Enterprise Architect

User Guide Series

Software Modeling Fundamentals

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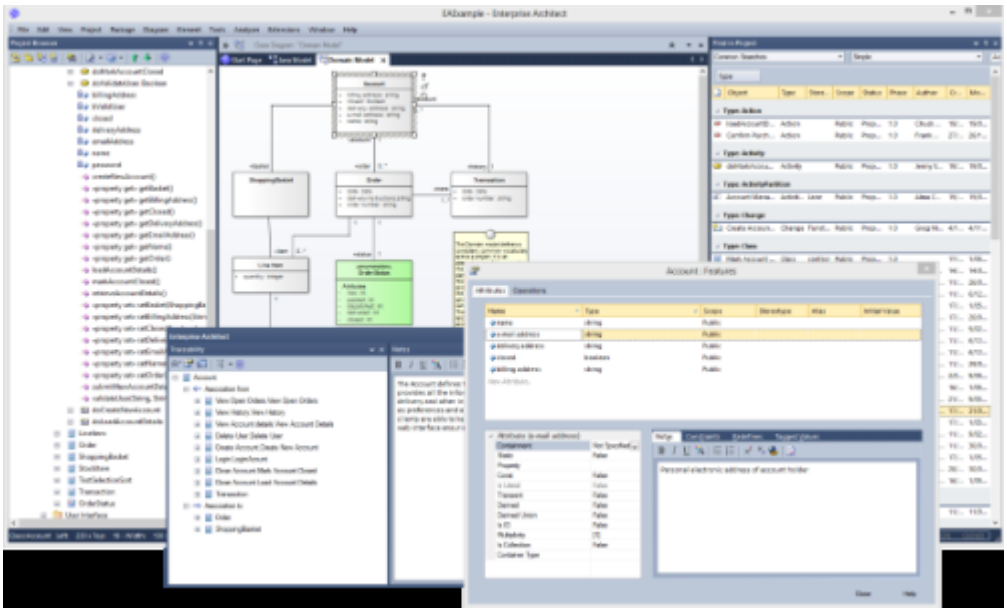
Table of Contents

Introduction

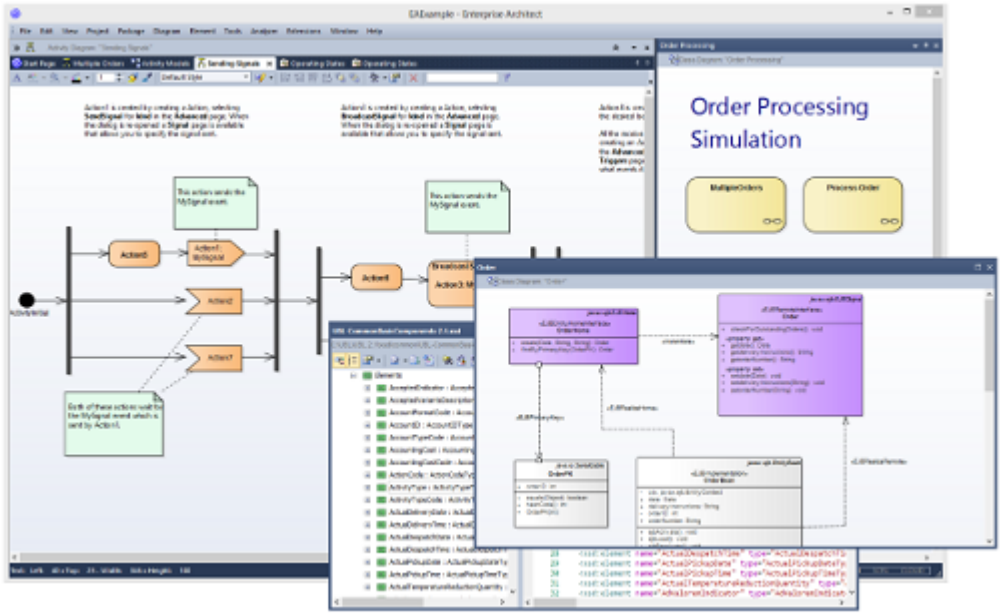


Enterprise Architect in addition to its powerful business model simulation, coding and visual execution analysis capability is a fully fledged Integrated Development Environment. This allows Software Engineers, Programmers and other technical staff to develop, maintain and round trip engineer source code in a wide range of programming languages with all the facilities that developers using other IDEs such as Eclipse and Visual Studio would expect and much more.

Round trip code engineering is supported by the Code Template Framework and the Grammar framework allowing any programming language to be incorporated. These frameworks provide a mechanism for developers to create support for additional languages or to configure the way that round trip engineering works out to the box.

In addition to the IDE there is support for the design, visualization and resource generation for Win32 screens.

There is also an integrated Database Engineering tool that connects to live databases and allows database schemas to be imported and exported including support for incremental changes. XML schemas can also be developed and managed using the powerful Schema Composer allowing user defined Schemas to be generated that are compliant with industry standard schemas such as NIEM.



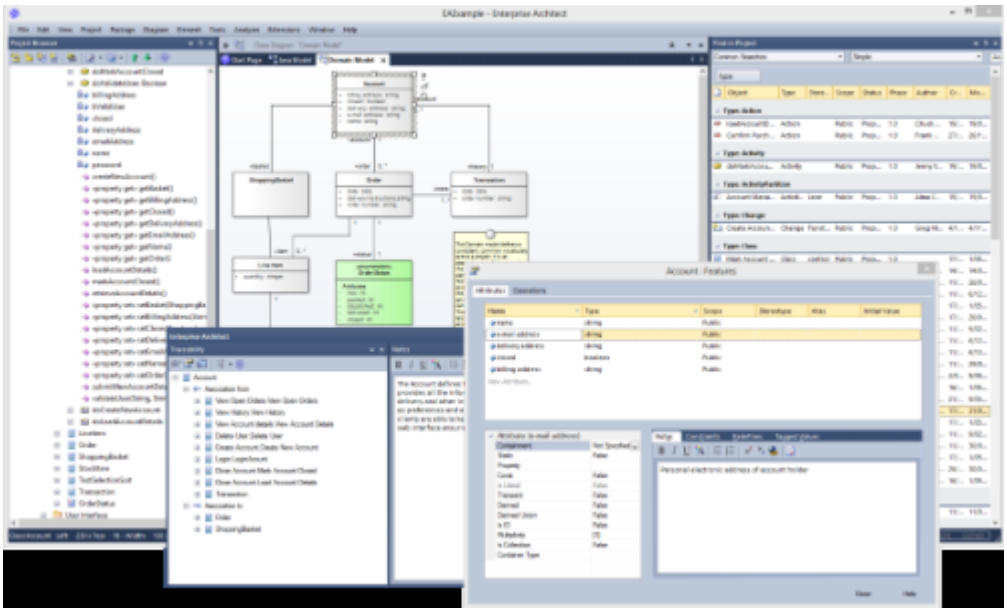
Software engineering is the discipline of designing, implementing and maintaining software. The process of software engineering starts with requirements and constraints as inputs and results in programming code and schemas that are deployed to a variety of platforms, creating running systems.

Enterprise Architect has a rich set of tools and features that assist Software Engineers to perform their work efficiently and to reduce the number of errors in implemented solutions. The features include design tools to create models of software, automated code generation, reverse engineering of source code, binaries and schemas, and tools to synchronize source code with the design models. The programming code can be viewed and edited directly in the integrated Code Editors within Enterprise Architect, which provide Intelli-sense and other features to aid in coding.

Another compelling aspect of the environment is the ability to trace the implementation Classes back to design elements and architecture, and then back to the requirements and constraints and other specifications, and ultimately back to stakeholders and their goals and visions.

Enterprise Architect supports a wide range of programming languages and platforms and provides a lightweight and seamless integration with the two most prevalent Integrated Development Environments: Visual Studio and Eclipse. In addition there is a fully featured Execution Analyzer that allows the Software Engineer to design, build debug and test software modules right inside Enterprise Architect.

Integrated Development



Enterprise Architect provides an unmatched set of tools and features for the Software Engineer, to assist in the process of creating robust and error free software systems. The engineer can start by defining the architecture and ensuring that it traces back to the requirements and specification. Technology neutral models can be transformed to target a comprehensive range of programming languages. The Model Driven Development Environment fits the bill for various technologies.

Features

Development Tools

- Model driven development with best-in-class UML tools
- Generate and reverse engineer code
- Customize code generation with templates
- Analyzer Scripts to manage your applications
- Code editors to author the code base
- Debuggers to investigate behavior
- Profilers to visualize behavior
- Analyzers to record behavior
- Testpoints for validation of programming contracts
- Integration with jUnit and nUnit
- Eclipse or Visual Studio Integration where required

Traceability At a glance traceability of Generalizations, Realizations, Associations, Dependencies and more. Customize relationship views. Easily navigate related elements in the model.

Usage Quickly browse element usage across all diagrams. Perform powerful element searches using sophisticated queries.

Popular Languages

- C/ C++
- Java

- Microsoft .NET family
- ADA
- Python
- Perl
- PHP

Toolboxes Toolboxes are provided for a vast array of modeling technologies and programming languages.

Application Patterns Enterprise Architect provides complete starter projects, including model information, code and build scripts, for several basic application types.

Feature Overview

Code Engineering with Enterprise Architect broadly encompasses various processes for the design, generation and transformation of code from your UML model.

Features

Model Driven Code Engineering

- Source code generation and reverse engineering for many popular languages, including C++, C#, Java, Delphi, VB.Net, Visual Basic, ActionScript, Python and PHP
- A built in 'syntax highlighting' source code editor
- Code generation templates, which enable you to customize the generated source code to your company specifications

Transformations for Rapid Development

- Advanced Model Driven Architecture (MDA) transformations using transformation templates
- Built-in transformations for DDL, C#, Java, EJB and XSD
- One Platform Independent Model can be used to generate and synchronize multiple Platform Specific Models, providing a significant productivity boost
- XSL Transform diagram, toolbox, editor and debugger.

Visual Execution Analysis / Debugging, Verification and Visualization

- Execute build, test, debug, run and deploy scripts
- Integrate UML development and modeling with source development and compilation
- Generate NUnit and JUnit test Classes from source Classes using MDA Transformations
- Integrate the test process directly into the Enterprise Architect IDE
- Debug .NET, Mono, Java and Microsoft Native (C, C++ and Visual Basic) applications
- Design and execute Test suites based on Programming by Contract principles
- XSL Stylesheet debugging

Database Modeling

Enterprise Architect enables you to:

- Reverse engineer from many popular DBMSs, including SQL Server, My SQL, Access, PostgreSQL and Oracle
- Model database tables, columns, keys, foreign keys and complex relationships using UML and an inbuilt data modeling profile
- Forward generate DDL scripts to create target database structures

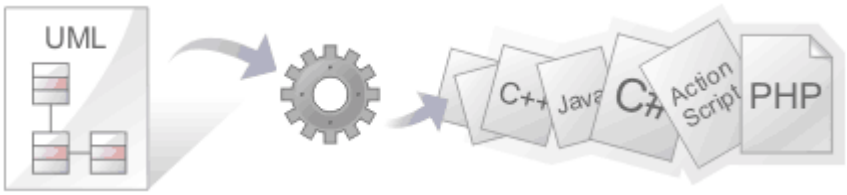
XML Technology Engineering

Enterprise Architect enables you to rapidly model, forward engineer and reverse engineer two key W3C XML technologies:

- XML Schema (XSD)
- Web Service Definition Language (WSDL)

XSD and WSDL support is critical for the development of a complete Service Oriented Architecture (SOA), and the coupling of UML 2.5 and XML provides the natural mechanism for implementing XML-based SOA artifacts within an organization.

Generate Source Code



Source code generation is the process of creating programming code from a UML model. There are great benefits in taking this approach as the source code Packages, Classes and Interfaces are automatically created and elaborated with variables and methods.

Enterprise Architect can also generate code from a number of behavioral models, including StateMachine, Sequence and Activity diagrams. There is a highly flexible template mechanism that allows the engineer to completely tailor the way that source code is generated, including the comment headers in methods and the Collection Classes that are used.

From an engineering and quality perspective, the most compelling advantage of this approach is that the UML models and therefore the architecture and design are synchronized with the programming code. An unbroken traceable path can be created from the goals, business drivers and the stakeholder's requirements right through to methods in the programming code.

Facilities

Facility	Description
Languages	Enterprise Architect supports code generation in each of these software languages: • Action Script • Ada • ArcGIS • C • C# (for .NET 1.1, .NET 2.0 and .NET 4.0) • C++ (standard, plus .NET managed C++ extensions) • Delphi • Java (including Java 1.5, Aspects and Generics) • JavaScript • MFQL • MySql • PHP • Python • Teradata SQL • Visual Basic • Visual Basic .NET • WorkFlowScript You can also generate Hardware Definition Language code in these languages: • VHDL • Verilog • SystemC

Elements	Code is generated from Class or Interface model elements, so you must create the required Class and Interface elements to generate from. All other types of element to contribute to the code (such as StateMachines or Activities) must be child elements of a Class. Add attributes (which become variables) and operations (which become methods). Constraints and Receptions are also supported in the code.
Settings	Before you generate code, you should ensure the default settings for code generation match your requirements; set up the defaults to match your required language and preferences. Preferences that you can define include default constructors and destructors, methods for interfaces and the Unicode options for created languages. Languages such as Java support 'namespaces' and can be configured to specify a namespace root. In addition to the default settings for generating code, Enterprise Architect facilitates setting specific generation options for each of the supported languages.
Code Template Framework	The Code Template Framework (CTF) enables you to customize the way Enterprise Architect generates source code and also enables generation of languages that are not specifically supported by Enterprise Architect.
Local Paths	Local path names enable you to substitute tags for directory names.
Behavioral Code	You can also generate software code from three UML behavioral modeling paradigms: • Interaction (Sequence) diagrams • Activity diagrams • StateMachine diagrams (using Legacy State Machine Templates in the code generation operations under 'Tasks') • StateMachine diagrams (using an Executable State Machine Artifact)
Live Code Generation	On the 'Develop > Preferences > Options' drop-down menu, you have the option to update your source code instantly as you make changes to your model.
Tasks	When you generate code, you perform one or more of these tasks: • Generate a Single Class • Generate a Group of Classes • Generate a Package • Update Package Contents

Notes

- Most of the tools provided by Enterprise Architect for code engineering and debugging are available in the Professional and higher editions of Enterprise Architect; Behavioral Code Generation is available in the Unified and Ultimate editions
- When security is enabled you require the access permissions 'Generate Source Code and DDL' and 'Reverse Engineer from DDL and Source Code'

Generate a Single Class

Before you generate code for a single Class, you:

- Complete the design of the model element (Class or Interface)
- Create Inheritance connectors to parents and Associations to other Classes that are used
- Create Inheritance connectors to Interfaces that your Class implements; the system provides an option to generate function stubs for all interface methods that a Class implements

Generate code for a single Class

Step	Action
1	Open the diagram containing the Class or Interface for which to generate code.
2	Click on the required Class or Interface and select the 'Develop > Source Code > Generate > Generate Single Element' ribbon option, or press F11. The 'Generate Code' dialog displays, through which you can control how and where your source code is generated.
3	In the 'Path' field, click on the  button and select a path name for your source code to be generated to.
4	In the 'Target Language' field, click on the drop-down arrow and select the language to generate; this becomes the permanent option for that Class, so change it back if you are only doing one pass in another language.
5	Click on the Advanced button. The 'Object Options' dialog displays, providing subsets of the 'Source Code Engineering' and code language options pages on the 'Preferences' dialog.
6	Set any custom options (for this Class alone), then click on the Close button to return to the 'Generate Code' dialog.
7	In the 'Import(s) / Header(s)' fields, type any import statements, #includes or other header information. Note that in the case of Visual Basic this information is ignored; in the case of Java the two import text boxes are merged; and in the case of C++ the first import text area is placed in the header file and the second in the body (.cpp) file.
8	Click on the Generate button to create the source code.
9	When complete, click on the View button to see what has been generated. Note that you should set up your default viewer/editor for each language type first; you can also set up the default editor on the 'Code Editors' page of the Preferences window ('Start > Desktop > Preferences > Preferences > Source Code Engineering > Code Editors').

Generate a Group of Classes

In addition to being able to generate code for an individual Class, you can also select a group of Classes for batch code generation. When you do this, you accept all the default code generation options for each Class in the set.

Generate Class Group

Step	Detail
1	Select a group of Classes and/or interfaces in a diagram.
2	Click on an element in the group and select the 'Develop > Source Code > Generate > Generate Selected Element(s)' ribbon option (or press Shift+F11). If no code exists for the selected elements, the 'Save As' dialog displays on which you specify the file path and name for each code file; enter this information and click on the Save button.
3	The 'Batch Generation' dialog displays, showing the status of the process as it executes (the process might be too fast to see this dialog). If code already exists for the selected Class elements, and changes have been made to the Class name or structure, the 'Synchronize Element <package name>.<element name>' dialog might also display; this dialog helps synchronize the model and code.

Notes

- If any of the elements selected are not Classes or interfaces the option to generate code is not available

Generate a Package

In addition to generating source code from single Classes and groups of Classes, you can generate code from a Package. This feature provides options to recursively generate code from child Packages and automatically generate directory structures based on the Package hierarchy. This helps you to generate code for a whole branch of your project model in one step.

Access

Ribbon	Develop > Source Code > Generate > Generate All
Keyboard Shortcuts	Ctrl+Alt+K

Generate code from a Package, on the Generate Package Source Code dialog

Step	Action
1	In the 'Synchronize' field, click on the drop-down arrow and select the appropriate synchronize option: • 'Synchronize model and code': Code for Classes with existing files is forward synchronized with that file; code for Classes with no existing file is generated to the displayed target file • 'Overwrite code': All selected target files are overwritten (forward generated) • 'Do not generate': Generate code for only those selected Classes that do not have an existing file; all other Classes are ignored
2	Highlight the Classes for which to generate code; leave unselected any to not generate code for. If you want to display more of the information within the layout, you can resize the dialog and its columns.
3	To make Enterprise Architect automatically generate directories and filenames based on the Package hierarchy, select the 'Auto Generate Files' checkbox; this enables the 'Root Directory' field, in which you select a root directory under which the source directories are to be generated. By default, the 'Auto Generate Files' feature ignores any file paths that are already associated with a Class; you can change this behavior by also selecting the 'Retain Existing File Paths' checkbox.
4	To include code for all sub-Packages in the output, select the 'Include Child Packages' checkbox.
5	Click on the Generate button to start generating code. As code generation proceeds, Enterprise Architect displays progress messages. If a Class requires an output filename the system prompts you to enter one at the appropriate time (assuming Auto Generate Files is not selected). For example, if the selected Classes include partial Classes, a prompt displays to enter the filename into which to generate code for the second partial Class.

Further information on the dialog options

Option	Action
Root Package	Check the name of the Package for which code is to be generated.
Synchronize	Select options that specify how existing files should be regenerated.
Auto Generate Files	Specify whether Enterprise Architect should automatically generate file names and directories, based on the Package hierarchy.
Root Directory	If Auto Generate Files is selected, display the path under which the generated directory structures are created.
Retain Existing File Paths	If Auto Generate Files is selected, specify whether to use existing file paths associated with Classes. If Auto Generate Files is unselected, Enterprise Architect generates Class code to automatically determined paths, regardless of whether source files are already associated with the Classes.
Include all Child Packages	Also generate code for all Classes in all sub-Packages of the target Package in the list. This option facilitates recursive generation of code for a given Package and its sub-Packages.
Select Objects to Generate	List all Classes that are available for code generation under the target Packages; only code for selected (highlighted) Classes is generated. Classes are listed with their target source file.
Select All	Mark all Classes in the list as selected.
Select None	Mark all Classes in the list as unselected.
Generate	Start the generation of code for all selected Classes.
Cancel	Exit the 'Generate Package Source Code' dialog; no Class code is generated.

Update Package Contents

In addition to generating and importing code, Enterprise Architect provides the option to synchronize the model and source code, creating a model that represents the latest changes in the source code and vice versa. You can use either the model as the source, or the code as the source.

The behavior and actions of synchronization depend on the settings you have selected on the 'Attributes and Operations' page of the 'Preferences' dialog. Working with these settings, you can either protect or automatically discard information in the model that is not present in the code, and prompt for a decision on code features that are not in the model. In these two examples, the appropriate checkboxes have been selected for maximum protection of data:

- You generated some source code, but made subsequent changes to the model; when you generate code again, Enterprise Architect adds any new attributes or methods to the existing source code, leaving intact what already exists, which means developers can work on the source code and then generate additional methods as required from the model, without having their code overwritten or destroyed
- You might have made changes to a source code file, but the model has detailed notes and characteristics you do not want to lose; by synchronizing from the source code into the model, you import additional attributes and methods but do not change other model elements

Using the synchronization methods, it is simple to keep source code and model elements up to date and synchronized.

Access

Ribbon	Develop > Source Code > Synchronize > Synchronize Package

Synchronize Package contents against source code

Field/Button	Action
Update Type	Select the radio button to either Forward Engineer or Reverse Engineer the Package Classes, as appropriate.
Include child packages in generation	Select the checkbox to include child Packages in the synchronization.
OK	Click on the button to start synchronization. Enterprise Architect uses the directory names specified when the project source was first imported/generated and updates either the model or the source code depending on the option chosen. If: • Performing forward synchronization AND • There are differences between the model and code AND • The 'On forward synch, prompt to delete code features not in model' checkbox is selected in the 'Options - Attributes and Operations' dialog THEN the 'Synchronize Element <package name>.<element name>' dialog displays. Otherwise, no further action is required.

Notes

- Code synchronization does not change method bodies; behavioral code cannot be synchronized, and code generation only works when generating the entire file
- In the Corporate, Unified and Ultimate editions of Enterprise Architect, if security is enabled you must have 'Generate Source Code and DDL' permission to synchronize source code with model elements

Synchronize Model and Code

You might either:

- Synchronize the code for a Package of Classes against the model in the Browser window, or
- Regenerate code from a batch of Classes in the model

In such processes, there might be items in the code that are not present in the model.

If you want to trap those items and resolve them manually, select the 'On forward synch, prompt to delete code features not in model' checkbox in the 'Options - Attributes and Operations' dialog, so that the 'Synchronize Element <package name>.<element name>' dialog displays, providing options to respond to each item.

Synchronize Items

Button	Detail
Select All	Highlight and select all items in the Feature column.
Clear All	Deselect and remove highlighting from all items in the Feature column.
Delete	Mark the selected code features to be removed from the code (the value in the Action column changes to Delete).
Reassign	Mark the selected code features to be reassigned to elements in the model. This is only possible when an appropriate model element is present that is not already defined in the code. The Select the Corresponding Class Feature dialog displays, from which you select the Class to reassign the feature to. Click on the OK button to mark the feature for reassignment.
Ignore	Mark the selected code elements not present in the model to be ignored completely (the default; the value in the Action column remains as or changes to <none>).
Reset to Default	Reset the selected items to Ignore (the value in the Action column changes to <none>).
OK	Make the assigned changes to the items, and close the dialog.

Namespaces

Languages such as Java support Package structures or namespaces. In Enterprise Architect you can specify a Package as a namespace root, which denotes where the namespace structure for your Class model starts; all subordinate Packages below a namespace root will form the namespace hierarchy for contained Classes and Interfaces.

To define a Package as a namespace root, click on the Package in the Browser window and select the 'Develop > Preferences > Options > Set as Namespace Root' ribbon option. The Package icon in the Browser window changes to show a colored corner indicating this Package is a namespace root.

Generated Java source code, for example, will automatically add a Package declaration at the beginning of the generated file, indicating the location of the Class in the Package hierarchy below the namespace root.

To clear an existing namespace root, click on the namespace root Package in the Browser window and deselect the 'Develop > Preferences > Options > Set as Namespace Root' ribbon option

To view a list of namespaces, select the 'Configure > Reference Data > Settings > Namespace Roots' ribbon option; the 'Namespaces' dialog displays. If you double-click on a namespace in the list, the Package is highlighted in the Browser window; alternatively, right-click on the namespace and select the 'Locate Package in Browser' option.

You can also clear the selected namespace root by selecting the 'Clear Namespace Attribute' option.

To omit a subordinate Package from a namespace definition, select the 'Develop >Preferences > Options > Suppress Namespace' ribbon option; to include the Package in the namespace again, deselect the ribbon option.

Notes

- When performing code generation, any Package name that contains whitespace characters is automatically treated as a namespace root

Importing Source Code

The ability to view programming code and the models it is derived from at the same time brings clarity to the design of a system. One of Enterprise Architect's powerful code engineering features is the ability to Reverse Engineer source code into a UML model. A wide range of programming languages are supported and there are options that govern how the models are generated. Once the code is in the model it is possible to keep it synchronized with the model regardless of whether the changes were made directly in the code or the model itself. The code structures are mapped into their UML representations; for example, a Java class is mapped into a UML Class element, variables are defined as attributes, methods modeled as operations, and interactions between the Java classes represented by the appropriate connectors.

The representation of the programming code as model constructs helps you to gain a better understanding of the structure of the code and how it implements the design, architecture and the requirements, and ultimately how it delivers the business value.

It is important to note that if a system is not well designed, simply importing the source into Enterprise Architect does not turn it into an easily understandable UML model. When working with a poorly designed system it is useful to assess the code in manageable units by examining the individual model Packages or elements generated from the code; for example, dragging a specific Class of interest onto a diagram and then using the 'Insert Related Elements' option at one level to determine the immediate relationships between that Class and other Classes. From this point it is possible to create Use Cases that identify the interaction between the source code Classes, providing an overview of the application's operation.

Several options guide how the code is reversed engineered, including whether comments are imported to notes and how they are formatted, how property methods are recognized and whether Dependency relationships are created for operation return and parameter types.

Copyright Ownership

Situations that typically lend themselves to reverse engineering tend to operate on source code that:

- You have already developed
- Is part of a third-party library that you have obtained permission to use
- Is part of a framework that your organization uses
- Is being developed on a daily basis by your developers

If you are examining code that you or your organization do not own or do not have specific permission to copy and edit, you must ensure that you understand and comply with the copyright restrictions on that code before beginning the process of reverse engineering.

Supported languages for Reverse Engineering

Language
Action Script
Ada 2012 (Unified and Ultimate editions)

C
C #
C++
CORBA IDL (MDG Technology)
Delphi
Java
PHP
Python
SystemC (Unified and Ultimate editions)
Verilog (Unified and Ultimate editions)
VHDL (Unified and Ultimate editions)
Visual Basic
Visual Basic .NET

Notes

- Reverse Engineering is supported in the Professional, Corporate, Unified and Ultimate editions of Enterprise Architect
- If security is enabled you must have 'Reverse Engineer From DDL And Source Code' permission to reverse engineer source code and synchronize model elements against code
- Using Enterprise Architect, you can also import certain types of binary file, such as Java .jar files and .NET PE files
- Reverse Engineering of other languages is currently available through the use of MDG Technologies listed on the MDG Technology pages of the Sparx Systems website

Import Projects

Enterprise Architect provides support for importing software projects authored in Visual Studio, Mono, Eclipse and NetBeans. Importing projects has multiple benefits, not least the immediate access to Enterprise Architect's renowned modeling tools and management features, but importantly the access to development tools such as simulation, debugging and profiling.

Access

Ribbon	Develop > Source Code > Solutions > Import a <project type>

Import Options

Option	Description
Prompt for Missing Macro Definitions	For C++ projects, the parser might encounter unrecognized macros. If you select this option, you will be prompted when such an event occurs and will have the opportunity to define the macro. If you do not select this option, the resultant Class model could be missing certain items.
Create Diagram for Each Package	When selected, a Class diagram is created depicting the Class model for each Package. The result is a larger but more colorful model. Deselecting this option will cause diagram creation to be skipped and the import to run faster.
Generate Analyzer Scripts	Selecting this option will generate Analyzer Scripts for each project configuration in addition to scripts for each Solution configuration. The scripts will allow for building and debugging the program(s) described by the solution immediately after the import completes. Note: Select the 'Windows' platform. If you do not select this option, no Execution Analyzer features will be configured.
Startup Project	When this is selected, the script for this Project will become the model default. The Execute ribbon and Toolbar buttons will automatically target this program.

Import Visual Studio Solution

This option allows you to import one or more projects from an existing Visual Studio Solution file or a running instance of Visual Studio. The wizard will generate a Class model for each of the projects and the appropriate Analyzer Scripts for each Visual Studio configuration.

Import Mono Solution

This option allows you to import Mono projects from a solution file. The dialog that is presented is the same as the 'Visual Studio Import' dialog, but you can choose to target either Linux or Windows. The wizard will generate a Class model for each of the projects and configure them for debugging.

Import Options

Option	Description
Find and Select the Solution File.	The Mono Solution files have a .sln file extension, as for Visual Studio.
Select the Projects to Import	After the solution is selected, the projects in the solution are displayed. Select the projects from the list that should be imported by the wizard.
Prompt for Missing Macros	Not applicable.
Create Diagram for Each Package	When selected, a Class diagram is created depicting the Class model for each Package. The result is a larger but more colorful model. Deselecting this option will cause diagram creation to be skipped and the import to run faster.
Generate Analyzer Scripts	This option allows you to target either Linux or Windows. If you select Linux, it is assumed the machine on which Enterprise Architect is running is Linux, that the platform (Java or Mono) is installed there, and that the compiled programs run on Linux.
Startup Project	Selecting the Startup project means that the debugging tools will be set to target that program by default.

Import Eclipse Project

The Eclipse 'Wizard' can reverse engineer a Java project described by its Eclipse .project file and ANT build. The feature will result in a UML Class model and Analyzer Scripts for each of the ANT targets you select. The process will also generate a script for each debug protocol you select through the 'Wizard'. You will be presented with the choice of JDWP (Java Debug Wire Protocol), good for servers, and JVMTI (Java Virtual Machine Tools Interface), which is suited to standalone Java applications. These scripts should be used for debugging the project in Enterprise Architect.

Import NetBeans Project

The NetBeans 'Wizard' can reverse engineer a Java project described by a NetBeans XML project file and ANT build. The 'Wizard' will create a UML Class model of the project and Analyzer Scripts for each of the ANT targets you select. The process will also generate a script for each debug protocol you select through the 'Wizard'. These scripts should be used for debugging the project in Enterprise Architect. You will be presented with the choice of JDWP (Java Debug Wire Protocol), good for servers, and JVMTI (Java Virtual Machine Tools Interface), which is suited to standalone Java applications

Import Source Code

You can import source code into your Enterprise Architect model, to reverse-engineer a module. As the import proceeds, Enterprise Architect provides progress information. When all files are imported, Enterprise Architect makes a second pass to resolve associations and inheritance relationships between the imported Classes.

Procedure - Import source code

Step	Action
1	In the Browser window, select (or add) a diagram into which to import the Classes.
2	Click on the diagram background and either: • Select the 'Develop > Source Code > Files' ribbon option and click on the appropriate language, or • If the Code Generation toolbar is displayed, click on the 'Import' drop-down arrow and select the language to import The list of languages will include any customized languages you have created model structures for.
3	From the file browser that appears, locate and select one or more source code files to import.
4	Click on the Open button to start the import process.

Notes on Source Code Import

You can import code into your Enterprise Architect project, in a range of programming languages. Enterprise Architect supports most constructs and keywords for each coding language. You select the appropriate type of source file for the language, as the source code to import.

If there is a particular feature you require support for that you feel is missing, please contact Sparx Systems.

Notes

- When reverse engineering attributes with parameter substitutions (templated attributes):
  - If a Class with proper template parameter definitions is found, an Association connector is created and its parameter substitutions are configured
  - An Association connector is also created if a matching entry is defined as a Collection Class or in the 'Additional Collection Classes' option (for C#, C++ and Java); for an example, see *Example Use of Collection Classes*

Programming Language notes

Language	Notes
ActionScript	Appropriate type of source file: .as code file.
C	Appropriate type of source file: .h header files and/or .c files. When you select a header file, Enterprise Architect automatically searches for the corresponding .c implementation file to import, based on the options for extension and search path specified in the C options. Enterprise Architect does not expand macros that have been used, these must be added into the internal list of Language Macros.
C++	Appropriate type of source file: .h header file. Enterprise Architect automatically searches for the .cpp implementation file based on the extension and search path set in the C++ options; when it finds the implementation file, it can use it to resolve parameter names and method notes as necessary. When importing C++ source code, Enterprise Architect ignores function pointer declarations. To import them into your model you could create a typedef to define a function pointer type, then declare function pointers using that type; function pointers declared in this way are imported as attributes of the function pointer type. Enterprise Architect does not expand macros that have been used; these must be added into the internal list of Language Macros.
C#	Appropriate type of source file: .cs.
Delphi	Appropriate type of source file: .pas.
Java	Appropriate type of source file: .java. Enterprise Architect supports the AspectJ language extensions.

	 Aspects are modeled using Classes with the stereotype aspect; these aspects can then contain attributes and methods as for a normal Class. If an intertype attribute or operation is required, you can add a tag 'className' with the value being the name of the Class it belongs to. Pointcuts are defined as operations with the stereotype <<pointcut>>, and can occur in any Java Class, Interface or aspect; the details of the pointcut are included in the 'behavior' field of the method. Advice is defined as an operation with the stereotype <<advice>>; the pointcut this advice operates on is in the 'behavior' field and acts as part of the method's unique signature. afterAdvice can also have one of the Tagged Values returning or throwing.
PHP	Appropriate type of source file: .php, .php4, or .inc. Nested if condition syntax is enabled.
Python	Appropriate type of source file: .py.
Visual Basic	Appropriate type of source file: .cls Class file.
Visual Basic .NET	Appropriate type of source file: .vb Class file.

Import Resource Script

Enterprise Architect supports the import and export of Microsoft Windows Resource Scripts (as .rc files), which contain the Win32® dialog definitions (those with the stereotype «win32Dialog») for an application's graphical user interface. Dialog resources are imported and exported for a specific language, defaulting to the locale of the current computer system.

Access

Ribbon	Develop > Source Code > Files > Import Resource Script
Keyboard Shortcuts	F7 (synchronize element with code)

Import dialog resources from a .rc file

Option	Action
Resource File	Click on the  button and locate the .rc file to import the screen elements(s) from.
Resource ID	Either: • Leave the default value 'All' to import all screen elements from the file, or • Click on the drop-down arrow and select the screen ID of a specific dialog to import
Language	Click on the drop-down arrow and select the language version (such as English - United States) of the dialog(s) to import.
Import	Click on this button to import the screens from the resource file. The progress of the import is reported in the field underneath the 'Language' field.

Export a dialog to a .rc file

Option	Action
Screen ID	Defaults from the Win32UI ID Tagged Value of the selected Screen element. (If the dialog does not have this ID, open the 'Win32UI' page of the element's 'Properties' dialog and provide a value for the ID tag.)
Resource File	Click on the  button and locate the .rc file into which to export the screen element(s).

	If the element was previously imported, this field defaults to the source file.
Language	Click on the drop-down arrow and select the language version (such as English - United States) of the exported dialog.
Export	Click on this button to export the screens from the resource file. The progress of the export is reported in the field underneath the 'Language' field.

Notes

- New dialogs are exported to an existing .rc file
- In an export to an existing .rc file, no dialogs are ever deleted from the file, even when they are deleted from the model
- In an import, no dialogs are deleted from the model even when omitted from the original .rc file

Import a Directory Structure

You can import from all source files in a complete directory structure, which enables you to import or synchronize multiple files in a directory tree in one pass.

Enterprise Architect creates the necessary Packages and diagrams during the import process.

Access

Ribbon	Develop > Source Code > Files > Import Source Directory
Keyboard Shortcuts	Ctrl+Shift+U

Import a directory structure, using the 'Import Source Directory' dialog

Step	Action
1	Select the options you require; you can configure: • The source directory • The source type • The file extensions to look at • Whether to process sub directories • Whether to create a diagram for each Package • Whether to import additional files as described in the 'Import Component Types' dialog • Whether to exclude private members from libraries being imported from the model • Whether to Synchronize or Overwrite existing Classes when found; if a model Class is found matching the one in code: - 'Synchronize' updates the model Class to include the details from the one in code, which preserves information not represented in code, such as the location of Classes in diagrams - 'Overwrite' deletes the model Class and generates a new one from code, which deletes and does not replace the additional information • Whether to create a Package for every directory, namespace or file; this might be restricted depending on the source type selected • How to handle Classes not found during the import (prompt for action enables you to review Classes individually) • What is shown on diagrams created by the import
2	Click on the OK button to start.

Import Binary Module

Enterprise Architect enables you to reverse-engineer certain types of binary module.

Access

Ribbon	Develop > Source Code > Files > Import Binary Module

Use

Currently the permitted types are:

- Java Archive (.jar)
- .NET PE file (.exe, .dll) - Native Windows DLL and EXE files are not supported, only PE files containing .NET assembly data
- Intermediate Language file (.il)

Enterprise Architect creates the necessary Packages and diagrams during the import process; selecting the 'Do not import private members' checkbox excludes private members from libraries from being imported into the model.

When importing .NET files, you can import via reflection or via disassembly, or let the system select the best method - this might result in both types being used.

The reflection-based importer relies on a .NET program, and requires the .NET runtime environment to be installed.

The disassembler-based importer relies on a native Windows program called Ildasm.exe, which is a tool provided with the MS .NET SDK; the SDK can be downloaded from the Microsoft website.

A choice of import methods is available because some files are not compatible with reflection (such as mscorlib.dll) and can only be opened using the disassembler; however, the reflection-based importer is generally much faster.

You can also configure:

- Whether to Synchronize or Overwrite existing Classes when found; if a model Class is found matching the one in the file:
  - Synchronize updates the model Class to include the details from the one in the file, which preserves information not represented in the file, such as the location of Classes in diagrams
  - Overwrite deletes the model Class and generates a new one from the file, which deletes and does not replace the additional information
- Whether to create a diagram for each Package
- What is shown on diagrams created by the import

Classes Not Found During Import

When reverse engineering from your code, there might be times when Classes are deliberately removed from your source code.

The 'Import Source Directory' functionality keeps track of the Classes it expects to synchronize with and, on the 'Import Directory Structure' dialog, provides options for how to handle the Classes that weren't found.

You can select the appropriate option to make Enterprise Architect, at the end of the import, ignore the missing Classes, automatically delete them or prompt you to manage them.

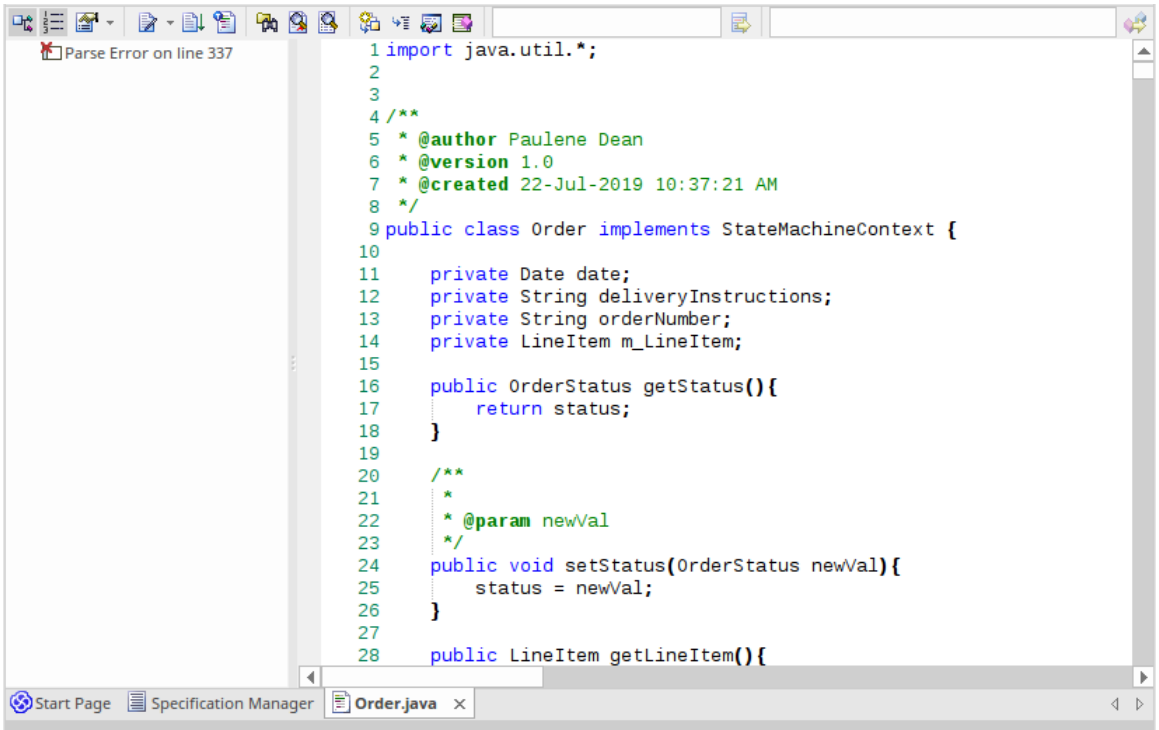
On the 'Import Directory Structure' dialog, if you select the 'Prompt For Action' radio button to manually review missing Classes, a dialog displays on which you specify the handling for each Class that was missing in the imported code.

By default, all Classes are marked for deletion; to keep one or more Classes, select them and click on the Ignore button.

Editing Source Code

Enterprise Architect contains a powerful source code editor that helps you to view, edit and maintain your source code directly inside the tool. Once source code has been generated for one or more Classes it can be viewed in this flexible editing environment. Seeing the code in the context of the UML models from which it is derived brings clarity to both the code and the models, and bridges the gap between design and implementation that has historically introduced errors into software systems.

The Source Code Editor is fully-featured, with a structure tree for easy navigation of attributes, properties and methods. Line numbers can be displayed and syntax highlight options can be configured. Many of the features that software engineers are familiar with in their favorite IDE, such as Intelli-sense and code completion are included in the editor. There are many additional features, such as macro recording that makes it easy to manage the source code inside Enterprise Architect. There are also many options for managing the code, available through the code editor context menu, toolbar and function keys.



For most programming languages a single file is created from a UML Class, but in the case of C++ both header and implementation classes are created and the source code editor displays these files in separate tabs.

A number of options change the way the source code editor works; they can be altered using the 'Preferences' dialog available from the Start ribbon:

'Start > Desktop > Preferences > Preferences > Source Code Engineering > Code Editors'

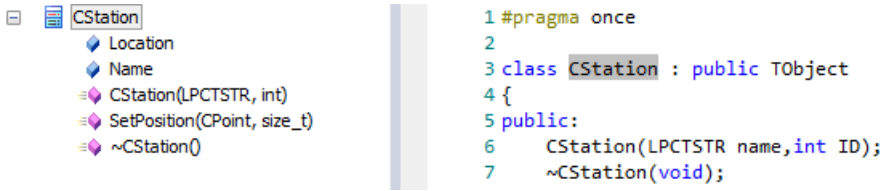
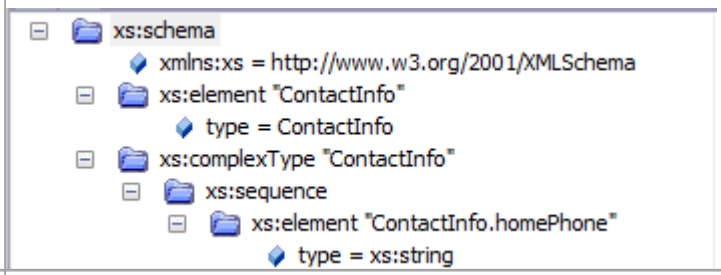
There are variants of the Source Code Editor, with different access methods. The variants are discussed in the *Compare Editors* topic.

Access

Ribbon	Execute > Source > Edit > Open Source File (external file) or Execute > Source > Edit > Edit Element Source (for an existing source file) or Execute > Source > Edit > Edit New Source File or Design > Element > Behavior or

	Develop > Source Code > Behavior
Keyboard Shortcuts	F12 or Ctrl+E (for existing code for model elements) Ctrl+Alt+O (to locate external files)

Facilities

Facility	Description
Source Code editor	By default the Source Code editor is set to: • Parse all opened files, and show a tree of the results • Show line numbers  If you are editing an XML file, the structure tree mirrors the exact order and structure of the document. 
Structure Tree	The structure tree is available for supported language files, such as C++, C#, Java and XML. The tree can be helpful to navigate content quickly in much the same way a table of contents would for other documents.

Notes

- For most selected elements you can use the keys F12 or Ctrl+E to view the source code.
- When you select an element to view source code, if the element does not have a generation file (that is, code has not been or cannot be generated, such as for a Use Case), Enterprise Architect checks whether the element has a link to either an operation or an attribute of another element - if such a link exists, and that other element has source code, the code for that element displays
- You can also locate the directory containing a source file that has been created in or imported to Enterprise Architect, and edit it or its related files using an external editor such as Notepad or Visual Studio; click on the element in the Browser window and press Ctrl+Alt+Y

Languages Supported

The Source Code Editors can display code in a wide range of languages, as listed here. For each language, the editor highlights - in colored text - the standard code syntax.

- Ada (.ada, .ads, .adb)
- ActionScript (.as)
- BPEL Document (.bpel)
- C++ (.h, .hh, .hpp, .c, .cpp, .cxx)
- C# (.cs)
- DDL Structured Query Language (.sql)
- Delphi/Pascal (.pas)
- Diff/Patch Files (.diff, .patch)
- Document Type Definition (.dtd)
- DOS Batch Files (.bat)
- DOS Command Scripts (.cmd)
- HTML (.html)
- Interface Definition Language (.idl, .odl)
- Java (.java)
- JavaScript (.javascript)
- JScript (.js)
- Modified Backus-Naur Form Grammar (.mbnf)
- PHP (.php, .php4, .inc)
- Python (.py)
- Standard Generalized Markup Language (.sgml)
- SystemC (.sc)
- Visual Basic 6 (.bas)
- VB.NET (.vb)
- VBScript (.vbs)
- Verilog (.v)
- VHSIC Hardware Description Language (.vhdl)
- Visual Studio Resource Configuration (.rc)
- XML (eXtensible Markup Language) (.xml)
- XSD (XML Schema Definition)
- XSL (XML Stylesheet Language)

Configure File Associations

If you are a Windows® user, you can configure Enterprise Architect to be the default document handler for your language source files.

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > Code Editors : Configure Enterprise Architect File Associations

Actions

For each file type that you would prefer to open in Enterprise Architect, click on the checkbox to the left of the file type name. After selecting all of the document types you require, click on the Save button.

After this, clicking on any corresponding file in Windows® Explorer will open it in Enterprise Architect.

Notes

- You can change the default programs, or documents handled by them, directly through the 'Default Programs' option in Windows ® Control panel.

Compare Editors

Enterprise Architect provides four principal code editor variants, available through a number of access paths. The most direct access options are identified in these descriptions.

The first three code editor variants listed have the same display format, option toolbar, context menu options and internal function keys. They differ in their method of access and display mechanism.

Editor Variants

Variant	Details
Source Code View	F12 Ctrl+E Class context menu | 'View Source Code' Description: Displays the code on a tab of the Diagram View; the tab label shows the file name and extension (such as .java); again, for C++, there are two tabs for the Header and Implementation files. You can display the source code for other Classes on additional tabs, by reselecting the menu option/keys on the next Class.
Source Code window (Dockable)	Alt+7 'Execute > Source > Edit > Open Source File' Description: Displays the contents of the source file for a selected Class (except if the language is C++, when the window displays a tab for the Header file and a tab for the Implementation file). If you select a different Class, the window changes to show the code for the new Class (unless the first Class calls the second, in which case the window scrolls down to the second Class's code instead).
Internal Editor, External Source Code	Ctrl+Alt+O 'Execute > Source > Edit > Open Source File' ribbon option Description: Use this option if you intend to edit external code, XML or DDL files (that is, code not imported to or generated in Enterprise Architect). Displays an external browser, then opens the specific selected code file as a tab of the Diagram View (for C++, not two code files); otherwise this is identical to the F12 option.
External Editor, Internal or External Source Code	Ctrl+Alt+Y Class context menu | Open Source Directory Description: Displays an external file browser, open to the directory containing the selected Class's source files; you can open the files in Notepad, Visual Studio or other tools you might have on your system.

Code Editor Toolbar

When you are reviewing the code for a part of your model in the Source Code editor, you can access a wide range of display and editing functions from the editor toolbar.

Code Editor Toolbar

Toolbar Options

Structure Tree Click on this icon to show or hide the element hierarchy panel (the left panel of the Source Code editor).

Line Numbers Click on this icon to show or hide the line numbers against the lines of code.

Source Code Engineering Properties Click on the drop-down arrow to display a menu of options to select individual 'Source Code Engineering' pages of the 'Preferences' dialog, from which you can configure display and behavior options for source code engineering:

- Language
- Syntax Highlighting Options
- Code Editor Options
- Code Engineering Options
- Code Editor Key Bindings

Editor Functions Click on the drop-down arrow to display a menu providing access to a range of code editing functions:

- Open Corresponding File (Ctrl+Shift+O) - opens the header or implementation file associated with the currently-open file
- Go to Matching Brace (Ctrl+E) - for a selected opening or closing brace, highlights the corresponding closing or opening brace in the pair
- Go to Line (Ctrl+G) - displays a dialog on which you select the number of the line to highlight; click on the OK button to move the cursor to that line
- Cursor History Previous (Ctrl+-) - the Source Code viewer keeps a history of the previous 50 cursor positions, creating a record when the cursor is moved either more than 10 lines away from its previous position, or in a find-and-replace operation; the menu option moves the cursor to the position in the immediately-previous cursor history record
- Cursor History Next (Ctrl+Shift+-) - if you have moved to an earlier cursor position, this option moves the cursor to the position in the immediately-following cursor history record
- Find (Ctrl+F) - displays a dialog in which you define a text string and search options to locate that text string in the code
- Replace (Ctrl+R) - displays a dialog in which you define a text string and search options to locate that text string in the code and replace it with another text string; the dialog has options to locate and replace each occurrence as you decide, or to replace all occurrences immediately
- Highlight Matching Words - (Ctrl+3) Enables or disables the highlighting of

matching words during a find operation; by default this option is enabled

- Record Macro - records your next keystrokes to be saved as a macro
- Stop Recording and Save Macro - stops recording the keystrokes and displays the 'Save Macro' dialog on which you specify a name for the macro
- Play Macro - displays the 'Open Macro' dialog from which you select and execute a saved macro, to repeat the saved keystrokes
- Toggle Line Comment (Ctrl+Shift+C) - comments out (//) or re-establishes the code for each full line in which text is highlighted
- Toggle Stream Comment (Ctrl+Shift+X) - inserts a stream comment (/* */) at the cursor position (comments out only the highlighted characters and lines), or re-establishes the commented text as code
- Toggle Whitespace Characters (Ctrl+Shift+W) - shows or hides the spacing characters: --> (tab space) and . (character space)
- Toggle EOL Characters (Ctrl+Shift+L) - shows or hides the end-of-line characters: CR (carriage return) and LF (line feed)
- Toggle Tree Synchronization - selects the tree item automatically as context changes within code editor
- Open Containing Folder - opens the file browser at the folder containing the code file; you can open other files in your default external editor for comparison and parallel work

Save Source and Resynchronize Class	Click on this icon to save the source code and resynchronize the code and the Class in the model.
Code Templates	Click on this icon to access the Code Templates Editor, to edit or create code templates for code generation.
Find in Project Browser	For a selected line of code, click on this icon to highlight the corresponding structure in the Browser window. If there is more than one possibility the 'Possible Matches' dialog displays, listing the occurrences of the structure from which you can select the required one.
Search in Files	Click on this icon to search for the selected object name in associated files, and display the results of the search in the File Search window. You can refine and refresh the search by specifying criteria on the Find in Files window toolbar.
Search in Model	Click on this icon to search for the selected text throughout the model, and display the results of the search in the Find in Project view.
Go to Declaration	Click on this icon to locate the declaration of a symbol in the source code.
Go to Definition	Click on this icon to locate the definition of a symbol in the source code (applicable to languages such as C++ and Delphi, where symbols are declared and defined in separate files).
Autocomplete List	Click on this icon to display the autocompletion list of possible values; double-click on a value to select it.
Parameter Information	When the cursor is between the parentheses of an operation's parameter list, click on this icon to display the operation's signature, highlighting the current parameter.
Find Current Class in Browser Window	Click on this icon to display the name of the currently-selected Class in the code, and highlight that name in the Browser window; if there is more than one possibility the 'Possible Matches' dialog displays, listing the occurrences of the

	Class from which you can select the required one.
Find Member	Click on this icon to display the name of the currently-selected attribute or method in the code, and highlight that name in the Browser window; if there is more than one possibility the 'Possible Matches' dialog displays, listing the occurrences of the feature from which you can select the required one.

Notes

- The 'Record Macro' option disables Intelli-sense while the macro is being recorded
- You can assign key strokes to execute the macro, instead of using the toolbar drop-down and 'Open Macro' dialog

Code Editor Context Menu

When working on a file with a code editor, you can perform a number of code search and editing operations to review the contents of the file. These options are available through the editor context menu, and can vary depending on which code editor you are using.

Access

Context Menu	Right-click on the code text string you are working on

Options

Go to Declaration	Locate and highlight the declaration of a symbol in the source code.
Go to Definition	Locate and highlight the definition of a symbol in the source code (applicable to languages such as C++ and Delphi, where symbols are declared and defined in separate places).
Open in Grammar Editor	Opens a view that lets you examine or validate the code using the appropriate grammar.
Synchronize Tree to Editor	Finds and displays the current element (method for example) in the structure tree.
Auto Synchronize Tree and Editor	When selected, the structure tree will automatically show the element being worked on in the editor.
XML Schema Validation	Allows an XML schema to validated.
Search for '<string>'	Display a submenu providing options to locate the selected text string in a range of locations. • 'Find in Project Browser' - Highlight the object containing the selected text in the Browser window • 'Search in Open Files' - Search for the selected text string in associated open files and display the results of the search in the Find in Files window; you can refine and refresh the search by specifying criteria on the Find in Files window toolbar • 'Search in Files' - Search for the selected text string in all associated files (closed or open), and display the results of the search in the Find in Files window; you can refine and refresh the search by specifying criteria on the Find in Files window toolbar (shortcut key: F12) • 'Search in Model' - Perform an 'Element Name' search in the Model Search facility, and display the results on the Model Search tab • 'Search in Scripts' - (Available while working in the Script Editor) Open the Find in Files window, set the 'Search Path' field to 'Search in Scripts' and the 'Search Text' field to the selected text, then search all scripts for the text string and display the results of the search; you can refine and refresh the search by

	specifying criteria on the Find in Files window toolbar • 'EA User Guide' - Display the description of the code item in the *Enterprise Architect User Guide* • 'Google' - Display the results of a Google search on the text • 'MSDN' - Display the results of a search on the text in the Microsoft Developer Network (MSDN) • 'Sun Java SE' - Display the results of a search on the text in the Sun Microsystems 'Sun Search' facility • 'Wikipedia' - Display any entry on the object on the Wikipedia web site • 'Koders' - Display the results of a search for the text string on Koders.com
Search Intelli-sense | <list of query names>	Perform an Intelli-sense search on the specified string using one of the listed queries, displayling the results in the Find in Files window, 'Intelli-sense Search' tab. Shortcut key: Shift+F12
Set Debugger to Line	(If the debugger is executing and has reached a breakpoint.) Move the execution point to the current line. Check that you do not skip over any code or declarations that affect the next section of code being debugged.
Display Variable	(If the debugger is executing.) Open the Locals window and highlight the local variable for the current point in the code.
Show in String Viewer	Display the full contents of a variable string in the String Viewer.
Create Use Case for '<string>'	Display the 'Create Use Case For Method' dialog, through which you create a Use Case for the method containing the text string.
Breakpoint	Display a submenu of options for creating a recording marker on the selected line of code. The recording markers you can add include: • Breakpoint • Start Recording Marker • End Recording Marker • Stack Auto Capture Marker • Method Auto Record Marker • Tracepoint
Testpoints	Display options to add a new Testpoint, show the Testpoints Manager (Testpoints window) or edit an existing Testpoint if one or more are already defined at the selected location. (The sub-options depend on the type of code file you are reviewing.)
XML Validation	Allows an XML document to be checked for compliance with its own schema references or using a user-specified schema; either a local schema file or a URL.
Open (Close) IME	Open (or close) the Input Method Editor, so that you can enter text in a selected foreign language script, such as Japanese. You set the keyboard language using the Windows Control Panel - Regional and Language Options facility.
Line Numbers	(Script Editor only.) Show or hide the code line numbers on the left hand side of the editor screen.
Undo	

Cut **Copy** **Paste** **Delete** **Select All**	These six options provide simple functions for editing the code.

Notes

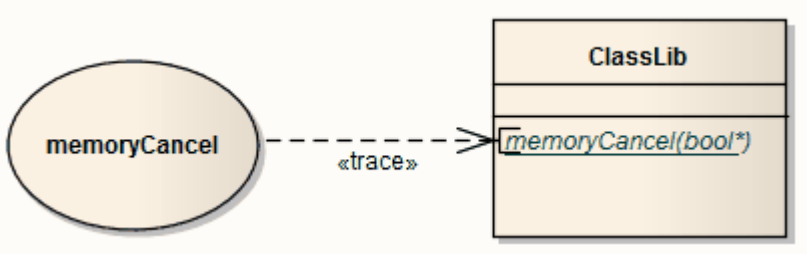
- The options in the lower half of the 'Search for <string>' submenu (after 'Search in Scripts') are configurable; you can add new search tools or remove existing ones by editing the searchProviders.xml file in the Sparx Systems > EA > Config folder - this file is in OpenSearch description document format

Create Use Case for Method

Using the code editor context menu, you can create a Use Case element for a method that you select from the code. You can also:

- Link the Use Case directly to the method
- Add the parent Class to a diagram (if it is not already in the selected diagram) and/or add the Use Case element to the diagram
- Block from display any attributes or methods that are not also the targets of feature links

Create a Use Case for a method, through the code editor

Step	Action
1	(If you want to depict the Use Case and its link to the method in a diagram) click on the diagram name in the Browser window.
2	In the code editor, right-click on either the method name or any part of the method body, and select the 'Create Method for <methodname>' option. The 'Create Use Case for Method' dialog displays.
3	The basic function of this dialog is to create a Use Case for the selected method: • If this is all that is required, click on the OK button; the Use Case element is created in the Browser window, in the same Package as the parent Class for the method, and with the same name as the method • If you intend to make the relationship tangible, continue with the procedure
4	To create a Trace connector linking the Use Case to the method, select the 'Link Use Case to Method' checkbox.
5	To add the method's parent Class to the diagram, if it is not already there, select the 'Add Class to Diagram' checkbox.
6	To add the newly-created Use Case to the diagram, select the 'Add Use Case to Diagram' checkbox; this would now show the Use Case, Class and Trace connector on the diagram.
7	To only show the features (attributes and methods) of the parent Class that are the targets of 'link to feature' relationships, select the 'Display only linked features in Class' checkbox. The Class might contain any number of attributes and methods, but those without a 'link to feature' relationship are hidden.
8	Click on the OK button to create and depict the Use Case and relationship; if you selected all options, the diagram now contains linked elements resembling this illustration: 

Code Editor Functions

The common Code Editor provides a variety of functions to assist with the code editing process, including:

- Syntax Highlighting
- Bookmarks
- Cursor History
- Brace Matching
- Automatic Indentation
- Commenting Selections
- Scope Guides
- Zooming
- Line Selection
- Intelli-sense
- Find and Replace
- Find in Files

A range of these functions is available through keyboard key combinations and/or context menu options.

You can customize several of the Code Editor features by setting properties in the Code Editor configuration files; for example, by default the line containing the cursor is always highlighted, but you can turn the highlighting off.

Function Details

Code Editor Functions

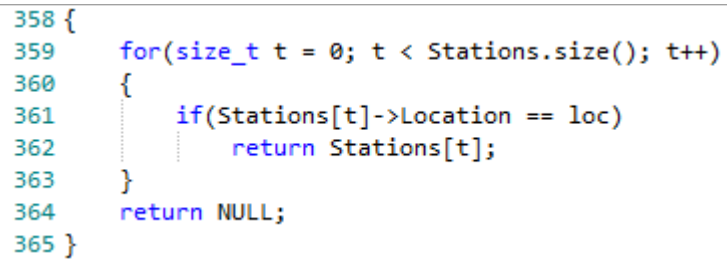
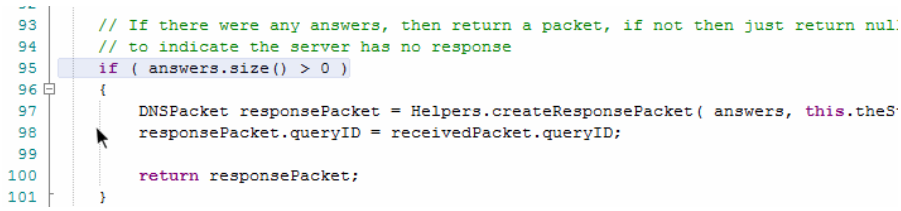
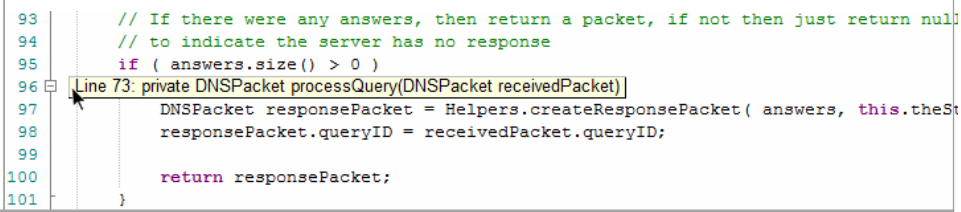
Function	Description

Syntax Highlighting	The Code Editor highlights - in colored text - the standard code syntax of all language file formats supported by Enterprise Architect
	`#pragma once`
	`#include "afxwin.h"`
	`#include "afxcmn.h"`
	
	`// CToolBox dialog`
	
	`class CToolBox : public CDialog`
	`{`
	`DECLARE_DYNAMIC(CToolBox)`
	`CRect m_rect;`
	`int m_offset;`
	You can define how the Code Editor implements syntax highlighting for each language, through the 'Code Editors' page of the 'Preferences' dialog.

Bookmarks	Bookmarks denote a line of interest in the document; you can toggle them on and off for a particular line by pressing Ctrl+F2. Additionally, you can press F2 and Shift+F2 to navigate to the next or previous bookmark in the document. To clear all bookmarks in the code file, press Ctrl+Shift+F2.
Cursor History	The Code Editor Control keeps a history of the previous 50 cursor positions; an entry in the history list is created when: • The cursor is moved more than 10 lines from its previous position • The cursor is moved in a find/replace operation You can navigate to an earlier point in the cursor history by pressing Ctrl+-, and to a later point by pressing Ctrl+Shift+-.

Brace Matching	When you place the cursor over a brace or bracket, the Code Editor highlights its corresponding partner; you can then navigate to the matching brace by pressing Ctrl+E.
	`function ProtectedFunctionTest: boolean;`
	`procedure ProtectedProcedureTest(a: WideString);`

Automatic Indentation	For each supported language, the Code Editor adjusts the indentation of a new line according to the presence of control statements or scope block tokens in the lines leading up to the cursor position.

	 The levels of indent are indicated by pale horizontal lines. You can also manually indent selected lines and blocks of code by pressing the Tab key; to un-indent the selected code, press Shift+Tab.
Commenting Selections	For languages that support comments, the Code Editor can comment entire selections of code. The Code Editor recognizes two types of commenting: • Line Commenting - entire lines are commented from the start (for example: // This is a comment) • Stream Commenting - sections of a line are commented from a specified start point to a specified end point (for example: /* This is a comment */) You can toggle comments on the current line or selection by pressing: • Ctrl+Shift+C for line comments, or • Ctrl+Shift+X for stream comments
Scope Guides	If the cursor is placed over an indentation marker, the Code Editor performs a 'look back' to find the line that started the scope at that indentation level; if the line is found and is currently on screen, it is highlighted in light blue.  Alternatively if the line is off screen, a calltip is displayed advising of the line number and contents: 
Zooming	You can zoom into and out of the contents of the Code Editor using: • Ctrl+keypad + and • Ctrl+keypad - Zoom can be restored to 100% using Ctrl+keypad /.
Line Selection	If you want to move the cursor to a specific line of code, press Ctrl+G and, in response to the prompt, type in the line number. Press the OK button; the editor displays the specified line of code with the cursor at

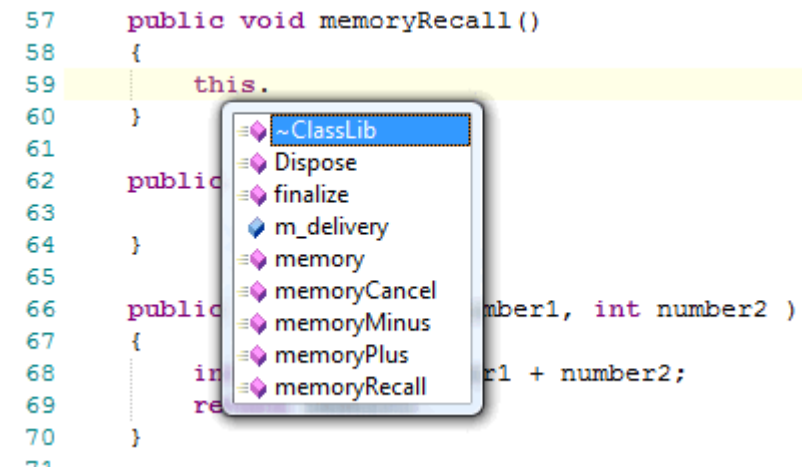
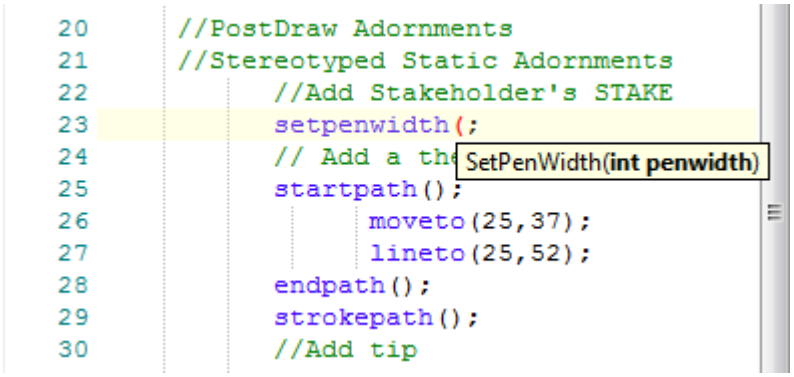
	the left.

Intelli-sense

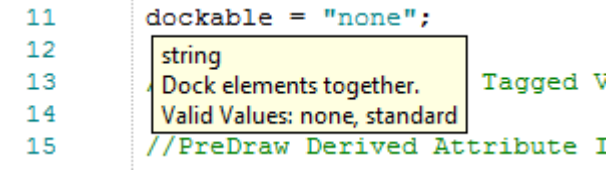
Intelli-sense is a feature that provides choices of code items and values as you type. Not all code editors use Intelli-sense; for example, Intelli-sense is disabled while you record a macro in the Source Code Viewer.

Intelli-sense provides you with context-based assistance through autocompletion lists, calltips and mouseover information.

Facilities

Facility	Description
Autocompletion List	An autocompletion list provides a list of possible completions for the current text; the list is automatically invoked when you enter an accessor token (such as a period or pointer accessor) after an object or type that contains members.  You can also invoke the autocompletion list manually by pressing Ctrl+Space; the Code Editor then searches for matches for the word leading up to the invocation point. Select an item from the list and press the Enter key or Tab key to insert the item into the code; to dismiss the autocompletion list, press Esc.
Calltips	Calltips display the current method's signature when you type the parameter list token (for example, opening parenthesis); if the method is overloaded, the calltip displays arrows that you can use to navigate through the different method signatures 
Mouseover Information	You can display supporting documentation for code elements (for example,

attributes and methods) by hovering the cursor over the element in question.



Find and Replace

Each of Enterprise Architect's code editors facilitates searching for and replacing terms in the editor, through the 'Find and Replace' dialog.

Access

Keyboard Shortcuts	Highlight the required text string and press: • Ctrl+F for the find controls only, or • Ctrl+R for both find and replace controls In each instance, the 'Find what' field is populated with the text currently selected in the editor. If no text is selected in the editor, the 'Find what' field is populated with the word at the current cursor position. If no word exists at the current cursor position, the last searched-for term is used.

Basic Operations - Commands

Command	Action
Find Next	Locate and highlight the next instance (relative to the current cursor position) of the text specified in the 'Find what' field.
Replace	Replace the current instance of the text specified in the 'Find what' field with the text specified in the 'Replace with' field, and then locate and highlight the next instance (relative to the current cursor position) of the text specified in the 'Find what' field.
Replace All	Automatically replace all instances of the text specified in the 'Find what' field with the text specified in the 'Replace with' field.

Basic Operations - Options

Option	Action
Match Case	Specify that the case of each character in the text string in the 'Find what' field is significant when searching for matches in the code.
Match whole word	Specify that the text string in the 'Find what' field is a complete word and should not be matched with instances of the text that form part of a longer string. For example, searches for ARE should not match those letters in instances of the words AREA or ARENA.
Search up	Perform the search from the current cursor position up to the start of the file, rather

	than in the default direction of current cursor position to end of file.
Use Regular Expressions	Evaluate specific character sequences in the 'Find what' and 'Replace with' fields as Regular Expressions.

Concepts

Concept	Description
Regular Expressions	A Regular Expression is a formal definition of a Search Pattern, which can be used to match specific characters, words or patterns of characters. For the sake of simplicity, the Code Editor's 'find and replace' mechanism supports only a subset of the standard Regular Expression grammar. Text in the 'Find what' and 'Replace with' fields is only interpreted as a Regular Expression if the 'Use Regular Expressions' checkbox is selected in the 'Find and Replace' dialog.
Metasequences	If the 'Use Regular Expressions' checkbox is selected, most characters in the 'Find what' field are treated as literals (that is, they match only themselves). The exceptions are called metasequences; each metasequence recognized in the Code Editor 'Find and Replace' dialog is described in this table: • \< - Indicates that the text is the start of a word; for example: \<cat is matched to *catastrophe* and *cataclysm*, but not *concatenate* • \> - Indicates that the text is the end of a word; for example: hat\> is matched to *that* and *chat*, but not *hate* • (...) - Indicates alternative single characters that can be matched - the characters can be specific (chr) or in an alphabetical or numerical range (a-m); for example: (hc) at is matched to *hat* and *cat* but not *bat*, and (a-m) Class is matched to any name in the range *aClass-mClass* • (^...) - Indicates alternative single characters that should be excluded from a match - the characters can be specific (^chr) or in an alphabetical or numerical range (^a-m); for example: (^hc) at is matched to *rat* and *bat*, but *hat* and *cat* are excluded, and (^a-m) Class is matched to any name in the range *nClass* to *zClass*, but *aClass* to *mClass* are excluded • ^ - Matches the start of a line • $ - Matches the end of a line • * - Matches the preceding character (or character set) 0 or more times; for example: ba*t is matched to *bt*, *bat*, *baat*, *baaat* and so on, and b(ea) *t is matched to *bt*, *bet*, *bat*, *beat*, *beet*, *baat* and so on • + - Matches the preceding character (or character set) 1 or more times; for example: ba+t is matched to *bat*, *baat* and *baaat* but not *bt*, and b(ea) +t is matched to *bet*, *bat*, *beat*, *beet* and *baat* but not *bt* If a single character metasequence is preceded by a backslash (\) it is treated as a literal character: c\(at\) matches c(at) as the brackets are treated literally. When the 'Use Regular Expressions' checkbox is selected, a metasequence helper menu is available to the right of both of the 'Find what' and 'Replace with' fields; selecting a metasequence from this menu inserts the metasequence into the field, replacing or wrapping the currently selected text as appropriate.
Tagged Regions	When 'find and replacing' with Regular Expressions, up to nine sections of the

	original term can be substituted into the replacement term. The metasequences '\(' and '\)' denote the start and the end of a tagged region; the section of the matched text that falls within the tagged region can be included in the replacement text with the metasequence '\n' (where *n* is the tagged region number between 1 and 9). For example: Find: \((A-Za-z) +\)*'s things* Replace with *items that belong to \1* Original text: *These are all Michael's things*. Replaced text: *These are all items that belong to Michael.*

Search in Files

File Text Searches are provided by the Find in Files window and from within the Code Editors, to search files for data names and structures. These files can be external code files, code files that you have already opened in Enterprise Architect, internal model scripts or the Help subsystem.

The 'File Search' tab maintains a history of the file paths you have explored, helping you to quickly return to frequently-used folders in your file system. You can similarly select a previously-used search string, if you need to repeat a search several times. When you are searching code files, you can also confine the search to files of specific types, by selecting the file extensions, and to include just the selected folder or all of its sub-folders as well. Another useful facility is being able to select to show the results of the search as either a list of every instance of the string, or a list of files containing the string with the instances grouped under the file in which they are found.

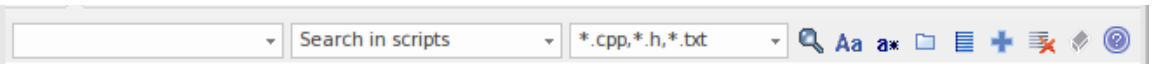
For all searches, you can qualify the search to be case-sensitive and/or to match the search string to complete words.

Access

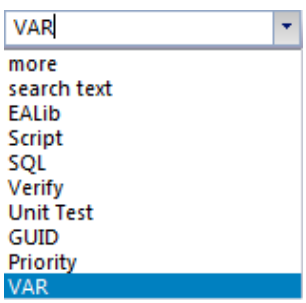
Ribbon	Explore > Search > Files Execute > Source > Find Execute > Source > Edit > Search in Files
Context Menu	Right-click on selected text | Search for <selected text> | Search in Files
Keyboard Shortcuts	F12, Ctrl+Shift+Alt+F

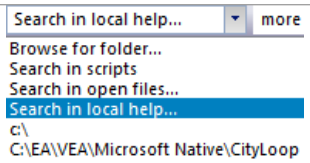
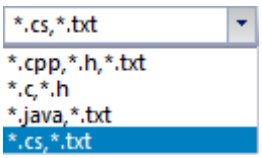
Search Toolbar

You can use the toolbar options in the Find in Files window to control the search operation. The state of each button persists over time to always reflect your previous search criteria.



Options

Option	Action
	The 'Search Text' field. Type the text string to search for. Any text you type in is automatically saved in the drop-down list, up to a maximum of ten strings; text added after that overwrites the oldest text string in the list. You can click on the drop-down arrow and select one of these saved text strings, if you prefer.
	The 'Search Path' field. Specify the folder to search, or the type of search.

	You can type the folder path to search directly into the text box, or click on the drop-down arrow and select 'Browse for folder' to search using the 'Browse for Folder' dialog. Any paths you enter are automatically saved in the drop-down list, up to a maximum of ten; paths added after that overwrite the oldest path in the list. You can select one of these saved paths if you prefer. Apart from 'Browse for folder', there are three other fixed options in the drop-down list: • 'Search in scripts', which searches the local and user-defined scripts in the 'Scripts' tab of the Scripting window • 'Search in open files', which confines the search to the files that you have open in Enterprise Architect • 'Search in local help', which searches the local Help files that have been installed from the Sparx Systems web site; the results list the Help topics containing the search term, and the line number and line in which the text occurs These options disable the 'Search File Types' list box.
	The 'Search File Types' field. Click on the drop-down arrow and select the file types (file extensions) to search.
	Click on this icon to begin the search. During the course of the search all other buttons in the toolbar are disabled. You can cancel the search at any time by clicking on the Search button again. If you switch any of these toggle buttons, you must run the search again to change the output.
	Click on this icon to toggle the case sensitivity of the search. The tool-tip message identifies the current setting.
	Click on this icon to toggle between searching for any match and searching for only those matches that form an entire word. The tool-tip message identifies the current setting.
	Click on this icon to toggle between limiting the search to a single path and including all subfolders under that path. The tool-tip message identifies the current setting.
	Click on this icon to select the presentation format of the search results; you have two options: • List View - (as shown) each result line consists of the file path and line number, followed by the line text; multiple lines from one file are listed as separate entries • Tree View - () each result line consists of the file path that matches the search criteria, and the number of lines matching the search text within that file; you can expand the entry to show the line number and text of each line
	Click on this icon to add a new search tab. You can create up to four new search tabs. Searches can also run concurrently.

	Click on this icon to clear the results.
	If necessary, click on this icon to remove all the entries in the Search Path, Search Text and Search File Types drop-down lists.
	Click on this icon to display this Help topic.

Find File

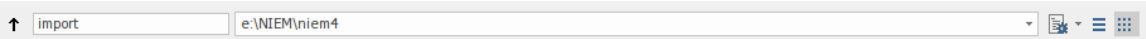
The Find in Files window 'Find File' tab provides a tool that can help you find files quicker. The tab acts as a file system explorer and offers a speedy alternative to the common open file dialog. File searches are quick and simple, allowing you to look up files of interest without losing your current workflow. The display can be switched between report and list view.

Access

Ribbon	Explore > Search > Files > Find File
Keyboard Shortcuts	Ctrl+Shift+Alt+F

Toolbar

The toolbar provides a search filter and folder navigation combo box. The toolbar provides options to remember search locations and alternate between list and report views.



Options

	Click to navigate to the parent folder.
	The filter control allows you to exclude files that do not match the criteria you type. The wildcard symbol * is automatically appended to the text so it is not necessary to add it yourself. To search for all files that contain the term 'jvm' simply type 'jvm'. To find .png images containing the term 'red' you could type *red*.png. Press the Enter key to update the results.
	Enter the path of a directory and press the Enter key to display the files in that location Use the drop down list to select from book-marked locations for the current model. Locations can be managed by using the toolbar menu.
	Allows you to manage the locations displayed in the directory combo. • Remember Path - stores the current value of the 'Directory' field so that, when you return to the Find in Files window at a later point the 'Directory' field either defaults to that value (if it is the only 'remembered' value) or offers the value in the drop-down list • Forget Path - clears the current value from memory so that it is not offered as a possible value for the 'Directory' field • Remember Filter - stores the current value in the 'Filter' field so that when you return to the Find in Files window at a later point the 'Filter' field defaults to

	that value • Forget Filter - removes the 'Filter' field value from memory so that it is not placed in the field next time you access the window
	In this view the list displays the columns 'Name', 'Modified Date', 'Type' and 'Size'. Columns can be sorted in either ascending or descending order. Click the column a third time to remove the sort order.
	The list view removes columns and is convenient when a folder contains many files.

Keyboard Shortcuts

	Sets focus to the filter control.
	Navigates to the parent folder.
	Navigates to the parent folder.
	If a folder is selected, opens the folder, otherwise opens the selected files.

Search Intelli-sense

The Intelli-sense capabilities of Enterprise Architect are built using Sparx Systems' Code Miner tool. The Code Miner provides fast and comprehensive access to the information in an existing code base. The system provides complete access to all aspects of the original source code, either on the fly as one might in a code editor, or as search results produced by queries written in the Codeminer mFQL language.

This feature is available from Enterprise Architect Release 14.1.

Access

On the Find in Files window, click on the 'Code Miner' tab.

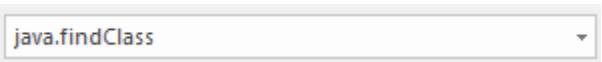
Ribbon	Explore > Search > Files
Keyboard Shortcuts	Ctrl+Shift+Alt+F

The Code Miner Control

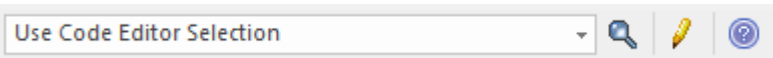
This control presents an interface for performing queries on several code bases at once. The code bases it uses are databases built using Enterprise Architect's Code Miner tool. These databases form a library. The Library can also be shared when deployed as a service. The queries that can be run are listed and selected using the toolbar. The control allows easy access to the source code for the queries, for editing and composition. Queries do not need to be compiled. They are viewed, edited and saved as one would any source code file. Queries that take a single parameter can utilize any selection in an open code editor. The interface also supports manual parameter entry for queries that take multiple arguments.

The first control on the toolbar lists the namespaces available. Selecting a namespace limits the queries that are displayed to those within that namespace.

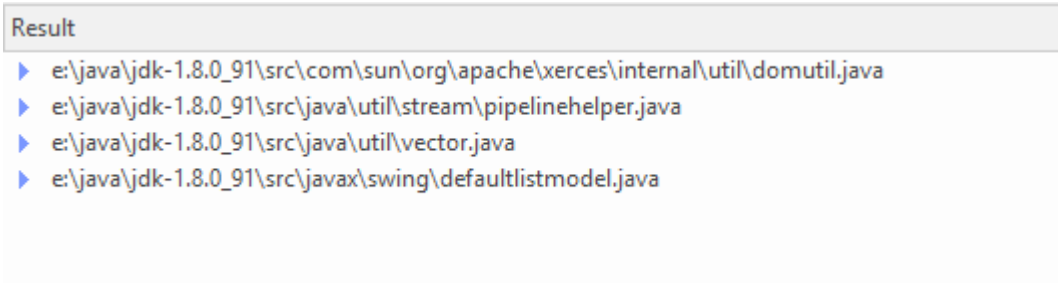
The next control is a combo box that lists all the queries in the query file for the selected namespace.



The next control is an edit combo box. By default a single query parameter is taken from the selected text in an any open code editor, but you can also type the parameter(s) directly into this field. Multiple parameters should be separated by commas. This is followed by the Search button to run the query. Queries can be edited at any time using the Edit button next to it.



The results window is a tree control that lists the results of the query grouped by file.



Code Miner Libraries

Code Miner libraries are a collection of databases that can be used by Enterprise Architect Intelli-sense providers to obtain and query for information across several code bases. Each database is created from the root source code directory of a code base, using a specialized grammar appropriate for its language (C++, Java or C#).

The libraries are created, updated, removed or added in the 'Analyzer Script Editor'. A typical scenario for using this feature would be to create a database for a development project and additional databases for frameworks referenced by the project. Your development database can be updated frequently as code changes accrue, while the static frameworks would be updated less often. Libraries can be searched in a similar way to the 'File Search' tool, but offers advanced search capabilities due to its mFQL language.

- Multiple domains / frameworks can be searched at once
- A query can be run in a fraction of the time required for a File Search
- Queries can be coded to assist with complex search criteria
- Queries can take multiple parameters
- All files are indexed based on equivalent UML constructs, allowing intelligent searches producing meaningful results in a modeling setting

Code Miner Query Files

Code Miner queries are maintained in a single source code file which should have the .mFQL extension. A basic set of queries is provided with each Enterprise Architect installation; these can be located in the config\codeminer sub directory. This query file should be named by default in any Analyzer Script you edit.

Before editing any queries it is advisable that you copy this file to a working location and name the copy in any Analyzer Script you use. This way you will always have a reference file to go back to.

Queries are best considered as functions that are written in the mFQL language. As such they have unique names, can be qualified by a single namespace and can specify parameters. The file provides the queries listed in the Intelli-sense control's toolbar. Whenever edits to a query file are saved, the queries listed in the search toolbar combo box will be updated accordingly. This image is an example of a simple query written in mFQL.

```
188
189 namespace java
190 {
191 //
192 // Find all references
193 //
194 query::findByName($param1)
195 {
196     distinct(GetByValue( $param1 +))
197 }
198
199 query::findMethodByName($name)
200 {
201     move( 1, "METHOD", intersect( GetByNode("NAME"), GetByValue( $name ) )  )
202 }
203
204 query::findMethodCall($name)
205 {
206     filter( "METHOD_ACCESS", intersect(GetByNode("NAME"), GetByValue( $name )) )
207 }
208
```

Code Editor Key Bindings

Keys

Key	Description
Ctrl+G	Move cursor to a specified line
↓	Move cursor down one line
Shift+↓	Extend selection down one line
Ctrl+↓	Scroll down one line
Alt+Shift+↓	Extend rectangular selection down one line
↑	Move cursor up one line
Shift+↑	Extend selection up one line
Ctrl+↑	Scroll up one line
Alt+Shift+↑	Extend rectangular selection up one line
Ctrl+(	Move cursor up one paragraph
Ctrl+Shift+(	Extend selection up one paragraph
Ctrl+)	Move cursor down one paragraph
Ctrl+Shift+)	Extend selection down one paragraph
←	Move cursor left one character
Shift+←	Extend selection left one character
Ctrl+←	Move cursor left one word
Ctrl+Shift+←	Extend selection left one word
Alt+Shift+←	Extend rectangular selection left one character
→	Move cursor right one character.
Shift+→	Extend selection right one character
Ctrl+→	Move cursor right one word
Ctrl+Shift+→	Extend selection right one word

Alt+Shift+→	Extend rectangular selection right one character
Ctrl+/	Move cursor left one word part
Ctrl+Shift+/	Extend selection left one word part
Ctrl+\	Move cursor right one word part
Ctrl+Shift+\	Extend selection right one word part
Home	Move cursor to the start of the current line
Shift+Home	Extend selection to the start of the current line
Ctrl+Home	Move cursor to the start of the document
Ctrl+Shift+Home	Extend selection to the start of the document
Alt+Home	Move cursor to the absolute start of the line
Alt+Shift+Home	Extend rectangular selection to the start of the line
End	Move cursor to the end of the current line
Shift+End	Extend selection to the end of the current line
Ctrl+End	Move cursor to the end of the document
Ctrl+Shift+End	Extend selection to the end of the document
Alt+End	Move cursor to the absolute end of the line
Alt+Shift+End	Extend rectangular selection to the end of the line
Page Up	Move cursor up a page
Shift+Page Up	Extend selection up a page
Alt+Shift+Page Up	Extend rectangular selection up a page
Page Down	Move cursor down a page
Shift+Page Down	Extend selection down a page
Alt+Shift+Page Down	Extend rectangular selection down a page
Delete	Delete character to the right of the cursor
Shift+Delete	Cut selection

Ctrl+Delete	Delete word to the right of the cursor
Ctrl+Shift+Delete	Delete until the end of the line
Insert	Toggle overtype
Shift+Insert	Paste
Ctrl+Insert	Copy selection
Backspace	Delete character to the left of the cursor
Shift+Backspace	Delete character to the left of the cursor
Ctrl+Backspace	Delete word to the left of the cursor
Ctrl+Shift+Backspace	Delete from the start of the line to the cursor
Alt+Backspace	Undo delete
Tab	Indent cursor one tab
Ctrl+Shift+I	Indent cursor one tab
Shift+Tab	Unindent cursor one tab
Ctrl+keypad(+)	Zoom in
Ctrl+keypad(-)	Zoom out
Ctrl+keypad(/)	Restore Zoom
Ctrl+Z	Undo
Ctrl+Y	Redo
Ctrl+X	Cut selection
Ctrl+C	Copy selection
Ctrl+V	Paste
Ctrl+L	Cut line
Ctrl+T	Transpose line
Ctrl+Shift+T	Copy line
Ctrl+A	Select entire document
Ctrl+D	Duplicate selection

Ctrl+U	Convert selection to lowercase
Ctrl+Shift+U	Convert selection to uppercase
Ctrl+E	Move cursor to matching brace
Ctrl+Shift+E	Extend selection to matching brace
Ctrl+Shift+C	Toggle line comment on selection
Ctrl+Shift+X	Toggle stream comment on selection.
Ctrl+F2	Toggle bookmark
F2	Go to next bookmark
Shift+F2	Go to previous bookmark
Ctrl+Shift+F2	Clear all bookmarks in current file
Ctrl+Shift+W	Toggle whitespace characters
Ctrl+Shift+L	Toggle EOL characters
Ctrl+Space	Invoke autocomplete.
Ctrl+-	Go backwards in cursor history
Ctrl+Shift+-	Go forwards in cursor history
F12	Start/Cancel search for keyword in file(s).
Ctrl+F	Find text
Ctrl+R	Replace text

Notes

- In addition to these keys, you can assign (Ctrl+Alt+<n>) key combinations to macros that you define within the Source Code Editor

Application Patterns (Model + Code)

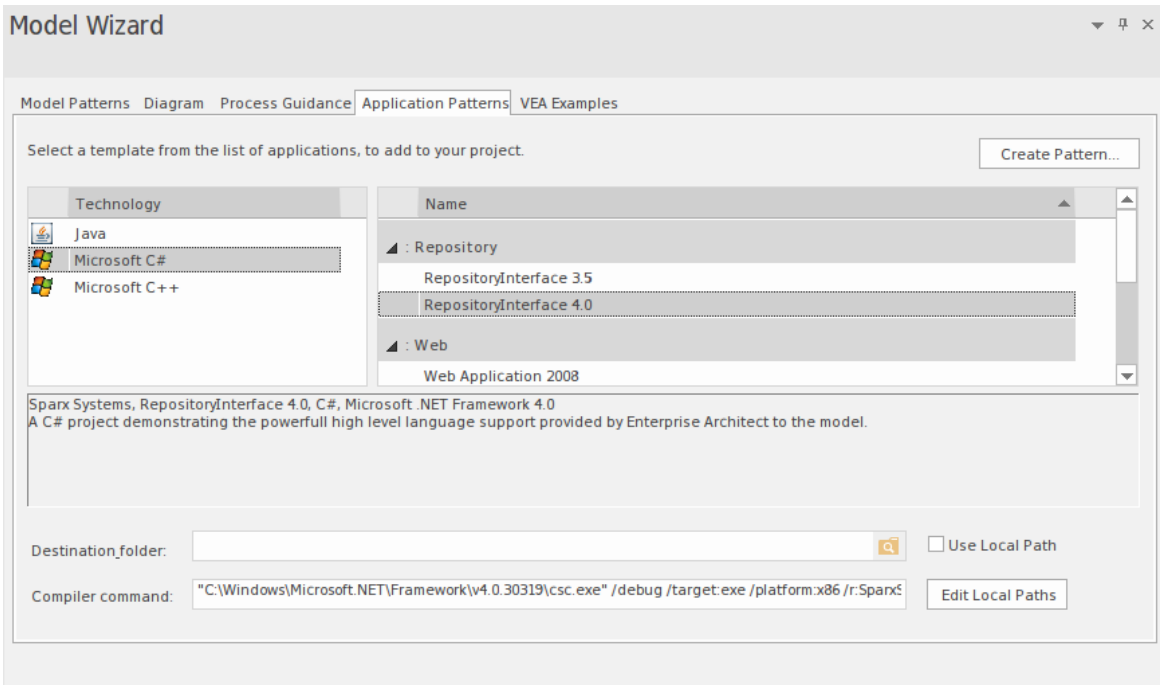
To get you going with a code based project as fast as possible, Enterprise Architect helps you to generate starter projects including model information, code and build scripts for one of several basic application types. Patterns include:

- MFC Windows applications
- Java programs
- ASP.NET web services

Access

Ribbon	Design > Model > Add > Model Wizard > Application Patterns
Context Menu	In Browser window | Right-click on a Package | Add a Model using Wizard > Application Patterns
Keyboard Shortcuts	Ctrl+Shift+M > Application Patterns

Generate Models



Option	Action
Technology	Select the appropriate technology.
Name	Displays the Application Patterns available for the selected technology; select the required Pattern to import.

<description>	Displays a description of the selected Pattern.
Destination folder	Browse for and select the directory in which to load the source code for the application.
Use Local Path	Enable the selection of an existing local path to place the source code under; changes the 'Destination folder' field to a drop-down selection.
Compiler command	Displays the default compiler command path for the selected technology; you must either: • Confirm that the compiler can be found at this path, or • Edit the path to the compiler location
Edit Local Paths	Many application Patterns specify their compiler using a local path. The first time you use any Pattern you must click on this button to ensure the local path points to the correct location. The 'Local Paths' dialog displays.

Notes

- If required, you can publish custom application Patterns by adding files to the *AppPatterns* directory where Enterprise Architect is installed; top level directories are listed as Technologies and can contain an icon file to customize the icon displayed for the technology
  Directories below this are defined as groups in the Patterns list; the Patterns are identified by the presence of four files with a matching name: a zip file (.zip), XMI file (.xml), config file (.cfg) and optional icon (.ico)
- The config file supports these fields:
  - [provider], [language], [platform], [url], [description], [version] - all displayed in the <description> field
  - [xmirootpaths] - the root path of the source code in the exported XMI; this is replaced with the selected destination folder when the user applies the Application Pattern

MDG Integration and Code Engineering

MDG Integration for Eclipse and MDG Integration for Visual Studio are products that help you to create and maintain your UML models directly inside these two popular Integrated Development Environments, using the Enterprise Architect Browser window. Models can be generated to source code using the powerful and flexible template engine that gives the engineer complete control over how the code is generated. Existing source code can also be reverse engineered and synchronized with the UML models. With the integration installed the IDE will become a feature rich modeling platform, saving time and effort and reducing the risk of error by linking requirements management, architecture and design to source code engineering.

Rich and expressive documentation can be generated automatically into a wide range of formats including Docx, PDF and HTML. The documentation can include diagrams of requirements, design and architecture as well as source code descriptions, putting the source code into context.

You can purchase MDG Integration for Eclipse and MDG Integration for Visual Studio or download Trial Editions, from the Sparx Systems web site.

Wireframe Models

The Wireframe Toolbox pages provide a wide range of icons that you can use in wireframe modeling to represent the appearance of a device at a particular point in the execution of an application. Devices you can model include:

- Android Phones and Tablets
- Apple iPhones and Tablets
- Windows 8.1 Phones
- Screen dialogs
- Web pages - to model how the web pages work

Access

On the Diagram Toolbox, click on  to display the 'Find Toolbox Item' dialog and specify 'Wireframing', 'Android', 'Apple', 'Dialog', 'Windows Phone' or 'Webpage'.

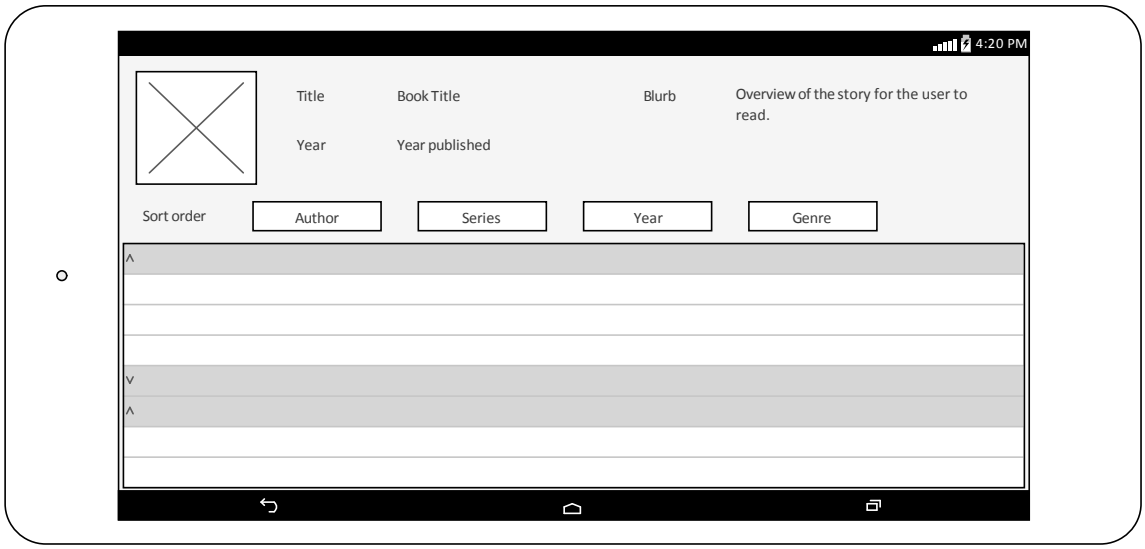
Ribbon	Design > Diagram > Toolbox
Keyboard Shortcuts	Ctrl+Shift+3

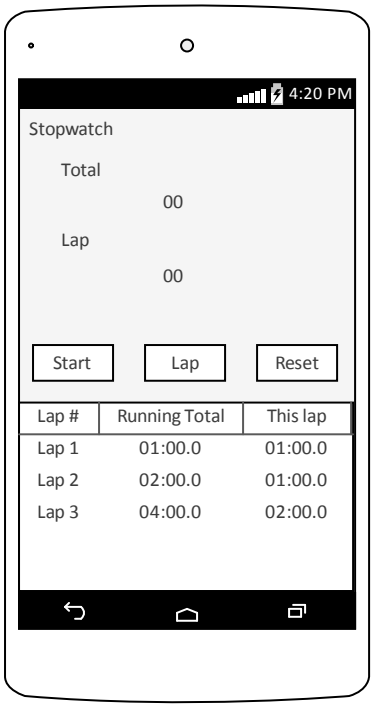
Notes

- Each of the Wireframing Diagram Toolboxes provides one or more Patterns that you can drag onto a diagram as an illustration of what you might achieve, or to act as the basis of the model you are developing
- The 'Properties' dialog for Wireframe elements automatically opens to either a top-level 'Wireframe' tab on which you can edit the element rendering directly, or a second-level 'Wireframing' Tagged Values tab if you define the element rendering by editing the XML for the properties of that element type
- Some of the elements you create from the 'Wireframe' Toolbox pages are properly rendered after you edit the Tagged Values that define their characteristics
- As you develop your Interface diagrams you can establish the positions and layout of the elements freehand by dragging and 'nudging' the elements, or impose some regularity using the 'Snap To Grid' diagram options

Android Wireframe Toolbox

The 'Android Wireframing' Diagram Toolbox pages provide the templates for modeling the physical appearance of an Android tablet or phone at a given state of execution of an application. They also provide Patterns for generating a standard model structure for each Android appliance.





Access

On the Diagram Toolbox, click on  to display the 'Find Toolbox Item' dialog and specify 'Wireframing' or 'Android'.

Ribbon	Design > Diagram > Toolbox

Keyboard Shortcuts	Ctrl+Shift+3

Android Screen Types

Item	Description
Android Phone	Generates a frame for the face of the Android Phone you are modeling. A prompt displays for you to specify portrait or landscape orientation. Child controls will be contained within the area of the screen. Tagged Values: • MenuButtons - click on the drop-down button and select to 'Show' or 'Hide' the menu button bar at the bottom of the screen • NotificationBar - click on the drop-down button and select to 'Show' or 'Hide' the Notification bar at the top of the screen
Android Tablet	Generates a frame for the Android Tablet you are modeling. A prompt displays for you to specify portrait or landscape orientation. Child controls will be contained within the area of the screen. Tagged Values: • MenuButtons - click on the drop-down button and select to 'Show' or 'Hide' the menu button bar at the bottom of the screen • NotificationBar - click on the drop-down button and select to 'Show' or 'Hide' the Notification bar at the top of the screen
Client Area	Generates a frame element that represents the client area of the device. Tagged Values: • Border Style - click on the drop-down arrow and select to render the border as a solid line or a dashed line, or to have no border at all (None) • ScrollbarH - click on the drop-down arrow and select to place a horizontal scrollbar at the top or bottom of the client area, or to have no horizontal scrollbar (<none>) • ScrollbarV - click on the drop-down arrow and select to place a vertical scrollbar on the left or right of the client area, or to have no vertical scrollbar (<none>)

Composite

Item	Description
Expandable List View	Generates an element that represents a two-level grouped list that can be expanded to show one or both levels of item. Double-click on the element to display the 'Properties' dialog at the 'Wireframe' page, which shows the root node (the Expandable List element name), the group heading items (directly under the element name) and the group items (under the group headings).

	• To add a new item click on the level above (the element name or the group heading names) and on the Add button, and in response to the prompt type in the name of the item, which adds the name to the bottom of the section of the list you have created it in To position the item on the list, click on it in the list and click on the  buttons • To remove an item from the list, click on it and click on the Remove button; the item is immediately removed from the list Click on the Item Name (the first-level list item directly underneath the element name). • Name - type in the name for this item group • Expanded - click on the drop-down arrow and select True to show the sub-items for this item, or False to hide the sub-items Click on a sub-item name (the second-level list item) directly under an Item name. Sub-item nodes do not have any child nodes. • Name - type the name of the sub-item • Selected - click on the drop-down arrow and select True to highlight the item as selected, or False to omit the highlight
Table	Generates a Table element with labeled columns, rows and cells. Double-click on the table to bring up the element 'Properties' dialog at the 'Wireframe' page, which provides the facilities for editing the table (adding, renaming and deleting columns and rows, changing the column width and editing the cell text) through context menu options and buttons. Note that the editor does not provide a true image of the table's appearance on the screen. • Draw Lines - click on the drop-down arrow and select True to display horizontal and vertical lines between the table cells, or False to hide the lines • Highlight Headers - click on the drop-down arrow and select True to highlight the header of each column, or False to leave the table columns a uniform color
Tab Host	Generates a tab control element on the diagram. You can name the tabs and mark them as selected; however, child elements will not 'switch' when changing tabs (that is, setting a different tab as selected will still display the same child items in the tab space). Tagged Values: • Tabs - click on the drop-down arrow and click on the tab that is to be highlighted as selected You can name the tabs, and add more to the list, by editing the 'Values:' list in the Tagged Value notes If you reduce the size of the element so that all tabs cannot be shown, a scroll icon () automatically displays in the top right corner of the element.
Simple List	Generates a list box containing a list of items with no sub-items. Double-click on the element to display the 'Properties' dialog at the 'Wireframe' page. To: • Change an item to different text, overtype the 'Item<n>' text in the 'Name' field • Highlight the item as selected, in the 'Selected' field click on the drop-down arrow and select True • Add another item, click on the element name and on the Add button, and type in the item name • Remove an item from the list, click on it and click on the Remove button

	• Move an item to a different position in the list, click on it and click on one of the  buttons as appropriate
2 Lane List	Generates a list box as for a Simple List, but each item name is in bold and can have a description underneath the item name. Double-click on the element to display the 'Properties' dialog at the 'Wireframe' page. • To add the description, click on the item name and, in the 'Text' field, type the description text Other options are the same as for the Simple List.
Checklist	Generates a list box as for a Simple List, but each item name has a tick outline to the right of it. For selected items, the outline is filled. Double-click on the element to display the 'Properties' dialog at the 'Wireframe' page. • To set a tick to selected (filled) click on the 'Checked' drop-down arrow and click on True; to change the tick to unselected (outline), set the field to False Other options are the same as for the Simple List.
Single Choice List	Generates a list box as for a Simple List, but each item name has a radio button outline to the right of it. For a selected item, the outline is filled. Double-click on the element to display the 'Properties' dialog at the 'Wireframe' page. • To set a radio button to selected (filled) click on the 'Selected' field drop-down arrow and click on True; to change the radio button to unselected (outline), set the field to False All items can be set to False (unselected), but if more than one item is set to True (selected) only the item lowest on the list displays as selected Other options are the same as for the Simple List.

Form Widgets

Item	Description
Switch	Generates an element representing a simple Android switch. The switch can have two states (such as On and Off) and a label taken from the name of the element. Tagged Values: • States - click on the drop-down arrow and select the switch position depicted by the element You can edit the 'Values:' field in the Tagged Value Notes to change the text of the state values You can add more than two values, but you can only toggle the 'States' field between the first two values in the list; the other values are ignored if selected
Rating Control	Generates an element depicting a star-rating band. The element always shows five stars, and the number of filled stars indicates the rating. Tagged Values: • Rating - click on the drop-down arrow and select the number of stars to show

	filled (the rating) You can only re-size the element horizontally; the vertical dimension adjusts automatically to always depict five uniformly-shaped stars.
Toggle Button	Generates an element depicting a single-celled switch with no label (the element name is not shown). You can edit the depicted state in the same way as for the 'Switch' element.
Progress Bar (Large)	Generates an element representing the circular Android progress icon.
Progress Bar (Horizontal)	Generates an element representing the progress of a process, defaulted to 30% complete. Tagged Values: • Progress - type the percentage completion of the progress to depict on the element
Button	Generates a simple labeled Button element, the label text being the name of the element.
Radio Button	Generates a labeled radio button element, the label text being the name of the element. Tagged Values: • State - click on the drop-down arrow and select the state to depict - 'Selected' (filled) or 'Unselected' (outline)
Checkbox	Generates a labeled checkbox element, the label text being the name of the element. Tagged Values: • State - click on the drop-down arrow and select the state to depict - 'Checked' (tick icon) or 'Unchecked' (box outline)
Seek Bar	Generates an element representing the progress in playing through an audio or video file. Tagged Values: • Progress - type the percentage progress to depict on the element
Keyboard	Generates an element that depicts a keyboard for Android applications. Tagged Values: • Type - switches the image between a text (QWERTY) keyboard and a numeric keyboard
Spinner	Generates an element representing the Android version of a drop-down combo box. Tagged Values: • Expanded - click on the drop-down arrow and select True to depict the combo box in use, displaying all values, or False to depict the combo box with a single selected value • Values - click on the drop-down arrow and select the value to depict as currently selected in the combo box You can change the text of the values, and add more to the list, by editing the 'Values:' list in the Tagged Value notes

Text Fields

Item	Description
Plain Text	Generates a text element with no border, the text being the element name. Tagged Values: • Align Text - click on the drop-down arrow and select to align the text to the left, center or right of the element frame • Multiline - click on the drop-down arrow and select True to allow the text to wrap around onto more than one line (automatically increasing the element depth), or False to only show the text that fits on one line within the current element width
Multiline Text	Generates a text element with no border, but that can contain multi-line text with basic HTML formatting. Tagged Values: • Align Text - click on the drop-down arrow and select to align the text to the left, center or right of the element frame • Text - click on the ... button to edit the Tagged Value Note screen, on which you can create the text to depict on the diagram; this can use HTML formatting tags such as for bold or <u> </u> for underlined - not all HTML formatting is supported

Image_Media

Item	Description
Image	Generates a place holder to indicate where an image will be placed on the phone or tablet. You can display an actual image by assigning an alternative image to the element.
Video Player	Generates an element that represents a video player control on the phone or tablet.
Audio Player	Generates an element that represents an audio player control on the phone or tablet.

Time_date

Item	Description
Calendar	Generates an element depicting a calendar (the default image), showing the current month, day and year based on the system date. Tagged Values: • DateFormat - click on the drop-down arrow and select the date format to

	display if spinners are shown: - d/m/y - m/d/y - y/m/d (not possible if the calendar is also displayed) • ShowCalendar - defaults to True to display the calendar; if spinners are also displayed, the calendar will force the spinner display to show the year at the right-hand end, and will replace the year spinner If set to False, the day, month and year spinners display regardless of the 'ShowSpinners' value • ShowSpinners - If set to True AND 'ShowCalendar' is True, displays spinner controls for the day and month (the calendar acts as a year marker) - If set to False AND 'ShowCalendar' is True, no spinners are shown with the calendar - If 'ShowCalendar' is set to False, the day, month and year spinners are automatically displayed in the format defined in 'DateFormat', showing the system date You cannot resize this element.
Date Picker	Generates an element that depicts a set of spinners showing today's date, derived from the system date. Tagged Values: • Date - click on the drop-down arrow and select a different date from the calendar; if the current date is not today, you can reset it to today's date by clicking on the Today button, or by simply clearing the 'Date' value field • DateFormat - as for the Calendar element • ShowCalendar - defaults to False to hide the calendar; otherwise, as for the Calendar element • ShowSpinners - as for the Calendar element You cannot resize this element.
Time Picker	Generates an element that depicts a pair of spinners showing the current time, in hours and minutes, derived from the system clock. Tagged Values: • 24 Hour View - click on the drop-down arrow and set to True to show the time in 24-hour format, or False to display the time in 12-hour format with AM or PM to the right of the time • Time - overtype the hours, minutes and AM/PM setting to display a time other than the system time (you can only set the time in 12-hour format); to revert to the system time, overtype the field with '12:00 AM' You cannot resize this element.
Clock	Generates an element that represents an analog clock face with hour and minute hands and no numerals, displaying the system time. You can change the rendition to a digital display. Tagged Values: • 24 Hour View - if you set the 'Type' to 'Digital', click on the drop-down arrow and select True to display the time in 24-hour format, or False to display the time in 12-hour format with AM or PM to the right, as appropriate • Time - overtype the hours, minutes and AM/PM setting to display a time other than the system time (you can only set the time in 12-hour format); to revert to the system time, overtype the field with 12:00 AM

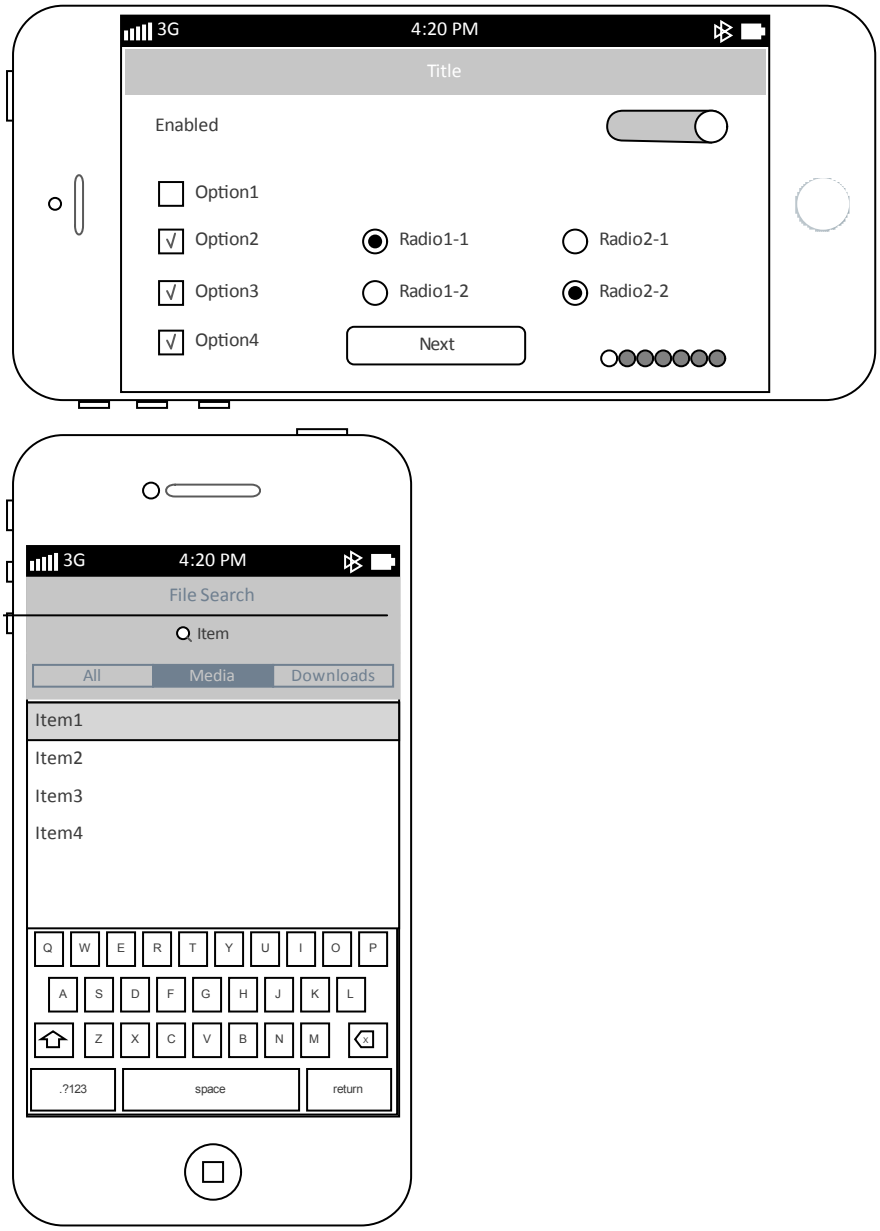
	• Type - click on the drop-down arrow and select 'Digital' to display the time as a digital display, or 'Analog' to display the time as the clock face You can resize the element in 'Analog' format, but not in 'Digital' format.

Android Patterns

Item	Description
Android Phone / Android Tablet	These Patterns create example models of the two Android product configurations. You can use them as your examples of how the elements are designed, as basic components of a larger model, or as the starting point to develop a more detailed model of one or more of the products.

Apple iPhone/Tablet Wireframe Toolbox

The 'Apple Wireframing' Diagram Toolbox pages provide the templates for modeling the physical appearance of an Apple iPhone or tablet at a given state of execution of an application. They also provide a number of Patterns for generating model structures for different versions of the iPhone or iPad.



Access

On the Diagram Toolbox, click on  to display the 'Find Toolbox Item' dialog and specify 'Wireframing' or 'Apple'.

Ribbon	Design > Diagram > Toolbox
Keyboard Shortcuts	Ctrl+Shift+3

Apple Screen Types

Item	Description
iPad Air, iPad Mini, iPhone 4s, iPhone 5c, iPhone 5s, iPhone 6, iPhone 6 Plus	These icons each generate a frame for the device type you have selected. A prompt displays for you to specify portrait or landscape orientation. (The main illustration shows a landscape iPhone 5s frame and a portrait iPhone 4s frame.) Tagged Values: • ShowStatusBar - click on the drop-down button and select to 'Show' or 'Hide' the status bar image on the element

Controls

Item	Description
Check Box	Generates a labeled checkbox element, the label text being the name of the element. Tagged Values: • State - click on the drop-down arrow and select the state to depict - 'Checked' (tick icon) or 'Unchecked' (box outline)
Radio Button	Generates a labeled radio button element, the label text being the name of the element. Tagged Values: • State - click on the drop-down arrow and select the state to depict - 'Selected' (filled) or 'Unselected' (outline)
Combo Box	Generates an element representing a drop-down combo box. Tagged Values: • DropDownState - click on the drop-down arrow and select 'Open' to depict the combo box in use, displaying all values, or 'Closed' to depict the combo box with a single selected value • Items - click on the drop-down arrow and select the item to depict as currently selected in the combo box and, if the list of items is expanded, highlighted in the list You can change the text of the items, and add or remove items in the list, by editing the 'Values:' list in the Tagged Value notes
Label	Generates a Label text element. The name of the element is the text of the label. Tagged Values: • Align Text - sets the alignment of the text to either left, centered or right • Multiline - sets the label to display text over multiple lines
List	Generates a List box element. Tagged Values:

	• Items - click on the drop-down arrow and select the item to show highlighted in the list You can add, remove and rename items by editing the 'Values:' list in the Tagged Values Notes • ListType - click on the drop-down arrow and select to display the list as 'Simple', 'Numbered' or 'Bulleted'
Table	Generates a Table element with labeled columns, rows and cells. Double-click on the table to bring up the element 'Properties' dialog at the 'Wireframe' page, which provides the facilities for editing the table (adding, renaming and deleting columns and rows, changing the column width and editing the cell text) You can either edit the text by clicking on it, or by right-clicking and selecting an option. Note that the editor does not provide a true image of the table's appearance on the screen. Tagged Values: • Draw Lines - hides (or shows) the lines on all cells under the column headings so the table resembles a List element instead • Highlight Headers - highlights the header of each column so that it is easily distinguishable • Properties - displays the HTML of the table
Image	Generates a place holder to indicate where an image will be placed on the dialog. You can display an actual image by assigning an alternative image to the element.

Apple Controls

Item	Description
Address Bar	Generates a URL Address Bar element. Tagged Values: • Address - defines the text displayed in the address bar
App Icon	Generates an App Icon element. Tagged Values: • Image - specifies the name of an image held in the Image Manager, which is displayed as the appearance of the App icon (simply type in the name of the image as listed in the 'Name' column of the Image Manager) • Notification count - indicates the number of notifications this app has waiting; the number is displayed in the circle in the top right corner of the element
Button	Generates a labeled Button element. The label text is the name of the element. Tagged Values: • Button Style - sets the element shape: - 'Normal' draws a rectangle with rounded edges - 'Previous' draws a pennant shape pointing to the left - 'Next' draws a pennant shape pointing to the right • Text Alignment - defines the alignment of the button text within the element; left aligned, centered or right aligned

Date/Time Picker	Generates a Date and Time display element. Tagged Values: • Date - sets the date that the element displays; if no date is specified this will be the current system date • Expanded - if True, draws the element as a section of calendar with the current date and/or time selected (as defined by the 'Type' Tagged Value); if False, draws the element as a simple text string showing the date and/or time • Time - sets the time displayed on the element; overtype the hour, minute and AM/PM segments as necessary If no time is specified it will display the current system time (non-specified time is displayed as 12:00 AM) • Type - draws the element showing the Date, the Time or both Date & Time
Group List	Generates a grouped list element with two levels of entry. Double-click on the element to open the 'Properties' dialog at the 'Wireframe' page. Use this page to compose the list entries. Click on the root node (the element name). • Show Groups - click on the drop-down arrow and select True to show the first-level list items, or False to hide them; the second-level list items display in either case but must belong to a group item whether it is shown or not Click on the Group node (the first-level list item) directly underneath the root node. • Name - type in the text for the first-level list item (the item group name) Click on an item node (the second-level list item) directly under a Group node. Item nodes do not have any child nodes. • Name - type the name of the list item • Text - type any additional text to be displayed (by default) under the item name • Text near link - click on the drop-down arrow and select True to display the additional text opposite the item name, where you can also add a link, or False to keep the text underneath the item name • Image - select an image name from the drop-down list or simply type in the name as listed in the 'Name' column of the Image Manager, to display the image to the left of the item name • Is Link - click on the drop-down arrow and select True to indicate that the item links to another page or additional information by displaying a '>' character to the right of the item name; select False to hide the link character • Link Image - select an image name from the drop-down list or simply type in the name as listed in the 'Name' column of the Image Manager, to display the image (if 'Is Link' is True) as the link icon instead of the > character • Selected - click on the drop-down arrow and select True to highlight the item name as selected, or False to not highlight the item
Keyboard	Generates an element that depicts a keyboard. Tagged Values: • Type - switches the image between a text (QWERTY) keyboard and a numeric keyboard
Loading Icon	Generates an element that depicts the Apple loading icon.
Page Control	Generates an element rendered as a row of gray circles, indicating the number of pages available and which of those represents the currently-displayed page. Tagged Values:

	• Current page - draws a white circle in the sequence of gray circles to indicate which represents the current page displayed • Pages - the number of circles to draw, indicating the number of pages this control moves through (resize the element manually to display all the specified number of circles)
Search Bar	Generates an element representing a search field. Tagged Values: • DrawStyle - toggles the element's appearance between the default app search with a query spyglass, and a web search on an Apple device • Placeholder - type in the text that will be displayed in the control, to prompt the user to enter the search term • Prompt - type the prompt text to display above the query field, such as a reminder of what to search for; for example, if the search is to look up movies/recorded videos on the device, you might type 'Search for Videos' ('DrawStyle' must be set to default) • Scope - click on the drop-down arrow and select which search location is highlighted in the Scope Bar ('DrawStyle' must be set to default and 'Show Scope Bar' must be set to True) • Show Bookmarks - when set to True will draw a small book symbol on the right side of the query field, to indicate that this search control will store previous searches and can use them again ('DrawStyle' must be set to default) • Show Cancel Button - displays a Cancel button to the right of the query field ('DrawStyle' must be set to default) • Show Scope Bar - displays a row of scope options for this search control, underneath the query field ('DrawStyle' must be set to default) • Show search results - displays a drop down arrow on the right side of the search area, to indicate that the query will display the search results (overrides the Bookmark icon if both are set to display) ('DrawStyle' must be set to default) • Text alignment - aligns the Placeholder text to the Left, Right or Center of the query field
Segment Control	Generates an element depicting a set of tabs (defaulted to three tabs). Tagged Values: • Tabs - click on the drop-down arrow and select the number of the tab to highlight to indicate the current tab; open and edit the Tagged Value Notes to add, remove or rename tabs
Spinner Control	Generates an element representing a spinner control with a list of items that can be selected from. Tagged Values: • Check Selected Item - when set to True will draw a tick on the left hand side of the item defined as selected • Items - click on the drop-down arrow and select the item to indicate as selected; you can open and edit the Tagged Value Notes to add, rename or remove items from the list • Rounded Edges - click on the drop-down arrow and select the side(s) that show rounded corners; you can use this property to dock multiple spinner controls next to each other to create more complex spinner control selections, such as a page displaying a selection for Country, State, City and Suburb - set: - Both to set rounded corners on both sides, if the spinner control is on its own

	- Left to set rounded corners on the left edge and sharp corners on the right edge, if this spinner is the first in a row of docked spinner controls - Right to set rounded corners on the right edge and sharp corners on the left edge, if this spinner is the last in a row of docked spinner controls, or - None to set sharp corners on both sides, if this spinner is docked between two others • Text alignment - click on the drop-down arrow and select where to align the item text - to the left, right or center of the control
Stepper	Generates an element depicting a decrement/increment (minus/plus) control.
Switch	Generates an element representing a sliding on/off switch. Tagged Values: • DisplayText - toggles between displaying and hiding the two state text values • State - toggles between the 'on' state (gray background with white circle on the right and - if DisplayText is True - the 'on' text) and the 'off' state (white background with white circle on the left and - if DisplayText is True - the 'off' text) The state text values default to On and Off; you can edit the Tagged Value Notes to change these to any other pair of values (you can add more values but only the first two are applied)
Text Field	Generates a text field in which the end user can type free text, such as the name for a login page. The field contains the text 'TextField' and a crossed circle. Tagged Values: • Border Style - click on the drop-down arrow and select the border style for the element: - Rounded Rect - a rectangle with rounded corners - Bezel - a rectangle with bevelled top and left edges - Line - a rectangle with sharp corners and single-line edges - None - a rectangle with no borders • Text alignment - click on the drop-down arrow and set the text to align to the left, right or center of the control
Title	Generates an element that represents the title for a page, the element name being the title text (such as 'Settings'). The element is a rectangle with gray background and white text.
Toolbar	Generates an image that represents a Toolbar with default icons, which you can add to or replace with images from the Image Manager. Double-click on the element to display the 'Properties' dialog at the 'Wireframe' page, which lists the icons displayed in the frame of the Toolbar element. • To add a new icon click on 'Toolbar' and on the Add button, and in response to the prompt type in the name of the icon, which adds the name to the bottom of the list; click on the name and in the 'Image' Property field type the name of the icon file, as displayed in the 'Loaded Image' panel of the Image Manager You can add a 'Separator' (displayed as |) to the list, to separate different groups of icons on the toolbar; simply type the name 'Separator' in the name prompt To position the icon on the toolbar, click on it in the list and click on the  buttons • To remove an icon from the list, click on it and click on the Remove button;

	the icon is immediately removed from the list and, when you close the dialog, from the Toolbar
Tab Bar	Generates an element that depicts a row of tabs represented by images. Double-click on the element to display the 'Properties' dialog at the 'Wireframe' page, which shows the root node (the TabBar element itself) and the items contained in the TabBar (as images). • To add a new icon click on 'TabBar' and on the Add button, and in response to the prompt type in the name of the item, which adds the name to the bottom of the list To position the item on the TabBar, click on it in the list and click on the  buttons • To remove an item from the list, click on it and click on the Remove button; the item is immediately removed from the list and, when you close the dialog, from the TabBar Root node Properties: • Show Text - displays (True) or hides (False) the item names as text underneath the tab images • Background Color - click on the drop-down arrow and select the background color of the TabBar • Selected Font Color - click on the drop-down arrow and select the font color of the text if the item is selected • Non Selected Font Color - click on the drop-down arrow and select the font color of the text if the item is not selected Item node Properties: • Name - the name of the item, which can be displayed underneath the image in the TabBar (see *Show Text*) • Image - the name of the image file to show if the item is not selected; the file name is as listed in the Image Manager • Selected Image - the name of the image file to show if the item is selected; the file name is as listed in the Image Manager Select the 'General' page of this Tab Bar element's 'Properties' dialog, and click on the 'Tags' tab. Element Tagged Value: • SelectedTab - Click on the drop-down arrow and select the name of the item to represent as selected

Apple Patterns

You can use any of these Patterns as examples of how the elements are used, as basic components of a larger model, or as the starting point to develop a more detailed model of one or more of the products.

Item	Description
Apple iPad Air	Creates an example model for the Apple iPad Air.
Apple iPad Mini	Creates an example model for the Apple iPad Mini.
Apple iPhone 4s	Creates an example model for the Apple iPhone 4s.

Apple iPhone 5c	Creates an example model for the Apple iPhone 5c.
Apple iPhone 5s	Creates an example model for the Apple iPhone 5s.
Apple iPhone 6	Creates an example model for the Apple iPhone 6.
Apple iPhone 6 Plus	Creates an example model for the Apple iPhone 6 Plus.

Windows Phone Wireframe Toolbox

The 'Windows Phone' Diagram Toolbox pages provide the templates for modeling the physical appearance of a Windows 8.1 Phone at a given state of execution of an application.

Access

On the Diagram Toolbox, click on  to display the 'Find Toolbox Item' dialog and specify 'Wireframing' or 'Windows Phone'.

Ribbon	Design > Diagram > Toolbox
Keyboard Shortcuts	Ctrl+Shift+3

Windows Screen Types

Item	Description
Windows Phone	Generates a frame with a screen area for the Windows 8 Phone device. A prompt displays in which you specify portrait or landscape orientation. Elements created within the screen area cannot be resized or moved to sit outside the borders of the screen. Elements created outside the frame can be dragged onto and off the frame, and can be as large as the view or element properties permit.

Text

Item	Description
Text Block	Generates an element that represents dominant text such as headings and labels. The element name is the displayed text. Double-click on the element to open the 'Properties' dialog at the 'Wireframe' page. This displays a default set of six levels of heading styles. Click on a style name to populate the 'Properties' panel on the right of the dialog, and click on the down-arrow for each property and select the appropriate settings for the style. If you prefer, you can also change the name of the style in the 'Name' property. If necessary, you can add further styles to the list. Click on the style **group** name and on the Add button. In the 'Enter name for item' prompt, type a name for the style and click on the OK button. The new style is added to the end of the list; if you want to move it further up the list, click on it and on the  icon. Again, you define the style using the 'Properties' panel. If you want to remove styles from the list, click on the style name and on the Remove button. When you have set the styles that can be used for this text, click on the 'General' page of the 'Properties' dialog and, in the 'Header Type' Tagged Value, click on the drop-down arrow and select the style to apply to the text of this specific Text Box.
Text Box	Generates a simple text field with a border, into which you can type any text you require. The element name is the displayed text, and does not wrap.

Controls

Item	Description
Button	Generates a rectangular icon representing a screen button, with the element name as the button text. Tagged Values: • State: click on the drop-down arrow and select the button state to represent:

	- Normal - the unselected button - Focused - the button when the cursor is passed over it - Selected - the button when it is clicked on - Disabled - the button grayed out, when it is not available
Checkbox	Generates an element representing a labeled checkbox, the element name being the label. Tagged Values: • Enabled: click on the drop-down arrow and select True to show the checkbox enabled for selection, or False to show the checkbox disabled and unavailable • State: click on the drop-down arrow and select 'Unchecked' to show the checkbox empty and unselected, or 'Checked' to show the checkbox selected with a tick inside it
Hyperlink Button	Generates a text element with the element name as the underlined text displayed, representing a hyperlink on the screen. Double-click on the element to open the 'Properties' dialog at the 'Wireframe' page, which lists the three hyperlink states of normal 'Link', 'Visited' and 'Hover'. Click on a state name to populate the 'Properties' panel on the right of the dialog, and click on the down-arrow for each property and select the appropriate settings for the style to apply to that state. If you prefer, you can also change the name of the state in the 'Name' property. If necessary, you can add further states to the list. Click on the state **group** name and on the Add button. In the 'Enter name for item' prompt, type a name for the state and click on the OK button. The new state is added to the end of the list; if you want to move it further up the list, click on it and on the  icon. Again, you define the style using the 'Properties' panel. If you want to remove states from the list, click on the state name and on the Remove button. When you have set the states that the hyperlink can have, click on the 'General' page of the 'Properties' dialog and, in the 'State' Tagged Value, click on the drop-down arrow and select the state in which this hyperlink is to be depicted.
Image	Generates a rectangular object containing an 'X', to indicate the location of an image on the screen. There are no properties to set.
Radio Button	Generates an element representing a labeled radio button, the element name being the label. Tagged Values: • Enabled: click on the drop-down arrow and select True to show the radio button enabled for selection, or False to show the radio button disabled and unavailable • State: click on the drop-down arrow and select 'Unselected' to show the radio button empty, or 'Selected' to show the radio button with a filled circle inside it

Tiles

Tile elements add to the phone screen a panel that, depending on type, shows an image and/or some text. The panel cannot be resized, and if it displays text the text occupies the top half of the element only. The amount of text displayed is influenced by the tile type, so you will need to experiment with the required type to see how much meaningful text you can display.

Item	Description
Collection Tile	Adds a tile with a random pattern, to represent a Windows Collection Tile. Tagged Values: • Header: type a suitable text string as the tile heading; the text is displayed when 'Show Back' is set to True and if the 'Tile Type' supports it • Show Back: click on the drop-down arrow and select True to display the back of the tile instead of the front; for some tile types the back does not display regardless of this setting • Text: a <memo> Tagged Value in which you type the text to display on the back of the tile; the format and font of the displayed text depends on the 'Tile Type' • Tile Type: click on the drop-down arrow and select the type of the collection tile; this will only affect the display of the back of the tile, the front will always remain the same (see the *Windows Tile Template Type Descriptions* web page for more information on tile types)
Image Tile	Adds a tile that initially displays as a box with an 'X' in the center, but is intended to show an image that you select. Tagged Values: • Image: click on the  icon and select the image to display for this tile, from the 'Image Manager' dialog • Text: type in the text that will be displayed in white at the bottom of the image, dependent on the 'Tile Type' • Tile Type: click on the drop-down arrow and select the type of Image tile to display; this will either be an image only, or an image with text (see the *Windows Tile Template Type Descriptions* web page for more information on tile types)
Peek Tile	Adds a tile similar to an Image Tile, except that it can display the back of the tile to show more information. Tagged Values: • Header: type a suitable text string as the tile heading; the text is displayed when 'Show Back' is set to True and if the 'Tile Type' supports it • Image: click on the  icon and select the image to display on the front of this tile, from the Image Manager window • Show Back: click on the drop-down arrow and select True to display the back of the tile instead of the front • Text: a <memo> Tagged Value in which you type the text to display on the back of the tile; the format and font of the displayed text depends on the 'Tile Type' • Tile Type: click on the drop-down arrow and select the type of Peek tile to display (see the *Windows Tile Template Type Descriptions* web page for more information on tile types)
Text Tile	Adds a tile that displays text only. Depending on tile type, you can show a text string in the top half of the panel and two text items in the bottom right corner of the panel. Tagged Values: • Block Text: type in a two-part text string to display at the bottom right of the tile, comprising a longer string that will be displayed in a small font, followed

	by a shorter string that will be displayed in a large font, the two strings separated by a semicolon; the short string will only display two characters in a square tile, or up to 5 characters in a wide tile, whilst the longer string can contain many more characters, for example: Messages;16 • Text: type in some additional text to display at the top of the tile (dependent on tile type) such as a description or definition of the object identified in the lower text • Tile Type: click on the drop-down arrow and select the type of Text tile to display (see the *Windows Tile Template Type Descriptions* web page for more information on tile types)

Windows Phone Controls

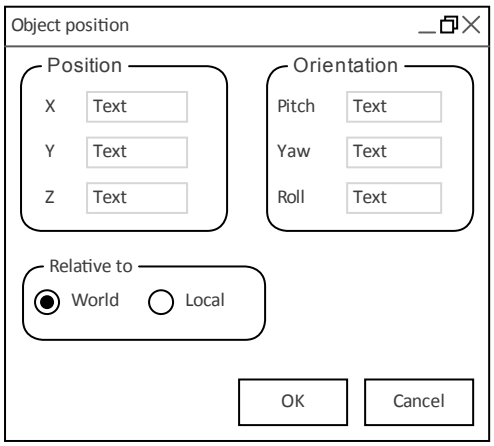
Item	Description
App Bar	Generates an element that represents the 'Windows App Bar', which is displayed at the bottom of the phone screen to supply additional commands. This can include up to a maximum of five icons and six strings. When you drag the icon onto the diagram, you are prompted to select the orientation of 'Portrait' or 'Landscape' to match the screen orientation. Double-click on the element to display the 'Properties' dialog at the 'Wireframe' page, displaying the element name at the top as the root node. Click on the element name and, in the right-hand 'Properties' panel, click on the drop-down arrow in the value field for the 'Mode' property and select: • 'Mini' - to represent the App Bar as a thin bar with just the expand menu icon () in the top right, with no other icons or text • 'Default' - to represent the App Bar as a thin bar unless it contains items, in which case it will display just the icon in a circle, with no text or icon names • 'Expanded' - to show the App Bar containing each icon in a circle, the name of the item under the circle and up to six text strings representing additional menu options You might prefer to set the App Bar properties after you have added some icons to it as child nodes. To add a child node, click on the root node and on the Add button and type in the name of the icon or object. In the right-hand panel, set the properties of the child node: • 'Name': displays the name of the item, which you can edit if necessary; if the App Bar is rendered in 'Expanded' mode, the name of a symbol or font item will be displayed below the icon, whilst for a text item it will be displayed below and to the left of the icons in a vertical list • 'Type': click on the drop-down arrow and select from the list of item types; the type you select will determine what other property prompts are displayed: - 'SymbolIcon': displays the item as a symbol icon - 'FontIcon': displays the item as a glyph, using a font - 'BitmapIcon': draws a selected image as the icon - 'Text': (applies only in 'Expanded' mode) displays the item name as a member of a vertical list below and to the left of the icons; a maximum of six items can be listed at once - 'Separator': draws a vertical line between icons, which counts as one of the five available spots for icons on the App Bar; Separator items do not display names • 'Symbol': (displays if the 'Type' is set to 'SymbolIcon') click on the drop down

	arrow and select the symbol from the list • 'FontFamily': (displays if the 'Type' is set to 'FontIcon') type in the name of the font to draw with, such as 'Segoe UI Symbol' • 'Glyph': (displays if the 'Type' is set to 'FontIcon') type in the Hex value of the glyph to draw - for example, for the © symbol you can set 'FontFamily' to 'Arial' and type the Hex code '00A9'; font codes in Windows can be found via 'Control Panel | Fonts | Find a Character' • 'Bitmap': (displays if the 'Type' is set to 'BitmapIcon') click on the drop-down arrow and select a bitmap (as listed in the Image Manager)
Date Picker	Generates an element that depicts three blocks showing today's day and date, month and year, derived from the system date. Tagged Values: • Date - if necessary, click on the drop-down arrow and select a different date from the calendar; if the displayed date is not today, you can reset it to today's date by clicking on the Today button • DateFormat - click on the drop-down arrow and select the date format to display: - d/m/y - m/d/y - y/m/d
Password Box	Generates an element that represents a password field on the screen. Tagged Values: • Password: a text string that represents a password • Password Character: a character that replaces each character of the 'Password' string when the password is hidden (when either 'Reveal Button' or 'Show Text' are set to False) • Reveal Button: if set to True (the default) draws a button that displays the 'Password' text string; if set to False the button is not displayed and the password string is represented by a string consisting of the 'Password Character' • Show Text: when 'Reveal Button' is set to True, setting 'Show Text' to True will display the 'Password' text string; otherwise a string displays composed of just the 'Password Character'
Progress Bar	Generates an element representing a 'process in progress' status bar, showing a number of 'dot' stages.
Progress Ring	Generates an element depicting the Windows 'processing in progress' circle of dots.
Search Bar	Generates an element representing a Windows search field, with the start search 'magnifying glass' icon at the end of it. Tagged Values: • Placeholder Text - defaults to the word 'Search'; if necessary, overtype this with an alternative text string
Slider	Generates an element representing a slide control switch, with the slider 50% of the way across. Tagged Values: • Fill amount - overtype the field with a value between 1 and 100, to set the percentage of the icon shown dark behind the slider

Time Picker	Generates an element that depicts two blocks showing the time in hours and minutes, in either 12-hour or 24-hour clock format. Tagged Values: • 24 Hour Display - click on the drop-down arrow and select True to display the time in 24-hour format, or False (the default) to display the time in 12-hour format • Time - displays the time in three sections - hours, minutes and AM/PM; click on and overtype each section with the required value for the time
Toggle Switch	Generates an element depicting a slide-over toggle switch with the switch on the left, representing the 'off' state. Tagged Values: • State - click on the drop-down arrow and select 'On' to represent the On state with the switch on the right of the icon, or 'Off' to move the switch back to the left of the icon to represent the Off state

Dialog Wireframe Toolbox

The 'Dialog Wireframing' Diagram Toolbox pages provide the templates for modeling the physical design, appearance and operation of a screen dialog. You can see and build on an example of how to model the dialog interface by dragging the 'Dialog Pattern' icon onto a diagram.



Access

Ribbon	Design > Diagram > Toolbox : > Specify 'Wireframing - Dialog' in the 'Find Toolbox Item' dialog
Keyboard Shortcuts	Ctrl+Shift+3 : > Specify 'Wireframing - Dialog' in the 'Find Toolbox Item' dialog
Other	You can display or hide the Diagram Toolbox by clicking on the or icons at the left-hand end of the Caption Bar at the top of the Diagram View.

Screen Types

Item	Description
Dialog	Generates an element that represents a dialog outline, with a title (the element name). This has several components that you can expose and define in the element 'Properties' dialog, some using the Tagged Values on the 'Wireframing' tab of the 'General' page, and some using the 'Wireframe' page of the dialog. **Tagged Values:** • Close Button - defaults to True to show a 'close dialog' icon in the top right corner of the dialog; click on the drop-down arrow and select False to omit the icon • Maximize Button - defaults to False to omit a 'maximize dialog' icon from the top right corner of the dialog; click on the drop-down arrow and select True to show the icon

	• Minimize Button - defaults to False to omit a 'minimize dialog' icon from the top right corner of the dialog; click on the drop-down arrow and select True to show the icon • ScrollbarH - defaults to '<none>' to omit a horizontal scrollbar on the dialog; click on the drop-down arrow and select 'Bottom' or 'Top' to show a scrollbar in the corresponding position • ScrollbarV - defaults to '<none>' to omit a vertical scrollbar on the dialog; click on the drop-down arrow and select 'Left' or 'Right' to show a scrollbar in the corresponding position • StatusBar - define the display of the Status Bar using the 'Wireframe' page • User Icon - type in the name of an icon exactly as listed in the Image Manager, to display that icon in the top left corner of the dialog before the dialog (element) name **Wireframe Page:** Displayed by default when you double-click on the element. Use the options to modify the Status Bar at the bottom of the dialog. Click on the element name. • Zoombar - defaults to True to depict a zoom bar at the right hand end of the Status Bar; click on the drop-down arrow and select False to omit the zoom bar • Resize Handle - defaults to True to depict a resize icon (triangle of dots) in the bottom right corner of the Status Bar; click on the drop-down arrow and select False to omit the icon Click on 'Label' - this defines the first segment of the progress bar at the left hand end of the Status Bar. • Name - if necessary, overtype the text with another name for the progress bar; this text is not displayed but the field cannot be blank • Text - if necessary, overtype the default text with different text to display next to the progress bar • Type - defaults to 'Text' to display the string contained in the 'Text' field; if necessary, click on the drop-down arrow and select: - Filled Progress Bar - to replace the text with a part-filled rectangle (to depict a section of Progress Bar with a portion of processing complete), or - Block Progress Bar - to replace the text with rectangle containing blocks (to depict a section of Progress Bar with processing in action) Click on 'Progressbar' - this defines a second segment of the progress bar. The properties are the same as for the first segment except that there is no default 'Text' and the 'Type' defaults to 'Filled'. If you want to add another segment to the progress bar, click on the element name, click on the Add button and provide a name for this segment. Provide values for the 'Text' and 'Type' properties as before. If you want to remove segments from the progress bar, click on the segment name and click on the Remove button. If you remove all segments and the 'Zoom Bar' and 'Resize Handle', the status bar itself is removed. You can change the sequence of segments by clicking on a segment name and on the  buttons.
Client Area	Generates a frame element that represents the client area of the device. Tagged Values: • BorderStyle - click on the drop-down arrow and select to render the border as a 'Solid' line or a 'Dashed' line, or to have no border at all ('None')

	• ScrollbarH - click on the drop-down arrow and select to place a horizontal scrollbar at the 'Top' or 'Bottom' of the client area, or to have no horizontal scrollbar ('<none>') • ScrollbarV - click on the drop-down arrow and select to place a vertical scrollbar on the 'Left' or 'Right' of the client area, or to have no vertical scrollbar ('<none>')

Controls

Item	Description
Button	Generates an element that represents a simple button with the element name as the button text. Tagged Values: • State - click on the drop-down arrow and select a status for the button: - Normal - simple rectangle, for normal display where the button is just available - Focused - a highlighted inner border, indicating, for example, that the button is the default selection - Selected - filled rectangle, indicating that the button is selected - Disabled - pale text and border, indicating that the button is not available
Check Box	Generates a labeled checkbox element, the label text being the name of the element. Tagged Values: • State - click on the drop-down arrow and select the state to depict - 'Checked' (tick icon) or 'Unchecked' (box outline)
Radio Button	Generates a labeled radio button element, the label text being the name of the element. Tagged Values: • State - click on the drop-down arrow and select the state to depict - 'Selected' (filled) or 'Unselected' (outline)
Combo Box	Generates an element representing a drop-down combo box. Tagged Values: • DropDownState - click on the drop-down arrow and select 'Open' to depict the combo box in use, displaying all values, or 'Closed' to depict the combo box with a single selected value • Items - click on the drop-down arrow and select the item to depict as currently selected in the combo box and, if the list of items is expanded, highlighted in the list You can change the text of the items, and add or remove items in the list, by editing the 'Values:' list in the Tagged Value notes
Label	Generates a Label text element, on which the label text is the name of the element. Tagged Values: • Align Text - click on the drop-down arrow and select to align the text to the left, center or right of the element frame

	• Multiline - click on the drop-down arrow and select True to allow the text to wrap around onto more than one line (automatically increasing the element depth), or False to only show the text that fits on one line within the current element width
List	Generates a List box element. Tagged Values: • Items - click on the drop-down arrow and select the item to show highlighted in the list You can add, remove and rename items by editing the 'Values:' list in the Tagged Values Notes • ListType - click on the drop-down arrow and select to display the list as 'Simple', 'Numbered' or 'Bulleted'
Table	Generates a Table element with labeled columns, rows and cells. Double-click on the table to display the element 'Properties' dialog at the 'Wireframe' page, which provides the facilities for editing the table (adding, renaming and deleting columns and rows, changing the column width and editing the cell text) through context menu options and buttons. Note that the editor does not provide a true image of the table's appearance on the screen. Tagged Values: • Draw Lines - click on the drop-down arrow and select True to display horizontal and vertical lines between the table cells, or False to hide the lines • Highlight Headers - click on the drop-down arrow and select True to highlight the header of each column, or False to leave the table columns a uniform color
Image	Generates a place holder to indicate where an image will be placed on the phone or tablet. You can display an actual image by assigning an alternative image to the element.

Dialog Controls

Item	Description
Checkbox List	Generates an element depicting a checklist where each item has a checkbox on the left hand side. Double-click on the table to display the element 'Properties' dialog at the 'Wireframe' page, which you use to maintain this element. For each 'Checkbox' item, complete these fields: • Name - type the name or text of the item • Checked - click on the drop-down arrow and select True to show a ticked checkbox against the item, or False to show a cleared checkbox To add another item to the list, click on the element name and on the Add button, then provide a name for the item. To remove an item from the list, click on the item and on the Remove button. You can change the sequence of items by clicking on an item name and on the  buttons.

Format Bar	Generates a simple element representing a text formatting bar. If you want to represent a toolbar containing icons you have defined, use the 'Toolbar' icon.
List View	Generates an element representing a horizontal, rectangular or vertical list of text items (depending on the size of the element) with or without associated images. Double-click on the table to display the element 'Properties' dialog at the 'Wireframe' page, which you can use to add, remove or change the items and their icons. For each item, complete these fields: • Name - type the name or text of the item; this field cannot be left blank • Image - type the name of the image, or click on the drop-down arrow and select the name, as listed in the Image Manager • Selected - click on the drop-down arrow and select True to highlight the name of the item, or False to omit any highlight; more than one item can be highlighted at once To add another item to the list, click on the element name and on the Add button, then provide a name for the item. To remove an item from the list, click on the item and on the Remove button. You can change the sequence of items by clicking on an item name and on the  buttons. If you reduce the size of the element so that not all items can be shown, a scroll bar automatically displays on the right edge of the element: 
Status Bar	Generates a status bar element identical to the automatically-generated status bar on the 'Dialog' element, except that you can position this element independently of the dialog, as required.
Toolbar	Generates an element to represent a toolbar of icons, already set up with some standard toolbar icons. Double-click on the element to display the 'Wireframe' page of the 'Properties' dialog, which you can use to add, remove or change the items and their icons. For each item, complete these fields: • Name - type the name or text of the item; this field cannot be left blank • Image - type the name of the icon image, or click on the drop-down arrow and select the name, as listed in the Image Manager To add another item to the list, click on the element name and on the Add button, then provide a name for the item. You can add one or more items called 'Separator' to the list, which display as a |, to partition groups of related icons in the toolbar. If you add an image to this item, the image is overridden by the |. To remove an item from the list, click on the item and on the Remove button. You can change the sequence of items by clicking on an item name and on the  buttons.
Audio Player	Generates a simple element to indicate an audio player control.
Calendar	Generates an element representing a basic calendar, showing today's date derived from the system date.

	Tagged Values: • Date - either: - Overtype the date displayed in this field or - Click on the drop-down arrow to display an active calendar page and select the date on that; click on the Today button to reset the date to the system date • Highlight Date - click on the drop-down arrow and select True to highlight the set date on the calendar icon, or False to omit the highlight
Header	Generates an element representing a title or header text on a dialog. The text itself is the element name. The element can reflect one of a range of header levels, each with a different font style. You specify which level of header to display using the 'HeaderType' Tagged Value within the element. Double-click on the element to display the 'Wireframe' page of the 'Properties' dialog, which you can use to add, remove or change the header levels and styles. For each item, complete these fields: • Name - type the name of the header level; this field cannot be left blank • Color - click on the drop-down arrow and select the appropriate color from the palette • Font Size - type in the font size, or click on the drop-down arrow and select the type size from the list • Font Family - click on the drop-down arrow and select the font type from the list • Font Style - click on the drop-down arrow and select the style from the list; select blank for no applied style • Text Align - click on the drop-down arrow and select to align the text left, right or centered • Text Decoration - click on the drop-down arrow and select whether to show an underline or a line-through, or neither (blank) To add another heading level to the list, click on the element name and on the Add button, then provide a name for the level. To remove a level from the list, click on the item and on the Remove button. You can change the sequence of heading levels by clicking on a level name and on the  buttons. Tagged Values: • HeaderType - click on the drop-down arrow and select the heading level to display
Hyperlink	Generates an element representing a hyperlink in one of three states: 'Link', 'Visited' and 'Hover' (mouse-over). The Hyperlink text is the element name. Double-click on the element to display the 'Wireframe' page of the 'Properties' dialog, which you can use to add, remove or change the hyperlink states. For each state, complete these fields: • Name - type the name of the state; this field cannot be left blank • Color - click on the drop-down arrow and select the appropriate color from the palette • Font Size - type in the font size, or click on the drop-down arrow and select the type size from the list • Font Family - click on the drop-down arrow and select the font type from the list

	• Font Style - click on the drop-down arrow and select the style from the list; select blank for no applied style • Text Align - click on the drop-down arrow and select to align the text left, right or centered • Text Decoration - click on the drop-down arrow and select whether to show an underline or a line-through, or neither (blank) To add another hyperlink state to the list, click on the element name and on the Add button, then provide a name for the state. To remove a state from the list, click on the item and on the Remove button. You can change the sequence of states by clicking on a state name and on the  buttons. Tagged Values: • State - click on the drop-down arrow and select the state to represent on the diagram
Menu Bar	Generates an element representing a standard menu bar at the top of the screen, initially with three options ('File', 'Edit' and 'View') with the 'File' option expanded into a sub-menu. Double-click on the element to display the 'Wireframe' page of the 'Properties' dialog, which you can use to add, remove or change the menu options in the top level, sub-menu and - if you prefer - further sub levels. For each menu option - at any level - complete these fields: • 'Name' - type in the name for this menu item • 'Expanded' - click on the drop-down arrow and select True to show the sub-menu for this option (if it has one), or False to hide the sub-menu • 'Highlighted' - click on the drop-down arrow and select True to highlight this option in the menu, or False to leave it un-highlighted; if 'Expanded' is set to True, the option is automatically highlighted To add a menu sub-option at any level, click on the parent option name and on the Add button, then provide a name for the sub-option. You can add one or more items called 'Separator' to the list, which displays as a horizontal line across the list, to partition groups of related options in the menu. To remove an option from the list, click on the item and on the Remove button. You can change the sequence of options by clicking on an option name and on the  buttons. To move an option between two levels of menu, click on the option name and on the  buttons.
Paragraph	Generates a text element with no border, but that can contain multi-line text with basic HTML formatting. Tagged Values: • Align Text - click on the drop-down arrow and select to align the text to the left, center or right of the element frame • Text - click on the  button to edit the 'Tagged Value Note' screen, on which you can create the text to depict on the diagram; this can use HTML formatting tags such as for bold or <u> </u> for underlined - not all HTML formatting is supported
Progress Bar	Generates a status bar element representing the progress of a process.

	Tagged Values: • Fill Percentage - defaults to 30% complete; type the percentage completion to depict (the amount the Progress Bar is filled) • Fill Style - click on the drop-down arrow and select: - 'Filled' to represent the percentage completion as a solid bar, or - 'Block' to represent the percentage completion as a series of blocks or vertical bars (similar to the Windows XP theme)
Rating Control	Generates an element depicting a star-rating band. The element always shows five stars, and the number of filled stars indicates the rating. Tagged Values: • Rating - click on the drop-down arrow and select the number of stars to show filled (the rating) You can only re-size the element horizontally; the vertical dimension adjusts automatically to always depict five uniformly-shaped stars.
Scrollbar - Horizontal	Generates an element representing a horizontal scrollbar.
Scrollbar - Vertical	Generates an element representing a horizontal scrollbar.
Tab Control	Generates an element representing a series of tabs or pages. You can name the tabs and mark them as selected; however, child elements will not 'switch' when changing tabs (that is, setting a different tab as selected will still display the same child items in the tab space). Tagged Values: • Tabs - click on the drop-down arrow and click on the tab that is to be highlighted as selected You can name the tabs, and add more to the list, by editing the 'Values:' list in the Tagged Value notes If you reduce the size of the element so that all tabs cannot be shown, a scroll icon () automatically displays in the top right corner of the element.
Text Field	Generates a text element with a pale border, the text being the element name, representing a simple data entry field.
Video Player	Generates an element that represents a video player control.
Date/Time Picker	Generates an element that represents the Microsoft Date/Time Picker. Tagged Values: • CustomFormat - type in a custom format for any or all of the day, date, month, year, hour, minute and second components, using these case-sensitive codes (listed in alphabetical order): - d - display the day of the month using either one or two digits - dd - display the day of the month using two digits, digits 1 to 9 preceded by a 0 - ddd - display the day of the week as a three-character abbreviation - dddd - display the name of the day in full - h - display the hour using either one or two digits, in 12 hour clock format - hh - display the hour using two digits, digits 1 to 9 preceded by

	a 0, in 12 hour clock format - H - display the hour using either one or two digits, in 24 hour clock format - HH - display the hour using two digits, digits 1 to 9 preceded by a 0, in 24 hour clock format - m - display the minutes using either one or two digits - mm - display the minutes using two digits, digits 1 to 9 preceded by a 0 - M - display the number of the month using either one or two digits - MM - display the number of the month using two digits, digits 1 to 9 preceded by a 0 - MMM - display the name of the month as a three-character abbreviation - MMMM -display the name of the month in full - s - display the seconds using either one or two digits - ss - display the seconds using two digits, digits 1 to 9 preceded by a 0 - t - identify morning or afternoon with a single character (A for AM, P for PM) - tt - identify morning or afternoon with the two-character abbreviation AM or PM - y - display the year using a single digit (2001 is displayed as 1) - yy - display the year using two digits (2001 is displayed as 01) - yyyy - display the year in full (for example, 2001) • Date - overtype the date, or click on the drop-down arrow to display a calendar from which you can select the date to display; defaults to today's date - if you change this to a fixed date and want to return to the current (system) date, click on the Today button • Format - click on the drop-down arrow and select the code for the format to use to display the date and time: - Long - the full day name, the day date, the full month name, the full year (for example: Wednesday, 18 February 2020) - Short - the day of the month in single/double digits, the month as a two-digit number, the year in full (for example: 18/02/2020) - Time - the hour, minutes and seconds in 12-hour format (for example 12:59:34 PM) - Custom - applies the custom format you defined in the 'CustomFormat' Tagged Value
Tree Control	Generates an element representing a hierarchy or tree of nodes, with broken lines connecting sibling nodes and an expansion box (+ or -) next to nodes that have subnodes. Double-click on the element to display the element 'Properties' dialog at the 'Wireframe' page, which you can use to add, remove or change the tree nodes in the top level, sub-level and - if you prefer - further sub levels. For each node - at any level - complete these fields: • Name - type in the name for this node • Expanded - click on the drop-down arrow and select True to show the subordinate nodes for this node (if it has any), or False to hide the subordinate nodes • Selected - click on the drop-down arrow and select True to highlight this node, or False to leave it un-highlighted To add a sub-node at any level, click on the parent node name and on the Add button, then provide a name for the sub-node. To remove a node from the hierarchy, click on the node name and on the Remove

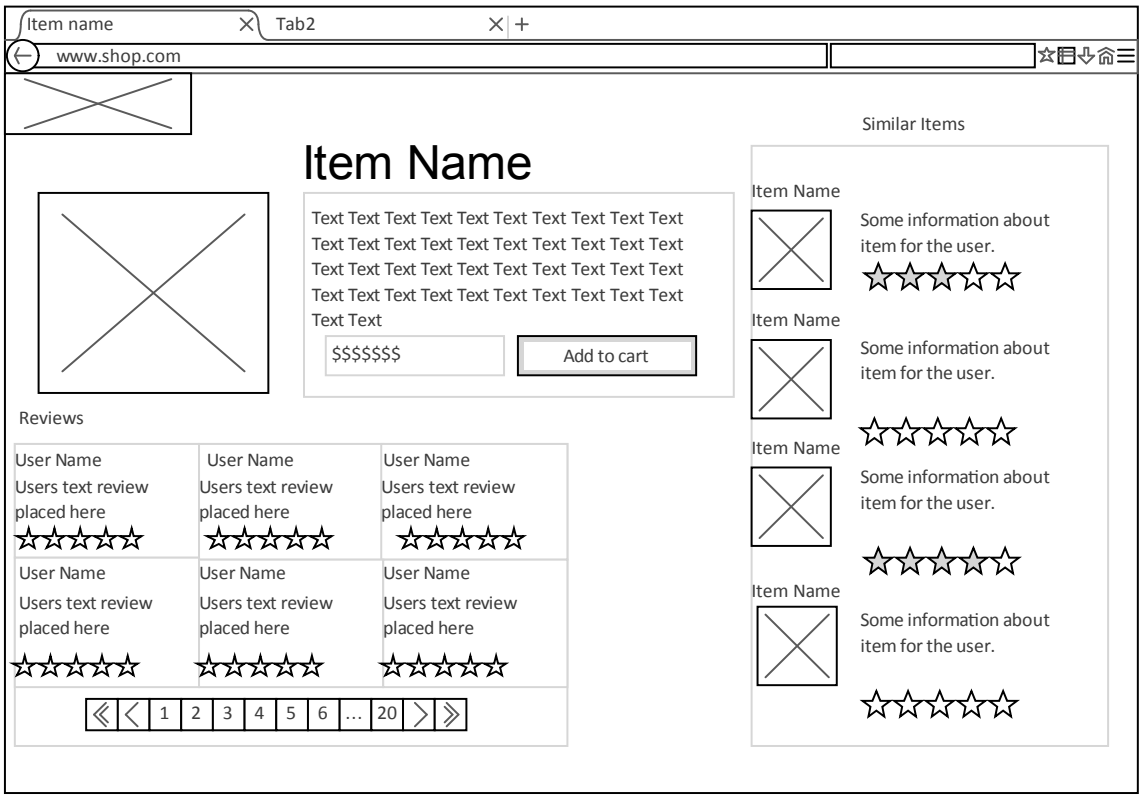
	button. You can change the sequence of nodes by clicking on a node name and on the  buttons. To move a node between two levels of the hierarchy, click on the node name and on the  buttons. You can also directly edit the XML of the element on the 'Wireframe' tab of the Properties window.
Groupbox	Generates an element representing a Groupbox, with the name of the element in the top left corner. You can use this element to enclose and group other elements of the dialog.

Patterns

Item	Description
Dialog	This Pattern generates a small dialog containing three panels with data entry fields and radio buttons, and two buttons, as depicted at the start of this topic. You can use this as an example, or as the basis for a similar dialog design.

Webpage Wireframe Toolbox

The 'Webpage Wireframe' Diagram Toolbox pages provide the templates for modeling the schematics, blueprints or framework of a website, defining how the web pages work. You can see and build on an example of how to model the webpage interface by dragging the 'Webpage Pattern' icon onto a diagram.



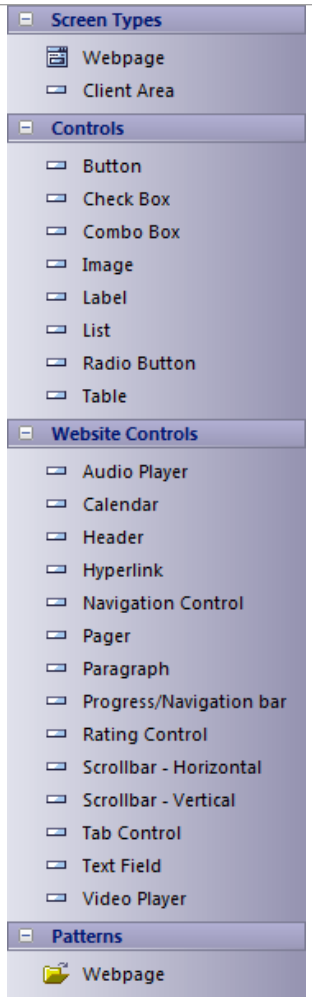
Access

On the Diagram Toolbox, click on  to display the 'Find Toolbox Item' dialog and specify 'Wireframing' or 'Webpage'.

Ribbon	Design > Diagram > Toolbox
Keyboard Shortcuts	Ctrl+Shift+3

Webpage Toolbox pages

Image	Detail
	Combobox, List, Progress/Navigation bar and Tab Control all provide lists of values, which you can extend by opening the 'Tagged Value Note' field of the appropriate Wireframing Tagged Value and adding, editing or removing items from the 'Values' list. In the Paragraph element you can set text alignment in the 'Align Text' Tagged



Value, and edit the text itself in the 'Value' field of the 'Text' Tagged Value (which is of type <memo>). You can also do basic HTML text formatting, as for other formatted notes in elements.

The Calendar element, when created, defaults to the current day and continues to update each day unless you set a value in the element's Date Tagged Value. If set, the date remains static until it is reset to 'Today' in the Tagged Value.

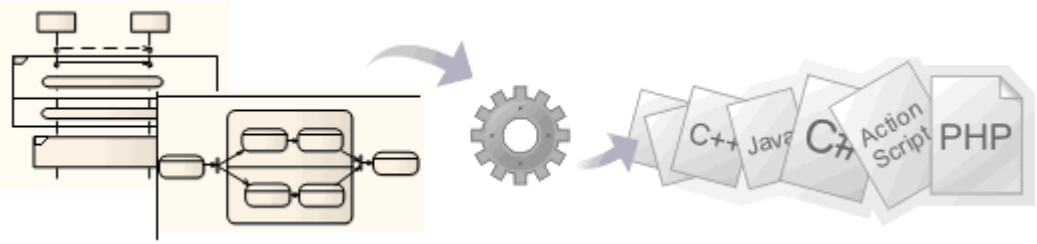
Navigation Control defines a menu with, if required, multiple levels of sub-menu options. You can add and remove options at any level using the 'Wireframe' tab of the 'Properties' dialog. Each option, at any level, has these properties:

- 'Name': Set the text of the menu option
- 'Expanded': Indicate if the option will display its sub options (if any); expanded items are always highlighted, regardless of the setting of 'Highlighted'
- 'Highlighted': Draw the item with a different colored background

Hyperlink and Header elements are both also defined on the 'Wireframe' tab, and have a number of style properties that you set using simple drop-down lists:

- Color
- Font Size
- Font Family
- Font Style
- Text Align
- Text Decoration

Behavioral Models



Enterprise Architect's powerful system engineering capability can be used to generate code for software, system and hardware description languages directly from behavioral models, such as StateMachine, Sequence (Interaction) and Activity diagrams. The supported languages include C(OO), C++, C#, Java, VB.Net, VHDL, Verilog and SystemC.

Software code can be generated from StateMachine, Sequence and Activity diagrams, and hardware description languages from StateMachine diagrams (using the Legacy State Machine templates).

Generate code from behavioral diagrams using the EAExample project

Step	Action
1	Open the EAExample.eap file by selecting the 'Start > Help > Help > Open the Example Model' ribbon option.
2	From the Browser window, select any of these Packages: Software Language Examples: • Example Model > Software Engineering > Java Model With Behaviors Generate the Account and Order classes • Example Model > Systems Engineering > Implementation Model > Software > C# Generate the DataProcessor Class • Example Model > Systems Engineering > SysML Example > Implementation Model > Software > C++ Generate the IO Class • Example Model > Systems Engineering > SysML Example > Implementation Model > Software > Java Generate the IO Class • Example Model > Systems Engineering > SysML Example > Implementation Model > Software > VBNet Generate the IO Class Hardware Language Examples: • Example Model > Systems Engineering > SysML Example: Portable Audio Player > Implementation Model > Hardware > SystemC Generate the PlayBack Class • Example Model > Systems Engineering > SysML Example: Portable Audio Player > Implementation Model > Hardware > VHDL Generate the PlayBack Class • Example Model > Systems Engineering > SysML Example: Portable Audio Player > Implementation Model > Hardware > Verilog Generate the PlayBack Class

3	When completed, press Ctrl+E to open the generated source code. You should see methods generated in the code.

Notes

- Software code generation from behavioral models is available in the Unified and Ultimate editions of Enterprise Architect
- Hardware code generation from StateMachine models is available in the Unified and Ultimate editions of Enterprise Architect
- For C(OO), on the 'C Specifications' page of the 'Preferences' dialog set the 'Object Oriented Support' option to True
- To be able to generate code from behavioral models, all behavioral constructs should be contained within a Class; if the behavioral constructs refer to external elements outside the current Package, you must add an Import connector from the current Package to the Package containing the external elements
- Code synchronization is not supported for behavioral code

Code Generation - Activity Diagrams

Code generation from Activity diagrams in a Class requires a validation phase, during which Enterprise Architect uses the system engineering graph optimizer to analyze the diagram and render it into various constructs from which code can be generated. Enterprise Architect also transforms the constructs into one of the various action types (if appropriate), similar to the Interaction diagram constructs.

Actions

Action	Description
Call Actions (Invocation Actions)	Used to invoke operations or behaviors in an Activity diagram; the two main variants of Call Actions supported in behavioral code generation are: • CallOperation Action - used to invoke operations, which can be within the same Class or in other Classes within the same Package; if referencing operations from other Classes within the same Package, you must have a target to which the request is passed • CallBehavior Action - used to invoke another Activity in an activity flow; the referenced Activity is expected to be within the same Class **Arguments** Call Actions can specify argument values corresponding to the parameters in the associated behavior or behavioral feature. You can add the arguments manually or create them automatically using the Synchronize button of the 'Arguments' dialog.
CreateObjectAction	Used to denote an object creation in the activity flow; you can set the result Pin of the CreateObjectAction as the object to be created, using the 'Assign Action Pins' dialog. The Classifier of the CreateObjectAction signifies the Classifier for which an instance is to be created.
DestroyObjectAction	Used to denote an object deletion in the activity flow; you can set the target Pin of the DestroyObjectAction as the object to be destroyed, using the 'Assign Action Pins' dialog.
Loops	Enterprise Architect's system engineering graph optimizer is also capable of analyzing and identifying loops; an identified loop is internally rendered as an Action Loop, which is translated by the EASL code generation macros to generate the required code. You can have a single loop, nested loops, and multiple levels of nested loops.
Conditional Statements	To model a conditional statement, you use Decision/Merge nodes. Alternatively, you can imply Decisions/Merges internally; the graph optimizer expects an associated Merge node for each Decision node, to facilitate efficient tracking of various branches and analysis of the code constructs within them.

Notes

- To be able to generate code from behavioral models, all behavioral constructs should be contained within a Class

Code Generation - Interaction Diagrams

During code generation from Interaction (Sequence) diagrams in a Class, Enterprise Architect applies its system engineering graph optimizer to transform the Class constructs into programmatic paradigms. Messages and Fragments are identified as two of the several action types based on their functionality, and Enterprise Architect uses the code generation templates to render their behavior accordingly.

Actions

Action	Description
Action Call	A Message that invokes an operation.
Action Create	A Message with Lifecycle = New.
Action Destroy	A Message with Lifecycle = Delete.
Action Loop	A Combined Fragment with Type = Alt.
Action If	A Combined Fragment with Type = loop.
Assign To	A Call Message with a valid target attribute set using the 'Assign To' field is rendered in the code as the target attribute of a Call Action.

Notes

- To be able to generate code from behavioral models, all behavioral constructs should be contained within a Class
- For an Interaction (Sequence) diagram, the behavioral code generation engine expects the Sequence diagram and all its associated messages and interaction fragments to be encapsulated within an Interaction element

Code Generation - StateMachines

A StateMachine illustrates how an object (represented by a Class) can change state, each change of state being a transition initiated by a trigger arising from an event, often under conditions or constraints defined as guards. As you model how the object changes state, you can generate and build (compile) code from it in the appropriate software language and execute the code, visualizing the execution via the Model Simulator.

It is also possible, in Enterprise Architect, to combine the StateMachines of separate but related objects to see how they interact (via Broadcast Events), and to quickly create and generate code from variants of the model. For example, you might model the behavior of:

- The rear off-side wheel of a vehicle in rear-wheel drive and front-wheel drive modes (one StateMachine)
- The steering wheel and all four drive wheels of a vehicle in 4-wheel drive mode (five StateMachines)
- The wheels of an off-road vehicle and of a sports car (two Artifacts, instances of a combination of StateMachines)

Of critical importance in generating and testing code for all of these options is the Executable StateMachine Artifact element. This acts as the container and code generation unit for your StateMachine models.

You do not use this method to generate code for Hardware Definition Languages, but you can also generate both HDL code and software code from StateMachines using the generic Code Generation facilities in Enterprise Architect (see the *Generate Source Code* procedures).

Prerequisites

- Select 'Configure > Model > Options > Source Code Engineering' and, for the appropriate software coding language (Java, C, C# or ANSI C++), set the 'Use the new Statemachine Template' option to 'True'
- If working in C++, select 'Configure > Model > Options > Source Code Engineering > C++' and set the 'C++ Version' option to 'ANSI'

This code generation method does not apply to the Legacy StateMachine code generation templates developed prior to Enterprise Architect Release 11.0, nor to generate Hardware Definition Language code.

Access

Drag an Executable StateMachine Artifact from the 'Artifacts' page of the Diagram Toolbox, onto your diagram. The 'Artifacts' page of the Diagram Toolbox can be accessed using any of the methods outlined in this table.

Ribbon	Design > Diagram > Toolbox > Artifacts
Keyboard Shortcuts	Ctrl+Shift+3 > Artifacts
Other	You can display or hide the Diagram Toolbox by clicking on the » or « icons at the left-hand end of the Caption Bar at the top of the Diagram View.

Prepare your StateMachine diagram(s)

Step	Action
1	For each StateMachine you want to model, create a Class diagram.

2	From the 'Class' page of the Diagram Toolbox, drag the 'Class' icon onto your diagram and give the element an appropriate name.
3	Right-click on the Class element and select the 'New Child Diagram | State Machine' context menu option. Give the StateMachine diagram an appropriate name.
4	Create the StateMachine model to reflect the appropriate transitions between States.

Set up the Executable StateMachine Artifact

Step	Action
1	Create a new Class diagram to contain the modeled StateMachine(s) from which you intend to generate code.
2	From the 'Artifacts' page of the Diagram Toolbox, drag the 'Executable StateMachine' icon onto the diagram to create the Artifact element. Name the element and drag its borders out to enlarge it.
3	From the Browser window, drag the (first) Class element containing a StateMachine diagram onto the Artifact element on the diagram. The 'Paste <element name>' dialog displays. In the 'Drop as' field, click on the drop-down arrow and select the value 'Property'. (If the dialog does not display, press Ctrl as you drag the Class element from the Browser window.)
4	Click on the OK button. The Class element is pasted inside the Artifact as a Part.
5	Repeat steps 3 and 4 for any other Classes with StateMachines that you want to combine and generate code for. These might be: • Repeat 'drops' of the same Class and StateMachine, modeling parallel objects • Different Classes and StateMachines, modeling separate interacting objects
6	Right-click on the Artifact element and select the 'Properties > Properties' option, expand the 'Advanced' category and, in the 'Language' field, click on the drop-down arrow and set the code language to the same language as is defined for the Class elements. You can now drag this Executable StateMachine Artifact element from the Browser window onto the diagram any number of times, and modify the Parts to model variations of the system or process, or the same system or process with different programming languages.

Generate Code From Artifact

Step	Action
1	Click on the Executable StateMachine Artifact element and select the 'Simulate > Executable States > Statemachine > Generate' ribbon option. The 'Executable Statemachine Code Generation' dialog displays.

2	In the 'Project output directory' field, type or browse for the directory path under which to create the output files. During code generation, all existing files in this directory are deleted.
3	Select the Target System. If you are running on WIndows select the 'Local' option. If you are working on Linux choose the 'Remote' option. The choice affects the scripts generated to support the Simulation.
4	In the 'Location of <compiler> installation directory' field, type or browse for the path of the compiler installation directory, to be automatically mapped to the local path (displayed to the left of the field). For each programming language, the paths might resemble these examples: • Java JAVA_HOME C:\Program Files (x86)\Java\jdk1.7.0_17 • C/C++ VC_HOME C:\Program Files (x86)\Microsoft Visual Studio 9.0 • C# CS_HOME C:\Windows\Microsoft.NET\Framework\V3.5
5	Click on the Generate button. The code files are created appropriate to the programming language. The System Output window displays with an 'Executable StateMachine Output' tab, showing the progress and status of the generation. During code generation, an automatic validation function is executed to check for diagram or model errors against the UML constraints. Any errors are identified by error messages on the 'Executable StateMachine Output' tab. Double-click on an error message to display the modeling structure in which the error occurs, and correct the mistake before re-generating the code.
6	When the code generates without error, click on the Artifact element and select the 'Simulate > Executable States > Statemachine > Build' ribbon option to compile the code. The System Output window displays with a 'Build' tab, showing the progress and status of the compilation. Notice that the compilation includes configuration of the simulation operation.

Code Generation Macros

You can also use two macros in the code generation for StateMachines.

Macro Name	Description
SEND_EVENT	Send an event to a receiver (the Part). For example: %SEND_EVENT("event1", "Part1")%
BROADCAST_EVENT	Broadcast an event to all receivers. For example: %BROADCAST_EVENT("event2")%

Execute/Simulate Code From Artifact

Step	Action

1	Select the ribbon option 'Simulate > Dynamic Simulation > Simulator > Apply Workspace' to display the Simulation window and the Simulation Events window together Dock the two windows in a convenient area of the screen.
2	On the diagram or Browser window, click on the Artifact element and select the 'Simulate > Executable States > Statemachine > Run' ribbon option. The first StateMachine diagram in the series displays with the simulation of the process already started. In the Simulation window, the processing steps are indicated in this format: [03516677] Part1[Class1].Initial_367_TO_State4_142 Effect [03516683] Part1[Class1].StateMachine_State4 ENTRY [03516684] Part1[Class1].StateMachine_State4 DO [03518375] Blocked
3	Click on the appropriate Simulation window toolbar buttons to step through the simulation as you prefer. When the simulation finishes at the Exit or Terminate element, click on the Stop button in the Simulation window toolbar.
4	Where the trace shows Blocked, the simulation has reached a point where a Trigger event has to occur before processing can continue. On the Simulation Events window, in the 'Waiting Triggers' column, double-click on the appropriate Trigger. When the Trigger is fired, the simulation continues to the next pause point, Trigger or exit.

Notes

- If you are making small changes to an existing StateMachine model, you can combine the code generation, build and run operations by selecting the 'Simulate > Executable States > Statemachine > Generate, build and run' ribbon option
- You can also generate code in JavaScript

Legacy StateMachine Templates

Code generation operates using a set of generation templates. From Release 11.0 of Enterprise Architect, a different set of templates are available as the default for software code generation from a StateMachine diagram into Java, C, ANSI C++ or C# code. You can still use the original templates, as described here, for models developed in earlier releases of Enterprise Architect, if you do not want to upgrade them for the new template facilities.

Switch Between Legacy and Release 11 templates

Access

Display the 'Manage Project Options' dialog, then show the 'Language Specifications' page for your chosen language, using one of the methods outlined in this table. If necessary, expand the 'StateMachine Engineering (for current model)' grouping and set the 'Use the new StateMachine Template' option to True (to use the later templates) or False (to use the Legacy templates).

Ribbon	Configure > Model > Options > Source Code Engineering > [language name]

Legacy Template Transformations

A StateMachine in a Class internally generates a number of constructs in software languages to provide effective execution of the States' behaviors (do, entry and exit) and also to code the appropriate transition's effect when necessary.

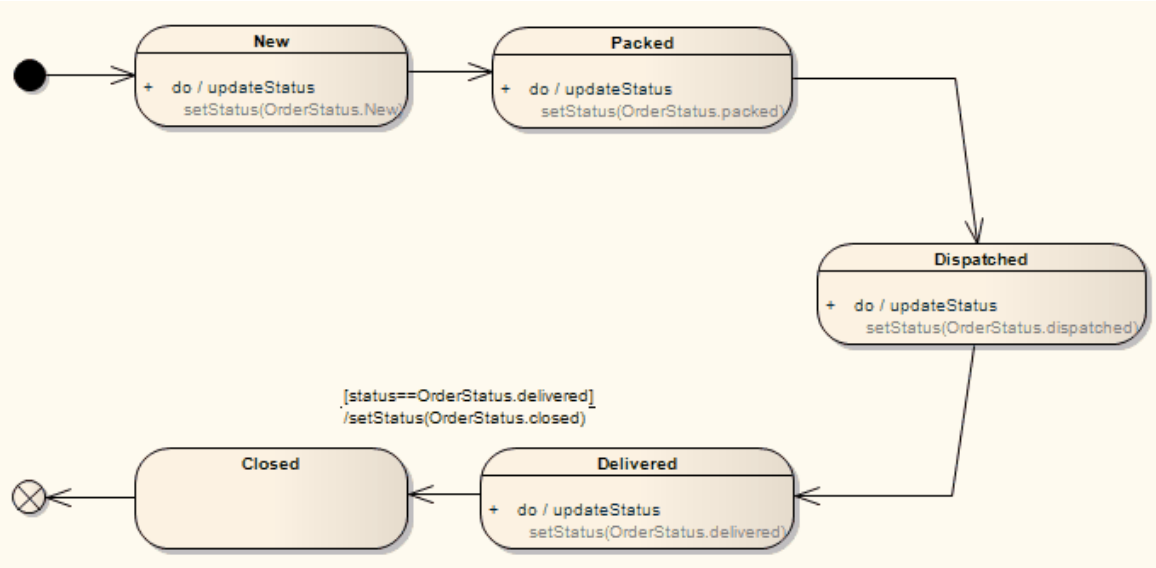
Model Objects	Code Objects
Enumerations	• StateType - consists of an enumeration for each of the States contained within the StateMachine • TransitionType – consists of an enumeration for each transition that has a valid effect associated with it; for example, ProcessOrder_Delivered_to_ProcessOrder_Closed • CommandType – consists of an enumeration for each of the behavior types that a State can contain (Do, Entry, Exit)
Attributes	• currState:StateType - a variable to hold the current State's information • nextState:StateType - a variable to hold the next State's information, set by each State's transitions accordingly • currTransition:TransitionType - a variable to hold the current transition information; this is set if the transition has a valid effect associated with it • transcend:Boolean - a flag used to advise if a transition is involved in transcending between different StateMachines (or Submachine states) • xx_history:StateType - a history variable for each StateMachine/Submachine State, to hold information about the last State from which the transition took place
Operations	• StatesProc - a States procedure, containing a map between a State's enumeration and its operation; it de-references the current State's information

	to invoke the respective State's function • TransitionsProc - a Transitions procedure, containing a map between the Transition's enumeration and its effect; it invokes the Transition's effect • <<State>> - an operation for each of the States contained within the StateMachine; this renders a State's behaviors based on the input CommandType, and also executes its transitions • initializeStateMachine - a function that initializes all the framework-related attributes • runStateMachine - a function that iterates through each State, and executes their behaviors and transitions accordingly

Notes

- To be able to generate code from behavioral models, all behavioral constructs should be contained within a Class

Java Code Generated From Legacy StateMachine Template




```
private enum StateType: int
{
    ProcessOrder_Delivered,
    ProcessOrder_Packed,
    ProcessOrder_Closed,
    ProcessOrder_Dispatched,
    ProcessOrder_New,
    ST_NOSTATE
}
private enum TransitionType: int
{
    ProcessOrder_Delivered_to_ProcessOrder_Closed,
    TT_NOTRANSITION
}
private enum CommandType
{
    Do,
    Entry,
    Exit
}
private StateType currState;
private StateType nextState;
private TransitionType currTransition;
private boolean transcend;
private StateType ProcessOrder_history;
private void processOrder_Delivered(CommandType command)
```

```
{
    switch(command)
    {
        case Do:
        {
            // Do Behaviors..
            setStatus(Delivered);
            // State's Transitions
            if((status==Delivered))
            {
                nextState = StateType.ProcessOrder_Closed;
                currTransition = TransitionType.ProcessOrder_Delivered_to_ProcessOrder_Closed;
            }
            break;
        }
        default:
        {
            break;
        }
    }
}
private void processOrder_Packed(CommandType command)
{
    switch(command)
    {
        case Do:
        {
            // Do Behaviors..
            setStatus(Packed);
            // State's Transitions
            nextState = StateType.ProcessOrder_Dispatched;
            break;
        }
        default:
        {
            break;
        }
    }
}
private void processOrder_Closed(CommandType command)
{
    switch(command)
```

```
    {
        case Do:
        {
            // Do Behaviors..
            // State's Transitions
            break;
        }
        default:
        {
            break;
        }
    }
}
private void processOrder_Dispatched(CommandType command)
{
    switch(command)
    {
        case Do:
        {
            // Do Behaviors..
            setStatus(Dispatched);
            // State's Transitions
            nextState = StateType.ProcessOrder_Delivered;
            break;
        }
        default:
        {
            break;
        }
    }
}
private void processOrder_New(CommandType command)
{
    switch(command)
    {
        case Do:
        {
            // Do Behaviors..
            setStatus(new);
            // State's Transitions
            nextState = StateType.ProcessOrder_Packed;
            break;
```

```
            }
            default:
            {
                break;
            }
        }
    }
    private void StatesProc(StateType currState, CommandType command)
    {
        switch(currState)
        {
            case ProcessOrder_Delivered:
            {
                processOrder_Delivered(command);
                break;
            }
            case ProcessOrder_Packed:
            {
                processOrder_Packed(command);
                break;
            }
            case ProcessOrder_Closed:
            {
                processOrder_Closed(command);
                break;
            }
            case ProcessOrder_Dispatched:
            {
                processOrder_Dispatched(command);
                break;
            }
            case ProcessOrder_New:
            {
                processOrder_New(command);
                break;
            }
            default:
            break;
        }
    }
    private void TransitionsProc(TransitionType transition)
    {
```

```
    switch(transition)
    {
        case ProcessOrder_Delivered_to_ProcessOrder_Closed:
        {
            setStatus(closed);
            break;
        }
        default:
        break;
    }
}
private void initalizeStateMachine()
{
    currState = StateType.ProcessOrder_New;
    nextState = StateType.ST_NOSTATE;
    currTransition = TransitionType.TT_NOTRANSITION;
}
private void runStateMachine()
{
    while (true)
    {
        if (currState == StateType.ST_NOSTATE)
        {
            break;
        }
        currTransition = TransitionType.TT_NOTRANSITION;
        StatesProc(currState, CommandType.Do);
        // then check if there is any valid transition assigned after the do behavior
        if (nextState == StateType.ST_NOSTATE)
        {
            break;
        }
        if (currTransition != TransitionType.TT_NOTRANSITION)
        {
            TransitionsProc(currTransition);
        }
        if (currState != nextState)
        {
            StatesProc(currState, CommandType.Exit);
            StatesProc(nextState, CommandType.Entry);
            currState = nextState;
        }
```

```
    }
}
```

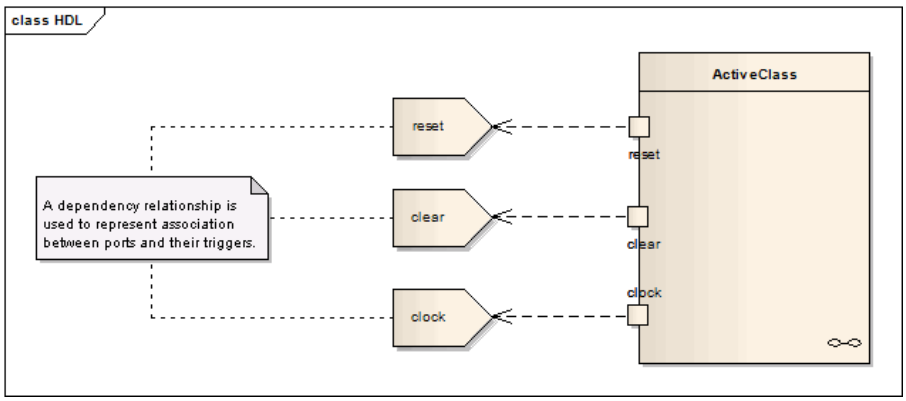
StateMachine Modeling For HDLs

To efficiently generate Hardware Description Language (HDL) code from StateMachine models, apply the design practices described in this topic. Hardware Description Languages include VHDL, Verilog and SystemC.

In an HDL StateMachine model, you might expect to:

- Designate Driving Triggers
- Establish Port–Trigger Mapping
- Add to Active State Logic

Operations

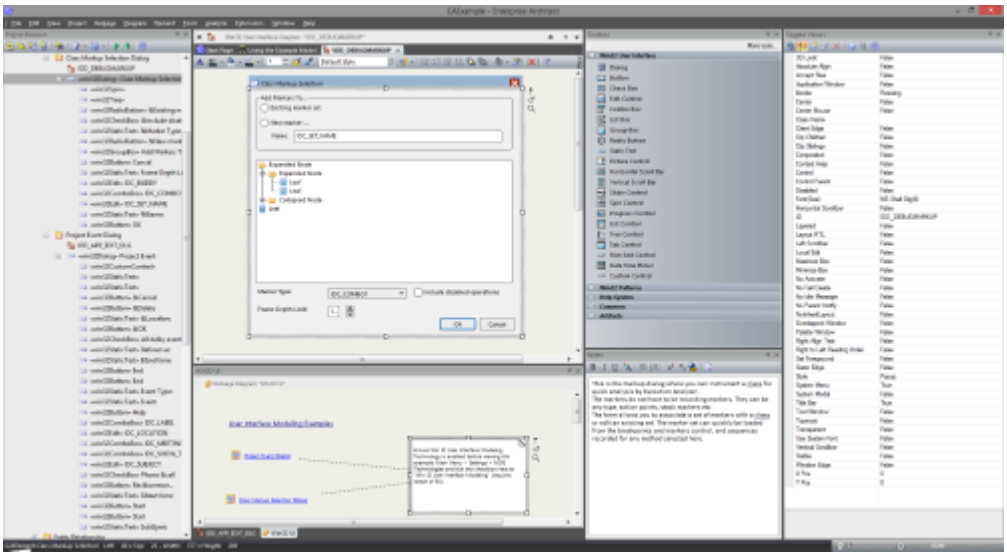
Operation	Description
Designate Driving Triggers	• A 'Change' Trigger is deemed to be an asynchronousTrigger if: - There is a transition from the actual SubMachine State (which encapsulates the actual logic) that it triggers, and - The target State of that transition has a self transition triggered by the same Trigger • Asynchronous Triggers should be modeled according to this pattern: - The Trigger should be of type Change (specification: True / False) - The active State (SubMachine State) should have a transition triggered by it - The target State of the triggered transition should have a self transition with the same Trigger • A Trigger of type 'Time', which triggers the transitions to the active state (SubMachine State), is deemed to be the Clock; the specification of this trigger should conform to the target language: - VHDL - rising_edge / falling_edge - Verilog - posedge / negedge - SystemC - positive / negative
Establish Port-Trigger Mapping	After successfully modeling the different operating modes of the component, and the Triggers associated with them, you must associate the Triggers with the component's Ports. A Dependency relationship from the Port to the associated Trigger is used to signify that association. 
Active State Logic	Designating the driving Trigger and establishing the Port-Trigger mapping put in place the preliminaries required for efficiently interpreting the hardware

	components. We now model the actual StateMachine logic within the Active (SubMachine) State.

Notes

- To be able to generate code from behavioral models, all behavioral constructs should be contained within a Class
- The current code generation engine supports only one clock Trigger for a component

Win32 UI Technology



Using the MDG Win32 UI Technology, you can design user interface screens that render as Win32® controls. The user interface produced can be used in any resource definition script. Resource definition scripts, or RC files, are a Microsoft technology that - as for other code - can be compiled and the assets used by native desktop applications. User interface screens or dialogs can be created from scratch or reverse engineered. User interface models can also be forward engineered using the synchronize code function (F7). Interface modeling takes place on diagrams in the exact same fashion as you would work with any technology in Enterprise Architect. An interesting aspect of User Interface design in Enterprise Architect is that components can take an active role in the simulation of StateMachines and Activities, enabling a simulation to interact with users, much like a real program!

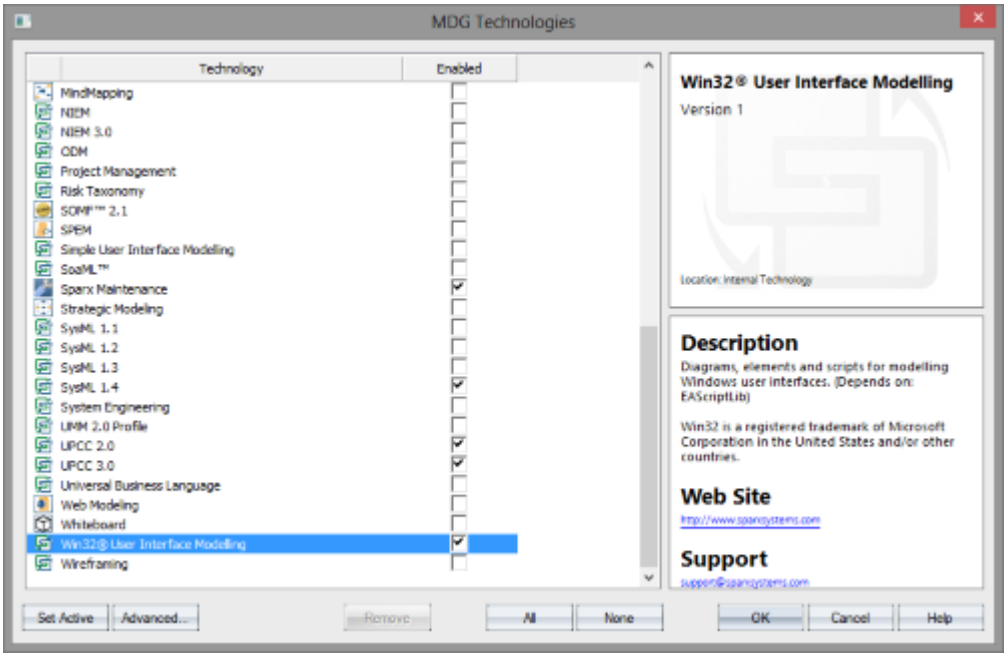
Access

Ribbon	Design > Diagram > Add > Type > User Interface Win32
Context Menu	Right-click on Package | Add Diagram > Type | User Interface Win32
Other	Browser window caption bar menu | New Diagram | User Interface Win32

Support

The MDG Win32® User Interface Technology is available in the Enterprise Architect Professional, Corporate and Suite editions

Enabling Win32 User Interface Technology



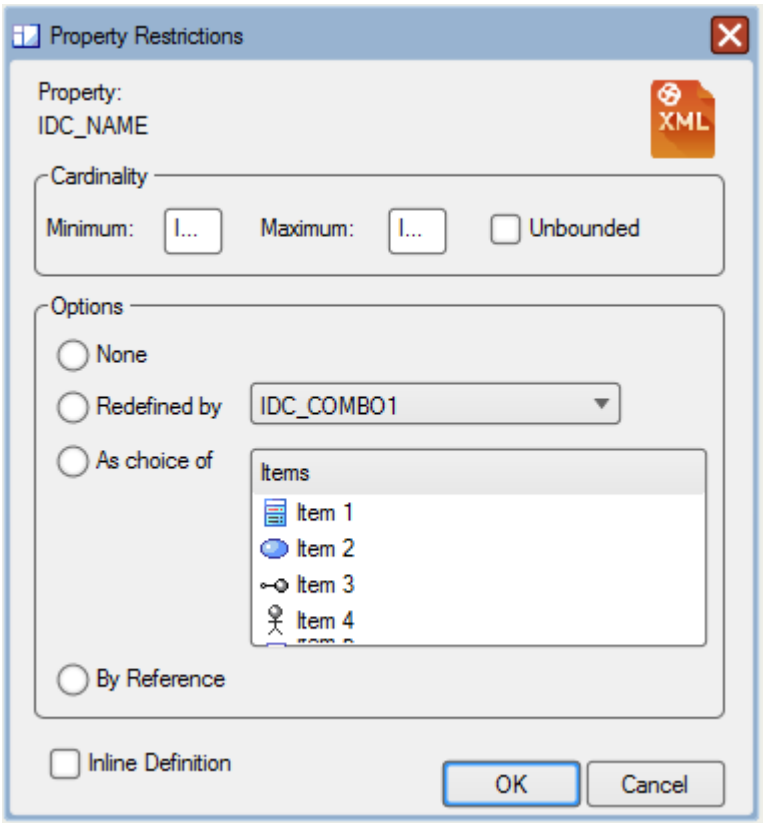
The Win32® UI Technology in Enterprise Architect is enabled or disabled using the 'MDG Technologies' dialog (select the 'Specialize > Technologies > Manage-Tech' ribbon option).

Default technology

You can set the MDG Win32® UI Technology as the active default technology to access the Toolbox pages directly.

Modeling UI Dialogs

The Win32 User Interface MDG Technology provides the tools to help you design a user interface that closely emulates the visual style and available options for Windows dialogs.



Win32 Dialog

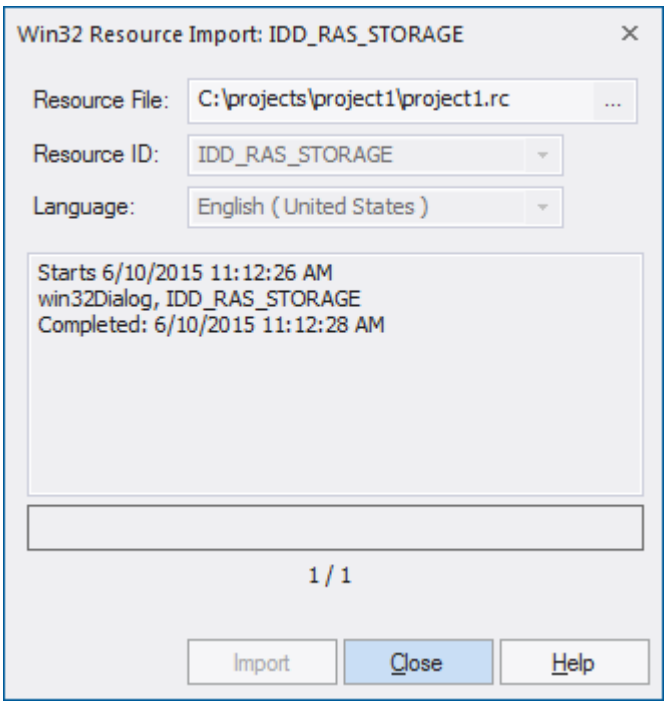
These user interface components are supported, each matching the equivalent-named RC resource.

Component	Details
win32Dialog	The equivalent of the RC format DIALOG and DIALOGEX resources.
win32StaticText	The equivalent of the RC format LTEXT, RTEXT, CTEXT resources.
win32Edit	The equivalent of the RC format EDITTEXT resource.
win32Button	The equivalent of the RC format BUTTON, DEFPUSHBUTTON and other resources.
win32CheckBox	The equivalent of the RC format CHECKBOX resource.
win32ScrollBarH	The equivalent of the RC format SCROLLBAR resource with SBS_HORZ style
win32ScrollBarV	The equivalent of the RC format SCROLLBAR resource with SBS_VERT style.
win32GroupBox	The equivalent of the RC format GROUPBOX resource.

win32ComboBox	The equivalent of the RC format COMBOBOX resource. Note: When you initially drag the 'Combo Box' icon - of type 'Drop Down' or 'Drop Down List' - onto a diagram, the middle 'tracking handle' on each side of the element is white, indicating that you can only adjust the width of the element. To adjust the height of the element as well as the width, click on the drop-down arrow part of the image; the middle 'tracking handle' on the bottom edge is now white, indicating that you can drag the base down to set the virtual height (the height of the element when it is expanded to show all possible values in the drop-down list).
win32ListBox	The equivalent of the RC format LISTBOX resource.
win32RadioButton	The equivalent of the RC format RADIOBUTTON resource.
win32TabPane	The equivalent of the RC format TABPANE resource.
win32Picture	The equivalent of the RC format STATIC resource with SS_BITMAP style. The control can render an image when applied from your model. An image can be applied by selecting it first and pressing Ctrl+Shift+W to display the Image Manager. Afterwards, you might need to change the value of the resource ID in the appropriate Tagged Value.
win32CustomControl	The equivalent of the RC format CONTROL resource.

Import Single Dialog from RC File

You can quickly import a single dialog by name.



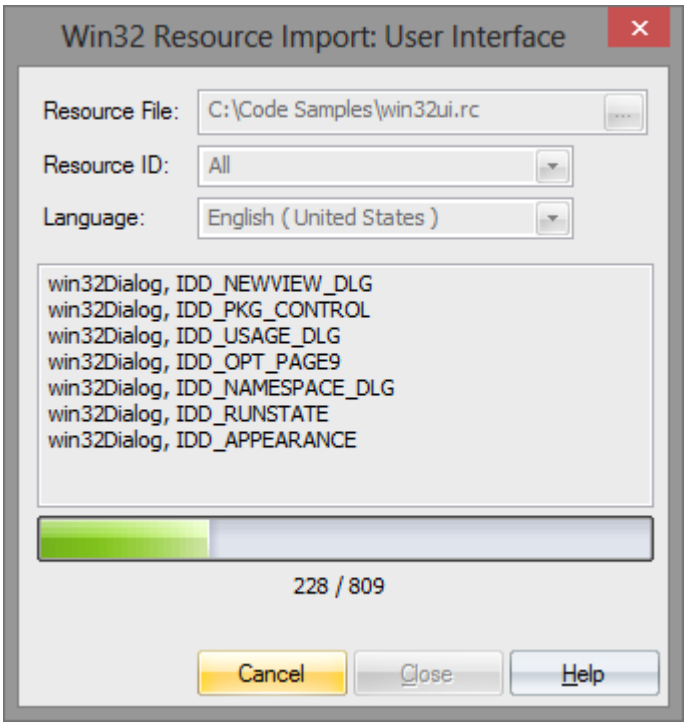
Access

In the Browser window, click on the target Package.

Ribbon	Develop > Source Code > Files > Import Resource Script

Import All Dialogs from RC File

All dialogs in a single RC file can be imported into your model. This image was captured one minute into the import, at which time over 200 large dialog definitions had been imported.

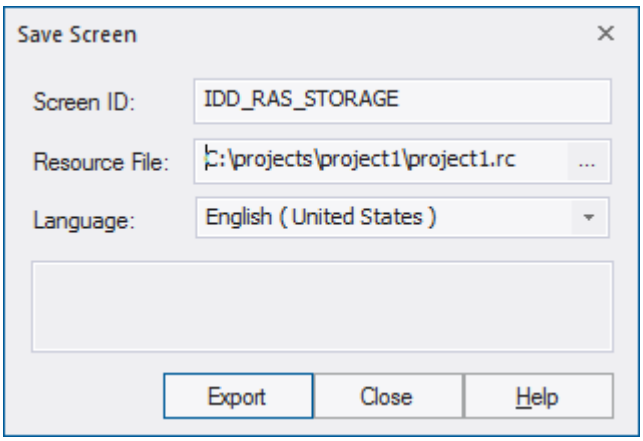


Access

Ribbon	Develop > Source Code > Files > Import Resource Script

Export Dialog to RC File

Once a screen design is modified or a new one created, you might want to get it back to the RC file you use to build your application, so that you can see how it looks with real data. Begin by selecting the Win32Dialog element in the Browser window, then use the ribbon to perform the synchronization.



Access

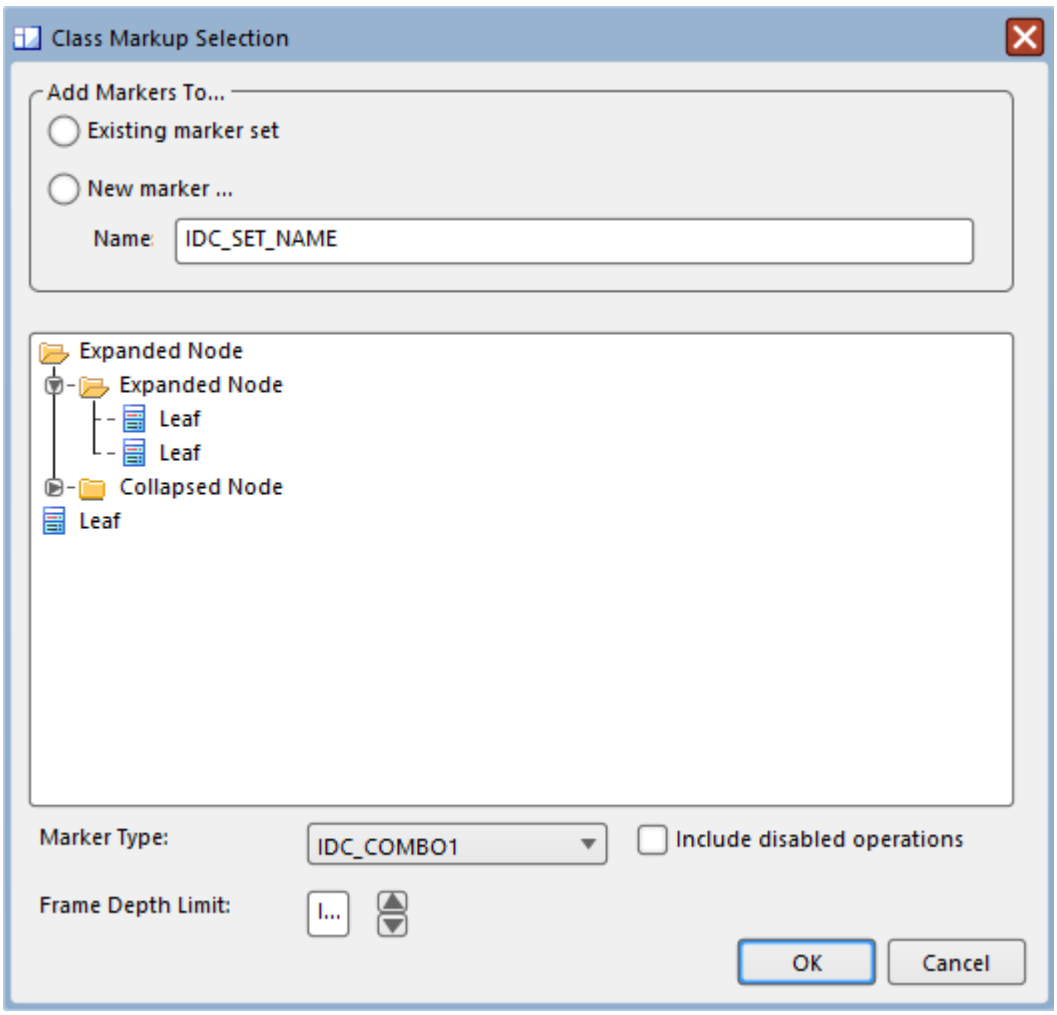
Click on the win32Dialog element.

Ribbon	Develop > Source Code > Generate > Generate Single Element
Keyboard Shortcuts	F11

Design a New Dialog

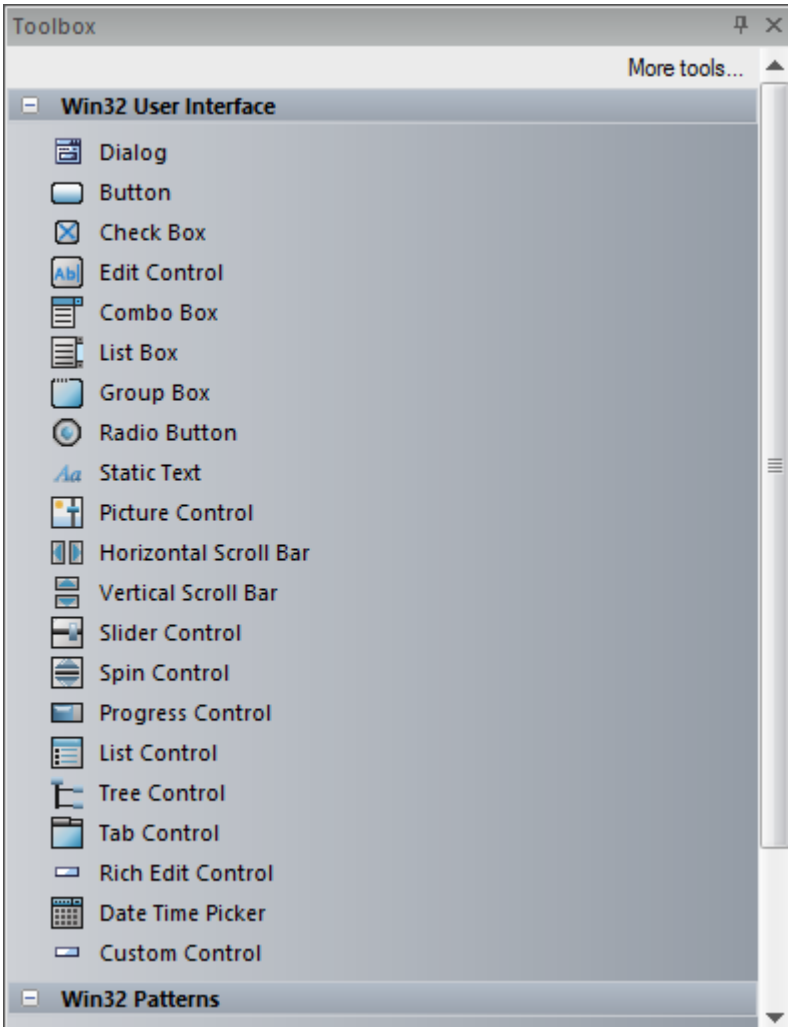
Creating a new Win32 dialog is easy and mostly visual. You will probably need a workspace that shows:

- The new diagram (select the 'Design > Diagram > Add > User Interface - Win32 > User Interface - Win32' ribbon path)
- The Win32 User Interface Toolbox (select the 'Design > Diagram > Tooolbox' ribbon option) and
- The Tagged Values tab of the Properties window



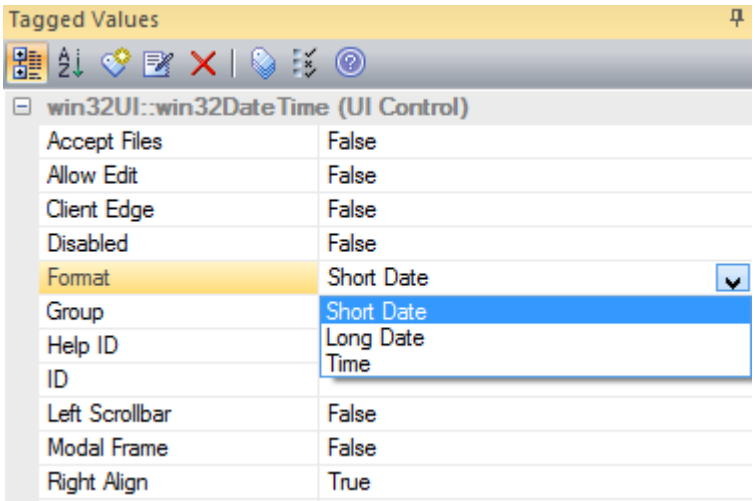
The UI Toolbox

All of the common RC elements can be found on the UI toolbox



The Tags Tab

This tab is provided on the Properties window and 'Properties' dialog for an object, and is where all the properties of a control can be viewed and edited.



Using the Picture Control

Images from your model (see *Image Manager*) can be applied by selecting the control on the dialog and pressing Ctrl+Shift+W. You might have to enter the value of the resource ID in the appropriate Tagged Value.

Note

- You can copy and paste dialog Packages

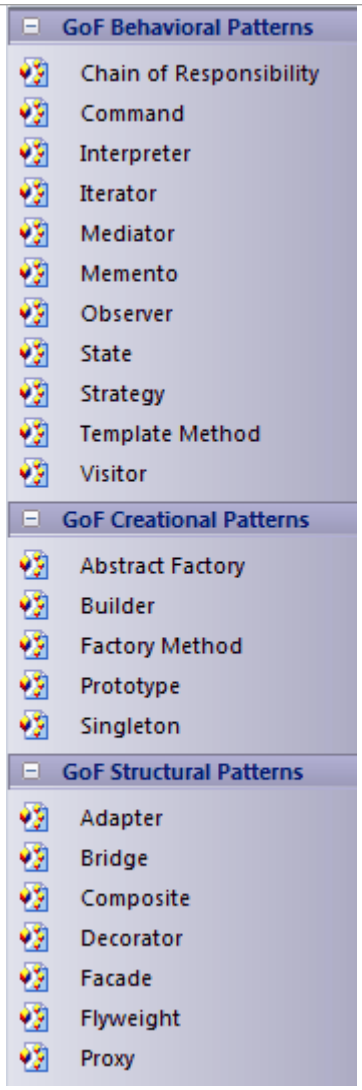
GoF Patterns

A Design Pattern is a template for solving commonly recurring design problems; it consists of a series of elements and connectors that can be reused in a new context. The advantage of using Patterns is that they have been tested and refined in a number of contexts and so are typically robust solutions to common problems. Enterprise Architect provides the Gang of Four Patterns as an MDG Technology that can be loaded into the current repository.

The Gang of Four (Gof) Patterns are a group of twenty three Design Patterns originally published in a seminal book entitled *Design Patterns: Elements of Reusable Object-Oriented Software*; the term 'Gang of Four' refers to the four authors. Enterprise Architect displays these Patterns in its powerful Pattern engine, helping you to visualize the elements of the Pattern and adjust the Pattern to the context of your software design problem.

GoF Patterns in Enterprise Architect

Features	Description
GoF Pattern Facilities	The GoF Patterns are provided in the form of: • GoF Behavioral Patterns, GoF Creational Patterns and GoF Structural Patterns pages in the Toolbox • Gang of Four Pattern entries in the Toolbox Shortcut Menu **GoF Pattern Toolbox Pages** You can access the 'GoF Pattern' pages of the Toolbox by clicking on  to display the 'Find Toolbox Item' dialog and specifying 'GoF Patterns'; these icons are available:



When you drag one of the Pattern elements onto a new diagram, the 'Add Pattern GoF <pattern group><pattern type>' dialog displays; if necessary, modify the action and/or default for the component elements, then click on the OK button to create a diagram based on the Pattern.

Configuration Settings

You can set the default code options such as the editors for each of the programming languages available for Enterprise Architect and special options for how source code is generated or reverse engineered. These options are defined according to whether they apply to:

- All users of the current model, set on the 'Manage Project Options' dialog, or
- All models that you access (other users can define their own settings that apply to the same models), set on the 'Preferences' dialog

You can also:

- For each programming language used in the model, for all users working on the model, define Collection Classes for generating code from Association connectors where the target role has a multiplicity setting greater than 1
- Define a local path for yourself, using the 'Local Path' dialog; these settings apply to all Enterprise Architect models that you access
- Define language macros within the model, which are useful in reverse engineering and can be exported from and imported to the model

Source Code Engineering Options

The 'Source Code Engineering' options apply to the languages in which you generate code from Enterprise Architect. They are divided into Model-specific options and User-specific options, as explained here.

Model-Specific Options

These options are defined on the 'Manage Project Options' dialog.

Access

Ribbon	Configure > Model > Options > Source Code Engineering

Types of Option

Option Type	Detail
Source Code Generation Options	You can define a number of settings for generating code in the model, such as the default language to generate code in and the Unicode character set for code generation.
Options - Object Lifetimes	You can configure various options concerning Object Lifetimes.
Code Language Options	For each of the code languages that Enterprise Architect supports, you can define the model-specific options and set any Collection Classes required.

User-Specific Options

These options are defined on the 'Preferences' dialog.

Access

On the 'Preferences' dialog, click on 'Source Code Engineering' in the left-hand list.

Ribbon	Start > Desktop > Preferences > Preferences
Keyboard Shortcuts	Ctrl+F9

Types of Option

Option Type	Detail
Source Code Generation Options	You can define a number of settings for generating code in any model that you access under the same user ID.
Code Editors	These are options for accessing and configuring the source code editor.
Attributes/Operations	Use these options for configuring attributes and operations.
Code Language Options	For each of the code languages that Enterprise Architect supports, you can define the user-specific options that apply to any model that you access under your user ID.

Code Generation Options

When you generate code for your model, you can set certain options. These include:

- The default language
- Whether to generate methods for implemented interfaces
- The Unicode options for code generation

Access

Ribbon	Configure > Model > Options > Source Code Engineering

Configure code generation options

Option	Action
Always synchronize with existing file (recommended)	Select the radio button to synchronize imported code with an existing file.
Replace (overwrite) existing source file	Select the radio button to overwrite the existing source file with imported code.
Component Types	Click on this button to open the 'Import component types' dialog, to set up the importation of component types.
Default Language for Code Generation	Click on the drop-down arrow and select the default language for code generation.
DDL Name Templates	Click on the  button to define the template names for Primary Key, Unique Constraint, Foreign Key and Foreign Key Index Name templates.
Default name for associated attrib	Type in a default name to be generated from imported attributes.
Generate methods for implemented interfaces	Select the checkbox to indicate that methods are generated for implemented interfaces.
Code page for source editing	Click on the drop-down arrow and select the appropriate Unicode character embedding format to apply.

Notes

- It is worthwhile to configure these settings, as they serve as the defaults for all Classes in the model; you can

override most of these on a per-Class basis using the custom settings (from the 'Code Generation' dialog)

Import Component Types

Using the 'Import Component Types' dialog you can configure what elements you want to be created for files of any extension found while importing a source code directory.

Access

Ribbon	Configure > Model > Options > Source Code Engineering: Component Types

Define Import Component Types

Option	Action
Extension	Type in the extension name for a component type.
Type	Click on the drop-down arrow and select the component type.
Stereotype	Type in any stereotype name that further identifies a component of this type.
Component List	Lists the currently-defined component types.
Save	Click on this button to saves the component definition and add it to the component list.
New	Click on this button to clear the dialog fields so that you can define a new component type.
Delete	Click on this button to delete the selected component type from the component list.

Notes

- You can transport these import component types between models, using the 'Configure > Model > Transfer > Export Reference Data' and 'Import Reference Data' ribbon options

Source Code Options

You can set a wide range of options for generating code in the models you work with. These include:

- How to format the generated code
- How to respond to certain events during code generation
- Whether to generate a diagram from the code

Access

On the 'Preferences' dialog, select the 'Source Code Engineering' option

Ribbon	Start > Desktop > Preferences > Preferences
Keyboard Shortcuts	Ctrl+F9

Configure code generation options

Field	Action
Wrap long comment lines at	Type in the number of characters to allow in a comment line before wrapping the text to the next line.
Auto Layout Diagram on Import	Click on the drop-down arrow and select if and when a diagram is automatically generated on code import.
Output files use both CR & LF	Select the checkbox to include carriage returns and line feeds; set this option according to what operating system is currently in use, as code might not render correctly.
Prompt when synchronizing (reversing)	Select the checkbox to display a prompt when synchronization occurs.
Remove hard breaks from comments on import	Select the checkbox to remove hard breaks from commented sections on importation.
Auto generate role names when creating code	Select the checkbox to generate role names when creating code.
Do not generate members where association direction is 'Unspecified'	Select the checkbox to prevent generation of members if the Association direction is unspecified.
Create dependencies for operation returns and parameter types	Select the checkbox to generate dependencies for operation returns and parameter types.
Comments: Generate	Select the checkbox to generate comments.

Comments: Reverse	Select the checkbox to generate reverse comments.
Remove prefixes when generating Get/Set properties	Type in the prefixes, separated by semi-colons, used in your variable naming conventions, to be removed in the variables' corresponding get/set functions.
Treat as suffixes	Select the checkbox to use the prefixes defined in the 'Remove prefixes when generating Get/Set properties' field as suffixes.
Capitalized Attribute Name for Properties	Select the checkbox to capitalize attribute names for properties.
Use 'Is' for Boolean property Get()	Select the checkbox to use the Is keyword for the Boolean property Get().

Notes

- It is worthwhile to configure these settings, as they serve as the defaults for all Classes in the model; you can override most of these on a per-Class basis using the custom settings (from the 'Code Generation' dialog)

Options - Code Editors

You access the source code editor options via the 'DDL' page of the 'Preferences' dialog. On this page you can configure options for Enterprise Architect's internal editor, as well as the default editor for DDL scripts. You can configure external editors for code languages on each language options page.

Access

On the 'Preferences' dialog, select the 'Source Code Engineering > Code Editors' option.

Ribbon	Start > Desktop > Preferences > Preferences
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
DDL Editor	Defaults to blank, indicating that the Enterprise Architect code editor is the DDL editor in use. You can select a different default editor if necessary; click on the ... button to browse for and select the required DDL editor. The editor name then displays in the 'DDL Editor' field.
Default Database	Click on the drop-down arrow and select the default database to be used.
MySQL Storage	Click on the drop-down arrow and select the MySQL storage engine to be used.
Use inbuilt editor if no external editor set	Select the checkbox to use the inbuilt editor for code in any language if no external editor is defined for that language in the user-specific options.
Show Line Numbers	Select the checkbox to display line numbers in the editor.
Show Structure Tree	Select the checkbox to show a tree with the results of parsing the open file (if the file is parsed successfully).
Automatically Reverse Engineer on File Save	If you select this checkbox, pressing Ctrl+S to save in the source code editor automatically reverse engineers the code in the same way as the Save Source and Re-Synchronize Class button does.
Don't parse files larger than	Click on the drop-down arrow and select the upper limit on file size for parsing. Setting this option prevents performance decrease due to parsing very large files.
Syntax Highlighting Options	Click on the ... button to display the 'Editor Language Properties' dialog, in which you can set both global and language-specific editor language properties.
Configure Enterprise	

Architect File Associations	Click on the  button to display the 'Set Associations for a Program' dialog, and select the file extensions for files that you want to open through the Enterprise Architect Document Handler.

Editor Language Properties

Using the 'Editor Language Properties' dialog, you can specify syntax highlighting properties for any of the programming languages that Enterprise Architect supports at installation.

Access

In the 'Preferences' dialog, select the 'Source Code Engineering | Code Editors' option and click on the  button next to 'Syntax Highlighting Options'.

Ribbon	Start> Desktop > Preferences > Preferences, select 'Source Code Engineering | Code Editors' option > click on the  button next to 'Syntax Highlighting Options'
Other	In the Code Editor window, click on the toolbar icon  | Syntax Highlighting Options

Options

Panel	Description
Language Panel	The panel on the left of the dialog lists the languages for which you can set properties. At the top of the list are three non-language options: • (Dark Theme) - assigns a dark background to the property fields and to the code panel in the code editor screen (you can apply a different color to specific properties) • (Light Theme) - assigns a pale background to the property fields and to the code panel in the code editor screen (you can apply a different color to specific properties) You can also set the background themes on the 'Application Look' dialog • (Global) provides properties that you can set for all programming languages; however, you can reset a global property to a different value for a particular language, in the properties specifically for that language Resetting a global property for one language does not affect that property's value for the other languages Click on the required language in the list, to display the properties for that language: • Properties shown in bold indicate that this is the highest level at which this property can be defined (for most language options other than 'Global', this is effectively the only point at which the property is defined) • Properties shown in normal font are generally the global properties that you can reset just for the current language
Properties Panel	Scroll through the property categories and individual properties for the language. You can collapse and expand categories as necessary, using the expansion box next

	to the category name ( ). When you click on a property name, an explanation of that property displays in the panel at the bottom right of the dialog. To define a property, click on the value field following the property name; depending on the type of property, either the field is enabled for direct editing or a drop-down arrow or  button displays (as described for the 'Tags' tab of the Properties window) so that you can select the values to define the property. Select or type in the required values. Use the Toolbar icons to: • Save your changes to the properties • Reset all properties fields to the default settings shipped with Enterprise Architect • Reset the current style field to the default setting (not enabled for non-style fields)
Assign Keys to Macros	In the 'Macros' category of the properties, you can assign (Ctrl+Alt+<n>) keystroke combinations to coding macros that you have created yourself in the 'Source Code Viewer'. When you click on the Browse button in a selected 'Macro' field, the 'Open Macro' dialog displays; this dialog lists the existing macros and, if a key combination has been assigned to a macro, what that key combination is. Click on the name of the macro and on the Open button to assign the selected keys to the macro.

Notes

- You cannot currently set properties for any additional languages you include through an MDG Technology
- You can resize this dialog, if required

Options - Object Lifetimes

You can use these options to configure various Object Lifetime settings such as:

- Defining constructor details when generating code
- Specifying whether to create a copy constructor
- Defining Destructor details

Access

Ribbon	Configure > Model > Options > Source Code Engineering > Object Lifetimes

Options

Option	Action
Constructor	If necessary, select the checkboxes to specify that a constructor is generated and (for C++) that the constructor is in-line. Click on the drop-down arrow and select the appropriate visibility of the default constructor - Private, Protected or Public.
Copy Constructor	If necessary, select the checkboxes to specify that a copy constructor is generated and (for C++) that the copy constructor is in-line. Click on the drop-down arrow and select the appropriate visibility of the default copy constructor - Private, Protected or Public.
Destructor	If necessary, select the checkboxes to specify that a destructor is generated and (for C++) that the destructor is in-line and/or virtual. Click on the drop-down arrow and select the appropriate visibility of the default destructor - Private, Protected or Public.

Options - Attribute/Operations

Your use of attributes and operations can be configured in a number of ways. You can set options to:

- Delete model attributes not included in the code during reverse synchronization
- Delete model methods not included in the code during reverse synchronization
- Delete code from features contained in the model during forward synchronization
- Delete model associations and aggregations that correspond to attributes not included in the code during reverse synchronization
- Define whether or not the bodies of methods are included and saved in the model when reverse engineering
- Create features in quick succession, clearing the Properties window when you click on 'Save' so that you can enter another feature name

You configure these options on the 'Attribute/Operations' page of the 'Preferences' dialog.

Access

On the 'Preferences' dialog, select the 'Source Code Engineering > Attribute/Operations' option.

Ribbon	Start > Desktop > Preferences > Preferences
Keyboard Shortcuts	Ctrl+F9

Options

Field	Action
On reverse synch, delete model attributes not in code	Select the checkbox to indicate that on reverse synchronization, attributes in the model that are not included within code are automatically removed from the model.
On reverse synch, delete model associations not in code	Select the checkbox to indicate that on reverse synchronization, associations in the model that are not included within code are automatically removed from the model.
On reverse synch, delete model methods not in code	Select the checkbox to indicate that on reverse synchronization, methods in the model that are not included within code are automatically removed from the model.
Include method bodies in model when reverse engineering	Select the checkbox to indicate that on reverse engineering code, method bodies in the code are included within your model.
After Save, re-select edited item	Select the checkbox to indicate that after saving an attribute or operation, the properties definition continues to display the details of the selected feature. If deselected, indicates that the fields of the properties definition will clear so that you can enter another attribute or operation name and details immediately.
On forward synch, prompt	Select the checkbox to indicate that, during forward synchronization, the

to delete code features not in model	'Synchronize Element <package name>.<element name>' dialog displays, so that you can either ignore, reassign or delete features in the code that are not in the model.

Modeling Conventions

The synchronization between UML models and programming code is achieved using a set of modeling conventions (mappings) between UML constructs and programming code syntax. The Software Engineer is advised to become familiar with these conventions in order to work with the code generation process for the programming languages they intend to target. There are a range of constructs used, including elements, features, connectors, connector ends, stereotypes and Tagged Values. The newcomer will require a little time to become familiar with these conventions but after a short time they will be translating between programming code and UML constructs without effort.

Supported Languages

Language
Action Script
Ada 2012 (Unified and Ultimate editions)
C
C#
C++
Delphi
Java
PHP
Python
SystemC (Unified and Ultimate editions)
Verilog (Unified and Ultimate editions)
VHDL (Unified and Ultimate editions)
Visual Basic
Visual Basic .NET

Notes

Enterprise Architect incorporates a number of visibility indicators or scope values for its supported languages; these include, for:

- All languages - Public (+), Protected (#) and Private (-)
- Java - Package (~)
- Delphi - Published (^)
- C# - Internal (~), Protected Internal (^)
- ActionScript - Internal (~)
- VB.NET - Friend (~), Protected Friend (^)
- PHP - Package (~)
- Python - Package (~)
- C - Package (~)
- C++ - Package (~)

ActionScript Conventions

Enterprise Architect supports round trip engineering of ActionScript 2 and 3, where these conventions are used.

Stereotypes

Stereotype	Applies To
literal	Operation Corresponds To: A literal method referred to by a variable.
property get	Operation Corresponds To: A 'read' property.
property set	Operation Corresponds To: A 'write' property.

Tagged Values

Tag	Applies To
attribute_name	Operation with stereotype property get or property set Corresponds To: The name of the variable behind this property.
dynamic	Class or Interface Corresponds To: The 'dynamic' keyword.
final	ActionScript 3: Operation Corresponds To: The 'final' keyword.
intrinsic	ActionScript 2: Class Corresponds To: The 'intrinsic' keyword.
namespace	ActionScript 3: Class, Interface, Attribute, Operation Corresponds To: The namespace of the current element.
override	ActionScript 3: Operation Corresponds To: The 'override' keyword.
prototype	ActionScript 3: Attribute Corresponds To: The 'prototype' keyword.
rest	ActionScript 3: Parameter Corresponds To: The rest parameter (...)

Common Conventions

- Package qualifiers (ActionScript 2) and Packages (ActionScript 3) are generated when the current Package is not a namespace root
- An unspecified type is modeled as 'var' or an empty 'Type' field

ActionScript 3 Conventions

- The Is Leaf property of a Class corresponds to the sealed keyword
- If a namespace tag is specified it overrides the Scope that is specified

Ada 2012 Conventions

Enterprise Architect supports round trip engineering of Ada 2012, where these conventions are used.

Stereotypes

Stereotype	Applies To
adaPackage	Class Corresponds To: A Package specification in Ada 2012 without a tagged record.
adaProcedure	Class Corresponds To: A procedure specification in Ada 2012.
delegate	Operation Corresponds To: Access to a subprogram.
enumeration	Inner Class Corresponds To: An enumerated type.
struct	Inner Class Corresponds To: A record definition.
typedef	Inner Class Corresponds To: A type definition, subtype definition, access type definition, renaming.

Tagged Values

Tag	Applies To
Aspect	Inner Class with stereotype typedef Operation Corresponds to: Aspect specification (Precondition and Postcondition of Subprogram type 'invariant', subtype 'predicate').
InstantiatedUnitType	Inner Class with stereotype typedef Corresponds To: The instantiated unit's type (Package / Procedure / Function).
IsAccess	Parameter Corresponds To: Determination of whether the parameter is an access variable.
IsAliased	Function parameter Corresponds to: Aliased function parameter.

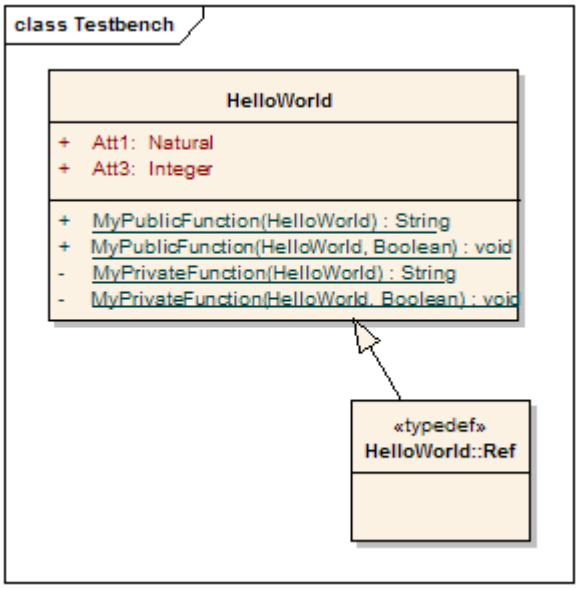
Discriminant	Inner Class with stereotype typedef Corresponds To: The type's discriminant.
PartType	Inner Class with stereotype typedef Corresponds To: The part type ('renames' or 'new').
Type	Inner Class with stereotype typedef Corresponds To: If 'Value' = 'SubType', set 'subtype' If 'Value' = 'Access', set 'access type'.

Other Conventions

- Appropriate type of source files: Ada specification file, .ads
- Ada 2012 imports Packages defined as either <<adaPackage>> Class or Class, based on the settings in the Ada 2012 options
- A Package in the Ada specification file is imported as a Class if it contains a Tagged Record, the name of which is governed by the options 'Use Class Name for Tagged Record' and 'Alternate Tagged Record Name'; all attributes defined in that Tagged Record are absorbed as the Class's attributes
- A procedure / function in an Ada specification file is considered as the Class's member function if its first parameter satisfies the conditions specified in the options 'Ref Param Style', 'Ignore Reference parameter name' and 'Ref parameter name'
- The option 'Define Reference for Tagged Record', if enabled, creates a reference type for the Class, the name of which is determined by the option 'Reference Type Name'; for example:

```
HelloWorld.ads
package HelloWorld is
    type HelloWorld is tagged record
        Att1: Natural;
        Att3: Integer;
    end record;

    -- Public Functions
    function MyPublicFunction (P: HelloWorld) return String;
    procedure MyPublicFunction (P1: in out HelloWorld; AFlag: Boolean);
private
    -- Private Functions
    function MyPrivateFunction (P: HelloWorld) return String;
    procedure MyPrivateFunction (P1: in out HelloWorld; AFlag: Boolean);
end HelloWorld;
```



Notes

- Ada 2012 support is available in the Unified and Ultimate editions of Enterprise Architect

C Conventions

Enterprise Architect supports round trip engineering of C, where these conventions are used:

Stereotype

Stereotype	Applies To
enumeration	Inner Class Corresponds To: An enumerated type.
struct	Inner Class Corresponds To: A 'struct' type.
Attribute	A keyword struct in variable definition.
typedef	Inner Class Corresponds To: A 'typedef' statement, where the parent is the original type name.
union	Inner Class Corresponds To: A union type.
Attribute	A keyword union in variable definition.

Tagged Values

Tag	Applies To
anonymous	Class also containing the Tagged Value typedef Corresponds To: The name of this Class being defined only by the typedef statement.
bitfield	Attribute Corresponds To: The size, in bits, allowed for storage of this attribute.
bodyLocation	Operation Corresponds To: The location the method body is generated to; expected values are header, classDec or classBody.
typedef	Class with stereotype other than 'typedef' Corresponds To: This Class being defined in a 'typedef' statement.
typeSynonyms	Class Corresponds To: The 'typedef' name and/or fields of this type.

C Code Generation for UML Model

UML	C Code
A Class	A pair of C files (.h + .c) Notes: File name is the same as Class name
Operation (public & protected)	Function declaration in .h file and definition in .c file Notes:
Operation (private)	Function definition in .c file only Notes:
Operation (static)	Function definition in .c file only Notes: Static functions will only appear in the .c file regardless of their scope.
Attribute (public & protected)	Variable definition in .h file Notes:
Attribute (private)	Variable definition in .c file Notes:
Inner Class (without stereotype)	(N/A) Notes: This inner Class would be ignored

Capture #define value to be generated in C code

For example, #define PI 3.14.

Step	Process
1	Add an attribute to the Class, with Name = PI and Initial Value = 3.14.
2	In the properties panel of the 'Attributes' page, update the 'Static' and 'Const' fields.
3	On the 'Tagged Values' tab of the 'Attributes' page, add a tag called 'define' with the value True.

Notes

- Separate conventions apply to Object Oriented programming in C

Object Oriented Programming In C

In Enterprise Architect, you apply a number of conventions for Object-Oriented programming in C.

To configure the system to support Object-Oriented programming using C, you must set the 'Object Oriented Support' option to True on the 'C Specifications' page of the 'Preferences' dialog.

Stereotypes

Stereotype	Applies To
enumeration	Class Corresponds To: An enumerated type.
struct	Class Corresponds To: A 'struct' type.
Attribute	A keyword struct in variable definition.
typedef	Class Corresponds To: A 'typedef' statement, where the parent is the original type name.
union	Class Corresponds To: A union type.
Attribute	A keyword union in variable definition.

Tagged Values

Tag	Applies To
anonymous	Class with stereotype of 'enumeration', 'struct' or 'union' Corresponds To: The name of this Class being defined only by the typedef statement.
bodyLocation	Operation Corresponds To: The location the method body is generated to; expected values are 'header', 'classDec' or 'classBody'.
define	Attribute Corresponds To: '#define' statement.
typedef	Class with stereotype of 'enumeration', 'struct' or 'union' Corresponds To: This Class being defined in a 'typedef' statement.

Object-Oriented C Code Generation for UML Model

The basic idea of implementing a UML Class in C code is to group the data variable (UML attributes) into a structure type; this structure is defined in a .h file so that it can be shared by other Classes and by the client that referred to it.

An operation in a UML Class is implemented in C code as a function; the name of the function must be a fully qualified name that consists of the operation name, as well as the Class name to indicate that the operation is for that Class.

A delimiter (specified in the 'Namespace Delimiter' option on the 'C Specifications' page) is used to join the Class name and function (operation) name.

The function in C code must also have a reference parameter to the Class object - you can modify the 'Reference as Operation Parameter', 'Reference Parameter Style' and 'Reference Parameter Name' options on the 'C Specifications' page to support this reference parameter.

Limitations of Object-Oriented Programming in C

- No scope mapping for an attribute: an attribute in a UML Class is mapped to a structure variable in C code, and its scope (private, protected or public) is ignored
- Currently an inner Class is ignored: if a UML Class is the inner Class of another UML Class, it is ignored when generating C code
- Initial value is ignored: the initial value of an attribute in a UML Class is ignored in generated C code

C# Conventions

Enterprise Architect supports the round trip engineering of C#, where these conventions are used.

Stereotypes

Stereotype	Applies To
enumeration	Class Corresponds To: An enumerated type.
event	Operation Corresponds To: An event.
extension	Operation Corresponds To: A Class extension method, represented in code by a 'this' parameter in the signature.
indexer	Operation Corresponds To: A property acting as an index for this Class.
partial	Operation Corresponds To: The 'partial' keyword on an operation.
property	Operation Corresponds To: A property possibly containing both read and write code.
struct	Class Corresponds To: A 'struct' type.

Tagged Values

Tag	Applies To
argumentName	Operation with stereotype extension Corresponds To: The name given to this parameter.
attribute_name	Operation with stereotype property or event Corresponds To: The name of the variable behind this property or event.
className	Operation with stereotype extension Corresponds To: The Class that this method is being added to.
const	Attribute

	Corresponds To: The const keyword.
definition	Operation with stereotype partial Corresponds To: Whether this is the declaration of the method, or the definition.
delegate	Operation Corresponds To: The 'delegate' keyword.
enumType	Operation with stereotype property Corresponds To: The datatype that the property is represented as.
expressionBody	Operation, Operation with stereotype property or indexer Corresponds To: 'True' if the 'Behavior Code' is from an expression body function member.
extern	Operation Corresponds To: The 'extern' keyword.
fixed	Attribute Corresponds To: The 'fixed' keyword.
generic	Operation Corresponds To: The generic parameters for this operation.
genericConstraints	Templated Class or Interface, Operation with tag 'generic' Corresponds To: The constraints on the generic parameters of this type or operation.
Implements	Operation Corresponds To: The name of the method this implements, including the interface name.
ImplementsExplicit	Operation Corresponds To: The presence of the source interface name in this method declaration.
initializer	Operation Corresponds To: A constructor initialization list.
new	Class, Interface, Operation Corresponds To: The 'new' keyword.
override	Operation Corresponds To: The 'override' keyword.
params	Parameter Corresponds To: A parameter list using the 'params' keyword.
partial	Class, Interface Corresponds To: The 'partial' keyword.

propertyInitializer	Operation with stereotype property Corresponds To: A property initializer.
readonly	Operation, <<struct>>Class Corresponds To: The 'readonly' keyword.
ref	Operation, <<struct>>Class Corresponds To: The 'ref' keyword.
sealed	Operation Corresponds To: The 'sealed' keyword.
static	Class Corresponds To: The 'static' keyword.
unsafe	Class, Interface, Operation Corresponds To: The 'unsafe' keyword.
virtual	Operation Corresponds To: The 'virtual' keyword.
writeonly	Operation with stereotype property Corresponds To: This property only defining 'write' code.

Other Conventions

- Namespaces are generated for each Package below a namespace root
- The Const property of an attribute corresponds to the readonly keyword, while the tag const corresponds to the const keyword
- The value of inout for the Kind property of a parameter corresponds to the ref keyword
- The value of out for the Kind property of a parameter corresponds to the out keyword
- Partial Classes can be modeled as two separate Classes with the partial tag
- The Is Leaf property of a Class corresponds to the sealed keyword

C++ Conventions

Enterprise Architect supports round trip engineering of C++, including the Managed C++ and C++/CLI extensions, where these conventions are used.

Stereotypes

Stereotype	Applies To
enumeration	Class Corresponds To: An enumerated type.
friend	Operation Corresponds To: The 'friend' keyword.
property get	Operation Corresponds To: A 'read' property.
property set	Operation Corresponds To: A 'write' property.
struct	Class Corresponds To: A 'struct' type.
typedef	Class Corresponds To: A 'typedef' statement, where the parent is the original type name.
alias	Class Corresponds to an 'Alias' declaration, where the parent is the original type name.
union	Class Corresponds To: A union type.

Tagged Values

Tag	Applies To
afx_msg	Operation Corresponds To: The afx_msg keyword.
anonymous	Class also containing the Tagged Value typedef Corresponds To: The name of this Class being only defined by the typedef statement.

attribute_name	Operation with stereotype property get or property set Corresponds To: The name of the variable behind this property.
bitfield	Attribute Corresponds To: The size, in bits, allowed for storage of this attribute.
bodyLocation	Operation Corresponds To: The location the method body is generated to; expected values are header, classDec or classBody.
callback	Operation Corresponds To: A reference to the CALLBACK macro.
explicit	Operation Corresponds To: The 'explicit' keyword.
initializer	Operation Corresponds To: A constructor initialization list.
inline	Operation Corresponds To: The inline keyword and inline generation of the method body.
mutable	Attribute Corresponds To: The 'mutable' keyword.
scoped	Class with stereotype enumeration Corresponds To: Either the 'class' or 'struct' keyword.
throws	Operation Corresponds To: The exceptions that are thrown by this method.
typedef	Class with stereotype other than 'typedef' Corresponds To: This Class being defined in a 'typedef' statement.
typeSynonyms	Class Corresponds To: The 'typedef' name and/or fields of this type.
volatile	Operation Corresponds To: The 'volatile' keyword.

Other Conventions

- Namespaces are generated for each Package below a namespace root
- By Reference attributes correspond to a pointer to the type specified
- The Transient property of an attribute corresponds to the volatile keyword
- The Abstract property of an attribute corresponds to the virtual keyword

- The Const property of an operation corresponds to the const keyword, specifying a constant return type
- The Is Query property of an operation corresponds to the const keyword, specifying the method doesn't modify any fields
- The Pure property of an operation corresponds to a pure virtual method using the "= 0" syntax
- The Fixed property of a parameter corresponds to the const keyword

Managed C++ Conventions

These conventions are used for managed extensions to C++ prior to C++/CLI. In order to set the system to generate managed C++ you must modify the C++ version in the C++ Options.

Stereotypes

Stereotype	Applies To
property	Operation Corresponds To: The '__property' keyword.
property get	Operation Corresponds To: The '__property' keyword and a read property.
property set	Operation Corresponds To: The '_ _property' keyword and a 'write' property.
reference	Class Corresponds To: The '__gc' keyword.
value	Class Corresponds To: The '__value' keyword.

Tagged Values

Tag	Applies To
managedType	Class with stereotype reference, value or enumeration; Interface Corresponds To: The keyword used in declaration of this type; expected values are 'class' or 'struct'.

Other Conventions

- The typedef and anonymous tags from native C++ are not supported
- The Pure property of an operation corresponds to the keyword __abstract

C++/CLI Conventions

These conventions are used for modeling C++/CLI extensions to C++. In order to set the system to generate managed C++/CLI you must modify the C++ version in the C++ Options.

Stereotypes

Stereotype	Applies To
event	Operation Description: Defines an event to provide access to the event handler for this Class.
property	Operation, Attribute Description: This is a property possibly containing both read and write code.
reference	Class Description: Corresponds to the 'ref class' or 'ref struct' keyword.
value	Class Description: Corresponds to the 'value class' or 'value struct' keyword.

Tagged Values

Tag	Applies To
attribute_name	Operation with stereotype property or event Description: The name of the variable behind this property or event.
generic	Operation Description: Defines the generic parameters for this Operation.
genericConstraints	Templated Class or Interface, Operation with tag generic Description: Defines the constraints on the generic parameters for this Operation.
initonly	Attribute Description: Corresponds to the 'initonly' keyword.
literal	Attribute Description: Corresponds to the literal keyword.
managedType	Class with stereotype reference, value or enumeration; Interface Description: Corresponds to either the 'class' or 'struct' keyword.

Other Conventions

- The typedef and anonymous tags are not used
- The property get/property set stereotypes are not used
- The Pure property of an operation corresponds to the keyword abstract

Delphi Conventions

Enterprise Architect supports round trip engineering of Delphi, where these conventions are used:

Stereotypes

Stereotype	Applies To
constructor	Operation Corresponds To: A constructor.
destructor	Operation Corresponds To: A destructor.
dispinterface	Class, Interface Corresponds To: A dispatch interface.
enumeration	Class Corresponds To: An enumerated type.
metaclass	Class Corresponds To: A metaclass type.
object	Class Corresponds To: An object type.
operator	Operation Corresponds To: An operator.
property get	Operation Corresponds To: A 'read' property.
property set	Operation Corresponds To: A 'write' property.
struct	Class Corresponds To: A record type.

Tagged Values

Tag	Applies To
attribute_name	Operation with stereotype property get or property set Corresponds To: The name of the variable behind this property.

overload	Operation Corresponds To: The 'overload' keyword.
override	Operation Corresponds To: The 'override' keyword.
packed	Class Corresponds To: The 'packed' keyword.
property	Class Corresponds To: A property; see *Delphi Properties* for more information.
reintroduce	Operation Corresponds To: The 'reintroduce' keyword.

Other Conventions

- The Static property of an attribute or operation corresponds to the 'class' keyword
- The Fixed property of a parameter corresponds to the 'const' keyword
- The value of inout for the Kind property of a parameter corresponds to the 'Var' keyword
- The value of out for the Kind property of a parameter corresponds to the 'Out' keyword

Java Conventions

Enterprise Architect supports round trip engineering of Java - including AspectJ extensions - where these conventions are used.

Stereotypes

Stereotype	Applies To
annotation	Interface Corresponds To: An annotation type.
default	Operation Corresponds To: The 'default' keyword.
enum	Attributes within a Class stereotyped enumeration Corresponds To: An enumerated option, distinguished from other attributes that have no stereotype.
enumeration	Class Corresponds To: An enumerated type.
operator	Operation Corresponds To: An operator.
property get	Operation Corresponds To: A 'read' property.
property set	Operation Corresponds To: A 'write' property.
static	Class or Interface Corresponds To: The 'static' keyword.

Tagged Values

Tag	Applies To
annotations	Anything Corresponds To: The annotations on the current code feature.
arguments	Attribute with stereotype enum Corresponds To: The arguments that apply to this enumerated value.

attribute_name	Operation with stereotype property get or property set Corresponds To: The name of the variable behind this property.
dynamic	Class or Interface Corresponds To: The 'dynamic' keyword.
generic	Operation Corresponds To: The generic parameters to this operation.
parameterList	Parameter Corresponds To: A parameter list with the ... syntax.
throws	Operation Corresponds To: The exceptions that are thrown by this method.
transient	Attribute Corresponds To: The 'transient' keyword.

Other Conventions

- Package statements are generated when the current Package is not a namespace root
- The Const property of an attribute or operation corresponds to the final keyword
- The Transient property of an attribute corresponds to the volatile keyword
- The Fixed property of a parameter corresponds to the final keyword

AspectJ Conventions

These are the conventions used for supporting AspectJ extensions to Java.

Stereotypes

Stereotype	Applies To
advice	Operation Corresponds To: A piece of advice in an AspectJ aspect.
aspect	Class Corresponds To: An AspectJ aspect.
pointcut	Operation Corresponds To: A 'pointcut' in an AspectJ aspect.

Tagged Values

Tag	Applies To
className	Attribute or operation within a Class stereotyped aspect Corresponds To: The Classes this AspectJ intertype member belongs to.

Other Conventions

- The specifications of a pointcut are included in the 'Behavior' field of the method

PHP Conventions

Enterprise Architect supports the round trip engineering of PHP 4 and 5, where these conventions are used.

Stereotypes

Stereotype	Applies To
trait	Class Corresponds To: A 'trait'.
property get	Operation Corresponds To: A 'read' property.
property set	Operation Corresponds To: A 'write' property.

Tagged Values

Tag	Applies To
attribute_name	Operation with stereotype property get or property set Corresponds To: The name of the variable behind this property.
final	Operations in PHP 5 Corresponds To: The 'final' keyword.

Common Conventions

- An unspecified type is modeled as var
- Methods returning a reference are generated by setting the Return Type to var*
- Reference parameters are generated from parameters with the parameter Kind set to inout or out

PHP 5 Conventions

- The final Class modifier corresponds to the Is Leaf property
- The abstract Class modifier corresponds to the Abstract property
- Parameter type hinting is supported by setting the Type of a parameter
- The value of inout or out for the Kind property of a parameter corresponds to a reference parameter

Python Conventions

Enterprise Architect supports the round trip engineering of Python, where these conventions are used.

Tagged Values

Tag	Applies To
Decorators	Class, Operation Corresponds To: The decorators applied to this element in the source.

Other Conventions

- Model members with Private Scope correspond to code members with two leading underscores
- Attributes are only generated when the Initial value is not empty
- All types are reverse engineered as var

SystemC Conventions

Enterprise Architect supports round-trip engineering of SystemC, where these conventions are used.

Stereotypes

Stereotype	Applies To
delegate	Method Corresponds To: A delegate.
enumeration	Inner Class Corresponds To: An enum type.
friend	Method Corresponds To: A friend method.
property	Method Corresponds To: A property definition.
sc_ctor	Method Corresponds To: A SystemC constructor.
sc_module	Class Corresponds To: A SystemC module.
sc_port	Attribute Corresponds To: A port.
sc_signal	Attribute Corresponds To: A signal.
struct	Inner Class Corresponds To: A struct or union.

Tagged Values

Tag	Applies To
kind	Attribute (Port) Corresponds To: Port kind (clocked, fifo, master, slave, resolved, vector).
mode	Attribute (Port) Corresponds To: Port mode (in, out, inout).

overrides	Method Corresponds To: The Inheritance list of a method declaration.
throw	Method Corresponds To: The exception specification of a method.

Other Conventions

- SystemC also inherits most of the stereotypes and Tagged Values of C++

SystemC Toolbox Pages

To model a SystemC design, drag these icons onto a diagram from the 'SystemC Constructs' page of the Diagram Toolbox.

Page	Icon
SystemC	Module Action: Defines a SystemC Module. An sc_module -stereotyped Class element.
SystemC Features	Port Action: Defines a SystemC Port. An sc_port- stereotyped attribute.

Access

Ribbon	Design > Diagram > Toolbox :  > Specify 'SystemC Constructs' in the 'Find Toolbox Item' dialogs
Keyboard Shortcuts	Ctrl+Shift+3 :  > Specify 'SystemC Constructs' in the 'Find Toolbox Item' dialog
Other	You can display or hide the Diagram Toolbox by clicking on the  or  icons at the left-hand end of the Caption Bar at the top of the Diagram View.

VB.NET Conventions

Enterprise Architect supports round-trip engineering of Visual Basic.NET, where these conventions are used. Earlier versions of Visual Basic are supported as a different language.

Stereotypes

Stereotype	Applies To
event	Operation Corresponds To: An event declaration.
import	Operation Corresponds To: An operation to be imported from another library.
module	Class Corresponds To: A module.
operator	Operation Corresponds To: An operator overload definition.
partial	Operation Corresponds To: The 'partial' keyword on an operation.
property	Operation Corresponds To: A property possibly containing both read and write code.

Tagged Values

Tag	Applies To
Alias	Operation with stereotype import Corresponds To: The alias for this imported operation.
attribute_name	Operation with stereotype property Corresponds To: The name of the variable behind this property.
Charset	Operation with stereotype import Corresponds To: The character set clause for this import - one of the values 'Ansi', 'Unicode' or 'Auto'.
delegate	Operation Corresponds To: The 'delegate' keyword.

enumTag	Operation with stereotype property Corresponds To: The datatype that this property is represented as.
Handles	Operation Corresponds To: The 'handles' clause on this operation.
Implements	Operation Corresponds To: The 'implements' clause on this operation.
Lib	Operation with stereotype import Corresponds To: The library this import comes from.
MustOverride	Operation Corresponds To: The 'MustOverride' keyword.
Narrowing	Operation with stereotype operator Corresponds To: The 'Narrowing' keyword.
NotOverrideable	Operation Corresponds To: The 'NotOverrideable' keyword.
Overloads	Operation Corresponds To: The 'overloads' keyword.
Overrides	Operation Corresponds To: The 'overrides' keyword.
parameterArray	Parameter Corresponds To: A parameter list using the 'ParamArray' keyword.
partial	Class, Interface Corresponds To: The 'partial' keyword.
readonly	Operation with stereotype property Corresponds To: This property only defining 'read' code.
shadows	Class, Interface, Operation Corresponds To: The 'Shadows' keyword.
Shared	Attribute Corresponds To: The 'Shared' keyword.
Widening	Operation with stereotype operator Corresponds To: The 'Widening' keyword.
writeonly	Operation with stereotype property Corresponds To: This property only defining 'write' code.

Other Conventions

- Namespaces are generated for each Package below a namespace root
- The Is Leaf property of a Class corresponds to the NotInheritable keyword
- The Abstract property of a Class corresponds to the MustInherit keyword
- The Static property of an attribute or operation corresponds to the Shared keyword
- The Abstract property of an operation corresponds to the MustOverride keyword
- The value of in for the Kind property of a parameter corresponds to the ByVal keyword
- The value of inout or out for the Kind property of a parameter corresponds to the ByRef keyword

Verilog Conventions

Enterprise Architect supports round-trip engineering of Verilog, where these conventions are used.

Stereotypes

Stereotype	Applies To
asynchronous	Method Corresponds To: A concurrent process.
enumeration	Inner Class Corresponds To: An enum type.
initializer	Method Corresponds To: An initializer process.
module	Class Corresponds To: A module.
part	Attribute Corresponds To: A component instantiation.
port	Attribute Corresponds To: A port.
synchronous	Method Corresponds To: A sequential process.

Tagged Values

Tag	Applies To
kind	Attribute (signal) Corresponds To: The signal kind (such as register, bus).
mode	Attribute (Port) Corresponds To: The Port mode (in, out, inout).
Portmap	Attribute (part) Corresponds To: The generic/Port map of the component instantiated.
sensitivity	Method Corresponds To: The sensitivity list of a sequential process.

type	Attribute Corresponds To: The range or type value of an attribute.

Verilog Toolbox Pages

Access: 'Design > Diagram > Toolbox : 'Hamburger' icon > HDL | Verilog Constructs'

Drag these icons onto a diagram to model a Verilog design.

Item	Action
Module	Defines a Verilog Module. A module-stereotyped Class element.
Enumeration	Defines an Enumerated Type. An enumeration element.
Port	Defines a Verilog Port. A port-stereotyped attribute.
Part	Defines a Verilog component instantiation. A part-stereotyped attribute.
Attribute	Defines an attribute.
Procedure	Defines a Verilog process: • Concurrent - An asynchronous-stereotyped method • Sequential - A synchronous-stereotyped method • Initializer - An initializer-stereotyped method

VHDL Conventions

Enterprise Architect supports round-trip engineering of VHDL, where these conventions are used.

Stereotypes

Stereotype	Applies To
architecture	Class Corresponds To: An architecture.
asynchronous	Method Corresponds To: An asynchronous process.
configuration	Method Corresponds To: A configuration.
enumeration	Inner Class Corresponds To: An enumerated type.
entity	Interface Corresponds To: An entity.
part	Attribute Corresponds To: A component instantiation.
port	Attribute Corresponds To: A port.
signal	Attribute Corresponds To: A signal declaration.
struct	Inner Class Corresponds To: A record definition.
synchronous	Method Corresponds To: A synchronous process.
typedef	Inner Class Corresponds To: A type or subtype definition.

Tagged Values

Tag	Applies To

isGeneric	Attribute (port) Corresponds To: The 'port' declaration in a generic interface.
isSubType	Inner Class (typedef) Corresponds To: A subtype definition.
kind	Attribute (signal) Corresponds To: The signal kind (such as 'register', 'bus').
mode	Attribute (Port) Corresponds To: The Port mode ('in', 'out', 'inout', 'buffer', 'linkage').
portmap	Attribute (part) Corresponds To: The generic/Port map of the component instantiated.
sensitivity	Method (synchronous) Corresponds To: The 'sensitivity' list of a synchronous process.
type	Inner Class (typedef) Corresponds To: The 'type' indication of a 'type' declaration.
typeNameSpace	Attribute (part) Corresponds To: The 'type' namespace of the instantiated component.

VHDL Toolbox Pages

Access

To model a VHDL design, drag icons from the VHDL toolbox pages and drop them on your diagram.

Ribbon	Design > Diagram > Toolbox :  > Specify 'VHDL Constructs' in the 'Find Toolbox Item' dialog
Keyboard Shortcuts	Ctrl+Shift+3 :  > Specify 'VHDL Constructs' in the 'Find Toolbox Item' dialog
Other	You can display or hide the Diagram Toolbox by clicking on the  or  icons at the left-hand end of the Caption Bar at the top of the Diagram View.

VHDL Toolbox Page

Item	Action
Architecture	Defines an architecture to be associated with a VHDL entity. An architecture-stereotyped Class element.
Entity	Defines a VHDL entity to contain the Port definitions. An entity-stereotyped interface element.
Enumeration	Defines an Enumerated Type. An Enumeration element.
Struct	Defines a VHDL record. A struct-stereotyped Class element.
Typedef	Defines a VHDL type or subtype. A typedef-stereotyped Class element.

VHDL Features Toolbox Page

Item	Action
Part	Defines a VHDL component instantiation. A part-stereotyped attribute.
Port	Defines a VHDL Port. A port-stereotyped attribute.
Signal	Defines a VHDL signal. A signal-stereotyped attribute.
Procedure	Defines a VHDL process: • Concurrent - An asynchronous-stereotyped method • Sequential - A synchronous-stereotyped method • Configuration - An configuration-stereotyped method

Visual Basic Conventions

Enterprise Architect supports the round trip engineering of Visual Basic 5 and 6, where these conventions are used. Visual Basic .NET is supported as a different language.

Stereotypes

Stereotype	Applies To
global	Attribute Corresponds To: The 'Global' keyword.
import	Operation Corresponds To: An operation to be imported from another library.
property get	Operation Corresponds To: A property 'get'.
property set	Operation Corresponds To: A property 'set'.
property let	Operation Corresponds To: A property 'let'.
with events	Attribute Corresponds To: The 'WithEvents' keyword.

Tagged Values

Tag	Applies To
Alias	Operation with stereotype import Corresponds To: The alias for this imported operation.
attribute_name	Operation with stereotype property get, property set or property let Corresponds To: The name of the variable behind this property.
Lib	Operation with stereotype import Corresponds To: The library this import comes from.
New	Attribute Corresponds To: The 'new' keyword.

Other Conventions

- The value of in for the Kind property of a parameter corresponds to the ByVal keyword
- The value of inout or out for the Kind property of a parameter corresponds to the ByRef keyword

Language Options

You can set up various options for how Enterprise Architect handles a particular language when generating and reverse-engineering code. These options are either specific to:

- Your user ID, for all models or
- The model in which they are defined, for all users

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > <language name> Configure > Model > Options > Source Code Engineering > <language name>
Keyboard Shortcuts	Ctrl+F9 ('Preferences' dialog)

Languages Supported

Language
Action Script
Ada 2012 (in the Unified and Ultimate editions of Enterprise Architect)
ArcGIS
ANSI C
C#
C++
Delphi
Java
PHP
Python
SystemC
Verilog (Unified and Ultimate editions)
VHDL (Unified and Ultimate editions)

Visual Basic
Visual Basic .NET

ActionScript Options - User

If you intend to generate ActionScript code from your model, you can configure the code generation options using the 'ActionScript Specifications' page of the 'Preferences' dialog to:

- Specify the default source directory
- Specify the editor for ActionScript code

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > ActionScript
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support ActionScript code generation. Select this checkbox to disable ActionScript code support.
Options for the current user	In the 'Default Source Directory' and 'Editor' fields, click on the  button and browse for the source directory and external file editor that you will use.

Notes

- These options apply to all models that you access

ActionScript Options - Model

If you intend to generate ActionScript code from your model, you can configure the model-specific code generation options using the 'ActionScript Specifications' page of the 'Manage Project Options' dialog to:

- Specify default ActionScript version to generate (AS2.0 or AS3.0)
- Specify default file extensions
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > ActionScript

Options

Option	Action
Options for the current model	Type in the default ActionScript version and default file extension to apply when generating ActionScript source code.
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

Ada 2012 Options - User

If you intend to generate Ada 2012 code from your model, you can configure the code generation options using the 'Ada' page of the 'Preferences' dialog to:

- Inform the reverse engineering process whether the name of the Tagged Record is the same as the Package name
- Advise the engine of the alternate Tagged Record name to locate
- Specify whether the engine should create a reference type for the Tagged Record (if one is not defined)
- Supply the name of the reference type to be created (default is Ref)
- Specify the reference parameter of a Reference / Access type
- Tell the engine to ignore the name of the reference parameter
- Indicate the name of the reference parameter to locate

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > Ada
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support Ada 2012 code generation. Select this checkbox to disable Ada 2012 code support.
Options for the current user	Specifies the options used for the current user; these options apply to all models that are accessed by the user.

Notes

- Ada 2012 support is available in the Unified and Ultimate editions of Enterprise Architect

Ada 2012 Options - Model

If you intend to generate Ada 2012 code from your model, you can configure the model-specific code generation options using the 'Ada' page of the 'Manage Project Options' dialog to:

- Specify the default file extension and
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > Ada

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating Ada source code.
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models
- Ada 2012 support is available in the Unified and Ultimate editions of Enterprise Architect

ArcGIS Options - User

If you intend to generate ArcGIS code from your model, you can configure the code generation options using the 'ArcGIS' page of the 'Preferences' dialog to:

- Specify default source directory
- Specify the editor for ArcGIS code

ArcGIS must be enabled in the 'MDG Technologies' dialog ('Specialize > Technologies > Manage') in order for the 'ArcGIS' page to be available.

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > ArcGIS
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support ArcGIS code generation. Select this checkbox to disable ArcGIS code support.
Options for the current user	Specifies the options used for the current user; these options apply to all models that are accessed by the user.

ArcGIS Options - Model

If you intend to generate ArcGIS code from your model, you can configure the model-specific code generation options using the 'ArcGIS' page of the 'Manage Project Options' dialog to:

- Specify default file extensions
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > ArcGIS

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating ArcGIS source code.
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

C Options - User

If you intend to generate C code from your model, you can configure the code generation options using the 'C Specifications' page of the 'Preferences' dialog.

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > C
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support C code generation. Select this option to disable C code support.
Options for the current user	In the value fields, specify the options that apply under your own user ID in all models that you access: • The default attribute type to create (fixed as int) • Whether a #define constant is imported as an attribute in imported C code (if 'Object Oriented programming' is set to True on the 'C Specifications' page of the 'Manage Project Options' dialog) • Whether to generate comments for C methods to the declaration, and to reverse engineer comments from the declaration • Whether to generate comments for C methods to the implementation, and to reverse engineer comments from the implementation • Whether to update comments in regenerating code from the model • Whether to update the implementation file in re-generating code from the model • The default source code directory location (click on the  button) • The default file extensions to read when importing a directory of C code • The Code Editor to use (click on the  button) • The search path for the implementation file relative to the header file path

C Options - Model

If you intend to generate C code from your model, you can configure the model-specific code generation options using the 'C Specifications' page of the 'Manage Project Options' dialog to:

- Specify default file extensions (header and source)
- Define support for Object Oriented programming
- Set the StateMachine engineering options
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > C

Options

Option	Action
Options for the current model	In the value fields, specify these options: • The default header and source file extensions for the code files • Support for Object Oriented programming; if this is True, then set: - The Namespace delimiter character - Whether the first parameter of an operation is a Class reference - The parameter reference style in generated C code - The reference parameter name in generated code - The default Constructor name in generated code - The default Destructor name in generated code
StateMachine Engineering	In the value fields, use the drop-down arrows to set the options to True or False; these options apply to generating code from StateMachine models in the current model only: • 'Use the new StateMachine Template' - set to True to use the code generation templates from Enterprise Architect Release 11 and later, set to False to apply the EASL Legacy templates • Generate Trace Code - set to True to generate Trace code, False to omit it
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

C# Options - User

If you intend to generate C# code from your model, you can configure the code generation options using the 'C# Specifications' page of the 'Preferences' dialog

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > C#
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support C# code generation. Select this checkbox to disable C# code support.
Options for the current user	In the value fields, specify the options that apply under your own user ID in all models that you access: • The default attribute type to create • Whether Namespaces should be generated when generating C# Classes • Whether to remove new lines (hard carriage returns) from the summary tag when importing XML.NET style comments • Whether to generate a Finalizer method when generating code for a C# Class • Whether to generate a Dispose method when generating code for a C# Class • The default source code directory location (click on the  button) • The Code Editor to use (click on the  button)

C# Options - Model

If you intend to generate C# code from your model, you can configure the model-specific code generation options using the 'C# Specifications' page of the 'Manage Project Options' dialog to:

- Specify the default file extension
- Indicate additional Collection Classes - to define custom Collection Classes, which can be simple substitutions (such as CArray<#TYPE#>) or a mix of other strings and substitutions (such as Cmap<CString,LPCTSTR,#TYPE#*,#TYPE#*>); these Collection Classes are defined by default:
  - List<#TYPE#>;Stack<#TYPE#>;Queue<#TYPE#>;
- Set the StateMachine Engineering options
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > C#

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating C# source code, and a list of any additional Collection Classes you want to define.
StateMachine Engineering	In the value fields, use the drop-down arrows to set the options to True or False; these options apply to generating code from StateMachine models in the current model only: • 'Use the new StateMachine Template' - set to True to use the code generation templates from Enterprise Architect Release 11 and later, set to False to apply the EASL Legacy templates • 'Generate Trace Code' - set to True to generate Trace code, False to omit it
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

C++ Options - User

If you intend to generate C++ code from your model, you can configure the code generation options using the 'C++ Specifications' page of the 'Preferences' dialog.

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > C++
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support C++ code generation. Select this option to disable C++ code support.
Options for the current user	In the value fields, specify the options that apply under your own user ID in all models that you access: • The default attribute type to create • Whether Namespaces should be generated when generating C++ Classes • What style to apply when generating and processing comments for C++ • Whether to generate comments for C++ methods to the declaration, or reverse engineer comments from the declaration • Whether to generate comments for C++ methods to the implementation, or reverse engineer comments from the implementation • Whether to update comments in re-generating code from the model • Whether to update the implementation file in re-generating code from the model • The default source code directory location (click on the  button) • The default file extensions to read when importing a directory of C++ code • The Code Editor to use (click on the  button) • The search path for the implementation file relative to the header file path

C++ Options - Model

If you intend to generate C++ code from your model, you can configure the model-specific code generation options using the 'C++ Specifications' page of the 'Manage Project Options' dialog to:

- Indicate the version of C++ to generate; this controls the set of templates used and how properties are created
- Specify the default reference type used when a type is specified by reference
- Specify the default file extensions
- Specify default Get/Set prefixes
- Specify the Collection Class definitions for Association connectors
- Define additional Collection Classes - to define custom Collection Classes, which can be simple substitutions (such as CArray<#TYPE#>) or a mix of other strings and substitutions (such as Cmap<CString,LPCTSTR,#TYPE#*,#TYPE#*>); these Collection Classes are defined by default:
  - CArray<#TYPE#>;CMap<CString,LPCTSTR,#TYPE#*,#TYPE#*>;
- Set the StateMachine Engineering options

Access

Ribbon	Configure > Model > Options > Source Code Engineering > C++

Options

Option	Action
Options for the current model	In the value fields, specify the options that affect all users of the current model: • The version of C++ you are using (which determines which templates to use when generating code) • The default reference type to use when creating properties for C++ attributes by reference • The default header and source file extensions for the code files • The default 'Get' prefix • The default 'Set' prefix • The additional Collection Classes
StateMachine Engineering Options	In the value fields, use the drop-down arrows to set the options to True or False; these options apply to generating code from StateMachine models in the current model only: • 'Use the new StateMachine Template' - set to True to use the code generation templates from Enterprise Architect Release 11 and later, set to False to apply the EASL Legacy templates • 'Generate Trace Code' - set to True to generate Trace code, False to omit it
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

Delphi Options - User

If you intend to generate Delphi code from your model, you can configure the code generation options using the 'Delphi Specifications' page of the 'Preferences' dialog to:

- Set the default attribute type
- Indicate a default source directory
- Set the default code editor to use to edit Delphi source code

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > Delphi
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support Delphi code generation. Select this option to disable Delphi code support.
Options for the current user	Specifies the options used for the current user; these options apply to all models that are accessed by the user.

Delphi Options - Model

If you intend to generate Delphi code from your model, you can configure the model-specific code generation options using the 'Delphi Specifications' page of the 'Manage Project Options' dialog to:

- Specify default file extensions (header and source)
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > Delphi

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating Delphi source code.
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

Delphi Properties

Enterprise Architect has comprehensive support for Delphi properties. These are implemented as Tagged Values, with a specialized property editor to help create and modify Class properties. By using the 'Feature Visibility' element context menu option, you can display the 'tags' compartment that contains the properties. Imported Delphi Classes with properties have this feature automatically made visible for your convenience.

Manually activate the property editor

- In the selected Class set the code generation language to 'Delphi'
- Right-click on the Class and select 'Delphi Properties' to open the editor

Using the Delphi Properties editor, you can build properties quickly and simply; from here you can:

- Change the name and scope (only Public and Published are currently supported)
- Change the property type (the drop-down list includes all defined Classes in the project)
- Set the Read and Write information (the drop-down lists have all the attributes and operations from the current Class; you can also enter free text)
- Set 'Stored' to True or False
- Set the Implements information
- Set the default value, if one exists

Notes

- When you use the 'Create Property' dialog from the 'Attribute' screen, the system generates a pair of Get and Set functions together with the required property definition as Tagged Values; you can manually edit these Tagged Values if required
- Public properties are displayed with a '+' symbol prefix and published with a '^'
- When creating a property in the 'Create Property Implementation' dialog (accessed through the 'Attributes' dialog), you can set the scope to 'Published' if the property type is Delphi
- Only 'Public' and 'Published' are supported
- If you change the name of a property and forward engineer, a new property is added, but you must manually delete the old one from the source file

Java Options - User

If you intend to generate Java code from your model, you can configure the code generation options using the 'Java Specifications' page of the 'Preferences' dialog.

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > Java
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support Java code generation. Select this checkbox to disable Java code support.
Options for the current user	In the value fields, specify the options that apply under your own user ID in all models that you access; the: • Default attribute type to create (select from the drop-down list) • Default source code directory location (click on the ... button) • Code Editor to use (click on the ... button)

Java Options - Model

If you intend to generate Java code from your model, you can configure the model-specific code generation options using the 'Java Specifications' page of the 'Manage Project Options' dialog to:

- Specify the default file extension
- Specify a default 'Get' prefix
- Specify a default 'Set' prefix
- Set the StateMachine Engineering options
- Specify the Collection Class definitions for Association connectors
- Define additional Collection Classes - to define custom Collection Classes, which can be simple substitutions (such as CArray<#TYPE#>) or a mix of other strings and substitutions (such as Cmap<CString,LPCTSTR,#TYPE#*,#TYPE#*>); these Collection Classes are defined by default:
  - HashSet<#TYPE#>;Map<String,#TYPE#>;

Access

Ribbon	Configure > Model > Options > Source Code Engineering > Java

Options

Option	Action
Options for the current model	In the value fields, specify the options that affect all users of the current model; the: • Default file extension for the code files • The default Get and Set prefixes • The default and additional Collection Classes
StateMachine Engineering	In the value fields, use the drop-down arrows to set the options to True or False; these options apply to generating code from StateMachine models in the current model only: • 'Use the new StateMachine Template' - set to True to use the code generation templates from Enterprise Architect Release 11 and later, set to False to apply the EASL Legacy templates • 'Generate Trace Code' - set to True to generate Trace code, False to omit it
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

PHP Options - User

If you intend to generate PHP code from your model, you can configure the code generation options using the 'PHP Specifications' page of the 'Preferences' dialog to:

- Define a semi-colon separated list of extensions to look at when doing a directory code import for PHP
- Set a default directory for opening and saving PHP source code
- Specify the default editor to use when editing PHP code

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > PHP
Keyboard Shortcuts	Ctrl+F9 | Source Code Engineering | PHP

Options

Option	Action
Disable Language	Leave this checkbox unselected to support PHP code generation. Select this option to disable PHP code support.
Options for the current user	Specifies the options used for the current user; these options apply to all models that are accessed by the user.

PHP Options - Model

If you intend to generate PHP code from your model, you can configure the model-specific code generation options using the 'PHP Specifications' page of the 'Manage Project Options' dialog to:

- Specify the default PHP version to generate
- Define the default file extension
- Specify a default 'Get' prefix
- Specify a default 'Set' prefix

Access

Ribbon	Configure > Model > Options > Source Code Engineering > PHP

Options

Option	Action
Options for the current model	Type in the default PHP version, the default file extension to apply when generating PHP source code, and the default 'Get' and 'Set' prefixes.

Notes

- These options affect all users of the current model; however, they do not apply to other models

Python Options - User

If you intend to generate Python code from your model, you can configure the code generation options using the 'Python Specifications' page of the 'Preferences' dialog to:

- Specify the default source directory to be used
- Specify the default editor used to write and edit Python code

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > Python
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support Python code generation. Select this option to disable Python code support.
Options for the current user	Specifies the options used for the current user; these options apply to all models that are accessed by the user.

Python Options - Model

If you intend to generate Python code from your model, you can configure the model-specific code generation options using the 'Python Specifications' page of the 'Manage Project Options' dialog to:

- Specify the default file extension

Access

Ribbon	Configure > Model > Options > Source Code Engineering > Python

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating Python source code.

Notes

- These options affect all users of the current model; however, they do not apply to other models

SystemC Options - User

If you intend to generate SystemC code from your model, you can configure the code generation options using the 'SystemC' page of the 'Preferences' dialog to:

- Specify a default source directory
- Specify an editor for changing code

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > SystemC
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support SystemC code generation. Select this option to disable SystemC code support.
Options for the current user	Specifies the options used for the current user; these options apply to all models that are accessed by the user.

SystemC Options - Model

If you intend to generate SystemC code from your model, you can configure the model-specific code generation options using the 'SystemC' page of the 'Manage Project Options' dialog to:

- Specify the default file extension
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > SystemC

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating SystemC source code.
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

VB.NET Options - User

If you intend to generate VB.NET code from your model, you can configure the code generation options using the 'VB.NET Specifications' page of the 'Preferences' dialog to:

- Specify the default attribute type
- Indicate whether to generate namespaces
- Specify a default source directory
- Specify an editor for changing code

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > VB.Net
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support VB.NET code generation. Select this option to disable VB.NET code support.
Options for the current user	Specifies the options used for the current user; these options apply to all models that are accessed by the user.

VB.NET Options - Model

If you intend to generate VB.NET code from your model, you can configure the model-specific code generation options using the 'VB.Net Specifications' page of the 'Manage Project Options' dialog to:

- Specify the default file extension
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > VB.Net

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating VB.Net source code.
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

Verilog Options - User

If you intend to generate Verilog code from your model, you can configure the code generation options using the 'Verilog' page of the 'Preferences' dialog to:

- Specify a default source directory
- Specify an editor for changing code

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > Verilog
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support Verilog code generation. Select this option to disable Verilog code support.
Options for the current user	Specifies the options used for the current user; these options apply to all models that are accessed by the user.

Verilog Options - Model

If you intend to generate Verilog code from your model, you can configure the model-specific code generation options using the 'Verilog' page of the 'Manage Project Options' dialog to:

- Specify the default file extension
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > Verilog

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating Verilog source code.
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

VHDL Options - User

If you intend to generate VHDL code from your model, you can configure the code generation options using the 'VHDL' page of the 'Preferences' dialog to:

- Specify a default source directory
- Specify an editor for changing code

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > VHDL
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support VHDL code generation. Select this option to disable VHDL code support.
Options for the current user	Specifies the options used for the current user; these options apply to all models that are accessed by the user.

VHDL Options - Model

If you intend to generate VHDL code from your model, you can configure the model-specific code generation options using the 'VHDL' page of the 'Manage Project Options' dialog to:

- Specify the default file extension
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > VHDL

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating VHDL source code.
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

Visual Basic Options - User

If you intend to generate Visual Basic code from your model, you can configure the code generation options using the 'VB Specifications' page of the 'Preferences' dialog to:

- Specify the default attribute type
- Define the default source directory
- Define the file extensions to search for code files to import
- Define the default editor to use for editing source code

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > Visual Basic
Keyboard Shortcuts	Ctrl+F9

Options

Option	Action
Disable Language	Leave this checkbox unselected to support Visual Basic code generation. Select this option to disable Visual Basic code support.
Options for the current user	Specifies the options used for the current use; these options apply to all models that are accessed by the user.

Visual Basic Options - Model

If you intend to generate Visual Basic code from your model, you can configure the model-specific code generation options using the 'VB Specifications' page of the 'Manage Project Options' dialog to:

- Specify the default Visual Basic version to generate
- Indicate the default file extension when reading/writing
- Indicate the MTS transaction mode for MTS objects
- Specify if a Class uses Multi use (True or False)
- Specify if a Class uses the Persistable property
- Indicate data binding and data source behaviors
- Set the global namespace
- Set the Exposed attribute
- Indicate if the Creatable attribute is True or False
- Specify the Collection Class definitions for Association connectors

Access

Ribbon	Configure > Model > Options > Source Code Engineering > Visual Basic

Options

Option	Action
Options for the current model	Type in the default file extension to apply when generating Visual Basic source code, and click on the drop-down arrow in each of the other fields and select the appropriate value.
Collection Classes	Click on this button to open the 'Collection Classes for Association Roles' dialog, through which you specify the Collection Class definitions for Association connectors.

Notes

- These options affect all users of the current model; however, they do not apply to other models

MDG Technology Language Options

If you have loaded an MDG Technology that specifies a code module into your *Sparx Systems > EA > MDG Technologies* folder, the language is included in the 'Source Code Engineering' list on the 'Preferences' dialog. The language is only listed on the 'Preferences' dialog if an MDG Technology file actually uses it in your model.

Access

Ribbon	Start > Desktop > Preferences > Preferences > Source Code Engineering > MDG
Keyboard Shortcuts	Ctrl+F9

Options

Field	Action
Default Extension	Default extension for generated source files; shown if the option is in the technology. This is saved per project.
Import File Extensions	Default folder to import source files from; shown if the technology supports namespaces. This is saved once for all projects.
Generate Namespaces	Indicates if namespaces are generated or not.
Default Source Directory	The default directory to save generated source files. This is always shown.
Editor	Indicates the editor that is used to edit source files.
Att Type	Indicates the default attribute type.

Notes

- These options are set in the technology inside the <CodeOptions> tag of a code module, as shown:
  <CodeOption name="DefaultExtension">.rb</CodeOption>

Reset Options

Enterprise Architect stores some of the options for a Class when it is first created. Some are global; for example, $LinkClass is stored when you first create the Class, so in existing Classes the global change in the 'Preferences' dialog will not automatically be picked up. You must modify the options for the existing Class.

Modify options for a single Class

Step	Action
1	Click on the Class to change, and select the 'Develop > Source Code > Generate > Generate Single Element' ribbon option. The 'Generate Code' dialog displays.
2	Click on the Advanced button. The 'Object Options' dialog displays.
3	Click on the 'Attributes/Operations' option.
4	Change the options, and click on the Close button to apply the changes.

Modify options for all Classes within a Package

Step	Action
1	Click on the Package in the Browser window, and select the 'Develop > Preferences > Options > Reset Source Language' ribbon option. The 'Manage Code Generation' dialog displays.
2	In the 'Where language is:' field, click on the drop-down arrow and select the language that you want to change from.
3	In the 'Convert to:' field, click on the drop-down arrow and select the language that you want to change to.
4	Select the checkbox against each option to apply to the changed Class elements in the Package: • Clear Filenames of the files to generate code to • Reset Default options on each Class • Process Child Packages under the selected Package
5	Click on the OK button to apply the changes.

Set Collection Classes

Using Enterprise Architect, you can define Collection Classes for generating code from Association connectors where the target role has a multiplicity setting greater than 1.

Tasks

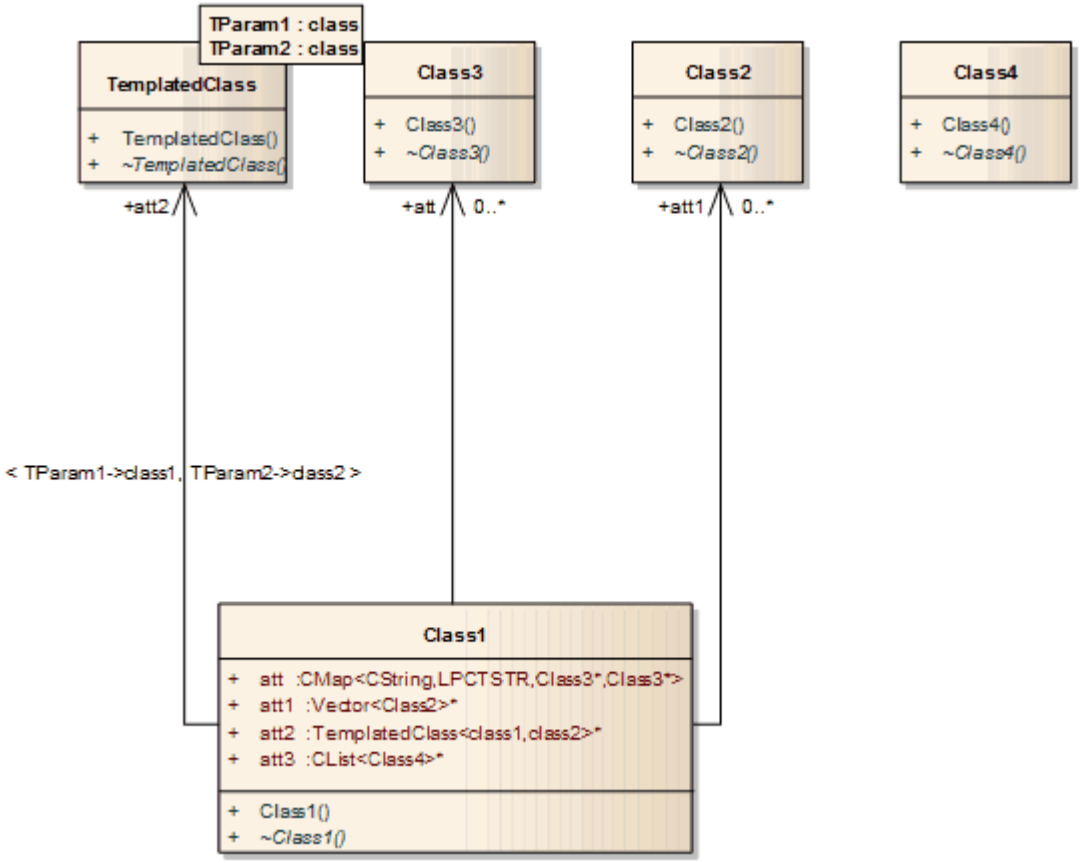
Task	Detail
Defining Collection Classes	On the 'Source Code Engineering' section of the 'Manage Project Options' dialog (select the 'Configure > Model > Options > Source Code Engineering' ribbon option), on each language page click on the Collection Classes button. The 'Collection Classes for Association Roles' dialog displays. On this dialog, you can define: • The default Collection Class for 1..* roles • The ordered Collection Class to use for 1..* roles • The qualified Collection Class to use for 1..* roles
Defining Collection Classes for a specific Class	Class-specific Collection Classes can be defined by clicking the Collection Classes button in the Class 'Properties' dialog of the element.
Code Generation Precedence	When Enterprise Architect generates code for a connector that has a multiplicity role >1: 1. If the Qualifier is set, use the qualified collection: - for the Class if set - else use the code language qualified collection 2. If the 'Order' option is set, use the ordered collection: - for the Class if set - else use the code language ordered collection 3. Else use the default collection: - for the Class if set - else use the code language default collection
Using Markers	You can include the marker #TYPE# in the collection name; Enterprise Architect replaces this with the name of the Class being collected at source generation time (for example, Vector<#TYPE#> would become Vector<foo>). Conversely, when reverse engineering, an Association connector is also created if a matching entry (for example, foo if foo is found in the model) is defined as a Collection Class.
Additional Collection Classes	Additional Collection Classes can be defined within the model-specific language options pages for C#, C++ and Java.
Member Type	On the 'Role(s)' tab of the Association 'Properties' dialog (accessible from the right-click context menu of any Association) there is a 'Member Type' field for each of the Source and Target Roles. If you set this, the value you enter overrides all the listed options.

Example Use of Collection Classes

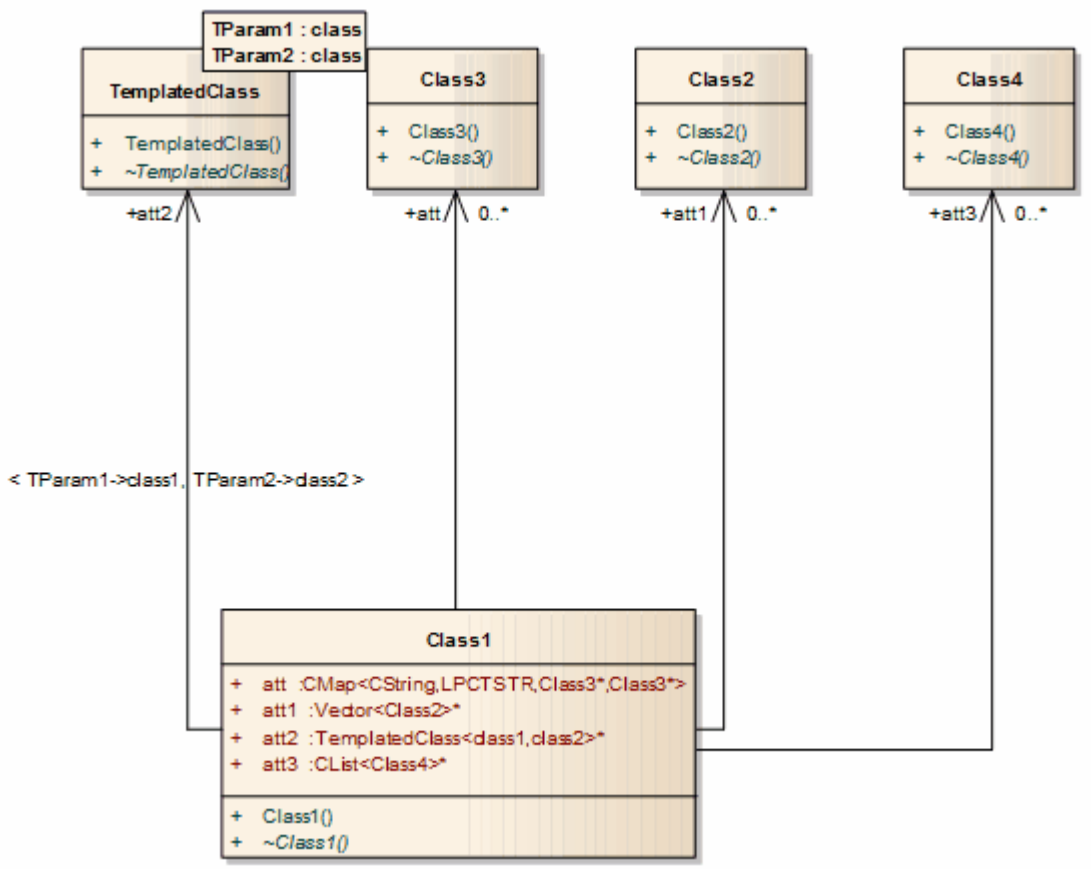
Consider this source code:

```
class Class1
{
public:
    Class1();
    virtual ~Class1();
    CMap<CString,LPCTSTR,Class3*,Class3*> att;
    Vector<Class2> *att1;
    TemplatedClass<class1,class2> *att2;
    CList<Class4> *att3;
};
class Class2
{
public:
    Class2();
    virtual ~Class2();
};
class Class3
{
public:
    Class3();
    virtual ~Class3();
};
class Class4
{
public:
    Class4();
    virtual ~Class4();
};
template<class TParam1, class TParam2>
class TemplatedClass
{
public:
    TemplatedClass() {
    }
    virtual ~TemplatedClass() {
    }
};
```

If this code is imported into the system with default import options, this diagram is generated:



If, however, you enter the value 'CList<#Type#>' in the 'Additional Collection Classes' field in the model-specific language options page (C#, Java, C++), an Association connector is also created to Class 4:


TParam1 : class
TParam2 : class
TemplatedClass
+ TemplatedClass()
+ ~TemplatedClass()
Class3
+ Class3()
+ ~Class3()
Class2
+ Class2()
+ ~Class2()
Class4
+ Class4()
+ ~Class4()
+att2
+att
0..*
+att1
0..*
+att3
0..*
< TParam1->class1, TParam2->class2 >
Class1
+ att :CMap<CString,LPCTSTR,Class3*,Class3*>
+ att1 :Vector<Class2>*
+ att2 :TemplatedClass<class1,class2>*
+ att3 :CList<Class4>*
+ Class1()
+ ~Class1()

Local Paths

When a team of developers are working on the same Enterprise Architect model, each developer might store their version of the source code in their local file system, but not always at the same location as their fellow developers. To manage this scenario in Enterprise Architect, you can define local paths for each user, on the 'Local Paths' dialog.

You can use local paths in generating code and reverse engineering, and in Version Control, developing XML schemas and generating document and web reports.

Local paths might take a little time to set up, but if you want to work collaboratively on source and model concurrently, the effort is well worth while.

For example, if:

- Developer A stores her .java files in a C:\Java\Source directory, while developer B stores his in D:\Source, and
- Both developers want to generate and reverse engineer into the same Enterprise Architect model located on a shared (or replicated) network drive

Developer A might define a local path of:

JAVA_SOURCE = "C:\Java\Source"

All Classes generated and stored in the Enterprise Architect project are stored as:

%JAVA_SOURCE%\<xxx.java>

Developer B defines a local path as:

JAVA_SOURCE ="D:\Source"

Now, Enterprise Architect stores all java files in these directories as:

%JAVA_SOURCE%\<filename>

On each developer's machine, the filename is expanded to the correct local version.

Access

Ribbon	Develop > Preferences > Options > Configure Local Paths

Local Paths Dialog

Using the 'Local Paths' dialog, you can set up local paths for a single user on a particular machine. For a description of the use of local paths, see the *Local Paths* topic.

Access

Ribbon	Develop > Preferences > Options > Configure Local Paths

Options

Option	Action
Path	Type in or browser for the path of the local directory in the file system (for example, d:\java\source).
ID	Type in the shared ID that is substituted for the Local Path (for example, JAVA_SRC).
Type	Click on the drop-down arrow and select the type of path to apply to (for example, Java).
Relative Paths	Lists the paths currently defined for the model, defaulting to most recent at the top. If you want to change the sequence of paths in the list, click on a path and use the  buttons to move the path up or down one position in the list.
Apply Path	Click on a path in the 'Relative Paths' list and click on this button to update any existing full path names in the model to the shared relative path name. For example: d:\java\source\main.java might become %JAVA_SRC%\main.java
Expand Path	Click on a path in the 'Relative Paths' list and click on this button to remove the relative path and substitute the full path name (the opposite effect of the Apply Path button).
New	Click on this button to clear the data fields so that you can define another local path.
Save	When you have defined a local path, click on this button to save it and add it to the 'Relative Paths' list.
Delete	Click on a path in the 'Relative Paths' list and click on this button to remove the path from the list altogether.
Close	Click on this button to close the dialog, saving any changes to the list.

Notes

- You can also set up a hyperlink (for an Enterprise Architect command) on a diagram to access the 'Local Paths' dialog, to switch, update or expand your current local path
- If the act of expanding or applying a path for a linked file will create a duplicate record, the process will skip that record and display a message at the end of the process

Language Macros

When reverse engineering a language such as C++, you might find preprocessor directives scattered throughout the code. This can make code management easier, but can hamper parsing of the underlying C++ language.

To help remedy this, you can include any number of macro definitions, which are ignored during the parsing phase of the reverse engineering. It is still preferable, if you have the facility, to preprocess the code using the appropriate compiler first; this way, complex macro definitions and defines are expanded out and can be readily parsed. If you don't have this facility, then this option provides a convenient substitute.

Access

Ribbon	Configure > Reference Data > Settings > Preprocessor Macros or Develop > Preferences > Options > Define Preprocessor Macros

Define a macro

Step	Action
1	Select the 'Preprocessor Macros' menu option. The 'Language Macros' dialog displays.
2	Click on the Add New button.
3	Enter details for your macro.
4	Click on the OK button.

Macros Embedded Within Declarations

Macros are sometimes used within the declaration of Classes and operations, as in these examples:

```
class __declspec Foo
{
int __declspec Bar(int p);
};
```

If declspec is defined as a C++ macro, as outlined, the imported Class and operation contain a Tagged Value called DeclMacro1 with value __declspec (subsequent macros would be defined as DeclMacro2, DeclMacro3 and so on).

During forward engineering, these Tagged Values are used to regenerate the macros in code.

Define Complex Macros

It is sometimes useful to define rules for complex macros that can span multiple lines; Enterprise Architect ignores the entire code section defined by the rule.

Such macros can be defined in Enterprise Architect as in these two examples; both types can be combined in one definition.

Block Macros

BEGIN_INTERFACE_PART ^ END_INTERFACE_PART

The ^ symbol represents the body of the macro - this enables skipping from one macro to another; the spaces surrounding the ^ symbol are required.

Function Macros

RTTI_EMULATION()

Enterprise Architect skips over the token including everything inside the parentheses.

Notes

- You can transport these language macro (or preprocessor macro) definitions between models, using the 'Configure > Model > Transfer > Export Reference Data' and 'Import Reference Data' options; the macros are exported as a Macro List

Developing Programming Languages

You can make use of a range of established programming languages in Enterprise Architect, but if these are not suitable to your needs you can develop your own. You would then apply it to your models through an MDG Technology that you might develop just for this purpose, or for broader purposes. After developing the language, you could also write MDA Transformation templates to convert a Platform Independent Model or a model in another language into a model for your new language, or vice-versa.

Access

Ribbon	Develop > Preferences > Options > Edit Code Templates
Keyboard Shortcuts	Ctrl+Shift+P

Develop a Programming Language

Step	Description
1	In the Code Template Editor, click on the New Language button and, on the 'Programming Languages Datatypes' dialog, click on the Add Product button. Enter your new programming language name and define the datatypes for it. You cannot access the new language in the Code Template Editor until at least one datatype has been added to the language.
2	After you have defined all the datatypes you need, click on the Close button, select the language in the 'Language' field of the Code Template Editor, and start to edit or create the code templates for the new language. The code templates define how the system should perform: • Forward code engineering of your models in the new language • Behavioral Code generation (if this is appropriate)
3	If you prefer, you can also define source code options for your new language. These are additional settings for the language that are not provided by the data types or code templates, and that help define how the system handles that language when generating and reverse-engineering code. The code options are made available to your models only through an MDG Technology.
4	Defining a grammar for your language is an optional step that provides two primary benefits: • Reverse engineering of existing code into your model • Synchronization during code generation so that changes made to the file since it was last generated are not lost. To access the grammar editor select the 'Develop > Preferences > Grammars' ribbon option.
5	If you intend MDA transformations to be made to (or from) your new programming language, you can also edit and create transformation templates for it. The process of creating transformation templates is very similar to that for creating code templates.
6	Having created the datatypes, code templates, code options, grammar and transformation templates for

	your new language, you can incorporate and distribute them in an MDG Technology.

Code Template Framework

When you use Enterprise Architect to generate code from a model, or transform the model, the system refers to the Code Template Framework (CTF) for the parameters that define how it should:

- Forward engineer a UML model
- Generate Behavioral Code
- Perform a Model Driven Architecture (MDA) Transformation
- Generate DDL in database modeling

A range of standard templates is available for the direct generation of code and for transformation; if you do not want to use the standard CTF configurations, you can customize them to meet your needs.

CTF Templates

Template Type	Detail
Code Templates	When you forward engineer a Class model, the code templates define how the skeletal code is to be generated for a given programming language. The templates for a language are automatically associated with the language. The templates are written as plain text with a syntax that shares some aspects of both mark-up languages and scripting languages.
Model Transformation Templates	Model Transformation Templates provide a fully configurable method of defining how Model Driven Architecture (MDA) Transformations convert model elements and model fragments from one domain to another. This process is two-tiered. It creates an intermediary language (which can be viewed for debugging) which is then processed to create the objects.
Behavioral Code Generation Templates	Enterprise Architect supports user-definable code generation of the UML Behavioral models. This applies the standard Code Template Framework but includes specific Enterprise Architect Simulation Library (EASL) code generation macros.
DDL Templates	DDL Templates are very similar to Code generation templates, but they have been extended to support DDL generation with their own set of base templates, macros, function macros and template options.

Code Template Customization

Enterprise Architect helps you to generate source code from UML models for a wide range of programming languages. Standard templates (mappings) are provided out-of-the-box but you can customize the way that code is generated by using the powerful and flexible Code Template Framework (CTF). This sophisticated framework allows you to customize every detail of the way code is generated, including the facility to create new templates for languages not supported in the base product. For example, JavaScript is not one of the supported languages but a series of templates can be written quickly to generate JavaScript from UML models. In these cases existing templates act as a useful starting point and reference for new languages.

The code template framework also provides the mechanism for generation of behavioral models and is used for the transformation templates.

Features

Feature	Detail
Default Templates	Default Code Templates are built into Enterprise Architect for forward engineering supported languages.
Code Template Editor	A Code Template Editor is provided for creating and maintaining user-defined Code Templates.
Customizing Code Templates	Descriptions of the template syntax and the macros and functions you can use to control the effects of the templates.
Synchronize Code	A subset of the default Code Templates to synchronize code.

Code and Transform Templates

Code templates and transform (Model Transformation) templates define how the system should generate or transform code in one or other of the programming languages that Enterprise Architect supports. Each language has a wide range of base templates, each of which defines how a particular code structure is generated. You can use these base templates as they are, or you can customize and add to the templates to better support your use of the standard languages, or of other languages that you might define to the system. You review, update and create templates through the Code Template editor or Transformation Template editor.

The order in which the base templates are listed in the two editors relates to the hierarchical order of the objects and their parts that are to be processed. Calls are made from certain base templates to others, and you can add further calls to both base templates and to your own custom templates. By default, the File template is the starting point of a code generation process through the templates; a File consists of Classes that can contain Attributes and Operations.

Access

Ribbon	Develop > Preferences > Options > Edit Code Templates Design > Tools > Transform > Transform Templates
Keyboard Shortcuts	Ctrl+Shift+P (Code Generation Templates) Ctrl+Alt+H (MDA Transformation Templates)

Application of Templates

Action	Detail

Calling Templates	Within any template, you can call other templates using %TemplateName%. The enclosing percent (%) signs indicate a macro.
	You would use this for a single call to the ClassBody template, %ClassBody%, as shown:
	% list = "TemplateName" @separator= "\n" @indent= " " %
	The %list macro performs an iterative pass on all the objects in the scope of the current template and calls the TemplateName for each of them:
	% list = "ClassBody" @separator= "\n" @indent= " " %
	After generation or transformation, each macro is substituted to produce the generated output; for a language such as C++, the result of processing this template might be:
	/**
	* This is an example Class note generated using code templates
	* @author Sparx Systems
	*/
	class ClassA: public ClassB
	{
	...
	}

Execution of Code Templates	Each template might act only on a particular element type; for example, the ClassNotes template only acts on UML Class and Interface elements. The element from which code is currently being generated is said to be in scope; if the element in scope is stereotyped, the system searches for a template that has been defined for that stereotype. If a specialized template is found, it is executed; otherwise the default implementation of the base template is used. Templates are processed sequentially, line by line, replacing each macro with its underlying text value from the model.
Transfer Templates Between Projects	If you edit a base Code Generation or Transformation template, or create a customized template, you can copy them from one project to another as Reference Data.

Base Templates

The Code Template Framework consists of a number of base templates. Each base template transforms particular aspects of the UML to corresponding parts of object-oriented languages.

The base templates form a hierarchy, which varies slightly across different programming languages. In a typical template hierarchy relevant to a language such as C# or Java (which do not have header files) the templates can be modeled as Classes, but usually are just plain text. This hierarchy would be slightly more complicated for languages such as C++ and Delphi, which have separate implementation templates.

Each of the base templates must be specialized to be of use in code engineering; in particular, each template is specialized for the supported languages (or 'products'). For example, there is a ClassBody template defined for C++, another for C#, another for Java, and so on; by specializing the templates, you can tailor the code generated for the corresponding UML entity.

Once the base templates are specialized for a given language, they can be further specialized based on:

- A Class's stereotype, or
- A feature's stereotype (where the feature can be an operation or attribute)

This type of specialization enables, for example, a C# operation that is stereotyped as «property» to have a different Operation Body template from an ordinary operation; the Operation Body template can then be specialized further, based on the Class stereotype.

Base templates used in the CTF

Template	Description
Attribute	A top-level template to generate member variables from UML attributes.
Attribute Declaration	Used by the Attribute template to generate a member variable declaration.
Attribute Notes	Used by the Attribute template to generate member variable notes.
Class	A top-level template for generating Classes from UML Classes.
Class Base	Used by the Class template to generate a base Class name in the inheritance list of a derived Class, where the base Class doesn't exist in the model.
Class Body	Used by the Class template to generate the body of a Class.
Class Declaration	Used by the Class template to generate the declaration of a Class.
Class Interface	Used by the Class template to generate an interface name in the inheritance list of a derived Class, where the interface doesn't exist in the model.
Class Notes	Used by the Class template to generate the Class notes.
File	A top-level template for generating the source file. For languages such as C++, this corresponds to the header file.
Import Section	Used in the File template to generate external dependencies.
Linked Attribute	A top-level template for generating attributes derived from UML Associations.

Linked Attribute Notes	Used by the Linked Attribute template to generate the attribute notes.
Linked Attribute Declaration	Used by the Linked Attribute template to generate the attribute declaration.
Linked Class Base	Used by the Class template to generate a base Class name in the inheritance list of a derived Class, for a Class element in the model that is a parent of the current Class.
Linked Class Interface	Used by the Class template to generate an Interface name in the inheritance list of a derived Class, for an Interface element in the model that is a parent of the current Class.
Namespace	A top-level template for generating namespaces from UML Packages (although not all languages have namespaces, this template can be used to generate an equivalent construct, such as Packages in Java).
Namespace Body	Used by the Namespace template to generate the body of a namespace.
Namespace Declaration	Used by the Namespace template to generate the namespace declaration.
Operation	A top-level template for generating operations from a UML Class's operations.
Operation Body	Used by the Operation template to generate the body of a UML operation.
Operation Declaration	Used by the Operation template to generate the operation declaration.
Operation Notes	Used by the Operation template to generate documentation for an operation.
Parameter	Used by the Operation Declaration template to generate parameters.

Templates for generating code for languages with separate interface and implementation sections

Template	Description
Class Impl	A top-level template for generating the implementation of a Class.
Class Body Impl	Used by the Class Impl template to generate the implementation of Class members.
File Impl	A top-level template for generating the implementation file.
File Notes Impl	Used by the File Impl template to generate notes in the source file.
Import Section Impl	Used by the File Impl template to generate external dependencies.
Operation Impl	A top-level template for generating operations from a UML Class's operations.
Operation Body Impl	Used by the Operation template to generate the body of a UML operation.

Operation Declaration Impl	Used by the Operation template to generate the operation declaration.
Operation Notes Impl	Used by the Operation template to generate documentation for an operation.

Export Code Generation and Transformation Templates

It is possible to export Code Generation and Transformation templates from your model to a .xml file. You can then import that file - and hence the templates - into other models, as reference data. You can export customized templates, which includes those that you or other users have created and updated, and base (standard) templates that have been tailored. You do not need to export base templates that have not been changed, as these are available in every installation of Enterprise Architect.

Access

Ribbon	Configure > Model > Transfer > Export Reference Data

Export a Code Generation template or Transformation template

Step	Action
1	On the 'Export Reference Data' dialog, in the 'Name' list, select the templates to export. The list includes any standard Code Generation or Transformation templates that have been changed, and any customized templates that you have created or changed. You can select one or more templates to be exported to a single XML file, by pressing Ctrl or Shift as you click on the template names.
2	Click on the Export button.
3	When prompted to do so, enter a valid file name with a .xml extension.
4	Click on the Save button and on the OK button. This exports the template(s) to the file; you can use any text or XML viewer to examine the file.

Import Code Generation and Transformation Templates

If you have exported Code Generation and/or Transformation templates from an Enterprise Architect model, you can import them into other Enterprise Architect models as reference data.

Access

Ribbon	Configure > Model > Transfer > Import Reference Data

Import Code Generation and/or Transformation Templates

Step	Action
1	On the 'Import Reference Data' dialog, click on the Select File button and browse to the .xml file containing the required Code Generation or Transformation templates.
2	Select the name of one or more template datasets and click on the Import button.

Synchronize Code

Enterprise Architect uses code templates during the forward synchronization of these programming languages:

- ActionScript
- C
- C++
- C#
- Delphi
- Java
- PHP
- Python
- VB
- VB.Net

Three types of change can occur in the source when it is synchronized with the UML model:

- Existing sections are synchronized: for example, the return type in an operation declaration is updated
- New sections are added to existing features: for example, Notes are added to a Class declaration where there were previously none
- New features and elements are added: for example, a new operation is added to a Class

Each of these changes has a different effect on the CTF and must be handled differently by Enterprise Architect, as described in these topics:

- *Synchronize Existing Sections*
- *Add New Sections to Existing Features*
- *Add New Features and Elements*

Code sections that can be synchronized

Only a subset of the CTF base templates is used during synchronization. This subset corresponds to the distinct sections that Enterprise Architect recognizes in the source code.

Code Template	Code Section
Class Notes	Comments preceding the Class declaration.
Class Declaration	Up to and including the Class parents.
Attribute Notes	Comments preceding an Attribute declaration.
Attribute Declaration	Up to and including the terminating character.
Operation Notes	Comments preceding an operation declaration.
Operation Notes Impl	As for Operation Notes.
Operation Declaration	Up to and including the terminating character.
Operation Declaration Impl	Up to and including the terminating character.

Operation Body	Everything between and including the braces.
Operation Body Impl	As for Operation Body.

Synchronize Existing Sections

When an existing section in the source code differs from the result generated by the corresponding template, that section is replaced.

Consider, for example, this C++ Class declaration:

(asm) class A: public B

Now assume that you add an inheritance relationship from Class A to Class C; the entire Class declaration would be replaced with something resembling this:

(asm) class A: public B, public C

Add New Sections

These sections can be added to existing features in the source code, as new sections:

- Class Notes
- Attribute Notes
- Operation Notes
- Operation Notes Impl
- Operation Body
- Operation Body Impl

Assume that, in this example, Class A had no note when you originally generated the code:

(asm) class A: public B, public C

If you now specify a note in the model for Class A, Enterprise Architect attempts to add the new note from the model during synchronization, by executing the Class Notes template.

To make room for the new section to be inserted, you can specify how much white space to append to the section via synchronization macros.

Add New Features and Elements

These features and elements can be added to the source code during synchronization:

- Attributes
- Inner Classes
- Operations

They are added by executing the relevant templates for each new element or feature in the model.

Enterprise Architect attempts to preserve the appropriate indenting of new features in the code, by finding the indents specified in list macros of the Class; for languages that make use of namespaces, the 'synchNamespaceBodyIndent' macro is available.

Classes defined within a (non-global) namespace are indented according to the value set for this macro, during synchronization.

The value is ignored:

- For Classes defined within a Package set up as a root namespace, or
- If the 'Generate Namespaces' option is set to False in the appropriate language page (C#, C++ or VB.Net) on the 'Preferences' dialog ('Start > Desktop > Preferences > Preferences > Source Code Engineering > <language>')

The Code Template Editor

The Code Template Editor provides the facilities of the Common Code Editor, including Intelli-sense for the various macros. For more information on Intelli-sense and the Common Code Editor, see the *Editing Source Code* topic.

Access

Ribbon	Develop > Preferences > Options > Edit Code Templates
Keyboard Shortcuts	Ctrl+Shift+P

Options

Option	Action
Language	Select the programming language.
New Language	Display the 'Programming Languages Datatypes' dialog, which enables you to include programming languages other than those supported for Enterprise Architect, for which to create or edit code templates.
Template	Display the contents of the active template, and open the editor for modifying templates.
Templates	List the base code templates; the active template is highlighted. The 'Modified' field indicates whether you have changed the default template for the current language.
Stereotype Overrides	List the stereotyped templates, for the active base template. The 'Modified' field indicates whether you have modified a default stereotyped template.
Add New Custom Template	Invoke a dialog for creating a custom stereotyped template.
Add New Stereotyped Override	Invoke a dialog for adding a stereotyped template, for the currently selected base template.
Get Default Template	Update the editor display with the default version of the active template.
Save	Overwrite the active templates with the contents of the editor.
Delete	If you have overridden the active template, the override is deleted and replaced by the corresponding default code template.

Notes

- User-modified and user-defined Code Templates can be imported and exported as reference data (see the *Sharing Reference Data* topic); the templates defined for each language are indicated in the 'Export Reference Data' dialog by the language name with the suffix _Code_Templates - if no templates exist for a language, there is no entry for the language in the dialog

Code Template Syntax

Code Templates are written using Enterprise Architect's Code Template Editor. The Code Template Editor supports syntax highlighting of the Code Template Framework language.

Syntax Elements

Elements	Detail
Basic Constructs	Templates can contain: • Literal Text • Variables • Macros • Calls to other templates
Comments	If you want to add comments to the templates, use the command: $COMMENT="text" where "text" is the text of the comment; this must be enclosed in quotes. The command is case-sensitive, and must be typed in upper case.

Literal Text

All text within a given template that is not part of a macro or a variable definition/reference, is considered literal text. With the exception of blank lines, which are ignored, literal text is directly substituted from the template into the generated code.

Consider this excerpt from the Java Class Declaration template:

```
$bases = "Base"
class % className % $bases
```

On the final line, the word 'class ', including the subsequent space, would be treated as literal text and thus for a Class named 'foo' would return the output:

```
class fooBase
```

A blank line following the variable $bases would have no effect on the output.

Inserting System Characters:

The %, $, " and \ characters have special meaning in the template syntax and cannot always be used as literal text. If these characters must be generated from within the templates, they can be safely reproduced using these direct substitution macros:

Macro	Action
%dl%	Produce a literal $ character.
%pc%	Produce a literal % character.
%qt%	Produce a literal " character.
%sl%	Produce a literal \ character

Notes

String conjunction operators (“+”, “+=”) are not required but can be used

Variables

Template variables provide a convenient way of storing and retrieving data within a template. This section explains how variables are defined and referenced.

Variable Definitions

Variable definitions take the basic form:

$<name> = <value>

where <name> can be any alpha-numeric sequence and <value> is derived from a macro or another variable.

A simple example definition would be:

$foo = %className%

Variables can be defined using values from:

- Substitution, function or list macros
- String literals, enclosed within double quotation marks
- Variable references

Definition Rules

These rules apply to variable definitions:

- Variables have global scope within the template in which they are defined and are not accessible to other templates
- Each variable must be defined at the start of a line, without any intervening white space
- Variables are denoted by prefixing the name with $, as in $foo
- Variables do not have to be declared, prior to being defined
- Variables must be defined using either the assignment operator (=), or the addition-assignment operator (+=)
- Multiple terms can be combined in a single definition using the addition operator (+)

Examples

Using a substitution macro:

$foo = %opTag:"bar"%

Using a literal string:

$foo = "bar"

Using another variable:

$foo = $bar

Using a list macro:

$ops = %list="Operation" @separator="\n\n" @indent="\t"%

Using the addition-assignment operator (+=):

$body += %list="Operation" @separator="\n\n" @indent="\t"%

That definition is equivalent to:

$body = $body + %list="Operation" @separator="\n\n" @indent="\t"%

Using multiple terms:

```
$templateArgs = %list="ClassParameter" @separator=", "%
$template ="template<" + $templateArgs + ">"
```

Variable References

Variable values can be retrieved by using a reference of the form:

```
$<name>
```

where <name> can be a previously defined variable.

Variable references can be used:

- As part of a macro, such as the argument to a function macro
- As a term in a variable definition
- As a direct substitution of the variable value into the output

It is legal to reference a variable before it is defined. In this case, the variable is assumed to contain an empty string value: ""

Variable References - Example 1

Using variables as part of a macro. This is an excerpt from the default C++ ClassNotes template.

```
$wrapLen = %genOptWrapComment%
$style = %genOptCPPCommentStyle%     (Define variables to store the style and wrap length options)
%if $style == "XML.NET"%     (Reference to $style as part of a condition)
%XML_COMMENT($wrapLen)%
%else%
%CSTYLE_COMMENT($wrapLen)%     (Reference to $wrapLen as an argument to function macro)
%endIf%
```

Variable References - Example 2

Using variable references as part of a variable definition.

```
$foo = "foo"         (Define our variables)
$bar = "bar"
$foobar = $foo + $bar     ($foobar now contains the value foobar)
```

Variable References - Example 3

Substituting variable values into the output.

```
$bases=%classInherits% (Store the result of the ClassInherits template in $bases)
Class %className%$bases (Now output the value of $bases after the Class name)
```

Macros

Macros provide access to element fields within the UML model and are also used to structure the generated output. All macros are enclosed within percent (%) signs, as shown:

%<macroname>%

In general, macros (including the % delimiters) are substituted for literal text in the output. For example, consider this item from the Class Declaration template:

... class %className% ...

The field substitution macro, %className%, would result in the current Class name being substituted in the output. So if the Class being generated was named Foo, the output would be:

... class Foo ...

The CTF contains a number of types of macro:

- Template Substitution Macros
- Field Substitution Macros
- Substitution Examples
- Attribute Field Substitution Macros
- Class Field Substitution Macros
- Code Generation Option Field Substitution Macros
- Connector Field Substitution Macros
- Constraint Field Substitution Macros
- Effort Field Substitution Macros
- File Field Substitution Macros
- File Import Field Substitution Macros
- Link Field Substitution Macros
- Linked File Field Substitution Macros
- Metric Field Substitution Macros
- Operation Field Substitution Macros
- Package Field Substitution Macros
- Parameter Field Substitution Macros
- Problem Field Substitution Macros
- Requirement Field Substitution Macros
- Resource Field Substitution Macros
- Risk Field Substitution Macros
- Scenario Field Substitution Macros
- Tagged Value Substitution Macros
- Template Parameter Substitution Macros
- Test Field Substitution Macros
- Function Macros
- Control Macros
- List Macro
- Branching Macros
- Synchronization Macros

- The Processing Instruction (PI) Macro
- EASL Code Generation Macros

Template Substitution Macros

Template substitution macros correspond to Base templates, and result in the execution of the named template. By convention, template macros are named according to Pascal casing.

Structure: %<TemplateName>%

where <TemplateName> can be one of the templates listed in this topic.

When a template is referenced from within another template, it is generated with respect to the elements currently in scope. The specific template is selected based on the stereotypes of the elements in scope.

As noted previously, there is an implicit hierarchy among the various templates. Some care should be taken in order to preserve a sensible hierarchy of template references. For example, it does not make sense to use the %ClassInherits% macro within any of the Attribute or Operation templates. Conversely, the Operation and Attribute templates are designed for use within the ClassBody template.

Template substitution macros in the CTF

- Attribute
- AttributeDeclaration
- AttributeDeclarationImpl
- AttributeNotes
- Class
- ClassBase
- ClassBody
- ClassBodyImpl
- ClassDeclaration
- ClassDeclarationImpl
- ClassImpl
- ClassInherits
- ClassInterface
- ClassNotes
- ClassParameter
- File
- FileImpl
- ImportSection
- ImportSectionImpl
- InnerClass
- InnerClassImpl
- LinkedAttribute
- LinkedAttributeDeclaration
- LinkedAttributeNotes
- LinkedClassBase
- LinkedClassInterface
- Namespace
- NamespaceBody

- NamespaceDeclaration
- NamespaceImpl
- Operation
- OperationBody
- OperationBodyImpl
- OperationDeclaration
- OperationDeclarationImpl
- OperationImpl
- OperationNotes
- Parameter

Field Substitution Macros

The field substitution macros provide access to data in your model. In particular, they are used to access data fields from:

- Packages
- Classes
- Attributes
- Operations, and
- Parameters

Field substitution macros are named according to Camel casing. By convention, the macro is prefixed with an abbreviated form of the corresponding model element. For example, attribute-related macros begin with att, as in the %attName% macro, to access the name of the attribute in scope.

Macros that represent checkboxes return a value of T if the box is selected. Otherwise the value is empty.

This table lists a small number of project field substitution macros. Type-specific macros are listed in the subtopics of this *Field Substitution Macros* section.

Project Macros

Macro Name	Description
eaDateTime	The current time with format: DD-MMM-YYYY HH:MM:SS AM/PM.
eaGUID	A unique GUID for this generation.
eaVersion	Program Version (located in the 'About Enterprise Architect' dialog by selecting 'Start > Help > Help > About EA').

Substitution Examples

Field substitution macros can be used in one of two ways:

- Direct Substitution or
- Conditional Substitution

Direct Substitution

This form directly substitutes the corresponding value of the element in scope into the output.

Structure: %<macroName>%

Where <macroName> can be any of the macros listed in the Field Substitution Macros tables.

Examples

- %className%
- %opName%
- %attName%

Conditional Substitution

This form of the macro enables alternative substitutions to be made depending on the macro's value.

Structure: %<macroName> (== "<text>") ? <subTrue> (: <subFalse>) %

Where:

- () denotes that values between the parentheses are optional
- <text> is a string representing a possible value for the macro
- <subTrue> and <subFalse> can be a combination of quoted strings and the keyword value; where the value is used, it is replaced with the macro's value in the output

Examples

- %classAbstract=="T" ? "pure" :""%
- %opStereotype=="operator" ? "operator" :""%
- %paramDefault != "" ? " = " value : ""%

These three examples output nothing if the condition fails. In this case the False condition can be omitted, resulting in this usage:

- %classAbstract=="T" ? "pure"%
- %opStereotype=="operator" ? "operator"%
- %paramDefault != "" ? " = "value%

The third example of both blocks shows a comparison checking for a non-empty value or existence. This test can also be omitted.

- %paramDefault ? " = " value : ""%

- %paramDefault ? " = " value%

All of these examples containing paramDefault are equivalent. If the parameter in scope had a default value of 10, the output from each of them would normally be:

= 10

Notes

- In a conditional substitution macro, any white space following <macroName> is ignored; if white space is required in the output, it should be included within the quoted substitution strings

Attribute Field Substitution Macros

This table lists each of the attribute field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Attribute Macros

Macro Name	Description
attAlias	'Attributes' dialog: Alias.
attAllowDuplicates	'Attributes Detail' dialog: 'Allow Duplicates' checkbox.
attClassifierGUID	The unique GUID for the classifier of the current attribute.
attCollection	'Attributes Detail' dialog: 'Attribute is a Collection' checkbox.
attConst	'Attributes' dialog: 'Const' checkbox.
attContainerType	'Attributes Detail' dialog: Container Type.
attContainment	'Attributes' dialog: Containment.
attDerived	'Attributes' dialog: 'Derived' checkbox.
attGUID	The unique GUID for the current attribute.
attInitial	'Attributes' dialog: Initial.
attIsEnumLiteral	'Attributes' dialog: 'Is Literal' checkbox.
attIsID	'Attributes Detail' dialog: 'isID' checkbox.
attLength	'Column' dialog: Length.
attLowerBound	'Attributes Detail' dialog: Lower Bound.
attName	'Attributes' dialog: Name.
attNotes	'Attributes' dialog: Notes.
attOrderedMultiplicity	'Attributes Detail' dialog: 'Ordered Multiplicity' checkbox.
attProperty	'Attributes' dialog: 'Property' checkbox.
attQualType	The attribute type qualified by the namespace path (if generating namespaces) and the classifier path (dot delimited). If the attribute classifier has not been set, is equivalent to the attType macro.

attScope	'Attributes' dialog: Scope.
attStatic	'Attributes' dialog: 'Static' checkbox.
attStereotype	'Attributes' dialog: Stereotype.
attType	'Attributes' dialog: Type.
attUpperBound	'Attributes Detail' dialog: Upper Bound.
attVolatile	'Attributes Detail' dialog: 'Transient' checkbox.

Class Field Substitution Macros

This table provides a list of methods for accessing each available Class property in the Code Generation and Transformation templates.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Class Macros

Macro Name	Description
elemType	The element type: Interface or Class.
classAbstract	Class 'Properties' dialog: 'Abstract' checkbox ('Details' tab).
classAlias	Class 'Properties' dialog: 'Alias' field.
classArguments	Class 'Detail' dialog: C++ Templates: Arguments.
classAuthor	Class 'Properties' dialog: 'Author' field.
classBaseName	'Type Hierarchy' dialog: Class Name (for use where no connector exists between child and base Classes).
classBaseScope	The scope of the inheritance as reverse engineered. (For use where no connector exists between child and base Classes.)
classBaseVirtual	The virtual property of the inheritance as reverse engineered. (For use where no connector exists between child and base Classes.)
classComplexity	Class 'Properties' dialog: 'Complexity' field.
classCreated	The date and time the Class was created.
classGUID	The unique GUID for the current Class.
classHasConstructor	Looks at the list of methods in the current object and, depending on the conventions of the current language, returns T if one is a default constructor. Typically used with the genOptGenConstructor macro.
classHasCopyConstructor	Looks at the list of methods in the current object and, depending on the conventions of the current language, returns T if one is a copy constructor. Typically used with the genOptGenCopyConstructor macro.
classHasDestructor	Looks at the list of methods in the current object and, depending on the conventions of the current language, returns T if one is a destructor. Typically used with the genOptGenDestructor macro.
classHasParent	True, if the Class in scope has one or more base Classes.

classHasStereotype	True, if the Class in scope has a stereotype that matches a stereotype name (which you can optionally specify as fully qualified). It therefore checks all stereotypes that a Class has and returns 'T' if any of them is the specified stereotype or a specialization of it. For example: • %classHasStereotype:"block"% will return 'T' for any block-stereotyped Class from any SysML version, including associationBlock • %classHasStereotype:"SysML1.4::block"% will specifically match the SysML 1.4 versions Compare this with classStereotype, later.
classImports	'Code Gen' dialog: Imports.
classIsActive	Class 'Advanced' dialog: 'Is Active' checkbox.
classIsAssociationClass	True, if the Association is an AssociationClass connector.
classIsInstantiated	True, if the Class is an instantiated template Class.
classIsLeaf	Class 'Advanced' dialog: 'Is Leaf' checkbox.
classIsRoot	Class 'Advanced' dialog: 'Is Root' checkbox.
classIsSpecification	Class 'Advanced' dialog: 'Is Specification' checkbox.
classKeywords	Class 'Properties' dialog: 'Keywords' field.
classLanguage	Class 'Properties' dialog: 'Language' field.
classMacros	A space separated list of macros defined for the Class.
classModified	The date and time the Class was last modified.
classMultiplicity	Class 'Advanced' dialog: Multiplicity.
className	Class 'Properties' dialog: 'Name' field.
classNotes	Class 'Properties' dialog: 'Note' field.
classParamDefault	Class 'Detail' dialog.
classParamName	Class 'Detail' dialog.
classParamType	Class 'Detail' dialog.
classPersistence	Class 'Properties' dialog: 'Persistence' field ('Details' tab)
classPhase	Class 'Properties' dialog: 'Phase' field.
classQualName	The Class name prefixed by its outer Classes. Class names are separated by double colons (::).
classScope	Class 'Properties' dialog: 'Scope' field.

classStereotype	Class 'Properties' dialog: 'Stereotype' field. Retrieves the name of the first stereotype applied to the Class. When used in a comparison, it checks whether that first stereotype exactly matches a string. For example: %classStereotype=="enumeration" ? "enum" : "class"% Compare this with classHasStereotype, earlier.
classStatus	Class 'Properties' dialog: 'Status' field.
classVersion	Class 'Properties' dialog: 'Version' field.

Code Generation Option Field Substitution Macros

Code generation option field substitution macros operate on the source code generation options defined in the 'Source Code Engineering' pages of either the:

- 'Preferences' dialog ('Start > Desktop > Preferences > Preferences > Source Code Engineering') for user-specific options, or
- 'Manage Project Options' dialog ('Configure > Model > Options') for model-specific options

For more information on the division of the options, see the *Source Code Engineering Options* topic.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty. This table lists each of the code generation option field substitution macros.

Code Generation Option Macros

Macro Name	Description
genOptActionScriptVersion	ActionScript Specifications page: Default Version.
genOptCDefaultAttributeType	C Specifications page: Default Attribute Type.
genOptCGenMethodNotesInBody	C Specifications page: Method Notes In Implementation.
genOptCGenMethodNotesInHeader	C Specifications page: Method Notes In Header.
genOptCSynchNotes	C Specifications page: Synchronize Notes in Generation.
genOptCSynchCFile	C Specifications page: Synchronise Implementation file in Generation.
genOptCDefaultSourceDirectory	C Specifications page: Default Source Directory.
genOptCNamespaceDelimiter	C Specifications page: Namespace Delimiter.
genOptCOperationRefParam	C Specifications page: Reference as Operation Parameter.
genOptCOperationRefParamStyle	C Specifications page: Reference Parameter Style.
genOptCOperationRefParamName	C Specifications page: Reference Parameter Name.
genOptCConstructorName	C Specifications page: Default Constructor Name.
genOptCDestructorName	C Specifications page: Default Destructor Name.

genOptCPPCommentStyle	C++ Specifications page: Comment Style.
genOptCPPDefaultAttributeType	C++ Specifications page: Default Attribute Type.
genOptCPPDefaultReferenceType	C++ Specifications page: Default Reference Type.
genOptCPPDefaultSourceDirectory	C++ Specifications page: Default Source Directory.
genOptCPPGenMethodNotesInHeader	C++ Specifications page: 'Method Notes In Header' checkbox.
genOptCPPGenMethodNotesInBody	C++ Specifications page: Method Notes In Body checkbox.
genOptCPPGetPrefix	C++ Specifications page: Get Prefix.
genOptCPPHeaderExtension	C++ Specifications page: Header Extension.
genOptCPPSetPrefix	C++ Specifications page: Set Prefix.
genOptCPPSourceExtension	C++ Specifications page: Source Extension.
genOptCPPSynchNotes	C++ Specifications page: Synchronize Notes.
genOptCPPSynchCPPFile	C++ Specifications page: Synchronize CPP File.
genOptCSDefaultAttributeType	C# Specifications page: Default Attribute Type.
genOptCSSourceExtension	C# Specifications page: Default file extension.
genOptCSGenDispose	C# Specifications page: Generate Dispose.
genOptCSGenFinalizer	C# Specifications page: Generate Finalizer.
genOptCSGenNamespace	C# Specifications page: Generate Namespace.
genOptCSDefaultSourceDirectory	C# Specifications page: Default Source Directory.
genOptDefaultAssocAttName	Source Code Engineering page: Default name for associated attribute.
genOptDefaultConstructorScope	Object Lifetimes page: Default Constructor Visibility.
genOptDefaultCopyConstr	Object Lifetimes page: Default Copy Constructor Visibility.

uctorScope	
genOptDefaultDatabase	Code Editors page: Default Database.
genOptDefaultDestructorScope	Object Lifetimes page: Default Destructor Constructor Visibility.
genOptGenCapitalisedProperties	'Source Code Engineering' page: 'Capitalize Attribute Names for Properties' checkbox.
genOptGenComments	'Source Code Engineering' page: 'Comments - Generate' checkbox.
genOptGenConstructor	Object Lifetimes page: 'Generate Constructor' checkbox.
genOptGenConstructorInline	Object Lifetimes page: 'Constructor Inline' checkbox.
genOptGenCopyConstructor	Object Lifetimes page: 'Generate Copy Constructor' checkbox.
genOptGenCopyConstructorInline	Object Lifetimes page: 'Copy Constructor Inline' checkbox.
genOptGenDestructor	Object Lifetimes page: 'Generate Destructor' checkbox.
genOptGenDestructorInline	Object Lifetimes page: 'Destructor Inline' checkbox.
genOptGenDestructorVirtual	Object Lifetimes page: 'Virtual Destructor' checkbox.
genOptGenImplementedInterfaceOps	'Code Generation' page: 'Generate methods for implemented interfaces' checkbox.
genOptGenPrefixBoolProperties	'Source Code Engineering' page: 'Use 'Is' for Boolean property Get()' checkbox.
genOptGenRoleNames	'Source Code Engineering' page: 'Autogenerate role names when creating code' checkbox.
genOptGenUnspecAssocDir	'Source Code Engineering' page: 'Do not generate members where Association direction is unspecified' checkbox.
genOptJavaDefaultAttributeType	Java Specifications page: Default attribute type.
genOptJavaGetPrefix	Java Specifications page: Get Prefix.
genOptJavaDefaultSourceDirectory	Java Specifications page: Default Source Directory.
genOptJavaSetPrefix	Java Specifications page: Set Prefix.

genOptJavaSourceExtension	Java Specifications page: Source code extension.
genOptPHPDefaultSourceDirectory	PHP Specifications page: Default Source Directory.
genOptPHPGetPrefix	PHP Specifications page: Get Prefix.
genOptPHPSetPrefix	PHP Specifications page: Set Prefix.
genOptPHPSourceExtension	PHP Specifications page: Default file extension.
genOptPHPVersion	PHP Specifications page: PHP Version.
genOptPropertyPrefix	'Source Code Engineering' page: Remove prefixes when generating Get/Set properties.
genOptVBMultiUse	VB Specifications page: 'Multiuse' checkbox.
genOptVBPersistable	VB Specifications page: 'Persistable' checkbox.
genOptVBDataBindingBehavior	VB Specifications page: 'Data binding behavior' checkbox.
genOptVBDataSourceBehavior	VB Specifications page: 'Data source behavior' checkbox.
genOptVBGlobal	VB Specifications page: 'Global namespace' checkbox.
genOptVBCreatable	VB Specifications page: 'Creatable' checkbox.
genOptVBExposed	VB Specifications page: 'Exposed' checkbox.
genOptVBMTS	VB Specifications page: MTS Transaction Mode.
genOptVBNetGenNamespace	VB.Net Specifications page: Generate Namespace.
genOptVBVersion	VB Specifications page: Default Version.
genOptWrapComment	'Source Code Engineering' page: Wrap length for comment lines.

Connector Field Substitution Macros

This table lists each of the connector field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Connector Macros

Macro Name	Description
connectorAlias	Connector 'Properties' dialog: 'Alias' field.
connectorAssociationClassElemGUID	The GUID of the connector's Association Class element.
connectorAssociationClassElemName	The name of the connector's Association Class element.
connectorDestAccess	Connector 'Properties' dialog, 'Target Role' tab: Access.
connectorDestAggregation	Connector 'Properties' dialog, 'Target Role' tab: Aggregation.
connectorDestAlias	Connector 'Properties' dialog, 'Target Role' tab: Alias.
connectorDestAllowDuplicates	Connector 'Properties' dialog, 'Target Role' tab: 'Allow Duplicates' checkbox.
connectorDestChangeable	Connector 'Properties' dialog, 'Target Role' tab: Changeable.
connectorDestConstraint	Connector 'Properties' dialog, 'Target Role' tab: Constraint(s).
connectorDestContainment	Connector 'Properties' dialog, 'Target Role' tab: Containment.
connectorDestDerived	Connector 'Properties' dialog, 'Target Role' tab: 'Derived' checkbox.
connectorDestDerivedUnion	Connector 'Properties' dialog, 'Target Role' tab: 'DerivedUnion' checkbox.
connectorDestElem*	A set of macros that access a property of the element at the target end of a connector. The * (asterisk) is a wildcard that corresponds to any Class substitution macro in the Class macro list. For example: • connectorDestElemAlias (classAlias) • connectorDestElemAuthor (classAuthor)
connectorDestElemType	The element type of the connector destination element. (Separate from the connectorDestElem* macros because there is no classType substitution macro.)
connectorDestFeature*	A set of macros that access a property of the feature at the target end of a connector. The * (asterisk) is a wildcard that corresponds to any attribute or operation substitution macro in the Attribute macro or Operation macro list, depending on the

	connectorDestFeatureType. For example: • connectorDestFeatureReturnClassifierGUID - an operation's return classifier GUID • connectorDestFeatureContainment - an attribute's containment
connectorDestFeatureType	The type of the connector destination feature. • connectorDestFeatureType="Attribute" or "Operation"
connectorDestMemberType	Connector 'Properties' dialog, 'Target Role' tab: Member Type.
connectorDestMultiplicity	Connector 'Properties' dialog, 'Target Role' tab: Multiplicity.
connectorDestNavigability	Connector 'Properties' dialog, 'Target Role' tab: Navigability.
connectorDestNotes	Connector 'Properties' dialog, 'Target Role' tab: Role Notes.
connectorDestOrdered	Connector 'Properties' dialog, 'Target Role' tab: 'Ordered' checkbox.
connectorDestOwned	Connector 'Properties' dialog, 'Target Role' tab: 'Owned' checkbox.
connectorDestQualifier	Connector 'Properties' dialog, 'Target Role' tab: Qualifier(s).
connectorDestRole	Connector 'Properties' dialog, 'Target Role' tab: Role.
connectorDestScope	Connector 'Properties' dialog, 'Target Role' tab: Target Scope.
connectorDestStereotype	Connector 'Properties' dialog, 'Target Role' tab: Stereotype.
connectorDirection	Connector Properties: Direction.
connectorEffect	'Transition Constraints' dialog: 'Effect' field.
connectorGuard	'Object Flow' and 'Transition Constraints' dialogs: 'Guard' field.
connectorGUID	The unique GUID for the current connector.
connectorIsAssociationClass	True, if the connector is an AssociationClass connector.
connectorName	Connector Properties: Name.
connectorNotes	Connector Properties: Notes.
connectorSourceAccess	Connector 'Properties' dialog, 'Source Role' tab: Access.
connectorSourceAggregation	Connector 'Properties' dialog, 'Source Role' tab: Aggregation.
connectorSourceAlias	Connector 'Properties' dialog, 'Source Role' tab: Alias.

connectorSourceAllowDuplicates	Connector 'Properties' dialog, 'Source Role' tab: Allow Duplicates checkbox.
connectorSourceChangeable	Connector 'Properties' dialog, 'Source Role' tab: Changeable.
connectorSourceConstraint	Connector 'Properties' dialog, 'Source Role' tab: Constraint(s).
connectorSourceContainment	Connector 'Properties' dialog, 'Source Role' tab: Containment.
connectorSourceDerived	Connector 'Properties' dialog, 'Source Role' tab: 'Derived' checkbox.
connectorSourceDerivedUnion	Connector 'Properties' dialog, 'Source Role' tab: 'DerivedUnion' checkbox.
connectorSourceElem*	A set of macros that access a property of the element at the source end of a connector. The * (asterisk) is a wildcard that corresponds to any Class substitution macro in the Class macro list. For example: • connectorSourceElemAlias (classAlias) • connectorSourceElemAuthor (classAuthor)
connectorSourceElemType	The element type of the connector source element. (Separate from the connectorSourceElem* macros because there is no classType substitution macro.)
connectorSourceFeature*	A set of macros that access a property of the feature at the source end of a connector. The * (asterisk) is a wildcard that corresponds to any attribute or operation substitution macro in the Attribute macro or Operation macro list, depending on the connectorSourceFeatureType. For example: • connectorSourceFeatureCode - Operation's Code • connectorSourceFeatureInitial - Attribute's Initial
connectorSourceFeatureType	The type of the connector source feature. • connectorSourceFeatureType="Attribute" or "Operation"
connectorSourceMemberType	Connector 'Properties' dialog, 'Source Role' tab: Member Type.
connectorSourceMultiplicity	Connector 'Properties' dialog, 'Source Role' tab: Multiplicity.
connectorSourceNavigability	Connector 'Properties' dialog, 'Source Role' tab: Navigability.
connectorSourceNotes	Connector 'Properties' dialog, 'Source Role' tab: Role Notes.
connectorSourceOrdered	Connector 'Properties' dialog, 'Source Role' tab: 'Ordered' checkbox.
connectorSourceOwned	Connector 'Properties' dialog, 'Source Role' tab: 'Owned' checkbox.
connectorSourceQualifier	Connector 'Properties' dialog, 'Source Role' tab: Qualifier(s).

connectorSourceRole	Connector 'Properties' dialog, 'Source Role' tab: Role.
connectorSourceScope	Connector 'Properties' dialog, 'Source Role' tab: Target Scope.
connectorSourceStereotype	Connector 'Properties' dialog, 'Source Role' tab: Stereotype.
connectorStereotype	Connector 'Properties' dialog: 'Stereotype' field.
connectorTrigger	'Transition Constraints' dialog: 'Trigger' field.
connectorType	The connector type; f or example, Association or Generalization.
connectorWeight	'Object Flow Constraints' dialog: 'Weight' field.

Constraint Field Substitution Macros

This table lists each of the 'Constraint' field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Constraint Macros

Macro Name	Description
constraintName	'Class' dialog, 'Constraints' tab: Name.
constraintNotes	'Class' dialog, 'Constraints' tab: Notes.
constraintStatus	'Class' dialog, 'Constraints' tab: Status.
constraintType	'Class' dialog, 'Constraints' tab: Type.
constraintWeight	'Class' dialog, 'Constraints' tab: ordering (hand up/down) keys.

Effort Field Substitution Macros

This table lists each of the 'Effort' field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Effort Macros

Macro Name	Description
effortName	Effort window: Effort.
effortNotes	Effort window: Notes (unlabelled).
effortTime	Effort window: Time.
effortType	Effort window: Type.

File Field Substitution Macros

This table lists each of the file field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

File Macros

Macro Name	Description
fileExtension	The file type extension of the file being generated.
fileName	The name of the file being generated.
fileNameImpl	The filename of the implementation file for this generation, if applicable.
fileHeaders	'Code Gen' dialog: Headers.
fileImports	'Code Gen' dialog: Imports. For supported languages this also includes dependencies derived from these types of relationship: • Aggregation • Association • Attribute classifier • Method return type • Method parameter classifier • Generalization • Realization (to interface) • Template Binding (C++) • Dependency
filePath	The full path of the file being generated.
filePathImpl	The full path of the implementation file for this generation, if applicable.

File Import Field Substitution Macros

This table lists each of the file import field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of T if the box is selected. Otherwise the value is empty.

File Import Macros

Macro Name	Description
importClassName	The name of the Class being imported.
importFileName	The filename of the Class being imported.
importFilePath	The full path of the Class being imported.
importFromAggregation	T if the Class has an Aggregation connector to a Class in this file, F otherwise.
importFromAssociation	T if the Class has an Association connector to a Class in this file, F otherwise.
importFromAtt	T if an attribute of a Class in the current file is of the type of this Class, F otherwise.
importFromDependency	T if the Class has a Dependency connector to a Class in this file, F otherwise.
importFromGeneralization	T if the Class has a Generalization connector to a Class in this file, F otherwise.
importFromMeth	T if a method return type of a Class in the current file is the type of this Class, F otherwise.
importFromParam	T if a method parameter of a Class in the current file is of the type of this Class; otherwise F.
importFromPropertyType	T if the Class has a property (Part/Port) typing to another Class, F otherwise.
importFromRealization	T if the Class has a Realization connector to a Class in this file, F otherwise.
importFromTemplateBinding	T if the Class has a TemplateBinding connector to a Class in this file, F otherwise.
importInFile	T if the Class is in the current file, F otherwise.
importPackagePath	The Package path with a '.' separator of the Class being imported.
ImportRelativeFilePath	The relative file path of the Class being imported from the file path of the file being generated.

Link Field Substitution Macros

If you want to provide access to data concerning connectors in the model, particularly Associations and Generalizations, you can use the 'Link field substitution' macros. The macro names are in Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected; otherwise the value is empty.

Link Macros

Macro Name	Description/Result
linkAttAccess	Association 'Properties' dialog, Target Role: 'Access' field.
linkAttAggregation	Association 'Properties' dialog, Source or Target Role: Aggregation.
linkAttCollectionClass	The collection appropriate for the linked attribute in scope.
linkAttContainment	Association 'Properties' dialog, Target Role: Containment.
linkAttName	'Association Properties' dialog: Target.
linkAttNotes	Association 'Properties' dialog, Target Role: Role Notes.
linkAttOwnedByAssociation	True, if the 'Owned' checkbox on the 'Role(s)' page of the Association 'Properties' dialog is not selected.
linkAttOwnedByClass	True, if the 'Owned' checkbox on the 'Role(s)' page of the Association 'Properties' dialog is selected.
linkAttQualName	The Association target qualified by the namespace path (if generating namespaces) and the classifier path (dot delimited).
linkAttRole	Association 'Properties' dialog, Target Role: Role.
linkAttRoleAlias	'Association Properties Target Role' dialog: Alias
linkAttStereotype	Association 'Properties' dialog, Target Role: Stereotype.
linkAttTargetScope	Association 'Properties' dialog, Target Role: Target Scope.
linkCard	Link 'Properties' dialog, Target Role: Multiplicity.
linkGUID	The unique GUID for the current connector.
linkIsAssociationClass	True, if the Association is an AssociationClass connector.
linkIsBound	Returns T if any TemplateBindings are specified on the connector.
linkParamSubs	Returns a comma-separated list of the arguments specified.
linkParentName	Generalization 'Properties' dialog: 'Target' field.

linkParentQualName	The Generalization target qualified by the namespace path (if generating namespaces) and the classifier path (dot delimited).
linkStereotype	The stereotype of the current connector.
linkVirtualInheritance	Generalization 'Properties' dialog: 'Virtual Inheritance' field.

Linked File Field Substitution Macros

This table lists each of the 'Linked File' field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Linked File Macros

Macro Name	Description
linkedFileLastWrite	Class 'Properties' dialog: 'Files' tab, 'Last Write' field.
linkedFileNotes	Class 'Properties' dialog: 'Files' tab, 'Notes' field.
linkedFilePath	Class 'Properties' dialog: 'Files' tab, 'File Path' field.
linkedFileSize	Class 'Properties' dialog: 'Files' tab, 'Size' field.
linkedFileType	Class 'Properties' dialog: 'Files' tab, 'Type' field.

Metric Field Substitution Macros

This table lists each of the Metric field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Metric Macros

Macro Name	Description
metricName	Metrics screen: 'Metric' field.
metricNotes	Metrics screen: (Notes) field.
metricType	Metrics screen: 'Type' field.
metricWeight	Metrics screen: 'Weight' field.

Operation Field Substitution Macros

The 'Operation field substitution' macros provide access to data concerning operations in the model. The macro names are in Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected; otherwise the value is empty.

Operation field substitution macros

Macro Name	Description/Result
opAbstract	'Operation' dialog: 'Virtual' checkbox.
opAlias	'Operation' dialog: Alias.
opBehavior	'Operation Behavior' dialog: Behavior.
opCode	'Operation Behavior' dialog: Behavior Code.
opConcurrency	'Operation' dialog: Concurrency.
opConst	'Operation' dialog: 'Const' checkbox.
opGUID	The unique GUID for the current operation.
opHasSelfRefParam	Scans the list of parameters in the current Operation, returning 'T' if one type is the Class reference (this could be ClassA* or ClassA&, depending on the value of the genOptCOperationRefParamStyle code generation option field substitution macro).
opImplMacros	A space-separated list of macros defined in the implementation of this operation.
opIsQuery	'Operation' dialog: 'IsQuery' checkbox.
opMacros	A space-separated list of macros defined in the declaration for this operation.
opName	'Operation' dialog: Name.
opNotes	'Operation' dialog: Notes.
opPure	'Operation' dialog: 'Pure' checkbox.
opReturnArray	'Operation' dialog: 'Return Array' checkbox.
opReturnClassifierGUID	The unique GUID for the classifier of the current operation.
opReturnQualType	The operation return type qualified by the namespace path (if generating namespaces) and the classifier path (dot delimited). If the return type classifier has not been set, it is equivalent to the opReturnType macro.
opReturnType	'Operation' dialog: Return Type.

opScope	'Operation' dialog: Scope.
opStatic	'Operation' dialog: 'Static' checkbox.
opStereotype	'Operation' dialog: Stereotype.
opSynchronized	'Operation' dialog: 'Synchronized' checkbox.

Package Field Substitution Macros

This table lists the Package Field Substitution macros.

Field Substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Package Macros

Macro Name	Description
packageAbstract	Package dialog: Abstract.
packageAlias	Package dialog: Alias.
packageAuthor	Package dialog: Author.
packageComplexity	Package dialog: Complexity.
packageGUID	The unique GUID for the current Package.
packageKeywords	Package dialog: Keywords.
packageLanguage	Package dialog: Language.
packageName	Package dialog: Name.
packagePath	The string representing the hierarchy of Packages, for the Class in scope. Each Package name is separated by a dot (.).
packagePhase	Package dialog: Phase.
packageScope	Package dialog: Scope.
packageStatus	Package dialog: Status.
packageStereotype	Package dialog: Stereotype.
packageVersion	Package dialog: Version.

Parameter Field Substitution Macros

This table lists each of the Parameter field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Parameter Macros

Macro Name	Description
paramClassifierGUID	The unique GUID for the classifier of the current parameter.
paramDefault	Operation 'Parameters' dialog: 'Default' field.
paramFixed	Operation 'Parameters' dialog: 'Fixed' checkbox.
paramGUID	The unique GUID for the current parameter.
paramIsEnum	True, if the parameter uses the enum keyword (C++).
paramKind	Operation 'Parameters' dialog: 'Kind' field.
paramName	Operation 'Parameters' dialog: 'Name' field.
paramNotes	Operation 'Parameters' dialog: 'Notes' field.
paramQualType	The parameter type qualified by the namespace path (if generating namespaces) and the classifier path (dot delimited). If the parameter classifier has not been set, is equivalent to the paramType macro.
paramType	Operation 'Parameters' dialog: 'Type' field.

Problem Field Substitution Macros

This table lists each of the Problem field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Problem Macros

Macro Name	Description
problemCompletedBy	'Maintenance' dialog, 'Element Issues' tab: Completed by.
problemCompletedDate	'Maintenance' dialog, 'Element Issues' tab: Completed.
problemHistory	'Maintenance' dialog, 'Element Issues' tab: History.
problemName	'Maintenance' dialog, 'Element Issues' tab: Name.
problemNotes	'Maintenance' dialog, 'Element Issues' tab: Description.
problemPriority	'Maintenance' dialog, 'Element Issues' tab: Priority.
problemRaisedBy	'Maintenance' dialog, 'Element Issues' tab: Raised by.
problemRaisedDate	'Maintenance' dialog, 'Element Issues' tab: Raised.
problemStatus	'Maintenance' dialog, 'Element Issues' tab: Status.
problemVersion	'Maintenance' dialog, 'Element Issues' tab: Version.

Requirement Field Substitution Macros

This table lists each of the Requirement field substitution macros with a description of the result.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Requirement Macros

Macro Name	Description
requirementDifficulty	'Properties' dialog: 'Require' tab: Difficulty.
requirementLastUpdated	'Properties' dialog: 'Require' tab: Last Update.
requirementName	'Properties' dialog: 'Require' tab: Short Description.
requirementNotes	'Properties' dialog: 'Require' tab: Notes.
requirementPriority	'Properties' dialog: 'Require' tab: Priority.
requirementStatus	'Properties' dialog: 'Require' tab: Status.
requirementType	'Properties' dialog: 'Require' tab: Type.

Resource Field Substitution Macros

This table lists each of the Resource field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Resource Macros

Macro Name	Description
resourceAllocatedTime	Resource Allocation window: Allocated Time.
resourceEndDate	Resource Allocation window: End Date.
resourceExpectedTime	Resource Allocation window: Expected Time.
resourceExpendedTime	Resource Allocation window: Time Expended.
resourceHistory	Resource Allocation window: History.
resourceName	Resource Allocation window: Resource.
resourceNotes	Resource Allocation window: Description.
resourcePercentCompleted	Resource Allocation window: Completed(%).
resourceRole	Resource Allocation window: Role.
resourceStartDate	Resource Allocation window: Start Date.

Risk Field Substitution Macros

This table lists each of the Risk field substitution macros.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Risk Macros

Macro Name	Description
riskName	Risks window: Risk.
riskNotes	Risks window: (Notes).
riskType	Risks window: Type.
riskWeight	Risks window: Weight.

Scenario Field Substitution Macros

This table lists each of the Scenario field substitution macros with a description of the result.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Scenario Macros

Macro Name	Description
scenarioGUID	The unique ID for a scenario. Identifies the scenario unambiguously within a model.
scenarioName	'Properties' dialog, 'Scenario' tab: Scenario.
scenarioNotes	'Properties' dialog, 'Scenario' tab: (Notes).
scenarioType	'Properties' dialog, 'Scenario' tab: Type.

Tagged Value Substitution Macros

Tagged Value macros are a special form of field substitution macros, which provide access to element tags and the corresponding Tagged Values. They can be used in one of two ways:

- Direct Substitution
- Conditional Substitution

Direct Substitution

This form of the macro directly substitutes the value of the named tag into the output.

Structure: %<macroName>:"<tagName>"%

<macroName> can be one of:

- attTag
- classTag
- connectorDestElemTag
- connectorDestTag
- connectorSourceElemTag
- connectorSourceTag
- connectorTag
- linkAttTag
- linkTag
- opTag
- packageTag
- paramTag

This corresponds to the tags for attributes, Classes, operations, Packages, parameters, connectors with both ends, elements at both ends of connectors and connectors including the attribute end.

<tagName> is a string representing the specific tag name.

Example

%opTag:"attribute"%

Conditional Substitution

This form of the macro mimics the conditional substitution defined for field substitution macros.

Structure: %<macroName>:"<tagName>" (== "<test>") ? <subTrue> (: <subFalse>) %

Note:

- <macroName> and <tagName> are as defined here
- (<text>) denotes that <text> is optional
- <test> is a string representing a possible value for the macro
- <subTrue> and <subFalse> can be a combination of quoted strings and the keyword value; where the value is used, it gets replaced with the macro's value in the output

Examples

%opTag:"opInline" ? "inline" : ""%

%opTag:"opInline" ? "inline"%

%classTag:"unsafe" == "true" ? "unsafe" : ""%

%classTag:"unsafe" == "true" ? "unsafe"%

Tagged Value macros use the same naming convention as field substitution macros.

Template Parameter Substitution Macros

If you want to provide access in a transformation template to data concerning the transformation of a Template Binding connector's binding parameter substitution in the model, you can use the Template Parameter substitution macros. The macro names are in Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected; otherwise the value is empty.

Template Parameter substitution macros

Macro Name	Description
parameterSubstitutionFormal	'Template Binding Properties' dialog, 'Binding Parameter' tab, 'Parameter Substitution(s)' panel: Formal Template Parameter name.
parameterSubstitutionActual	'Template Binding Properties' dialog, 'Binding Parameter' tab, 'Parameter Substitution(s)' panel: Actual parameter name/expression.
parameterSubstitutionActualClassifier	'Template Binding Properties' dialog, 'Binding Parameter' tab, 'Parameter Substitution(s)' panel: Actual parameter classifier.

Test Field Substitution Macros

This table lists each of the Test field substitution macros with a description of the result.

Field substitution macros are named according to Camel casing. Macros that represent checkboxes return a value of 'T' if the box is selected. Otherwise the value is empty.

Test Macros

Macro Name	Description
testAcceptanceCriteria	Testing window: Acceptance Criteria.
testCheckedBy	Testing window: Checked By.
testDateRun	Testing window: Last Run.
testClass	Testing window: Test Class (the type of test defined: Unit, Integration, System, Acceptance, Inspection, Scenario)
testInput	Testing window: Input.
testName	Testing window: Test.
testNotes	Testing window: Description.
testResults	Testing window: Results.
testRunBy	Testing window: Run By. (Values are derived from the Project Author definitions in the 'People' dialog - 'Configure > Reference Data > Model Types > People > Project Authors'.)
testStatus	Testing window: Status.
testType	Testing window: Type.

Function Macros

Function macros are a convenient way of manipulating and formatting various element data items. Each function macro returns a result string. There are two primary ways to use the results of function macros:

- Direct substitution of the returned string into the output, such as: %TO_LOWER(attName)%
- Storing the returned string as part of a variable definition such as: $name = %TO_LOWER(attName)%

Function macros can take parameters, which can be passed to the macros as:

- String literals, enclosed within double quotation marks
- Direct substitution macros without the enclosing percent signs
- Variable references
- Numeric literals

Multiple parameters are passed using a comma-separated list.

Function macros are named according to the All-Caps style, as in:

%CONVERT_SCOPE(opScope)%

The available function macros are described here. Parameters are denoted by square brackets, as in:

FUNCTION_NAME([param]).

CONVERT_SCOPE([umlScope])

For use with supported languages, to convert [umlScope] to the appropriate scope keyword for the language being generated. This table shows the conversion of [umlScope] with respect to the given language.

Language	Conversions
C++	Package ==> public Public ==> public Private ==> private Protected ==> protected
C#	Package ==> internal Public ==> public Private ==> private Protected ==> protected
Delphi	Package ==> protected Public ==> public Private ==> private Protected ==> protected
Java	Package ==> {blank} Public ==> public Private ==> private Protected ==> protected
PHP	Package ==> public

	Public ==> public Private ==> private Protected ==> protected
VB	Package ==> Protected Public ==> Public Private ==> Private Protected ==> Protected
VB .Net	Package ==> Friend Public ==> Public Private ==> Private Protected ==> Protected

COLLECTION_CLASS([language])

Gives the appropriate collection Class for the language specified for the current linked attribute.

CSTYLE_COMMENT([wrap_length])

Converts the notes for the element currently in scope to plain C-style comments, using /* and */.

DELPHI_PROPERTIES([scope], [separator], [indent])

Generates a Delphi property.

DELPHI_COMMENT([wrap_length])

Converts the notes for the element currently in scope to Delphi comments.

EXEC_ADD_IN(, [function_name],, ...,)

Invokes an Enterprise Architect Add-In function, which can return a result string.

[addin_name] and [function_name] specify the names of the Add-In and function to be invoked.

Parameters to the Add-In function can be specified via parameters [prm_1] to [prm_n].

```
$result = %EXEC_ADD_IN("MyAddin", "ProcessOperation", classGUID, opGUID)%
```

Any function that is to be called by the EXEC_ADD_IN macro must have two parameters: an EA.Repository object, and a Variant array that contains any additional parameters from the EXEC_ADD_IN call. Return type should be Variant.

```
Public Function ProcessOperation(Repository As EA.Repository, args As Variant) As Variant
```

FIND([src], [subString])

Position of the first instance of [subString] in [src]; -1 if none.

GET_ALIGNMENT()

Returns a string where all of the text on the current line of output is converted into spaces and tabs.

JAVADOC_COMMENT([wrap_length])

Converts the notes for the element currently in scope to javadoc -style comments.

LEFT([src], [count])

The first [count] characters of [src].

LENGTH([src])

Length of [src]. Returns a string.

MATH_ADD(x,y) MATH_MULT(x,y) and MATH_SUB(x,y)

In a code template or DDL template, these three macros perform, respectively, the mathematical functions of:

- Addition (x+y)
- Multiplication (x*y) and
- Subtraction (x-y)

The arguments x and y can be integers or variables, or a combination of the two. Consider these examples, as used in a 'Class' template for C++ code generation:

- $a = %MATH_ADD(3,4)%
- $b = %MATH_SUB(10,3)%
- $c = %MATH_MULT(2,3)%
- $d = %MATH_ADD($a,$b)%
- $e = %MATH_SUB($b,$c)%
- $f = %MATH_MULT($a,$b)%
- $g = %MATH_MULT($a,10)%
- $h = %MATH_MULT(10,$b)%

These compute, in the same sequence, to:

- a = 3 + 4 = $a
- b = 10 - 3 = $b
- c = 2 * 3 = $c

- d = a + b = $d
- e = b - c = $e
- f = a * b = $f
- g = a * 10 = $g
- h = 10 * b = $h

When the code is generated, the .h file (for C++) contains these corresponding strings:

- a = 3 + 4 = 7
- b = 10 - 3 = 7
- c = 2 * 3 = 6
- d = a + b = 14
- e = b - c = 1
- f = a * b = 49
- g = a * 10 = 70
- h = 10 * b = 70

MID([src], [start]) MID([src], [start], [count])

Substring of [src] starting at [start] and including [count] characters. Where [count] is omitted the rest of the string is included.

PI([option], [value], {[option], [value]})

Sets the PI for the current template to [value]. Valid values for [value] are:

- "\n"
- "\t "
- “ “
- “”

<option> controls when the new PI takes effect. Valid values for <option> are:

- I, Immediate: the new PI is generated before the next non-empty template line
- N, Next: the new PI is generated after the next non-empty template line

Multiple pairs of options are allowed in one call. An example of the situation where this would used is where one keyword is always on a new line, as illustrated here:

%PI=" "%

%classAbstract ? "abstract"%

%if classTag:"macro" != ""%

%PI("I", "\n", "N", " ")%

%classTag:"macro"%

%endIf%

class

%className%

For more details, see *The Processing Instruction (PI) Macro*.

PROCESS_END_OBJECT([template_name])

Enables the Classes that are one Class further away from the base Class, to be transformed into objects (such as attributes, operations, Packages, parameters and columns) of the base Class. [template_name] refers to the working template that temporarily stores the data.

REMOVE_DUPLICATES([source], [separator])

Where [source] is a [separator] separated list; this removes any duplicate or empty strings.

REPLACE([string], [old], [new])

Replaces all occurrences of [old] with [new] in the given string <string>.

RESOLVE_OP_NAME()

Resolves clashes in interface names where two method-from interfaces have the same name.

RESOLVE_QUALIFIED_TYPE() RESOLVE_QUALIFIED_TYPE([separator]) RESOLVE_QUALIFIED_TYPE([separator], [default])

Generates a qualified type for the current attribute, linked attribute, linked parent, operation, or parameter. Enables the specification of a separator other than. and a default value for when some value is required.

RIGHT([src], [count])

The last [count] characters of [src].

TO_LOWER([string])

Converts [string] to lower case.

TO_UPPER([string])

Converts [string] to upper case.

TRIM([string]) TRIM([string], [trimChars])

Removes trailing and leading white spaces from [string]. If [trimChars] is specified, all leading and trailing characters in

the set of <trimChars> are removed.

TRIM_LEFT([string]) TRIM_LEFT([string], [trimChars])

Removes the specified leading characters from <string>.

TRIM_RIGHT([string]) TRIM_RIGHT([string], [trimChars])

Removes the specified trailing characters from <string>.

VB_COMMENT([wrap_length])

Converts the notes for the element currently in scope to Visual Basic style comments.

WRAP_COMMENT([comment], [wrap_length], [indent], [start_string])

Wraps the text [comment] at width [wrap_length] putting [indent] and [start_string] at the beginning of each line.

```
$behavior = %WRAP_COMMENT(opBehavior, "40", " ", "//")%
```

<wrap_length> must still be passed as a string, even though WRAP_COMMENT treats this parameter as an integer.

WRAP_LINES([text], [wrap_length], [start_string] {, [end_string] })

Wraps [text] as designated to be [wrap_length], adding [start_string] to the beginning of every line and [end_string] to the end of the line if it is specified.

XML_COMMENT([wrap_length])

Converts the notes for the element currently in scope to XML-style comments.

Control Macros

Control macros are used to control the processing and formatting of the templates. The basic types of control macro include:

- The list macro, for generating multiple element features, such as attributes and operations
- The branching macros, which form if-then-else constructs to conditionally execute parts of a template
- The PI macro for formatting new lines in the output, which takes effect from the next non-empty line
- A PI function macro that enables setting PI to a variable and adds the ability to set the PI that is generated before the next line
- The synchronization macros

In general, control macros are named according to Camel casing.

List Macro

If you need to loop or iterate through a set of Objects that are contained within or are under the current object, you can do so using the *%list* macro. This macro performs an iterative pass on all the objects in the scope of the current template, and calls another template to process each one.

The basic structure is:

%list=<TemplateName> @separator=<string> @indent=<string> (<conditions>) %

where <string> is a double-quoted literal string and <TemplateName> can be one of these template names:

- Attribute
- AttributeImpl
- Class
- ClassBase
- ClassImpl
- ClassInitializer
- ClassInterface
- Constraint
- Custom Template (custom templates enable you to define your own templates)
- Effort
- InnerClass
- InnerClassImpl
- LinkedFile
- Metric
- Namespace
- Operation
- OperationImpl
- Parameter
- Problem
- Requirement
- Resource
- Risk
- Scenario
- Test

<conditions> is optional and looks the same as the conditions for 'if' and 'elseIf' statements.

Example

In a Class transform, the Class might contain multiple attributes; this example calls the Attribute transform and outputs the result of processing the transform for each attribute of the Class in scope. The resultant list separates its items with a single new line and indents them two spaces respectively. If the Class in scope had any stereotyped attributes, they would be generated using the appropriately specialized template.

%list="Attribute" @separator="\n" @indent=" "%

The separator attribute, denoted by @separator, specifies the space that should be used between the list items, excluding the last item in the list.

The indent attribute, denoted by @indent, specifies the space by which each line in the generated output should be indented.

Special Cases

There are some special cases to consider when using the %list macro:

- If the Attribute template is used as an argument to the %list macro, this also generates attributes derived from Associations by executing the appropriate LinkedAttribute template
- If the ClassBase template is used as an argument to the %list macro, this also generates Class bases derived from links in the model by executing the appropriate LinkedClassBase template
- If the ClassInterface template is used as an argument to the %list macro, this also generates Class bases derived from links in the model by executing the appropriate LinkedClassInterface template
- If InnerClass or InnerClassImpl is used as an argument to the %list macro, these Classes are generated using the Class and ClassImpl templates respectively; these arguments direct that the templates should be processed based on the inner Classes of the Class in scope

Branching Macros

Branching macros provide if-then-else constructs. The CTF supports a limited form of branching through these macros:

- if
- elseIf
- else
- endIf
- endTemplate (which exits the current template)

The basic structure of the if and elseIf macros is:

```
%if <test> <operator> <test>%
```

where <operator> can be one of:

- ==
- !=
- < (mathematics comparison, less than)
- > (mathematics comparison, greater than)
- <= (mathematics comparison, less than or equal to)
- >= (mathematics comparison, greater than or equal to)

and <test> can be one of:

- a string literal, enclosed within double quotation marks
- a direct substitution macro, without the enclosing percent signs
- a variable reference

Note that if you are using one of the mathematics comparison operators, <test> must be a decimal number in string format.

Branches can be nested, and multiple conditions can be specified using one of:

- and, or
- or

When specifying multiple conditions, 'and' and 'or' have the same order of precedence, and conditions are processed left to right.

If conditional statements on strings are case sensitive, 'a String' does not equal 'A STRING'. Hence in some situations it is better to set the variable $str=TO_LOWER(variable) or TO_UPPER(variable) and then compare to a specific case.

Macros are not supported in the conditional statements. It is best to assign the results of a macro (string) to a variable, and then use the variable in the comparison.

```
$fldType = % TO_LOWER ($parameter1)%
$COMMENT = "Use the first 4 characters for Date and Time field types"
$fldType4 = % LEFT ($fldType, 4)%
%if $fldType4 == "date"%
Datetime
%endif%
```

This takes a parameter of value “Datetime”, “DATETIME” or “Date”, and returns “Datetime”.

The endif or endTemplate macros must be used to signify the end of a branch. In addition, the endTemplate macro causes the template to return immediately, if the corresponding branch is being executed.

Example 1

```
%if elemType == "Interface"%
;
%else%
%OperationBody%
%endIf%
```

In this case:

- If the elemType is "Interface" a semi-colon is returned
- If the elemType is not "Interface", a template called Operation Body is called

Example 2

```
$bases="ClassBase"
$interfaces=""%
%if $bases !="" and $interfaces !=""%
: $bases, $interfaces
%elseIf $bases !=""%
: $bases
%elseIf $interfaces !=""%
: $interfaces
%endIf%
```

In this case the text returned is ':ClassBase'.

Conditions using Boolean Value

When setting up branching using conditions that involve a system checkbox (boolean fields), such as Attribute.Static (attStatic) the conditional statement would be written as:

```
%if attStatic == "T"%
```

For example:

```
% if attCollection == "T" or attOrderedMultiplicity == "T" %
% endTemplate %
```

Synchronization Macros

The synchronization macros are used to provide formatting hints to Enterprise Architect when inserting new sections into the source code, during forward synchronization. The values for synchronization macros must be set in the File templates.

The structure for setting synchronization macros is:

%<name>=<value>%

where <name> can be one of the macros listed here and <value> is a literal string enclosed by double quotes.

Synchronization Macros

Macro Name	Description
synchNewClassNotesSpace	Space to append to a new Class note. Default value: \n.
synchNewAttributeNotesSpace	Space to append to a new attribute note. Default value: \n.
synchNewOperationNotesSpace	Space to append to a new operation note. Default value: \n.
synchNewOperationBodySpace	Space to append to a new operation body. Default value: \n.
synchNamespaceBodyIndent	Indent applied to Classes within non-global namespaces. Default value: \t.

The Processing Instruction (PI) Macro

The PI (Processing Instruction) macro provides a means of defining the separator text to be inserted between the code pieces (which represent entities) that are generated using a template.

The structure for setting the Processing Instruction is:

```
%PI=<value>%
```

In this structure, <value> is a literal string enclosed by double quotes, with these options:

- "\n" - New line (the default)
- " " - Space
- "\t" - Tab
- "" - Null

By default, the PI is set to generate a new line (\n) for each non-empty substitution, which behavior can be changed by resetting the PI macro. For instance, a Class's Attribute declaration in simple VB code would be generated to a single line statement (with no new lines). These properties are derived from the Class-Attribute properties in the model to generate, for example:

```
Private Const PrintFormat As String = "Portrait"
```

The template for generating this starts with the PI being set to a space rather than a new line:

```
% PI = " " %
% CONVERT_SCOPE (attScope)%
% endIf %
% if attConst == "T" %
Const
% endIf %
```

On transforming this, attscope returns the VB keyword 'Private' and attConst returns 'Const' on the same line spaced by a single space (fitting the earlier VB Class.Attribute definition example).

Alternatively, when generating a Class you might want the Class declaration, the notes and Class body all separated by double lines. In this case the %PI is set to '/n/n' to return double line spacing:

```
% PI = "\n\n" %
% ClassDeclaration %
% ClassNotes %
% ClassBody %
```

PI Characteristics

- Blank lines have no effect on the output
- Any line that has a macro that produces an empty result does not result in a PI separator (space/new line)
- The last entry does not return a PI; for example, %Classbody% does not have a double line added after the body

Code Generation Macros for Executable StateMachines

The templates listed here are available through the Code Template Editor (the Develop > Preferences > Options > Edit Code Templates' ribbon option); select 'STM_C++_Structured' in the 'Language' field.

The templates are structured as shown here:

StmContextStateMachineEnum
    StmStateMachineEnum

StmContextStateEnum
    StmAllStateEnum

StmContextTransitionEnum
    StmTransitionEnum

StmContextEntryEnum
    StmAllEntryEnum

StmContextStateMachineStringToEnum
    StmStateMachineStringToEnum

StmContextStateEnumToString
    StmStateEnumToString

StmContextTransitionEnumToString
    StmTransitionEnumToString

StmContextStateNameToGuid
    StmStateNameToGuid

StmContextTransitionNameToGuid
    StmTransitionNameToGuid

StmContextDefinition
    StmStateMachineEnum
    StmAllStateEnum
    StmTransitionEnum
    StmAllEntryEnum
    StmAllRegionVariableInitialize
    StmStateWithDeferredEvent
        StmDeferredEvent
    StmTransitionProcMapping

- StmTransitionProc
  - StmTransitionExit
  - StmTransitionEntry
  - StmTargetOutgoingTransition
  - StmTargetParentSubmachineState
- StmStateProcMapping
- StmStateProc
  - StmStateEntry
    - StmOutgoingTransition
    - StmConnectionPointReferenceEntry
    - StmParameterizedInitial
  - StmSubMachineInitial
  - StmRegionInitial
  - StmRegionDeactive
    - StmStateExitProc
- StmStateTransition
  - StmStateEvent
    - StmStateTriggeredTransition
  - StmStateCompletionTransition
  - StmStateIncomingTransition
  - StmStateOutgoingTransition
  - StmSubmachineStateExitEvent
    - StmVertexOutgoingTransition
    - StmConnectionPointReferenceExitEvent
  - StmStateExitEvent
    - StmVertexOutgoingTransition
- StmAllRegionVariable
- StmStateMachineStringToEnum
- StmStateMachineRun
  - StmStateInitialData
  - StmStateMachineEntry
    - StmOutgoingTransition
- StmStateMachineRunInitial
  - StmStateMachineInitial
- StmStateMachineRuns

StmContextManager

StmSimulationManager
- StmContextInstanceDeclaration
- StmContextInstance
  - StmContextVariableRunstate

StmContextInstanceAssociation
StmContextInstanceClear

StmEventProxy
StmSignalEnum
StmContextJoinEventEnum
StmJoinEventEnum
StmEventEnum
StmSignalDefinition
StmSignalAttributeAssignment
StmSignalAttribute
StmSignalInitialize
StmEventStringToEnum
StmEventEnumToString
StmEventNameToGuid

StmConsoleManager
StmContextInstanceDeclaration
StmContextInstance
StmContextVariableRunstate
StmContextInstanceAssociation
StmContextInstanceClear

StmStateMachineStrongToEnum

StmInitialForTransition

StmVertextOutgoingTransition

StmSendEvent

StmBroadcastEvent

StmContextRef

Signal & Event

Macro name	Description
stmEventEnum	The name of the Event with the prefix 'ENUM_', all upper case.
StmEventGuid	The GUID of the Event.

stmEventName	The name of the Event with spaces and asterisks removed.
stmEventVariable	The name of the Event with the prefix 'm_' in lower case.
stmIsSignalEvent	Is 'T' if the element is a SignalEvent.
stmSignalEnum	The name of the Signal with the prefix 'ENUM_', all upper case.
stmSignalFirstEvent	The name of the Event with the prefix 'ENUM_', all upper case.
stmSignalGuid	The GUID of the Signal.
stmSignalName	The name of the Signal with spaces and asterisks removed.
stmSignalVariable	The name of the Signal with the prefix 'm_' in lower case.
stmTriggerName	Transition Properties: The name of the Trigger.
stmTriggerSpecification	Transition Properties: The specification of the Trigger.
stmTriggerType	Transition Properties: The type of the Trigger.

Context

Macro name	Description
stmContextName	The name of the Class with spaces and asterisks removed.
stmContextQualName	The qualified name of the Class for which code is being generated.
stmContextVariableName	
stmContextFileName	The output file name for the Class for which code is being generated.

Writing Object Runstate to StateMachine Initialization

Macro name	Description
stmContextVariableRunstateName	
stmContextVariableRunstateValue	
stmContextHasStatemachin	Is 'T' if the current context has one or more StateMachines.

e	
stmHasHistoryPattern	Is 'T' if the StateMachine has a History Pattern.
stmHasTerminatePattern	Is 'T' if the StateMachine has a Terminate Pattern.
stmHasDeferredEventPatte rn	Is 'T' if the StateMachine has a Deferred Event Pattern.
stmHasSubmachinePattern	Is 'T' if the StateMachine has a Submachine Pattern.
stmHasOrthogonalPattern	Is 'T' if the StateMachine has an Orthogonal Pattern.

StateMachine

Macro name	Description
stmStatemachineName	The name of the StateMachine with asterisks and spaces removed.
stmStatemachineEnum	The name of the StateMachine plus 'ENUM_' plus the name of the StateMachine in upper case.
stmStatemachineGuid	The GUID of the StateMachine element.
stmStateCount	The number of State elements in the StateMachine.
stmSubmachineInitialCoun t	The number of Initial elements in the Sub Machine State element.
stmStatemachineHasSubm achineState	Is 'T' if the StateMachine has at least one SubMachine State.
stmStatemachineInitialCou nt	The number of Initial elements in the StateMachine.

Region

Macro name	Description
stmRegionEnum	The name of the State Region plus 'ENUM_' plus the name of the State Region in upper case.
stmRegionFQName	The fully qualified name of the State Region.
stmRegionName	The name of the State Region with spaces and asterisks removed.

stmRegionVariable	The name of the State Region with the prefix 'm_' in lower case.
stmRegionFQVariable	The fully qualified name of the State Region with the prefix 'm_' in lower case.
stmRegionGuid	The GUID of the Region.
stmRegionInitial	
stmRegionIsOwnedByStateMachine	Is 'T' if the Region is owned by a StateMachine.

Transition

Macro name	Description
stmTransitionEnum	The name of the Transition with the prefix 'ENUM_', plus the name of the Transition in upper case.
stmTransitionGuid	The GUID of the Transition.
stmTransitionName	The name of the Transition with spaces and asterisks removed.
stmTransitionSourceGuid	The GUID of the Source element in the Transition.
stmTransitionTargetGuid	The GUID of the Target element in the Transition.
stmTransitionVariable	The name of the Transition with the prefix 'm_' in lower case.
stmTransitionSourceVariable	
stmTransitionTargetVariable	
stmTransitionFQVariable	
stmSourceVertexEnum	The name of the Transition's source vertex plus '_ENUM' plus the name of the Transition's source vertex in upper case.
stmTargetVertexEnum	The name of the Transition's target vertex plus '_ENUM' plus the name of the Transition's target vertex in upper case.
stmSourceIsInitial	Is 'T' if the Transition's source is an Initial.
stmSourceIsState	Is 'T' if the Transition's source is a State.
stmSourceIsEntryPoint	Is 'T' if the Transition's source is an Entry Point.
stmSourceIsExitPoint	Is 'T' if the Transition's source is an Exit Point.

stmSourceIsFork	Is 'T' if the Transition's source is a Fork.
stmSourceIsJoin	Is 'T' if the Transition's source is a Join element.
stmTargetIsFinalState	Is 'T' if the Transition's target is a Final State element.
stmTargetIsExitPoint	Is 'T' if the Transition's target is an Exit Point element.
stmTargetIsState	Is 'T' if the Transition's target is a State element.
stmTargetIsChoice	Is 'T' if the Transition's target is a Choice element.
stmTargetIsJunction	Is 'T' if the Transition's target is a Junction element.
stmTargetIsEntryPoint	Is 'T' if the Transition's target is an Entry Point element.
stmTargetIsConnectionPointReference	Is 'T' if the Transition's target is a Connection Point Reference element.
stmTargetIsFork	Is 'T' if the Transition's target is a Fork element.
stmTargetIsJoin	Is 'T' if the Transition's target is a Join element.
stmTransitionEffect	The Effect of the Transition.
stmTransitionGuard	The Guard of the Transition.
stmTransitionKind	The type or kind of the Transition.
stmTargetInitialTransition	
stmTargetIsSubmachineState	Is 'T' if the Transition's target is a Submachine State.
stmSourceStateEnum	The name of the Transition's source state with the prefix '_ENUM' in upper case.
stmTargetStateEnum	The name of the Transition's target state, with the prefix '_ENUM' in upper case.
stmTargetVertexFQName	The fully qualified name of the Transition's target vertex.
stmTargetIsDeepHistory	Is 'T' if the Transition's target is a Deep History State.
stmTargetIsShallowHistory	Is 'T' if the Transition's target is a Shallow History State.
stmTargetIsTerminate	Is 'T' if the Transition's target is a Terminate element.
stmParentIsStateMachine	Is 'T' if the vertex is an Entry Point or Exit Point, or if the container is a StateMachine.
stmSourceParentStateEnum	

stmTargetParentStateEnum	
stmTargetSubmachineEnum	
stmTargetRegionIndex	
stmIsSelfTransition	Is 'T' if the Transition's source is the same as its target.
stmHistoryOwningRegionInitialTransition	
stmDefaultHistoryTransition	

Vertex and State

Macro name	Description
stmVertexName	The name of the Vertex.
stmStateName	The name of the State.
stmVertexGuid	The GUID of the Vertex.
stmVertexFQName	The fully qualified name of the Vertex.
stmStateFQName	The fully qualified name of the State.
stmVertexType	The type of the vertex; one of 'State', 'FinalState', 'Pseudostate', 'ConnectionPointReference' or ' ' (empty).
stmPseudostateKind	The kind of the Pseudostate; one of 'initial', 'deepHistory', 'shallowHistory', 'join', 'fork', 'junction', 'choice', 'entryPoint', 'exitPoint' or 'terminate'.
stmPseudostateName	The name of the Pseudostate.
stmPseudostateVariable	The name of the Pseudostate with the prefix 'm_' in lower case.
stmPseudostateStateMachineName	The name of the Pseudostate StateMachine.
stmPseudostateStateMachineVariable	The name of the Pseudostate StateMachine with the prefix 'm_' in lower case.
stmVertexVariable	The name of the Vertex with the prefix 'm_' in lower case.
stmVertexEnum	The name of the Vertex plus '_ENUM' plus the name of the Vertex in upper case.

stmStateEnum	The name of the State plus '_ENUM' plus the name of the State in upper case.
stmConnectionPointReferenceStateName	The name of the Connection Point Reference.
stmConnectionPointReferenceStateVariable	The name of the Connection Point Reference with the prefix 'm_' in lower case.
stmConnectionPointReferenceEntryCount	
stmParameterizedInitialCount	
stmInitialCountForTransition	
stmStateVariable	The name of the State with the prefix 'm_' in lower case.
stmStateEntryBehavior	The behavior defined for an 'entry' Action operation for a State (the text on the 'Behavior' tab for the 'entry' Action operation on the Features window for the element).
stmStateEntryCode	The initial code defined for an 'entry' Action operation for a State (the text for the 'entry' Action operation on the Behavior's 'Code' tab).
stmStateDoBehavior	The behavior defined for a 'do' Action operation for a State (the text on the 'Behavior' tab for the 'do' Action operation on the Features window for the element).
stmStateDoCode	The initial code defined for a 'do' Action operation for a State (the text for the 'do' Action operation on the Behavior's 'Code' tab).
stmStateExitBehavior	The behavior defined for an 'exit' Action operation for a State (the text on the 'Behavior' tab for the 'exit' Action operation on the Features window for the element).
stmStateExitCode	The initial code defined for an 'exit' Action operation for a State (the text for the 'exit' Action operation on the Behavior's 'Code' tab).
stmStateSubmachineName	The name of the Submachine.
stmStateSubmachineVariable	The name of the Submachine with the prefix 'm_' in lower case.
stmStateIsFinal	Is 'T' if the State is a FinalState.
stmStateIsSubmachineState	Is 'T' if the State is a Submachine State ('Properties' page | Advanced | 'isSubmachineState' property).
stmSubMachineEnum	The name of the Submachine followed by '_ENUM' plus the name of Submachine in upper case.
stmStateHasChildrenToJoi	

n	
stmStateIsTransitionTarget	
stmThisIsSource	
stmThisIsSourceState	
stmStateParentIsSubmachine	Is 'T' if the State's container is a StateMachine.
stmStateContainerMatchTransitionContainer	
stmVertexRegionIndex	
stmStateRegionCount	The number of regions in the State.
stmStateInitialCount	The number of Initial elements in the StateMachine.
stmVertexContainerVariable	
stmVertexParentEnum	
stmStateHasUnGuardedCompletionTransition	
stmStateEventHasUnGuardedTransition	
stmInitialTransition	

Instance Association

Macro name	Description
stmSourceInstanceName	
stmTargetInstanceName	
stmSourceRoleName	
stmTargetRoleName	

EASL Code Generation Macros

Enterprise Architect provides a number of Enterprise Architect Simulation Library (EASL) code generation macros to generate code from behavioral models. These are:

- EASL_INIT
- EASL_GET
- EASLList and
- EASL_END

EASL_INIT

The EASL_INIT macro is used to initialize an EASL behavior model. The behavior model code generation is dependent on this model.

Aspect	Description
Syntax	%EASL_INIT(<<GUID>>)% where: • <<GUID>> is the GUID of the Object (usually a Class element) that is the owner of the behavior model

EASL_GET

The EASL_GET macro is used to retrieve a property or a collection of an EASL object. The EASL objects and the properties and collections for each object are identified in the *EASL Collections* and *EASL Properties* topics.

Aspect	Description
Syntax	$result = %EASL_GET(<<Property>>, <<Owner ID>>, <<Name>>)% where: • <<Property>> is one of "Property", "Collection", "At", "Count", or "IndexOf" • <<OwnerID>> is the ID of the owner object for which the property/collection is to be retrieved • <<Name>> is the name of the property or Collection being accessed • $result is the returned value; this is “” if not a valid property If <<Property>> is: • "At", then <<OwnerID>> is the ID of a collection and <<Name>> is the index into the collection for which the item is to be retrieved • "Count", then <<Owner ID>> is the ID of a collection and <<Name>> is not used; it will retrieve the item number in the collection • "IndexOf", then <<Owner ID>> is the ID of a collection and <<Name>> is the ID of the item in the collection; it will retrieve the index (string format) of the item within the collection
Example	$sPropName = %EASL_GET("Property", $context, "Name")%

EASLList

The EASLList macro is used to render each object in an EASL collection using the appropriate template.

Aspect	Description
Syntax	$result = %EASLList=<<TemplateName>> @separator=<<Separator>> @indent=<<indent>> @owner=<<OwnedID>> @collection=<<CollectionName>> @option1=<<OPTION1>> @option2=<<OPTION2>>..... @optionN=<<OPTIONN>>% where: • <<TemplateName>> is the name of any behavioral model template or custom template • <<Separator>> is a list separator (such as "\n") • <<indent>> is any indentation to be applied to the result • <<OwnedID>> is the ID of the object that contains the required collection • <<CollectionName>> is the name of the required collection • <<OPTION1>...<<OPTION99>> are miscellaneous options that might be passed on the template; each option is given as an additional input parameter to the template • $result is the resultant value; this is "" if not a valid collection
Example	$sStates = %EASLList="State" @separator="\n" @indent="\t" @owner=$StateMachineGUID @collection="States" @option=$sOption%

EASL_END

The EASL_END macro is used to release the EASL behavior model.

Aspect	Description
Syntax	%EASL_END%

Behavioral Model Templates

- Action
- Action Assignment
- Action Break
- Action Call
- Action Create
- Action Destroy
- Action If

- Action Loop
- Action Opaque
- Action Parallel
- Action RaiseEvent
- Action RaiseException
- Action Switch
- Behavior
- Behavior Body
- Behavior Declaration
- Behavior Parameter
- Call Argument
- Decision Action
- Decision Condition
- Decision Logic
- Decision Table
- Guard
- Property Declaration
- Property Notes
- Property Object
- State
- State CallBack
- State Enumerate
- State EnumeratedName
- StateMachine
- StateMachine HistoryVar
- Transition
- Transition Effect
- Trigger

EASL Collections

This topic lists the EASL collections for each of the EASL objects, as retrieved by the EASL Code Generation Macros code generation macro.

Action

Collection Name	Description
Arguments	The Action's arguments.
SubActions	The sub-actions of the Action.

Behavior

Collection Name	Description
Actions	The Behavior's Actions.
Nodes	The Behavior's nodes.
Parameters	The Behavior's parameters.
Variables	The Behavior's variables.

Classifier

Collection Name	Description
AllStateMachines	All StateMachines for the Classifier.
AsynchProperties	The asynchronous properties of the Classifier.
AsynchTriggers	The asynchronous triggers of the Classifier.
Behaviors	The behaviors of the Classifier.
Properties	The properties of the Classifier.
TimedProperties	The timed properties of the Classifier.
TimedTriggers	The timed triggers of the Classifier.

Triggers	All triggers of the Classifier.

Construct

Collection Name	Description
AllChildren	The Construct's children.
ClientDependencies	The client dependencies on the Construct.
StereoTypes	The stereotypes of the Construct.
SupplierDependencies	The supplier dependencies on the Construct.

Node

Collection Name	Description
IncomingEdges	The Node's incoming edges.
OutgoingEdges	The Node's outgoing edges.
SubNodes	The sub-nodes of the Node.

State

Collection Name	Description
DoBehaviors	The State's Do behaviors.
EntryBehaviors	The State's Entry behaviors.
ExitBehaviors	The State's Exit behaviors.

StateMachine

Collection Name	Description
AllFinalStates	The StateMachine's final States.

AllStates	All States within the StateMachine, including those within Submachine States.
DerivedTransitions	The StateMachine's derived Transitions with the associated valid effect.
States	The States within the StateMachine.
Transitions	The transitions within the StateMachine.
Vertices	The StateMachine's vertices.

Transition

Collection Name	Description
Effects	The Transition's effects.
Guards	The Transition's guards.
Triggers	The Transition's triggers.

Trigger

Collection Name	Description
TriggeredTransitions	The triggered transitions associated with the Trigger.

Vertex

Collection Name	Description
DerivedOutgoingTransitions	The Vertex's derived outgoing transitions after traversing the pseudo-nodes.
IncomingTransitions	The Vertex's incoming transitions.
OutgoingTransitions	The Vertex's outgoing transitions.

EASL Properties

This topic lists the EASL properties for each of the EASL objects, as retrieved by the EASL Code Generation Macros code generation macro.

Action

Property Name	Description
Behavior	The Action's associated behavior (Call Behavior Action or Call Operation Action).
Body	The Action's body.
Context	The Action's context.
Guard	The Action's guard.
IsFinal	A check on whether the action is a final Action.
IsGuarded	A check on whether the action is a guarded Action.
IsInitial	A check on whether the action is an initial Action.
Kind	The Action's kind.
Next	The Action's next action.
Node	The Action's associated node in the graph.

Argument

Property Name	Description
Parameter	The ID of the Argument's associated parameter.
Value	The default value of the argument.

Behavior

Property Name	Description
InitialAction	The Behavior's initial action.

isReadOnly	The isReadOnly of the Behavior.
isSingleExecution	The isSingleExecution of the Behavior.
Kind	The kind of Behavior.
ReturnType	The return type of the Behavior.
Specification	The specification of the Behavior.

CallEvent

Property Name	Description
Operation	The operation of the CallEvent.

ChangeEvent

Property Name	Description
ChangeExpression	The change expression of the ChangeEvent.

Classifier

Property Name	Description
HasBehaviors	A check on whether the Classifier has behavioral models (Activity and Interaction).
Language	The Classifier's language.
StateMachine	The StateMachine of the Classifier.

Condition

Property Name	Description
Expression	The Condition's expression.
Lower	The Condition's lower value.

Upper	The Condition's upper value.

Construct

Property Name	Description
GetTaggedValue	The Property's Tagged Value.
IsStereotypeApplied	A check on whether a particular stereotype is applied to the Property.
Notes	Notes on the Property.
UMLType	The UML type of the Property.
Visibility	The visibility of the Property.

Edge

Property Name	Description
From	The ID of the node from which the Edge arises.
To	The ID of the node at which the Edge is targeted.

EventObject

Property Name	Description
EventKind	The event kind of the Event Object.

Instance

Property Name	Description
Classifier	The classifier of the Instance.
Value	The value of the Instance.

Parameter

Property Name	Description
Direction	The direction of the Parameter.
Type	The type of the Parameter.
Value	The value of the parameter.

Primitive

Property Name	Description
FQName	The FQ name of the Primitive.
ID	The ID of the Primitive.
Name	The name of the Primitive.
ObjectType	The object type of the Primitive.
Parent	The IDParent of the Primitive.

PropertyObject

Property Name	Description
BoundSize	The bound size of the PropertyObject (if it is a collection).
ClassifierStereoType	The stereotype of the PropertyObject's classifier.
IsAsynchProp	A check on whether the PropertyObject is an asynchronous property.
IsCollection	A check on whether the PropertyObject is a collection.
IsOrdered	A check on whether the PropertyObject is ordered (if it is a collection).
IsTimedProp	A check on whether the PropertyObject is a timed property.
Kind	The PropertyObject's kind.

LowerValue	The PropertyObject's lower value (if it is a collection).
Type	The PropertyObject's type.
UpperValue	The PropertyObject's upper value (if it is a collection).
Value	The PropertyObject's value.

SignalEvent

Property Name	Description
Signal	The signal of the SignalEvent.

State

Property Name	Description
HasSubMachine	A check on whether the State is a Submachine state.
IsFinalState	A check on whether the State is a final state.
SubMachine	Get the ID of the Submachine contained by the State (if applicable).

StateMachine

Property Name	Description
HasSubMachineState	A check on whether the StateMachine has a Submachine state.
InitialState	The StateMachine's initial state.
SubMachineState	The StateMachine's Submachine State.

TimeEvent

Property Name	Description
When	The 'when' property of the TimeEvent.

Transition

Property Name	Description
HasEffect	A check on whether the transition has a valid effect.
IsDerived	A check on whether the transition is a derived transition.
IsTranscend	A check on whether the transition transcends from one StateMachine (Submachine State) to another.
IsTriggered	A check on whether the transition is triggered.
Source	The Transition's source.
Target	The Transition's target.

Trigger

Property Name	Description
AsynchDestinationState	The asynchronous destination state of the Trigger (if it is an asynchronous trigger).
DependentProperty	The ID of the property associated with the Trigger.
Event	The Trigger's event.
Name	The Trigger's name.
Type	The Trigger's type.

Vertex

Property Name	Description
IsHistory	A check on whether the vertex is a history state.
IsPseudoState	A check on whether the vertex is a pseudo state.
PseudoStateKind	The Vertex's pseudo-state kind.

Call Templates From Templates

Using function calls with parameters, you can call templates from other templates, whether standard templates or user-defined templates created within your project. Also, called templates can return a value, and can be called recursively.

Examples

A call statement returning a parameter to a variable:

```
$sSource = %StateEnumeratedName($Source)%
```

A call statement to a template that has parameters:

```
%RuleTask($GUID, $index)%
```

Using the $parameter statement in the called template:

```
$GUID = $parameter1
$index = $parameter2
```

Templates support recursive calls, such as this recursive call on the template RuleTask:

```
$GUID = $parameter1
$index = $parameter2
% PI = "" %
$nul = "Initialize condition and action object"
$count = %BR_GET("RuletCount")%
% if $count == "" or $count == $index %
%ComputeRulet($GUID)%
\n
% endTemplate %
%Rulet($index)%
\n
$index = %MATH_ADD($index, "1")%
%RuleTask($GUID, $index)%
```

The Code Template Editor in MDG Development

These topics describe how you use the Code Template Editor window to create custom templates:

- Create Custom Templates
- Customize Base Templates
- Add New Stereotyped Templates

The Code Template Editor provides the facilities of the Common Code Editor, including Intelli-sense for the code generation template macros. For more information on Intelli-sense and the Common Code Editor, see the *Editing Source Code* topic.

Create Custom Templates

Enterprise Architect provides a wide range of templates that define how code elements are generated. If these are not sufficient for your purposes - for example, if you want to generate code in a language not currently supported by Enterprise Architect - you can create completely new custom templates. You can also add stereotype overrides to your custom templates; for example, you might list all of your parameters and their notes in your method notes.

Access

Ribbon	Develop > Preferences > Options > Edit Code Templates Design > Tools > Transform > Transform Templates
Keyboard Shortcuts	Ctrl+Shift+P (code generation templates) Ctrl+Alt+H (MDA transformation templates)

Create custom templates using the Code Templates Editor

Step	Description
1	In the 'Language' field, click on the drop-down arrow and select the appropriate programming language.
2	Click on the Add New Custom Template button. The 'Create New Custom Template' dialog displays.
3	In the 'Template Type' field, click on the drop-down arrow and select the appropriate modeling object. The '<None>' option requires special treatment; it enables the definition of a function macro that doesn't actually apply to any of the types, but must be called as a function to define variables $parameter1, $parameter2 and so on for each value passed in.
4	In the 'Template Name' field, type an appropriate name. Click on the OK button.
5	On the 'Code Templates Editor' tab, the new template is included in the 'Templates' list, with the value 'Yes' in the 'Modified' field. The template is called <Template Type>__<Template Name>. Note the double underscore character between the template type and template name.
6	Select the template from the Templates list and edit the contents in the Template field to meet your requirements.
7	Click on the Save button. This stores the new template, which is now available from the list of templates for use. You can also add a stereotype override to the template, if necessary.

Notes

- For a custom language, you must define the File template so that it can call the Import Section, Namespace and Class templates, and any other templates that you decide are applicable

Customize Base Templates

Enterprise Architect provides a wide range of templates that define how code elements are generated. If you want to change the way a code element is generated, you can customize the appropriate templates. Your changes might be to the effect of the template itself, or to its calls to other templates. You can also add stereotype overrides to your customized templates; for example, you might list all of your parameters and their notes in your method notes.

When you customize a system-provided (base) template, you effectively create a copy of the template that is used in preference to the original. All subsequent changes are to that copy, and the original base template is hidden. If you subsequently delete the copy it can no longer override the original, which is then brought into use again.

Access

Ribbon	Develop > Preferences > Options > Edit Code Templates
Keyboard Shortcuts	Ctrl+Shift+P

Customize a base template

Step	Description
1	On the Code Template Editor, in the 'Language' field, click on the drop-down arrow and select the programming language for which you want to customize the base templates.
2	In the Templates list, click on the base template to edit.
3	Update the template.
4	Click on the Save button to store your changes.
5	Repeat steps 2 to 4 for each of the relevant base templates you want to customize.
6	If you prefer, add one or more stereotype overrides to any of the templates.

Add New Stereotyped Templates

Sometimes it is useful to define a specific code generation template for use with elements of a given stereotype. This enables different code to be generated for elements, depending on their stereotype. Enterprise Architect provides some default templates, which have been specialized for commonly used stereotypes in supported languages. For example, the 'Operation Body' template for C# has been specialized for the property stereotype, so that it automatically generates its constituent 'get' and 'set' methods. You can override the default stereotyped templates as described in the *Override Default Templates* topic. Additionally, you can define templates for your own stereotypes, as described here.

Access

Ribbon	Develop > Preferences > Options > Edit Code Templates
Keyboard Shortcuts	Ctrl+Shift+P

Add a new stereotyped template using the Code Template Editor

Step	Description
1	Select the appropriate language, from the Language list.
2	Select one of the base templates, from the Templates list.
3	Click on the 'Add New Stereotyped Override' button. The 'New Template Override' dialog displays.
4	Select the required Feature and/or Class stereotype. Click on the OK button.
5	The new stereotyped template override displays in Stereotype Overrides list, marked as modified.
6	Make the required modifications in the Code Templates Editor.
7	Click on the Save button to store the new stereotyped template in the project file. Enterprise Architect can now use the stereotyped template, when generating code for elements of that stereotype.

Notes

- Class and feature stereotypes can be combined to provide a further level of specialization for features; for example, if properties should be generated differently when the Class has a stereotype MyStereotype, then both property and MyStereotype should be specified in the New Template Override dialog

Override Default Templates

Enterprise Architect has a set of built-in or default code generation templates. The Code Templates Editor enables you to modify these default templates, hence customizing the way in which Enterprise Architect generates code. You can choose to modify any or all of the base templates to achieve your required coding style.

Any templates that you have overridden are stored in the project file. When generating code, Enterprise Architect first checks whether a template has been modified and if so, uses that template. Otherwise the appropriate default template is used.

Access

Ribbon	Develop > Preferences > Options > Edit Code Templates
Keyboard Shortcuts	Ctrl+Shift+P

Reference

Override a default code generation template using the Code Templates Editor.

When generating code, Enterprise Architect now uses the overriding template instead of the default template.

Field/Button	Description
Language	Select the appropriate language from the list.
Templates	Select one of the base templates from the list.
Stereotype Overrides	If the base template has stereotyped overrides, you can select one of these from the list.
<Other fields>	Make any other modifications required.
Save	Click on this button to store the modified version of the template to the project file. The template is marked as modified.

Grammar Framework

Enterprise Architect provides reverse engineering support for a number of popular programming languages. However, if the language you are using is not supported, you can write your own grammar for it, using the in-built Grammar Editor. You can then incorporate the grammar into an MDG Technology to provide both reverse engineering and code synchronization support for your target language.

The framework for writing a grammar and importing it into Enterprise Architect is the direct complement to the Code Template Framework. While code templates are for converting a model to a textual form, grammars are required to convert text to a model. Both are required to synchronize changes into your source files.

An example language source file and an example Grammar for that language are provided in the Code Samples directory, which you can access from your installation directory (the default location is C:\Program Files\Sparx Systems\EA). Two other grammar files are also provided, illustrating specific aspects of developing Grammars.

Components

Component	Description
Grammar Syntax	Grammars define how a text is to be broken up into a structure, which is necessary when you are converting code into a UML representation. At the simplest level, a grammar is instructions for breaking up an input to form a structure. Enterprise Architect uses a variation of Backus–Naur Form (nBNF) to include processing instructions, the execution of which returns structured information from the parsed results in the form of an Abstract Syntax Tree (AST), which is used to generate a UML representation.
Grammar Editor	The Grammar Editor is an in-built editor that you can use to open, edit, validate and save grammar files.
Grammar Debugging	You can debug the grammar files you create using two facilities: • The Parser, which generates the AST for the Grammar • The Profiler, which also parses the Grammar and generates the AST but which exposes the Profiling pathway to show exactly what happened at each step of the process

Grammar Syntax

Grammars define how a text is to be broken up into a structure, which is exactly what is needed when you are converting code into a UML representation. At the simplest level, a grammar is just instructions for breaking up an input to form a structure. Enterprise Architect uses a variation of Backus–Naur Form (BNF) to express a grammar in a way that allows it to convert the text to a UML representation. What the grammar from Enterprise Architect offers over a pure BNF is the addition of processing instructions, which allow structured information to be returned from the parsed results in the form of an Abstract Syntax Tree (AST). At the completion of the AST, Enterprise Architect will process it to produce a UML model.

Syntax

Syntax	Detail
Comments	Comments have the same form as in many programming languages. // You can comment to the end of a line by adding two /s. /* You can comment multiple lines by adding a / followed by a *. The comment is ended when you add a * followed by a /. */
Instructions	Instructions specify the key details of how the grammar works. They are generally included at the top of the grammar, and resemble function calls in most programming languages.
Rules	Rules make up the body of a grammar. A rule can have one or more definitions separated by pipe delimiters (|). For a rule to pass, any single complete definition must pass. Rules are terminated with the semi-colon character (;).
Definitions	A definition is one of the paths a rule can take. Each definition is made up of one or more terms.
Definition Lists	A definition list corresponds to one or more sets of terms. These will be evaluated in order until one succeeds. If none succeed then the containing rule fails. Each pair of definitions is separated by a | character. This is a simple rule with three definitions: <greeting> ::= "hello" | "hi" | ["good"] "morning";
Terms	A term can be a reference to a rule, a specific value, a range of values, a sub-rule or a command.
Commands	Like instructions, commands resemble function calls. They serve two main purposes: • To process tokens in a specific way or • To provide a result to the caller

Grammar Instructions

Instructions specify the key details of how the grammar works. They are generally included at the top of the grammar, and resemble function calls in most programming languages.

Instructions

Instruction	Description
caseSensitive()	One of these two instructions is expected to specify if token matching needs to be case sensitive or not. For example, languages in the BASIC family are case insensitive while languages in the C family are case sensitive.
caseInsensitive()	
delimiters(DelimiterRule: Expression)	The delimiters instruction tells the lexical analyzer which rule to use for delimiter discovery. Delimiters are used during keyword analysis, and can be defined as the characters that can be used immediately before or after language keywords.
lex(TokenRule: Expression)	The lex instruction tells the lexical analyzer the name of the root rule to use for its analysis.
parse(RootRule: Expression) parse(RootRule: Expression, SkipRule: Expression)	The parse instruction tells the parser the name of the root rule to use for its processing. The optional second argument specifies a skip (or escape) rule, which is generally used to handle comments.

Grammar Rules

Rules are run to break up text into structure. A rule is made up of one or more definitions, each of which is made up of one or more terms.

Types of Rule

Rule	Description
Named rules	A name, followed by a definition list. For example: <rule> ::= <term1> <term2> | "-" <term1>;
Inline Rules	Inside a definition, a rule defined within parentheses. These act in exactly the same way as if they were a named rule being called by a term. For example: <rule> ::= (<inline>);
Optional Rules	Inside a definition, a rule defined within square brackets. This rule succeeds even if the contents fail. For example: <rule> ::= [<inline>];
Repeating Rules	Inside a definition, a term followed by a plus sign. This rule matches the inner rule once or more than once. For example: <rule> ::= <inline>+; rule ::= (<term1> <term2>)+;
Optional Repeating Rules	Inside a definition, a rule followed by a star. This rule matches the inner rule zero or more times, meaning it succeeds even if the inner rule never succeeds. For example: <rule> ::= <inline>*; rule ::= (<term1> <term2>)*;

Grammar Terms

Terms identify where tokens are consumed.

Types of Term

Type	Description
Concrete terms	Quoted strings. For example, "class"
Unicode characters	A lexer-only term, having the prefix of U+0x followed by a hexadecimal number. For example: U+0x1234
Ranges	A lexer-only term, matching any character between the two characters specified. For example, "a".."z" or U+0x1234..U+2345
References	The name of another rule, in angled brackets. The token will match if that rule succeeds. For example, <anotherRule>
Commands	A call to a specific command.

Grammar Commands

Commands, like Instructions, resemble function calls. They serve two main purposes:

- To process tokens in a specific way or
- To provide a result to the caller

Commands

Command	Description
attribute(Name: String, Value: Expression)	Creates an attribute on the current AST node. The attribute will be created with the Name specified in the grammar source, and will be given the value of all tokens consumed as a part of executing the Value expression. This command produces the AST node attributes that Enterprise Architect operates on in code engineering.
attributeEx(Name: String) attributeEx(Name: String, Value: String)	Creates an attribute on the current AST node without consuming any tokens. The attribute will be created with the same name as is specified in the grammar source, and with either an empty value or the value specified by the optional Value argument. This command produces the AST node attributes that Enterprise Architect operates on in code engineering.
node(Name: String, Target: Expression)	Creates an AST node under the current AST node (the nodes that Enterprise Architect operates on in code engineering). The node will be created with the Name specified in the grammar source.
token(Target: Expression)	Creates a token during lexical analysis for processing during parsing. The value of the token will be the value of all characters consumed as a result of executing the Target expression.
keywords()	Matches any literal string used as a grammar term; that is, if you enter an explicit string that you are searching for, it becomes a key word.
skip(Target: Expression) skip(Target: Expression, Escape: Expression)	Consumes input data (characters when lexing, and tokens when parsing) until the 'Target' expression is matched. The optional 'Escape' expression can be used to handle instances such as escaped quotes within strings.
skipBalanced(Origin: Expression, Target: Expression) skipBalanced(Origin: Expression, Target: Expression, Escape: Expression)	Consumes input data (characters or tokens) until the 'Target' expression is matched and the nesting level reaches zero. If the 'Origin' expression is matched during this process, the nesting level is increased. If the 'Target' expression is matched, the nesting level is decreased. When the nesting level reaches zero, the command exits with success. An optional 'Escape' expression can be provided.
skipEOF()	Consumes all remaining data (characters or tokens) until the end of the file.
fail()	Causes the parser to fail the current rule, including any remaining definitions.

warning()	Inserts a warning into the resulting AST.
except(Target: Expression, Exception: Expression)	Consumes input data that matches the Target expression, but fail on data that matches the Exception expression. This operates somewhat similar to, but exactly the opposite of, the skip command.
preProcess(Target: Expression)	Evaluates an expression and uses that pre-processed data in multiple definitions. This is most useful within expression parsing, where the same left hand side expression will be evaluated against a number of operators. This command reduces the work the parser must do to make this happen.

AST Nodes

In defining a grammar, you would use AST nodes and AST node attributes that can be recognized in code engineering in Enterprise Architect, in the AST results that are returned by the attribute, attributeEx and node commands. The nodes and attributes are identified in these tables. Any others will be ignored in code engineering.

FILE Node

The FILE node represents a file. It isn't mapped to anything, but contains all the required information.

Multiplicity / Nodes	Description
0..* / PACKAGE	See *PACKAGE Node*.
0..* / CLASS	See *CLASS Node*.
0..* / IMPORT	
0..* / COMMENT	Field labels as part of a skip rule will be at the root level; the code generator looks for comments of this sort by position relative to the node.
0..1 / INSERT_POSITION	This gives the position where new Classes, Packages and method implementations can be inserted into the file. If it is not found, the code generator will automatically insert new items immediately after the last one is found in code.

PACKAGE node

The PACKAGE node corresponds to a namespace or equivalent in the file. When importing with 'package per namespace', Enterprise Architect will create a Package directly under the import for this and place all Classes within it. When not importing namespaces, Enterprise Architect will look for Classes under this point, but it will do nothing with this node.

Additionally, if you are generating with namespaces enabled (see the *Code Options* topics for generic languages) a generated Class will not match a Class in code unless they are under the same Package structure.

Contained in nodes: FILE

Multiplicity / Nodes	Description
1 / NAME	See *NAME Node*.
0..* / CLASS	See *CLASS Node*.
0..* / PACKAGE	
0..1 / OPEN_POSITION	Gives the position where the Package body opens. This can also be used as an insert position.
0..1 / INSERT_POSITION	Gives the position where new Classes and Packages can be inserted into the file. If it is not found, the code generator will automatically insert new items immediately after the last one is found in code.

0..1 / SUPPRESS	Prevents indenting when inserting into this Package.

CLASS/INTERFACE Node

The CLASS (or INTERFACE) node is the most important in code generation. It is brought in as Class (or Interface) Objects.

See *Class DECLARATION* and *Class BODY*.

Contained in Nodes: FILE, PACKAGE, Class BODY

CLASS Declaration

Contained in Nodes: CLASS/INTERFACE

Multiplicity / Nodes	Description
1 / NAME	See *NAME Node*.
0..* / PARENT	See *PARENT Node*.
0..* / TAG	See *TAG Node*.
0..1 / DESCRIPTION	See *DESCRIPTION Node*.
1 / NAME	The name of the Class. If there is a node NAME, that will overwrite this attribute.
0..1 / SCOPE	The UML Scope of the Class - Public, Private, Protected or Package.
0..1 / ABSTRACT	If present, indicates that this is an abstract Class.
0..1 / VERSION	The version of the Class.
0..1 / STEREOTYPE	The stereotype that Enterprise Architect should assign to the Class. This does not support multiple stereotypes.
0..1 / ISLEAF	
0..1 / MULTIPLICITY	
0..1 / LANGUAGE	Generally, you do not need to set this.
0..1 / NOTE	Generally not used as it is addressed by the comments above the Class.
0..1 / ALIAS	
0..* / MACRO	Adds a numbered Tagged Value that Enterprise Architect can use to round trip macros.

Class BODY Node

Contained in Nodes: CLASS/INTERFACE

Multiplicity / Nodes	Description
0..* / METHOD	See *METHOD Node*.
0..* / ATTRIBUTE	See *ATTRIBUTE Node*.
0..* / FIELD	See *FIELD Node*.
0..* / CLASS	See *CLASS Node*.
0..* / SCOPE	See *SCOPE Node*.
0..* / PROPERTY	
0..* / TAG	See *TAG Node*.
0..* / PARENT	See *PARENT Node*.
0..1 / OPEN_POSITION	Gives the position where the Class body opens. This can also be used as an insert position.
0..1 / INSERT_POSITION	Gives the position where new Class members can be inserted into the file. If it is not found, the code generator will automatically insert new items immediately after the last one is found in code.

SCOPE Node

This is an optional feature for languages resembling C++ that have Blocks that specify the scope of elements. The language needs to have a name specified that is used for the scope of all elements in the Block. In all other respects it behaves identically to the Class BODY node.

Contained in Nodes: Class BODY

Multiplicity / Nodes	Description
1 / NAME	Used as the scope for all methods and attributes contained within the scope.

METHOD Node

Contained in Nodes: Class BODY, SCOPE

Multiplicity / Nodes	Description

1 / Method DECLARATION	See *Method DECLARATION Node*.

Method DECLARATION Node

Contained in Nodes: METHOD

Multiplicity / Nodes	Description
0..1 / TYPE	See *TYPE Node*.
0..* / PARAMETER	See *PARAMETER Node*.
0..* / TAG	See *TAG NODE*.
0..1 / DESCRIPTION	See *DESCRIPTION Node*.
0..1 / MULTI PARAMETER	Supports Delphi's parameter list style of declaration. This is the equivalent of FIELD.
1 / NAME	
0..1 / TYPE	
0..1 / SCOPE	
0..1 / ABSTRACT	
0..1 / STEREOTYPE	
0..1 / STATIC	
0..1 / CONST or CONSTANT	
0..1 / PURE	
0..1 / ISQUERY	
0..1 / ARRAY	
0..1 / SYNCHRONIZED	
0..* / MACRO	
0..1 / CSHARPIMPLEMENTS	Specifies special behavior for C#.
0..1 / BEHAVIOR	Provides support for Aspect J, using behavior.

0..1 / SHOWBEHAVIOR	Provides support for Aspect J, using behavior, and shows the reverse-engineered behavior on the diagram.

ATTRIBUTE Node

Contained in Nodes: Class BODY, SCOPE

Multiplicity / Nodes	Description
1 / TYPE	See *TYPE Node*.
0..* / TAG	See *TAG Node*.
0..1 / DESCRIPTION	See *DESCRIPTION Node*.
1 / NAME	
0..1 / TYPE	
0..1 / SCOPE	
0..1 / DEFAULT	
0..1 / CONTAINER or ARRAY	
0..1 / CONTAINMENT	Reference or value.
0..1 / STEREOTYPE	
0..1 / STATIC	
0..1 / CONST or CONSTANT	
0..1 / ORDERED	
0..1 / LOWBOUND	
0..1 / HIGHBOUND	
0..1 / TRANSIENT or VOLATILE	

FIELD Node

A field corresponds to multiple attribute declarations in one. Anything not defined in the Declarators but defined in the field itself will be set for each declarator. Everything supported in an attribute is supported in the field. If no declarators

are found then this works in the same way as an attribute.

Contained in Nodes: Class BODY, SCOPE

Multiplicity / Nodes	Description
0..* / DECLARATOR	See *ATTRIBUTE Node*.

PARAMETER Node

Contained in Nodes: Method DECLARATION, TEMPLATE

Multiplicity / Nodes	Description
1 / TYPE	See *TYPE Node*.
0..* / TAG	See *TAG Node*.
0..1 / DESCRIPTION	See *DESCRIPTION Node*.
0..1 / NAME	
0..1 / TYPE	
0..1 / KIND	Expected to be in, inout, out or return.
0..1 / DEFAULT	
0..1 / FIXED	
0..1 / ARRAY	

NAME Node

Contained in Nodes: PACKAGE, Class DECLARATION

Multiplicity / Nodes	Description
1 / NAME	
0..* / QUALIFIER	
0..* / NAMEPART	An alternative to using NAME and QUALIFIER. A string of values, all except the last one taken as qualifiers. The last one is taken as the Name.

TYPE Node

Contained in Nodes: Method DECLARATION, ATTRIBUTE, PARAMETER

Multiplicity / Nodes	Description
0..1 / TEMPLATE	The entire text of the template is the name of the type. Only used if NAME is undefined. See *TEMPLATE Node*.
1 / NAME	
0..* / QUALIFIER	
0..* / NAMEPART	An alternative to using NAME and QUALIFIER. A string of values, all except the last one taken as qualifiers. The last one is taken as the Name.

TEMPLATE Node

Contained in Nodes: TYPE

Multiplicity / Nodes	Description
0..* / PARAMETER	See *PARAMETER Node*.
1 / NAME	

PARENT Node

Contained in Nodes: Class DECLARATION

Multiplicity / Nodes	Description
0..1 / TYPE	Has the value Parent, Implements or VirtualP.
1 / NAME	
0..* / QUALIFIER	
0..* / NAMEPART	An alternative to using NAME and QUALIFIER. A string of values, all except the last one taken as qualifiers. The last one is taken as the Name.
0..1 / INSTANTIATION	

TAG Node

Contained in Nodes: Class DECLARATION, Method DECLARATION, ATTRIBUTE, PARAMETER

Multiplicity / Nodes	Description
1 / NAME	
0..* / VALUE	
0..1 / MEMO	
0..1 / NOMEMO	
0..1 / GROUP	

DESCRIPTION Node

Contained in Nodes: Class DECLARATION, Method DECLARATION, ATTRIBUTE, PARAMETER

Multiplicity / Nodes	Description
0..* / VALUE	

Editing Grammars

If you need to write and edit a grammar for code imported in a new programming language, you can do so using the built-in Grammar Editor.

Access

Ribbon	Develop > Preferences > Grammars

Create and Edit Grammar

Field/Button	Action
Open Grammar	Display a browser through which you can locate and open the file containing the grammar you want to edit.
Recent	Recently used grammars can be quickly accessed using this combo box.
Save	Save the current file.
Save As	Saves a copy of the current file
Validate Grammar	The grammar validation will run a series of tests on the current grammar to ensure its validity. Errors and warnings will be displayed informing you of both errors that will make the grammar unusable, and conditions where you might get unexpected results.
Help	Display this Help topic.

Context Menu Options

Field/Button	Action
Open File	Display a browser through which you can locate and open the file containing the grammar you want to edit.
Validate	The grammar validation will run a series of tests on the current grammar to ensure its validity. Errors and warnings will be displayed informing you of both errors that will make the grammar unusable, and conditions where you might get unexpected results.
Language	The Grammar Editor defaults to normal Backus–Naur Form (nBNF). The mBNF option is also available.

Line Numbers	Turn line numbers on or off in the grammar editor.

Parsing AST Results

The Abstract Syntax Tree (AST) is the code that Enterprise Architect sees as it processes a grammar.

You parse the text in the bottom half of the Grammar Editor window and review what is displayed as a result. You can either open a file or paste text in. If you have pasted text that corresponds to something that cannot appear at the file level (such as Operation Parameters) you can select an alternative rule to use as a starting point. The parse will then commence from that rule.

Access

Ribbon	Develop > Preferences > Grammars > Grammar Debugger > AST Results

Toolbar Options

Option	Action
Open File	Open a sample input file to test against.
Recent	Recently opened source files can be selected from this combo box.
Parse	Perform the parse operation. If the parse is successful, the 'AST Results' tab will contain the resulting AST.
Select Rule	This drop down allows you to select an alternative root rule for processing your sample source.
Help	Display this Help topic.

Profiling Grammar Parsing

When you parse a grammar that you have created, it might show errors that you cannot immediately diagnose. To help you resolve such errors, you can review the process that the parser followed to generate the AST you can see, using the Grammar Profiler.

You again parse the text in the bottom half of the Grammar Editor window, but this time the tree shows each rule that the parser attempted, where it got to and if it passed or not. Rules for opening a file, pasting a file and setting the starting rule remain the same.

Access

Ribbon	Develop > Preferences > Grammars > Grammar Debugger > Profiler Results

Toolbar Options

Option	Action
Open File	Display a browser through which you can locate and open the file containing the grammar you want to edit.
Parse	Perform the parse operation. If the parse is successful, the 'AST Results' tab will contain the resulting AST, and the 'Profile Results' tab will contain debug information regarding the path that the parser took through your grammar. The profile data is extremely useful when debugging a new grammar.
Select Rule	If you want to use a different root rule for processing your sample source, click on the drop-down arrow and select the alternative rule.
Help	Display this Help topic.

Notes

- Because profiling can take a very long time for large files, the 'Profile Results' tab is not filled if you are not displaying that tab when you begin parsing

Macro Editor

The macro editor allow a user to supplement the grammar with a list of keywords and rules to exclude macros during grammar parse operations. The macro definition list is particularly useful when developing grammars for languages that support macros such as C++. It avoids the necessity of describing these rules in the grammar itself, and can be used with multiple grammars.

This feature is available from Enterprise Architect Release 14.1.

Access

Ribbon	Develop > Preferences > Grammars > Macro Editor

Editing Macros

Open File	Open an existing macro definition list
Recent	Recently opened macro definition lists can be selected from this combo box
Save	Saves changes to the opened macro definition list
Save As	Saves a copy of the existing macro definition list
Validate	Validates the grammar of the macro definition list

Example Grammars

The Code Samples directory set up by the Enterprise Architect installer contains an example Grammar that you can load into the Grammar editor to review, and into the Grammar Debugger to parse and profile.

The Grammar example consists of two files:

- test.ssl - a simple sample language source file, in the style of C, and
- ssl.nbnf - a grammar for the simple sample language

The example illustrates:

- Tokenization (using the Lexer)
- Creation of a Package
- Creation of a Class or Interface
- Creation of an attribute
- Creation of an operation (with parameters)
- Importing comments

The Code Samples directory also contains two other Grammar files that you can examine:

- Expressions Sample.nBNF - this illustrates how expression parsing is set up and processed, with detailed comment text providing explanations
- CSV Sample.nBNF - an example grammar for processing CSV files