties` (formerly `:UML properties`)
- `:operations`
- `:flow properties`

For any given property, these compartments will show information from the classifier of the property in conformity with SysML specifications outlined in the 'Compartment on Internal Properties' section.

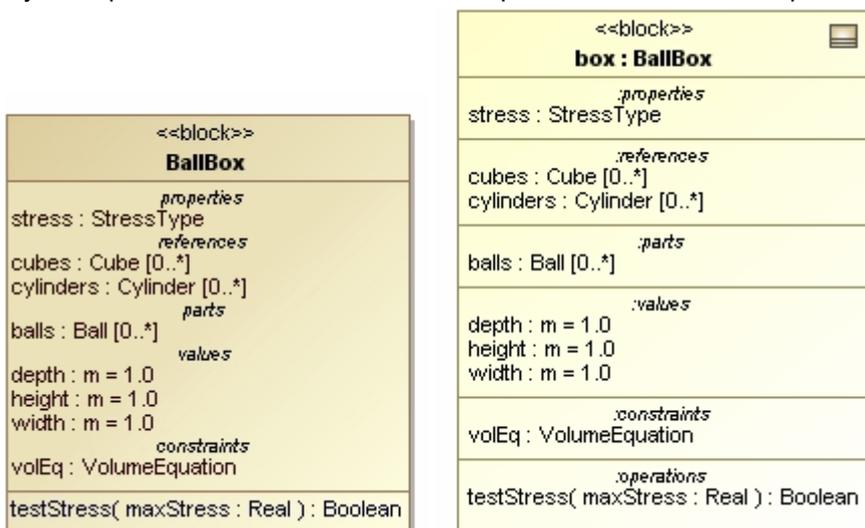


Figure 14 -- Compartments in block vs. Feature-based compartments in internal property

For any property typed by a Block, feature-based compartments will contain the same information as that of the compartments on the Block symbol, such as values, parts, references, constraints, UML properties, and operations compartments.

5.1.9.1 Expanding and Suppressing Feature-based Compartments

You can expand or suppress feature-based compartments using either the Symbols Properties dialog or the property shortcut menu.

Using the Symbol Properties Dialog of an Internal Property

To expand or suppress a feature-based compartments using the Symbol Properties dialog

1. Either right-click the property symbol and select **Symbol(s) Properties** or select the property and press **Alt + Enter**. The **Properties** dialog opens.
2. In the **SysML Internal Properties Compartments** property group, do one of the following:
 - Set the value of the corresponding symbol property to **false** by clearing the check box.
 - Set the value of the corresponding symbol property to **true** by selecting the check box.

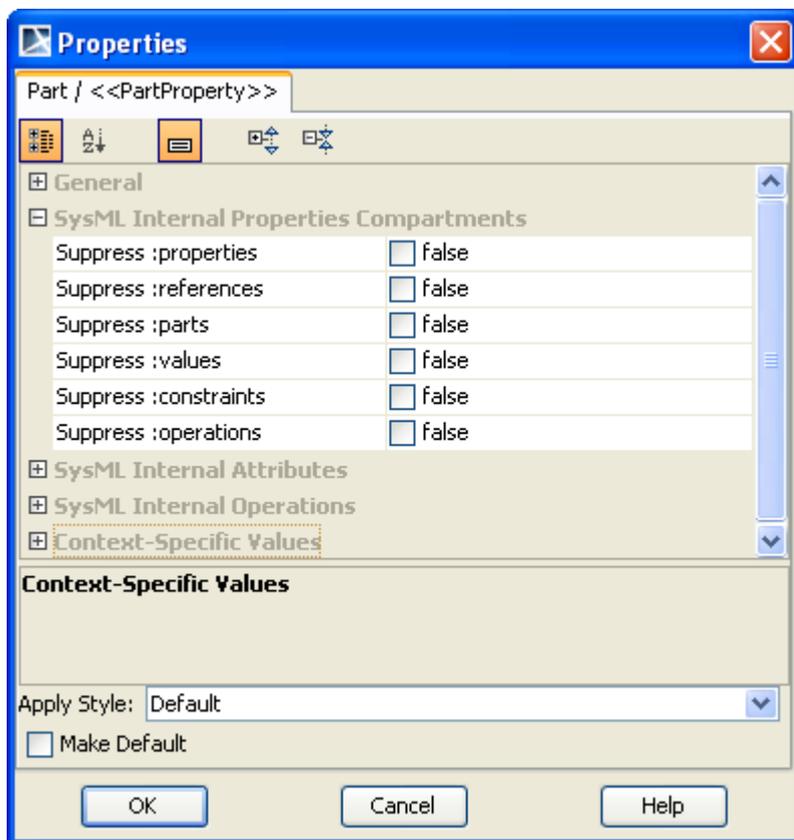


Figure 15 -- Symbol Properties dialog - SysML internal properties compartments

5.1.9.2 Displaying Options in Feature-based Compartments

Elements displayed in the feature-based compartments of a property can be customized using the symbol properties listed under **SysML Internal Attributes** and **SysML Internal Operations** in the **Symbol(s) Properties** dialog of each property.

To customize the display of the elements in the feature-based compartments

- Select or clear any of the check boxes as shown in the following figure.

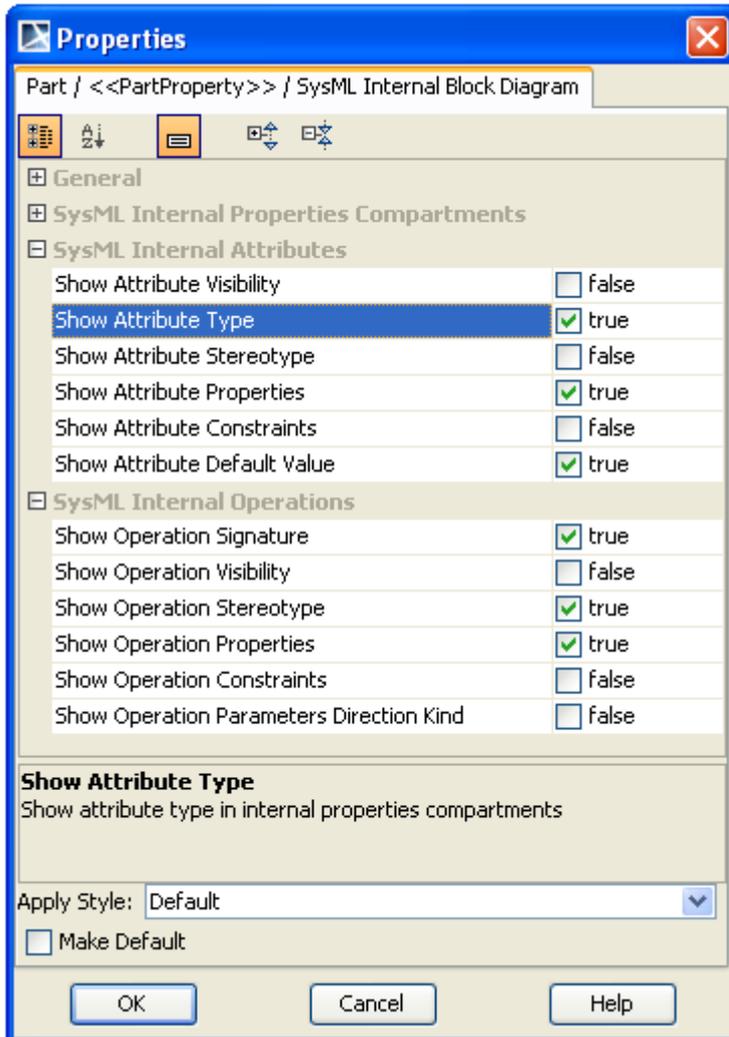


Figure 16 -- Symbol Properties dialog - SysML internal attributes and operations

5.1.10 **NEW!** Managing Element Groups

You can create and manage element groups, add, or remove group elements faster and more easily.

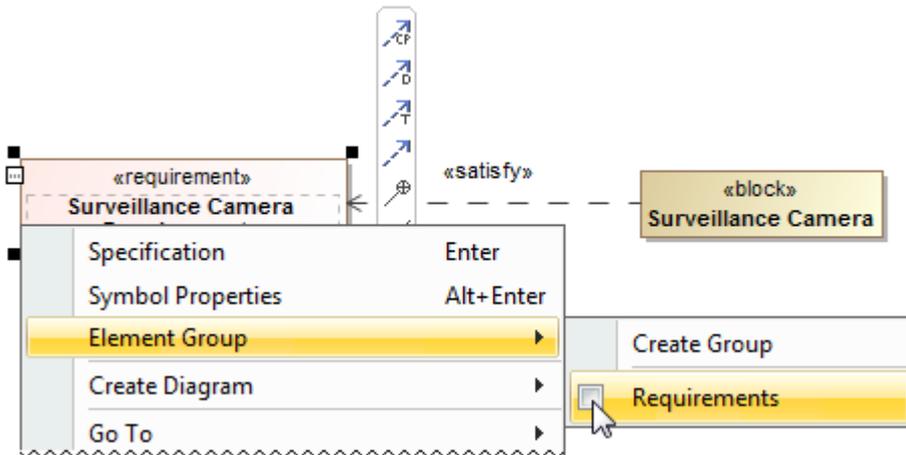


Figure 17 -- Add element to group

5.1.11 **NEW!** Displaying Rake icon on symbol

You can use rake icon for faster navigation in the model. The rake icon on the symbol indicates that the appropriate element has an internal structure. Double-click the element to open the internal diagram. The rake icon is shown by default on the symbol.

To hide rake icon

1. Right-click the symbol.
2. Select **Symbol Properties** from shortcut menu or press Alt+Enter.
3. Set the **Show Rake Icon** property value to *false*.

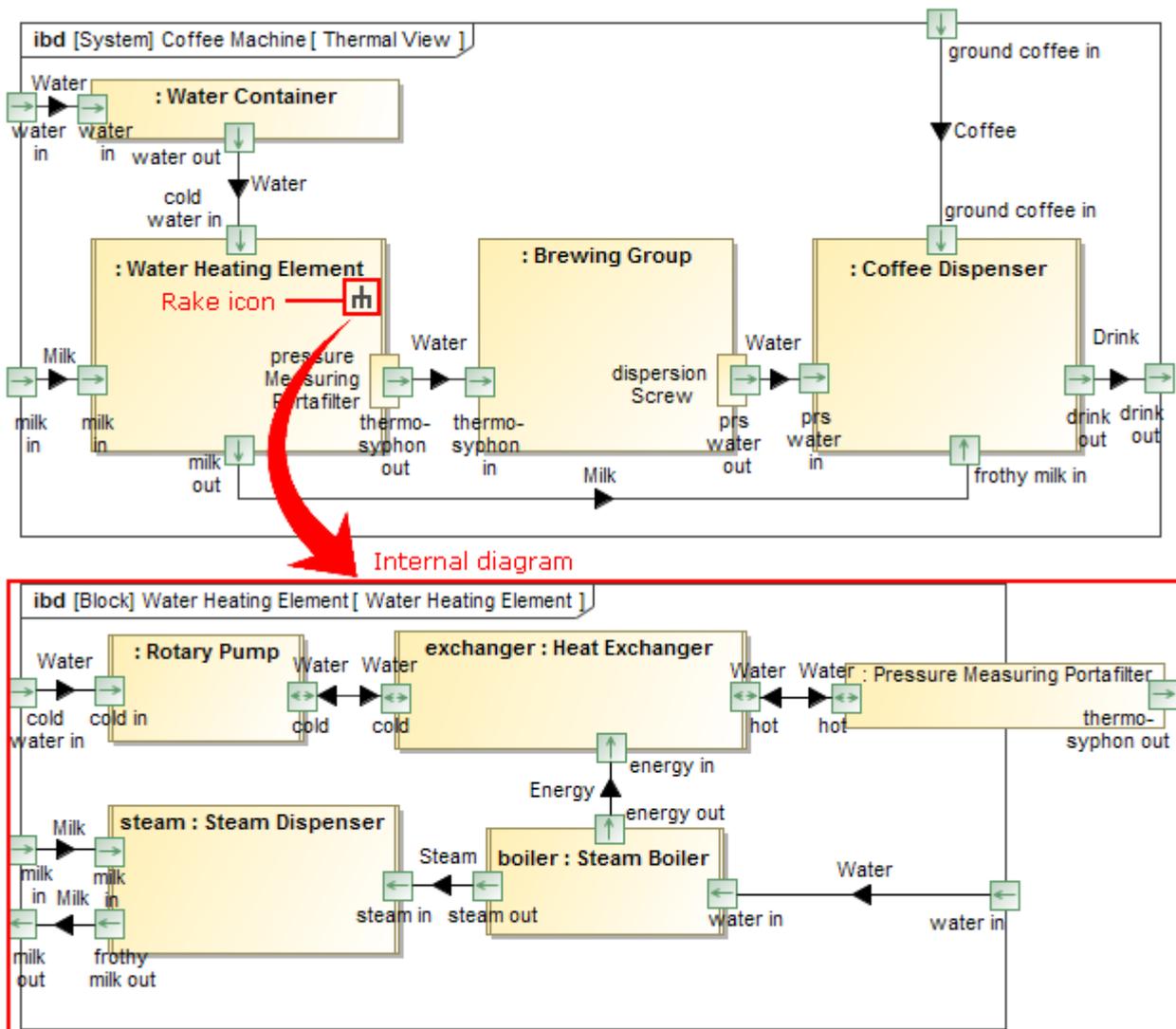


Figure 18 -- Using rake icon

5.1.12 Transferring mathematical expressions from MATLAB source code into the model

MATLAB source code contains a functions declaration. The m-file is a text file containing a list of commands written in MATLAB or Octave syntax. You can define functions and scripts in the m-file.

You can move the mathematical expressions from MATLAB source code into the model. Use the m-file to transfer functions to a Constraint Block, Constraint Property, or Call Behavior Action.

Creation of elements from MATLAB source code is supported in the following diagrams:

- SysML Internal Block definition diagram
- SysML Block Definition diagram
- SysML Parametric diagram
- SysML Activity diagram
- UML Class diagram
- UML Composite Structure diagram

- UML Activity diagram

The following figure illustrates the function declaration in m-file. It is for least-square fitting to find the slope (m) and the y-intercept (b) of a straight-line equation from two given input parameters x and y. The constraint expression is: $[m, b] = \text{linefit}(x, y)$. The constraint parameters are: x, y, m, and b. After the function transfer into the element, its type, property, and parameter are set automatically and are displayed on the element shape.

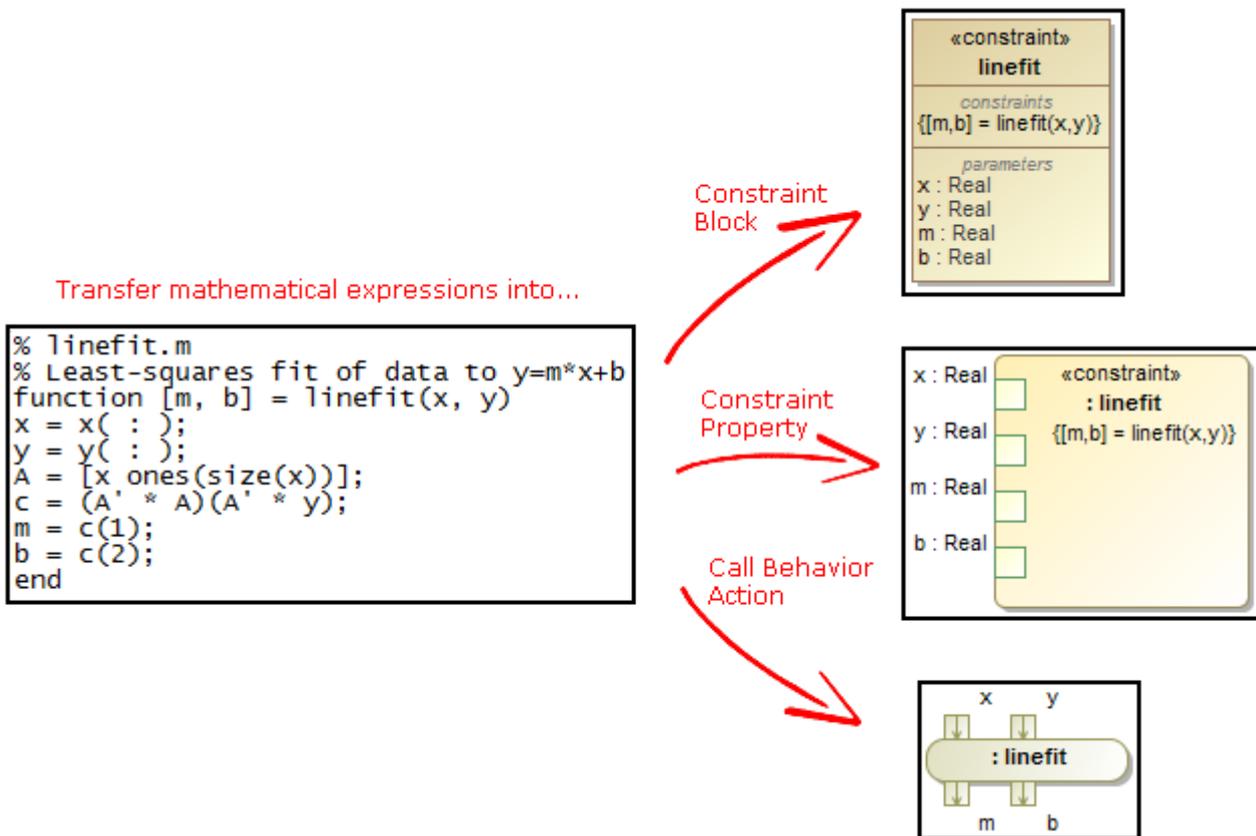


Figure 19 -- Creating Constraint Block, Constraint Property, or Call Behavior Action from MATLAB source code

The name of the created element is the same as the name of the function in the m-file. If the name of that element already exists, the name duplicates with incremental number at the end of the name.

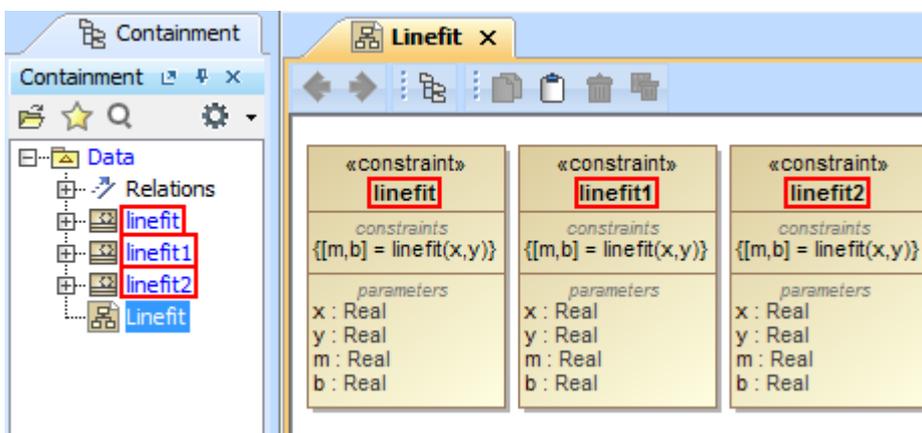


Figure 20 -- Element name duplication with incremental number

If m-file contains multiple functions declarations, only the first function is transferred into the model.

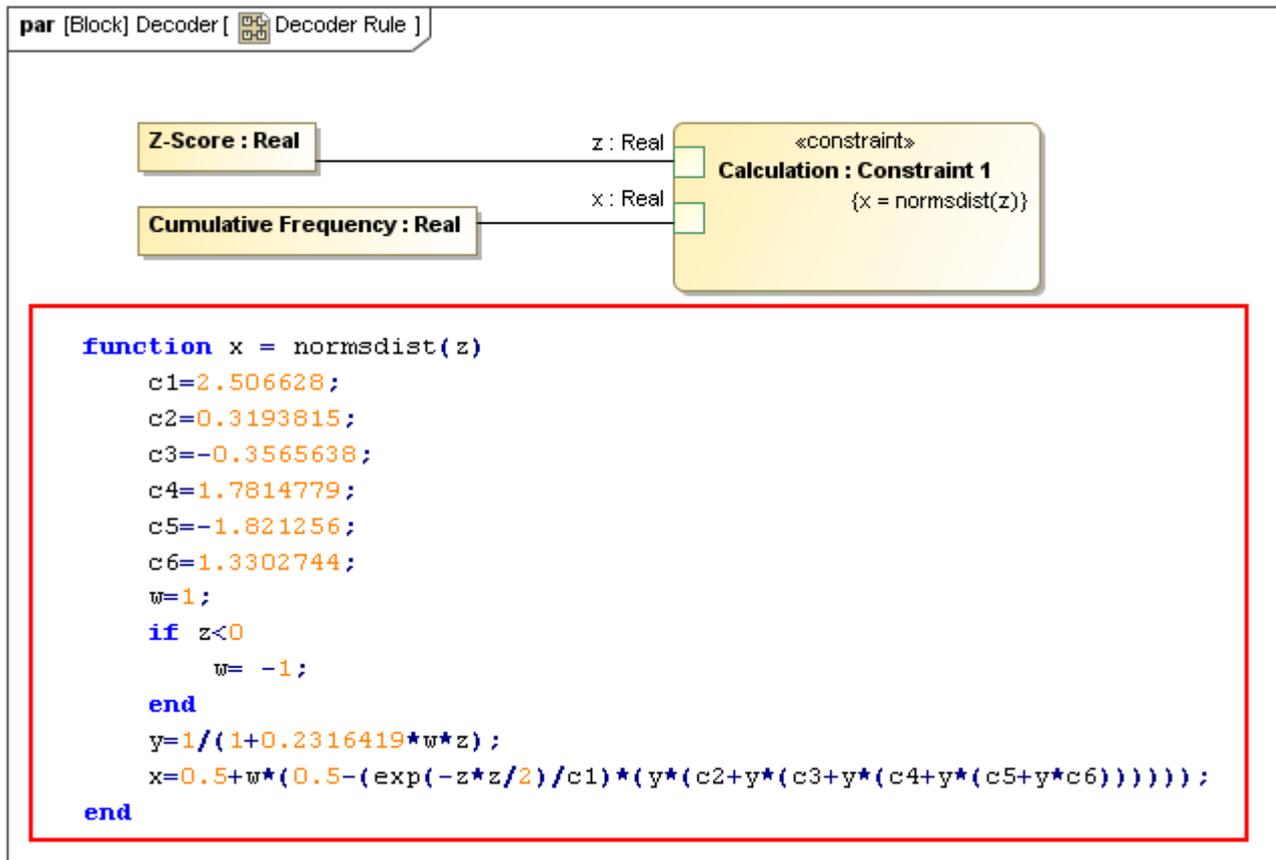


Figure 21 -- Transferring m-file with multiple functions declaration

Use one of the following ways to transfer the mathematical expressions from MATLAB source code into the model:

- **NEW!** Drag the m-file directly to the diagram pane.
- Drag the m-file onto the already existing element shape (empty or full).



The Activity diagram does not support this way of transferring mathematical expressions.

- Use shortcut menu on the already existing element shape (empty or full).



The Activity diagram does not support this way of transferring mathematical expressions.

NEW! Drag the m-file directly to the diagram pane to create one of the following:

- Constraint Block with its properties and parameters in the SysML Block Definition or UML Class diagrams.
- Constraint Property and Constraint Block in the SysML Internal Block, SysML Parametric, or UML Composite Structure diagrams. Constraint Block automatically is set as type for newly created Constraint Property. The properties and parameters of Constraint Block are displayed on the Constraint Property shape.
- Call Behavior Action with its pins and opaque in the SysML or UML Activity diagrams.

Drag the m-file onto the already existing element shape (empty or full) to set one of the following:

- Constraints and parameters for Constraint Block in the SysML Block Definition or UML Class diagrams.
- Type for Constraint Property by creating new the Constraint Block in SysML Internal Block, SysML Parametric, or UML Composite Structure diagrams. The properties and parameters of newly created Constraint Block are displayed on the Constraint Property shape.

To transfer the mathematical expression into the Constraint Block or Constraint Property

1. In the Containment tree or on the diagram pane, select a Constraint Block or Constraint Property (with set type).
2. From the shortcut menu, choose **Tools > Create Expression from M-File**. The **Open file** dialog opens.
3. Select the m-file and click **Open**.
The constraints and parameters are set for Constraint Block.

Related diagrams

[SysML Block Definition Diagram \(BDD\)](#)

[SysML Internal Block Diagram \(IBD\)](#)

[SysML Parametric Diagram](#)

[SysML Activity Diagram](#)

Related external resources

“Class Diagram” in “Magic Draw UserManual.pdf”

“Composite Structure Diagram” in “Magic Draw UserManual.pdf”

“Activity Diagram” in “Magic Draw UserManual.pdf”

5.2 Diagram Specific Procedures

- [SysML Block Definition Diagram Procedures](#)
- [SysML Internal Block Diagram Procedures](#)
- [SysML Package Diagram Procedures](#)
- [SysML Parametric Diagram Procedures](#)
- [Requirements Diagram Procedures](#)
- [SysML Activity Diagram Procedures](#)
- [SysML Use Case Diagram Procedures](#)
- [SysML Sequence Diagram Procedures](#)

5.2.1 SysML Block Definition Diagram Procedures

SysML Block Definition Diagram specific features include:

- [Inserting a new SysML property](#)
- [Inserting a new SysML diagram](#)
- [Using SysML-Style compartments](#)
- [Creating an association block](#)
- [Creating a SysML Internal Block Diagram](#)
- [Representing association roles as block properties](#)

- [NEW! Managing Interfaces of the Block](#)
- [NEW! Managing Block properties](#)

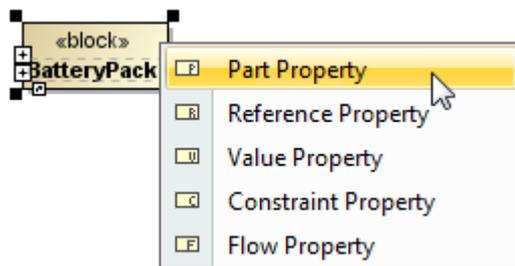
5.2.1.1 Inserting a new SysML property

You can create a SysML property in the following ways:

- Block shortcut menu
- Block Smart Manipulator menu

To create a SysML property

1. Do one of the following:
 - Select a block and from its shortcut menu, select **Insert New SysML Property**.
 - On a selected block, click the Insert SysML property button.
2. Select a SysML property you want to create.



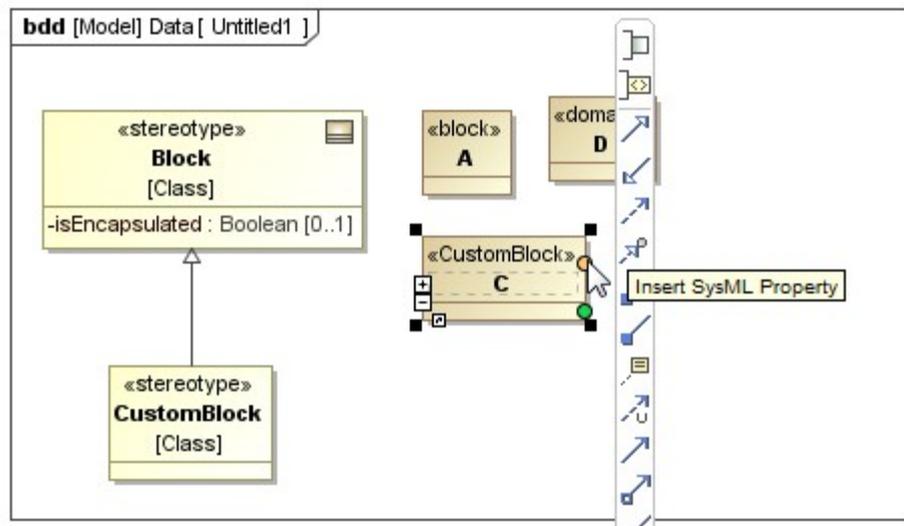
For more information on SysML properties, see the "[SysML Block Definition Diagram \(BDD\)](#)" section.



You can also use the Block shortcut menu to create a new UML property or UML operation. For more information see *MagicDraw UserManual.pdf*.



The Block smart manipulator menu will not be displayed after you have created a new stereotype as a subtype of a Block *unless you save and restart your project first*.



5.2.1.2 Inserting a new SysML diagram

To create a SysML diagram with a Block as its owner

- From the selected Block shortcut menu, select **New Diagram** and then select a diagram you want to create.

5.2.1.3 Using SysML-Style compartments

SysML Specifications allow Blocks to have multiple compartments. SysML plugin provides five independent, compatible block compartments:

- parts
- references
- values
- constraints
- property's compartments

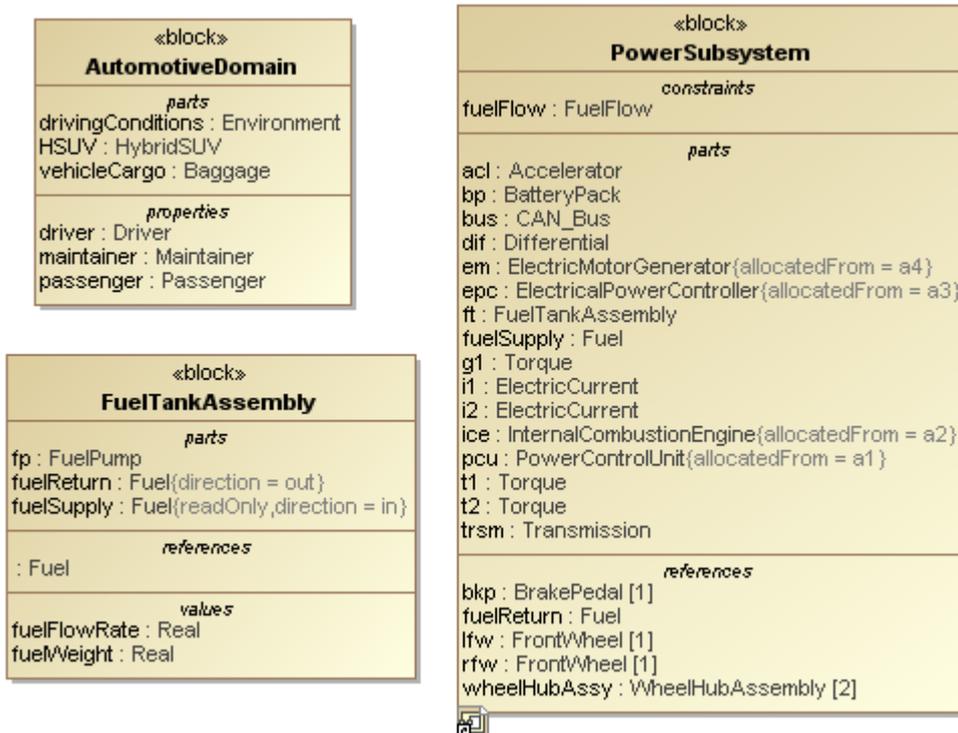


Figure 22 -- SysML block compartments

SysML Compartments	Displayed Elements
parts	<p>Part Properties: properties which are typed by Blocks or subtypes of Block, except Constraint Block, having 'composite' aggregation kind.</p> <p>Any Part property automatically becomes a reference property if aggregation kind is set to "shared" or "none".</p>

SysML Compartments	Displayed Elements
references	Shared Properties and Reference Properties are the properties typed by Blocks or subtypes of Block, except Constraint Block, having 'shared' and 'none' aggregation kind, respectively. There is no distinction between Shared Property and Reference Property.
values	Value Properties: properties which are typed by Value Types or subtypes of Value Type, always having 'composite' aggregation kind.
constraints	Constraints and Constraint Properties. Constraint Properties: properties which are typed by Constraint Blocks, or subtypes of Constraint Block, always having 'composite' aggregation kind.
flow properties	Flow Properties: properties which apply the «FlowProperty» stereotype.
properties	All other properties which cannot be classified into the previous compartments.

In addition, three SysML compartments are provided for displaying the Constraint Block properties: constraints, others, and parameters' compartments.

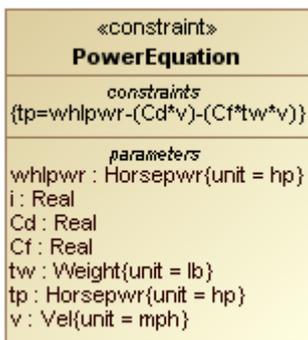


Figure 23 -- SysML constraint block compartments

SysML Compartments	Displayed Elements
constraints	Constraints and Constraint Properties. Constraint Properties are properties that are typed by Constraint Blocks, or subtypes of a Constraint Block, always having 'composite' aggregation kind.
others	All other properties that cannot be classified into the previous compartments.
parameters	Constraint Parameters (reusing the 'ports' compartment of a Class).

5.2.1.4 Creating an association block

Participant properties will be created automatically when an Association Block is created between Blocks.

To create an Association Block in a Block Definition Diagram

- Do one of the following:
 - From the diagram panel, select **Association Block**. On the diagram pane, select a Block to be used as the source of the to-be-created Association Block.

- Select the **Association Block** icon on the **Smart Manipulator** menu of a Block to be used as the source of the Association Block.
2. Select a target of the Association Block by either selecting an existing Block on the diagram to be used, or clicking on empty space on the diagram to create such target Block.
 3. An Association Block will then be created between the source and target Blocks.

5.2.1.5 Creating a SysML Internal Block Diagram

To create a SysML Internal Block diagram for a Block

1. Select the Block symbol. The smart manipulator menu will appear.
2. Click the SysML Internal Block diagram button . The SysML Internal Block diagram will then be created and owned by the selected block.
3. The SysML Internal Block diagram and the owner block will have the same name. The hyperlink to the created diagram will be added to the selected block.

5.2.1.6 Representing association roles as block properties

When a Block is represented in the other BDD diagrams, all Association roles will be represented in the Block properties compartment as normal properties. This representation option for Association roles is enabled by default in all new SysML projects. This option, however, does not apply to any existing projects you may already have.

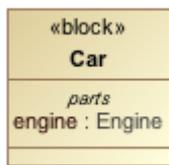


Figure 24 -- Association Role is represented as normal property

5.2.1.7 Creating instances of blocks with complex structure

Creating instances for a complex model can be quite difficult, especially, since instances are frequently used in SysML (unlike in UML), in particular when assembling systems. Starting with version 16.5, a new feature has been included: Automatic Instantiation.

The purpose of this feature is to provide a wizard for automatic instantiation of the composite structures of a system or system parts. Instances are widely used in simulation environments, for example, ParaMagic, and also for defining different system configurations and test cases.

The following two samples will describe how to use the Automatic Instantiation feature.

To automatically instantiate a Block

1. Right-click a Block and select **Tools > Create Instance** on the shortcut menu. The **Automatic Instantiation Wizard** opens.
2. Follow the steps of the wizard.
3. Click **Finish** to create the instance specifications and diagram. The Instance specifications will be created and displayed in the chosen diagram.

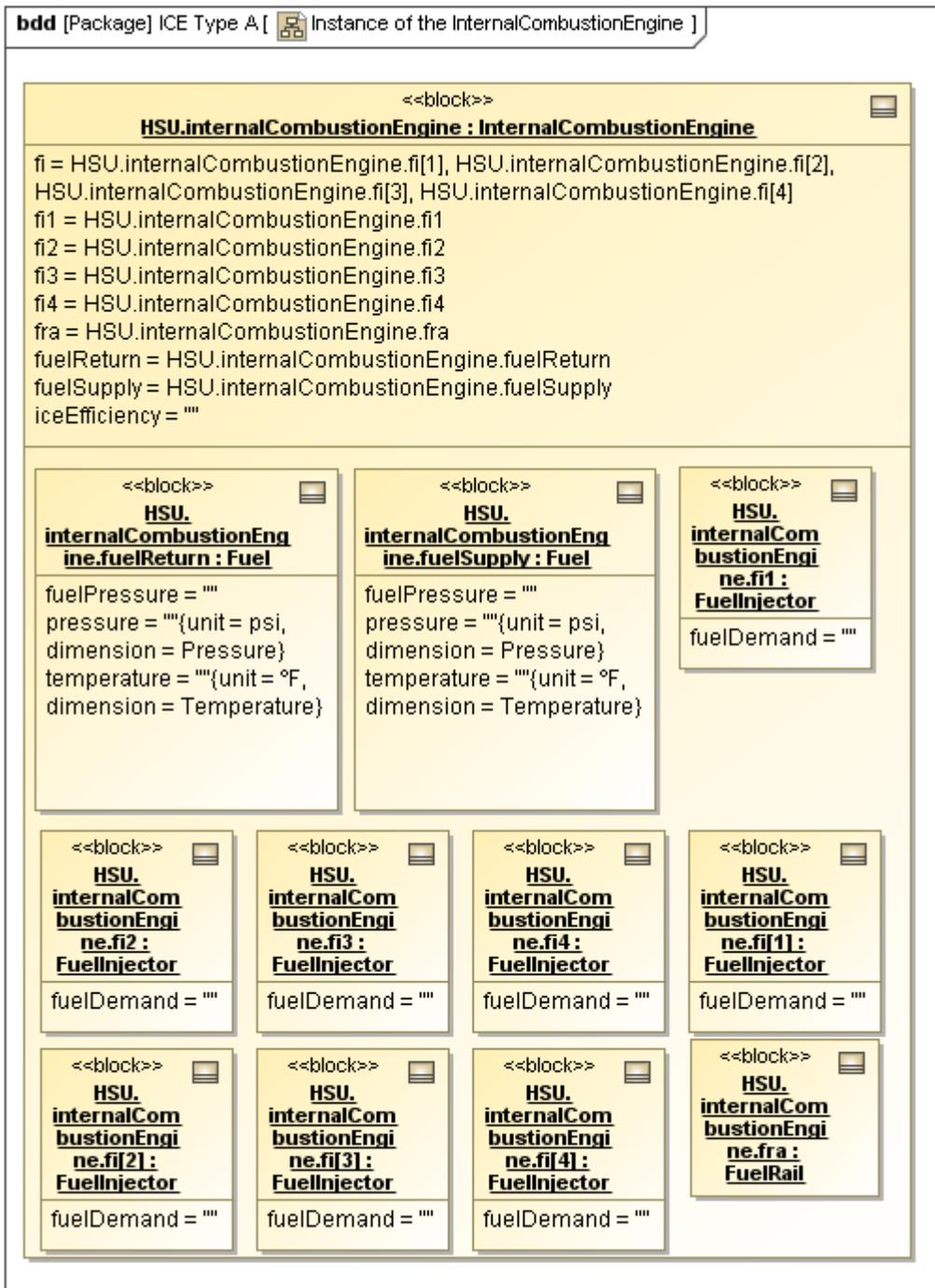


Figure 25 -- Example of instance created by Automatic Instantiation Wizard

You can reassign some values, for example, if you like to use “SuperFuel” for “fuelReturn” instead, then reassign the **fuelReturn** slot in the **HSU.internalCombustionEngine : InternalCombustionEngine** instance specification to **SuperFuel**, a Fuel kind with a specific fuelPressure.

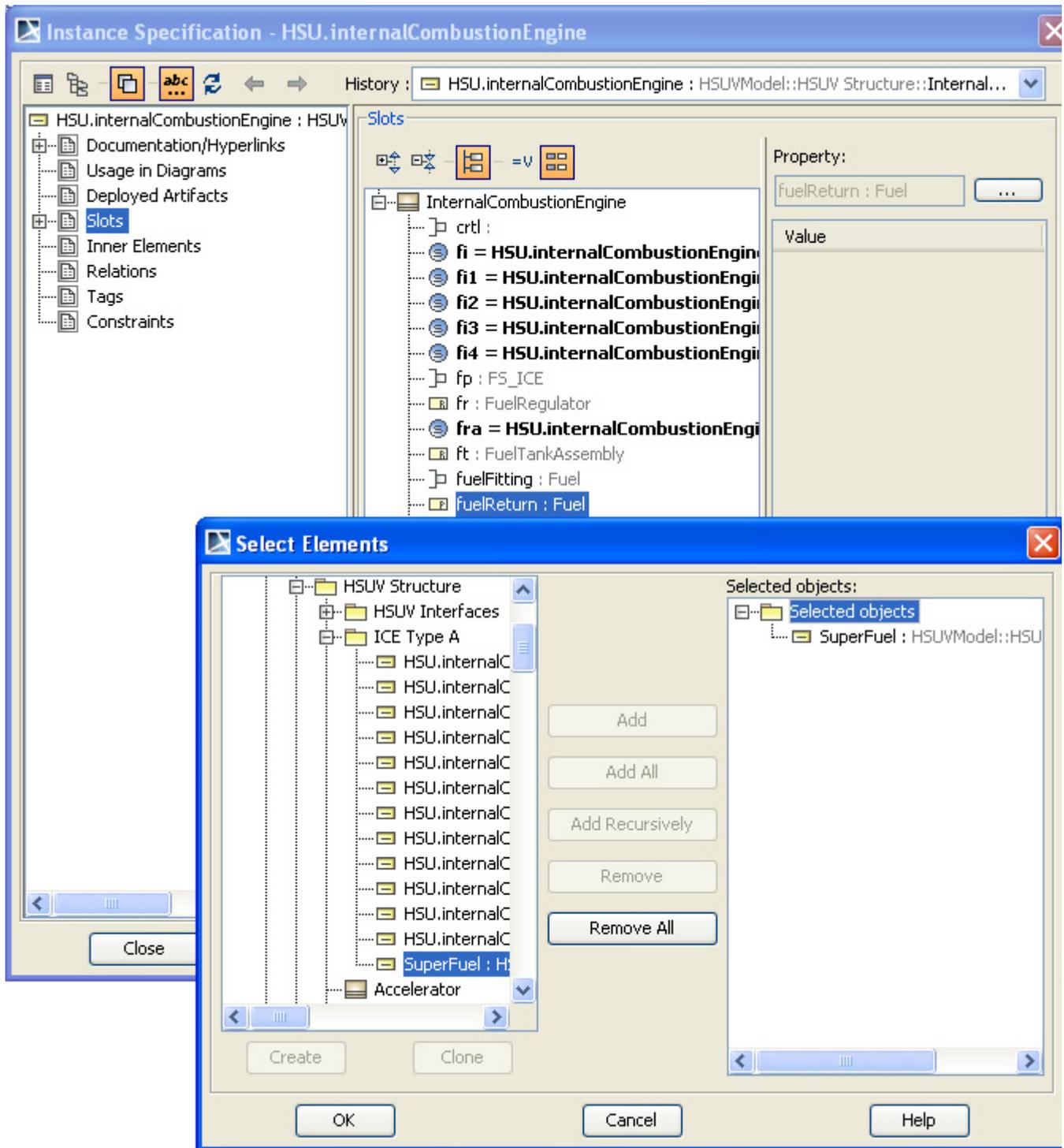


Figure 26 -- Changing slot value of "fuelReturn" property

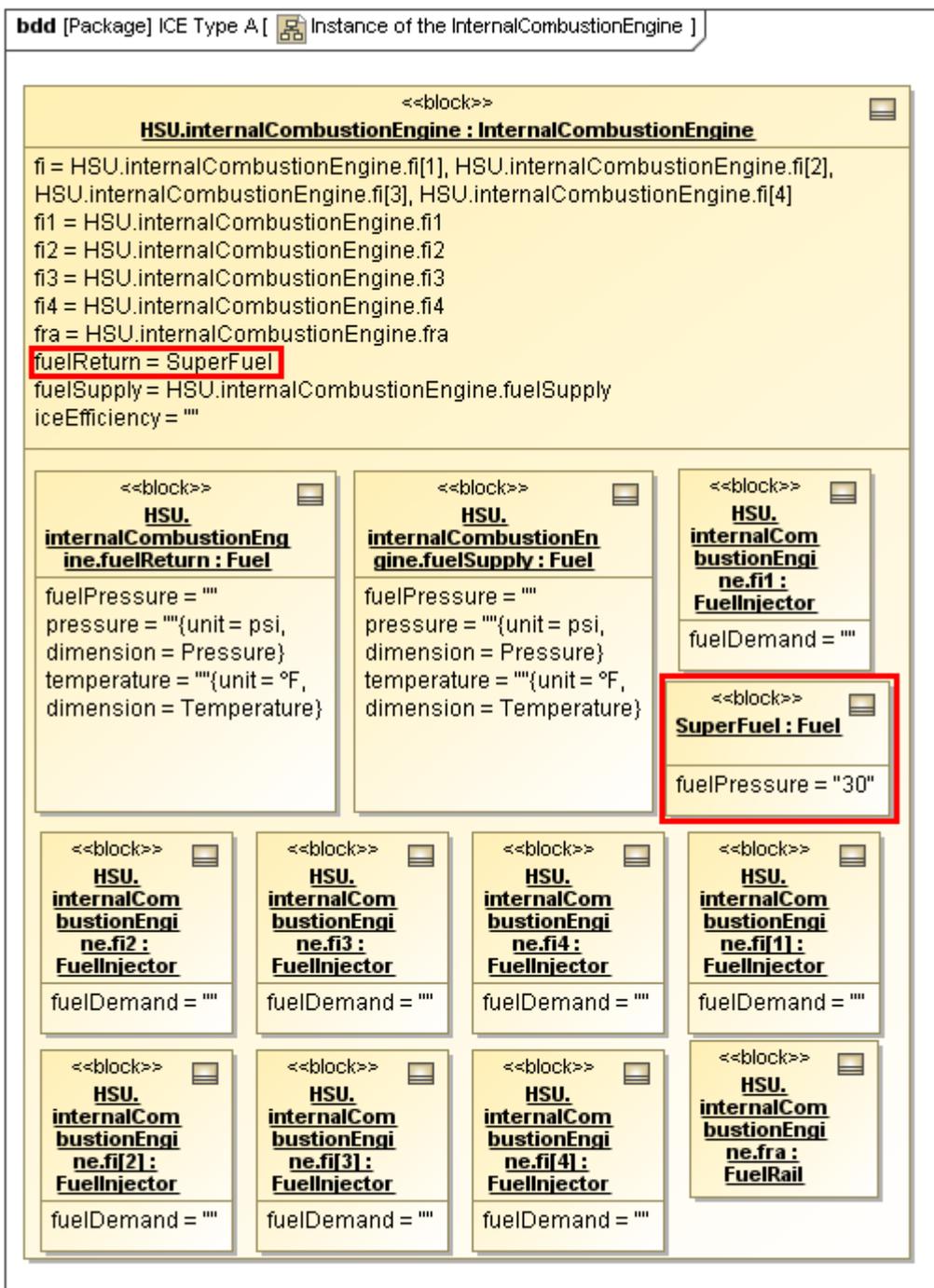


Figure 27 -- Instances after changing slot value of "fuelReturn" property

Case Study:

To automatically instantiate a Block to be used with ParaMagic Plugin

1. Right-click a block and select **Tools > Create Instance** on the shortcut menu. The **Automatic Instantiation Wizard** opens.



Note that ParaMagic sample projects are available in the `<md.install.dir>/samples/ParaMagic` directory after you installed ParaMagic Plugin. The `Satellite.mdzip` sample here is used to demonstrate how this feature works.

2. In **Step 1**, select the required properties as shown in the following figure and set the value for each value property of the instantiate classifier.
3. Click **Next**.

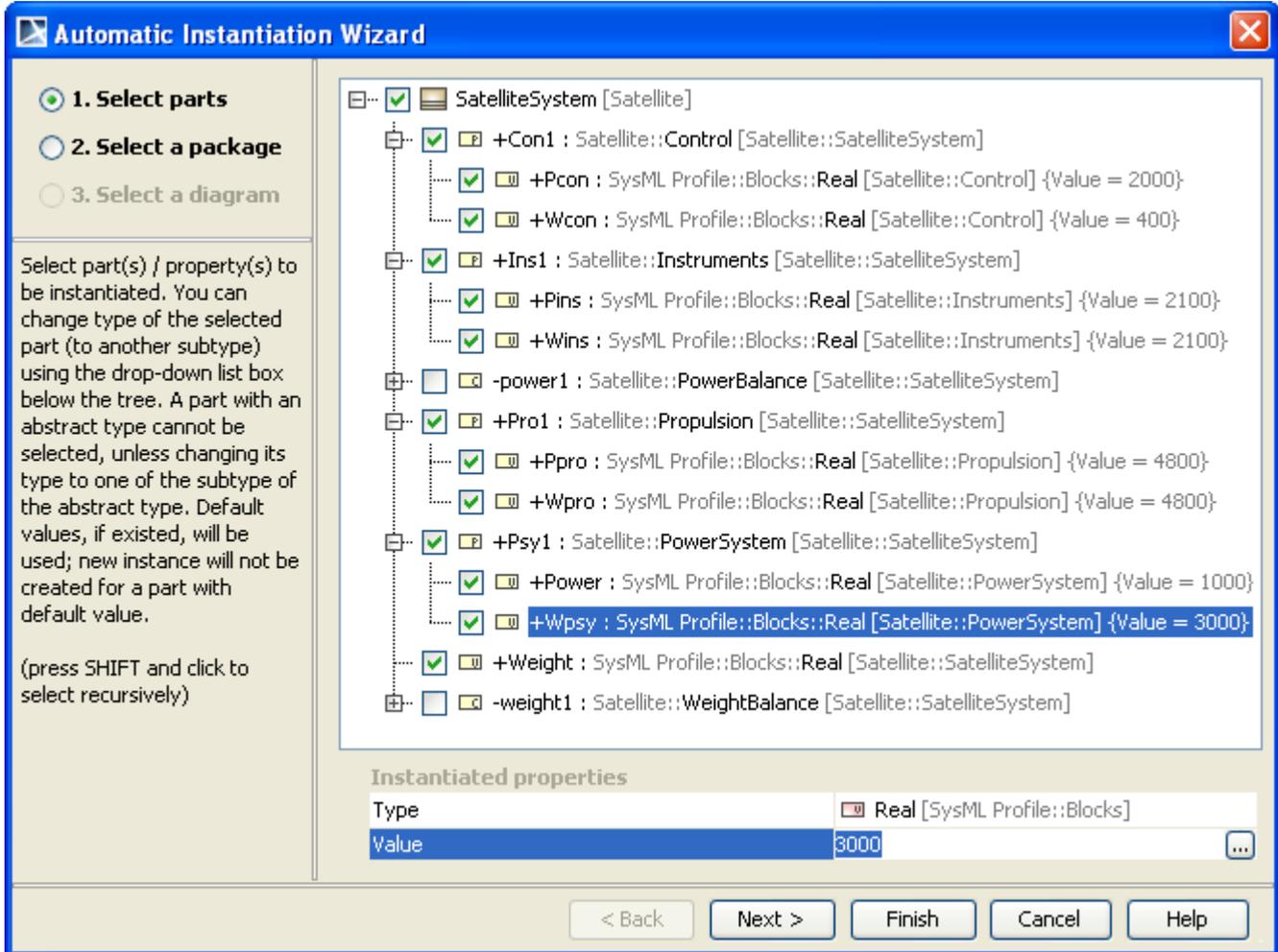


Figure 28 -- Automatic Instantiation Wizard - Step 1. Select parts

4. In **Step 2**, create a new package named **SatelliteInstance02** and click **Next**.

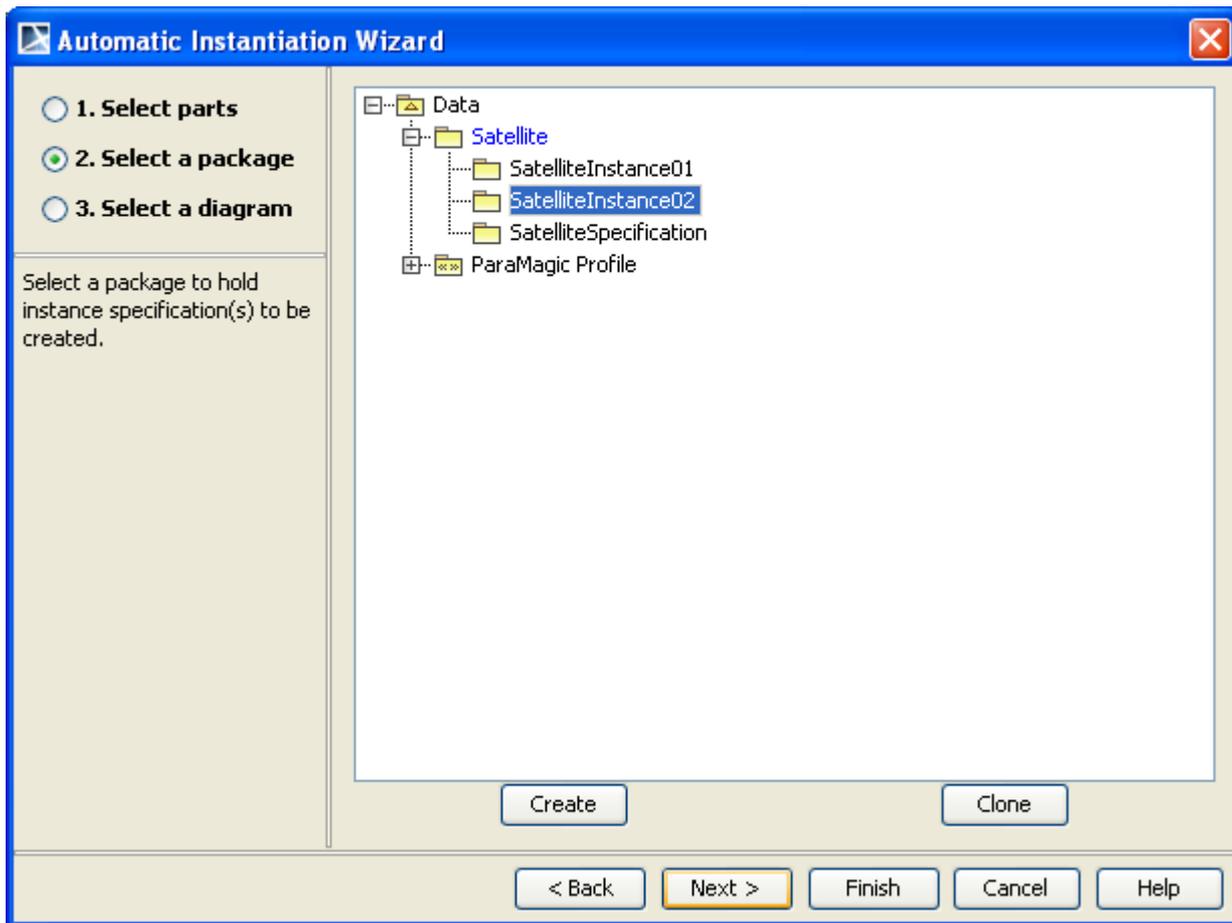


Figure 29 -- Automatic Instantiation Wizard - Step 2. Select a package

5. In **Step 3**, type: **SatInstance02BDD** in the **Type diagram name** box, and select **BDD** as the diagram type.

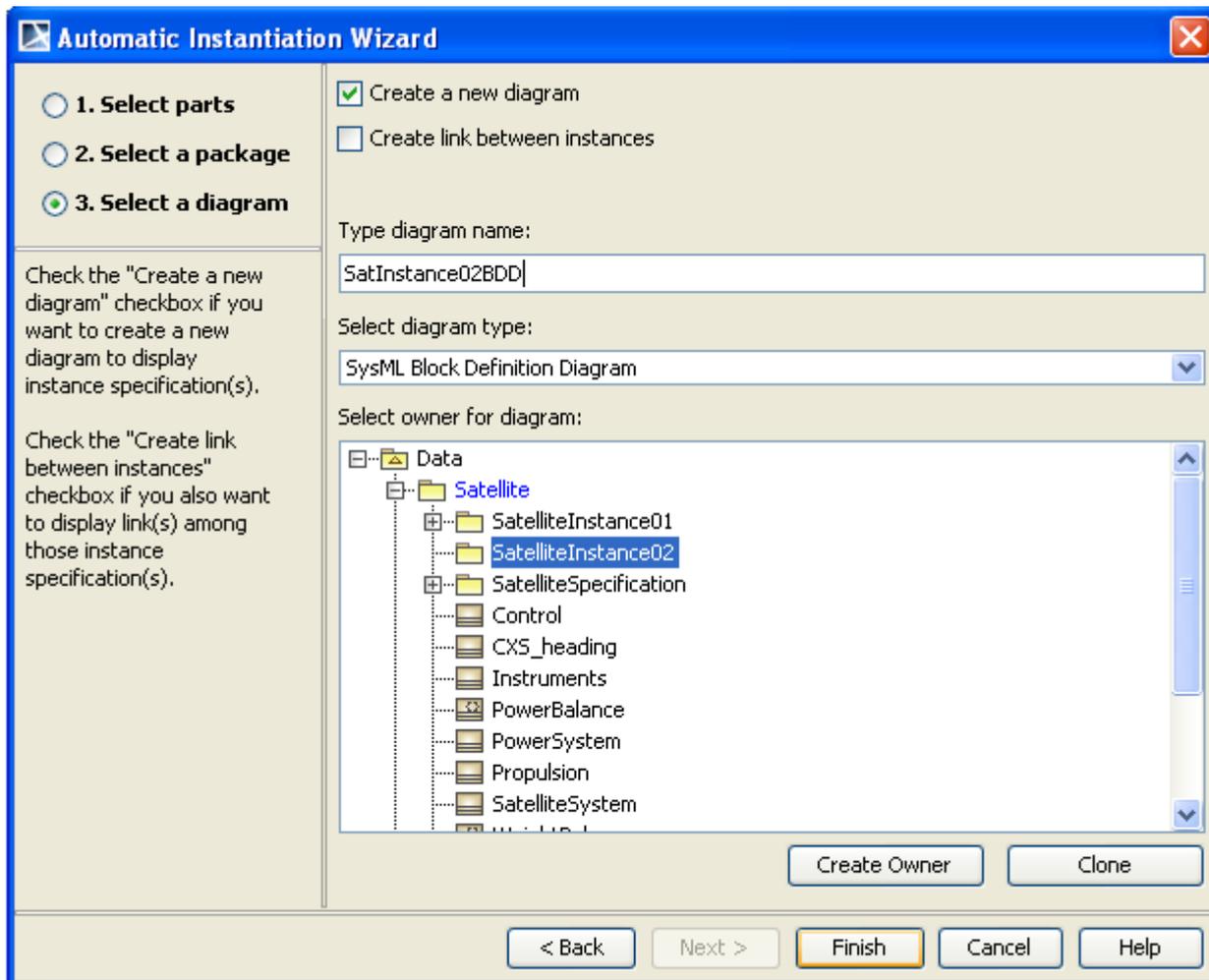


Figure 30 -- Automatic Instantiation Wizard - Step 3. Select a diagram

6. Click **Finish**. The **SatInstance02BDD** diagram will be created.

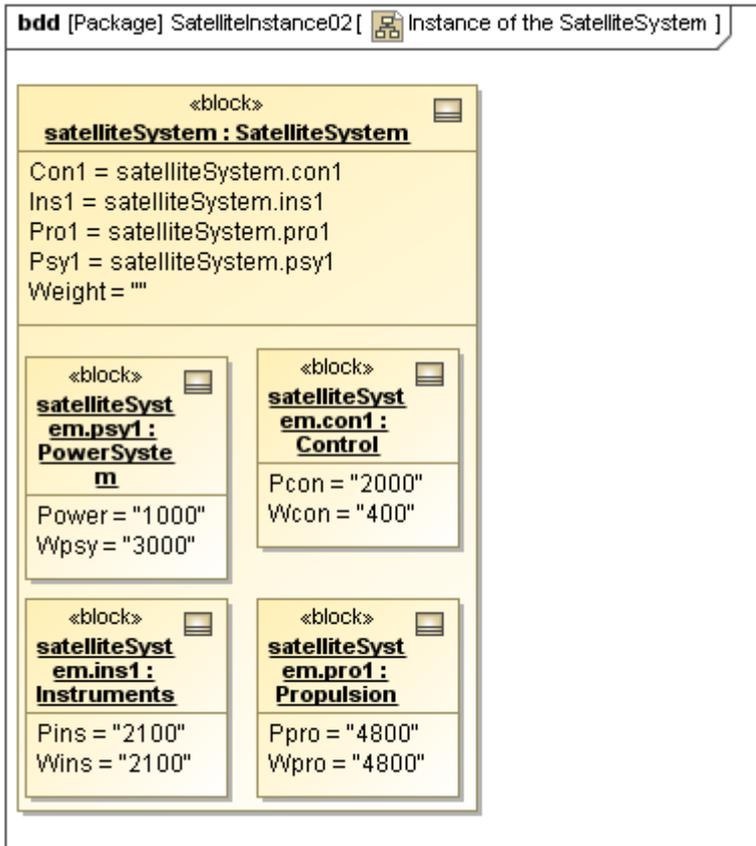


Figure 31 -- Example of instance created with Automatic Instantiation Wizard with initialized slots

7. Right-click the **SatelliteInstance02** package in the browser and select **ParaMagic > Util > Create CXI_heading**.
8. Right-click again and select **ParaMagic > Util > Add default causalities**. The package will then be ready for ParaMagic Plugin.
9. Right-click the **SatelliteInstance02** package in the browser and select **ParaMagic > Browse** to open the ParaMagic browser.

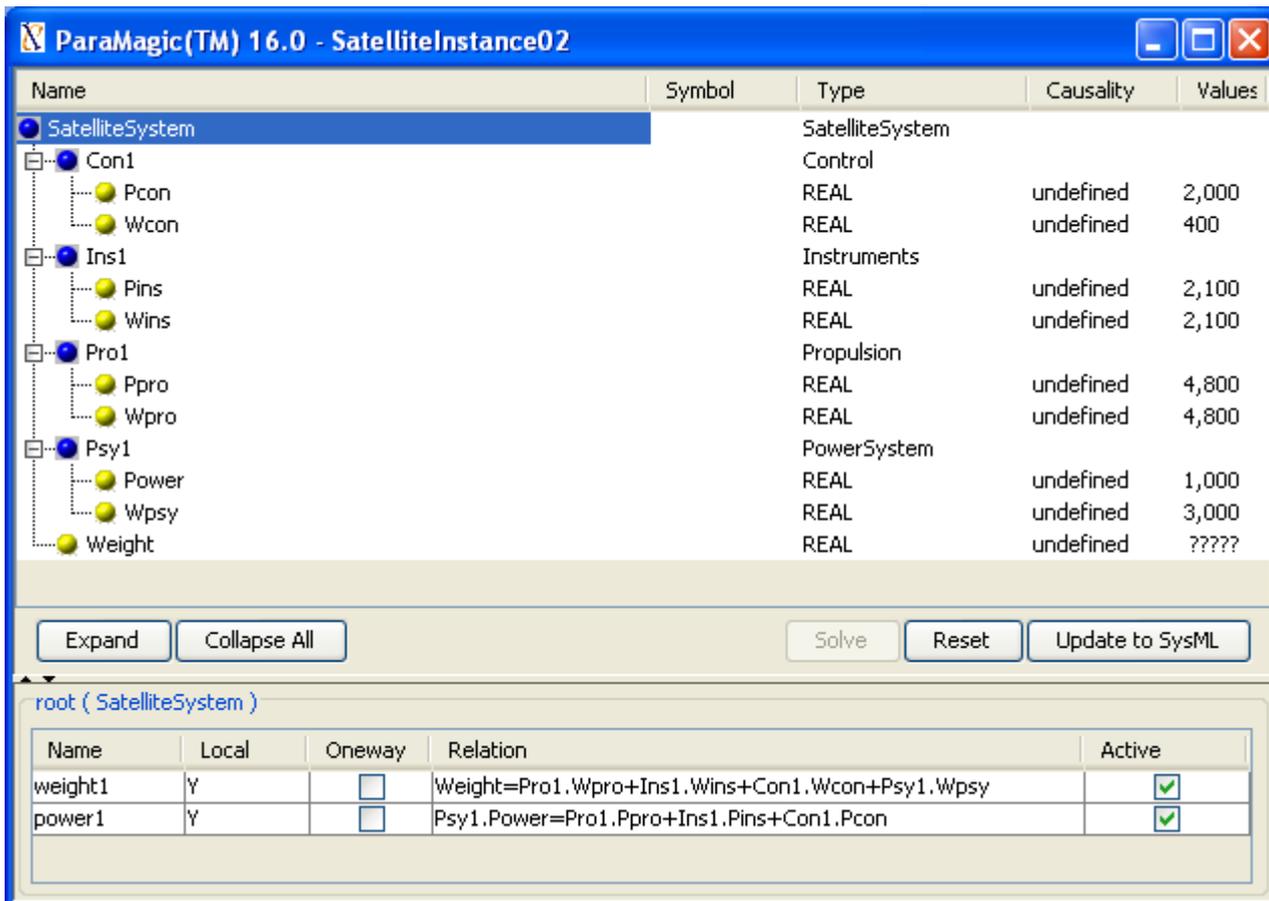


Figure 32 -- ParaMagic browser

10. You can then use this browser to calculate the values of the properties. For more information on how to use this browser, see ParaMagic User Manual.



TIP!

For more information about using the Automatic Instantiation Wizard, see Automatic Instantiation Wizard chapter in *MagicDraw UserManual.pdf*.

5.2.1.8 SysML callout box

To create a callout box showing the attributes, constraints, and tag values of an element

1. Do one of the following:
 - Create an anchored Note to the symbol of element on the diagram using the anchor button on the smart manipulator.
 - Create a **Note** by using the diagram toolbar and create anchor line to the symbol of element.
2. Either:
 - Click **Edit compartment** of anchored Note using the smart manipulator button on a Note.
 - Select the context menu items in **Edit Compartment** menu group.

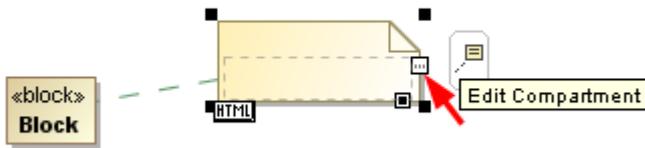


Figure 33 -- Edit Compartment manipulator button

3. The **Compartment Edit** dialog will open.

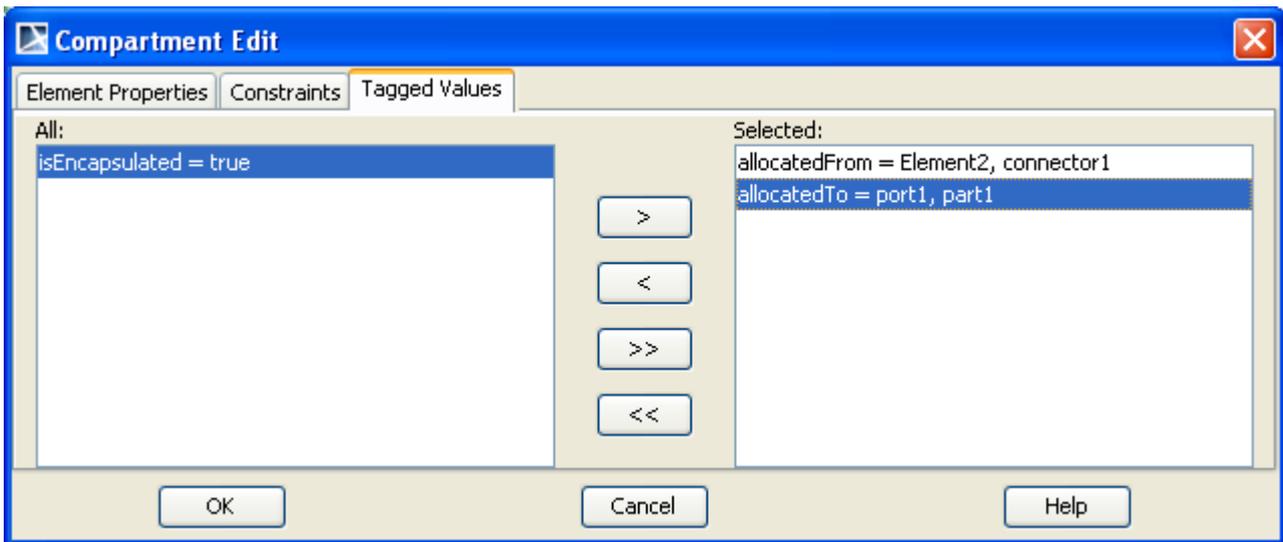


Figure 34 -- Compartment Edit dialog

4. Select the element properties, constraints, and tagged values that you want to show in the callout box. Then click **OK** to close the dialog.
5. Select **Show Tagged Values** on the context menu of Note symbol to show the selected tagged values in the callout box.

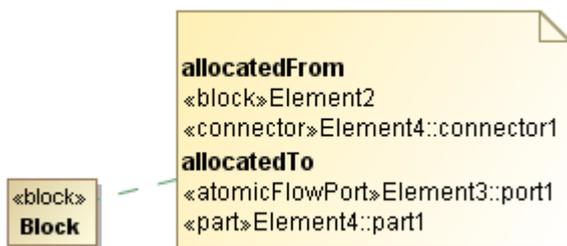


Figure 35 -- Callout box with SysML callout style

6. You can customize the way the callout box looks using the **Symbol Properties** dialog of Note symbol.
 - **SysML Callout Style** symbol property can be used to switch between MagicDraw standard callout style and the SysML callout style. By default, this property is set to true for the SysML project. With SysML callout style, the element types (for example, «block», «connector», «atomicFlowPort», and «part») will be shown instead of the icon of the tagged values which are the model elements.

- **SysML Element Type** symbol property can be used to show or hide the element types in the callout box when it is displayed with SysML callout style.

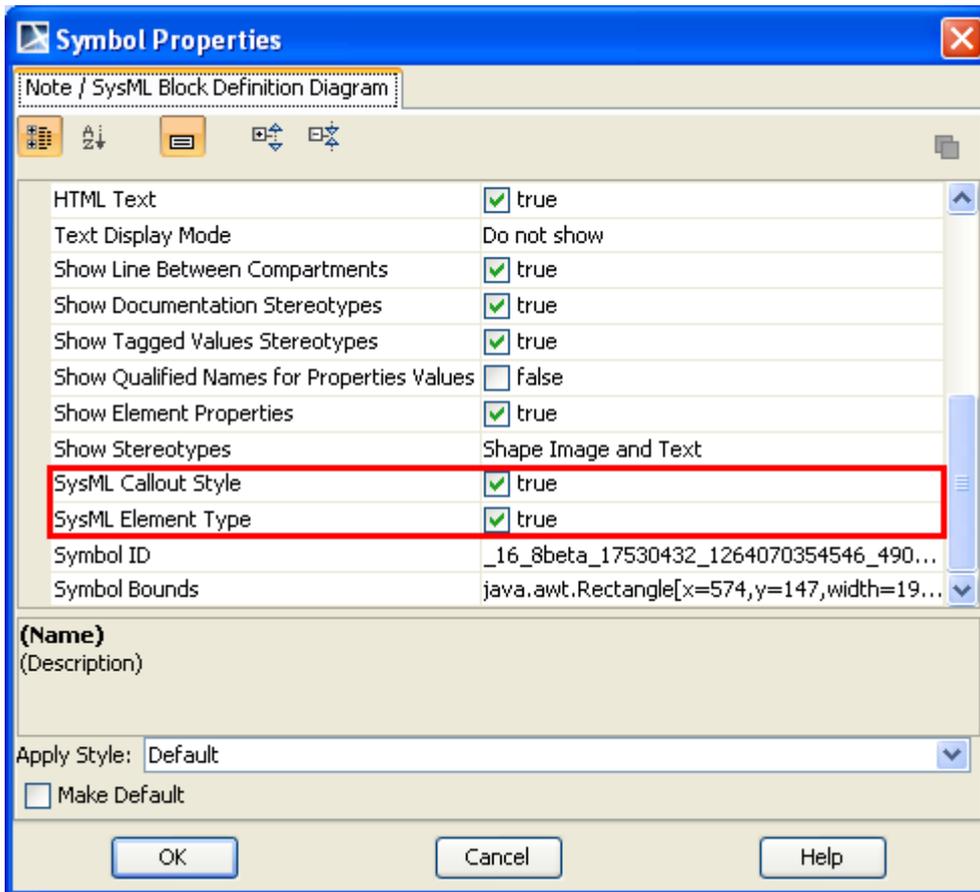


Figure 36 -- Symbol Properties dialog of callout box



The new callout notation applies to all types of SysML diagrams.

5.2.1.9 **NEW!** Managing Interfaces of the Block

All owned and inherited Ports and their Interfaces of the selected Block are collected on the left of the Block Specification window > **Ports/Interfaces**. Manage them by creating, redefining or deleting.

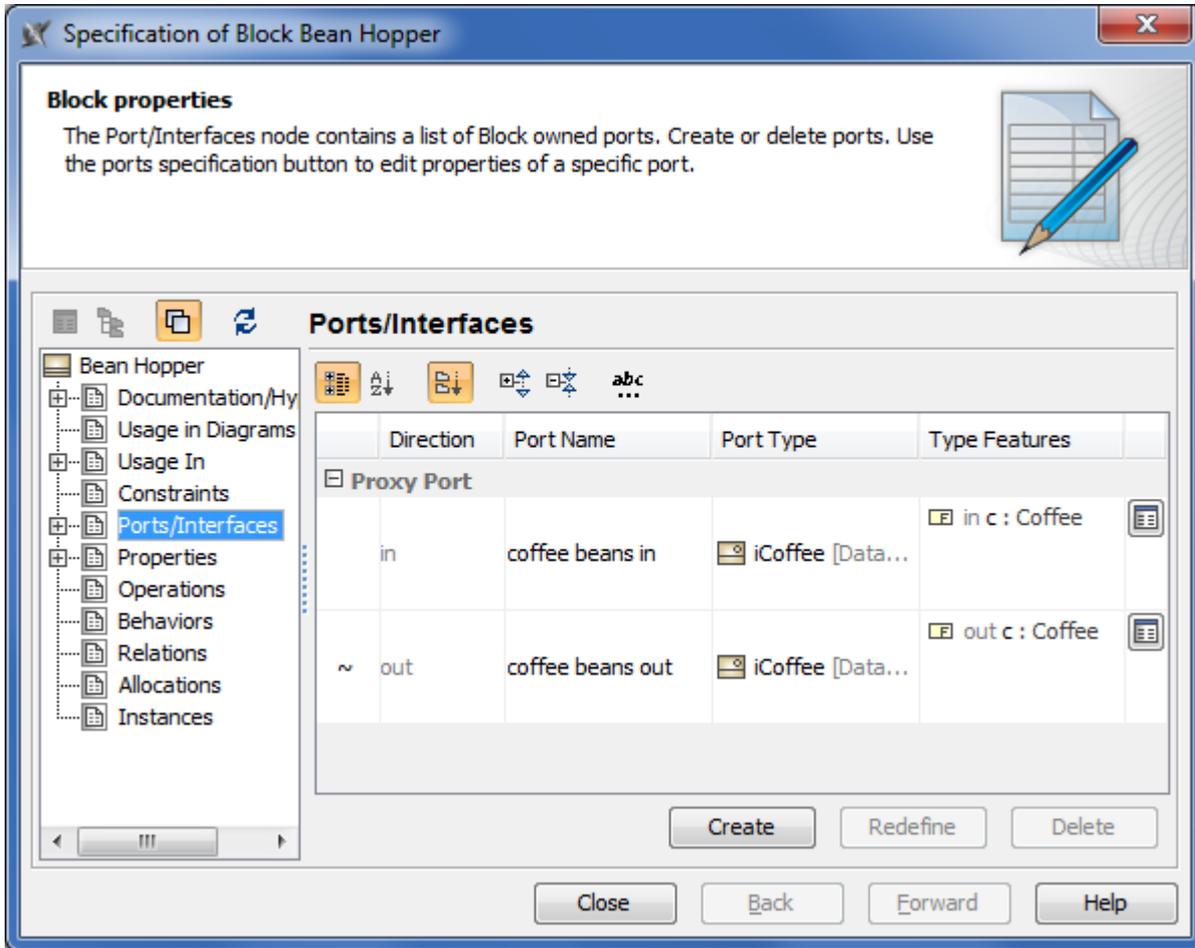


Figure 37 -- Block Specification window. Ports/ Interfaces node

Column name	Description
Direction	Direction prefix of the Port. The tilde symbol (~) appears before the direction prefix when the Port is conjugated.
Port Name	Name of the Port.
Port Type	Type of the Port.
Type Features	Features of the Port type

Button name	Description
	Opens the Specification window of the selected Port.
Create	Opens the list with the available to create properties. Click to create the Connector property, Part property, Reference property, Value property, Constraint property, Flow property.
Redefine	Duplicates the selected item and marks its name in ascending order.
Delete	Removes the selected item from the list.

5.2.1.10 **NEW!** Managing Block properties

All owned and inherited Block properties are collected on the left of the Block Specification window > **Properties**. Block properties are grouped as in the Block compartments. Manage them by creating, redefining or deleting directly in the General Specification pane.

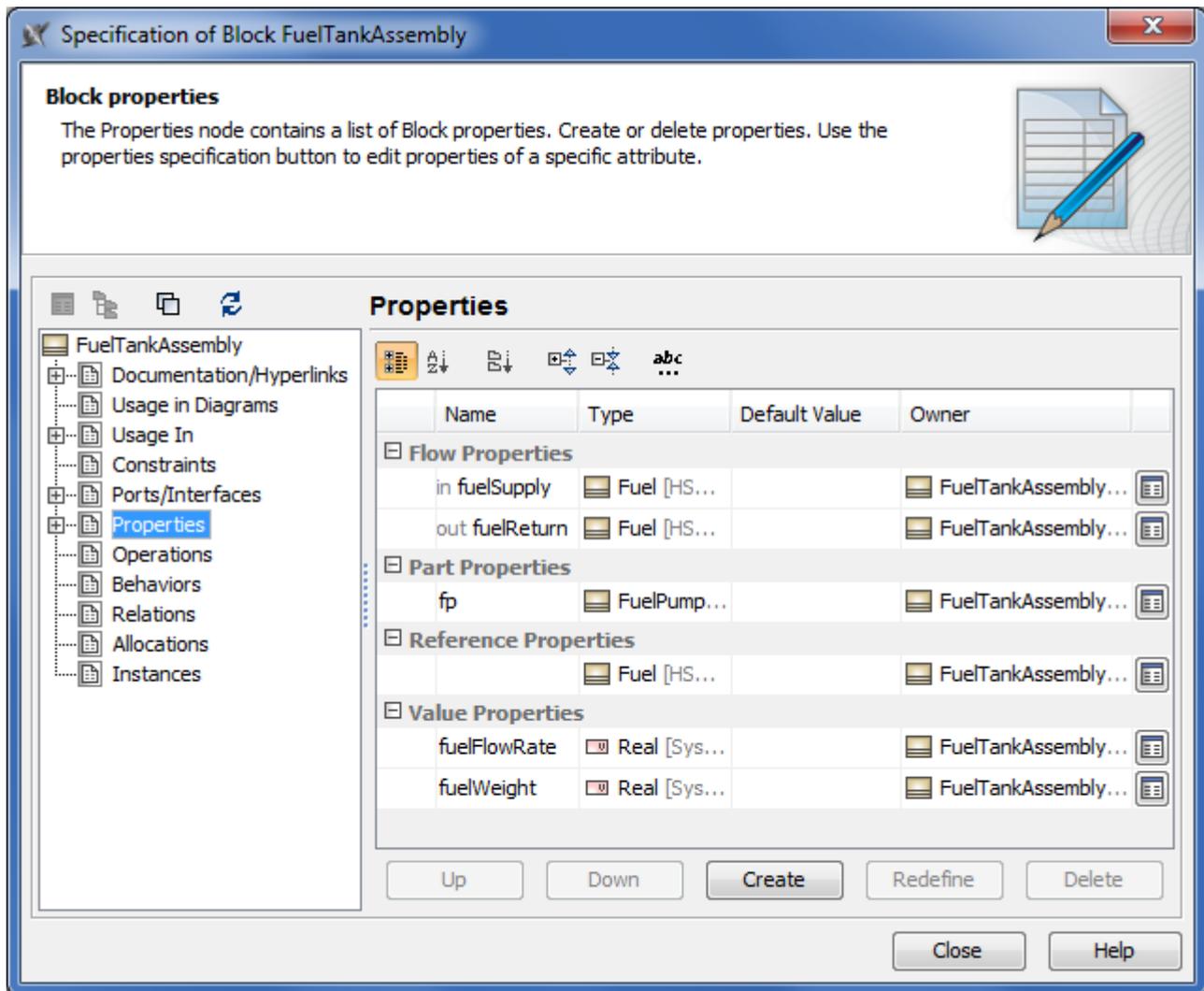


Figure 38 -- Block Specification window. Properties node

Column name	Description
Name	Property name.
Type	Property type.
Default Value	Property default value.
Owner	Block name that contains the current property.

Button name	Description
	Opens the Specification window of the selected property.
Create	Opens the list with the available to create properties. Click to create the Connector property, Part property, Reference property, Value property, Constraint property, Flow property.
Redefine	Duplicates the selected item and marks its name in ascending order.

Button name	Description
Delete	Removes the selected item from the list.

5.2.2 SysML Internal Block Diagram Procedures

The SysML IBD specific features include:

- [Creating Ports](#)
- [Displaying Parts](#)
- [Displaying Ports](#)
- [NEW! Displaying Direction Prefixes of Proxy and Full Ports](#)
- [NEW! Displaying Combined Direction on Proxy Port](#)
- [NEW! Displaying Direction Prefixes of Flow Property](#)
- [Using Edit Compartment](#)
- [Show Default Value and Show Slot Type](#)
- [Provided/Required Interfaces](#)
- [NEW! Managing Interfaces of the Proxy Port](#)
- [Create Directed Features and Specify Feature Directions](#)
- [Displaying Structures of Blocks in Compartments and IBDs](#)

5.2.2.1 Creating Ports

You can easily create full and proxy ports.

A full port is a part on a boundary. You can now easily convert your parts into full ports by dragging them to the diagram frame. All ports, connectors, other information, including the layout will remain unchanged.

To convert a part to the full port

1. Select a part and drag it to the diagram frame.
2. When the diagram frame is highlighted, release the part. The full port is created on the diagram frame.



When the full port is created on the diagram frame, you cannot drag it back (except Undo the conversion).

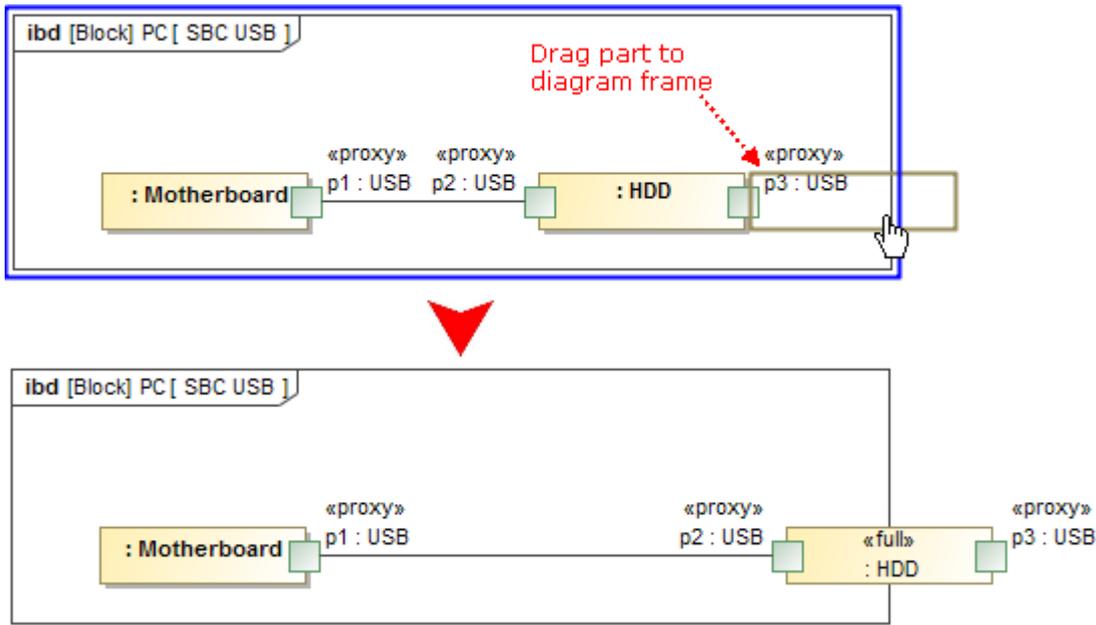


Figure 39 -- Part converted to full port

To create a proxy port

1. Select a part or a port on the part and from the smart manipulator toolbar select Connector.
2. Attach a connector to any part or diagram frame. The appropriate port is created.

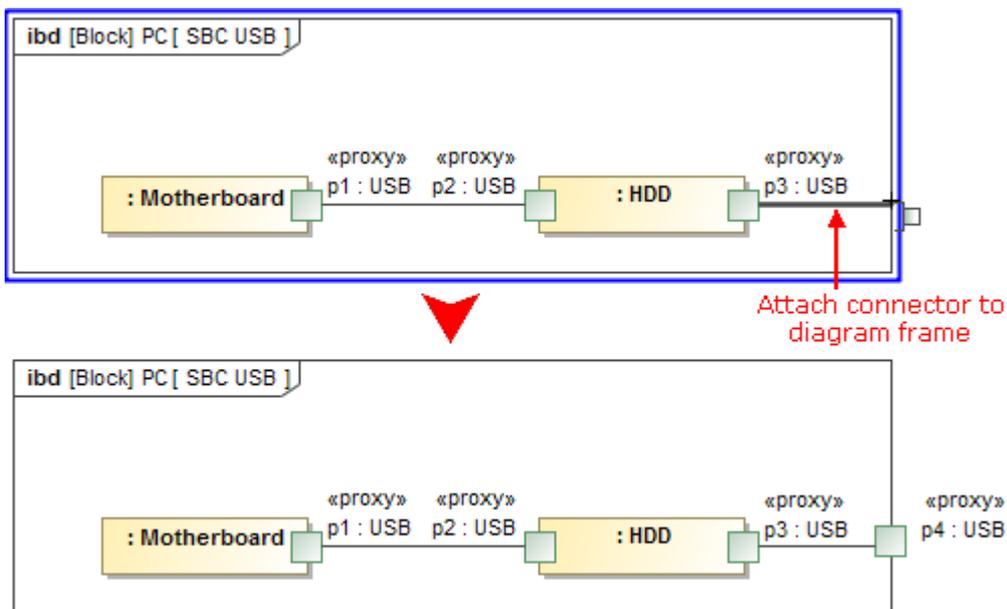


Figure 40 -- Creating proxy port

5.2.2.2 Displaying Parts

If you have already defined the parts (properties) of a Block, you can then display the parts on any IBD, having the Block as its context.

To display parts in IBD

1. Right-click IBD and select **Related Elements > Display Parts**. All the parts selected will be listed in the **Select Parts** dialog.

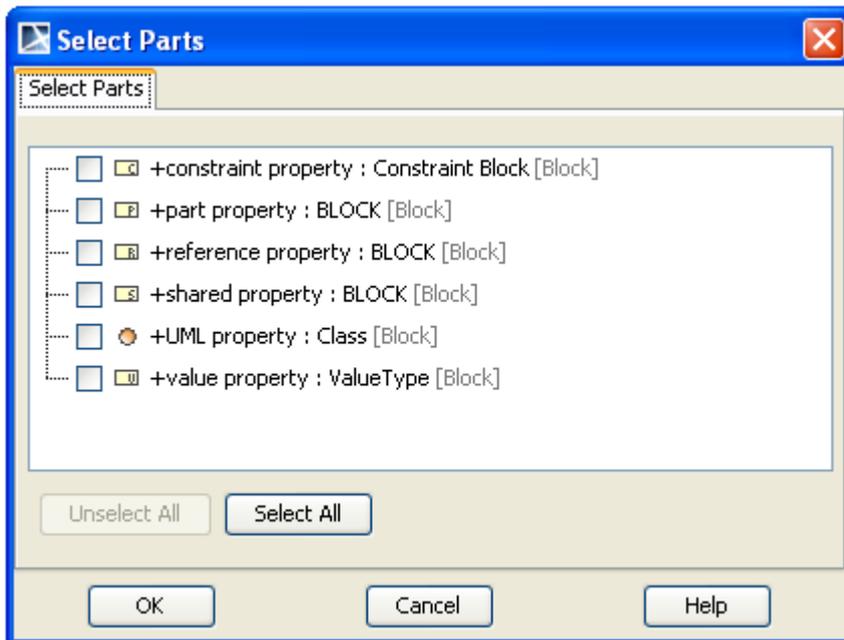


Figure 41 -- Select Parts dialog

2. Select parts and click **OK** to show the selected parts on the IBD.

5.2.2.3 Displaying Ports

If you have already defined the port(s) / flow port(s) of a Block, you can then display the port(s) / flow port(s) / full port(s) / proxy port(s) on any part typed by the Block.

To display ports / flow ports on a part on an IBD

1. Do one of the following:
 - Select **Related Elements**. If the type (classifier) of the part owns at least one port/flow port, the **Display Ports** option will be enabled for you to select. Select this option.
 - Click the **Display Ports** icon on the **Smart Manipulator** menu of the part.



Figure 42 -- Property smart manipulator menu to display ports

2. All ports (including flow ports) will then be listed in the **Select Parts** dialog.
3. Click **OK** to view the selected (checked) port(s) on the part symbol.

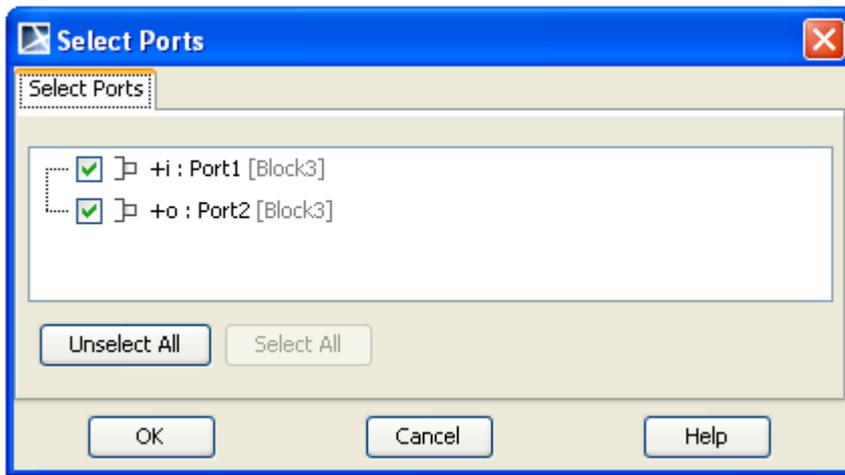
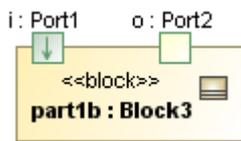


Figure 43 -- Select Ports dialog

4. The selected ports will then be displayed on the part symbol.



5.2.2.4 **NEW!** Displaying Direction Prefixes of Proxy and Full Ports

Directions of Proxy and Full Ports can be identified with help of direction prefixes.

The Proxy Port direction prefixes are displayed:

- On Blocks (1). To hide the Proxy Port direction prefixes on the Block, set the **Show Proxy Port Direction in Compartment** property value to *false* in the **Symbol Properties** dialog of that Block.

The Proxy and Full Port direction prefixes are displayed:

- In the Model Browser (2).
- On the Port shape when its name is displayed inside the shape (3). For this, open the **Symbol Properties** dialog of the Proxy or Full Port and select **Name and Type Labels Inside** or **All Labels Inside** as the **Position of Labels** property value. To hide the direction prefix on the Port shape, set the **Show Direction Prefix Inside Port** property value to *false* in the **Symbol Properties** dialog of that Port.
- On the ToolTip which opens when you move the pointer over the Proxy or Full Port or their names (4).

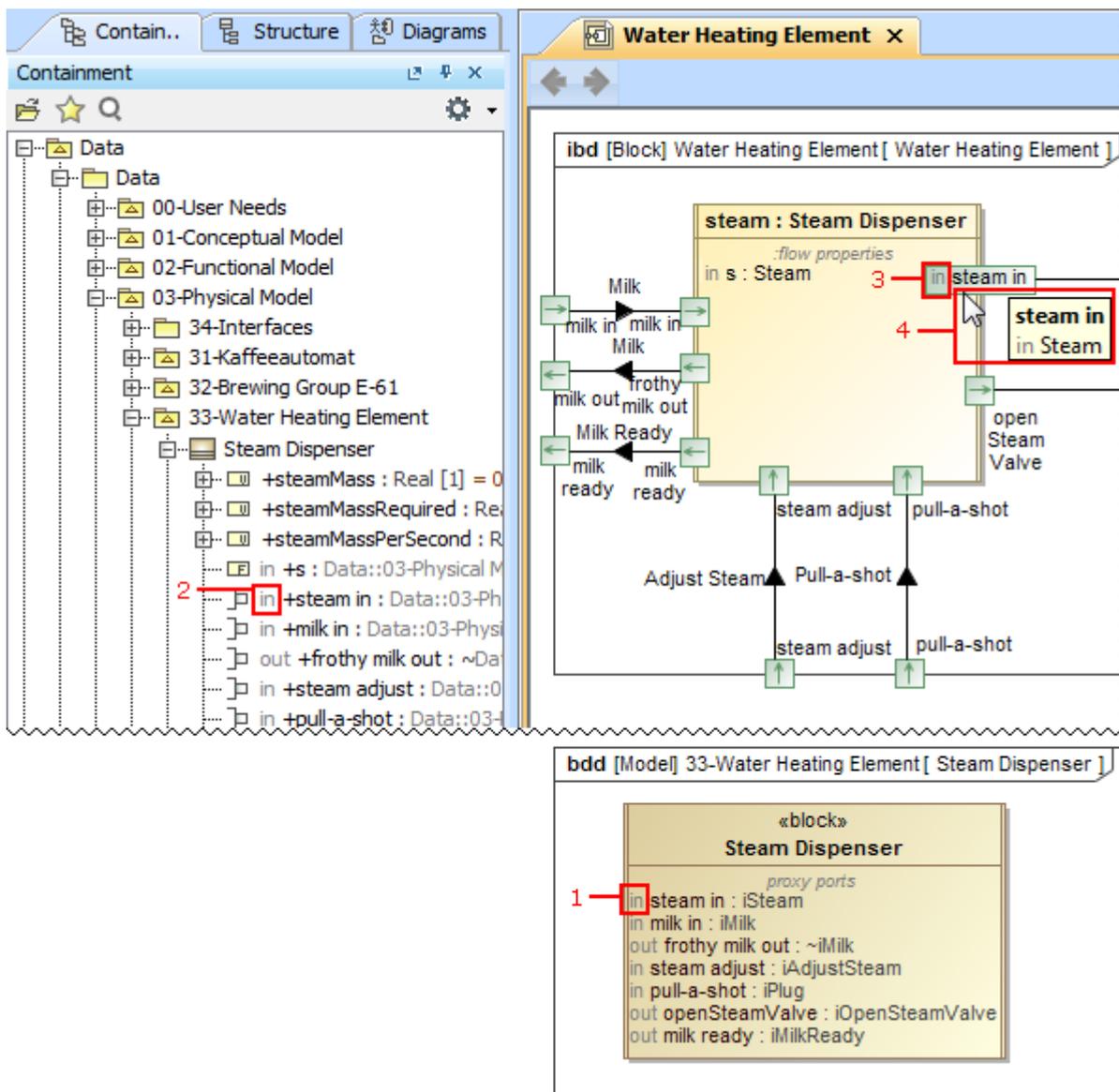


Figure 44 -- Places of displaying Proxy or Full Port's direction prefixes

5.2.2.5 NEW! Displaying Combined Direction on Proxy Port

Combined direction consists of all owned and inherited flow properties and directed features of the Proxy Port. The flow properties direction are shown by default on the Proxy Port shape. To include directed features into combined direction of the Proxy Port set the **Include Directed Features into Combined Direction of Proxy Port** property value to *true* in the **Project Options** dialog.

If all features have direction "out" or "provided", the combined direction is "out". If all features have direction "in" or "required", the combined direction is "in". Otherwise the direction is "inout".

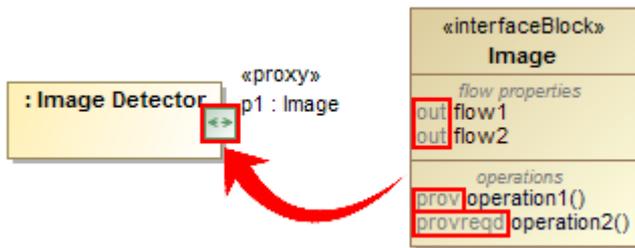


Figure 45 -- Proxy Port's combined direction including directed features

5.2.2.6 NEW! Displaying Direction Prefixes of Flow Property

Directions of flow property can be identified with help of direction prefixes.

The flow property direction prefixes are displayed:

- On Parts (1). To hide flow property direction prefix on the Part, set the **Show Flow Property Direction in Compartment** property value to *true* in the **Symbol Properties** dialog of that Part.
- In the Model Browser (2).

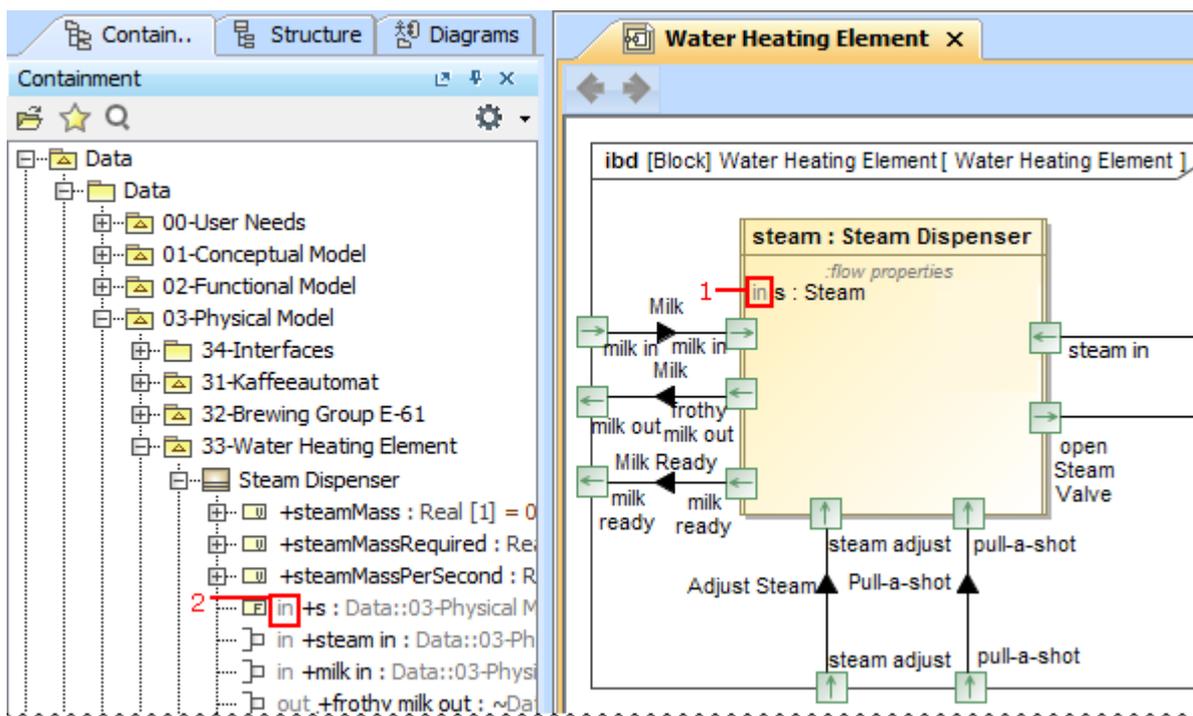


Figure 46 -- Places of displaying flow property's direction prefixes

5.2.2.7 Using Edit Compartment

You can customize elements to be displayed in the various compartments of a part. Such compartments include Constraints, Tagged Values, Default Value, Structure, and many more.

To customize a compartment of a part

1. Right-click a part and select **Edit Compartment** on the shortcut menu.

2. Select a compartment to be customized. The **Compartment Edit** dialog will open.
3. In the **Compartment Edit** dialog, move an element from the **All:** to the **Selected:** box to display the element.
4. Click **OK** when done.

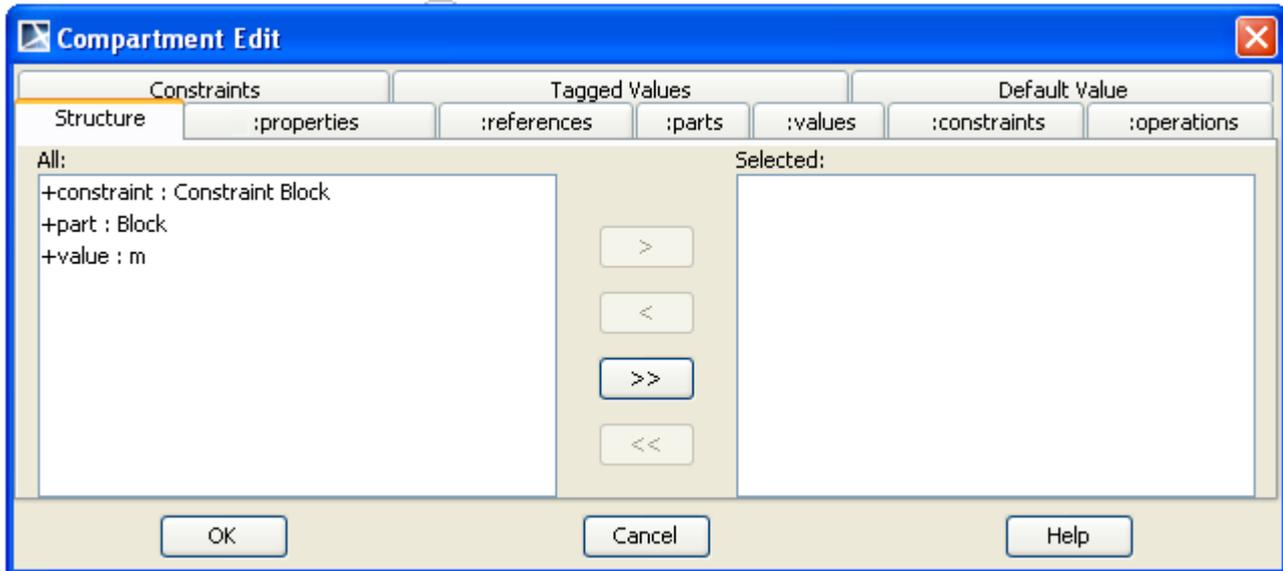


Figure 47 -- Compartment Edit dialog

5.2.2.8 Show Default Value and Show Slot Type

Use **Show Default Value** to display the default value of a part. If the default value is an Instance Specification, the **defaultValue** compartment containing the Instance Specification slots will be displayed on the part instead. In this case, you can use **Show Slot Type** to display the types of the slots) in the compartment.

Show Default Value

To display the default value of a part (property)

1. Right-click a part or property and select **Show Default Value** (if it already has a default value) on the shortcut menu.



If the property has no default value, drag an instance with slot(s) to the property symbol. The instance will then be assigned as the default value for this property, and its slots with values will be displayed inside the property symbol.

2. The default value of the property will be displayed. If the default value is an Instance Specification, the **defaultValue** compartment containing the Instance Specification slot(s) will be displayed instead.

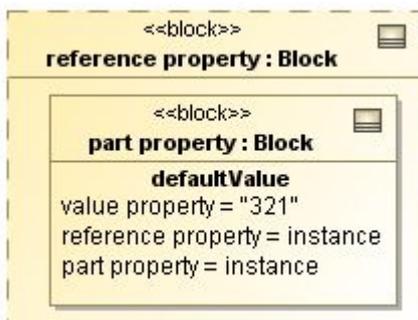


Figure 48 -- defaultValue compartment

Show Slot Type

Use the Show Slot Type shortcut menu to display the slot types in the default value compartment of a property, having an Instance Specification as its default value:

To display the slot types of a part

1. Right-click a property and select **Show Slot Type** on the shortcut menu. Three **Show Slot Type** options will be available on the shortcut menu
 - None (no type slot will be displayed)
 - Name
 - Qualified Name
2. If you select **Name** or **Qualified Name**, the slot types will be displayed.

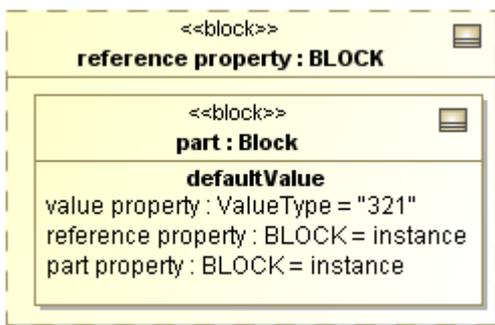


Figure 49 -- defaultValue compartment with slot types

5.2.2.9 Provided/Required Interfaces

Provided/Required Interfaces help identify compatible ports that can be connected together in an IBD. On a port, you can

- create a new Provided/Required Interface using the port specification dialog, or
- display an existing Provided/Required Interface using the port shortcut menu.

Creating New Provided/Required Interfaces Using the Port Specification Dialog

To create new Provided/Required Interface of a port

1. Do one of the following:
 - Right-click a port to open its shortcut menu, and then select **Specification** to open the **Specification** dialog. Then, select the **Provided/Required Interfaces** group to open the **Provided/Required Interfaced** pane.

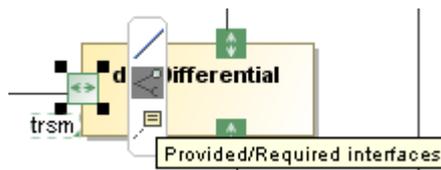


Figure 50 -- Port Smart Manipulator Menu - Provided/Required interfaces

- Click a port in a diagram to open its smart manipulator menu, and then select the **Provided/Required interfaces** icon to open the **Provided/Required Interfaced** pane.

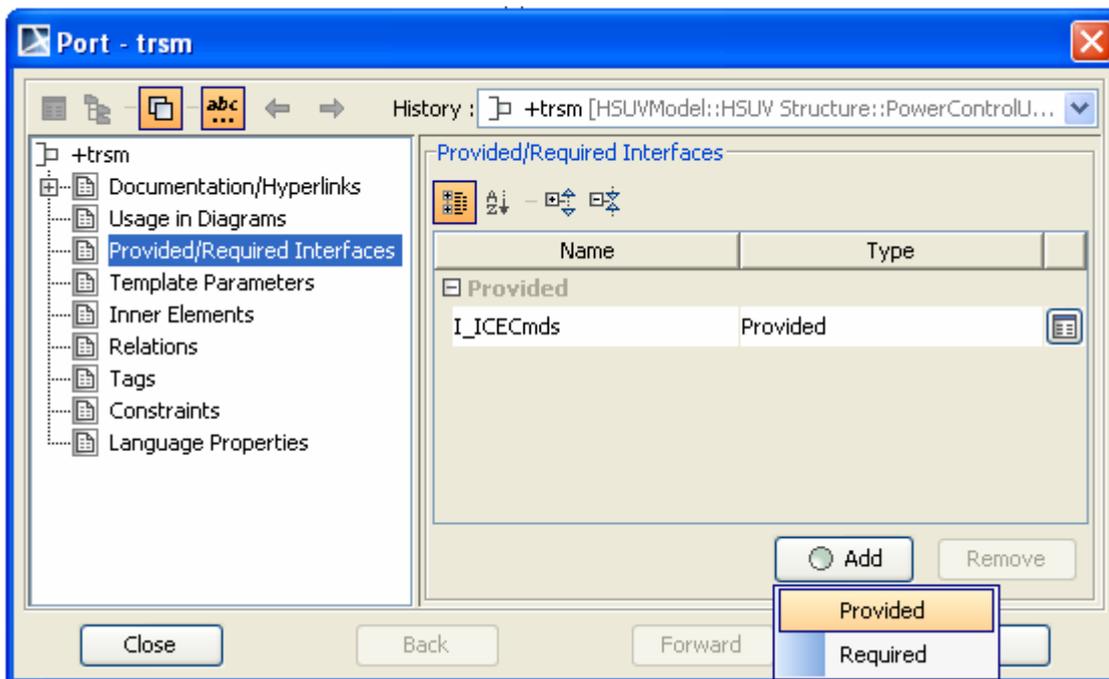


Figure 51 -- Port Specification window, Provided/Required Interfaces group



Only typed ports can **realize / use** interfaces.

2. Click **Add** and then select either **Provided** or **Required**.

Case Study #1:

If the port is typed, the **Select Interface** dialog will open. You can either:

- select any of the existing interfaces (and flow specifications) to be used as the Provided / Required Interface of the port, or
- click **Create** to create a new interface. The interface specification dialog will then be displayed, prompting you to type in its name. The new interface will then be used as the Provided / Required Interface of the port.

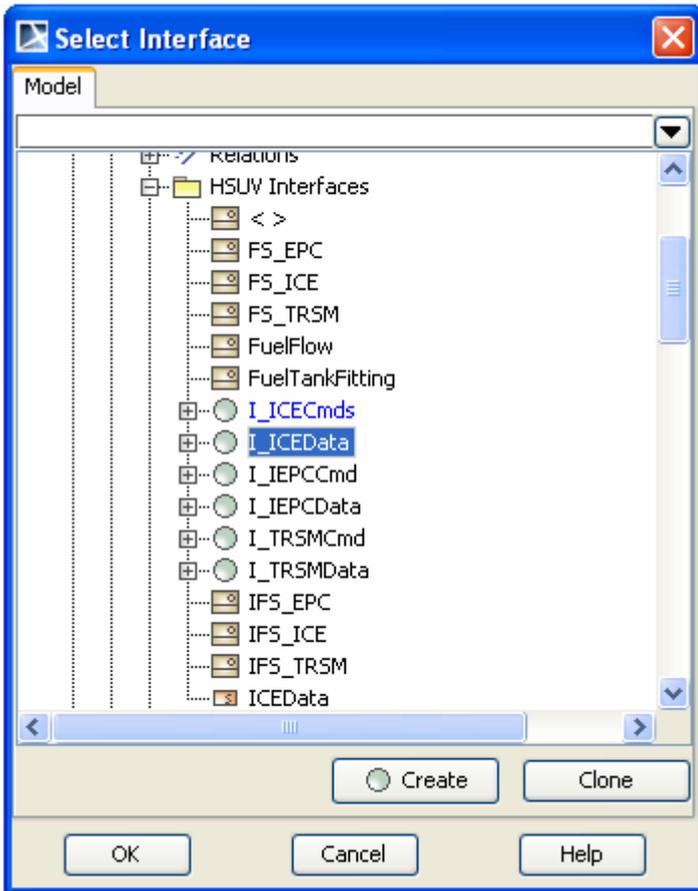


Figure 52 -- Select Interface dialog

Case Study #2:

If the port is not typed, the **Select Port Type** menu will then display.



Figure 53 -- Select Port Type menu - Provided Interface



Figure 54 -- Select Port Type menu - Required Interface

You can then select:

- (For Provided Interface only) **Set provided interface as port type**. The **Select Interface** dialog will then open. In the dialog, you can either choose an existing interface or create a new one, to be used as the Provided Interface and the type of the port.

- **Create “dummy” port type automatically.** The **Select Interface** dialog will then open. In the dialog, you can either choose an existing interface or create a new one, to be used as the Provided or Required Interface of the port. In addition, a dummy classifier, realizing (for Provided) or using (for Required) the interface, will be automatically created and used as the type of the port.
- **Select or create port type manually.** The **Select Port Type** dialog will then open. You can then choose a classifier to be used as the type of the port. Click **OK**, the **Select Interface** dialog will then open. In the dialog, you can either choose an existing interface or create a new one, to be used as the Provided or Required Interface of the port. In addition, a Realization (or Usage) dependency will be automatically created from the port type to the Provided (or Required) Interface of the port.

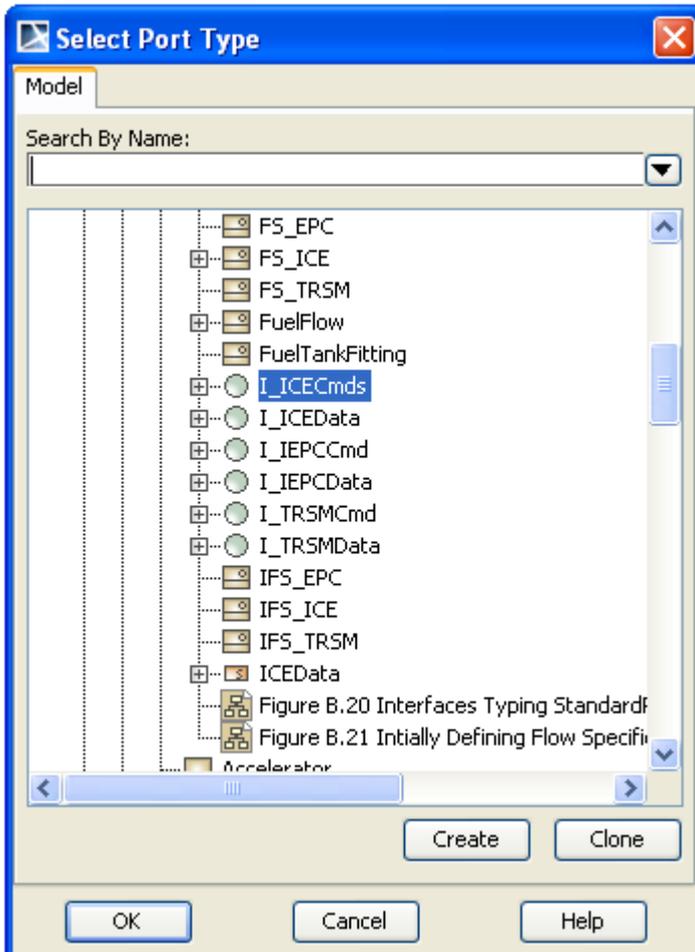


Figure 55 -- Select Port Type dialog for Provided / Required interface

Displaying Existing Provided/Required Interfaces

To display the existing Provided/Required Interface of a port

1. Right-click a port to open its shortcut menu and do one of the following:
 - select **Show Required Interfaces** or **Show Provided Interfaces**
 - select **Related Elements > Display Provided/Required Interfaces**
2. The Required / Provided Interfaces will be displayed on the port, in the form of ball-socket (lollipop) notation.

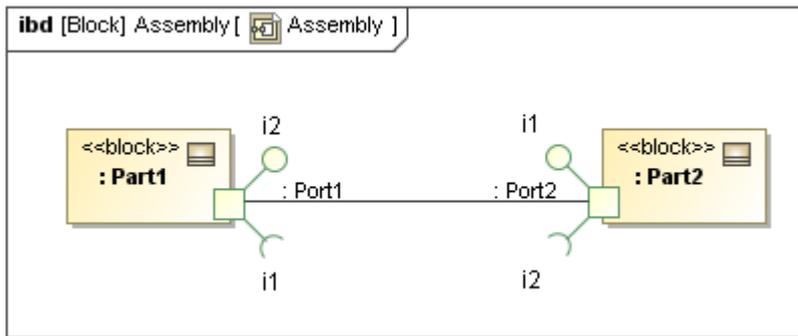


Figure 56 -- IBD with required and provided interfaces displayed

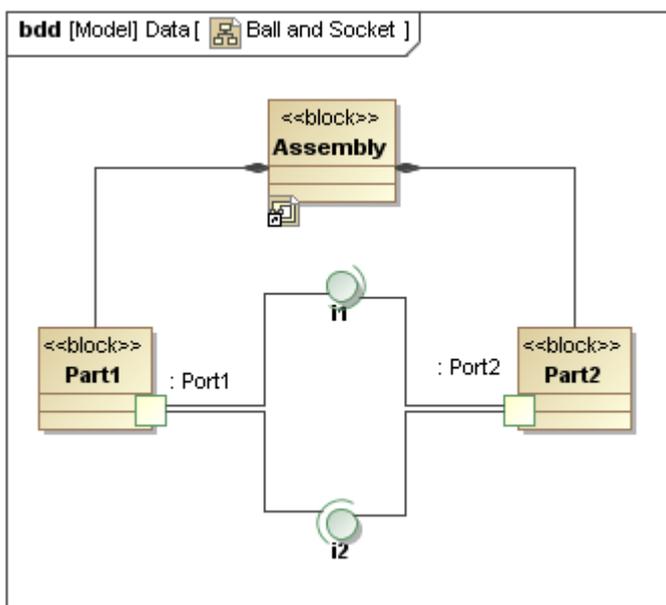


Figure 57 -- BDD with parts, ports, and interfaces

5.2.2.10 **NEW!** Managing Interfaces of the Proxy Port

The detailed information about Proxy Port interface is collected on the left of the Port Specification window > **Interface Block Properties**.

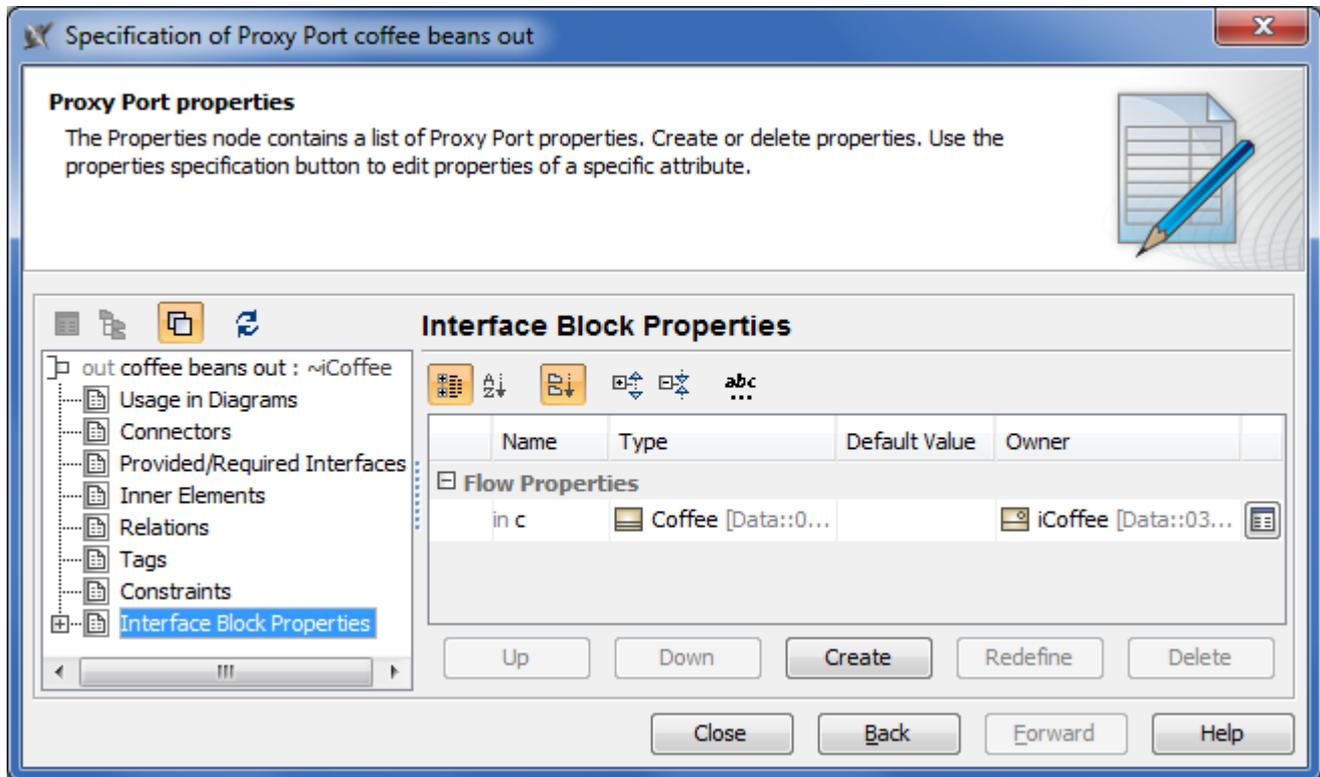


Figure 58 -- Proxy Port Specification window. Interface Block Properties Node

Column name	Description
Name	Compartment name.
Type	Compartment type.
Default Value	Use to set the value manually.
Owner	Interface Block which is the owner of the selected Proxy Port.

Button name	Description
	Opens the Specification window of the compartment
Up	Move item to upper position in the list. The items are automatically renumbered after moving.
Down	Move item to lower position in the list. The items are automatically renumbered after moving.
Create	Opens the list with the available to create properties. Click to create the Value property, Flow property or Reference property.
Redefine	Duplicates the selected item and marks its name in ascending order.
Delete	Removes the selected item from the list.

5.2.2.11 Create Directed Features and Specify Feature Directions

The directed feature is a Feature element that applies the «DirectedFeature» stereotype. MagicDraw SysML plugin provides the diagram context menu to specify the feature direction of the selected feature. When you set the feature direction to the selected feature, it will apply the «DirectedFeature» stereotype automatically.

To specify a feature direction

1. Right-click a feature's symbols owned by a block such as part, attribute, operation, and signal reception.
2. Go to **Feature Direction** and select one of the directions of the feature.

5.2.2.12 Displaying Structures of Blocks in Compartments and IBDs

Composite Structure diagrams will not let you display the already-defined internal structures of Blocks reused as parts in other structures (deep-nested structures). The same limitation exists when you need to modify or extend existing structures in subtypes. Composite Structure diagrams will only let you display:

- Parts
- Nested parts
- Ports on the frame
- Ports on every part
- Paths for every part and port

Nested parts can be displayed with the dot notation in addition to using structure compartment. In the Display Parts dialog, when only the nested part property of a class is selected, that class with the nested part property selected will be displayed with the name of the class that contains the nested part property inside and the name of the nested part, separated from each other with the dot notation.

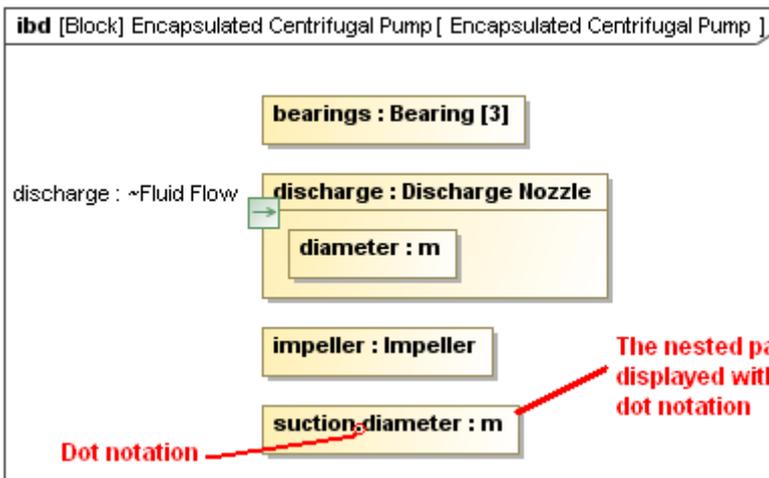
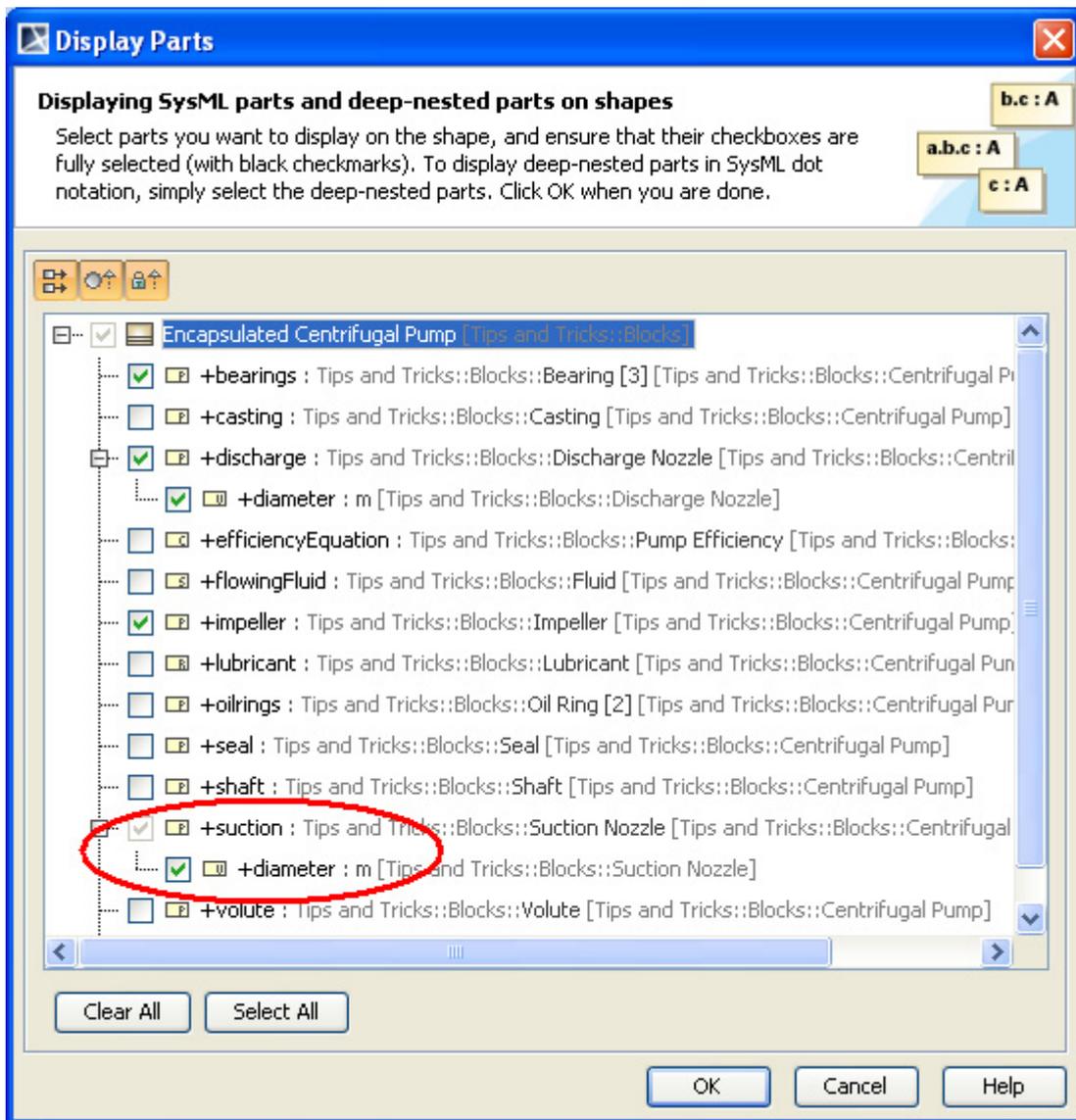


Figure 59 -- Nested part property selected and shown with its class and dot notation

Thus, to redisplay an internal structure in another structure, you have to recreate the internal structure manually. The graphical layout must also be applied manually, making it a time-consuming activity.

With the **Display Internal Structure** feature you can copy and paste (display) an existing structure diagram defining a Block (Class) either in:

- The structure compartment of that Block, a subtype of that Block, a part typed by that Block, or a part typed by a subtype of that Block, or
- Another diagram defining either a subtype of that Block or that Block itself.

With this feature, you can now display the already-defined internal structures of Blocks, reused as parts in other structures (deep nested structures).

To redisplay a Block structure, already-defined in, at least, one structure diagram

1. Suppose there is the **FrontWheelsAssembly** IBD, having the **FrontWheelsAssembly** block as its context.
2. Right-click the property and select **Related Elements > Display Internal Structure** from the shortcut menu. Each IBD having either the type or a supertype of the type of the property as its context will be available for you to select. For example, in the following figure, the **FrontWheelsAssembly** IBD is available. Select it to display the structure of **FrontWheelsAssembly** block in the property.

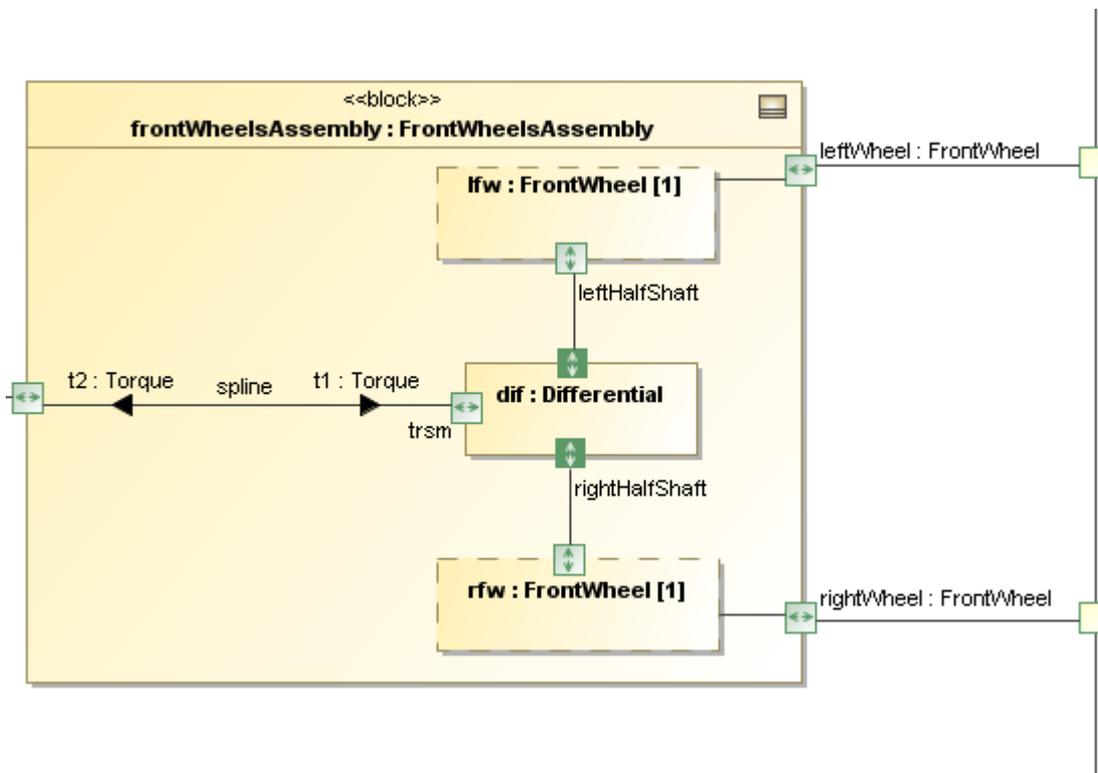


Figure 60 -- Sample of structure displayed in property

3. You can also display the structure in a new blank IBD, having the **FrontWheelsAssembly** block or a subtype of the **FrontWheelsAssembly** block as its context, using the IBD shortcut menu.

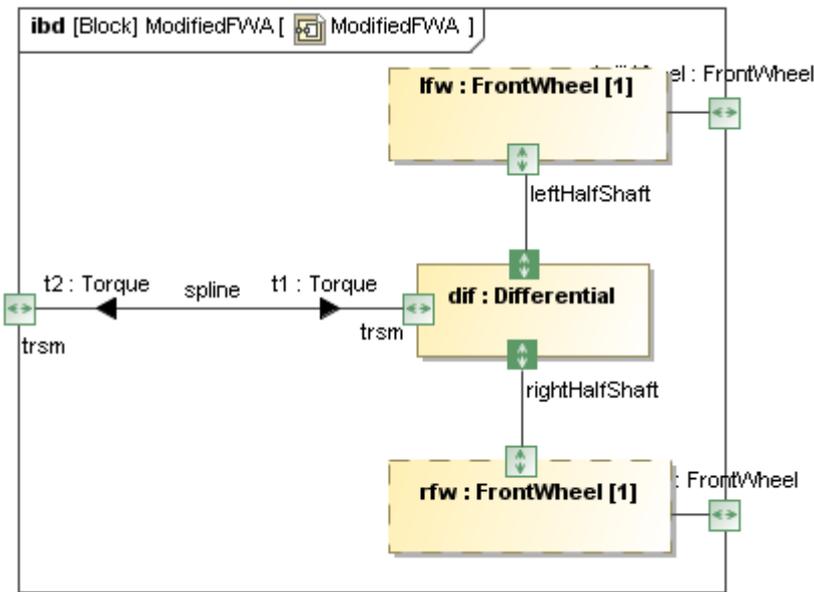


Figure 61 -- Sample of structure displayed in IBD

4. You can also display the structure of the **FrontWheelsAssembly** block in the structure compartment of the block itself.

5.2.2.13 Converting nested parts to dot notation

To convert a Part or a set of Nested Parts to the “Dot Notation” form, simply drag such Parts and drop them on another valid view. For example, drag the part d:D to empty space in the containing diagram as shown below.

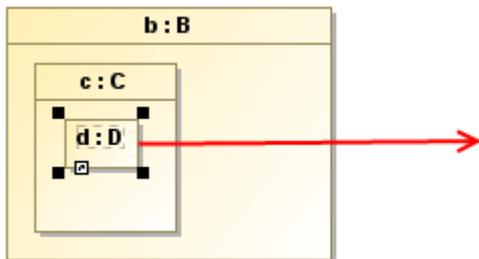


Figure 62 -- Drag and drop the part to be converted to dot notation

The confirmation dialog will be then open. Click the “Show in Path Notation” button to convert the Part to the “Dot Notation” form.

Then, the part will be moved to the diagram canvas, and displayed in the “Dot Notation” form.

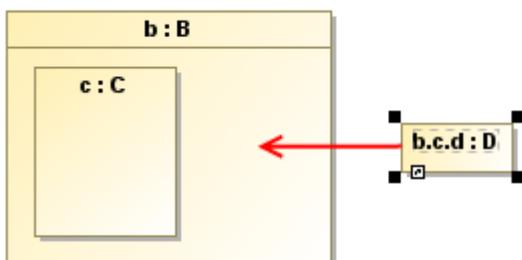


Figure 63 -- Dot notation part created

You can also move the created part from the diagram back to the structure compartment of the part b:B. The part will then be moved to the structure compartment and shown in the “Dot Notation” form.

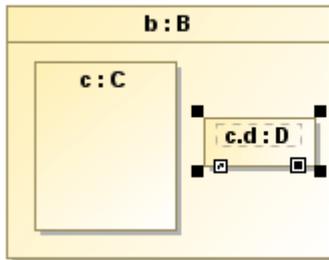


Figure 64 -- Dot notation part in Structure compartment

You can also convert a Part displayed in the “Dot Notation” form to a set of Nested Parts (where applicable). Simply right-clicks the part, and then select **Refactor > Convert to Nested Parts**.

The part will be converted to a set of Nested Parts.

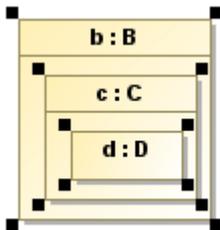


Figure 65 -- Nested parts after conversion

5.2.2.14 Extracting structure

Extract Structure is the first advanced automated refactoring method in our “Refactoring” tools group.

Extract Structure allows you to easily select a portion of an existing system structure and transform it into another reusable Block (or Subsystem) which may then be used as parts in many other structures. In addition to this, the Extract Structure feature can also play a 'move' or a 'decompose' role when a structure becomes too complex and requires to be decomposed into several smaller reusable parts.

Recursive decomposition of structure and behavior is an important aspect of the iterative development process. This feature is particularly useful for the automotive, aerospace, and defense communities for modeling complex systems-of-systems and building reusable components.

To extract a new structure from an existing structure in a classifier

1. In an Internal Block Diagram or a structure compartment, right-click a portion of the internal structure (part(s)) which you want to move or reuse (see the red selection rectangle).



These selected symbols must be owned by the same Classifier.

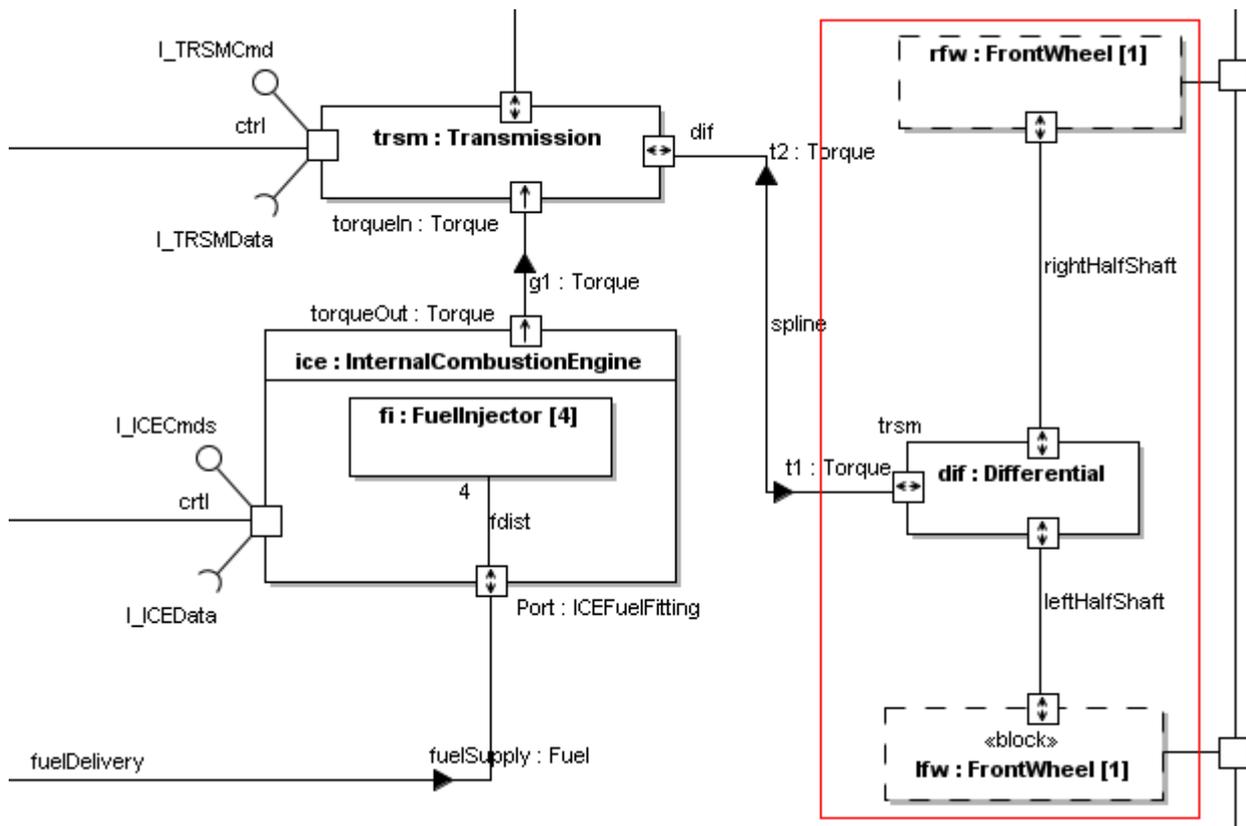


Figure 66 -- Internal Block diagram before extracting structure

2. Select **Refactor > Extract**. The **Extract Structure Wizard** dialog will open, listing three steps to extract a structure: Specify a new element, Create port(s), and Create a property.
3. Follow the steps of the wizard.

The following figure shows the IBD after the structure was extracted. Since it preserves the diagram space of the previous structure, the original diagram will have minimal distortion and the existing layout will remain.

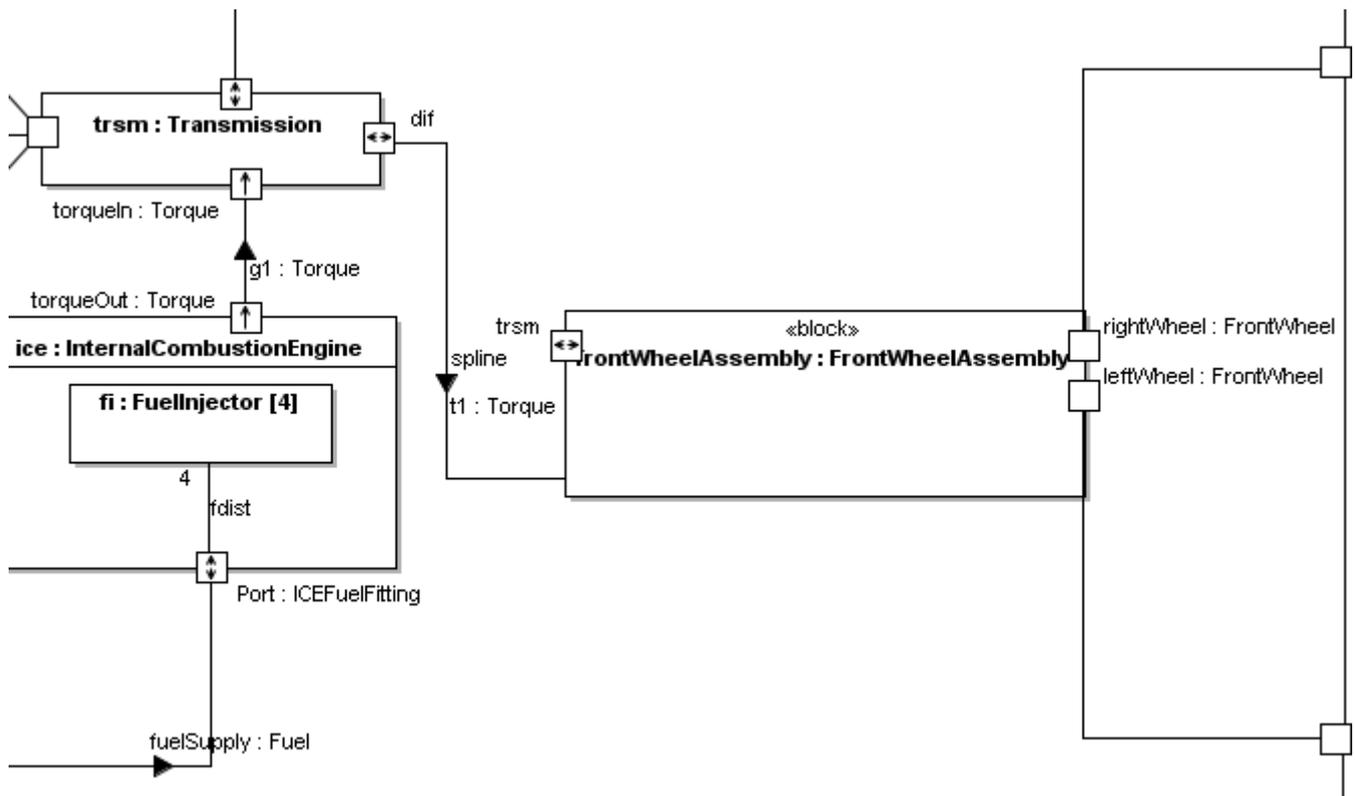


Figure 67 -- Internal block diagram after extracting structure

You can check how the automatically-created new Block looks like by right-clicking the part and select **Go To > Type <name>** to select the Block in the browser.

Open the created IBD to display the structure which was recently extracted. The structure view will be ready.

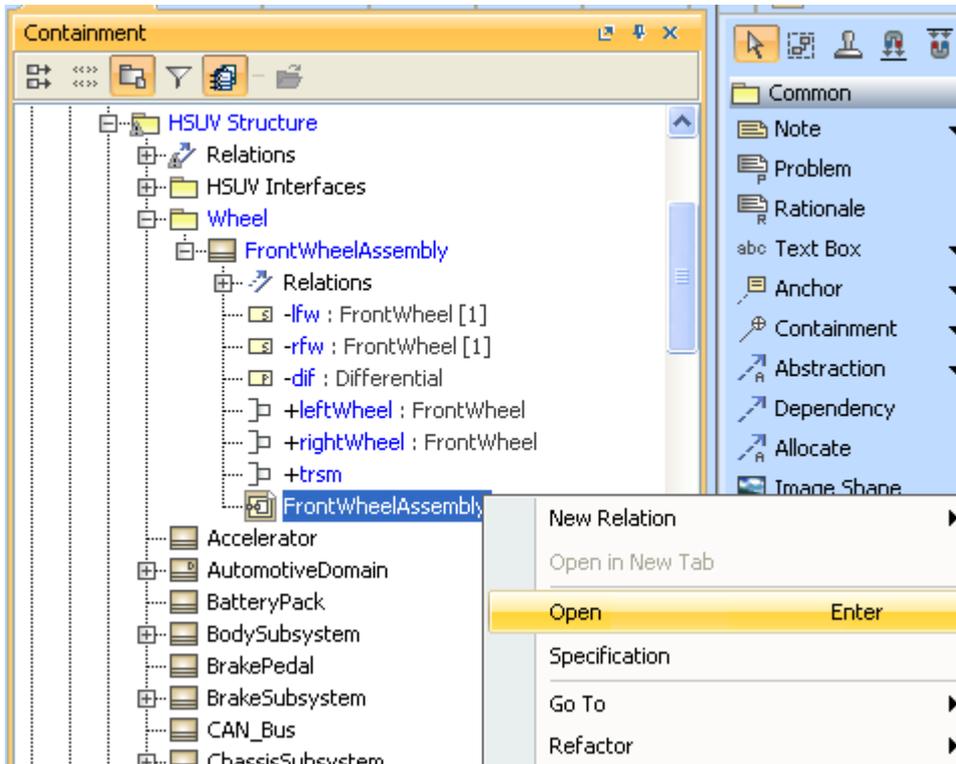


Figure 68 -- The created IBD of extracted classifier

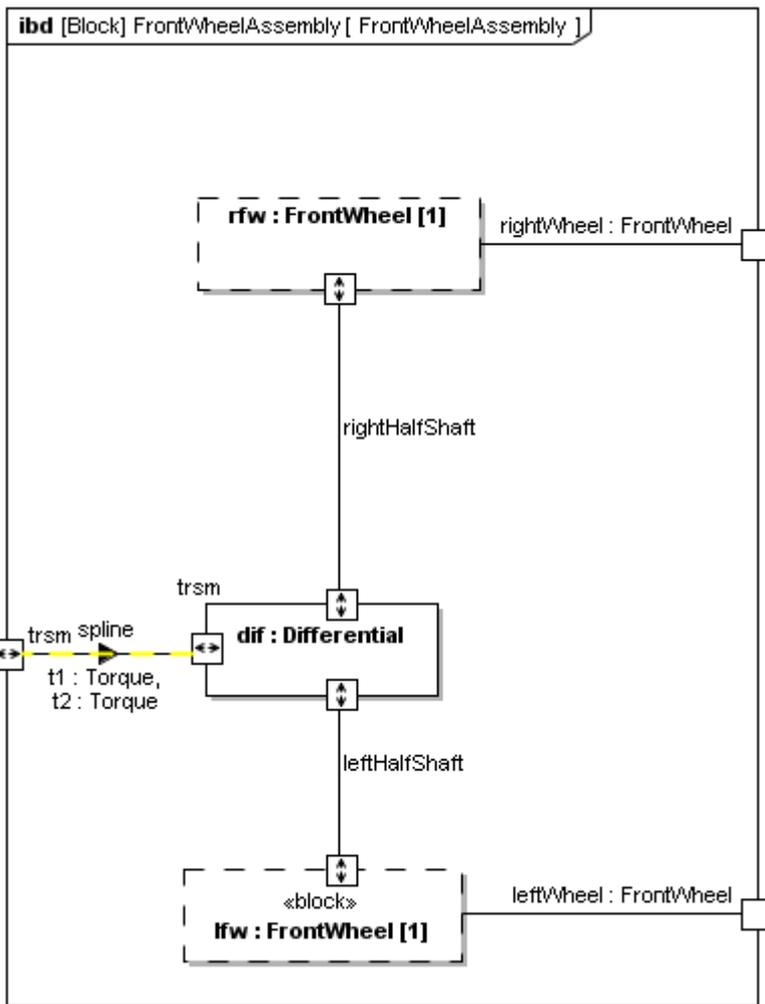


Figure 69 -- Displayed extracted structure

5.2.2.15 Creating a flow port

In general, a port / flow port should be defined in a BDD. However, you can also create a flow port on a part in an IBD by using the IBD toolbar button.

To create a flow port on a part

1. Click the **Flow Port** button  either:
 - on the IBD toolbar, or
 - in the smart manipulator of the part.
2. If you click the **Flow Port** button on the IBD toolbar, select a part where the flow port will be created. If you clicked the smart manipulator of the part, go directly to step 3.

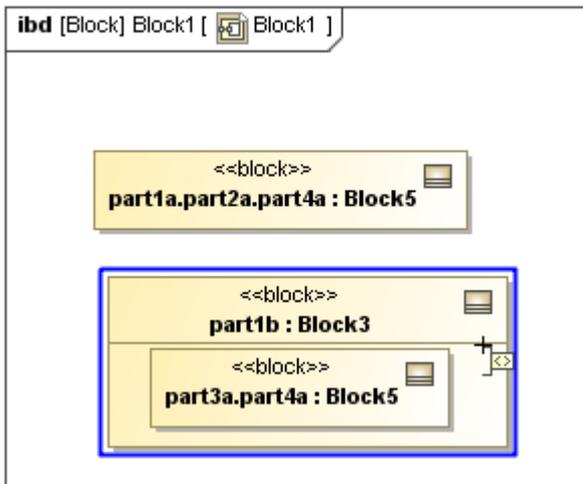


Figure 70 -- Flow port created on part

3. Select a port type in the **Select Port Type** dialog. The flow port will then be created, having an 'inout' direction.
4. You can change its direction using the port shortcut menu. Note that, without a direction, the flow port will be just like a normal port (it will not enforce any direction on the item(s) flowing in/out of the port).



The Flow Port direction must be defined.

ItemProperty

Item Property is the only attribute of Item Flow. An Item Flow describes the flow of items across a connector or an association. If an Item Flow is assigned to a connector, in general, you can specify this optional attribute, Item Property, to relate the flowing item to the instances of the connectors' enclosing block.

In general, Item Flows (and Item Property) are defined on connectors in IBDs.

To create an Item Flow having the Item Property tag initialized on a connector

1. Do one of the following:
 - click the **Item Property** button on the IBD diagram toolbar, and then select the connector, or
 - click the **Item Property** icon on the connector smart manipulator menu, or
 - drag the property, which will be used as the item property, to the connector.
2. The **Item Flow / Item Property** dialog will then open.

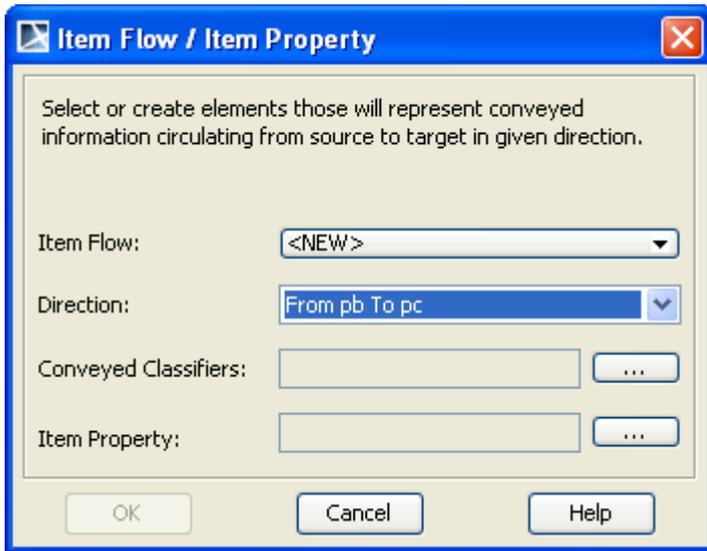


Figure 71 -- Item Flow / Item Property dialog

3. The existing item flows on the selected connector can be selected for setting the item property using the **Item Flow** drop-down menu. The item flows, whose realizing connector property contains the selected connector, will be listed in this drop-down menu.

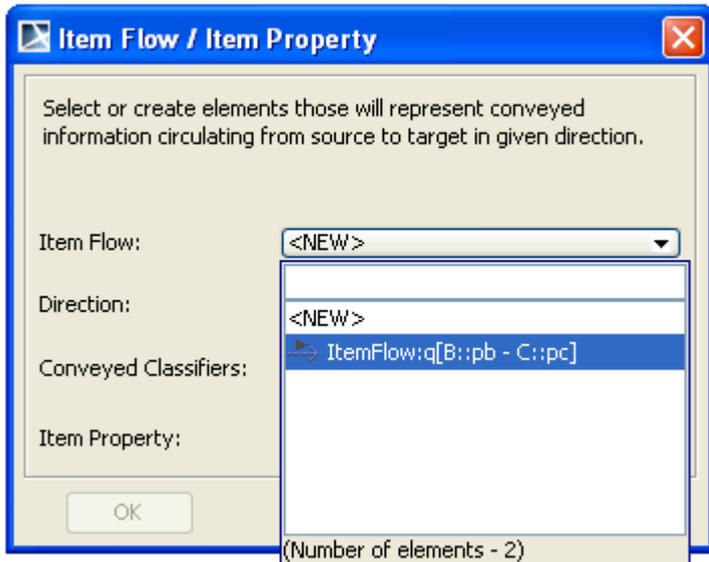


Figure 72 -- Item Flow / Item Property dialog - Item Flow selection

4. You can also create a new item flow by selecting **<NEW>** in the drop-down menu.
5. In the **Item Flow / Item Property** dialog, you can also choose the direction of the Item Flow from the **Direction** drop-down menu.

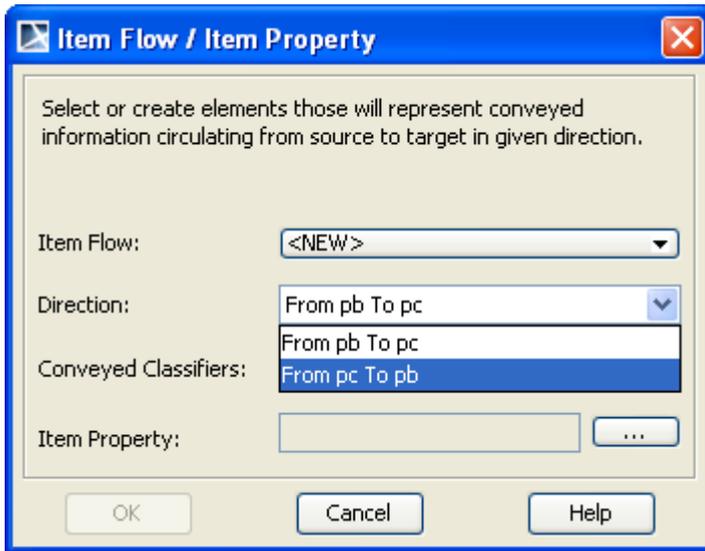


Figure 73 -- Item Flow / Item Property dialog - Direction selection

6. Click the browse button “...” next to the **Conveyed Classifiers** box. The **Select Conveyed Classifier** dialog will open.
7. Select a classifier to be used as the Conveyed Classifier and click **OK**.

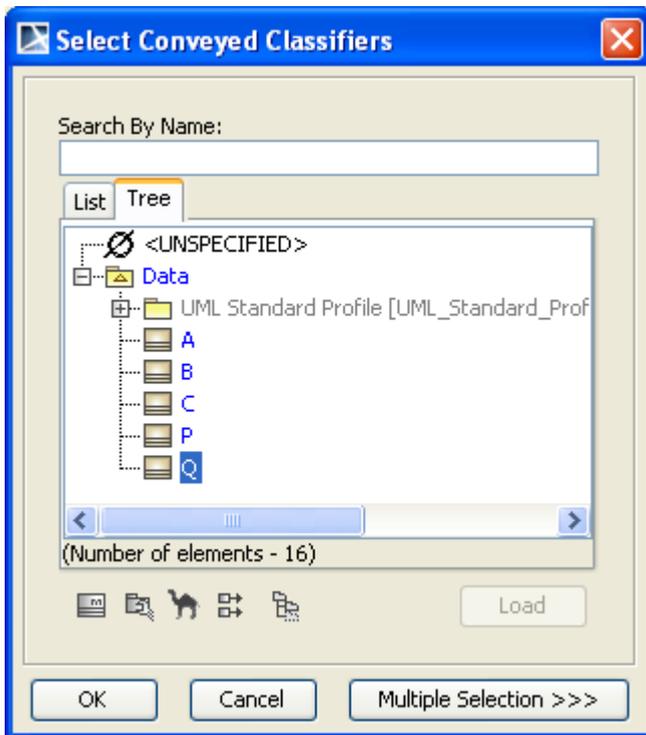


Figure 74 -- Select Conveyed Classifiers dialog

8. Click the browse button “...” next to the **Item Property** box. The **Select Item Property** dialog will open.
9. Select a part (property) to be used as the Item Property and click **OK**.

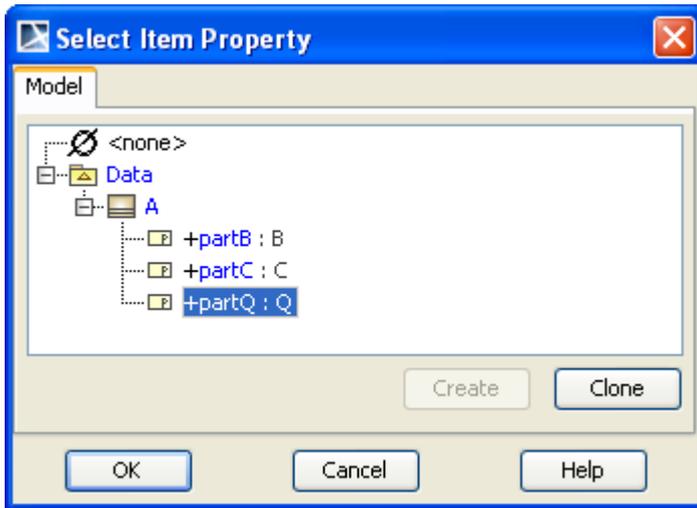


Figure 75 -- Select Item Property dialog

10. Click **OK** in the **Item Flow / Item Property** dialog. An Item Flow having the selected property as its Item Property will be created on the connector.



You can create a new conveyed classifier either on a new item flow or on an existing item flow by dragging the classifier to a connector or association. The dragged classifier will be a conveyed classifier of the item flow.

5.2.3 SysML Package Diagram Procedures

- [Using package element](#)

5.2.3.1 Using package element

You can display the name of a package either on top of it or on its tab.

To display a package name

1. Right-click a package and select **Header Position** on the shortcut menu.
2. Select either:
 - **Top** to display the package name on top
 - **In Tab** to display it in the tab

You can also show a list of elements owned by a package.

To show an element list

1. Right-click a package and select **Show Elements List** on the shortcut menu.
2. The elements owned by the package will then be displayed in the package.



Figure 76 -- List of elements

5.2.4 SysML Parametric Diagram Procedures

SysML Parametric Diagram features include **Display Parameters** and the other six specific features similar to IBD. They are as follows:

- [Displaying parameters](#)
- [Creating automatic constraint parameters](#)
- [Creating a binding connector](#)

For more information on the above six features, see the [SysML Internal Block Diagram Procedures](#) section.

5.2.4.1 Displaying parameters

This feature enables you to display the constraint parameters of a constraint block on a Constraint Property typed by the Constraint Block.

To display constraint parameters

1. Do one of the following:
 - Select **Display Parameters** on the property shortcut menu.
 - Click the **Display Parameters** icon on the property smart manipulator.
2. The **Select Parameters** dialog will open and the constraint parameter(s) owned by the type of the constraint property will be listed in the dialog.
3. Select constraint parameters to be shown on the constraint property symbol. The selected constraint parameters will be displayed as small square boxes.

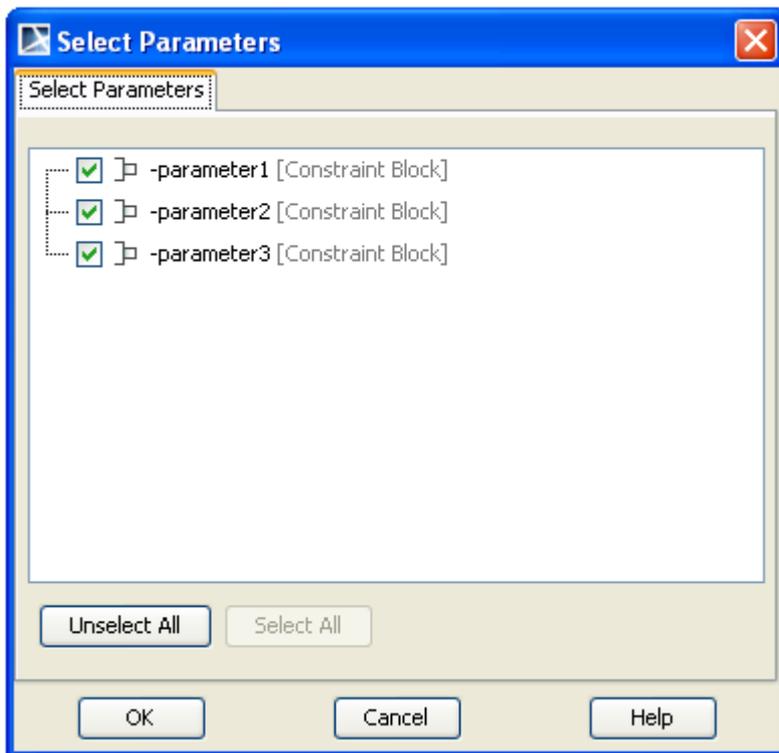


Figure 77 -- Select Parameters dialog

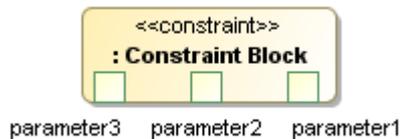


Figure 78 -- Constraint property with its constraint parameters

5.2.4.2 Creating automatic constraint parameters

When you drag a binding connector from a property to a constraint property, MagicDraw SysML automatically shows a list of hidden constraint parameters in the constraint property and suggest new names for a constraint parameters that you might want to create. If the constraint parameter you want to connect does not exist, you can create it on the spot. The suggested parameter names come from the names of the properties on the other end of the binding connector you are trying to connect, and the extracted variable names come from the constraint expressions defined in a constraint block that types the constraint property.

To create new constraint parameters from the context menu of a constraint block

1. Right-click a constraint block, for example **Sum**, and select **Tools > Create Parameters**.
2. Create a constraint parameter, in this example, 'z', which is the variable in an expression that has not been created as a constraint parameter. A new constraint parameter 'z' will be created in the constraint block **Sum**.

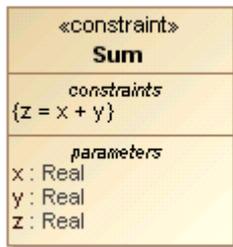


Figure 79 -- New parameter

The following examples further illustrate how to create new constraint parameters with this new constraint parameters creation mechanism.

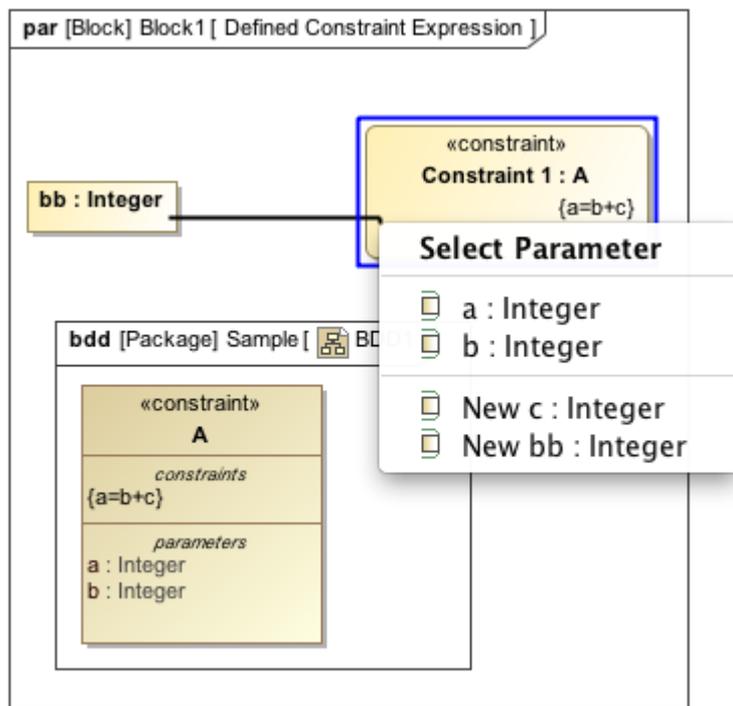


Figure 80 -- Binding connector connects to defined constraint expression constraint property

In in the preceding figure, the constraint parameter a:Integer and b:Integer have already been defined in the constraint block A. However, they are hidden on the constraint property Constraint 1:A. If you select a:Integer from the list, the constraint parameter a:Integer will appear on the constraint property Constraint 1:A.

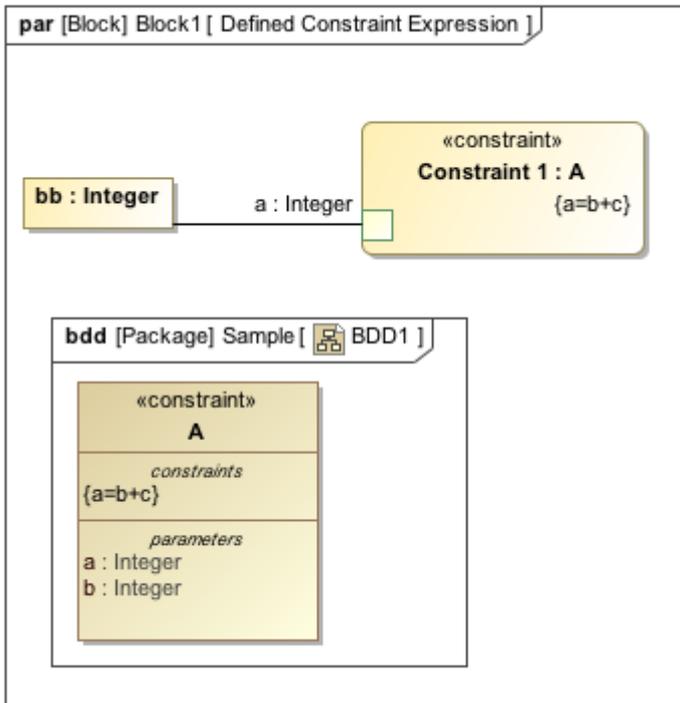


Figure 81 -- Connecting binding connector to existing constraint parameter

If you choose to create a new constraint parameter, for example, select New c:Integer from the list, and MagicDraw SysML will create and add it into the constraint block A. The name of the new parameter is c. It will be typed by Integer because the opposite end of the binding connector is the value property typed by Integer.

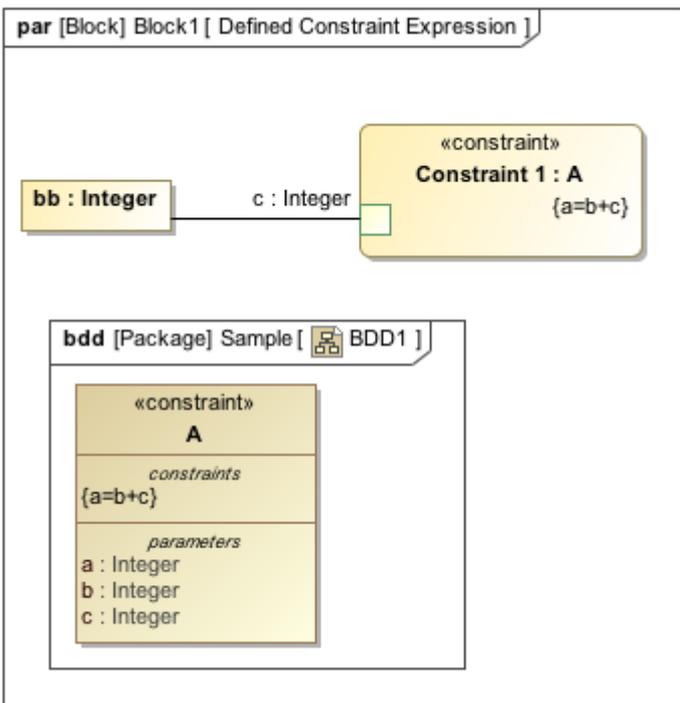


Figure 82 -- Automatically created constraint parameter of defined constraint expression constraint property

In the case that the constraint block typing the constraint property has no parameter and the constraint expression is undefined, SysML will create a new constraint parameter using the name and the type of the property at the

opposite end of the binding connector. The created constraint parameter will be visible on the selected constraint property with the binding connector attached.

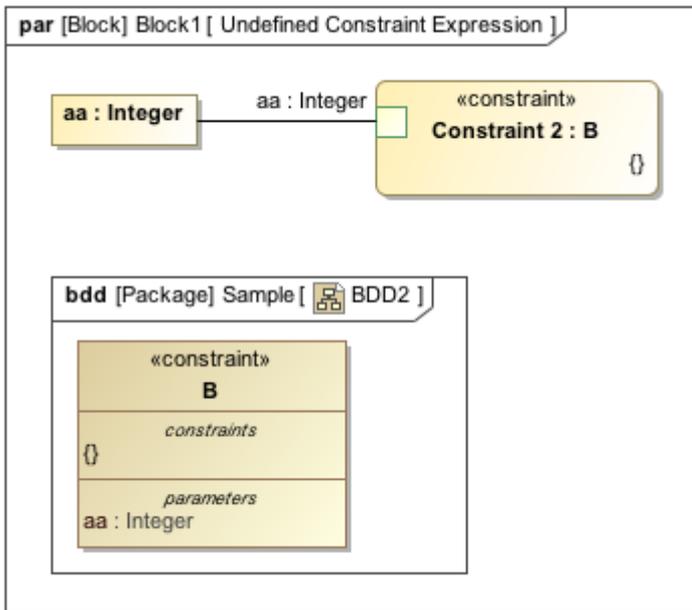


Figure 83 -- Binding connector connects to undefined constraint expression constraint property

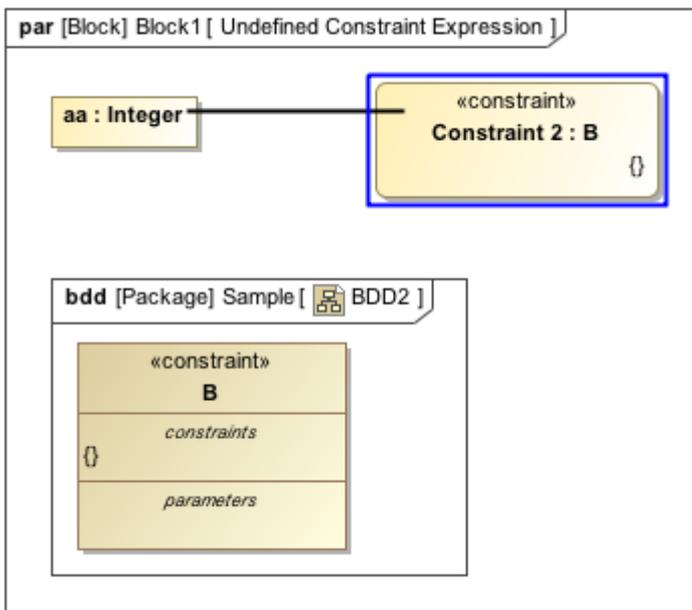


Figure 84 -- Automatically created constraint parameter of undefined constraint expression constraint property

5.2.4.3 Creating a binding connector

Binding connectors enable you to bind each constraint block parameter to the property of another block in the surrounding context of that constraint block. Binding connectors are the only connectors allowed to bind constraint parameters to the properties of other blocks.

To create a binding connector

1. Click either the **Binding Connector** button on the Parametric diagram toolbar or the **Binding Connector** icon on the smart manipulator of a constraint parameter or a part (property).
2. If you have clicked the **Binding Connector** button on the toolbar, select a part as the connector's origin, but if you clicked the **Binding Connector** icon from the smart manipulator, go directly to step 3.
3. Select a part / constraint parameter as the connector's destination.

5.2.5 Requirements Diagram Procedures

The Requirement Diagram procedures are as follows:

- [Changing requirement type](#)
- [Creating Requirements Diagram for sub-requirements](#)
- [Numbering requirement IDs](#)
- [Using requirement element](#)

For more information about creating, importing, and analyzing requirements, see [CameoRequirementsModelingPlugin UserGuide.pdf](#).

5.2.5.1 Changing requirement type

Use this feature to change one or several requirement types to another requirement type.

To change one or more requirement types to another requirement type

1. Right-click a requirement(s) whose type(s) you would like to change and select **Refactor > Convert To**.
2. Select **More Specific**, **More General**, or **Other**. The requirement type options will be displayed.
3. Select a new requirement type from the options. The type(s) of the selected requirement(s) will then be changed.

5.2.5.2 Creating Requirements Diagram for sub-requirements

MagicDraw SysML provides an easy way to create a requirements diagram for sub-requirements of the selected requirement symbol.

To create requirements diagram for sub-requirements

1. Click the requirement symbol in which you want to create the requirements diagram for its sub-requirements.
2. Click the **Create diagram for sub-requirements** button from the smart manipulator.

- The new requirements diagram for the sub-requirements will then be created with the same name as that of the selected requirement.

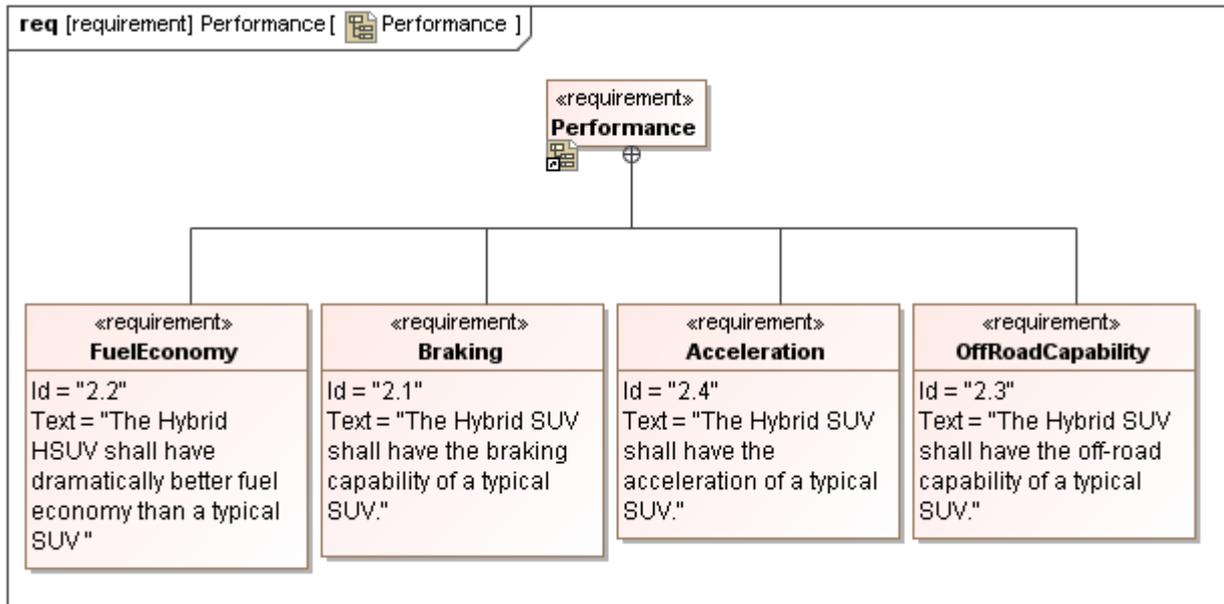


Figure 85 -- Requirements Diagram for sub-requirements

5.2.5.3 Numbering requirement IDs

Numbering requirements is a trivial, time-consuming task, in particular, when working with a large SysML project. SysML Plugin uses the DSL numbering engine, which is generic, highly flexible, and customizable. The requirements numbering mechanism in SysML is the same as that in MagicDraw. Consequently the **Requirement ID Numbering** menu has been changed to **Element Numbering** and the **Requirement ID Numbering** dialog has been replaced with the **Element Numbering** dialog.

To edit the requirements numbering settings

- On the main menu, click **Options > Project**. The **Project Options** dialog will open.
- Select **General project options** from the list on the left-hand side. You will see the Numbering options opens on the right-hand side.
- You can select the **Use Element Auto-numbering** check box if you want SysML to number requirements automatically and then select the **Display Element Number** check box if you want requirement numbers appear before the requirements in the Containment tree.
- Click **OK**.

Manual Numbering

To number a requirement or edit a requirement's number using the Element Numbering dialog

- Right-click a requirement in the Containment tree and select **Element Numbering**. The **Element Numbering** dialog will open.
- Select, for example, the **HSUV Requirements** package in the browser on the left-hand side of the dialog. The requirements owned by the package will appear in the **Requirements** pane on the right-hand side of the dialog.
- In the **Requirements** pane, select the requirement(s). Use the **Edit**, **Create/Remove**, **Increase**, **Decrease**, **Renumber** or **Renumber Recursively** buttons to number the selected requirements.
- For example, if you click the **Renumber** button, the requirements under the package selected in the browser on the left-hand side of the dialog will be renumbered using the predefined **Separator**, **Prefix**, **Numbering Scheme**.

5. You can click the **Recursive Renumber** button to renumber all requirements that are recursively contained inside the selected node. The Numbering Scheme, Prefix, and Separator, which are defined in the selected node, will be used for recursive renumbering. If the Package-specific Numbering Configuration of the lower-level nodes exists, then a message box will open to ask whether to replace the existing values with the values of the selected node.
6. Since there is no **Numbering Scheme, Prefix and Separator** values defined in the 'HSUV Specification', 'HSUV Requirements' and 'HSUVModel' packages, the values defined in the 'Data' package (default) will be used instead (Numbering Style = Multi-Levels, Prefix = "", and Separator = '.').



TIP!

For more information about numbering elements, see the *MagicDraw User Guide.pdf*.



NOTE

The **Edit, Create/Remove, Increase, Decrease, Renumber** or **Renumber Recursively** buttons are used to add / edit / remove requirements' numbers **directly owned by the package or the selected requirement** (selected in the browser on the left-hand side of the **Element Numbering** dialog) only.



NOTE

- SysML Plugin provides two numbering styles to number requirement IDs: **Consecutive** (previously called normal style) and **Multi-Levels** (previously called nested style).
 - Using the Consecutive numbering style, each requirement ID is numbered with a prefix, followed by numbers, without any separator.
 - Using the Multi-Levels numbering style, each requirement ID is numbered with a prefix, followed by numbers. A separator is used to separate each level of number. The level will be increased by the containing level of the requirement.
- You can use a character or a symbol, excluding number, as a **Separator**.



NOTE

- **Numbering Scheme, Prefix and Separator** can be defined at a package or a top-level requirement. A requirement is considered to be top-level only if it is directly owned by a package, model, or profile. A requirement owned by another requirement is NOT considered as a top-level requirement. A top-level requirement ID cannot contain any separator.
- The **Numbering Scheme, Prefix, and Separator** values defined in an upper-level node (package, model, profile) will be overridden by the values defined in a lower-level node (package, model, profile, top-level requirement).
- The 'Data' package contains the default **Numbering Scheme, Prefix and Separator** values defined for your project (Numbering Scheme = Multi-Level, Prefix = "", and Separator = '.').

Automatic Numbering

Once this functionality is turned on, the IDs of the newly-created requirements will be numbered automatically.

To number requirement IDs automatically

1. Click **Options > Project** on the main menu. The **Project Options** dialog will open.
2. Under the **SysML** group, select the **Use Element Auto-numbering** check box.
3. The IDs of any newly-created requirements will now be numbered automatically with the Numbering Style, Prefix, and Separator which are defined in the requirement owner.



NOTE

Automatic Numbering will NOT modify any existing ID. Thus, requirements with IDs will NOT participate in Automatic Numbering.

Suggested Solutions for Invalid Requirement's ID

When the ID of a requirement element is invalid with respect to the validation constraint 'Requirement[A]' (a requirement's ID must be unique), the requirement will be highlighted. If you select such a requirement, the requirement smart manipulator menu will also propose the following two solutions.

Assigning A New Number

You can also use this solution to automatically re-assign a new requirement's ID to the selected requirement. The first available correct ID will be assigned to the requirement automatically.

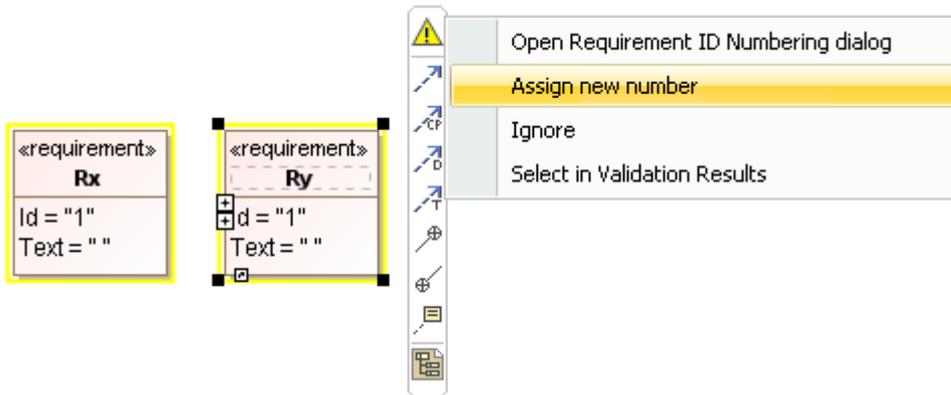


Figure 86 -- Assign new number solution

Finding A Requirement

To find a requirement in the Containment tree and in the Requirement ID Numbering dialog tree

1. Select a requirement in the Containment tree or the Requirement ID Numbering dialog tree.
2. To search for a requirement by its ID, type the ID of the requirement. A matching requirement will be selected, if any.

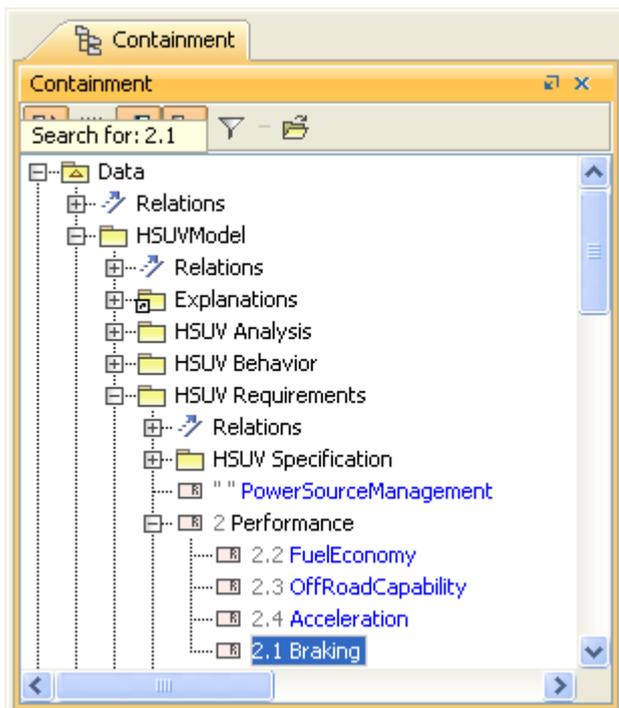


Figure 87 -- Finding requirement by ID in Containment tree

3. To search for a requirement by its name, type "*" followed by the name of the requirement. A matching requirement will be selected, if any.

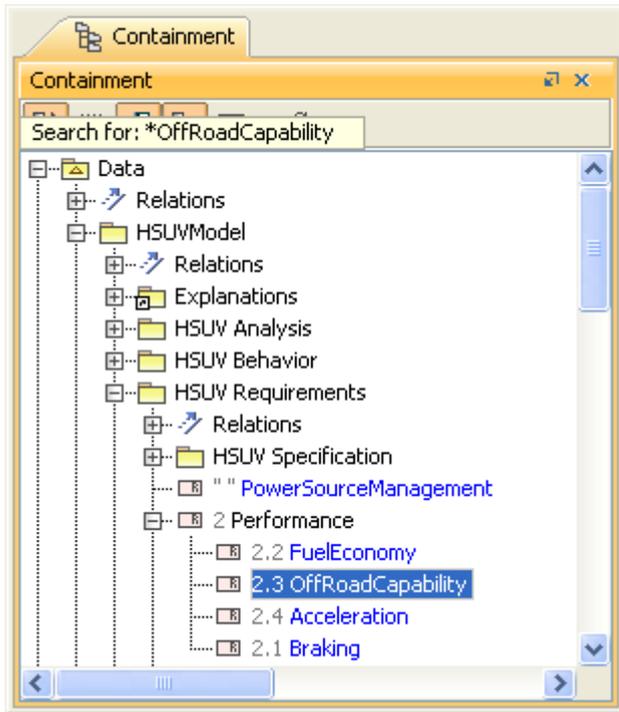


Figure 88 -- Finding requirement by name in Containment tree



This type of search for requirement will not work if the element is not shown in browser when searching.

To find the requirement using the **Find** dialog

1. You can either select **Edit > Find** in the main menu, or press **Ctrl + F** to open the **Find** dialog.
2. To search for a requirement by ID, select the tab for searching element by tag value in the **Find** dialog. In **Name** combo box, type "Id" and then type the ID of the requirement into the **Value** combo box. Click **Find** button.

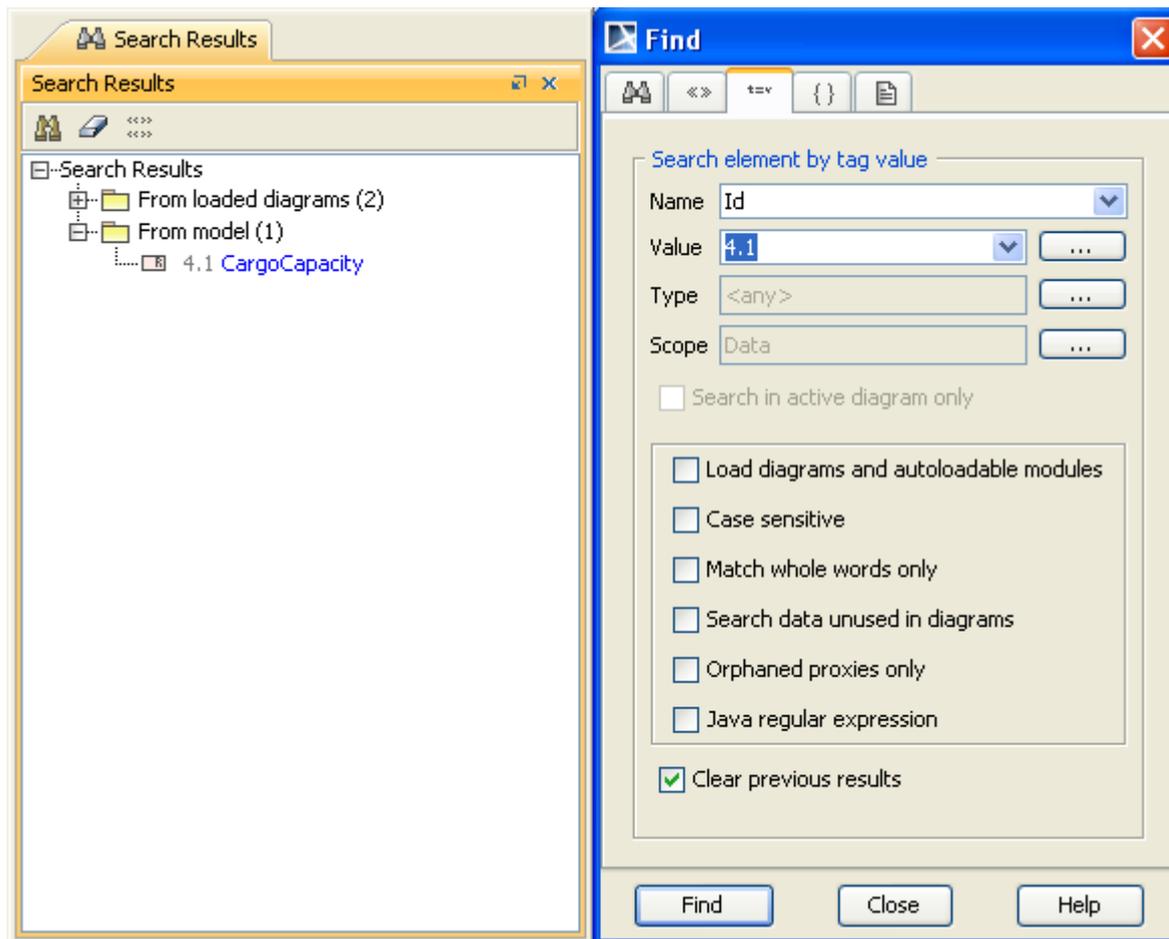


Figure 89 -- Finding requirement by ID using Find dialog

- To search for a requirement by its name, select the tab for searching element by name. Type the name of requirement into the **Name** combo box. Then click the ... button next to the **Type** text field and select **Requirement**. Finally, click the **Find** button.

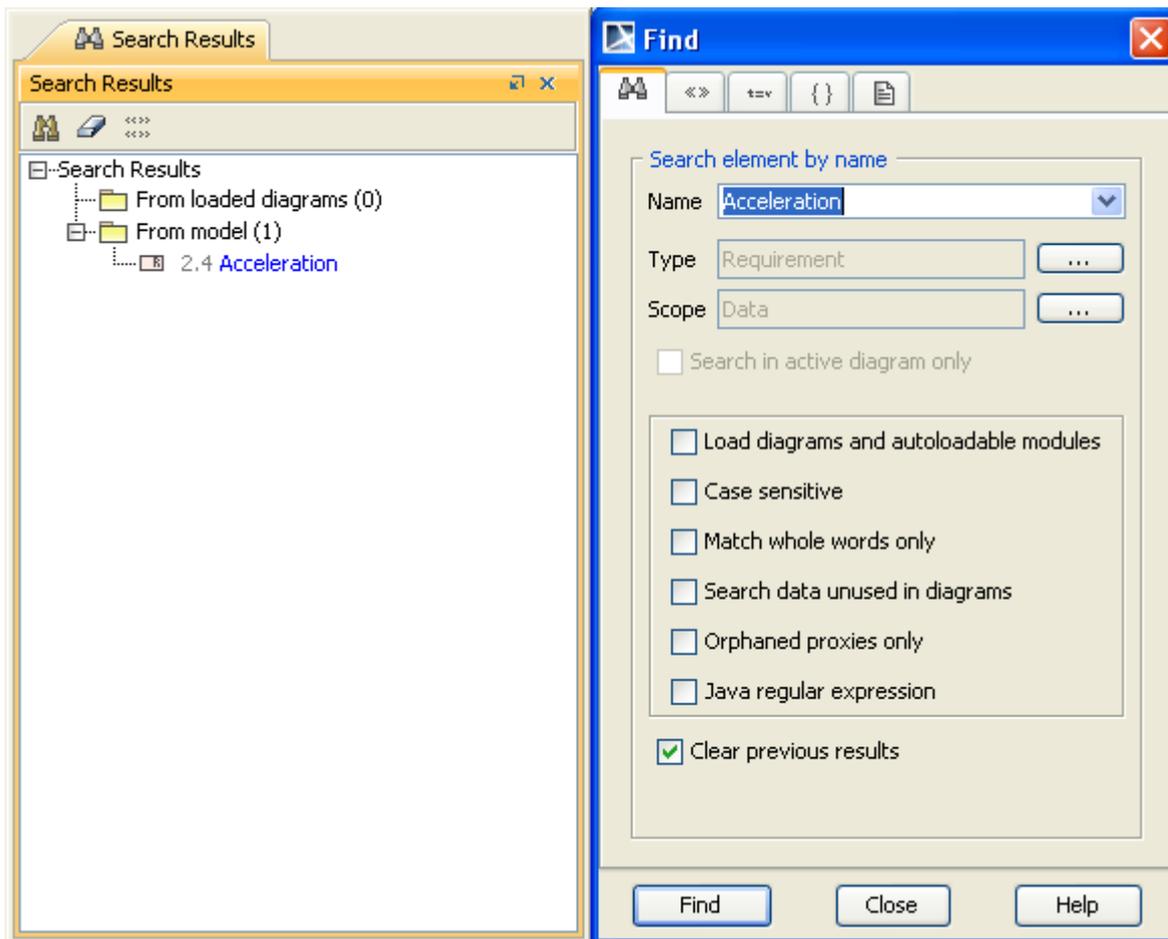


Figure 90 -- Finding requirement by name using **Find** dialog

To find the requirement using the **Quick Find** dialog

1. You can either select **Edit > Quick Find...** in the main menu or press **Ctrl + Alt + F** to open the **Quick Find** dialog.
2. To search for a requirement by ID, type the ID of the requirement into the combo box **Type Name** in the **Quick Find** dialog.

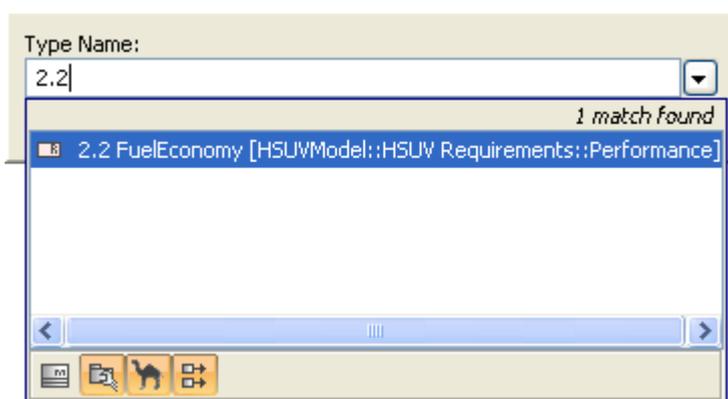


Figure 91 -- Finding requirement by ID using **Quick Find** dialog

- To search for a requirement by its name, type "*" before the name of the requirement in the combo box Type Name.

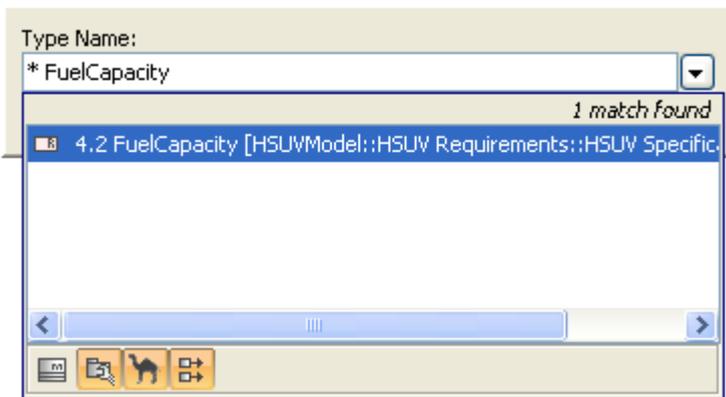


Figure 92 -- Finding requirement by name using Quick Find dialog

5.2.5.4 Using requirement element

Creating Your Own Requirement Type (Subtype) NR

You can define an additional requirement type by creating a new stereotype that generalizes the requirement stereotype).

Requirement Subtypes

The following table provides the definitions of the non-normative enumerations that are used to type the properties of the requirement subtypes.

Enumeration	Enumeration Literals	Function
RiskKind	High	To indicate an unacceptable level of risk.
	Medium	To indicate an acceptable level of risk.
	Low	To indicate a minimal level of risk or no risk.
VerificationMethodKind	Analysis	To indicate that verification will be performed by technical evaluation using mathematical representations, charts, graphs, circuit diagrams, data reduction, or other representative data. Analysis also includes the requirement verification under conditions, which are simulated or modeled; where results are derived from the analysis of the results produced by the model.
	Demonstration	To indicate that verification will be performed by the operation, movement, or adjustment of the item under specific conditions to perform the design functions without the record of quantitative data. Demonstration is typically considered the least restrictive verification type.

Enumeration	Enumeration Literals	Function
	Inspection	To indicate that verification will be performed by examining the item, reviewing descriptive documentation, and comparing the appropriate characteristics with a predetermined standard to determine conformance to the requirements without the use of special laboratory equipment or procedures.
	Test	To indicate that verification will be performed through systematic exercising of the applicable item under appropriate conditions with instrumentation to measure the required parameters and the collection, analysis, and evaluation of quantitative data to show that the measured parameters are equal to or exceed the specified requirements.

Test Cases



 The type of return parameter (Direction = return) of a Test Case element must be VerdictKind (an enumeration).

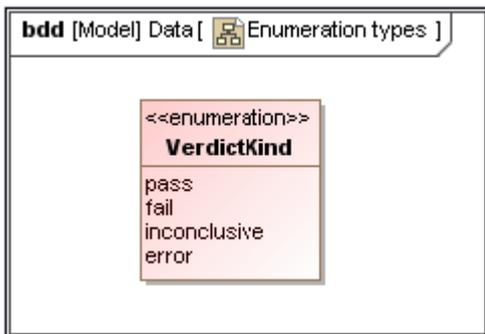


Figure 93 -- VerdictKind enumeration

Requirement Relationships

Derive Relationship (Dependency)

As with other dependencies, the arrow direction points from the derived (client) requirement to the (supplier) requirement from which it is derived.

 The supplier and the client of a Derive dependency must be requirement elements or requirement subtype elements.

Satisfy Relationship (Dependency)

 The supplier must be a requirement element or one requirement subtype.

Copy Relationship (Dependency)

A Copy dependency created between two requirements maintains a master/slave relationship between the two elements for the purpose of requirements reuse in different contexts. When a

Copy dependency exists between two requirements, the requirement text of the client requirement is a copy of the requirement text of the requirement at the supplier end of the dependency.

⚠ The supplier and the client of a Copy dependency must be requirement elements or requirement subtype elements.

5.2.6 SysML Activity Diagram Procedures

SysML Activity Diagram specific features include:

- [Select Operation](#)
- [Dynamic Centerlines](#)
- [Decomposing activities](#)

5.2.6.1 Select Operation

Click **Select Operation** on the Call Operation Action shortcut menu to select an operation for that Call Operation Action.

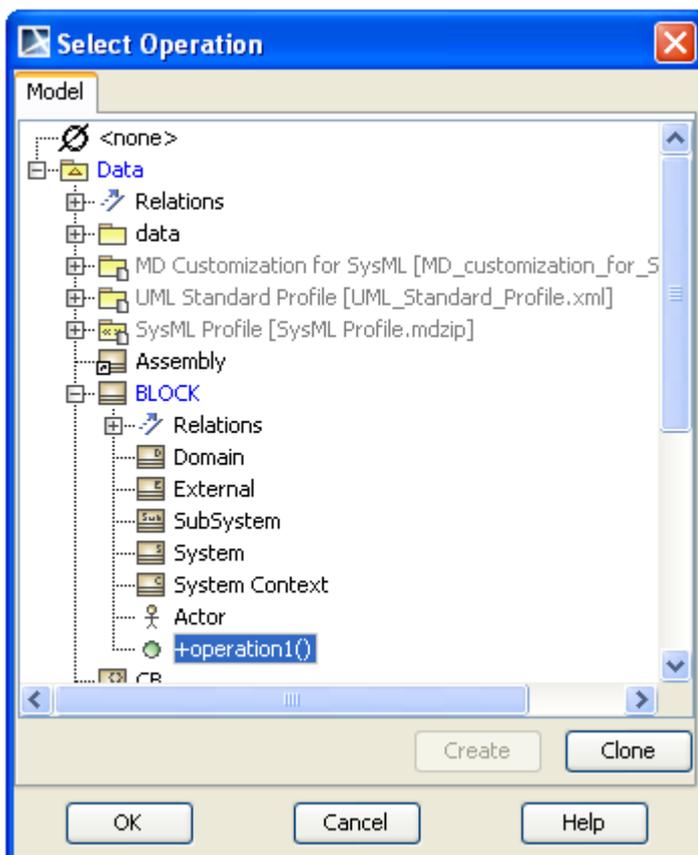


Figure 94 -- Select Operation dialog

5.2.6.2 Dynamic Centerlines

This feature will display a horizontal or vertical centerline to make it easier for you to align a newly-created shape (or an existing one that is being shifted around) with one or two existing shapes in a SysML Activity Diagram.

This centerline, however, will only be displayed in situations where the center of the newly-created or shifted shape coincides with the horizontal or vertical axis of the shape(s) with which it is being aligned, regardless of how close to or remote from that shape it is.

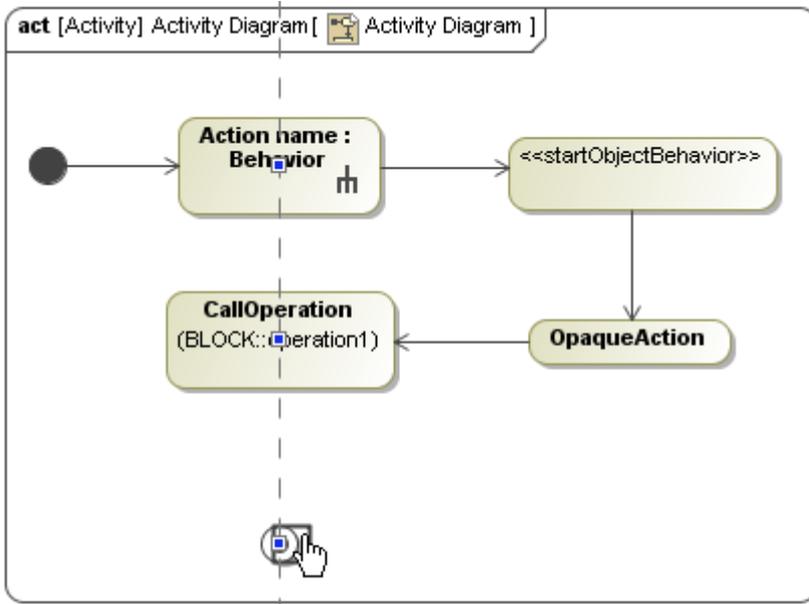


Figure 95 -- Dynamic vertical centerline

Dynamic Centerlines is enabled by default, So, if you do not want to have an horizontal or vertical centerline displayed in your diagram, you need to disable it.

To disable Dynamic Centerlines

- Click the **Show Centerlines** button on the activity diagram toolbar.
- Press **C**.
- Select **Options > Environment** on the main menu. The **Environment Options** dialog will then open. Clear the **Show centerlines in flow diagrams** option under the **Diagram > Display** group of the **Environment Options** dialog.

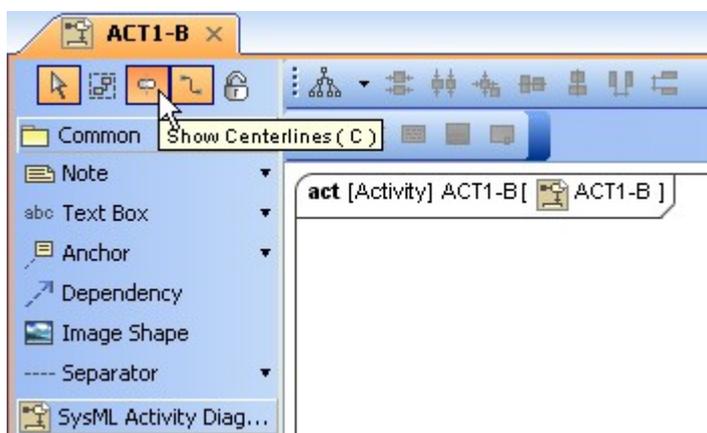


Figure 96 -- Show Centerlines button

5.2.6.3 Decomposing activities

You can decompose activities using the Activity Decomposition Hierarchy Wizard, which makes it possible to convert activities into Class Diagrams or into SysML BDDs, and represent, analyze, or document activity hierarchies in a diagram structure.

To decompose activities using the Activity Decomposition Hierarchy Wizard

1. Do one of the following:
 - From the SysML Activity diagram shortcut menu, select **Activity Decomposition Hierarchy Wizard**.
 - On the main menu, select **Diagrams > Diagram Wizards > Activity Decomposition Hierarchy Wizard**.
 - On the main menu, select **Analyze > Model Visualizer**. The **Model Visualizer** dialog opens. Select the **Activity Decomposition Hierarchy Wizard**.
2. Follow the three steps in the **Activity Decomposition Hierarchy Wizard**. The Class Diagram will then be generated.

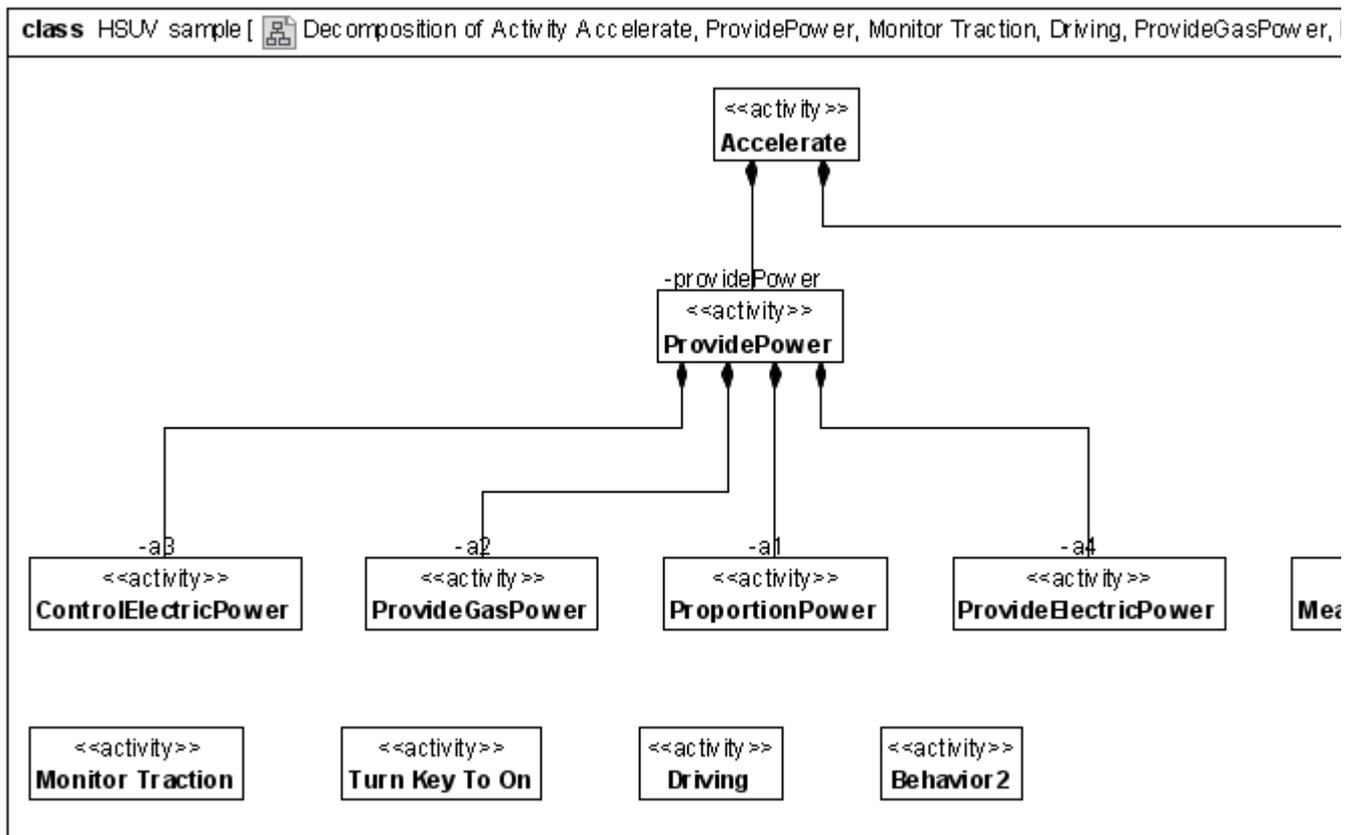


Figure 97 -- Class diagram of the decomposed activities

Swimlane Allocations

Actions and subactivities can be organized into swimlanes in the activity diagrams. The swimlanes are used to organize responsibility for actions and subactivities according to the class. They often correspond to the organizational units in a business model.

The swimlanes limit and provide a view on the behaviors invoked in the activities. They consist of one or more partitions. They can be vertical and horizontal.

An activity diagram can be divided visually into “swimlanes”, each separated from the neighboring swimlanes by vertical or horizontal solid lines on both sides. Each swimlane represents a responsibility for part of the overall activity, and may eventually be implemented by one or more objects. The relative ordering of the swimlanes has no semantic significance, but can indicate some affinity. Each action is assigned to one swimlane. Transitions can cross lanes. There is no significance to the routing of a transition path.

You can specify swimlane properties in the swimlane Specification window. In the same window, you can find the description of each property. Descriptions are presented in the description area of the Specification window.

The «AllocatedActivityPartition» stereotype is applied on the partitions automatically when creating swimlanes.

Allocation Mode is now available for the swimlanes:

- **Definition** mode allocates a behavior to the block. This mode is selected by default.
- **Usage** mode allocates an action to the part.

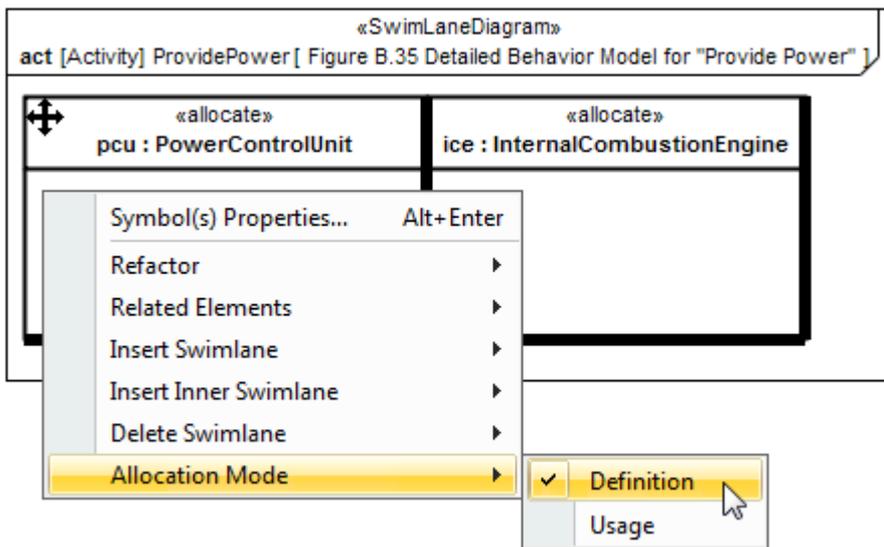


Figure 98 -- Allocation modes

Making changes in the model (changing types, moving elements among swimlanes, changing allocation mode, etc.) can impact allocations. In this version, all such changes are validated automatically. In the swimlanes, the actions that are not allocated or allocated incorrectly are highlighted and automatic solutions are suggested.

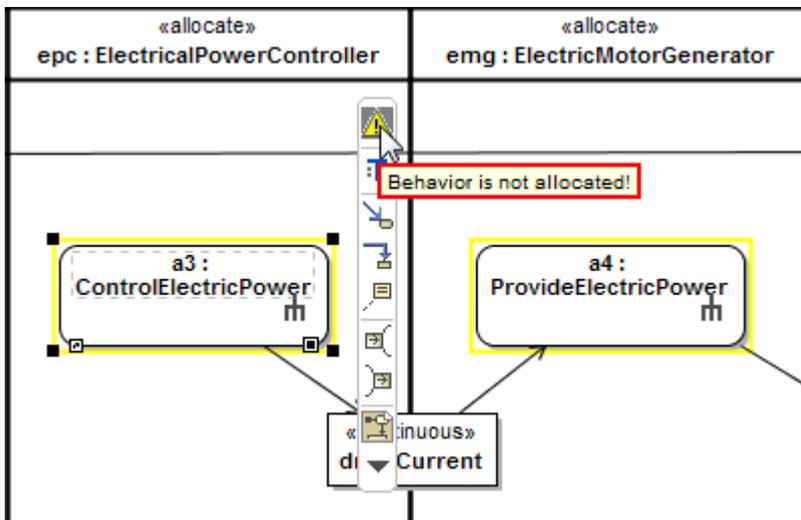


Figure 99 -- Highlighting not allocated behaviors

All allocated behaviors are now listed in the Behaviors property group of the Block Specification window.

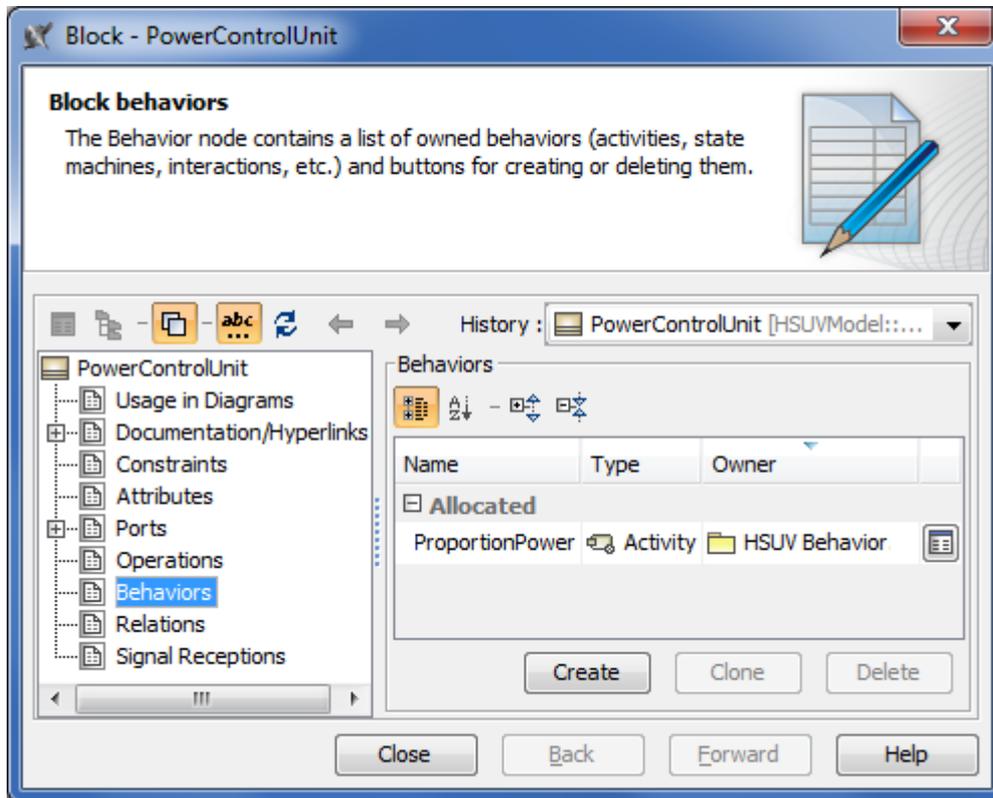


Figure 100 -- Allocations in behavior Specification window

Accept Change Structural Feature Event Action

An Accept Change Structural Feature Event action is a UML Accept Change Event action applying the «AcceptChangeStructuralFeatureEvent» stereotype. It can be used for handling the Change Structural Feature event which will occur when the value of a specified Structural feature is changed. The Change Structural Feature event is a Change event applying the «ChangeStructuralFeatureEvent» stereotype. It must be an Event element of the Accept Change Structural Feature Event action.

To create an Accept Change Structural Feature Event action

1. Select **Accept Change Structural Feature Event Action** from the **SysML Activity Diagram** toolbar. Then click **SysML Activity Diagram** to specify the location of the newly created symbol of the action. The **Select Property** dialog will open for selecting the structural feature.

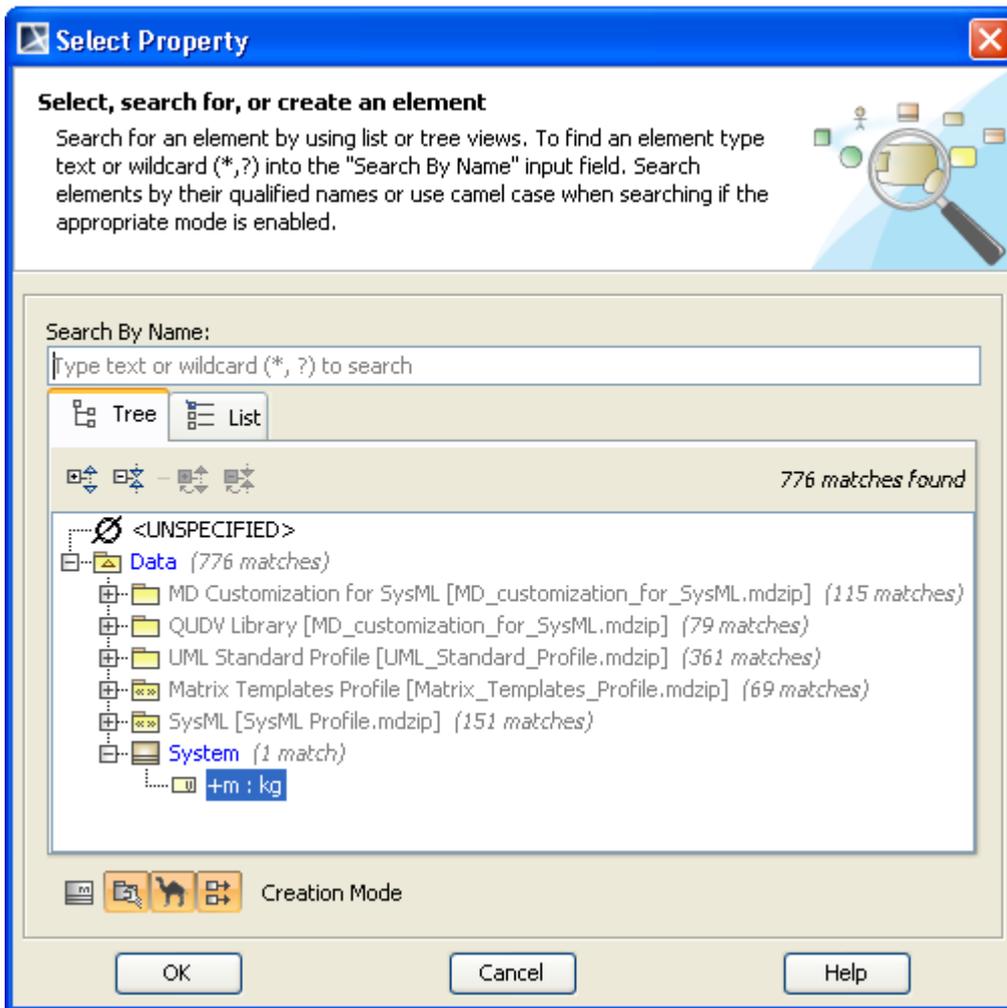


Figure 101 -- Select Property dialog

2. Select a structural feature. The Change Structural Feature event model occurrences of changes to values of the selected structural feature will be created and set as an Event element of the trigger of the created Accept Change Structural Feature Event action.

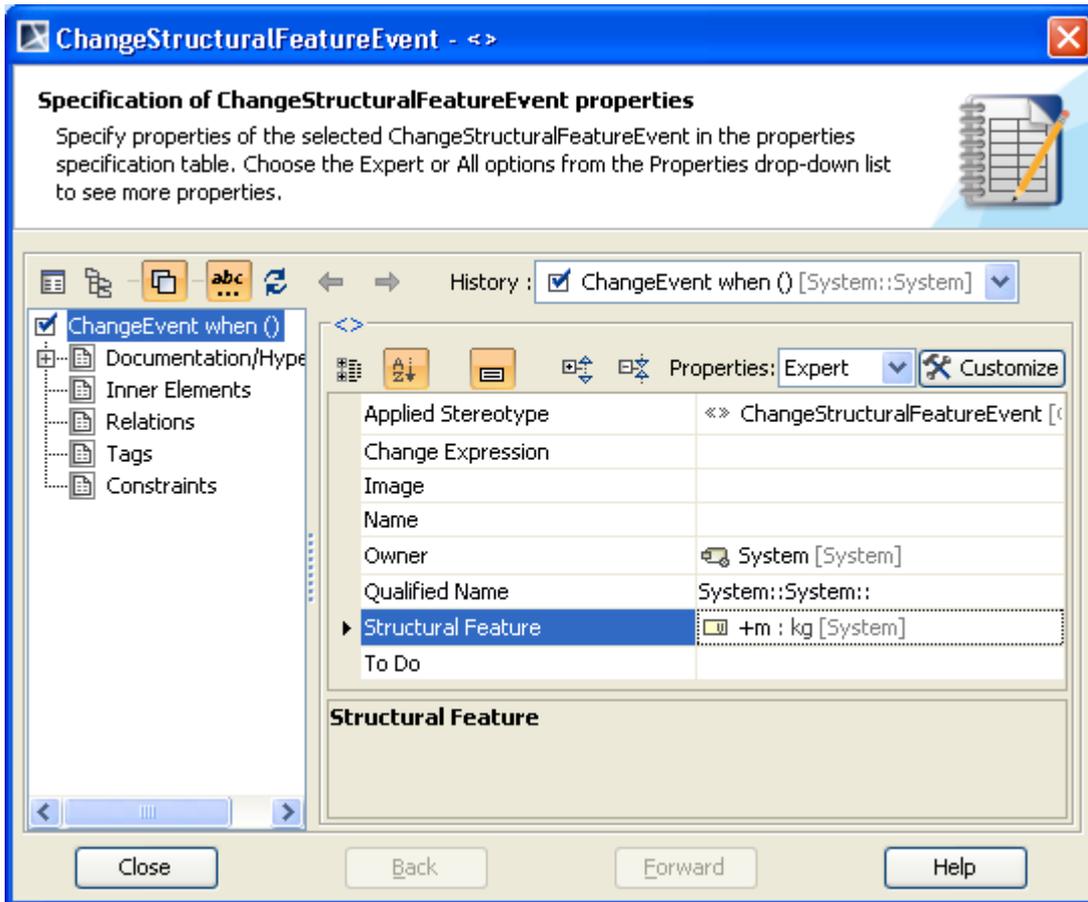


Figure 102 -- Specification window of created change structural feature event

3. Click **OK** in the **Select Property** dialog. The Accept Structural Feature Event action will be created in the selected SysML Activity diagram.

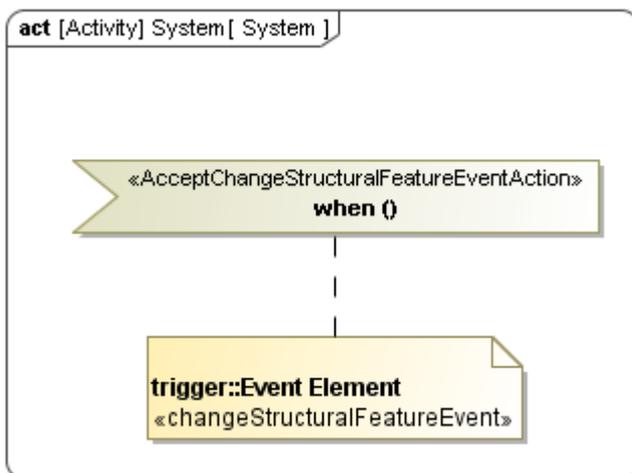


Figure 103 -- Created accept change structural feature event action

5.2.7 SysML Use Case Diagram Procedures

The SysML Use Case diagram specific features include:

[Numbering Use Cases](#)

5.2.7.1 Numbering Use Cases

To number the use cases in a Use Case diagram

1. Select **Use Case Numbering** on the diagram shortcut menu. A **Question** dialog will open, indicating that this feature requires **UseCase Description Profile**, and ask if you would like to use it.



You can also select **Use Case Numbering** on:

- Use Case shortcut menu
- Package shortcut menu

2. Click **Yes**. The **Change Use Cases Numbering** dialog will open.

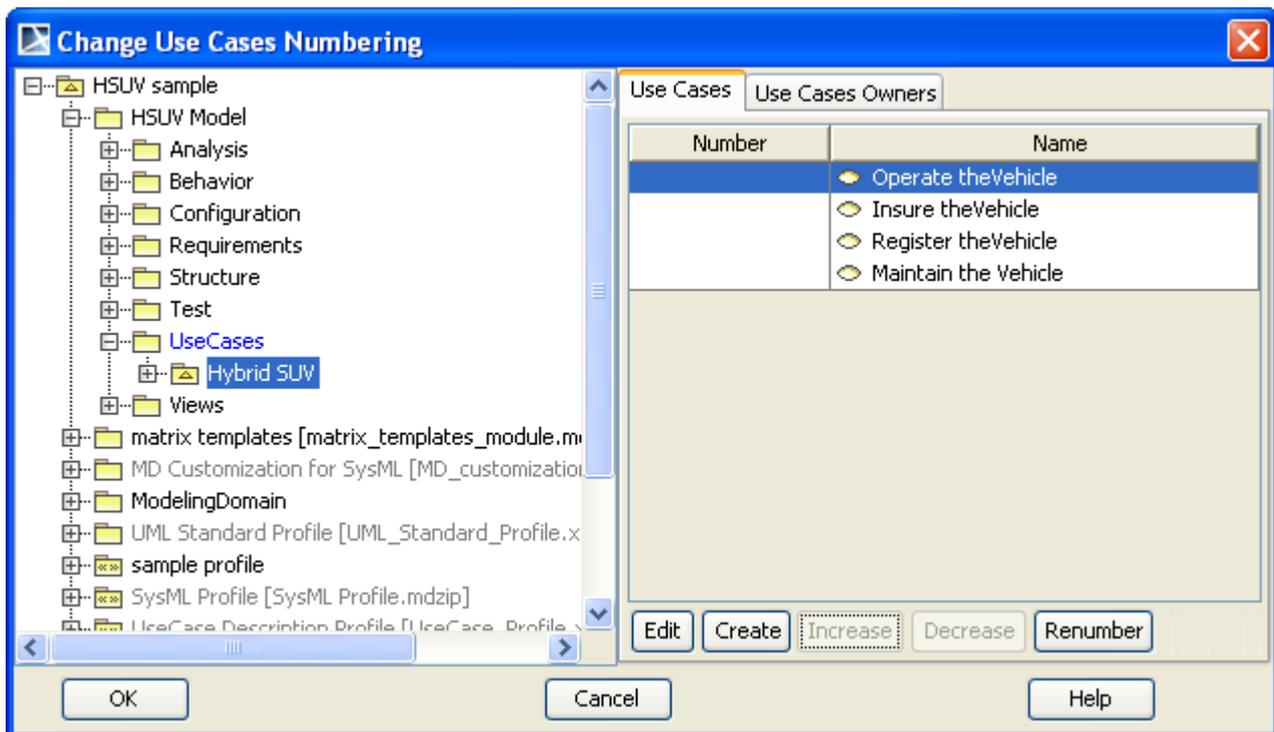


Figure 104 -- Change Use Cases Numbering dialog

3. Click **Create** to automatically number the selected use case. Each use case number will be increased by increments of one. For example, if the **Operate theVehicle** use case is numbered '1', select the **Insure theVehicle** use case, and then click the **Create** button to number the use case to '2'.
4. Click **Remove**, **Increase**, or **Decrease** to subsequently remove, increase-by-one, or decrease-by-one a use case number previously ascribed.
5. Click **Edit** to arbitrarily create a new number or change an existing number to another number. Once selected, the **Type Number** dialog will open.

5.2.8 SysML Sequence Diagram Procedures

The Sequence diagram focuses on the Message interchange between a number of Lifelines.

A sequence diagram shows the interaction information with an emphasis on the time sequence. The diagram has two dimensions: the vertical axis that represents time and the horizontal axis that represents the participating objects. The time axis could be an actual reference point (by placing the time labels as text boxes). The horizontal ordering of the objects is not significant to the operation, and you can rearrange them as necessary.

The “dot notation” is available for the lifelines. Now you can send messages directly to the deeply nested parts.

To display a deeply nested part

1. Create a Sequence diagram. The **Display Lifelines** dialog opens.

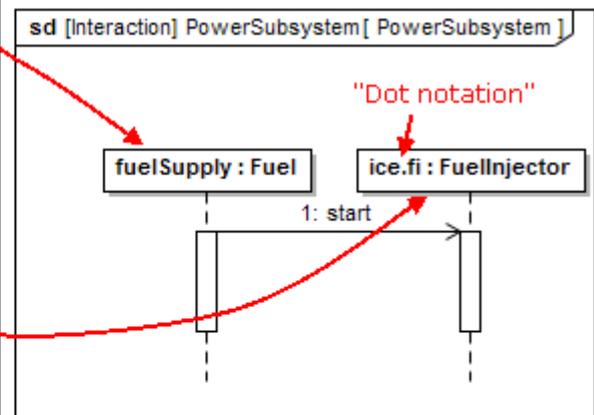
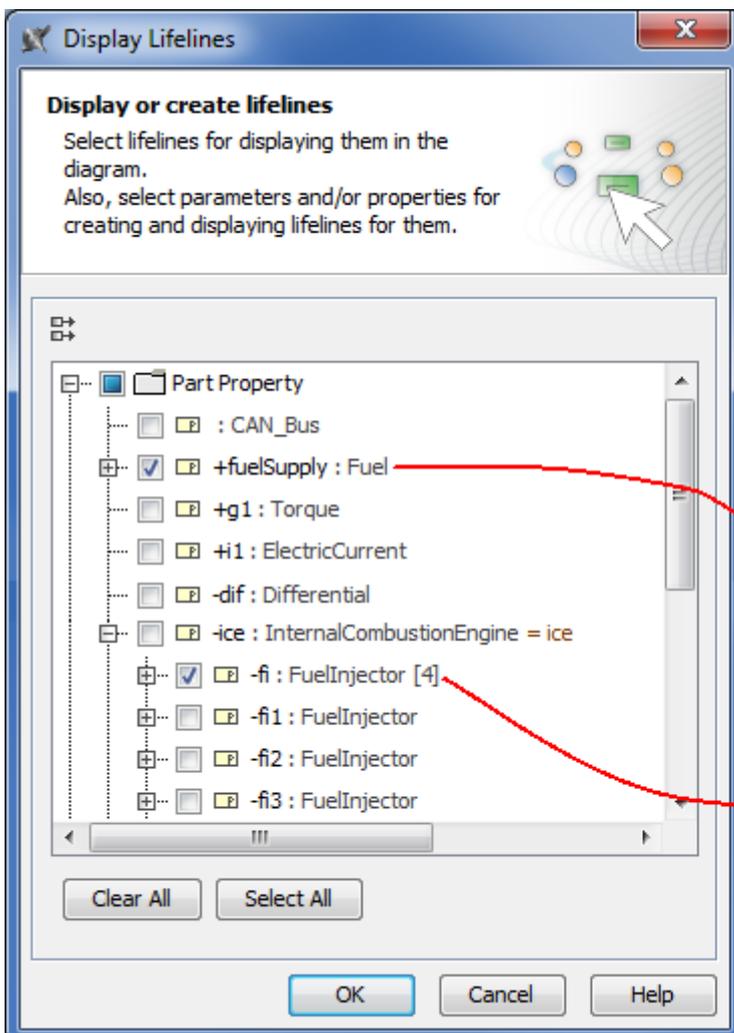


You can open the Display Lifelines dialog in the existing diagram. On the diagram pane, click the right mouse button and from the shortcut menu, select **Related Elements > Display Lifelines**.

2. Select a nested part you want to display.



Make sure that the nesting part is not selected, otherwise it will be displayed instead of the nested part.



1 APPENDIX I. QUDV

6.1 Model Library for Quantities, Units, Dimensions, and Values (QUDV)

SysML Specifications define the model of the quantities, units, and dimensions (quantity kind) in Annex C: Non-normative Extensions. You can define your own quantity and unit using the QuantityKind and Unit blocks defined in QUDV Model Library.

6.1.1 QUDV Model Library

QUDV Model Library is available for use in every new SysML project. The library, located in `<md.install.dir>/modelLibraries` directory, consists of four sub-libraries:

- [QUDV](#)
- [SI Definitions](#)
- [SI Specializations](#)
- [SI Value Type Library](#)

6.1.1.1 QUDV

QUDV Model Library (QUDV.mdzip) consists of main definitions of new units and quantity kinds system as specified in OMG SysML Specifications, for example, SimpleUnit, SimpleQuantityKind, DerivedUnit, DerivedQuantityKind, AffineConversionUnit, UnitFactor, QuantityKindFactor, and many more. Full details of QUDV Library Model definitions are available in Annex C: Non-normative Extensions to OMG SysML specifications.

6.1.1.2 SI Definitions

The SI Definitions library (SIDefinitions.mdzip) consists of predefined units and quantity kinds in QUDV system that you can use in your model. You can customize the units and value types.

6.1.1.3 SI Specializations

The SI Specializations library (SISpecializations.mdzip) consists of a diagram (and Blocks). It demonstrates how to extend the current QUDV system.

6.1.1.4 SI Value Type Library

MagicDraw SysML provides a model library that contains predefined value types. You can use them for typing the value properties in your SysML model. These value types use the units and quantity kinds defined in the QUDV model library.

Name	Unit	Quantity Kind
A	ampere : SimpleUnit	electricCurrent : SimpleQuantityKind
A/m	amperePerMeter : DerivedUnit	magneticFieldStrength : DerivedQuantityKind
A/m²	amperePerSquareMeter : DerivedUnit	currentDensity : DerivedQuantityKind

APPENDIX I. QUDV

Model Library for Quantities, Units, Dimensions, and Values (QUDV)

Name	Unit	Quantity Kind
Bq	becquerel : DerivedUnit	radionuclideActivity : DerivedQuantityKind
C	coulomb : DerivedUnit	electricCharge : DerivedQuantityKind
cd	candela : SimpleUnit	luminousIntensity : SimpleQuantityKind
cd/m²	candelaPerSquareMeter : DerivedUnit	luminance : DerivedQuantityKind
F	farad : DerivedUnit	capacitance : DerivedQuantityKind
Gy	gray : DerivedUnit	absorbedDose : DerivedQuantityKind
H	henry : DerivedUnit	inductance : DerivedQuantityKind
Hz	hertz : DerivedUnit	frequency : DerivedQuantityKind
J	joule : DerivedUnit	energy : DerivedQuantityKind
K	kelvin : SimpleUnit	thermodynamicTemperature : SimpleQuantityKind
kat	katal : DerivedUnit	catalyticActivity : DerivedQuantityKind
kg	kilogram : SimpleUnit	mass : SimpleQuantityKind
kg/m³	kilogramPerCubicMeter : DerivedUnit	massDensity : DerivedQuantityKind
lm	lumen : DerivedUnit	luminousFlux : DerivedQuantityKind
lx	lux : DerivedUnit	illuminance : DerivedQuantityKind
m	meter : SimpleUnit	length : SimpleQuantityKind
m/s	meterPerSecond : DerivedUnit	velocity : DerivedQuantityKind
m/s²	meterPerSecondSquared : DerivedUnit	acceleration : DerivedQuantityKind
mol	mole : SimpleUnit	amountOfSubstance : SimpleQuantityKind
mol/m³	molePerCubicMeter : DerivedUnit	amountOfSubstanceConcentration : DerivedQuantityKind
m²	squareMeter : DerivedUnit	area : DerivedQuantityKind
m³	cubicMeter : DerivedUnit	volume : DerivedQuantityKind
m³/kg	cubicMeterPerKilogram : DerivedUnit	specificVolume : DerivedQuantityKind
m⁻¹	reciprocalMeter : DerivedUnit	waveNumber : DerivedQuantityKind
N	newton : DerivedUnit	force : DerivedQuantityKind
Pa	pascal : DerivedUnit	pressure : DerivedQuantityKind
rad	radian : DerivedUnit	planeAngle : DerivedQuantityKind
s	second : SimpleUnit	time : SimpleUnit
S	siemens : DerivedUnit	electricConductance : DerivedQuantityKind
sr	steradian : DerivedUnit	solidAngle : DerivedQuantityKind
Sv	sievert : DerivedUnit	doseEquivalent : DerivedQuantityKind
T	tesla : DerivedUnit	magneticFluxDensity : DerivedQuantityKind
V	volt : DerivedUnit	electricPotentialDifference : DerivedQuantityKind
W	watt : DerivedUnit	power : DerivedQuantityKind
Wb	weber : DerivedUnit	magneticFlux : DerivedQuantityKind

APPENDIX I. QUDV

Model Library for Quantities, Units, Dimensions, and Values (QUDV)

Name	Unit	Quantity Kind
°C	celciusTemperature : AffineConversionUnit	celciusTemperature : DerivedQuantityKind
Ω	ohm : DerivedUnit	electricResistance : DerivedQuantityKind

1 APPENDIX II. VALIDATION

7.1 Validation

MagicDraw provides the Validation functionality to validate user-created models against a set of constraints. Use SysML validation suite (**SysML ValSuite**) in SysML Plugin with this MagicDraw functionality to validate SysML models.

See MagicDraw User Manual for more information on this MagicDraw functionality.

SysML ValSuite includes seven validation suites:

1. SysML ValSuite - Activities
2. This suite contains SysML constraints on the following elements: Control Operator, Control Value, Discrete, noBuffer, Optional, Probability and Rate.
3. SysML ValSuite - Blocks
4. This suite contains SysML constraints on the following elements: Binding Connector, Block, Distributed Property, Part Property, Reference Property, Shared Property, Value Property and Value Type.
5. SysML ValSuite - Constraint Blocks
6. This suite contains SysML constraints on the following elements: Constraint Block and Constraint Property.
7. SysML ValSuite - Model Elements
8. This suite contains SysML constraints on the following elements: View and Viewpoint.
9. SysML ValSuite - Non-normative Extensions
10. This suite contains SysML constraints on the following elements: nonStreaming, Streaming, Design Constraint, Functional Requirement, Interface Requirement and Performance Requirement.
11. SysML ValSuite - Port and Flows
12. This suite contains SysML constraints on the following elements: Flow Port, Flow Property, Flow Specification and Item Flow.
13. SysML ValSuite - Requirements
14. This suite contains SysML constraints on the following elements: Copy, DeriveReq, Requirement and Test Case.



If you use **SysML ValSuite** as the validation criteria, your model will be validated against all seven SysML validation suites at the same time.

To validate a SysML project

1. Click **Analyze > Validation > Validation** on the main menu.
2. The **Validation** dialog will open.
3. Select a validation suite, for example, **SysML ValSuite [MD Customization for SysML::SysML constraints]**, in the **Validation Suite** drop-down list to validate your model against a set of SysML constraints, in this example, all of them.

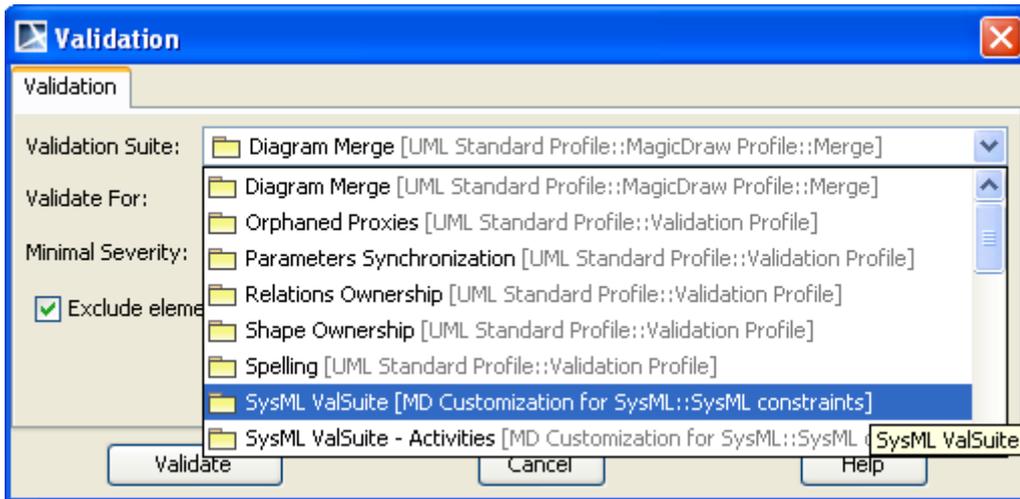


Figure 1 -- validation suite package selection



To limit the scope of the constraints to be validated against, select another smaller validation suite, for example, **SysML ValSuite - Blocks** to validate against the constraints in OMG SysML specifications, chapter 8: Blocks. This is useful because, generally, a user has a limited scope of concerns. Business Analysts, for example, only concern themselves with Requirements, thus **SysML ValSuite - Requirements** should be chosen.

4. In the **Validate For** drop-down list, select one of the following:
 - **Whole Project** to validate the entire SysML project
 - **Validation Selection** to validate only specific elements in that SysML project.

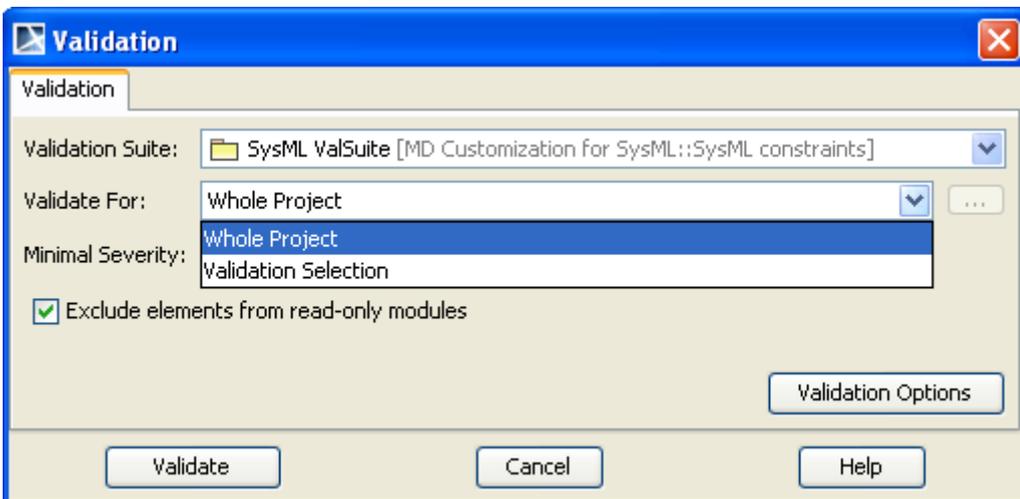


Figure 2 -- Validation element selection

5. If you have selected **Validation Selection**, click the browse button ... to open the **Select Elements** dialog. Add elements to the **Selected objects** pane using buttons in the middle of the dialog. Only the element(s) listed in the **Selected objects** pane will then be validated. When all required elements are selected, click **OK**.

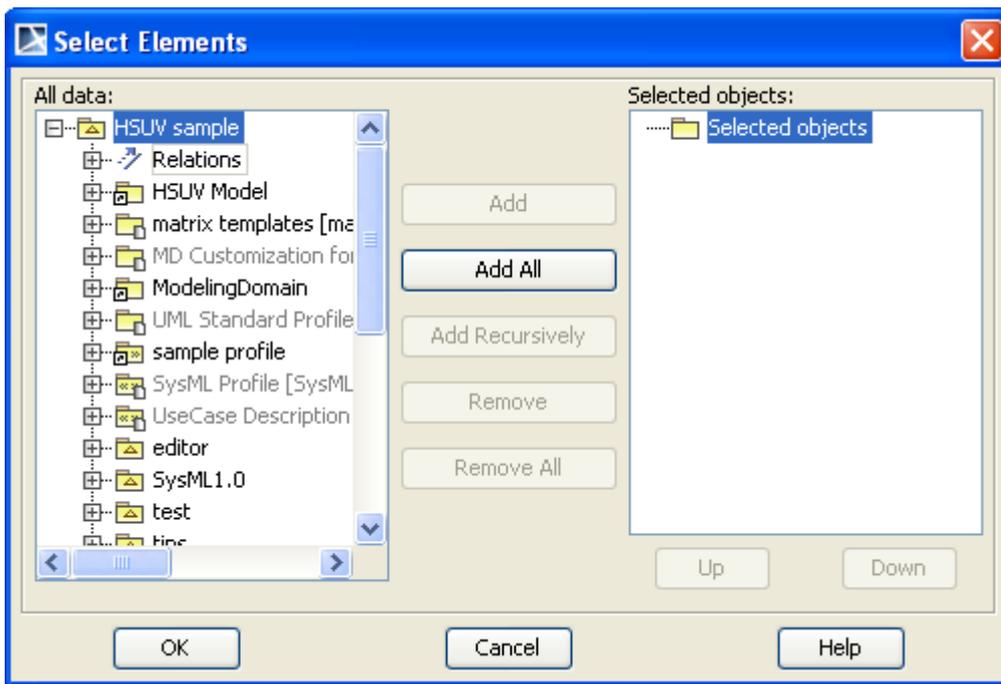


Figure 3 -- Select Elements dialog

- Click the **Validate** button in the **Validation** dialog once elements have been selected to be validated. When the validation process is completed, the results of the validation will be displayed in the **Validation Results** window, usually located at the bottom of the MagicDraw window



- Mark **Exclude elements from read-only modules** to ignore the elements in read-only modules from the validation process.
- Validation may take several minutes if your model is large.

- The **Validation Results** window will show the elements that do not conform to some constraints in the selected validation suite. These elements are called “invalid” elements and are highlighted. If a highlighted invalid element is selected, for example, the Loss of Fluid requirement element, a warning will appear.

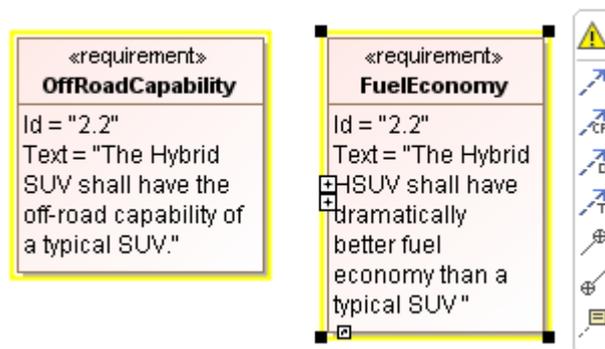


Figure 4 -- Invalid elements highlighted after Validation

- Place your mouse pointer on the warning icon to display the error message corresponding to the broken constraint.

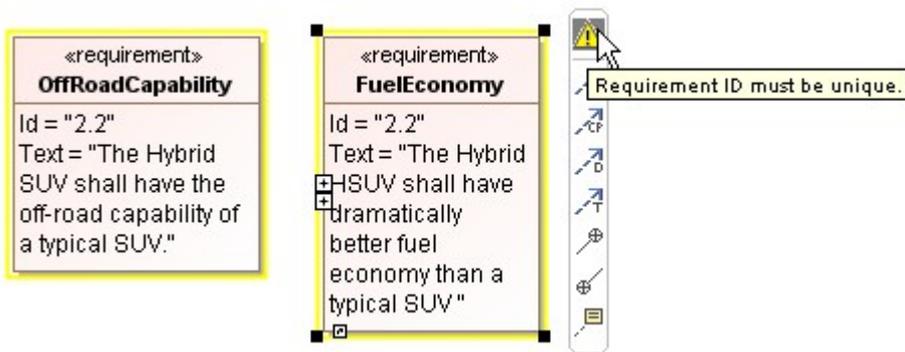


Figure 5 -- Error message displayed on warning symbol

9. Click the warning icon to display a menu. Then, select either **Ignore** or **Select in the Validation Results**.
 - If you select **Ignore**, the invalid element will then be excluded from the next validation process.
 - If you select **Select in the Validation Results**, the element will then be selected in the **Validation Results** window. This option helps identify the invalid element instantly, especially when there are a number of invalid elements displayed in the **Validation Results** window.

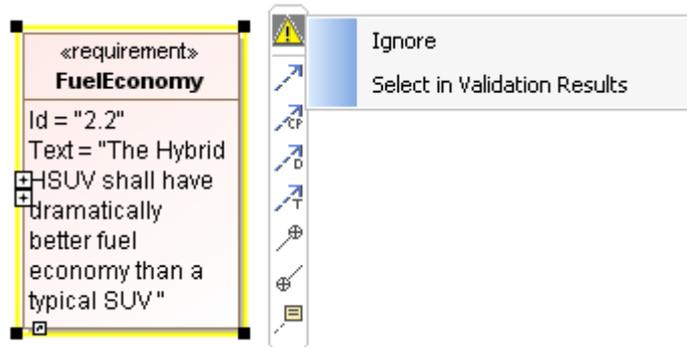


Figure 6 -- Invalid element validation options

10. The Validation Results window includes the following icons. If you click the:
 -  icon (Select in Containment Tree), you will be redirected to the selected invalid element in the Containment Tree.
 -  icon (Select Rule in the Containment Tree), you will be redirected to the broken constraint of the selected invalid element in the Containment Tree.
 -  icon (Open all diagrams containing the selected element), any diagram containing the selected invalid element will then be displayed.
 -  icon (Solve), you can either ignore the selected element (which will thus not be considered in the next validation process), or select one of the solutions provided to resolve the invalidity.
 -  icon (Run validation with current settings), the validation process will be executed immediately, using the previous setting.
 -  icon (Run validation with a new settings), the **Validation Suite Packages Selection** dialog will open. You can then change the settings and re-validate your model again.



Additional validation rules / constraints can be added and grouped into a validation suite (either in a newly-created one or in an existing one).



For more information about the Validation feature, see the Model Analysis in the Validation section in the *MagicDraw User Manual.pdf*.

7.1.1 Active Validation

This feature enables you to check at once if a model is correct and complete. Unlike the regular Validation feature in the [Validation](#) section above, Active Validation will instantly display any errors in the model and suggest appropriate solutions.

To validate a SysML model, **SysML ActiveValSuite** package contains six active validation suites:

- SysML_activeValSuite - Activities
- This suite contains SysML constraints on the following elements: Discrete and noBuffer.
- SysML_activeValSuite - Blocks
- This suite contains SysML constraints on the following elements: Binding Connector, Block, Distributed Property and Value Type.
- SysML_activeValSuite - Constraint Blocks
- This suite contains SysML constraints on the following elements: Constraint Block and Constraint Property.
- SysML_activeValSuite - Non-normative Extensions
- This suite contains SysML constraints on the following elements: nonStreaming, Streaming, Design Constraint, Functional Requirement, Interface Requirement and Performance Requirement.
- SysML_activeValSuite - Port and Flows
- This suite contains SysML constraints on the following elements: Flow Port, Flow Property, Flow Specification and Item Flow.
- SysML_activeValSuite - Requirements
- This suite contains SysML constraints on the following elements: Copy, Requirement and Test Case.

To turn on the Active Validation feature

1. Click **Analyze > Validation > Enable Active Validation**, making sure that **Enable Active Validation** is selected. The Active Validation engine will validate in real time the model you are working on whenever the need arises, for example, when a project is loaded or an element of a model changed.

The following example, a simple SysML project with three requirements and a Copy dependency, illustrates how this Active Validation feature works.

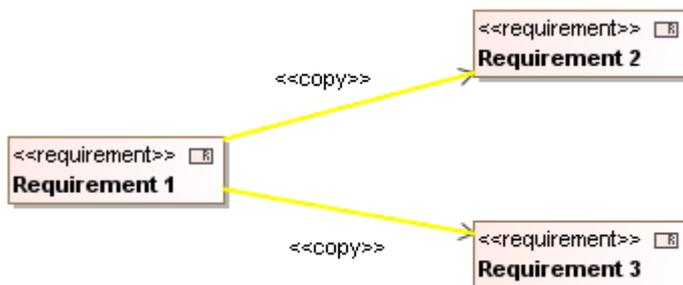


Figure 7 -- Invalid elements detected by Active Validation

The model in this project was designed so that **Requirement 1** copies **Requirement 2** and **Requirement 3** at the same time. However, one of the constraints of a 'Copy' dependency is that a

requirement cannot copy more than one requirement at a time. Thus, this model is invalid since some elements are invalid against the constraint.

2. Whenever an element is invalid, it will be highlighted in the diagram. On the status bar at the bottom of the screen,

- a notification symbol (info , warning  or error ), and
- numbers and severities of invalid elements

will be displayed. For example,

-  **4 W** means that there are 4 invalid elements violating constraint(s) of the 'warning' severity.
-  **1 E, 7 W, 92 I** in means that there are 1, 7 and 92 invalid elements violating constraint(s) of the 'error', 'warning' and 'info' severities, respectively.

3. To find out the reason why an element is invalid, you can either:

- Click the warning symbol on the status bar. The **Active Validation Results** window will then open (usually at the bottom of the screen), displaying the element(s) that does not conform to some constraint(s) in the active validation suite(s) and the reason for the invalidity.
- Select a highlighted invalid element in the diagram. Once a highlighted invalid element has been selected in the diagram, a warning symbol will appear. Place your pointer on the warning symbol to see the error message related to the constraint, for instance, *A requirement can't copy more than one requirement.*

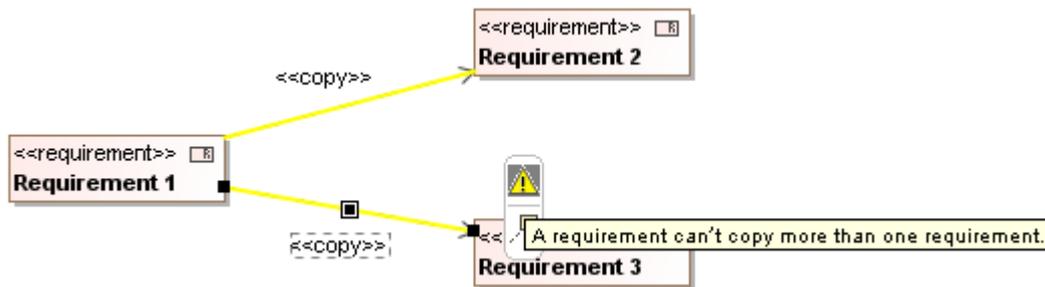
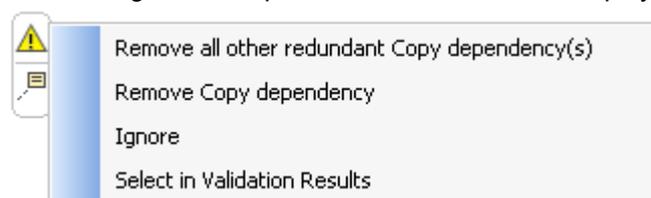


Figure 8 -- Invalid «copy» dependency usage

4. Unlike the Validation feature in the *Validation* section, this Active Validation feature will, in most cases, also suggest solution(s) to fix model invalidity problem(s). To see the list of appropriate solution(s) for an invalid element, you can do one of the following:

- Right-click the invalid element in the **Active Validation Results** window if you have open this window before.
- Click the warning symbol after you have clicked the invalid element in the diagram. After clicking, for example, solutions will then be displayed.



5. The **Active Validation Results** window includes the following icons. If you click the:

- Select in Containment Tree, you will be redirected to the selected invalid element in the Containment Tree.
- Select Rule in the Containment Tree, you will be redirected to the broken constraint of the selected invalid element in the Containment Tree.
- Open all diagrams containing the selected element, any diagram containing the selected invalid element will then be displayed.

- Solve, you can either ignore the selected element (which will thus not be considered in the next validation process), or select one of the solutions provided to resolve the invalidity.
 - Active Validation Options, the **Project Options** dialog will then open for you to customize all the options listed under **Active Validation**.
6. In the example below, a constraint, referenced as “Copy[A]”, is broken. If the solution suggested by the Active Validation feature, in this case, *Remove all other redundant Copy dependency(s)*, is selected, the correctness of the model will be satisfied.

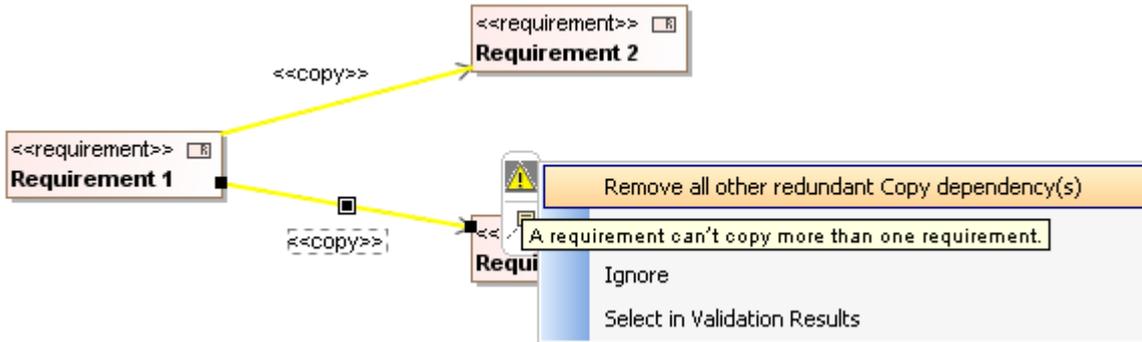


Figure 9 -- Selection of first solution

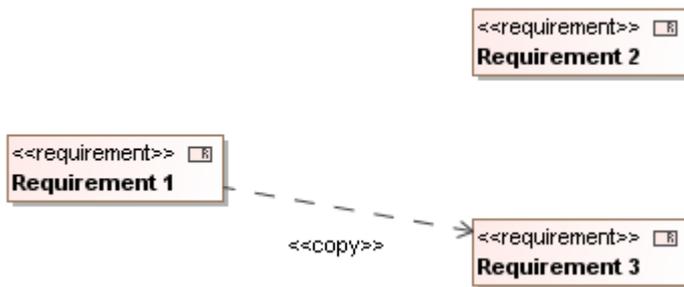


Figure 10 -- Valid elements



Each implemented constraint has its own appropriate solutions. The Active Validation feature ensures that SysML modeling is consistent with OMG SysML Specifications.

7.1.1.1 Active Validation Options

You can customize the Active Validation feature using the five options in the following figure.

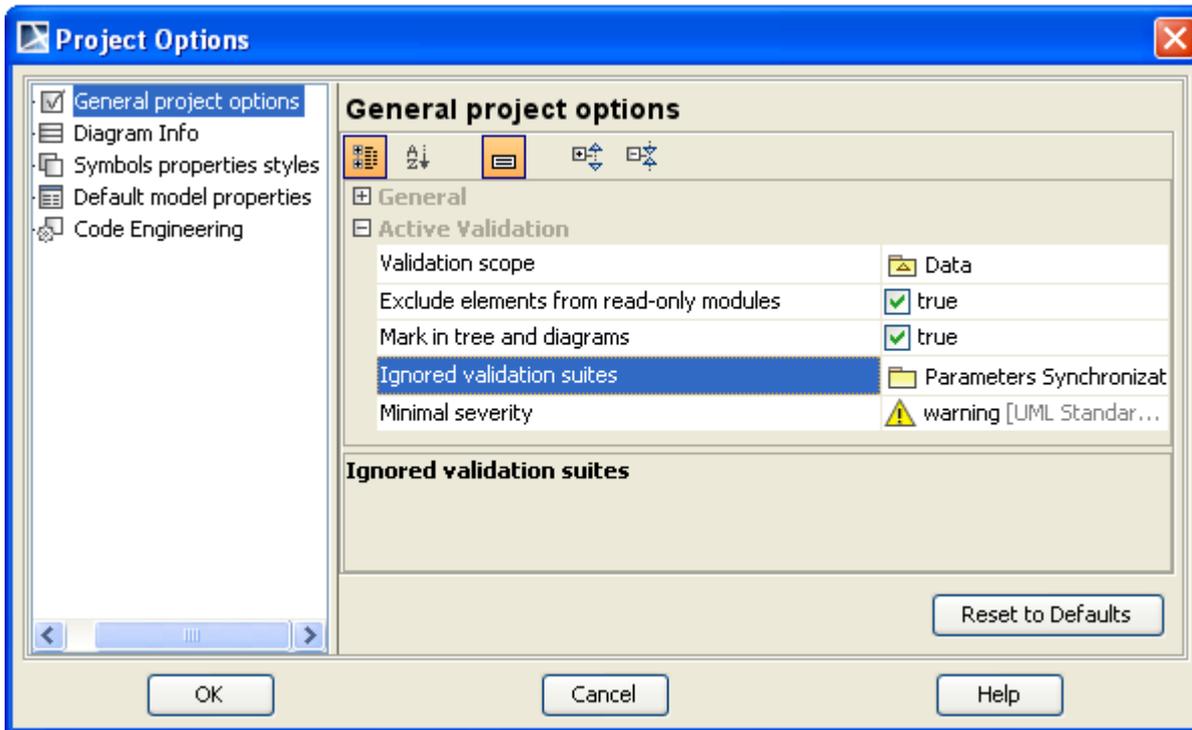


Figure 11 -- Project Option dialog

7. **Validation scope** (default = data): use this option to limit the scope of elements to be actively validated.
8. **Exclude elements from read-only modules** (default = true): if this option is selected (selecting the check box means 'true'), read-only modules, for example read-only profiles, will not be actively validated.
9. **Mark in tree and diagrams** (default = true): if this option is selected (selecting the check box means 'true'), invalid elements will be marked with small icons in the Containment Tree and highlighted in the diagrams.
10. **Ignored validation suites**: you can enter the active validation suite(s) you would like to exclude from the Active Validation process.
11. **Minimal severity**: you can specify the minimal severity level of the constraints to be validated against. There are five levels of severities:
 - **>=debug**: All constraints will be included in the active validation.
 - **>=info**: Constraints with infos, warnings, errors, or fatal severities will be included.
 - **>=warning (default)**: Constraints with warnings, errors, or fatal severities will be included.
 - **>=error**: Constraints with error or fatal severities will be included.
 - **Fatal**: Only constraints with fatal severities will be included.

To open the Active Validation Options dialog

1. Click **Analyze > Validation > Active Validation Options**. The **Project Options** dialog opens.
2. Go to the **General project options** pane and select **Active Validation > Ignored validation suites**.

To ignore some unused or unimportant active validation suites

1. Click the **Browse**  button. The **Select Suites** dialog opens.

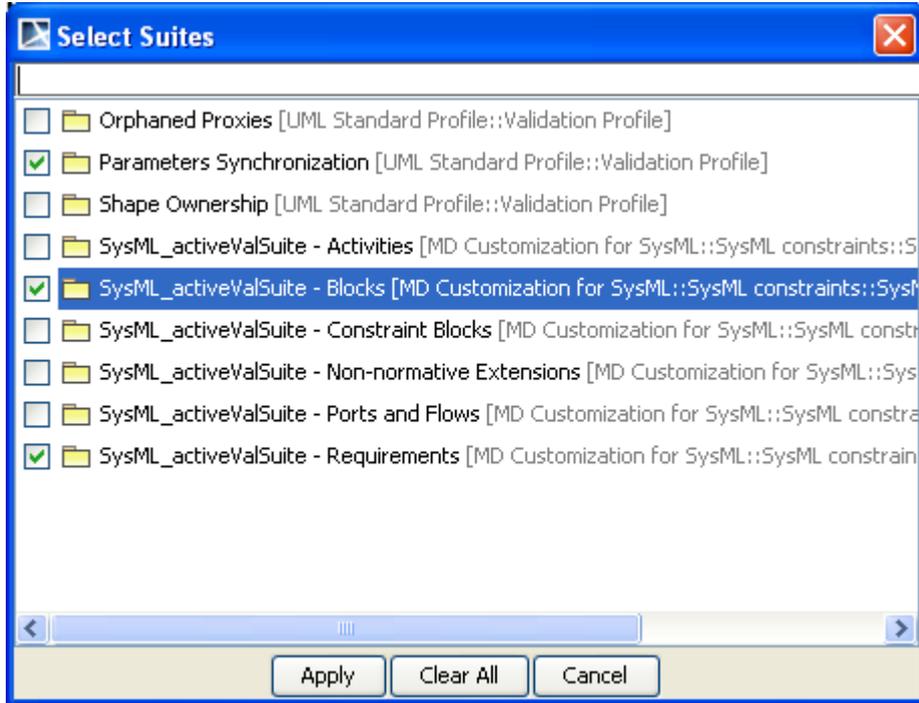


Figure 12 -- Select Suites dialog

2. Select the check boxes in order to ignore the active validation suites, and then click **Apply**. In this example, three validation suites will be excluded from the validation process.



Additional validation rules / constraints can be added and grouped into an active validation suite (in a newly-created one or in an existing one).



For more information on the Active Validation feature, see the *Model Analysis* in the Validation section in the MagicDraw User Manual.pdf.

7.1.2 SysML Constraints

SysML constraints implementation for SysML validation suites and active validation suites include the following:

Constraint		Constraint Description (Description excerpts have been taken from the OMG SysML Specifications 1.3 with permission.)	Directly specified in OMG SysML spec	Derived from OMG SysML spec
Binding Connector	1	The two ends of a Binding Connector must have either the same type or types that are compatible, so that equality of their values can be defined.	8.3.2.1	
Block	7	Within an instance of a SysML Block, the instances of properties with composite aggregation must form an acyclic graph.	8.3.2.2	
Block	8	Any classifier which specializes a Block must also have the «Block» stereotype applied.	8.3.2.2	

APPENDIX II. VALIDATION

Validation

Constraint		Constraint Description (Description excerpts have been taken from the OMG SysML Specifications 1.3 with permission.)	Directly specified in OMG SysML spec	Derived from OMG SysML spec
Block	A	If isEncapsulated of a block is true, then the block is treated as a black box. A part typed by this black box can only be connected to its ports or directly to its outer boundary.		8.3.2.2
BlockProperty	A	The block's properties must be applied with the matching stereotype. <ul style="list-style-type: none"> Part property, which is the property that is typed by Block and has composite aggregation, must be applied with «PartProperty». Shared property, which is the property that is typed by Block and has shared aggregation, must be applied with «SharedProperty». Reference property, which is the property that is typed by Block and has none aggregation, must be applied with «ReferenceProperty». Value property, which is the property that is typed by value type, must be applied with «ValueProperty». 		
ValueProperty	A	The type of a value property must be a value type.		8.3.2.2
DistributedProperty	1	The «DistributedProperty» stereotype may be applied only to properties of classifiers stereotyped by Block or Value Type.	8.3.2.4	
ValueType	1	Any classifier which specializes a ValueType must also have the «ValueType» stereotype applied.	8.3.2.10	
ValueType	A	If a value is present for the 'unit' attribute, the 'quantity kind' attribute must be equal to the value of the 'quantity kind' attribute of the referenced unit.		8.3.2.10
AcceptChangeStructural FeatureEventAction	1	The action has exactly one trigger, the event of which must be a Change Structural Feature event.	9.3.2.1	
AcceptChangeStructural FeatureEventAction	2	The action has two result pins with the type and order the same as the type and order of the structural feature of an trigger event. The action's multiplicity is also compatible with the multiplicity of a structural feature.	9.3.2.1	
AcceptChangeStructural FeatureEventAction	3	The structural feature of a trigger event must be owned by or inherited to the context of the behavior containing an action (The context of a behavior is its owning block, or itself if it is not owned by a block. See the definition in the UML 2 Superstructure Specification.).	9.3.2.1	
AcceptChangeStructural FeatureEventAction	4	Visibility of the structural feature of the trigger event must allow access to the object that performs the action.	9.3.2.1	
ChangeStructuralFeatur eEvent	1	The structural feature must not be static.	9.3.2.3	
ChangeStructuralFeatur eEvent	2	The structural feature must have exactly one featuringClassifier.	9.3.2.3	

APPENDIX II. VALIDATION

Validation

Constraint		Constraint Description (Description excerpts have been taken from the OMG SysML Specifications 1.3 with permission.)	Directly specified in OMG SysML spec	Derived from OMG SysML spec
DirectedFeature	1	DirectedFeature can only be applied to behavioral features or to properties that do not have FlowProperty applied, including subset or redefined features	9.3.2.4	
DirectedFeature	2	Operations that are not provided must not have or inherit methods.	9.3.2.4	
FlowPort	1	A FlowPort must be typed by a Flow Specification, Block, Signal, or Value Type	Deprecat ed	
FlowPort	2	If the FlowPort is atomic (isAtomic=True), the direction must be specified (has a value) and isConjugated must not be specified (has no value).	Deprecat ed	
FlowPort	3	If the FlowPort is nonatomic and if all of the Flow Properties of the Flow Specification typing the port have 'in' direction, the FlowPort direction will be 'in' (or 'out' if isConjugated=true). If all the Flow Properties are 'out', the FlowPort direction will be 'out' (or 'in' if isConjugated=true). If the Flow Properties are both 'in' and 'out', the direction will be 'inout'.	Deprecat ed	
FlowPort	4	A FlowPort can be connected (via connectors) to one or more flow ports that have matching Flow Properties. There are three options in matching Flow Properties: <ul style="list-style-type: none"> 1. Type Matching: The type being sent is the same type or a sub-type of the type being received. 2. Direction Matching: If the connector connects two parts that are external to one another, then the direction of the Flow Properties must be opposite, or at least one of the ends should be 'inout'. If the connector is internal to the owner of one of the flow ports, then the direction should be the same or at least one of the ends should be 'inout'. 3. Name Matching: If the type and direction match several Flow Properties at the other end, the property that has the same name at the other end is selected. If there is no such property, then the connection will then be ambiguous (ill-formed). 	Deprecat ed	
FlowPort (non-active)	A	The default direction of the atomic FlowPort should be set to 'inout' when creating a new atomic FlowPort or changing nonatomic to atomic type.		Deprecat ed
FlowPort	B	A FlowPort can only be applied to a port which is owned by a Block or its subtype.		Deprecat ed
FlowProperty	1	FlowProperties must be typed by a ValueType, Block, or a Signal.	9.3.2.7	
FlowProperty	B	A Flow Property must have its direction specified and the default value of the direction should be 'inout'.		9.3.2.7
FlowSpecification	A	A FlowSpecification can be used as a type of a FlowPort only.		Deprecat ed

APPENDIX II. VALIDATION

Validation

Constraint		Constraint Description (Description excerpts have been taken from the OMG SysML Specifications 1.3 with permission.)	Directly specified in OMG SysML spec	Derived from OMG SysML spec
FullPort	1	Full ports cannot also be proxy ports. This applies even if some of the stereotypes are on subset or redefined ports.	9.3.2.8	
FullPort	2	Binding connectors cannot link full ports to other composite properties of the block owning the port, except ports that are not full.	9.3.2.8	
FullPort	3	Full ports cannot be behavioral. (isBehavior = false).	9.3.2.8	
FullPort	4	Full ports cannot be conjugated (isConjugated = false).	9.3.2.8	
InterfaceBlock	1	Interface blocks cannot own or inherit behaviors and have classifier behaviors or methods for their behavioral features.	9.3.2.9	
InterfaceBlock	2	Interface blocks cannot have composite properties that are not ports.	9.3.2.9	
InterfaceBlock	3	Ports owned by interface blocks can only be typed by interface blocks.	9.3.2.9	
InterfaceBlock	A	Interface block should inherit from interface block only.		
InvocationOnNestedPort Action	1	The onPort property of an invocation action must have a value when this stereotype is applied.	9.3.2.10	
InvocationOnNestedPort Action	2	The port at the first position in the onNestedPort property must be owned by the target object of a stereotyped action.	9.3.2.10	
InvocationOnNestedPort Action	3	The port at each successive position of the onNestedPort property, following the first position, must be contained in the block that types the port at an immediately preceding position.	9.3.2.10	
InvocationOnNestedPort Action	4	Within a stereotyped invocation action, the onPort port of the invocation action must be contained in the type of the port at the last position of the onNestedPort list.	9.3.2.10	
ItemFlow	2	An ItemFlow itemProperty must be typed by a Block or by a ValueType.	9.3.2.11	
ItemFlow	3	ItemProperty is a property of the common (possibly indirect) owner of a source and target.	9.3.2.11	
ItemFlow	5	If an ItemFlow has an itemProperty, one of the classifiers of conveyed items must be the same as the type of the item property.	9.3.2.11	
ItemFlow	4	Item property cannot have a value if the item flow is realized by an Association.	9.3.2.11	
ItemFlow	6	If an ItemFlow has an itemProperty, its name should be the same as the name of the item flow.	9.3.2.11	
ItemFlow	A	The conveyed classifiers must be the same or subtype of classifier that type flow property of flow specification.		9.3.2.11

APPENDIX II. VALIDATION

Validation

Constraint		Constraint Description (Description excerpts have been taken from the OMG SysML Specifications 1.3 with permission.)	Directly specified in OMG SysML spec	Derived from OMG SysML spec
ProxyPort	1	Proxy ports cannot also be full ports. This applies even if some of the stereotypes are on subset or redefined ports.	9.3.2.12	
ProxyPort	2	Proxy ports can only be typed by interface blocks.	9.3.2.12	
ProxyPort	3	Ports owned by the type of a proxy port must be proxy ports.	9.3.2.12	
TriggerOnNestedPort	1	The port property of a stereotyped trigger must have exactly one value, and the value cannot be a full port.	9.3.2.13	
TriggerOnNestedPort	2	The values of the onNestedPort property must not be full ports.	9.3.2.13	
TriggerOnNestedPort	3	The port at the first position in the onNestedPort property must be owned by a block in which the trigger is used.	9.3.2.13	
TriggerOnNestedPort	4	The port at each successive position of the onNestedPort property, following the first position, must be contained in the block that types the port at an immediately preceding position.	9.3.2.13	
TriggerOnNestedPort	5	The value of the port property of a stereotyped trigger must be contained in the type of the port at the last position of the onNestedPort list.	9.3.2.13	
ConstraintBlock	1	A ConstraintBlock cannot own any structural or behavioral elements beyond: <ul style="list-style-type: none"> ● constraint parameters. ● constraint properties that hold internal usages of constraint blocks. ● binding connectors between its internally nested constraint parameters. ● constraint expressions that define an interpretation for the constraint block. ● general purpose model management and crosscutting elements. 	10.3.2.1	
ConstraintBlock	2	Any classifier which specializes a ConstraintBlock must also have the «ConstraintBlock» stereotype applied.	10.3.2.1	
ConstraintBlock	A	Binding connectors are used to bind each parameter of the constraint block to a property in the surrounding context.		10.3.2.1
ConstraintParameter	A	This constraint parameter has not been used in a constraint expression of its constraint block. (This constraint is not explicitly specified in OMG SysML spec, however, the unused constraint parameter can imply that there is a high probability of the presence of an excess constraint parameter or an incorrectly named constraint parameter.)		

APPENDIX II. VALIDATION

Validation

Constraint		Constraint Description (Description excerpts have been taken from the OMG SysML Specifications 1.3 with permission.)	Directly specified in OMG SysML spec	Derived from OMG SysML spec
ConstraintProperty (non-active)	1	A property to which the «ConstraintProperty» stereotype is applied, must be owned by a SysML Block.	10.3.2.2	
Discrete	1	The «discrete» and «continuous» stereotypes cannot be applied to the same element at the same time.	11.3.2.3	
NoBuffer	1	The «nobuffer» and «overwrite» stereotypes cannot be applied to the same element at the same time.	11.3.2.4	
Overwrite	1	The «overwrite» and «nobuffer» stereotypes cannot be applied to the same element at the same time.	11.3.2.5	
AllocateActivityPartition	A	The represented element of the activity partition which is applied with «AllocateActivityPartition» stereotype, should be the Property.		15.3.2.3
AllocateActivityPartition	B	An Action appearing in an AllocateActivityPartition will be the /client (from) end of an allocate dependency. The element that represents the AllocateActivityPartition will be the /supplier (to) end of the same allocate dependency.		15.3.2.3
Copy	1	A 'Copy' dependency may only be created between two classes that have the «requirement» stereotype, or a subtype of the «requirement» stereotype applied.	16.3.2.1	
Copy	2	The text property of the client requirement is constrained to be a copy of the text property of the supplier requirement.	16.3.2.1	
Copy	A	A requirement cannot copy more than one requirement.		16.3.2.1
Copy	B	'Copy' dependencies should not form a cyclic graph.		16.3.2.1
Copy	C	If the supplier requirement has sub requirements, copies of the sub requirements are made recursively in the context of the client requirement. 'Copy' dependencies are created between each sub requirement and the associated copy.		16.3.2.1
Requirement	5	A nested classifier of a class that is stereotyped by «requirement» must also be stereotyped by «requirement».	16.3.2.3	
Requirement	A	A Requirement ID must be unique.		16.3.2.3
TestCase	1	The type of return parameter of the stereotyped model element must be VerdictKind. (Note this is consistent with the UML Testing Profile.)	16.3.2.5	
streaming	1	The activity has at least one streaming parameter.	C.1.2	
streaming/non- Streaming	A	The «streaming» and «nonstreaming» stereotypes cannot be applied to the same element at the same time.		C.1.2
nonStreaming	1	The activity has no streaming parameter.	C.1.2	
functionalRequirement	1	Must be satisfied by an operation or a behavior.	C.2.2	

APPENDIX II. VALIDATION

Validation

Constraint		Constraint Description (Description excerpts have been taken from the OMG SysML Specifications 1.3 with permission.)	Directly specified in OMG SysML spec	Derived from OMG SysML spec
interfaceRequirement	1	Must be satisfied by a port, connector, item flow, and/or a constraint property.	C.2.2	
performanceRequirement	1	Must be satisfied by a value property.	C.2.2	
designConstraint	1	Must be satisfied by a block or a part.	C.2.2	
PropertySpecificType (non-active)	1	A classifier to which the «PropertySpecificType» stereotype is applied must be referenced as the type of one and only one property.	8.3.2.7	
PropertySpecificType (non-active)	2	The name of a classifier to which a «PropertySpecificType» is applied must be missing (The "name" attribute of the NamedElement metaclass must be empty).	8.3.2.7	
PropertySpecificType (non-active)	A	Classifiers with the «PropertySpecificType» stereotype are owned by the block which owns the property which has the property-specific type.		8.3.2.7
PropertySpecificType (non-active)	B	Property which is typed by the «PropertySpecificType» should be owned by block or subtypes of block.		8.3.2.7

1 APPENDIX III. OPEN API

8.1 Stereotype Usage

Standard stereotypes in SysML plugin are defined in SysML Profile and MD Customization for SysML Profile. Both profiles have their corresponding API classes: `com.nomagic.magicdraw.sysml.util.SysMLProfile` and `com.nomagic.magicdraw.sysml.util.MDCustomizationForSysMLProfile`, respectively. Each class allows you to:

- Get a string constant for each property of stereotype (tag).
- Get a stereotype element.
- Check if an element is stereotyped.

See [index.html](#) in **SysMLProfileJavaDoc.zip**, located at “plugins/com.nomagic.magicdraw.sysml/openapi/docs”, for the JavaDoc for the two API classes.

8.1.1 SysML Profile

You need to import `com.nomagic.magicdraw.sysml.util.SysMLProfile` to use this API class.

Get a string constant for each property of stereotype (tag)

Usage includes “`SysMLProfile.STEREOTYPE_PROPERTY_NAME`”.

For example, `SysMLProfile.ALLOCATED_ALLOCATEDFROM_PROPERTY` returns a string of “`allocatedFrom`”.

Get a stereotype element

Usage includes:

- “`SysMLProfile.getInstance(project).getStereotype()`” - where `project` refers to a project that uses SysML Profile.
- “`SysMLProfile.getInstance(element).getStereotype()`” - where `element` refers to the element in a project that uses SysML Profile.

For example, `SysMLProfile.getInstance(project).getBlock()` returns the reference to the «Block» stereotype object.

Check if an element is stereotyped

Usage includes “`SysMLProfile.isStereotype(Elem)`” - where `Elem` is the element you would like to check.

For example, given an element “`Elem`”, `SysMLProfile.isBlock(Elem)` returns `True` if the element “`Elem`” has «Block» stereotype applied, and returns `false` otherwise.

8.1.2 MD Customization for SysML Profile

You need to import `com.nomagic.magicdraw.sysml.util.MDCustomizationForSysMLProfile` to use this API class.

Get a string constant for each property of stereotype (tag)

Usage includes “`MDCustomizationForSysMLProfile.STEREOTYPE_PROPERTY_NAME`”.

For example, `MDCustomizationForSysMLProfile.NUMBEROWNER_PREFIX_PROPERTY` returns a string of “prefix”.

Get a stereotype element

Usage includes:

- “`MDCustomizationForSysMLProfile.getInstance(project).getStereotype()`” - where `project` refers to the project which uses MD Customization for SysML Profile.
- “`MDCustomizationForSysMLProfile.getInstance(element).getStereotype()`” - where `element` refers to the element in the project which uses MD Customization for SysML Profile.

For example, `MDCustomizationForSysMLProfile.getInstance(project).getPartProperty()` returns the reference to the «PartProperty» stereotype object.

Check if an element is stereotyped

Usage includes “`MDCustomizationForSysMLProfile.isStereotype(Elem)`” - where `Elem` is the element you would like to check.

For example, given an element “Elem”, `MDCustomizationForSysMLProfile.isValueProperty(Elem)` returns True if the element “Elem” has «ValueProperty» stereotype applied, and returns false otherwise.

8.1.3 SysML Profile API Changes

SysML Profile API changes were made in relation to the SysML 1.4 support.

The following constants were moved from the `com.nomagic.magicdraw.sysml.util.SysMLProfile` to `com.nomagic.magicdraw.sysml.util.MDCustomizationForSysMLProfile`:

```
public static final String CONSTRAINTPROPERTY_STEREOTYPE = "ConstraintProperty";
public static final String QUANTITYKIND_STEREOTYPE = "QuantityKind";
public static final String QUANTITYKIND_DEFINITIONURI_PROPERTY = "definitionURI";
public static final String QUANTITYKIND_DESCRIPTION_PROPERTY = "description";
public static final String QUANTITYKIND_SYMBOL_PROPERTY = "symbol";
public static final String UNIT_STEREOTYPE = "Unit";
```

The following methods were moved from the `com.nomagic.magicdraw.sysml.util.SysMLProfile` to the `com.nomagic.magicdraw.sysml.util.MDCustomizationForSysMLProfile`:

```
getConstraintProperty()
getQuantityKind()
getUnit()
isQuantityKind()
isUnit()
isConstraintProperty()
```

The constant `NESTEDCONNECTOREND_PROPERTYPATH_PROPERTY` changed to `ELEMENTPROPERTYPATH_PROPERTYPATH_PROPERTY`.

8.2 SysML classes for open API

Classes which are available for open API are included in SysML plugin open API documentation. Find these in `<SysML plugin installation directory>\openapi\docs`.

The `com.nomagic.magicdraw.sysml.util.SysMLUtilities` class was added to the open APIs. It provides utility methods for easier work with SysML projects.

Methods and classes marked as *deprecated* do not support the development of external plugins.