SPARX SYSTEMS

ENTERPRISE ARCHITECT

User Guide Series

Software Modeling Advanced

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CREATED WITH ENTERPRISE ARCHITECT

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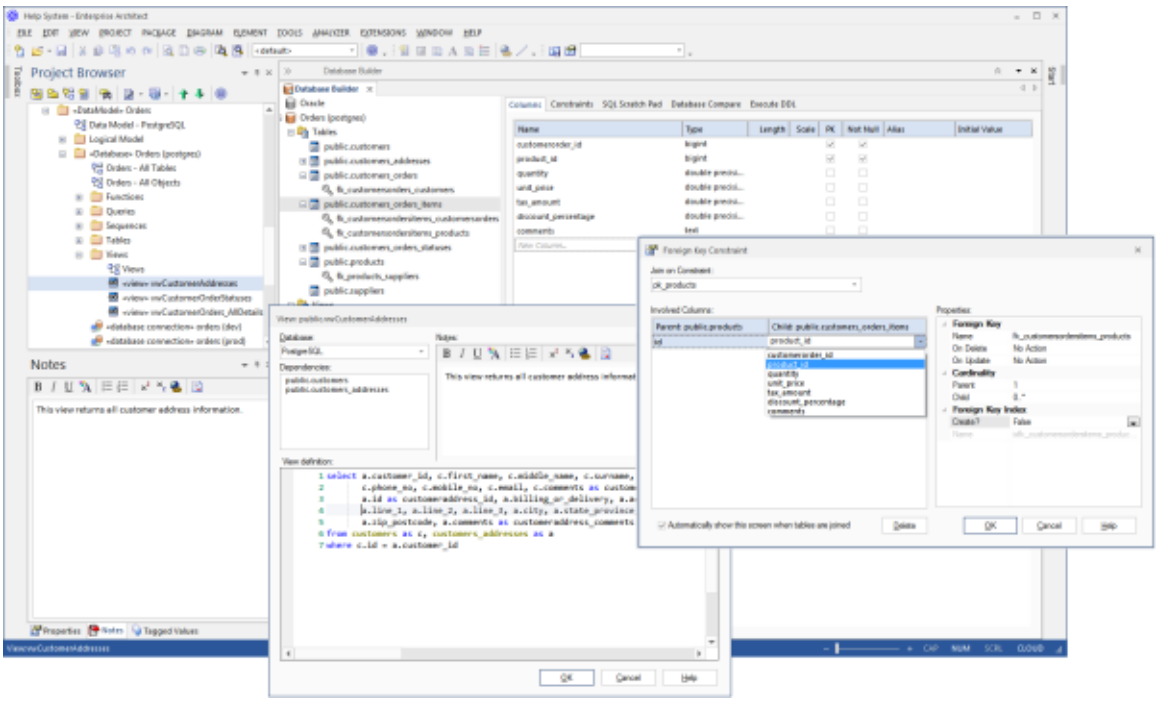
Information Engineering

Design, Create and Manage Conceptual, Logical and Physical Data Models

The power of model-based system development is the ability to visualize, analyze and design all aspects of a system. Being able to view and manage information and data alongside other models of a system provides great clarity and reduces the chance of error. Enterprise Architect has extensive support for the data modeling discipline, ranging from the representation of information in a conceptual model right down to the generation of database objects. Whether you are generating database objects from the UML model or reverse engineering legacy DBMS into a model for analysis, the tool features will save time and valuable project resources.



This illustration shows the Database Builder Interface including DDL Generation and the Foreign Key dialog.

Enterprise Architect supports the modeling of information at the conceptual, logical and physical layers. Using a number of standard features, these models can be interconnected, providing traceability. The logical and physical models can also be generated automatically using a fully customizable Transformation engine. Legacy systems can be imported, analyzed and compared using the handy reverse engineering facility.

In this topic you will learn how to use the feature rich toolset including the Database Builder to design, create, manage, visualize data including reverse and forward engineering of data models to live database.

The Database Builder tool can be used to create and maintain physical data models and can connect to a running DBMS, so you can therefore import, generate, compare and alter a live database.

Getting Started

Information Modelers, Data Modelers and Architects are responsible for creating models of an organization's information that span multiple levels of abstraction, from conceptual through to logical and physical. The conceptual models are technology independent and can be used for discussions with business people and domain experts, allowing the basic concepts in the domain to be represented, discussed and agreed upon. The logical model elaborates the conceptual model, adding more detail and precision but is still typically technology neutral, allowing Information Analysts to discuss and agree on logical structures. The physical model applies technology specific data to the models and allows engineers to discuss and agree on technology decisions in preparation for generation to a target environment, such as a database management system.

Selecting the Perspective

Enterprise Architect partitions the tool's extensive features into Perspectives, which ensures that you can focus on a specific task and work with the tools you need without the distraction of other features. To work with the Data Modeling features you first need to select one of these Perspectives:

<perspective name> > Database Engineering > Database Engineering

<perspective name> > Database Engineering > Entity Relationships

Setting the Perspective ensures that the Database Engineering diagrams, their tool boxes and other features of the Perspective will be available by default.

Example Diagram

An example diagram provides a visual introduction to the topic and allows you to see some of the important elements and connectors that are created in specifying or describing the way a data model is defined including: Tables, Views, Procedures, Sequences, Functions.

Data Model Types

Information can be modeled at a number of level of abstraction starting with a conceptual model that is typically created by or for business people, a Logical model which is used by business and systems analysts and a physical model which is the concern of the technologists such as database engineers. In this topic you will learn how to manage all three levels of information models.

Creating and Managing Data Models

In this topic you will learn how to work in detail using Enterprise Architect to manage your Physical Database schema. This includes the use of the Database Builder tool which allows you to interact with any number of live database through an ODBC connection.

Import Database Schema

This topic will show you how to connect to a live database including Production, Test and Development systems and reverse engineer the database into a model creating Tables, Views, Procedures, Declarative Referential Integrity and

more. A diagram of the database is automatically created and the elements such as tables can be related to other elements in the model including Conceptual and Logical Models, Programming classes tests and more.

Generate Database Definition Language (DDL)

In this topic you will learn how to harness the power of the data models by generating Database Definition Language code directly from the model. Enterprise Architect can generate code into a wide range of Database Management systems.

Supported Database Management Systems

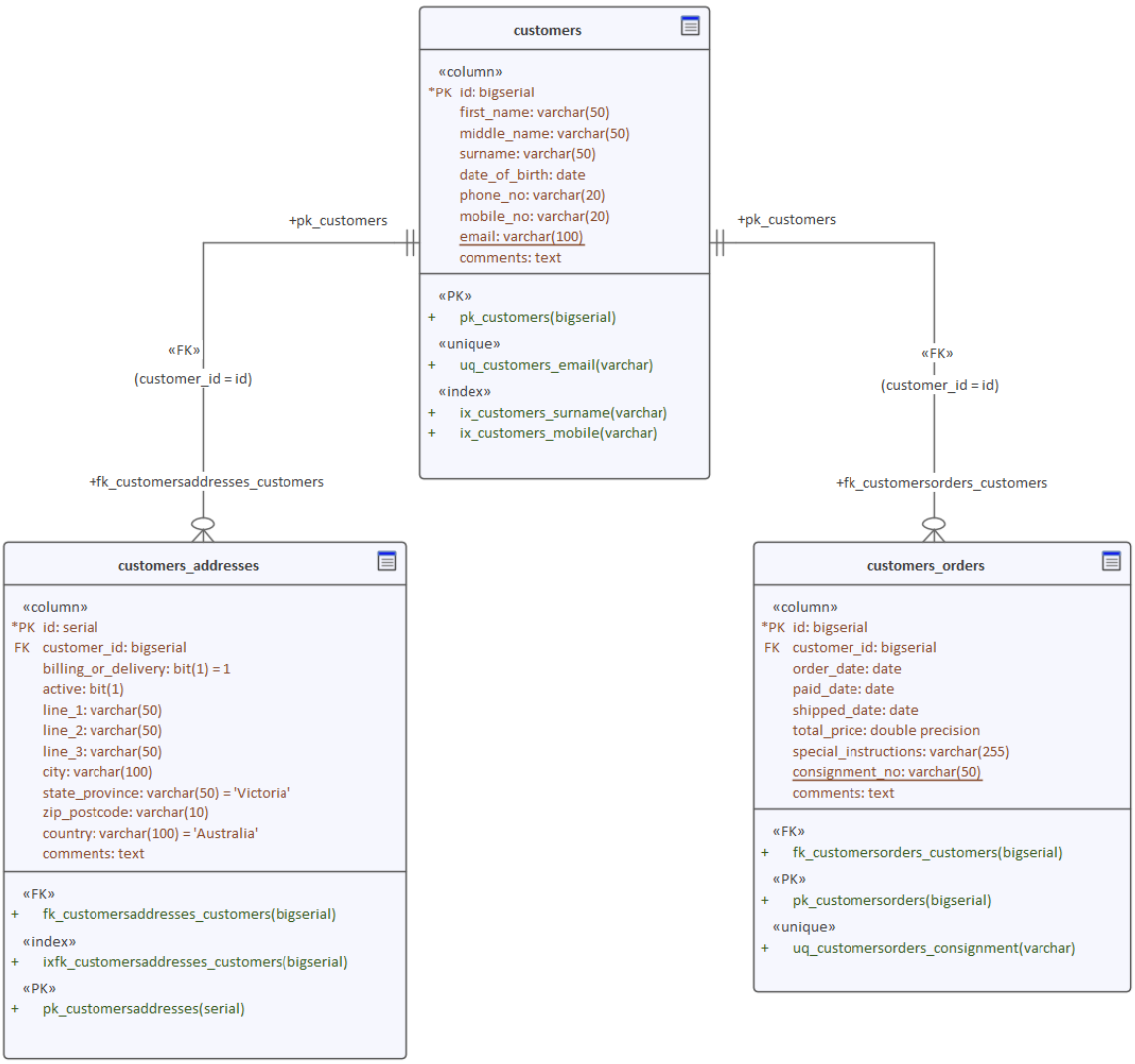
Enterprise Architect has rich support for most of the main stream Database Management Systems (DBMS). This feature allows models from disparate systems to be compared either for code generation or for analysis by using the import feature. This topic lists the supported DBMS and

More Information

This section provides useful links to other topics and resources that you might find useful when working with the Data Modeling tool features.

Example Diagram

Using the Database engineering features of Enterprise Architect you can create rich models of the objects that make up a data model at any level of abstraction from Conceptual through Logical to Physical. These models are created by adding tables and other database objects from the toolbox or by reverse engineering and existing database into a model from a range of RDBMSs. A database diagram can contain Tables, VIews, Procedures, Sequences and Functions. Table Columns are annotated as Primary and Foreign Keys are modeled using specialized association relationships. In this example the user has created a simple physical data model of Customers and their Addresses and Orders.



Physical Data model showing Tables with Columns and Primary and Foreign Keys.

Working with Data Model Types

Enterprise Architect provides a number of features to assist in the process of creating models of information, including the ability to develop conceptual, logical and physical models and to be able to trace the underlying concepts between the models. The physical models can be developed for a wide range of database systems, and forward and reverse engineering allows these models to be synchronized with live databases.

Data Models

Type	Description
Conceptual Data Models	Conceptual data models, also called Domain models, establish the basic concepts and semantics of a given domain and help to communicate these to a wide audience of stakeholders. Conceptual models also serve as a common vocabulary during the analysis stages of a project; they can be created in Enterprise Architect using Entity-Relationship or UML Class models.
Logical Data Models	Logical data models add further detail to conceptual model elements and refine the structure of the domain; they can be defined using Entity-Relationship or UML Class models. One benefit of a Logical data model is that it provides a foundation on which to base the Physical model and subsequent database implementation. Entity-relationship modeling is an abstract and conceptual database modeling method, used to produce a schema or semantic data model of, for example, a relational database and its requirements, visualized in Entity-Relationship Diagrams (ERDs). ERDs assist you in building conceptual data models through to generating Data Definition Language (DDL) for the target DBMS. A Logical model can be transformed to a Physical data model using a DDL Transformation.
Physical Data Models	Physical data models in Enterprise Architect help you visualize your database structure and automatically derive the corresponding database schema; you use Enterprise Architect's UML Profile for Data Modeling specifically for this purpose. The profile provides useful extensions of the UML standard that map database concepts of Tables and relationships onto the UML concepts of Classes and Associations; you can also model database columns, keys, constraints, indexes, triggers, referential integrity and other relational database features. Because Enterprise Architect helps you visualize each type of data model in the same repository, you can easily manage dependencies between each level of abstraction to maximize traceability and verify completeness of system implementation.

Conceptual Data Model

A Conceptual data model is the most abstract form of data model. It is helpful for communicating ideas to a wide range of stakeholders because of its simplicity. Therefore platform-specific information, such as data types, indexes and keys, is omitted from a Conceptual data model. Other implementation details, such as procedures and interface definitions, are also excluded.

This is an example of a Conceptual data model, rendered using two of the notations supported by Enterprise Architect.

Entity Relationship diagram showing a One-to-Many relationship

Using Entity-Relationship (ER) notation, we represent the data concepts 'Customers' and 'Customers Addresses' as Entities with a one-to-many relationship between them. We can represent exactly the same semantic information using UML Classes and Associations.

Unified Modeling Language diagram showing the same One-to-many Relationship

Whether you use UML or ER notation to represent data concepts in your project depends on the experience and preferences of the stakeholders involved. The detailed structure of the data concepts illustrated in a Conceptual data model is defined by the Logical data model.

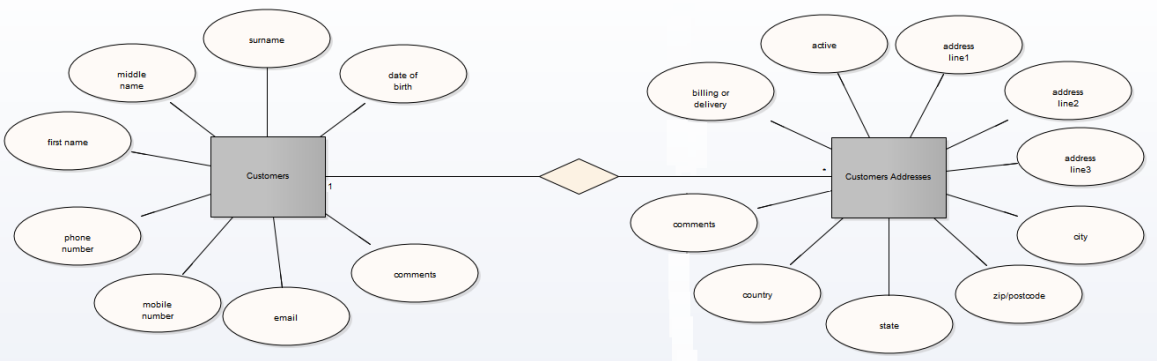
Entity Relationship Diagrams (ERDs)

According to the online Wikipedia:

An entity-relationship model (ERM) is an abstract and conceptual representation of data. Entity-relationship modeling is a database modeling method, used to produce a type of conceptual schema or semantic data model of a system, often a relational database, and its requirements in a top-down fashion. Diagrams created by this process are called Entity-Relationship Diagrams, ER Diagrams, or ERDs.

Entity Relationship Diagrams in Enterprise Architect

Entity Relationship diagrams in Enterprise Architect are based on Chen's ERD building blocks: entities (tables) are represented as rectangles, attributes (columns) are represented as ellipses (joined to their entity) and relationships between the entities are represented as diamond-shape connectors.



ERD technology in Enterprise Architect assists you in every stage from building conceptual data models to generating Data Definition Language (DDL) for the target DBMS.

ERD and ERD Transformations

Enterprise Architect enables you to develop Entity Relationship diagrams quickly and simply, through use of an MDG Technology integrated with the Enterprise Architect installer.

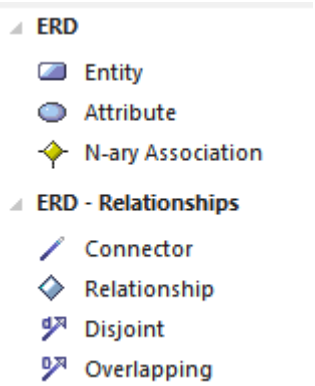
The Entity Relationship diagram facilities are provided in the form of:

- An Entity Relationship diagram type, accessed through the 'New Diagram' dialog
- An Entity Relationship Diagram page in the Diagram Toolbox
- Entity Relationship element and relationship entries in the 'Toolbox Shortcut' menu and Quick Linker

Enterprise Architect also provides transformation templates to transform Entity Relationship diagrams into Data Modeling diagrams, and vice versa.

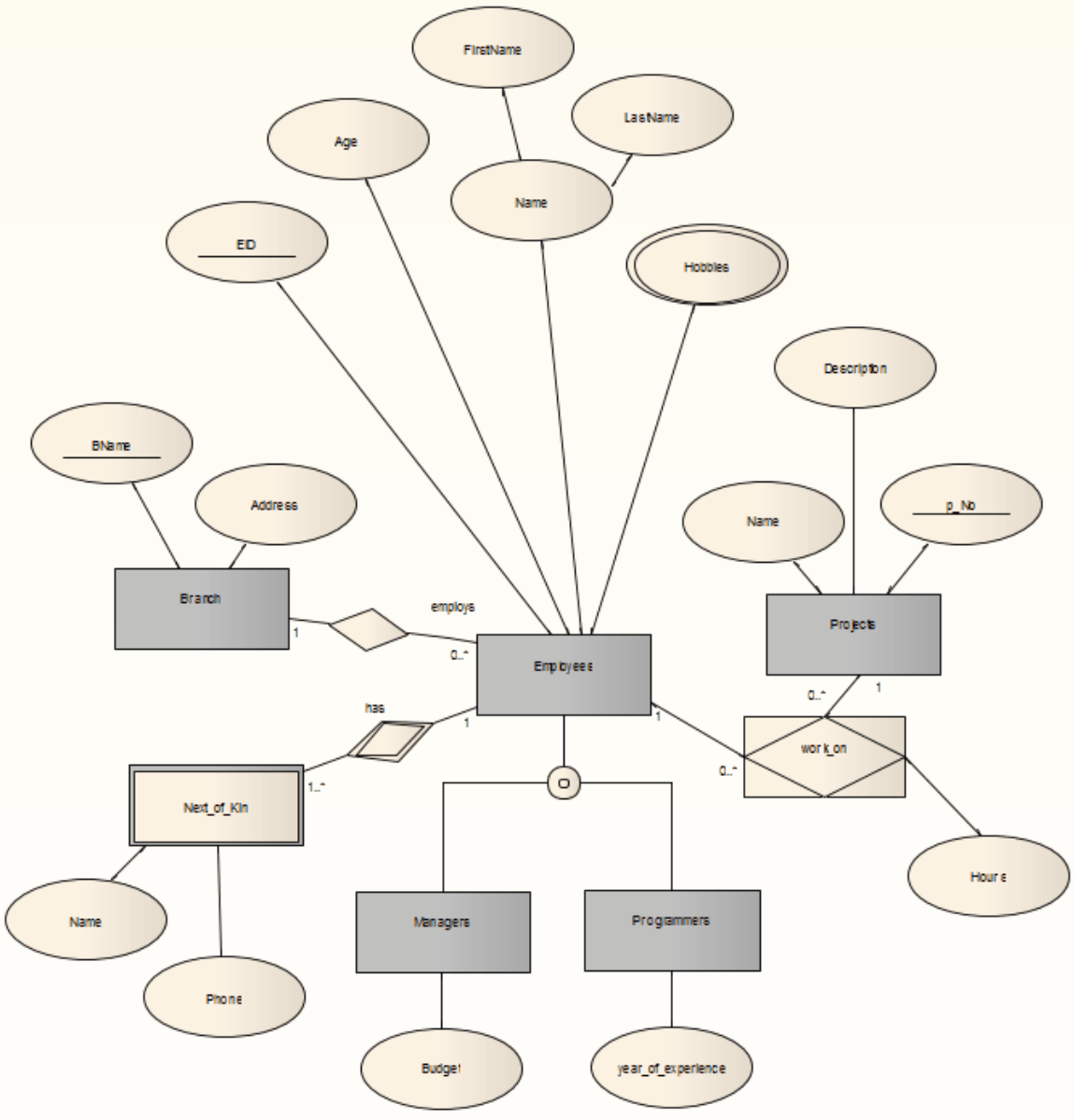
Entity Relationship Diagram Toolbox Page

You can access the 'Entity Relationship Diagram' page of the Diagram Toolbox by specifying 'Entity Relationship Diagrams' in the Toolbox 'Find Toolbox Item' dialog



- Entity is an object or concept that is uniquely identifiable; the property of 'Multiplicity' in the SourceRole and TargetRole definitions for the Relationship connector can be used to define the cardinality of an Entity that participates in this relationship
- Attribute is a property of an entity or a relationship type
- N-ary Association represents unary (many-to-many recursive) or ternary relationships and can also be used to represent relationships that have attributes among the entities; the N-ary Association element should always be at the target end of a connector
- Connector is a connector between an Entity and an Attribute, and between two Attributes
- Relationship is a diamond-shape connector, representing the meaningful association among entities
- Disjoint and Overlapping represent the relationships between the super-class Entity and the sub-class Entity

A typical Entity Relationship diagram



Tagged Values

Some of the Entity Relationship diagram components can be modified by Tagged Values, as indicated:

Component	Tagged Value / Notes
Entity	isWeakEntity Notes: If true, this entity is a weak entity.
Attribute	attributeType Notes: There are four valid options: 'normal', 'primary key', 'multi-valued' and 'derived'
Attribute	commonDataType Notes: Defines the common data type for each attribute.

Attribute	dbmsDataType Notes: Defines the customized DBMS data type for each attribute. This option is only available when the *commonDataType* tag is set to 'na'. You must define the customized type first through the 'Settings > Reference Data > Settings > Database Datatypes' ribbon option.
N-ary Association	isRecursive Notes: If true, the N-ary Association represents the many-to-many recursive relationship. For one-to-many and one-to-one recursive relationships, we suggest using the normal Relationship connector. Sometimes you might want to limit the stretch of the diamond-shape Relationship connectors; simply pick a Relationship connector, right-click to display the context menu, and select the 'Bend Line at Cursor' option.
Relationship	isWeak Notes: If true, the Relationship is a weak relationship.
Disjoin Overlapping	Participation Notes: There are two valid options, 'partial' and 'total'.

Notes

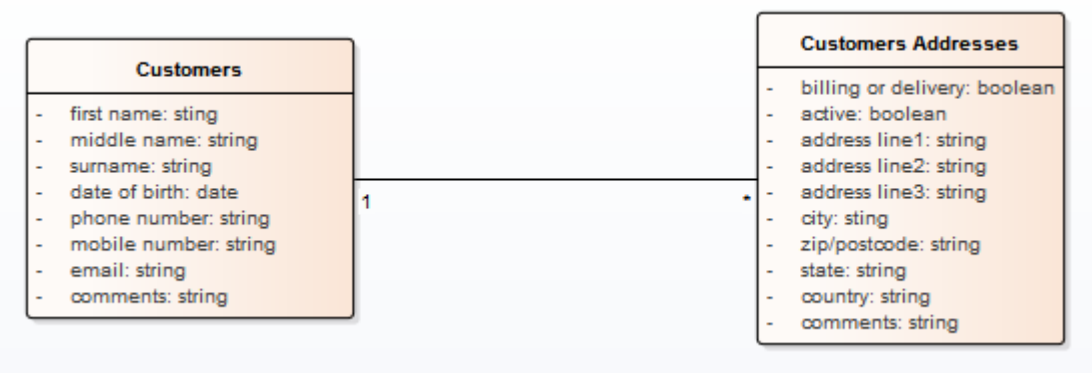
- Entity Relationship diagrams are supported in the Corporate, Unified and Ultimate Editions of Enterprise Architect

Logical Data Model

Logical data models help to define the detailed structure of the data elements in a system and the relationships between data elements. They refine the data elements introduced by a Conceptual data model and form the basis of the Physical data model. In Enterprise Architect, a Logical data model is typically represented using the UML Class notation.

Example

This diagram is a simple example of a Logical data model. The Logical Model adds detail to the Conceptual Model but without going to the level of specifying the Database Management System that will be used.



Conceptual Data Model with tables modeling Customers and their Addresses.

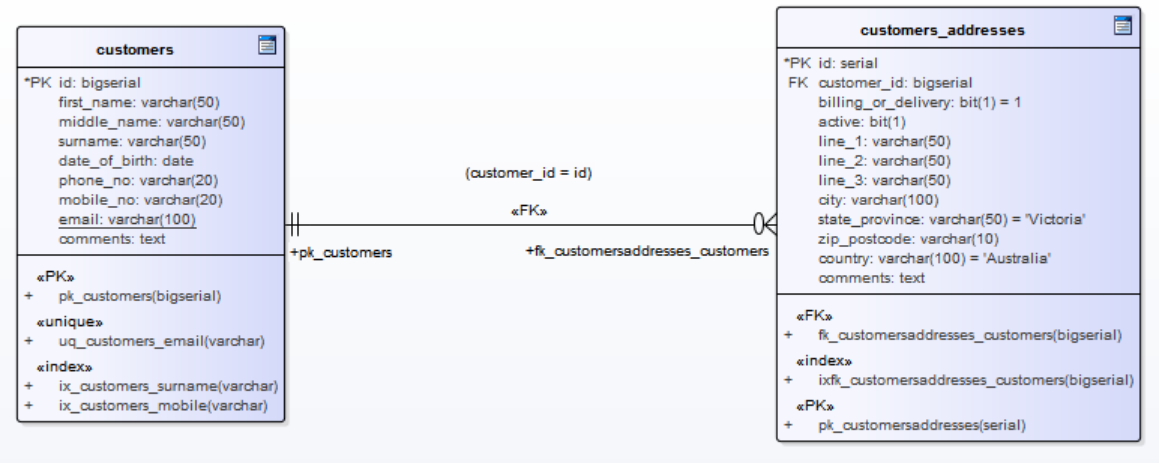
Note that the data elements 'Customers' and 'Customers Addresses' contain UML attributes; the names and generic data types to remain platform-independent. Platform-specific data types and other metadata that relate to a specific DBMS implementation are defined by the Physical data model.

Physical Data Models

A Physical Data Model visually represents the structure of data as implemented by a relational database schema. In addition to providing a visual abstraction of the database structure, an important benefit of defining a Physical Data Model is that you can automatically derive the database schema from the model. This is possible due to the richness of metadata captured by a Physical Data Model and its close mapping to aspects of the database schema, such as database Tables, columns, Primary Keys and Foreign Keys.

Example Data Model

This example shows a Physical Data Model that could be used to automatically generate a database schema. Each Table is represented by a UML Class; Table columns, Primary Keys and Foreign Keys are modeled using UML attributes and operations. This model demonstrates the use of the Information Engineering connector style.



Notation

The example model is defined using Enterprise Architect's UML Profile for Data Modeling; the relationship between the Tables uses the default Information Engineering notation.

Information Engineering is one of three notations that Enterprise Architect supports to help Data Modelers identify cardinality in relationships. You can change the notation by selecting the 'Design > Diagram > Manage > Properties' ribbon option, clicking on the 'Connectors' page and selecting the required option in the 'Connector Notation' drop-down list. You would most probably change the notation to IDEFX1, but the UML2.1 notation is also available.

Default DBMS

Prior to creating a Physical Data Model it is advisable for you to set the default DBMS for the project. Setting a default DBMS ensures that all new database elements that are created on diagrams are automatically assigned the default DBMS.

If the default DBMS is not set, new Tables are created without a DBMS assigned, this restricts Enterprise Architect's ability to model the physical objects correctly. For example Enterprise Architect is unable to determine the correct list of datatypes for columns.

You can set the default DBMS type using:

- 'Start > Appearance > Preferences > Preferences > Source Code Engineering > Code Editors', or
- 'Settings > Reference Data > Settings > Database Datatypes or

- 'Develop > Data Modeling > Datatypes or
- The second data entry field in the Code Generation Toolbar

Note: When modeling via the Database Builder the default DBMS is defined at the model level (as a Tagged Value 'DBMS' against the <<Database>> Package) instead of at the project level, thereby allowing for greater flexibility when projects involve multiple DBMSs.

DDL Transformation

The DDL transformation converts the logical model to a data model structured to conform to one of the supported DBMSs. The target database type is determined by which DBMS is set as the default database in the model (see the *Database Datatypes* Help topic, 'Set As Default' option). The data model can then be used to automatically generate DDL statements to run in one of the system-supported database products.

The DDL transformation uses and demonstrates support in the intermediary language for a number of database-specific concepts.

Concepts

Concept	Effect
Table	Mapped one-to-one onto Class elements. 'Many-to-many' relationships are supported by the transformation, creating Join tables.
Column	Mapped one-to-one onto attributes.
Primary Key	Lists all the columns involved so that they exist in the Class, and creates a Primary Key Method for them.
Foreign Key	A special sort of connector, in which the Source and Target sections list all of the columns involved so that: • The columns exist • A matching Primary Key exists in the destination Class, and • The transformation creates the appropriate Foreign Key

MDG Technology to customize default mappings

DDL transformations that target a new, user defined DBMS require an MDG Technology to map the PIM data types to the new target DBMS.

To do this, create an MDG Technology .xml file named 'UserDBMS Types.xml', replacing UserDBMS with the name of the added DBMS. Place the file in the EA\MDGTechnologies folder. The contents of the MDG Technology file should have this structure:

```
<MDG.Technology version="1.0">
    <Documentation id="UserdataTypes" name="Userdata Types" version="1.0" notes="DB Type mapping for UserDBMS"/>
    <CodeModules>
        <CodeModule language="Userdata" notes="">
            <CodeOptions>
                <CodeOption name="DBTypeMapping-bigint">BIGINT</CodeOption>
                <CodeOption name="DBTypeMapping-blob">BLOB</CodeOption>
                <CodeOption name="DBTypeMapping-boolean">TINYINT</CodeOption>
```

```
            <CodeOption name="DBTypeMapping-text">CLOB</CodeOption>
            ...
        </CodeOptions>
    </CodeModule>
</CodeModules>
</MDG.Technology>
```

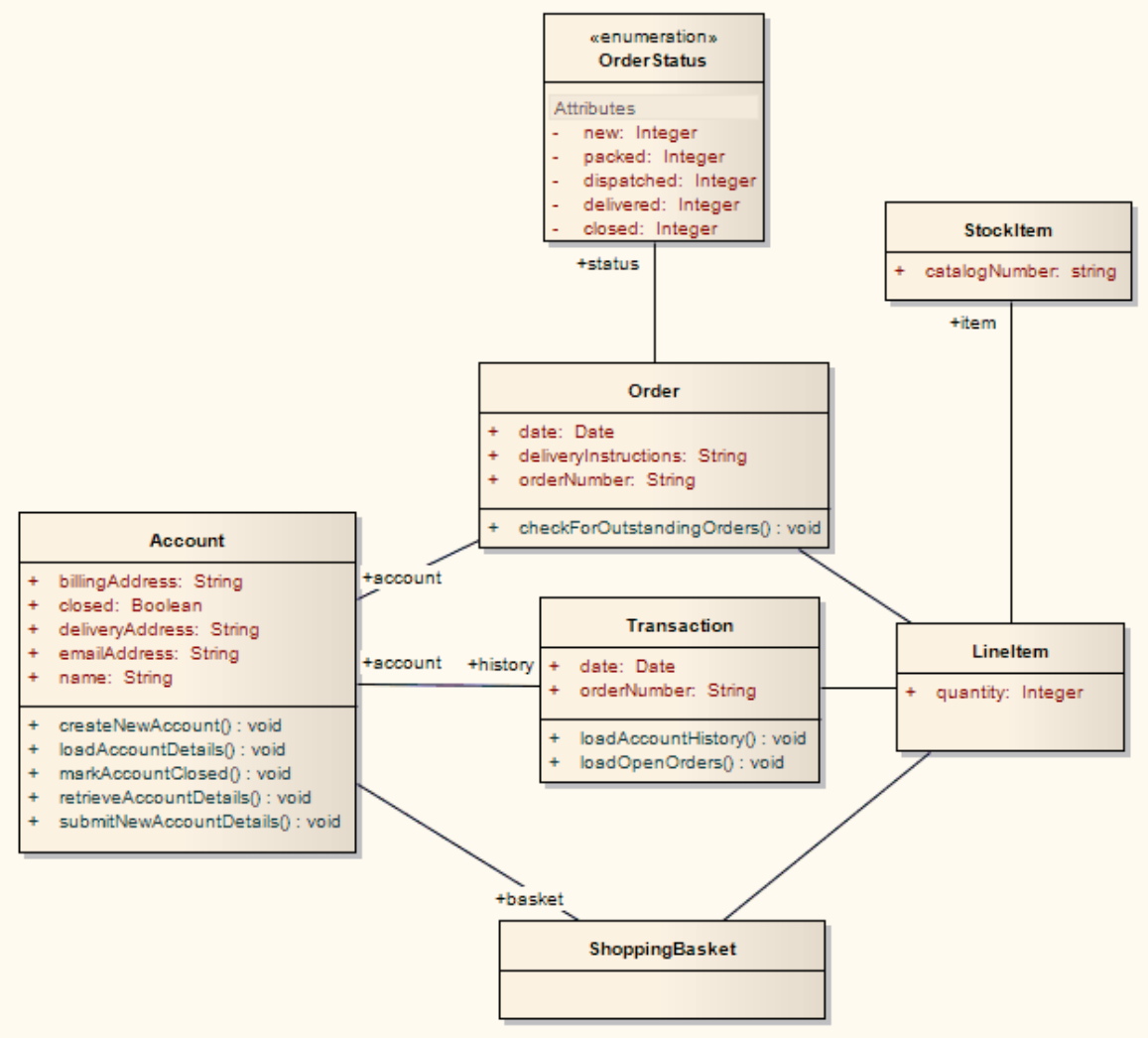
As an example, 'text' is a Common Type (as listed in the 'Database Datatypes' dialog) that maps to a new DBMS's 'CLOB' data type.

Notes

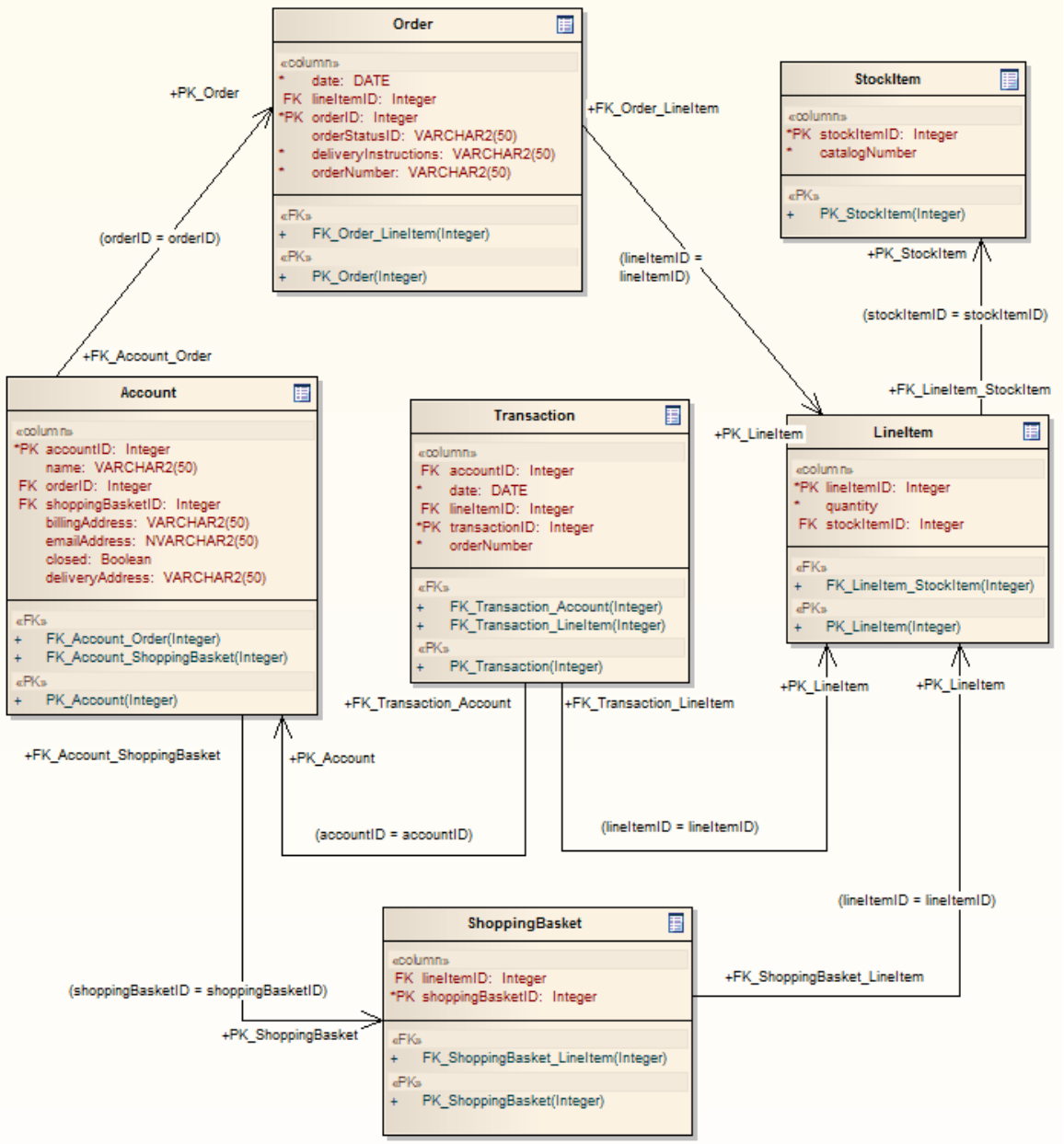
- You can define DBMS-specific aspects not depicted in a Logical model, such as Stored Procedures, Triggers, Views and Check Constraints, after the transformation; see the *Physical Data Model* Help topic

Example

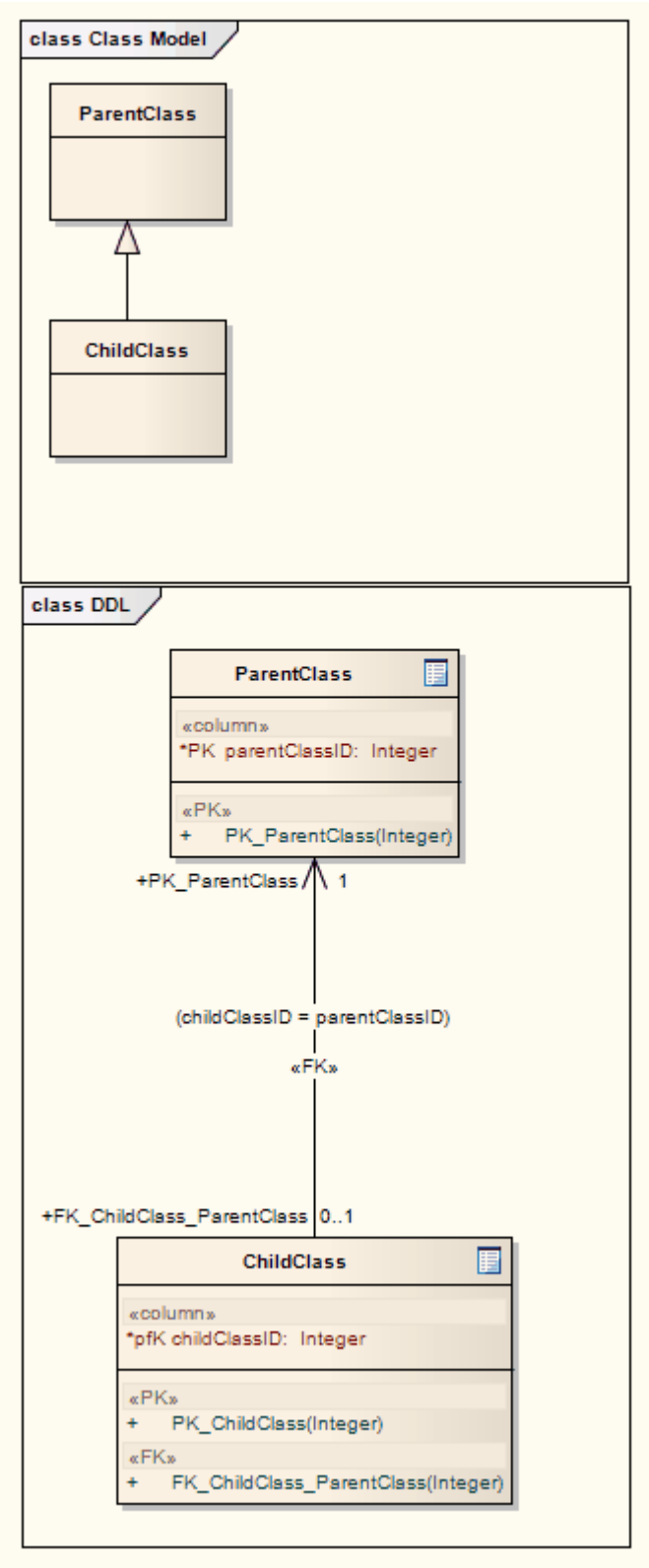
The PIM elements



After transformation, become the PSM elements

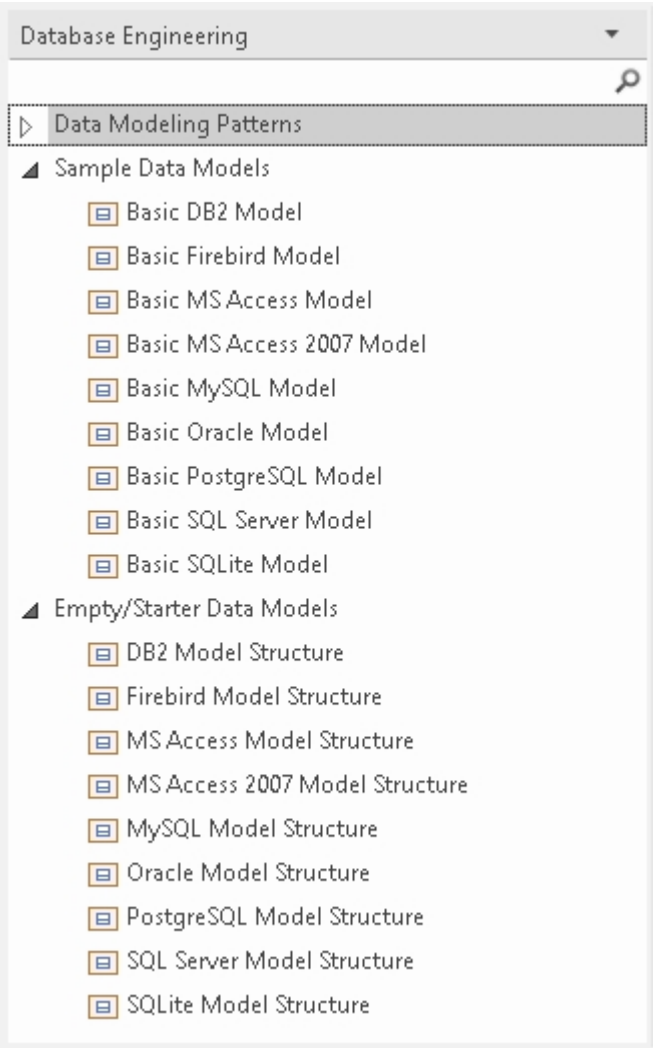


Generalizations are handled by providing the child element with a Foreign Key to the parent element, as shown. Copy-down inheritance is not supported.


class Class Model
ParentClass
ChildClass
class DDL
ParentClass
«column»
*PK parentClassID: Integer
«PK»
+ PK_ParentClass(Integer)
+PK_ParentClass
1
(childClassID = parentClassID)
«FK»
+FK_ChildClass_ParentClass
0..1
ChildClass
«column»
*pfK childClassID: Integer
«PK»
+ PK_ChildClass(Integer)
«FK»
+ FK_ChildClass_ParentClass(Integer)

Creating and Managing Data Models

Enterprise Architect is a fully featured database modeling platform that enables the user to work with their Physical Data models at all stages, from design right through to the implementation of the live database, for a wide range of database management systems such as Microsoft SQL Server, Oracle, PostgreSQL and MySQL.



This figure shows the starter model wizard patterns for database design for a range of RDBMS.

Create a Data Model from a Model Pattern

The easiest way to create a Data Modeling workspace is to use the predefined Database Model Patterns, available through the Model Builder. Enterprise Architect provides a Pattern for each DBMS supported by the system.

Access

Display the Model Builder using any of the methods outlined here.

In the Model Builder dialog, select the 'Database Engineering' Perspective.

Ribbon	Start > Personal > Model Builder Design > Package > Model Builder
Context Menu	Right-click on Package | Model Builder (pattern library)
Keyboard Shortcuts	Ctrl+Shift+M
Other	Browser window caption bar menu | Model Builder (pattern library)

Create a Data Model

Field/Button	Action
Add to Package	Displays the name of the selected root Package.
Technology	Click on 'Database'.
Name	If necessary, expand the Database Engineering group of Patterns. Click on the checkbox against each Database Management System you are supporting in the model.
All	Click on this button to select the checkboxes for all Database Engineering model types and the Entity Relationship diagram, to include them all in the model.
None	Click on this button to clear all selected checkboxes so that you can re-select certain checkboxes individually.
OK	Click on this button to add to the Browser window the Packages and diagram for each Database Management System you are modeling.

What each Data Modeling Pattern provides

- A summary diagram of the model

- A Report Specification Artifact element (on the summary diagram) that can be used to quickly document the data model
- A Package for each of the Logical and Physical models
- Within the Physical Model Package, a predefined hierarchy of sub-Packages, one for each object type supported by the DBMS being modeled (such as Tables, Views, Procedures and Functions); these automatically organize the database objects as they are added
- The DBMS type for the workspace
- A default owner
- A Data Modeling diagram in each Package with the connector notation set to IDEF1X

Notes

- Once a data modeling workspace has been created, you can begin to develop your model in one of two ways:
  - Through the Database Builder, which is a purpose-built view that supports database modelers
  - Through the Browser window and diagrams, which is the traditional method that might suit users who are experienced UML modelers

Create a Data Model Diagram

To model the structure of a relational database you use Data Modeling diagrams, which are extended Class diagrams. When you open a Data Modeling diagram the matching Diagram Toolbox is automatically opened, which contains the diagram elements:

- Table
- View
- Procedure
- Sequence
- Function
- Association and
- Database Connection

Access

Display the 'New Diagram' dialog using any of the methods outlined here.

Ribbon	Design > Diagram > Add Diagram
Context Menu	Right-click on Package | New Diagram Right-click on element | Add | New Diagram
Keyboard Shortcuts	Ctrl+Insert
Other	Browser window caption bar menu | New Diagram

Create a Data Modeling diagram

Field/Button	Action
Package	Defaults to the name of the Package selected in the Browser window or, if the parent is an element, the name of the Package containing that element. If you are adding a diagram directly to a Package and notice that it is not the correct Package, click on the button and browse for the correct Package.
Parent	If you are adding a diagram to an element, this field displays the element name.
Diagram	This field defaults to the name of the parent Package or element. If required, overtype the default name with your preferred name.
Select From	Click on this header and select the Perspective Group and Perspective or Workspace most appropriate to the area you are working in (in this instance, 'Information Engineering > Database Models'). From the options listed in the panel, click on 'Extended'.

Diagram Types	Click on 'Data Modeling'.
OK	Click on this button to create the diagram. The Diagram View displays the blank diagram, and the 'Data Modeling' pages display in the Diagram Toolbox. Drag elements and connectors from the Toolbox onto your diagram, to create your data model.

Notes

- The default diagram connector notation for all new diagrams is Information Engineering, although many data modelers prefer the notation IDEF1X; to make this change select 'Design > Diagram > Manage > Properties > Connectors' and click on the required option in the 'Connector Notation' drop-down list

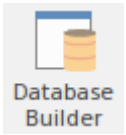
Example Data Model Diagram

This example of a Data Model diagram shows a data model of a bookstore warehousing system. The tables are modeled using a stereotyped class with a compartment for Columns which displays the name and type of the Columns. Primary and Foreign Keys are indicated by stereotypes on the columns. You can examine this model in greater detail in the Example model, installed with Enterprise Architect and available from this ribbon location.

Start > Help > Help > Open the Example Model

Data modeling diagram with suppressed operation compartment showing tables connected to indicate foreign key relationships.

The Database Builder

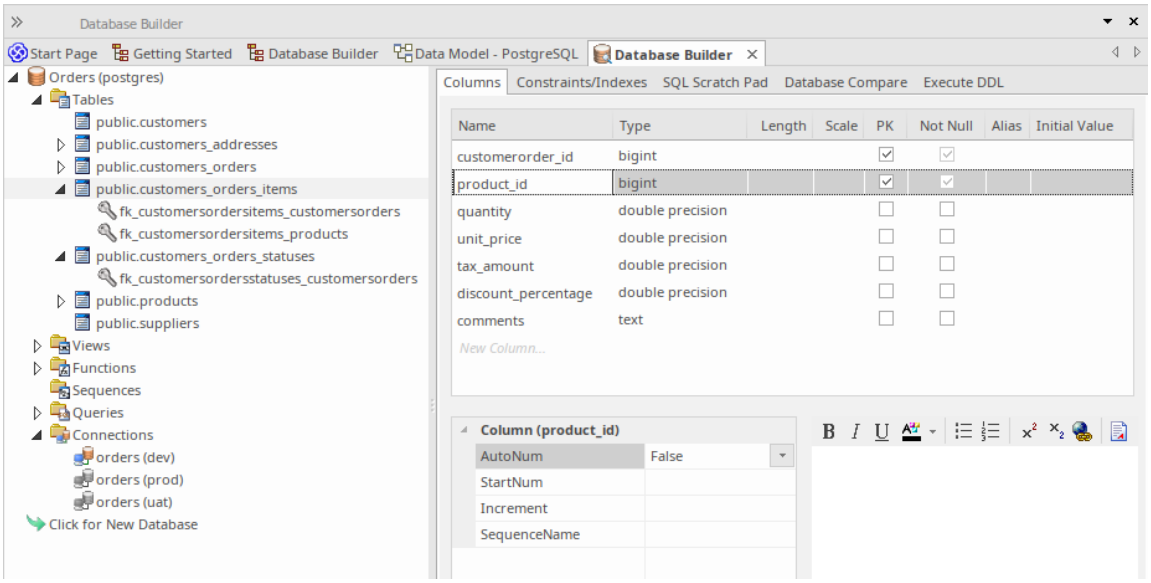


The Database Builder is a tailored interface for the data modeler; all database-related modeling tasks can be performed in a single location. The interface and its related screens include only the information relevant to data modeling, thereby streamlining and simplifying the modeling process.

Access

Ribbon	Develop > Data Modeling > Database Builder

Database Builder



This figure shows the Database Builder loaded with the 'Orders (postgres)' data model as it appears in the Example model.

Overview

The interface of the Database Builder consists of:

- A Tree of data models, listing all defined data models in the current repository
- A 'Columns' tab through which you directly manage the Table columns
- A 'Constraints/Indexes' tab for the direct management of Table constraints such as Primary Keys, Foreign Keys and Indexes
- An SQL Scratch Pad that you can use to run ad-hoc SQL queries against a live database

- A 'Database Compare' tab that displays the results of comparisons between the data model and a live database
- An 'Execute DDL' tab on which you can execute generated DDL against a live database, instantly

You can use the Database Builder to:

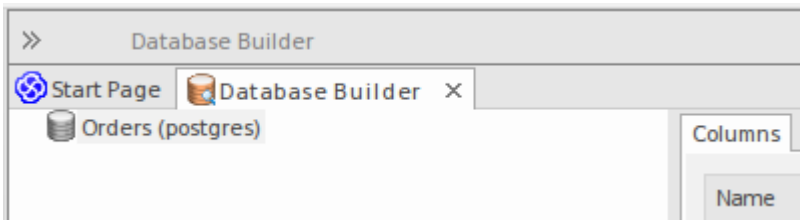
- Create, edit and delete database objects (Tables, Views, Procedures, Sequences and Functions)
- Create, edit and delete Table constraints (Primary Keys, Indexes, Unique Constraints, Check Constraints and Triggers)
- Create, edit and delete Table Foreign Keys
- Reverse engineer database schema information
- Generate DDL from a modeled database
- Compare a live database schema with a modeled database
- Execute generated DDL against a live database
- Execute adhoc SQL statements against a live database

Notes

- The Database Builder is available in the Corporate, Unified and Ultimate Editions of Enterprise Architect

Opening the Database Builder

When you first open the Database Builder, it searches the entire project for all Packages that have the stereotype <<Data Model>> and loads the corresponding data models as root nodes into the tree. A grayed-out icon indicates that the details of the data model are not loaded.



This figure shows the Database Builder with a single unloaded data model called 'Orders (postgres)'.

Using the Database Builder

You can start working in the Database Builder in one of these two ways:

Task	Action
Create a new data model	Once you have opened the Database Builder view, right-click in the empty space of the tree and select 'New Data Model' to invoke the Model Builder.
Load an existing Data Model	Once the Database Builder view is opened, load any of the defined data models by either: • Right-clicking on the name and selecting 'Load', or • Double-clicking on the name

Data Model Properties

In earlier versions of Enterprise Architect (prior to the introduction of the Database Builder) it was necessary for the data modeler to manually set properties on database objects before some tasks were allowed. For example, Enterprise Architect would not allow the definition of a Table column without the Table first being assigned a DBMS. This was because the DBMS controls the list of available datatypes.

To improve efficiency and the user experience, the Database Builder defines defaults for a number of properties at the data model level and then applies these default values automatically whenever new objects are created.

Properties

Option	Description
DBMS	*Defined against:* The data model's <<Database>> Package *Defined as:* Tagged Value *Details:* Defines the DBMS of the current data model

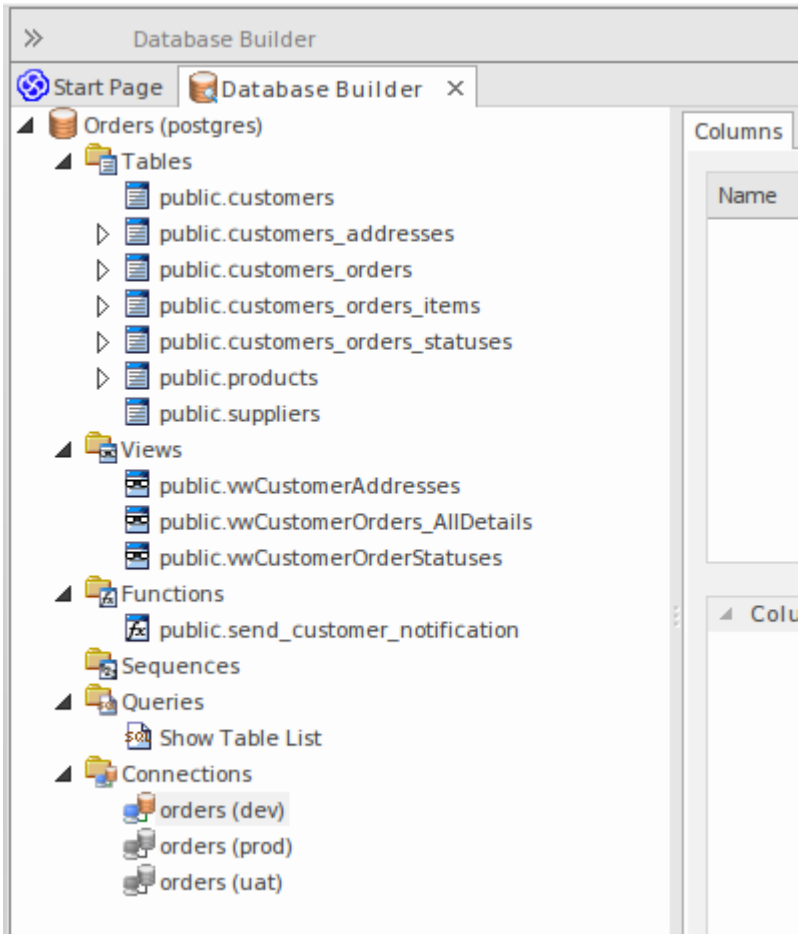
	Extra Information: • Controls which logical folders are shown for the current data model in the Database Builder's tree • Controls what DBMS rules are applied during database comparisons • Is automatically assigned to every new database object created in the current data model
DefaultOwner	*Defined against:* The data model's <<Database>> Package *Defined as:* Tagged Value *Details:* Defines the default Owner for the current data model *Extra Information:* • Is automatically assigned to every new database object created in the current data model, if the DBMS supports owners/schemas
DefaultConnection	*Defined against:* The data model's <<Database>> Package *Defined as:* Tagged Value *Details:* (Optional) the name of the default connection *Extra Information:* • Whenever a data model is loaded, the 'DefaultConnection' property is checked; if present, the Connection by that name is automatically made active • The database engineering model Patterns do not define a value for this property, it is created or updated whenever a user sets a Connection as the default

Notes

- If a data model is selected in the Browser window when the Database Builder is opened, that model's details will be automatically loaded

Working in the Database Builder

When a data model is loaded, the Database Builder creates a set of logical folders, one for each object type supported by the current DBMS. Each logical folder is populated with all objects of that type found in the data model's hierarchy of Packages (as shown in the Browser window).



In this image the data model 'Orders (postgres)' shows logical folders for Tables, Views, Functions, Sequences, Queries and Connections. It is worth noting there is no folder for 'Procedures' since PostgreSQL does not support database procedures.

Available Actions in the Database Builder Tree

The majority of the Database Builder functions are accessible via context menus. Each object in the Tree has its own set of unique menu items based on its type and status. This table describes the available context menu items and identifies which objects they apply to.

Menu Option	Applies to / Description
New data model	*Applies To:* Blank Space *Description:* Opens the Model Builder.
Refresh All	*Applies to:* Blank Space *Description:* Reloads the complete list of data models.
Load	*Applies to:* Root Node

	Description: Loads the full details of the data model.
Unload	*Applies to:* Root Node *Description:* Unloads the full details of the data model.
Import DB Schema	*Applies to:* Loaded Root Node *Description:* Opens the 'Import DB schema' dialog using the current active connection as the Live database source.
Generate DDL	*Applies to:* Loaded Root Node, Folder, Table, View, Procedure, Function, Sequence, Package *Description:* Opens the 'Generate DDL' dialog with the current object(s) selected.
Show Differences	*Applies to:* Loaded Root Node, Folder, Table, View, Procedure, Function, Sequence *Description:* Compares the selected objects to the current active connection.
Show Differences with Options	*Applies to:* Loaded Root Node, Folder, Table, View, Procedure, Function, Sequence, Package *Description:* Compares the selected objects to the current active connection and optionally ignore some of the differences based on the specified compare options.
Manage DBMS Options	*Applies to:* Loaded Root Node *Description:* Opens the 'Manage DBMS Options' dialog, which can be used to change the allocated DBMS and Owner of multiple objects.
View Record Count	*Applies to:* Table, View *Description:* Builds and runs a SELECT query (formatted to suit the element's DBMS) to show the number of records in the selected Table or View. If there is no active connection, you are prompted to select one.
View Top 100 Rows	*Applies to:* Table, View *Description:* Builds and runs a SELECT query (formatted to suit the element's DBMS) to show the top 100 rows of the selected Table or View. If there is no active connection, you are prompted to select one.
View Top 1000 Rows	*Applies to:* Table, View *Description:* Builds and runs a SELECT query (formatted to suit the element's DBMS) to show the top 1000 rows of the selected Table or View. If there is no active connection, you are prompted to select one.
View All Rows	*Applies to:* Table, View *Description:* Builds and runs a SELECT query (formatted to suit the element's DBMS) to show all rows of the selected Table or View. If there is no active connection, you are prompted to select one.
Properties	*Applies to:* Loaded Root Node, Folder, Table, View, Procedure, Function, Sequence, Package, Connection *Description:* Opens the standard 'Properties' dialog for the selected object.
Find in Project Browser	*Applies to:* Loaded Root Node, Folder, Table, View, Procedure, Function,

	Sequence, Package, SQL Query, Connection *Description:* Finds the selected object in the Browser window.
Refresh	*Applies to:* Loaded Root Node *Description:* Reloads the details of the current loaded data model. This is necessary when objects are added, changed or deleted by other users or when the changes are performed outside of the Database Builder.
Add new <type>	*Applies to:* Folder, Table, View, Procedure, Function, Sequence, Package, SQL Query, Connection *Description:* Creates a new object of the specified type.
Clone <name>	*Applies to:* Folder, Table, View, Procedure, Function, Sequence, Package, SQL Query, Connection *Description:* Makes a new copy of the selected object. When you select this option, a prompt displays on which you set the name and owner of the new object. For Table objects, you can choose which existing constraints should be copied (and set a name for each one) along with which Foreign Keys should be copied. For SQL-based objects, you can make any necessary changes to the SQL for the new element.
Delete <name>	*Applies To:* Table, View, Procedure, Function, Sequence, Package, SQL Query, Connection *Description:* Permanently deletes the selected object from the repository.
Add new Foreign Key on <name>	*Applies to:* Table *Description:* Creates a new relationship between the selected Table and another one, then shows the 'Foreign Key Constraint' screen for the new relationship.
SQL Object Properties	*Applies to:* View, Procedure, Function, Sequence *Description:* Opens the 'SQL Object Editor' screen.
Edit	*Applies to:* SQL Query *Description:* Loads the SQL (as defined in the selected element) into the SQL Scratch Pad.
Run	*Applies to:* SQL Query *Description:* Loads the SQL in the SQL Scratch Pad and runs it. If there is no active connection, you are prompted to select one.
Set as active DB Connection	*Applies to:* Connection *Description:* Flags the selected Database Connection as the active one for the current session.
Set as Default DB Connection	*Applies to:* Connection *Description:* Flags the selected Database Connection as the active one each time the data model is loaded.
DB Connection Properties	*Applies to:* Connection *Description:* Opens the 'Database Connection Properties' screen, to manage the connection settings.

Create/Edit/Delete Database Objects

The pages listed in this section describe in detail how to use the Database Builder's interface to create and manipulate database Tables; however, the process of creating and manipulating SQL-based database objects is documented in other areas. See these topics for details:

- Database Views
- Database Procedures
- Database Functions
- Database Sequences
- Database Connections

Database Connections in the Database Builder

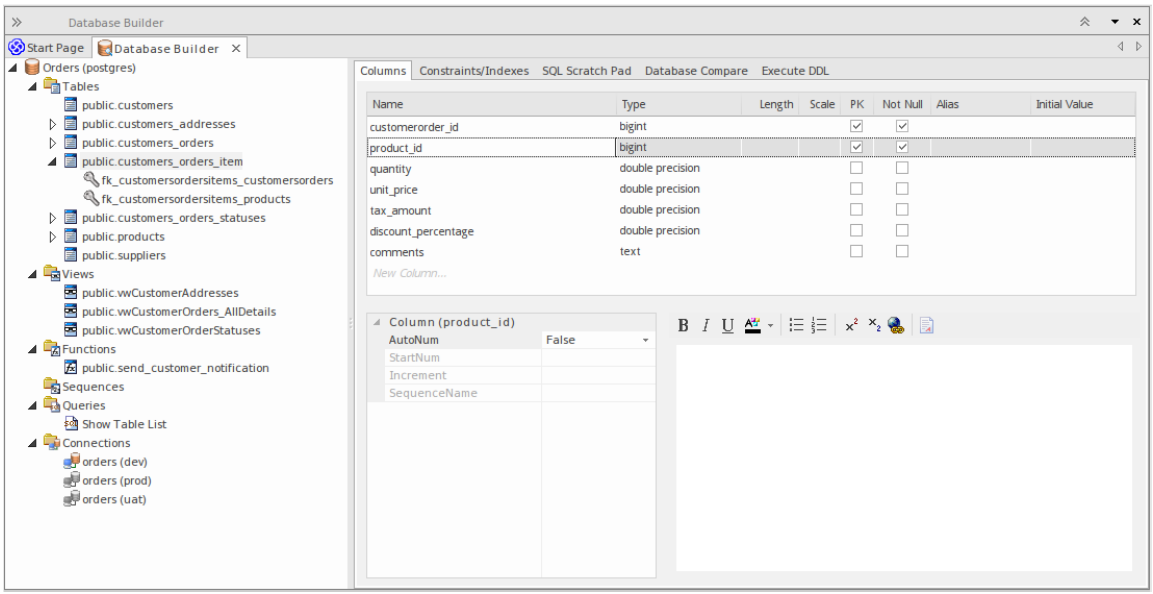
When performing certain tasks such as 'Compare' or 'Execute DDL', the Database Builder requires an active database connection. Only one database connection can be made active (indicated by a colored 'Database Connection' icon, while the others are gray) at a given time. If a database connection is not currently active and you try to perform a task that requires one, the Database Builder performs one of these actions based on how many connections are defined:

- 0 Connections – prompts you to create a connection and, if successful, continues
- 1 Connection – sets it as active and continues
- 2 (or more) Connections – prompts you to select one and, if successful, continues

Columns

Tables are the fundamental database object, and Columns (and their properties) are the most frequently modified Table feature updated and changed by data modelers, therefore the 'Columns' page is conveniently located as the first page of the Database Builder's interface.

Once a Table is selected in the Database Builder's tree, the 'Columns' page is populated with the currently defined list of columns for that Table. The data modeler can then make changes to main column properties directly in the list or grid. As the data modeler selects individual columns in the list, the column's extended properties (and Comments) are shown immediately under the list, allowing modification to these extended properties.



This figure show the Database Builder interface showing the tree of objects and the Columns tab showing the Columns for the selected table.

Notes

- The 'Columns' page will only be populated when a Table item is selected in the Database Builder's tree

Create Database Table Columns

A database Table column is represented in the UML Data Modeling Profile as an attribute with the <<column>> stereotype. For a selected Table, you can review the existing columns and create new columns, on the 'Columns' page of the Database Builder or on the 'Columns and Constraints' screen.

You can define column details directly on the list of columns on the 'Columns' tab. The changes are automatically saved as you complete each field. Some fields have certain restrictions on the data you can enter, as described here. The tab also contains a 'Properties' panel and a 'Notes' field, which are populated with the existing information on the selected column. Each new column that you create is automatically assigned a set of default values and added to the bottom of the list.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table > Columns > Right-Click > Add new Column
Context Menu	In diagram, right-click on required Table | Features | Columns | Right-Click | Add new Column
Keyboard Shortcuts	Select a table | F9 | Tab Key (to set input focus on the 'Columns' tab) | Ctrl+N

Create columns in a Table

Option	Action
Name	Overtype the default name with the appropriate column name text.
Type	Click on the drop-down arrow and select the appropriate datatype for the column. The available datatypes depend on the DBMS assigned to the parent Table.
Length	(Optional) Some datatypes have a length component - for example, VARCHAR has a length that defines the number of characters that can be stored. If the datatype does not have a length component, this field is disabled. If the field is available and if you need to define a number of characters, type the value here.
Scale	(Optional) Some datatypes have a scale component - for example, DECIMAL has a scale that defines the number of decimal places that can be held. If the datatype does not have a scale component, this field is disabled. If the field is available and if you need to define a scale, type the value here.
PK	Select the checkbox if the column is part of the Primary Key for this Table.
Not Null	Select the checkbox if empty values are forbidden for this column. The checkbox is disabled if the 'PK' checkbox is selected.

Alias	If required for display and documentation purposes, type in an alternative name for the field.
Initial Value	If required, type in a value that can be used as a default value for this column.
Notes	Type in any additional information necessary to document the column. You can format the text using the Notes toolbar at the top of the field.

Column Properties

The appropriate properties for the Table's Database Management System automatically display in the 'Property' panel (expand the 'Column (<name>)' branch if they are not visible).

Property	DBMS
Autonum (Startnum Increment)	Oracle MySQL SQL Server DB2 PostgreSQL Notes: If you require an automatic numbering sequence, set this property to True and, if necessary, define the start number and increment.
Generated	DB2 Notes: Set this additional property for auto numbering in DB2, to 'By Default' or 'Always'.
NotForRep	SQLServer Notes: Set this property to True if you want to block replication.
Zerofill	MySQL Notes: Set this property to True or False to indicate if fields are zerofilled or not.
Unsigned	MySQL Notes: Set this property to True or False to indicate whether or not fields accept unsigned numbers.
LengthType	Oracle Notes: Set this property to define the character semantics as 'None', 'Byte' or 'Char'.

Delete Database Table Columns

For a selected database Table, you can review the existing columns and delete any individual column, on the 'Columns' tab of the Columns and Constraints screen.

Access

Use one of the methods outlined here to display a list of columns for a table, then select a column and delete it.

When you select the 'Delete column '<name>" option, if all validation rules are satisfied the column is immediately deleted.

Ribbon	Develop > Data Modeling > Database Builder > Click on Table > Columns > Right-click on column name > Delete column <name>
Context Menu	In diagram, right-click on required Table | Features | Columns | Right-click on column name | Delete column <name>
Keyboard Shortcuts	F9 | Use 'Up Arrow' or 'Down Arrow' to select a column | Ctrl+D

Notes

- If the deleted database Table column is involved in any constraints it will automatically be removed from them

Reorder Database Table Columns

If you have several columns defined in a database Table, you can change the order in which they are listed. The order in the list is the order in which the columns appear in the generated DDL.

Access

Use one of the methods outlined here to display a list of columns for a Table, then select a column and reposition it within the list.

Ribbon	Develop > Data Modeling > Database Builder > Click on Table
Context Menu	In diagram, right-click on required Table | Features | Columns
Keyboard Shortcuts	F9

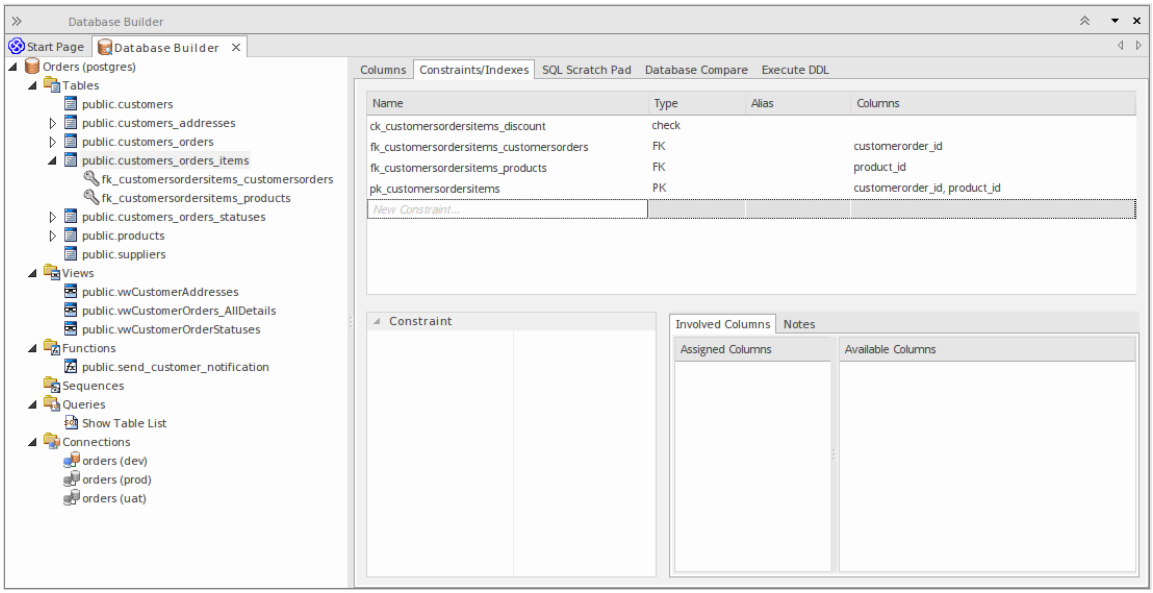
Change the column order

Step	Action
1	In the 'Columns' tab, click on the required column name in the list.
2	Right-click and select the: • 'Move column <name> up' option (or press Ctrl+Up Arrow) to move the column up one position • 'Move column <name> down' option (or press Ctrl+Down Arrow) to move the column down one position These options have an immediate effect both in the 'Columns' tab and on a diagram.

Constraints/Indexes

Tables are the fundamental database object, and Constraints and Indexes (and their properties) are the second most frequently modified Table feature updated and changed by data modelers, therefore the 'Constraints/indexes' page is conveniently located as the second page of the Database Builder's interface.

Once a Table is selected in the Database Builder's tree, the 'Constraints/Indexes' page is populated with the currently defined list of constraints and indexes for the selected Table. The data modeler can then make changes to main properties directly in the list. As the data modeler selects individual constraints or indexes in the list, the constraint's extended properties (and Comments) are shown immediately under the list, allowing modification of these extended properties.



This figure show the Database Builder interface showing the tree of objects and the Columns tab showing the Columns for the selected table.

Notes

- The 'Constraints/Indexes' page will only be populated when a Table item in the Database Builder's tree is selected

Database Table Constraints/Indexes

Within Enterprise Architect, Table Constraints and Indexes are modeled on the same screen; collectivity they are referred to as Constraints. Database Constraints define the conditions imposed on the behavior of a database Table. They include:

- Primary Key - uniquely identifies a record in a Table, consisting of one or more columns
- Index - improves the performance of retrieval and sort operations on Table data
- Unique Constraints - a combination of values that uniquely identify a row in the Table
- Foreign Key - a column (or collection of columns) that enforce a relationship between two Tables
- Check Constraints - enforces domain integrity by limiting the values that are accepted by a column
- Table Trigger - SQL or code automatically executed as a result of data in a Table being modified

In Enterprise Architect, you can define and maintain Table Constraints using either the purpose-designed 'Constraints/Indexes' page of the Database Builder or the Columns and Constraints screen.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes | Right-click | Add New Constraint
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes | Right-click | Add New Constraint
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes: Ctrl+N

Create a Constraint

The process of creating any of these constraint types is the same and is achieved in one of the ways described here.

Create a Constraint - Using the context menu or keyboard

Step	Action
1	A new constraint is automatically created and assigned the default name *constraint n* (where *n* is a counter) and a 'Type' of 'index'. Overtype the default name with your own constraint name.
2	If necessary, in the 'Type' field click on the drop-down arrow and select the appropriate constraint type.
3	If you prefer, type an alias for the constraint, in the 'Alias' field. The 'Columns' field is read-only; it is populated with the columns that you assign to the 'Involved Columns' tab.

Create a Constraint - Overtype the template text

Step	Action
1	On the 'Constraints/Indexes' tab for the selected Table, the list of constraints ends with the template text *New Constraint*. Overtype this text with the appropriate constraint name, and press the Enter key.
2	The new constraint is automatically created and assigned the default Type of index. If necessary, in the 'Type' field click on the drop-down arrow and select the appropriate constraint type.
3	If you prefer, type an alias for the constraint, in the 'Alias' field. The 'Columns' field is read-only; it is populated with the columns that you assign to the 'Involved Columns' tab.

Assign Columns to a Constraint

The constraint types of Primary Key, Foreign Key, Index and Unique all must have at least one column assigned to them; this defines the columns that are involved in the constraint.

Step	Action
1	On the 'Constraints/Indexes' tab for the selected Table, click on the constraint to which you are assigning columns.
2	The 'Available Columns' panel lists all columns defined for the Table. For each column to assign to the constraint, right-click on the column name and select 'Assign column <name>'. The column name is transferred to the 'Assigned Columns' list.

Unassign Columns from a Constraint

Step	Action
1	On the 'Constraints/Indexes' tab for the selected Table, click on the constraint from which you are unassigning columns.
2	In the 'Assigned Columns' list, right-click on the name of the column to unassign from the constraint and select 'Unassign column <name>'. The column name is transferred to the 'Available Columns' list.

Reorder the Assigned Columns in a Constraint

If you have a number of columns in the constraint, you can re-arrange the sequence by moving a selected column name one place up or down the list at a time. To do this:

- Right-click on the column name to move and select either:
  - Move column '<name>' up (Ctrl+Up Arrow) or
  - Move column '<name>' down (Ctrl+Down Arrow)

Delete a constraint

To delete a constraint you no longer require, right-click on the constraint name in the list on the 'Constraints/Indexes' tab and select the 'Delete constraint <name>' option. If all validation rules for the given constraint type are met, the constraint is immediately removed from the repository along with all related relationships (if there are any).

Primary Keys

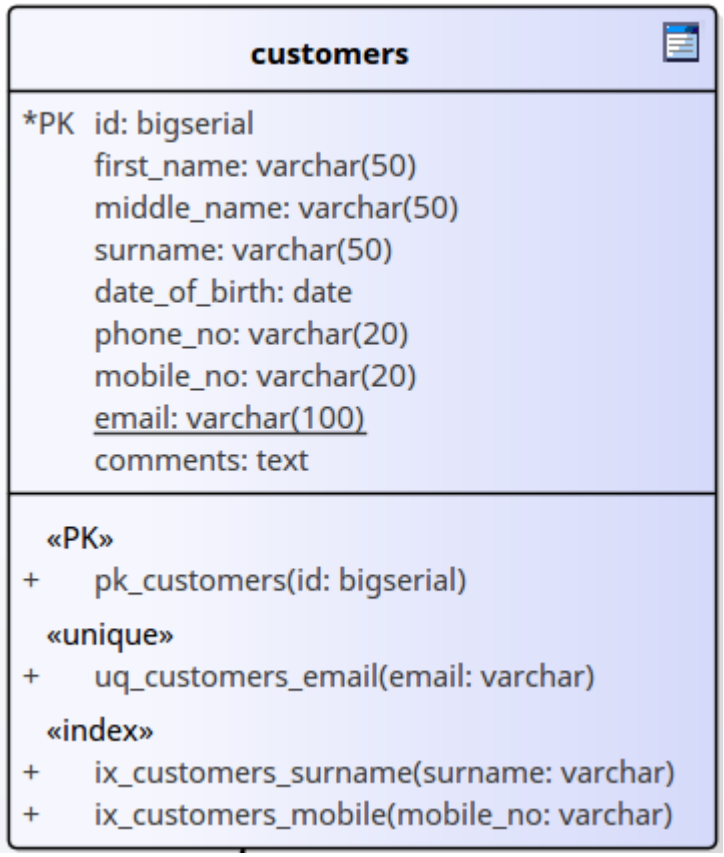
A Primary Key is a column (or set of columns) that uniquely identifies each record in a Table. A Table can have only one Primary Key. Some DBMSs support additional properties of Primary Keys, such as Clustered or Fill Factor.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes

Create a Primary Key

In Enterprise Architect you can create a Primary Key from either the 'Columns' tab or the 'Constraints/Indexes' tab. In either case, when you add a column to a Primary Key constraint, the column is automatically set to be 'Not Null'. Additionally any diagram (assuming the 'Show Qualifiers and Visibility Indicators' option is set) containing the Table element will show the 'PK' prefix against the column name. In this image, see the first column 'id: bigserial'.



Create a Primary Key - from the Columns tab

Step	Action
1	Either: • In the Database Builder, click on a Table with one or more defined columns, and click on the 'Columns' tab, or • On a diagram, click on a Table and press F9 to display the 'Columns' tab
2	For each column to include in the Primary Key, select the 'PK' checkbox. If a Primary Key constraint is not previously defined for the current Table, the system will create a new constraint using the Primary Key Name template.

Create a Primary Key - from the Constraints tab

Step	Action
1	Either: • In the Database Builder, click on a Table with one or more defined columns, and click on the 'Constraints/Indexes' tab, or • On a diagram, click on a Table and press F10 to display the 'Constraints/Indexes' tab
2	Overtype the *New Constraint* text with the Primary Key name, press the Enter key and click on the 'Type' field drop-down arrow, and select 'PK'.
3	Assign the required columns to the PK constraint.
4	Set the Primary Key's extended properties using the property panel. • Fill Factor is a numeric value between 0 and 100 • Is Clustered is a Boolean value that determines the physical order of how the data is stored; for most DBMSs the Is Clustered property defaults to True for Primary Keys

Remove columns from a Primary Key

You can remove columns from a Primary Key using either the 'Columns' tab or the 'Constraints/Indexes' tab.

Remove columns from a Primary Key - using the Columns tab

Step	Action
1	Either: • In the Database Builder, click on the Table with the Primary Key, and click on the 'Columns' tab, or • On a diagram, click on a Table and press F9 to display the 'Columns' tab

2	Against each column you want to remove from the Primary Key, deselect the 'PK' checkbox. If you have removed all columns from the Primary Key constraint and the Primary Key is no longer needed, it must be manually deleted.

Remove columns from a Primary Key - using the Constraints/Indexes tab

Step	Action
1	Either: • In the Database Builder, click on the Table with the Primary Key, and click on the 'Constraints/Indexes' tab, or • On a diagram, click on a Table and press F10 to display the 'Constraints/Indexes' tab
2	Unassign the columns on the PK constraint, as necessary.

Notes

- Warning: Enterprise Architect assumes that Primary Key constraints have at least one column assigned to them; however, Enterprise Architect does not enforce this rule during modeling
  If DDL is generated for a Table whose Primary Key has no column assigned, that DDL will be invalid

Database Indexes

Database indexes are applied to Tables to improve the performance of data retrieval and sort operations. Multiple indexes can be defined against a Table; however, each index imposes overheads (in the form of processing time and storage) on the database server to maintain them as information is added to and deleted from the Table

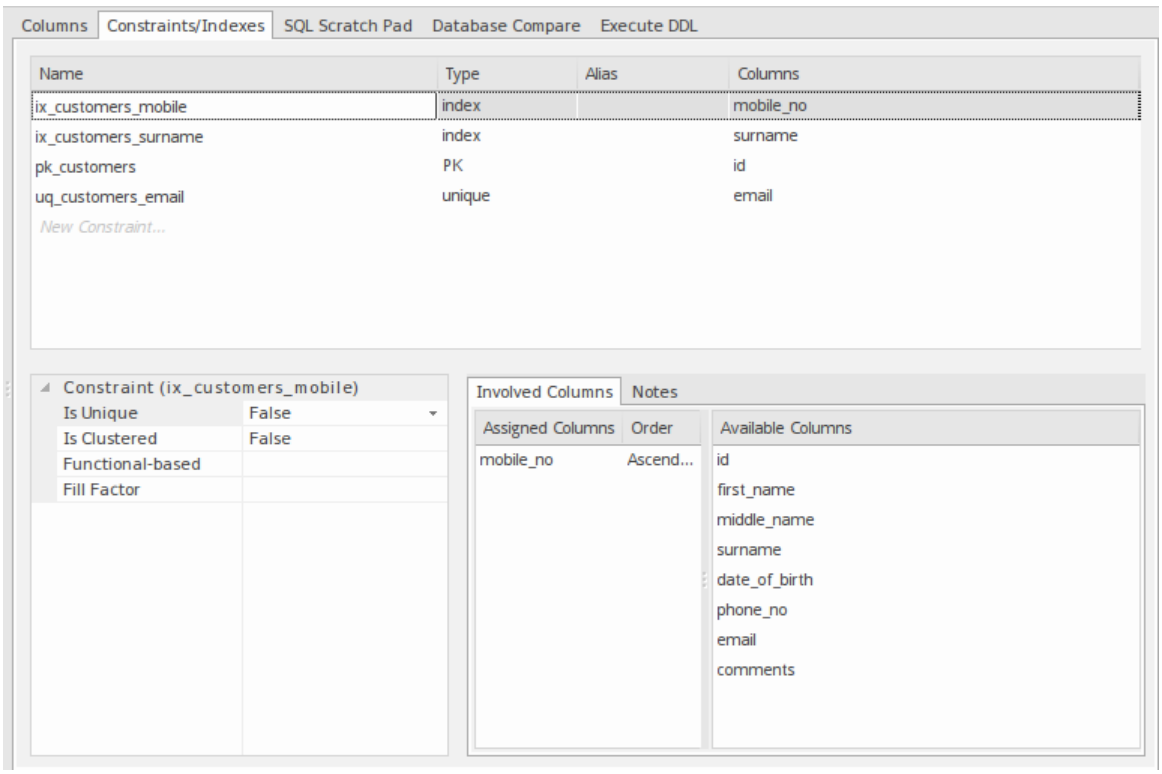
In Enterprise Architect an index is modeled as a stereotyped operation.

Some DBMSs support special types of index; Enterprise Architect defines these using additional properties such as function-based, clustered and fill-factor.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes

Work on an index



Step	Action
1	On the 'Constraints/Indexes' tab for the Table, right-click and select 'Add new constraint'.

	The new constraint is added with the default name 'constraint1' and the Type of 'index'. Overtype the name with your preferred index name.
2	Assign the appropriate columns to the Index. The 'Assigned Columns' list has an additional 'Order' field that specifies the order (Ascending or Descending) in which each assigned column is stored in the index. You can toggle the order for each column, as required. Additionally, for MySQL indexes, a 'Len' field will be visible in which you can define Partial Indexes; that is, an index that uses the leading 'n' number of characters of a text based field. The 'Len' field takes only whole number numeric values of between 0 and the column's defined length. A value of 0 (which is the default) indicates that the entire column is to be indexed.
3	In the 'Property' panel, review the settings of the extended properties that are defined for the current DBMS.

Additional Properties

Property	Description
Is Unique	(True / False) indicates whether the current index is a 'Unique Index'. A Unique Index ensures that the indexed column (or columns) does not contain duplicate values, thereby ensuring that each row has a unique value (or combination of values when the index consists of multiple columns).
Is Clustered	(True / False) indicates whether the current index is a 'Clustered Index'. With a clustered index, the rows of the table are physically stored in the same order as in the index, therefore there can be only one clustered index per table. By default a table's Primary Key is clustered. Not all DBMS's support clustered indexes, therefore the 'Is Clustered' Index property will only be visible for DBMSs that support it.
Is Bitmap	(True / False) indicates whether the current index is a 'Bitmap' index. Bitmap indexes are meant to be used on columns that have relatively few unique values (referred to as 'low cardinality' columns) and that physically consist of a bit array (commonly called bitmaps) for each unique value. Each of the arrays will have a bit for each row in the table. Consider this example: a bitmap index is created on a column called 'Gender', which has the options 'Male' or 'Female'. Physically, the index will consist of two bit arrays, one for 'Male' and one for 'Female'. The female bit array will have a 1 in each bit where the matching row has the value 'Female'. The 'Is Bitmap' and 'Is Unique' properties are mutually exclusive, and so the DDL generation will ignore the 'Is Unique' property when the 'Is Bitmap' property is True. Bitmap Indexes are only supported by Oracle; therefore, this property is only visible while modeling Oracle indexes.
Fill Factor	A numeric value between 0 and 100, that defines the percentage of available space that should be used for data. Not all DBMSs support fill factor, therefore the 'Fill Factor' index property will only be visible for DBMSs that support it.

Functional-based	A SQL statement that defines the function/statement that will be evaluated and the results indexed; for example: LOWER("field") Not all DBMSs support functional-based indexes, therefore the 'Functional-based' Index property will only be visible for DBMSs that support them, such as PostgreSQL and Oracle.
Include	Identifies a comma-separated list (CSV) of non-key Columns from the current table. Not all DBMSs support the 'Include' property on indexes, therefore this property will only be visible for DBMSs that support it.

Notes

- Warning: Enterprise Architect assumes that Indexes have at least one column assigned to them; however, Enterprise Architect does not enforce this rule during modeling
  If DDL is generated for a Table that has an Index defined without column(s) assigned, that DDL will be invalid, unless the index is functional-based
- Any columns assigned to a functional-based index are ignored

Unique Constraints

Unique Constraints enforce the 'uniqueness' of a set of fields in all rows of a Table, which means that no two rows in a Table can have the same values in the fields of a Unique Constraint. Unique Constraints are similar to Primary Keys (in that they also enforce 'uniqueness') but the main difference is that a Table can have multiple Unique Constraints defined but only one Primary Key.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes > Right-click > Add New Constraint
Context Menu	In diagram or Browser window | Right-click on Table element | Features | Constraints/Indexes
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes: Ctrl+N

Create a Constraint

Step	Action
1	On the 'Constraints/Indexes' tab, a new constraint is automatically created and assigned the default constraint name and a 'Type' of index. Overtype the constraint name with a name that identifies this as a unique constraint.
2	In the 'Type' field, change the value from 'index' to 'unique'.

Notes

- Warning: Enterprise Architect assumes that Unique Constraints have at least one column assigned to them; however, Enterprise Architect does not enforce this rule during modeling
  If DDL is generated for a Table that has a unique constraint defined without column(s) assigned, that DDL will be invalid

Foreign Keys

A Foreign Key defines a column (or a collection of columns) that enforces a relationship between two Tables. It is the responsibility of the database server to enforce this relationship to ensure data integrity. The model definition of a Foreign Key consists of a parent (primary) Table containing a unique set of data that is then referred to in a child (foreign) Table.

In Enterprise Architect, a Foreign Key is modeled with two different (but related) UML components:

- A Foreign Key constraint (a UML operation with the stereotype of <<FK>>) stored on the child Table and
- An Association connector (stereotype of <<FK>>) defining the relationship between the two Tables

Create a Foreign Key

Although the definition of a Foreign Key can be complex, the Foreign Key Constraint screen simplifies the modeling of Foreign Keys. This screen is purpose-designed to help you select which constraint in the parent Table to use, and will automatically match the child Table columns to those in the parent Table that are part of the constraint. Different aspects of the process of developing a Foreign Key are described here separately for illustration, but the overall process should be a smooth transition.

A number of conditions must be met before a Foreign Key definition can be saved:

- Both Tables must have matching DBMSs defined
- The parent Table must have at least one column
- The parent Table must have a Primary Key, unique constraint or unique index defined

Create a Foreign Key - using the Database Builder

Step	Action
1	In the Database Builder tree, right-click on the child Table name and click on 'Add new Foreign Key on <table name>'. A dialog displays listing all the possible parent Tables.
2	Double-click on the required parent Table name in the list or select it and click on the OK button. The 'Foreign Key Constraint' screen displays.

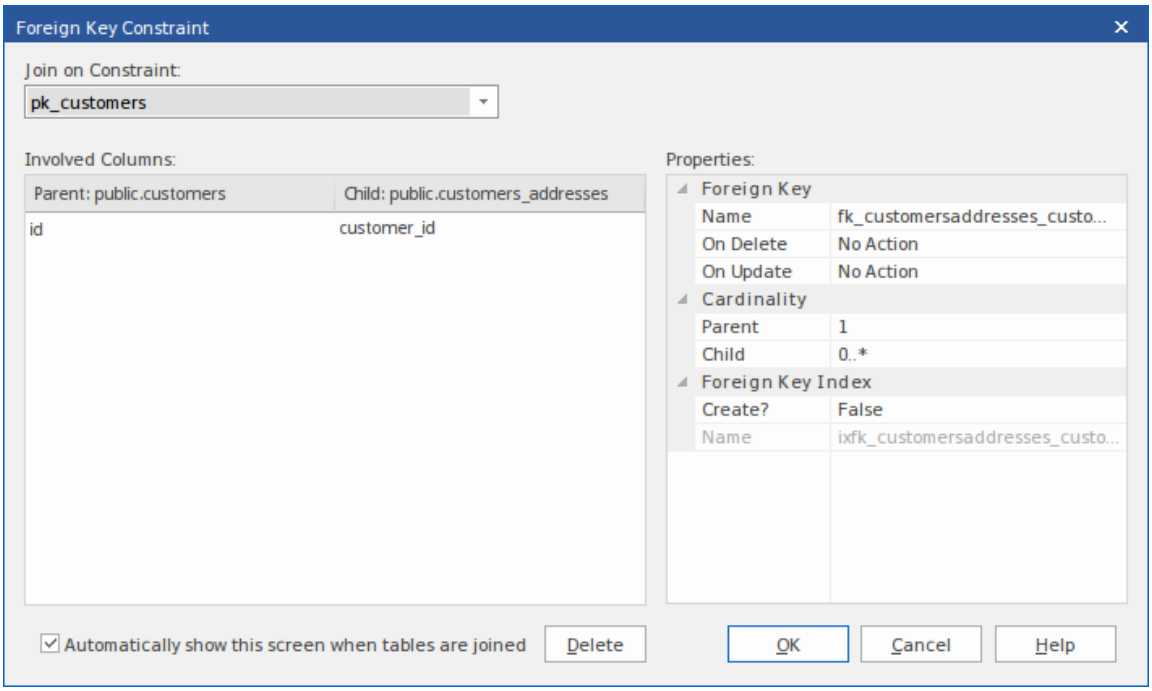
Create a Foreign Key - using a relationship on a diagram

Step	Action
1	In the Data Modeling diagram, locate the required child (Foreign Key) Table and parent (Primary Key) Table.
2	Select an Association connector in the 'Data Modeling' page of the Diagram Toolbox.
3	Click on the child Table and draw the connector to the parent Table.

4	If the Foreign Key Constraint screen has been set to display automatically when two Tables are joined, it displays now. Otherwise, either: • Double-click on the connector or • Right-click on the connector and select the 'Foreign Keys' option The Foreign Key Constraint screen displays.

The Foreign Key Constraint Screen

As an example this image shows the Foreign Key Constraint screen loaded with the details of 'fk_customersaddresses_customers' (as defined in the Example model).

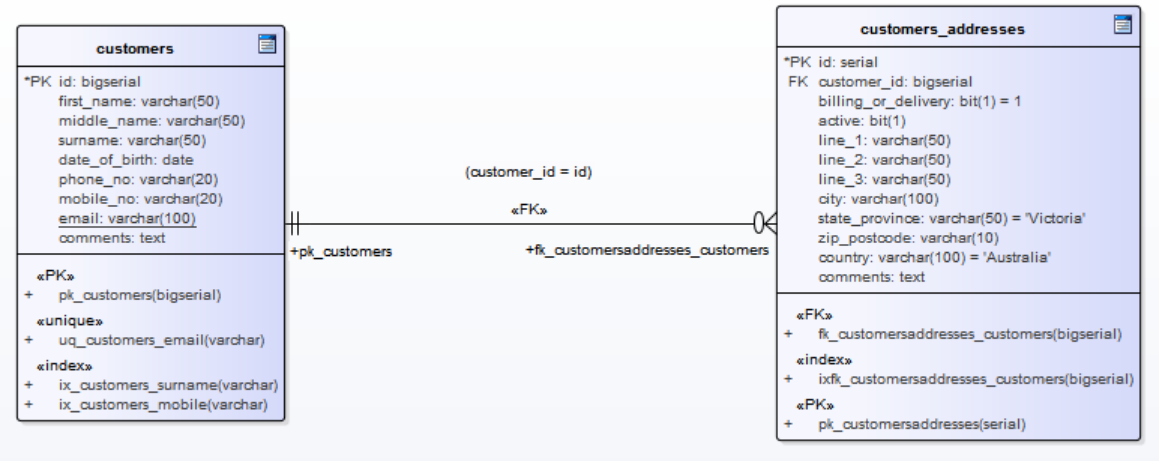


Option	Action
Join on Constraint	This combo box lists all defined constraints in the parent Table that could be used as the basis of a Foreign Key. (These constraints can be Primary Keys, Unique Constraints or Unique Indexes.) The first constraint in the list is selected by default; if this is not the constraint you want, select the correct constraint from the combo box. When you select the constraint, its columns are automatically listed in the 'Involved Columns' panel, under the 'Parent: <tablename>' column.
Involved Columns	This list is divided into two: the columns involved in the selected constraint are listed on the left, and the child columns that are going to be paired to the parent columns are listed on the right. When a constraint is selected (in the 'Join on constraint' field) the parent side is refreshed to display all columns assigned to the selected constraint. On the child side the system will automatically attempt to match each parent column to one of the same name in the child Table. If the child Table does not have a column of the same name, a new column of that name will be added to the list, flagged with (*) to indicate that a new column will be created in the Table.

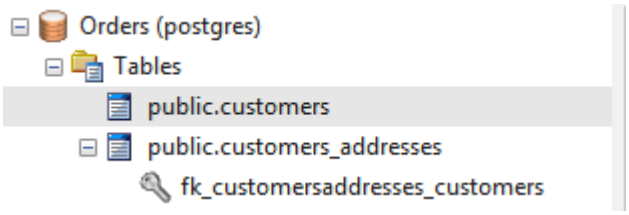
	However, if you want to force the pairing to an existing child Table column or a new column with a different name, click on the column name field and either: • Type in the replacement name, or • Select an existing column (click on the drop-down arrow and select the name from the list)
Name	This field defines the name of the Foreign Key constraint, and defaults to a name constructed by the Foreign Key Name Template. To change the name to something other than the default, simply overtype the value.
On Delete	Select the action that should be taken on the data in the child Table when data in the parent is deleted, so as to maintain referential integrity.
On Update	Select the action that should be taken on the data in the child Table when data in the parent is updated, so as to maintain referential integrity.
Parent	Click on the drop-down arrow and select the cardinality of the parent Table in the Foreign Key.
Child	Click on the drop-down arrow and select the cardinality of the child Table in the Foreign Key.
Create?	If you want to create a Foreign Key Index at the same time as the Foreign Key, set this property to True. The name of the Foreign Key Index is controlled by the Foreign Key Index template, and the generated name is shown in the 'Name' field underneath the 'Create?' field.
Automatically show this screen when tables are joined	(For diagrammatic modeling) Select this checkbox to automatically display this screen whenever an Association is created between two Tables.
Delete	Click on this button to delete the currently selected existing (saved) Foreign Key. A prompt is displayed to confirm the deletion (and the deletion of the Foreign Key Index, if one exists) - click on the Yes button. Deleting a Foreign Key leaves an Association connector in place, which you can either edit or delete (right-click and select 'Delete association: to <Table name>').
OK	Click on this button to save the Foreign Key.

Examples

This example shows simple Foreign Keys in a diagram:



The same Foreign Key will be shown in the Database Builder's tree as a child node under the Table 'customers.addresses'.



Check Constraints

A Check Constraint enforces domain integrity by limiting the values that are accepted by a column.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes > Right-click > Add New Constraint
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes | Right-click | Add New Constraint
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes: Ctrl+N

Create a Constraint

Step	Action
1	On the 'Constraints/Indexes' tab of the Columns and Constraints screen, a new constraint is automatically created and assigned the default constraint name and a 'Type' of index. Overtype the constraint name with a name that identifies the constraint as a check constraint, such as 'CHK_ColumnName' (the CHK_ prefix is optional).
2	In the 'Type' field, change the value from 'index' to 'check'.
3	In the 'Properties' panel for the Condition property, type the SQL statement that will be used as the Check Condition; for example, column1 < 1000. If the condition is long, click on the button to display a SQL editor (with syntax highlighting).

Delete a Check Constraint

If you do not want to keep a check constraint, either:

- Right-click on it in the list and select 'Delete constraint <name>', or
- Click on the item and press Ctrl+D

The constraint is immediately deleted.

Notes

- Any columns assigned to a check constraint are ignored

Table Triggers

A Table trigger is SQL or code that is automatically executed as a result of data being modified in a database Table. Triggers are highly customizable and can be used in many different ways; for example, they could be used to stop certain database activities from being performed during business hours, or to provide validation or perform deletions in secondary Tables when a record in the primary Table is deleted.

In Enterprise Architect, a Table trigger is modeled as a stereotyped operation and managed using the Table's 'Constraints' screen.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes | Right-click | Add New Constraint
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes | Right-click | Add New Constraint
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes: Ctrl+N

Create a Table Trigger

Step	Action
1	On the 'Constraints/Indexes' tab, a new constraint is automatically created and assigned the default constraint name and a 'Type' of index. Overtype the constraint name with a name that identifies the constraint as a trigger, such as TRG_OnCustomerUpdate. (The TRG_ prefix is optional.)
2	In the 'Type' field, change the value from 'index' to 'trigger'.
3	In the 'Properties' panel for the Statement property, type in the complete SQL statement (including CREATE TRIGGER) that will define the Trigger. If the condition is long, click on the button to display a SQL editor (with syntax highlighting).
4	The properties Trigger Time and Trigger Event are currently information-only values and are not used in DDL generation.

Delete a Table Trigger

If you do not want to keep a trigger, either:

- Right-click on it in the list and select 'Delete constraint <name>', or
- Click on the item and press Ctrl+D

The trigger is immediately deleted.

Notes

- Any columns assigned to table triggers are ignored

SQL Scratch Pad

The SQL Scratch Pad provides a mechanism to develop and run ad-hoc SQL Queries against a live database. While you develop your data model you might want to execute and test ad-hoc SQL Queries for a DDL script, or run enquiries on the live database; all of this is possible within the Enterprise Architect Database Builder interface.

The SQL Scratch Pad requires the Database Builder to have a valid connection to a live database. This database connection is shared between the 'SQL Scratch Pad', 'Database Compare' and 'Execute DDL' tabs of the Database Builder.

The Scratch Pad consists of:

- A toolbar providing facilities for importing, saving, executing and clearing the SQL Queries
- An editor panel in which you create or import the SQL Queries - this panel provides SQL-based syntax highlighting for the current data model
- A tabbed panel consisting of two pages, one to show the results of executing the Query and one to display any messages generated during the execution

Access

Open the Database Builder window, then display the 'SQL Scratch Pad' tab.

Ribbon	Develop > Data Modeling > Database Builder > SQL Scratch Pad

The Scratch Pad Toolbar

The functionality of each button on the Scratch Pad Toolbar is described in this table, working from left to right.

Button	Action
Run SQL	Executes the SQL Query currently shown in the Scratch Pad. Check the 'Results' and 'Messages' tabs for the output of executing the Query.
New	Clears the SQL Query editor fields so that you can enter a new query.
Open	Loads an SQL Query from file. A source file browser displays, defaulted to display SQL files. Click on the file name and on the Open button to display the file contents in the Scratch Pad.
Save to SQL Query	Saves this SQL statement to the SQL Query object it came from.
Save to New SQL Query	Creates a new SQL Query object and saves this statement to that object.
Save to File	Saves the currently-displayed Query to the file it came from. If you created the Query from scratch, a source file browser displays in which you type the new file name and click on the Save button to save the Query.
Save to New File	Saves the currently-displayed Query to a new .sql file.

	A source file browser displays on which you type in the new file name and click on the Save button to save the Query.
Clear	Clears the contents of the Scratch Pad. Any Query displayed in the Scratch Pad remains there until you either replace it with another Query from file or you close the model.
Toggle Comment	Applies the SQL comment characters '--' to the beginning of each selected line or, if the selected lines are already commented, removes the comment characters. Alternatively, press Ctrl+Shift+C.
Statement Separator	Type in the character(s) to use to mark the end of each statement.
Help	Displays the Help on the SQL Query Scratch Pad.
Query Description	Displays a label providing a description of the current SQL, whether there are pending changes (indicated by a leading *), and the name of the loaded SQL Query object or Filename.

Notes

- The SQL Scratch Pad does not manipulate your SQL in any way, so you must use the correct syntax for the current DBMS
- While the SQL Scratch Pad can execute multiple SQL statements, and the status and messages of each statement are shown in the 'Messages' list, only the results of one SELECT statement can be shown in the 'Results' list at a time; all subsequent SELECT statements will be ignored

Database Compare

The 'Database Compare' tab provides a mechanism for comparing the current data model with a live database, and optionally synchronizing any differences in either direction. Differences 'pushed' into a live database are performed using 'Alter DDL' statements, while changes imported from the live database can be directly 'pulled' into the model.

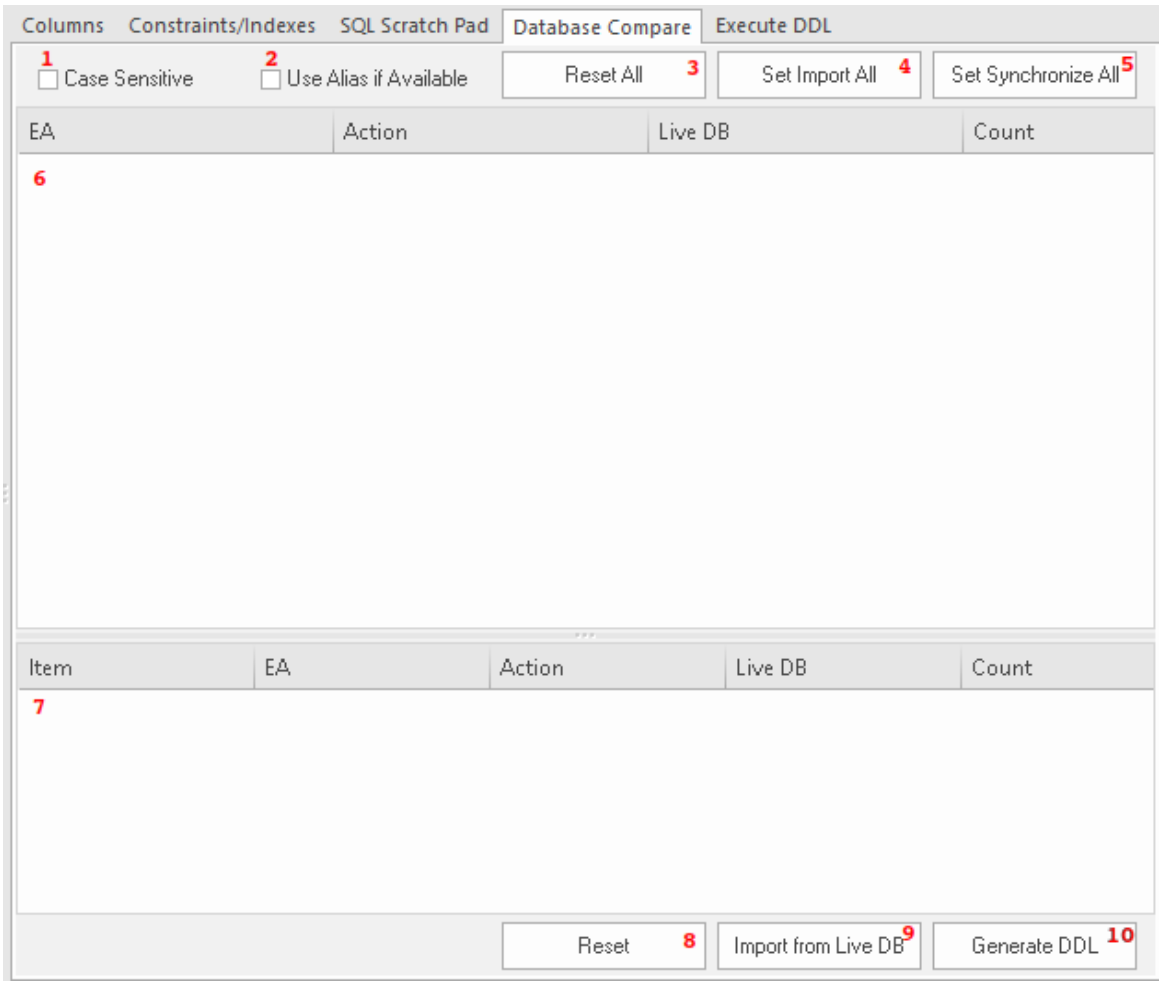
The Database Compare functionality requires the Database Builder to have a valid connection to a live database. This database connection is shared by the 'SQL Scratch Pad', 'Database Compare' and 'Execute DDL' tabs of the Database Builder.

Access

Open the Database Builder window, then display the 'Database Compare' tab.

Ribbon	Develop > Data Modeling > Database Builder > Database Compare

The DDL Compare Tab



The 'Database Compare' tab has a number of controls, as described here.

Number & Name	Description

1 Case Sensitive	Click on this checkbox to make all comparisons of properties recognize differences in letter-case in the property text.
2 Use Alias if Available	Click on this checkbox to indicate that any defined aliases should be used instead of object names (at both object and column level).
3 Reset All	Click on this button to set the 'Action' flag for all objects back to the default value.
4 Set Import All	Click on this button to set the 'Action' flag of all detected differences to <====; that is, update the model with the value(s) from the live database.
5 Set Synchronize All	Click on this button to set the 'Action' flag of all detected differences to ====>; that is, update the live database with the value(s) from the model.
6 Differences	Review the list of objects found to have mis-matches between the model and the live database. Selecting an item in this list will populate the 'Components' list. (See the *Differences List* table for a detailed description of each column.)
7 Components	Review this list of properties of the selected object that differ between the model and the live database. (See the *Component List* table for a detailed description of each column.)
8 Reset	Click on this button to set the 'Action' flag for all properties of the current object back to the default value.
9 Import from Live DB	Click on this button to import all properties' values (with the 'Action' of <===) from the live database into the model.
10 Generate DDL	Click on this button to generate the 'Alter DDL' statements for all objects with an 'Action' of ====>, and send the statements to the 'Execute DDL' tab.

Differences List

Column	Description
EA	Displays the name of each object in the model that has one or more detected differences. Blank values indicate that the object is missing in the model but exists in the live database.
Action	Defaults to 'No Action' as the action to take considering this object's difference(s). Click on the drop-down arrow and select a specific action. The list of available actions in the list will depend on whether or not the given object is paired in the model and live database. **Paired objects** • No Action - do not update the database or model with this change • ===> - update the object in the database from the model • <=== - update the object in the model from the database • Customize - set the items to No Action prior to setting different actions on each

	item in the lower panel • Unpair - separate the paired objects so that they are not compared with each other or updated from each other **Unpaired objects** • Create <object name> - create the missing database object in the database or model, as appropriate • Delete <object name> - delete the object from the model • Drop <object name> - delete the object from the database • Pair with <object name> - pair the object in the database with the named (unpaired) object in the model, so that they are compared for differences between them The 'Action' fields in the 'Components List' (the lower panel) will be updated based on the selection of this field. For example, if the live database has a Table column 'Address1' and the model doesn't, setting the object 'Action' to '**===>**' (update the object in the database from the model) sets the column 'Item Action' to 'Drop Address1', which will remove the column from the live database.
Live DB	Shows the name of each object in the live database that has one or more detected differences. Blank values indicate that the object exists in the model but is missing in the live database.
Count	Shows the total number of detected differences for the object (and all of its components) between the model and live database.

Component List

Column	Description
Item	Shows the component name or description for each detected difference. The differences are grouped into three categories: Properties, Columns and Constraints, in a tree structure.
EA	Shows the value of the given component as detected in the model. Blank values indicate that the value is missing in the model but exists in the live database.
Action	Defaults to the action corresponding to the setting of the object 'Action' field in the 'Differences' list, to indicate the action to take regarding the difference detected for the component. Click on the drop-down arrow to select an alternative action; the available options in the list depend on the component's type and the detected difference. • No Action - do not update the database or model • ===> - update the object in the live database from the model • <=== - update the object in the model from the live database • Add <item name> - create the missing item in the database or model, as appropriate • Delete <item name> - delete the item from the model

	• Drop <item name> - delete the item from the live database
Live DB	Shows the value for the selected component in the live database. Blank values indicate that the value exists in the model but is missing in the live database.
Count	Shows the number of differences between the model and the live database detected in the selected component.

Working with the Database Comparison

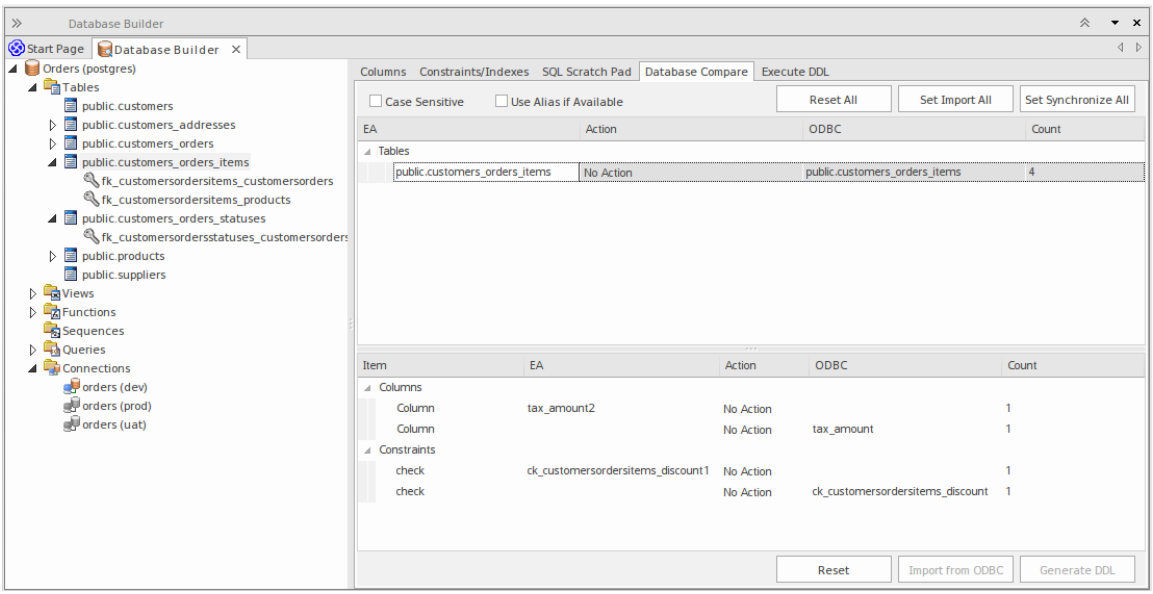
Whenever you perform a comparison, Enterprise Architect reads the definition from both the live database and the model, and then attempts to 'pair' each object from one source with the other, using its name (and schema, if relevant for the current DBMS).

If a match is found, the object name is shown in both the 'EA' and 'Live DB' columns with a default action of 'No Action'. The 'Count' column indicates the total number of differences found for the object and its components or properties.

If a match is not found between the systems, the object name is shown in the source column (either 'EA' or 'Live DB') while the other column is blank. In this state it is possible to pair the object with an object of a different name; the 'Action' dropdown list will present the available objects. If a new pairing is made the two objects' definitions are compared for differences and the results are shown in the 'Components' list, with the default action of '====>' selected.

If you select an action at the object level, this will set the matching action for all of the object's components and properties. However, if you select the 'Customize' action at the object level, you can determine a different action for each component.

As an example, both a column (tax_amount) and constraint (ck_customersordersitems_discount) were renamed in Table 'public.customers_order_items' (in the Example model) and a database compare performed; this image shows the differences found:



In the image there is only one Table that had detected differences - 'public.customers_order_items'; selecting this populates the 'Components' list. From the detected results it can be determined that the data model contains a column (tax_amount2) and a check constraint (ck_customerordersitems_discount1) that the live database doesn't and in turn the live database contains a column (tax_amount) and a check constraint (ck_customerordersitems_discount) that the data model doesn't.

Comparing with Options

The 'Compare with Options' functionality works in the same manner as for a direct comparison, except that you are prompted to choose which object/property comparisons should be performed. This enables you to ignore particular differences that are not of relevance at the current time.

These tables describe the different comparisons that can be enabled or disabled.

All Objects, Owner

Comparison	Action
Owner	Select to indicate that the 'Owner' property of all database objects should be compared, after the objects have been 'paired'.

Table Options

Option	Action
Tables	Select this parent option to enable all of the Table comparison options. Deselect to disable all the other options. You would then deselect or select specific options in the list.
Table - Extended Properties	Select to indicate that extended properties of Tables (such as DB Version and Tablespace) should be compared.
Table - Remarks	Select to indicate that remarks applied to Tables should be compared.
Columns	Select this parent option to enable all of the 'Column comparison' options. Deselect to disable all the other 'Column' options. You would then deselect or select specific options in the list.
Column - Type	Select to indicate that the datatype name for the Table Columns should be compared.
Column - Size	Select to indicate that the datatype size for the Table Columns should be compared.
Column - Default Value	Select to indicate that the default values of the Table Columns should be compared.
Column - Position	Select to indicate that the Table Column positions should be compared.
Column - Not Null	Select to indicate that the not null property of the Table Columns should be compared.
Column - Auto Numbering	Select to indicate that the autonumbering properties for the Table Columns should be compared (such as AutoNum, StartNum and Increment).

Column - Unmatched Columns	Select to indicate that Table Columns that are unmatched between the model and the live database should be compared. Typically these are columns that exist in one system but do not exist in the other.
Column - Extended Properties	Select to indicate that extended properties of Table Columns (such as Unsigned and Zerofill) should be compared.
Column - Remarks	Select to indicate that remarks applied to Table Columns should be compared.
Constraints	Select this parent option to enable all of the 'Table Constraint comparison' options. Deselect to disable all the 'Table Constraint' options. You would then deselect or select specific options in the list.
Constraint - Primary Keys	Select to indicate that properties related to Primary Keys should be compared.
Constraint - Foreign Keys	Select to indicate that properties related to Foreign Keys should be compared.
Constraint - Indexes	Select to indicate that properties related to Indexes should be compared.
Constraint - Unique Constraints	Select to indicate that properties related to Unique Constraints should be compared.
Constraint - Check Constraints	Select to indicate that properties related to Check Constraints should be compared.
Constraint - Table Triggers	Select to indicate that properties related to Table Triggers should be compared.
Constraint - Unmatched Constraints	Select to indicate that Table Constraints that are unmatched between the model and the live database should be compared. Typically these are constraints that exist in one system but do not exist in the other.
Constraints - Extended Properties	Select to indicate that extended properties of Table Constraints (such as Fill Factor and Clustered) should be compared.
Constraints - Remarks	Select to indicate that remarks applied to Table Constraints should be compared.

Notes

- The Database Compare functionality currently can perform comparisons on Table, View, Procedure, Function and Sequence object types

Execute DDL

The 'Execute DDL' tab provides a mechanism to easily execute generated DDL statements against a live database, and provides instant feedback on their success, all within the Enterprise Architect interface and without the need for other products.

There are two different types of DDL statement that Enterprise Architect can generate and send to the 'Execute DDL' tab:

- Create DDL statements, created by the Generate DDL screen, and
- Alter DDL statements, created by the Database Compare window

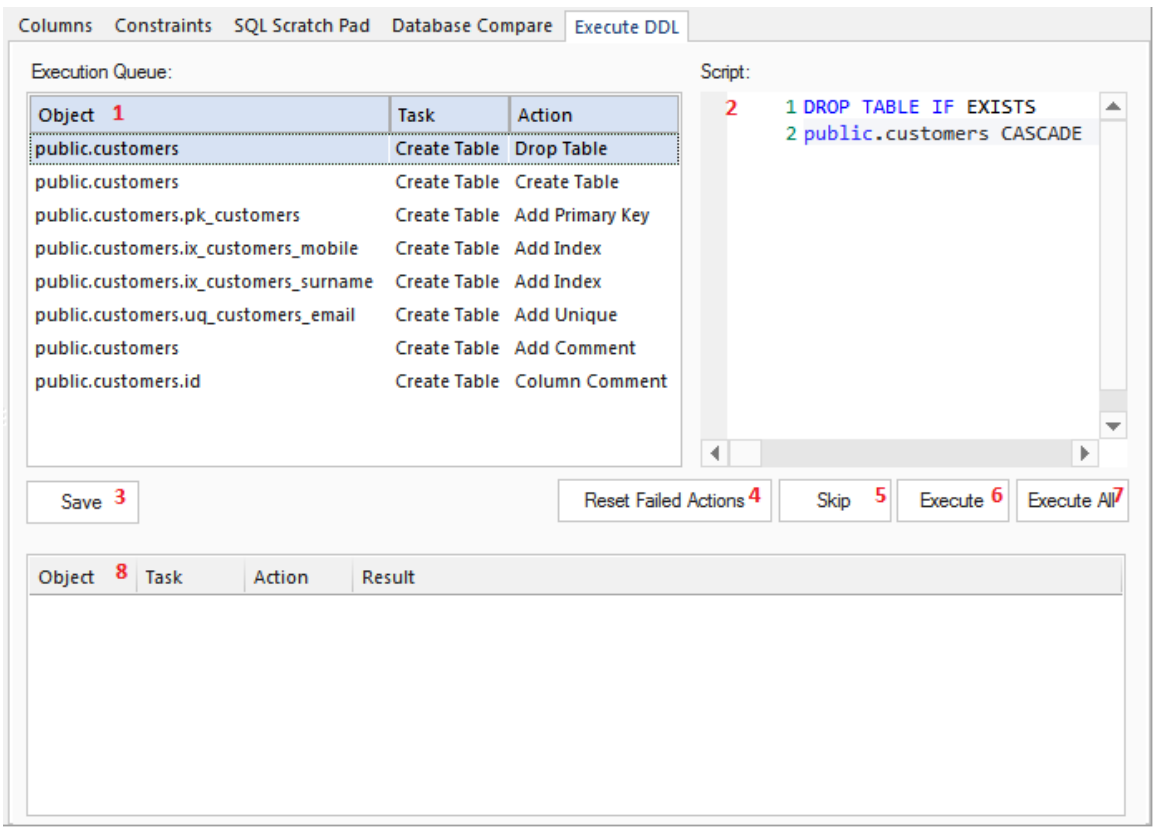
The Execute DDL functionality requires the Database Builder to have a valid connection to a live database. This database connection is shared between the SQL Scratch Pad, Database Compare and 'Execute DDL' tabs of the Database Builder.

Access

Open the Database Builder window, then display the 'Execute DDL' tab.

Ribbon	Develop > Data Modeling > Database Builder > Execute DDL

Execute the DDL



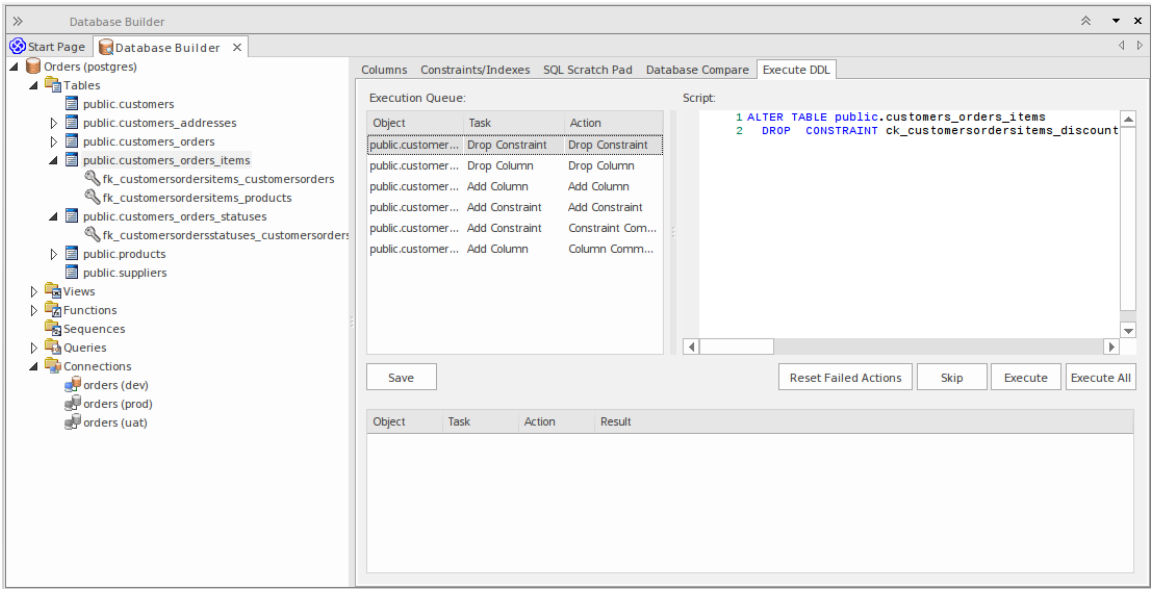
The 'Execute DDL' tab has these fields and buttons:

Field/Button	Action

1 Execution Queue	Lists the tasks (each with an associated DDL statement) that are yet to be executed. The list has three columns that specify the name of the object involved, the task and the action being performed. Selecting an item in the list will display the associated DDL statement (in the 'Script' field) for the given task.
2 Script	A text box with SQL syntax highlighting, showing the DDL statement for the selected task.
3 Save	Click on this button to save all the individual DDL statements from both the 'Execution Queue' and the 'Results List' into a single file.
4 Reset Failed Actions	Click on this button to re-queue any failed or skipped tasks from the 'Results List' to the bottom of the 'Execution Queue'.
5 Skip	Click on this button to skip over the next task in the 'Execution Queue' and not execute it. The task will be moved into the 'Results List' and not given a result. When you click on the Reset Failed Actions button, skipped tasks are returned to the Execution Queue along with any failed tasks.
6 Execute	Click on this button to execute the next task in the 'Execution Queue'. The task is removed from the top of the 'Execution Queue' and added to the end of the 'Results List' with the execution result.
7 Execute All	Click on this button to execute all tasks in the 'Execution Queue'. When execution is complete, the 'Results List' will display the results of each individual task.
8 Results List	Lists the executed tasks with the results of execution for each task. Selecting an item in this list will display the DDL statement that was executed, in the 'Script' field.

Example

In the example used in the earlier section on Database Comparison (when a column and constraint were renamed), if the defaults are used to 'push' the data model changes into the live database the Execute DDL screen is populated with the details shown here.



In summary, DDL is generated to drop both the old column and the old constraint (tasks 'Drop Column' and 'Drop Constraint'), then the column and constraint are created with the new names (tasks 'Add Column' and 'Add Constraint') and finally each has their comments/remarks applied (tasks 'Add Constraint - Constraint Comment' and 'Add Column - Column Comment').

Database Objects

Whilst Tables are the fundamental components of a relational database and allow the definition of Columns, Data Types, Keys and Indexes, there are a number of other Objects that are important in RDBM systems including:

- Views - a View represents the result-set of a pre-defined query; they are dynamically derived from the data stored in one or more Tables (or other Views)
- Procedures - a feature that some DBMS products implement to provide subroutines that can contain one or more SQL statements to perform a specific task such as data validation, access control, or to reduce network traffic between clients and the DBMS servers
- Functions - a feature that some DBMS products implement to provide a mechanism to extend the functionality of the database server; each is a routine that can accept parameters, perform an action (such as a complex calculation) and return the result of that action as a value
- Sequences - a feature that some DBMS products implement to provide a mechanism to generate unique values - the Sequence ensures that each call to it returns a unique value

The UML itself does not specify how data modeling is performed, but Enterprise Architect has a fully integrated UML profile for data modeling and a range of features built in to the core product that will make data modeling easy.

The profile uses stereotypes and Tagged Values to extend standard UML elements into data modeling constructs. This is achieved by adding the database object stereotype to a UML Class; so that you would model:

- Data Modeling diagrams as extended UML Class diagrams
- Tables as UML Class objects with a stereotype of <<table>>
- Views as UML Class objects with a stereotype of <<view>>
- Procedures as UML Class objects with a stereotype of <<procedure>>
- Functions as UML Class objects with a stereotype of <<function>>
- Sequences as UML Class objects with a stereotype of <<dbsequence>>

You can quickly create and configure all of these objects in your database model with Enterprise Architect.

Database Tables

Tables are the fundamental components of a relational database, representing multiple rows of structured data elements (referred to as Columns). Every individual item of data entered into a relational database is represented by a value in a column.

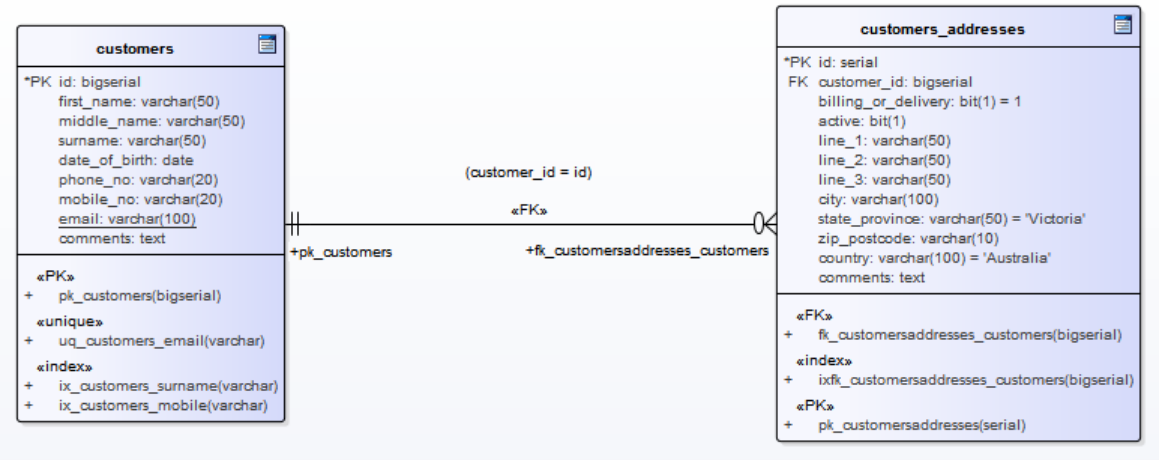
Enterprise Architect's UML Profile for Data Modeling represents:

- Database Tables as UML Class objects with a stereotype of <<table>>
- Table columns as UML attributes of a Table, with a stereotype of <<column>>
- Primary Keys as UML operations/methods of a Table, with a stereotype of <<PK>>
- Foreign Keys as UML operations/methods of a Table, with a stereotype of <<FK>>
- Indexes as UML operations/methods of a Table, with a stereotype of <<index>>
- Unique Constraints as UML operations/methods of a Table, with a stereotype of <<unique>>
- Check Constraints as UML operations/methods of a Table, with a stereotype of <<check>>
- Table Triggers as UML operations/methods of a Table, with a stereotype of <<trigger>>

Enterprise Architect refers to all of the UML operations of a Table collectively as Constraints, hence the screen you use to maintain a Table's UML attributes and operations is called the Columns and Constraints screen.

Example

This simple example of a Physical Data Model diagram in Enterprise Architect consists of two Database Tables represented by UML Classes, named *customers* and *customer_addresses*.



Each Table defines database columns, using UML attributes typed appropriately for the target DBMS (in this case, PostgreSQL).

Notes

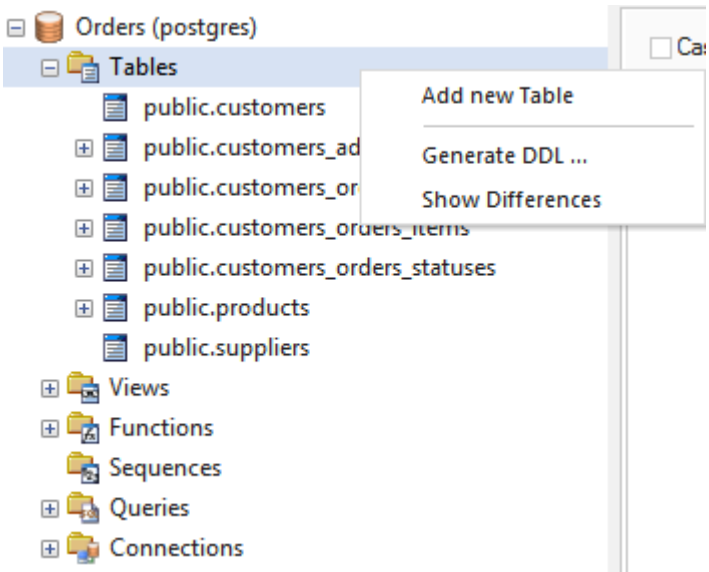
- The Table stereotype is denoted by the icon in the top-right corner of each Class (see the *Data Modeling Notation* topic)
- The Enterprise Architect maintenance screen for managing Table Columns doesn't allow you to change the attributes stereotype, since <<column>> is the only valid option
- It is possible to hide the <<column>> stereotype label shown in the example Tables (see the *Data Modeling Notation* topic)

Create a Database Table

Fundamental to data modeling is the creation of Database Tables within the model. There are three ways to create a Table:

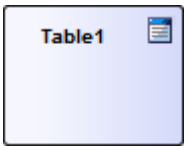
- Within the Database Builder
- On an open Data Model diagram
- Using the Browser New Element option

Add a Database Table with the Database Builder

Step	Action
1	Open the Database Builder ('Develop > Data Modeling > Database Builder').
2	Load or create a Data model.
3	Right-click on the Tables Package and select 'Add New Table'. 
4	Overtype the default name with the appropriate name for the Table, and press the Enter key.
5	Double-click on the Table element to define the Table properties.

Add a Database Table to a diagram

Step	Action
1	Create and/or open a Data Modeling diagram.
2	Drag and drop the 'Table' toolbox icon onto the diagram.

	Table This generates a new Table element: 
3	Double-click on the Table element to define the Table properties.

Database Table Columns

In a relational database, a Table column (sometimes referred to as a field) stores a single data value of a particular type in each row of the Table. Table columns can have various individual properties such as a default value or whether the field accepts Null values.

A Database Table Column is represented in the UML Data Modeling Profile as a stereotyped attribute; that is, an attribute with the <<column>> stereotype. In Enterprise Architect you define and maintain Table Columns using the purpose-designed 'Columns' page of the Database Builder, or the 'Columns and Constraints' dialog.

Create Database Table Columns

A database Table column is represented in the UML Data Modeling Profile as an attribute with the <<column>> stereotype. For a selected Table, you can review the existing columns and create new columns, on the 'Columns' page of the Database Builder or on the 'Columns and Constraints' screen.

You can define column details directly on the list of columns on the 'Columns' tab. The changes are automatically saved as you complete each field. Some fields have certain restrictions on the data you can enter, as described here. The tab also contains a 'Properties' panel and a 'Notes' field, which are populated with the existing information on the selected column. Each new column that you create is automatically assigned a set of default values and added to the bottom of the list.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table > Columns > Right-Click > Add new Column
Context Menu	In diagram, right-click on required Table | Features | Columns | Right-Click | Add new Column
Keyboard Shortcuts	Select a table | F9 | Tab Key (to set input focus on the 'Columns' tab) | Ctrl+N

Create columns in a Table

Option	Action
Name	Overtype the default name with the appropriate column name text.
Type	Click on the drop-down arrow and select the appropriate datatype for the column. The available datatypes depend on the DBMS assigned to the parent Table.
Length	(Optional) Some datatypes have a length component - for example, VARCHAR has a length that defines the number of characters that can be stored. If the datatype does not have a length component, this field is disabled. If the field is available and if you need to define a number of characters, type the value here.
Scale	(Optional) Some datatypes have a scale component - for example, DECIMAL has a scale that defines the number of decimal places that can be held. If the datatype does not have a scale component, this field is disabled. If the field is available and if you need to define a scale, type the value here.
PK	Select the checkbox if the column is part of the Primary Key for this Table.
Not Null	Select the checkbox if empty values are forbidden for this column. The checkbox is disabled if the 'PK' checkbox is selected.

Alias	If required for display and documentation purposes, type in an alternative name for the field.
Initial Value	If required, type in a value that can be used as a default value for this column.
Notes	Type in any additional information necessary to document the column. You can format the text using the Notes toolbar at the top of the field.

Column Properties

The appropriate properties for the Table's Database Management System automatically display in the 'Property' panel (expand the 'Column (<name>)' branch if they are not visible).

Property	DBMS
Autonum (Startnum Increment)	Oracle MySQL SQL Server DB2 PostgreSQL Notes: If you require an automatic numbering sequence, set this property to True and, if necessary, define the start number and increment.
Generated	DB2 Notes: Set this additional property for auto numbering in DB2, to 'By Default' or 'Always'.
NotForRep	SQLServer Notes: Set this property to True if you want to block replication.
Zerofill	MySQL Notes: Set this property to True or False to indicate if fields are zerofilled or not.
Unsigned	MySQL Notes: Set this property to True or False to indicate whether or not fields accept unsigned numbers.
LengthType	Oracle Notes: Set this property to define the character semantics as 'None', 'Byte' or 'Char'.

Delete Database Table Columns

For a selected database Table, you can review the existing columns and delete any individual column, on the 'Columns' tab of the Columns and Constraints screen.

Access

Use one of the methods outlined here to display a list of columns for a table, then select a column and delete it.

When you select the 'Delete column '<name>" option, if all validation rules are satisfied the column is immediately deleted.

Ribbon	Develop > Data Modeling > Database Builder > Click on Table > Columns > Right-click on column name > Delete column <name>
Context Menu	In diagram, right-click on required Table | Features | Columns | Right-click on column name | Delete column <name>
Keyboard Shortcuts	F9 | Use 'Up Arrow' or 'Down Arrow' to select a column | Ctrl+D

Notes

- If the deleted database Table column is involved in any constraints it will automatically be removed from them

Reorder Database Table Columns

If you have several columns defined in a database Table, you can change the order in which they are listed. The order in the list is the order in which the columns appear in the generated DDL.

Access

Use one of the methods outlined here to display a list of columns for a Table, then select a column and reposition it within the list.

Ribbon	Develop > Data Modeling > Database Builder > Click on Table
Context Menu	In diagram, right-click on required Table | Features | Columns
Keyboard Shortcuts	F9

Change the column order

Step	Action
1	In the 'Columns' tab, click on the required column name in the list.
2	Right-click and select the: • 'Move column <name> up' option (or press Ctrl+Up Arrow) to move the column up one position • 'Move column <name> down' option (or press Ctrl+Down Arrow) to move the column down one position These options have an immediate effect both in the 'Columns' tab and on a diagram.

Working with Database Table Properties

Once you have created a Database Table, you can review its properties and check that the DBMS and Owner values are correct. To display the 'Properties' dialog for a Table, either double-click on the Table name in the 'Database Builder Tables' Package or on the Table element on a diagram.

Important

A DBMS must be assigned to a Table before you can add columns in it. If you are using the Database Builder then the DBMS of the data model will be automatically applied to all new Tables; however, if you have added a Table by other means (such as working on a diagram) then this is a manual step.

Tasks

Once the Database Table properties are defined, you are ready to add columns.

Task
Set the database type for a Table - other than the Table name, the most important property to set for a Database Table is the database type.
Set the database Table Owner - For some DBMSs all Tables must be assigned an Owner/Schema; in Enterprise Architect this property is defined as a Tagged Value with the name Owner.
Set extended options - some DBMSs have extended options that are only relevant to that DBMS. These extended properties are stored as Tagged Values.

Default DBMS

Prior to creating a Physical Data Model it is advisable for you to set the default DBMS, which will be automatically applied to new database objects that you create outside of the Database Builder. You can set the default DBMS type in one of these ways:

- Select 'Start > Appearance > Preferences > Preferences > Source Code Engineering > Code Editors', then set the field 'Default Database'
- Select 'Settings > Reference Data > Settings > Database Datatypes', then select a Product Name and select the 'Set as Default' checkbox
- Set the DBMS in the second field of the Code Generation Toolbar

Set the Database Type

The most important property to set for a Database Table (after its name) is the database type or DBMS. The DBMS value selected will control how Enterprise Architect will determine:

- How the Table name will be shown (with or without an Owner)
- What set of validation rules will be applied while database modeling
- The data types that are available when creating columns,
- What set of DDL templates will be used in DDL Generation

Access

Select a Table in the Browser window or on a diagram then, using any of the methods outlined here, open the Table's 'Properties' dialog, display the 'General' tab, then display the 'Main' child tab.

Ribbon	Design > Element > Editors > Properties Dialog > General > Main
Context Menu	Right-click on the Table element | Properties | Special Action | General | Main
Keyboard Shortcuts	Shift+Enter | General | Main
Other	Double-click on the Table element |General | Main

Options

Field/Button	Action
Database	Click on the drop-down button and select the required database type from the list.
Apply	Click on the Apply button to save any pending changes.
OK	Click on the OK button to save any pending changes and close the screen.

Set Database Table Owner/Schema

For some DBMSs all Tables must be assigned an Owner/Schema. In Enterprise Architect this property is physically defined as a Tagged Value with the name Owner. However, a special properties page is provided to help you easily manage the Owner property.

Access

Select a Table in the Browser window or on a diagram then, using any of the methods outlined here, open the Table's 'Properties' dialog, display the 'General' tab and display the 'Table Detail' child tab.

Ribbon	Design > Element > Editors > Properties > << table >>
Context Menu	Right-click on the Table element | Properties |Special Action > General > Table Detail
Keyboard Shortcuts	Shift+Enter | General | Table Detail
Other	Double-click on the Table element |'General' | 'Table Detail'

Set the Database Table owner

Step	Action
1	In the 'Owner' field, type the name of the owner or schema of the Table.

Set MySQL Options

To make use of Foreign Keys in MySQL, you must declare the Database Table type as InnoDB.

Declare the Table type as InnoDB

Step	Action
1	Add a Tagged Value named *Type* to the Table.
2	Set the 'Value' field to 'InnoDB'.

Generate DDL

When you generate DDL for this Table, the Table type is included in the SQL script.
To allow for later versions of MySQL, additional Table options that can be added in the same way include:

Tag	Value (Example)
ENGINE	InnoDB
CHARACTER SET	latin1
CHARSET	latin1
COLLATE	latin1_german2_ci

Set Oracle Database Table Properties

To set additional Oracle Database Table properties, you use the Table's Tagged Values.

Set Properties

The same properties can be added to indexes and constraints, by highlighting the index or constraint Operation and adding the appropriate Tagged Values.

Step	Action
1	Add one or more Tagged Values to the Table, using the names provided in the 'Property/Tag' column of the 'Properties' Table.
2	Specify the appropriate value for each tag. Examples are provided in the 'Value' column of this Properties Table. • CACHE - NOCACHE • DBVERSION - 9.0.111 • FREELISTS - 1 • GRANT OWNER1 - SELECT • GRANT OWNER2 - DELETE, INSERT, SELECT, UPDATE • INITIAL - 65536 • INITRANS - 1 • LOGGING - LOGGING • MAXEXTENTS - 2147483645 • MAXTRANS - 255 • MINEXTENTS - 1 • MONITORING - MONITORING • OWNER - OWNER1 • PARALLEL - NOPARALLEL • PCTFREE - 10 • PCTINCREASE - 0 • PCTUSED - 0 • SYNONYMS - PUBLIC:TABLE_PUB;OWNER2:TABLE_OWNER2 • TABLESPACE - MY_TABLESPACE • TEMPORARY - YES

Database Table Constraints/Indexes

Within Enterprise Architect, Table Constraints and Indexes are modeled on the same screen; collectivity they are referred to as Constraints. Database Constraints define the conditions imposed on the behavior of a database Table. They include:

- Primary Key - uniquely identifies a record in a Table, consisting of one or more columns
- Index - improves the performance of retrieval and sort operations on Table data
- Unique Constraints - a combination of values that uniquely identify a row in the Table
- Foreign Key - a column (or collection of columns) that enforce a relationship between two Tables
- Check Constraints - enforces domain integrity by limiting the values that are accepted by a column
- Table Trigger - SQL or code automatically executed as a result of data in a Table being modified

In Enterprise Architect, you can define and maintain Table Constraints using either the purpose-designed 'Constraints/Indexes' page of the Database Builder or the Columns and Constraints screen.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes | Right-click | Add New Constraint
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes | Right-click | Add New Constraint
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes: Ctrl+N

Create a Constraint

The process of creating any of these constraint types is the same and is achieved in one of the ways described here.

Create a Constraint - Using the context menu or keyboard

Step	Action
1	A new constraint is automatically created and assigned the default name *constraint n* (where *n* is a counter) and a 'Type' of 'index'. Overtype the default name with your own constraint name.
2	If necessary, in the 'Type' field click on the drop-down arrow and select the appropriate constraint type.
3	If you prefer, type an alias for the constraint, in the 'Alias' field. The 'Columns' field is read-only; it is populated with the columns that you assign to the 'Involved Columns' tab.

Create a Constraint - Overtype the template text

Step	Action
1	On the 'Constraints/Indexes' tab for the selected Table, the list of constraints ends with the template text *New Constraint*. Overtype this text with the appropriate constraint name, and press the Enter key.
2	The new constraint is automatically created and assigned the default Type of index. If necessary, in the 'Type' field click on the drop-down arrow and select the appropriate constraint type.
3	If you prefer, type an alias for the constraint, in the 'Alias' field. The 'Columns' field is read-only; it is populated with the columns that you assign to the 'Involved Columns' tab.

Assign Columns to a Constraint

The constraint types of Primary Key, Foreign Key, Index and Unique all must have at least one column assigned to them; this defines the columns that are involved in the constraint.

Step	Action
1	On the 'Constraints/Indexes' tab for the selected Table, click on the constraint to which you are assigning columns.
2	The 'Available Columns' panel lists all columns defined for the Table. For each column to assign to the constraint, right-click on the column name and select 'Assign column <name>'. The column name is transferred to the 'Assigned Columns' list.

Unassign Columns from a Constraint

Step	Action
1	On the 'Constraints/Indexes' tab for the selected Table, click on the constraint from which you are unassigning columns.
2	In the 'Assigned Columns' list, right-click on the name of the column to unassign from the constraint and select 'Unassign column <name>'. The column name is transferred to the 'Available Columns' list.

Reorder the Assigned Columns in a Constraint

If you have a number of columns in the constraint, you can re-arrange the sequence by moving a selected column name one place up or down the list at a time. To do this:

- Right-click on the column name to move and select either:
  - Move column '<name>' up (Ctrl+Up Arrow) or
  - Move column '<name>' down (Ctrl+Down Arrow)

Delete a constraint

To delete a constraint you no longer require, right-click on the constraint name in the list on the 'Constraints/Indexes' tab and select the 'Delete constraint <name>' option. If all validation rules for the given constraint type are met, the constraint is immediately removed from the repository along with all related relationships (if there are any).

Primary Keys

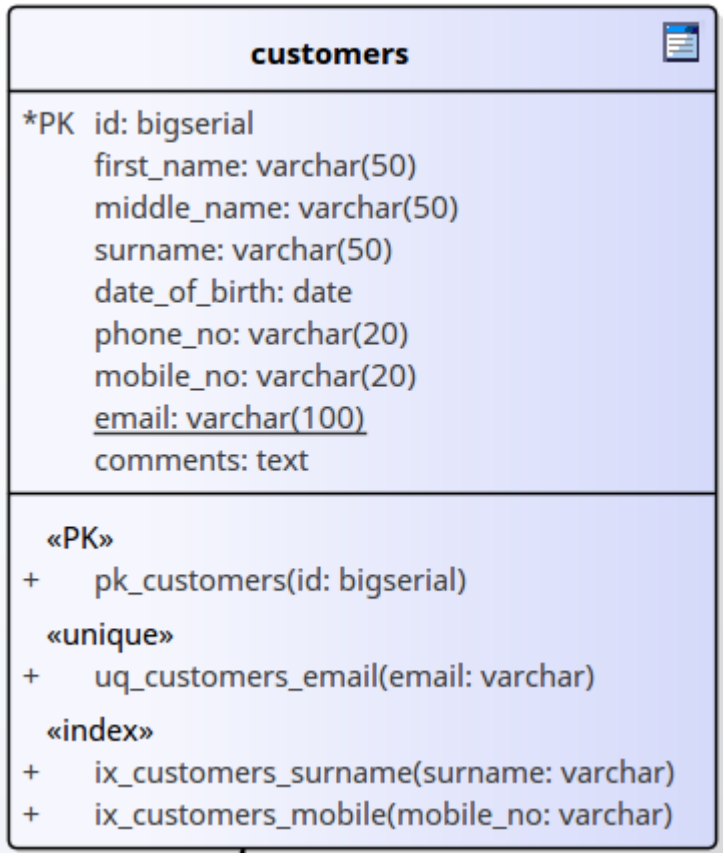
A Primary Key is a column (or set of columns) that uniquely identifies each record in a Table. A Table can have only one Primary Key. Some DBMSs support additional properties of Primary Keys, such as Clustered or Fill Factor.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes

Create a Primary Key

In Enterprise Architect you can create a Primary Key from either the 'Columns' tab or the 'Constraints/Indexes' tab. In either case, when you add a column to a Primary Key constraint, the column is automatically set to be 'Not Null'. Additionally any diagram (assuming the 'Show Qualifiers and Visibility Indicators' option is set) containing the Table element will show the 'PK' prefix against the column name. In this image, see the first column 'id: bigserial'.



Create a Primary Key - from the Columns tab

Step	Action
1	Either: • In the Database Builder, click on a Table with one or more defined columns, and click on the 'Columns' tab, or • On a diagram, click on a Table and press F9 to display the 'Columns' tab
2	For each column to include in the Primary Key, select the 'PK' checkbox. If a Primary Key constraint is not previously defined for the current Table, the system will create a new constraint using the Primary Key Name template.

Create a Primary Key - from the Constraints tab

Step	Action
1	Either: • In the Database Builder, click on a Table with one or more defined columns, and click on the 'Constraints/Indexes' tab, or • On a diagram, click on a Table and press F10 to display the 'Constraints/Indexes' tab
2	Overtype the *New Constraint* text with the Primary Key name, press the Enter key and click on the 'Type' field drop-down arrow, and select 'PK'.
3	Assign the required columns to the PK constraint.
4	Set the Primary Key's extended properties using the property panel. • Fill Factor is a numeric value between 0 and 100 • Is Clustered is a Boolean value that determines the physical order of how the data is stored; for most DBMSs the Is Clustered property defaults to True for Primary Keys

Remove columns from a Primary Key

You can remove columns from a Primary Key using either the 'Columns' tab or the 'Constraints/Indexes' tab.

Remove columns from a Primary Key - using the Columns tab

Step	Action
1	Either: • In the Database Builder, click on the Table with the Primary Key, and click on the 'Columns' tab, or • On a diagram, click on a Table and press F9 to display the 'Columns' tab

2	Against each column you want to remove from the Primary Key, deselect the 'PK' checkbox. If you have removed all columns from the Primary Key constraint and the Primary Key is no longer needed, it must be manually deleted.

Remove columns from a Primary Key - using the Constraints/Indexes tab

Step	Action
1	Either: • In the Database Builder, click on the Table with the Primary Key, and click on the 'Constraints/Indexes' tab, or • On a diagram, click on a Table and press F10 to display the 'Constraints/Indexes' tab
2	Unassign the columns on the PK constraint, as necessary.

Notes

- Warning: Enterprise Architect assumes that Primary Key constraints have at least one column assigned to them; however, Enterprise Architect does not enforce this rule during modeling
  If DDL is generated for a Table whose Primary Key has no column assigned, that DDL will be invalid

Non Clustered Primary Keys

When you create a Primary Key in some DBMSs (such as SQL Server or ASA), it is automatically created with the 'Is Clustered' property set to True. Therefore when you model a Primary Key in an Enterprise Architect data model, the same behavior occurs.

Clustered indexes provide improved performance for accessing the column(s) involved, by physically organizing the data by those columns. There can be only one clustered index per Table.

In some situations, you might be more interested in the performance of columns other than the ones assigned to the Primary Key, and therefore you would need to change the default assignment so that the Primary Key is not clustered.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes
Context Menu	In diagram or Browser window | Right-click on Table | Features | Constraints/Indexes
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes

Define Primary Key as non-clustered

Subsequently, you can model an index for the same Table as clustered.

Step	Action
1	Highlight the existing Primary Key constraint. The Primary Key properties display in the 'Property' panel.
2	For the *Is Clustered* property, in the 'Value' field click on the drop-down arrow and change the value to False.

Database Indexes

Database indexes are applied to Tables to improve the performance of data retrieval and sort operations. Multiple indexes can be defined against a Table; however, each index imposes overheads (in the form of processing time and storage) on the database server to maintain them as information is added to and deleted from the Table

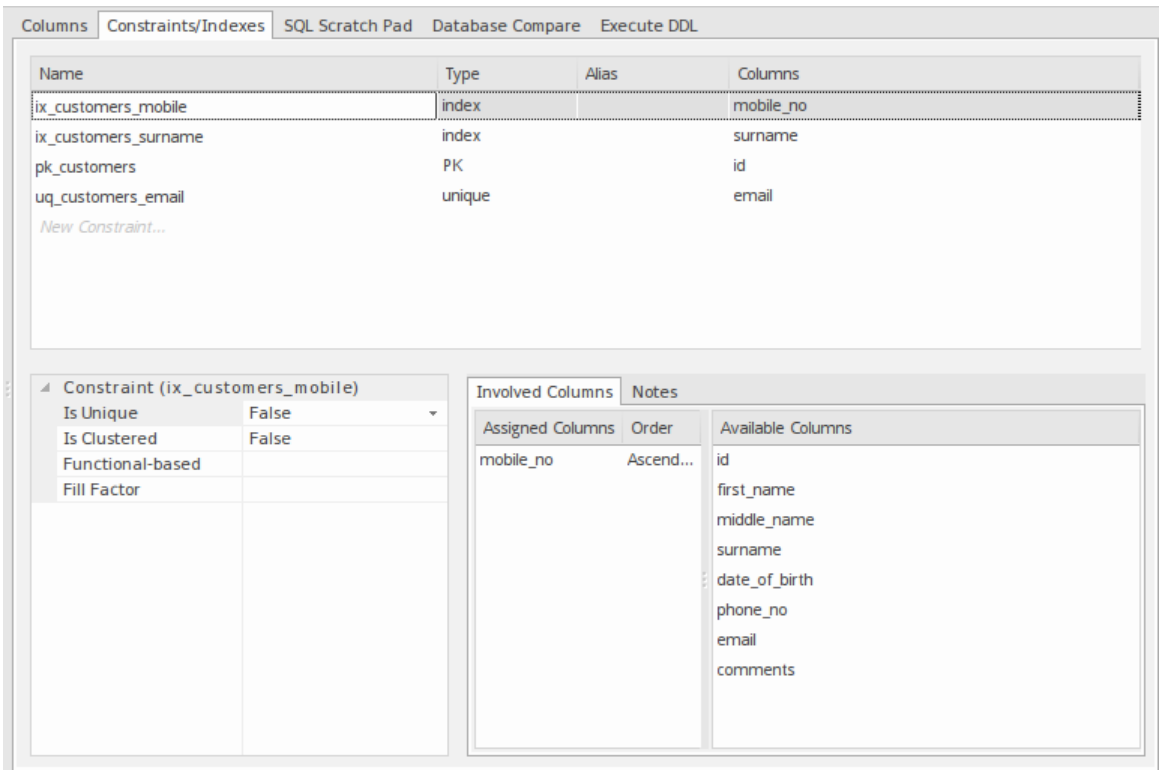
In Enterprise Architect an index is modeled as a stereotyped operation.

Some DBMSs support special types of index; Enterprise Architect defines these using additional properties such as function-based, clustered and fill-factor.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes

Work on an index



Step	Action
1	On the 'Constraints/Indexes' tab for the Table, right-click and select 'Add new constraint'.

	The new constraint is added with the default name 'constraint1' and the Type of 'index'. Overtype the name with your preferred index name.
2	Assign the appropriate columns to the Index. The 'Assigned Columns' list has an additional 'Order' field that specifies the order (Ascending or Descending) in which each assigned column is stored in the index. You can toggle the order for each column, as required. Additionally, for MySQL indexes, a 'Len' field will be visible in which you can define Partial Indexes; that is, an index that uses the leading 'n' number of characters of a text based field. The 'Len' field takes only whole number numeric values of between 0 and the column's defined length. A value of 0 (which is the default) indicates that the entire column is to be indexed.
3	In the 'Property' panel, review the settings of the extended properties that are defined for the current DBMS.

Additional Properties

Property	Description
Is Unique	(True / False) indicates whether the current index is a 'Unique Index'. A Unique Index ensures that the indexed column (or columns) does not contain duplicate values, thereby ensuring that each row has a unique value (or combination of values when the index consists of multiple columns).
Is Clustered	(True / False) indicates whether the current index is a 'Clustered Index'. With a clustered index, the rows of the table are physically stored in the same order as in the index, therefore there can be only one clustered index per table. By default a table's Primary Key is clustered. Not all DBMS's support clustered indexes, therefore the 'Is Clustered' Index property will only be visible for DBMSs that support it.
Is Bitmap	(True / False) indicates whether the current index is a 'Bitmap' index. Bitmap indexes are meant to be used on columns that have relatively few unique values (referred to as 'low cardinality' columns) and that physically consist of a bit array (commonly called bitmaps) for each unique value. Each of the arrays will have a bit for each row in the table. Consider this example: a bitmap index is created on a column called 'Gender', which has the options 'Male' or 'Female'. Physically, the index will consist of two bit arrays, one for 'Male' and one for 'Female'. The female bit array will have a 1 in each bit where the matching row has the value 'Female'. The 'Is Bitmap' and 'Is Unique' properties are mutually exclusive, and so the DDL generation will ignore the 'Is Unique' property when the 'Is Bitmap' property is True. Bitmap Indexes are only supported by Oracle; therefore, this property is only visible while modeling Oracle indexes.
Fill Factor	A numeric value between 0 and 100, that defines the percentage of available space that should be used for data. Not all DBMSs support fill factor, therefore the 'Fill Factor' index property will only be visible for DBMSs that support it.

Functional-based	A SQL statement that defines the function/statement that will be evaluated and the results indexed; for example: LOWER("field") Not all DBMSs support functional-based indexes, therefore the 'Functional-based' Index property will only be visible for DBMSs that support them, such as PostgreSQL and Oracle.
Include	Identifies a comma-separated list (CSV) of non-key Columns from the current table. Not all DBMSs support the 'Include' property on indexes, therefore this property will only be visible for DBMSs that support it.

Notes

- Warning: Enterprise Architect assumes that Indexes have at least one column assigned to them; however, Enterprise Architect does not enforce this rule during modeling
  If DDL is generated for a Table that has an Index defined without column(s) assigned, that DDL will be invalid, unless the index is functional-based
- Any columns assigned to a functional-based index are ignored

Unique Constraints

Unique Constraints enforce the 'uniqueness' of a set of fields in all rows of a Table, which means that no two rows in a Table can have the same values in the fields of a Unique Constraint. Unique Constraints are similar to Primary Keys (in that they also enforce 'uniqueness') but the main difference is that a Table can have multiple Unique Constraints defined but only one Primary Key.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes > Right-click > Add New Constraint
Context Menu	In diagram or Browser window | Right-click on Table element | Features | Constraints/Indexes
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes: Ctrl+N

Create a Constraint

Step	Action
1	On the 'Constraints/Indexes' tab, a new constraint is automatically created and assigned the default constraint name and a 'Type' of index. Overtype the constraint name with a name that identifies this as a unique constraint.
2	In the 'Type' field, change the value from 'index' to 'unique'.

Notes

- Warning: Enterprise Architect assumes that Unique Constraints have at least one column assigned to them; however, Enterprise Architect does not enforce this rule during modeling
  If DDL is generated for a Table that has a unique constraint defined without column(s) assigned, that DDL will be invalid

Foreign Keys

A Foreign Key defines a column (or a collection of columns) that enforces a relationship between two Tables. It is the responsibility of the database server to enforce this relationship to ensure data integrity. The model definition of a Foreign Key consists of a parent (primary) Table containing a unique set of data that is then referred to in a child (foreign) Table.

In Enterprise Architect, a Foreign Key is modeled with two different (but related) UML components:

- A Foreign Key constraint (a UML operation with the stereotype of <<FK>>) stored on the child Table and
- An Association connector (stereotype of <<FK>>) defining the relationship between the two Tables

Create a Foreign Key

Although the definition of a Foreign Key can be complex, the Foreign Key Constraint screen simplifies the modeling of Foreign Keys. This screen is purpose-designed to help you select which constraint in the parent Table to use, and will automatically match the child Table columns to those in the parent Table that are part of the constraint. Different aspects of the process of developing a Foreign Key are described here separately for illustration, but the overall process should be a smooth transition.

A number of conditions must be met before a Foreign Key definition can be saved:

- Both Tables must have matching DBMSs defined
- The parent Table must have at least one column
- The parent Table must have a Primary Key, unique constraint or unique index defined

Create a Foreign Key - using the Database Builder

Step	Action
1	In the Database Builder tree, right-click on the child Table name and click on 'Add new Foreign Key on <table name>'. A dialog displays listing all the possible parent Tables.
2	Double-click on the required parent Table name in the list or select it and click on the OK button. The 'Foreign Key Constraint' screen displays.

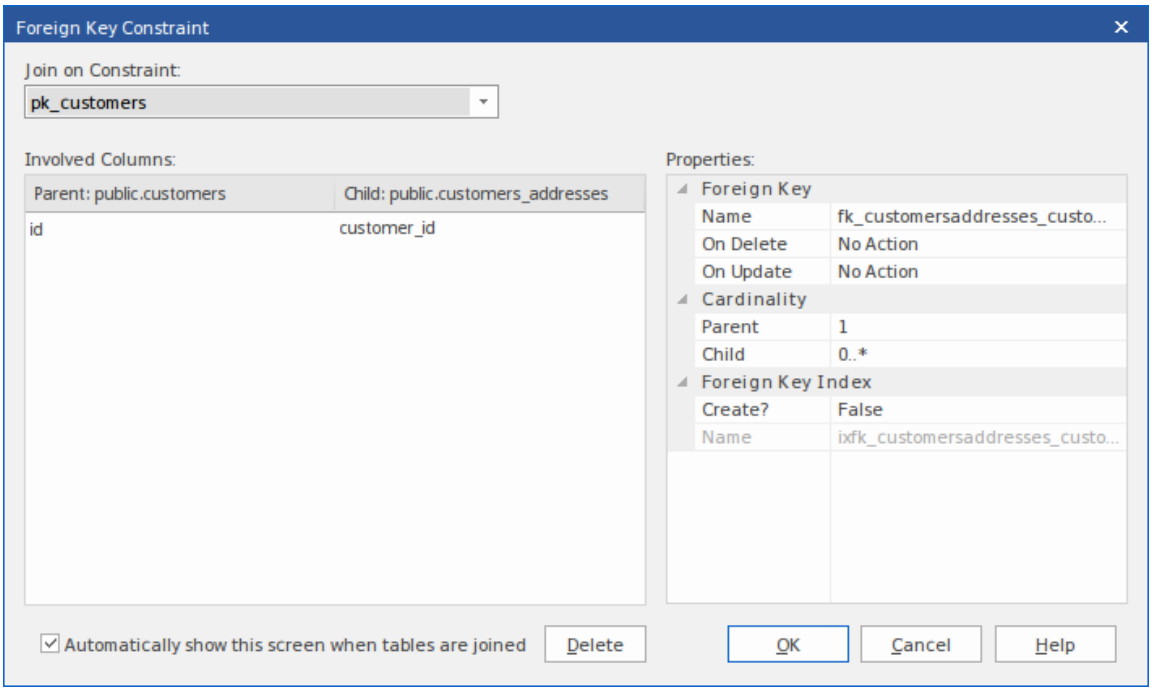
Create a Foreign Key - using a relationship on a diagram

Step	Action
1	In the Data Modeling diagram, locate the required child (Foreign Key) Table and parent (Primary Key) Table.
2	Select an Association connector in the 'Data Modeling' page of the Diagram Toolbox.
3	Click on the child Table and draw the connector to the parent Table.

4	If the Foreign Key Constraint screen has been set to display automatically when two Tables are joined, it displays now. Otherwise, either: • Double-click on the connector or • Right-click on the connector and select the 'Foreign Keys' option The Foreign Key Constraint screen displays.

The Foreign Key Constraint Screen

As an example this image shows the Foreign Key Constraint screen loaded with the details of 'fk_customersaddresses_customers' (as defined in the Example model).

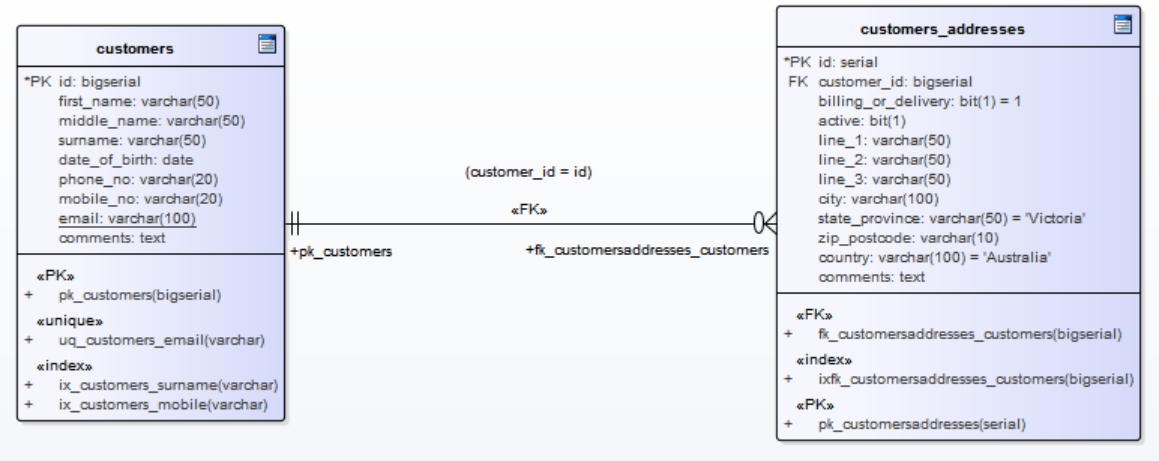


Option	Action
Join on Constraint	This combo box lists all defined constraints in the parent Table that could be used as the basis of a Foreign Key. (These constraints can be Primary Keys, Unique Constraints or Unique Indexes.) The first constraint in the list is selected by default; if this is not the constraint you want, select the correct constraint from the combo box. When you select the constraint, its columns are automatically listed in the 'Involved Columns' panel, under the 'Parent: <tablename>' column.
Involved Columns	This list is divided into two: the columns involved in the selected constraint are listed on the left, and the child columns that are going to be paired to the parent columns are listed on the right. When a constraint is selected (in the 'Join on constraint' field) the parent side is refreshed to display all columns assigned to the selected constraint. On the child side the system will automatically attempt to match each parent column to one of the same name in the child Table. If the child Table does not have a column of the same name, a new column of that name will be added to the list, flagged with (*) to indicate that a new column will be created in the Table.

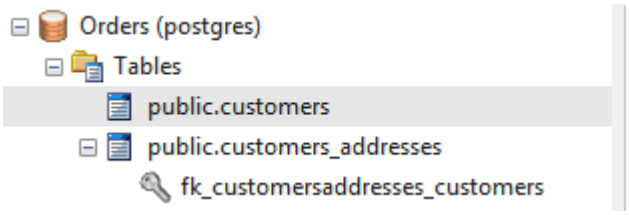
	However, if you want to force the pairing to an existing child Table column or a new column with a different name, click on the column name field and either: • Type in the replacement name, or • Select an existing column (click on the drop-down arrow and select the name from the list)
Name	This field defines the name of the Foreign Key constraint, and defaults to a name constructed by the Foreign Key Name Template. To change the name to something other than the default, simply overtype the value.
On Delete	Select the action that should be taken on the data in the child Table when data in the parent is deleted, so as to maintain referential integrity.
On Update	Select the action that should be taken on the data in the child Table when data in the parent is updated, so as to maintain referential integrity.
Parent	Click on the drop-down arrow and select the cardinality of the parent Table in the Foreign Key.
Child	Click on the drop-down arrow and select the cardinality of the child Table in the Foreign Key.
Create?	If you want to create a Foreign Key Index at the same time as the Foreign Key, set this property to True. The name of the Foreign Key Index is controlled by the Foreign Key Index template, and the generated name is shown in the 'Name' field underneath the 'Create?' field.
Automatically show this screen when tables are joined	(For diagrammatic modeling) Select this checkbox to automatically display this screen whenever an Association is created between two Tables.
Delete	Click on this button to delete the currently selected existing (saved) Foreign Key. A prompt is displayed to confirm the deletion (and the deletion of the Foreign Key Index, if one exists) - click on the Yes button. Deleting a Foreign Key leaves an Association connector in place, which you can either edit or delete (right-click and select 'Delete association: to <Table name>').
OK	Click on this button to save the Foreign Key.

Examples

This example shows simple Foreign Keys in a diagram:



The same Foreign Key will be shown in the Database Builder's tree as a child node under the Table 'customers.addresses'.



Check Constraints

A Check Constraint enforces domain integrity by limiting the values that are accepted by a column.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes > Right-click > Add New Constraint
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes | Right-click | Add New Constraint
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes: Ctrl+N

Create a Constraint

Step	Action
1	On the 'Constraints/Indexes' tab of the Columns and Constraints screen, a new constraint is automatically created and assigned the default constraint name and a 'Type' of index. Overtype the constraint name with a name that identifies the constraint as a check constraint, such as 'CHK_ColumnName' (the CHK_ prefix is optional).
2	In the 'Type' field, change the value from 'index' to 'check'.
3	In the 'Properties' panel for the Condition property, type the SQL statement that will be used as the Check Condition; for example, column1 < 1000. If the condition is long, click on the button to display a SQL editor (with syntax highlighting).

Delete a Check Constraint

If you do not want to keep a check constraint, either:

- Right-click on it in the list and select 'Delete constraint <name>', or
- Click on the item and press Ctrl+D

The constraint is immediately deleted.

Notes

- Any columns assigned to a check constraint are ignored

Table Triggers

A Table trigger is SQL or code that is automatically executed as a result of data being modified in a database Table. Triggers are highly customizable and can be used in many different ways; for example, they could be used to stop certain database activities from being performed during business hours, or to provide validation or perform deletions in secondary Tables when a record in the primary Table is deleted.

In Enterprise Architect, a Table trigger is modeled as a stereotyped operation and managed using the Table's 'Constraints' screen.

Access

Ribbon	Develop > Data Modeling > Database Builder > Click on Table name > Constraints/Indexes | Right-click | Add New Constraint
Context Menu	In diagram | Right-click on Table | Features | Constraints/Indexes | Right-click | Add New Constraint
Keyboard Shortcuts	Click on Table: F9 > Constraints/Indexes: Ctrl+N

Create a Table Trigger

Step	Action
1	On the 'Constraints/Indexes' tab, a new constraint is automatically created and assigned the default constraint name and a 'Type' of index. Overtype the constraint name with a name that identifies the constraint as a trigger, such as TRG_OnCustomerUpdate. (The TRG_ prefix is optional.)
2	In the 'Type' field, change the value from 'index' to 'trigger'.
3	In the 'Properties' panel for the Statement property, type in the complete SQL statement (including CREATE TRIGGER) that will define the Trigger. If the condition is long, click on the button to display a SQL editor (with syntax highlighting).
4	The properties Trigger Time and Trigger Event are currently information-only values and are not used in DDL generation.

Delete a Table Trigger

If you do not want to keep a trigger, either:

- Right-click on it in the list and select 'Delete constraint <name>', or
- Click on the item and press Ctrl+D

The trigger is immediately deleted.

Notes

- Any columns assigned to table triggers are ignored

Database Views

A Database View represents the results of a pre-defined query. Unlike a Table, a View is dynamically derived from data in one or more Tables (or other Views). Enterprise Architect supports the definition of Views both with and without this statement:

"Create View {viewName} As" statement

The system will automatically add it dynamically (if missing) whenever DDL generation is performed. The advantage of not defining this statement is that when a view object is renamed the 'View Definition' property does not have to be manually updated.

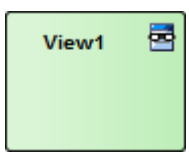
You can create a Database View either:

- Within the Database Builder or
- By dragging the 'View' icon from the Data Modeling Toolbox onto a diagram

Add a Database View with the Database Builder

Step	Action
1	Open the Database Builder.
2	Load or create a Data model.
3	Right-click on the 'Views' Package and select 'Add New View'.
4	Overtype the default name with the appropriate name for the View, and press the Enter key.
5	Double-click on the new View, or right-click on it and select 'SQL Object Properties'. The 'SQL Object Editor' dialog displays.

Add a Database View to a diagram

Step	Action
1	Open your Data Modeling diagram and, if necessary, display the 'Data Modeling' page of the Diagram Toolbox (click on to display the 'Find Toolbox Item' dialog and specify 'Data Modeling').
2	Drag the 'View' icon onto the diagram. This generates the View element: 
3	Right-click on the new View element and select 'SQL Object Properties'.

	The 'SQL Object Editor' dialog displays.

SQL Object Editor

The 'SQL Object Editor' dialog is shared by a number of SQL-based database objects (Views, Procedures, Functions and Sequences); it helps the data modeler manage the various properties of the SQL-based object.

Option	Action
Database	If it has already been set, the default database type displays. If the default has not been set, or you want to change the database type for this View, click on the drop-down arrow and select the target DBMS to model.
Dependencies	A list of objects that the current object depends on. The 'Dependencies' list shows: • Each Depends connector between this View and another Table or View • Any object names (specified as a CSV list) in the 'parents' Tagged Values
Notes	If necessary, type in a comment on the current View.
Definition	Type the full SQL View definition. For releases of Enterprise Architect up to 12.1 (Build 1227), this must include the CREATE_VIEW syntax as appropriate for the target DBMS (for later versions this is not needed). For example: CREATE VIEW 'MyViewName' AS [view definition] The code editor provides Intelli-sense for basic SQL keywords, functions and names of all objects in the current data model.

Database Procedures

Database Procedures (sometimes referred to as Stored Procedures or Procs) are subroutines that can contain one or more SQL statements that perform a specific task. They can be used for data validation, access control, or to reduce network traffic between clients and the DBMS servers. Extensive and complex business logic can be embedded into the subroutine, thereby offering better performance.

Database Procedures are similar to Database Functions. The major difference is the way in which they are invoked - Database Functions can be used in the same way as for any other expression within SQL statements, whereas Database Procedures must be invoked using the CALL or EXEC statement, depending on the DBMS.

In Enterprise Architect, Database Procedures can be modeled in one of two ways:

- As individual objects (the default method) or
- As operations in a container

Functionally the two methods result in the same DDL being produced. The main difference is visual - by having several Operations in one container, you have fewer elements and less clutter on the diagram.

Individual objects

Database Procedures modeled as individual objects are UML Classes with the stereotype ?procedure?; you create these either:

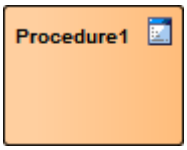
- Within the Database Builder or
- By dragging the 'Procedure' icon from the Data Modeling Toolbox onto a diagram

Add a Database Procedure using the Database Builder

Step	Action
1	Open the Database Builder.
2	Load or create a Data model.
3	Right-click on the Procedures Package and select 'Add New Procedure'.
4	Overtype the default name with the appropriate name for the Procedure, and press the Enter key.
5	Double-click on the new Procedure, or right-click on it and select 'SQL Object Properties'. The SQL Object Editor screen displays.

Add a Database Procedure to a diagram

Step	Action
1	Open your Data Modeling diagram and, if necessary, display the 'Data Modeling' page of the Diagram Toolbox (click on to display the 'Find Toolbox Item' dialog and specify 'Data Modeling').

2	Drag the 'Procedure' icon onto the diagram. This generates the Procedure element: 
3	Right-click on the new Procedure element and select 'SQL Object Properties'. The SQL Object Editor screen displays.

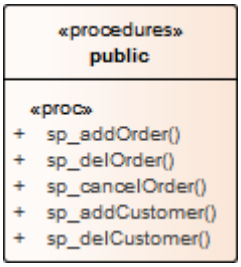
SQL Object Editor

The 'SQL Object Editor' dialog is shared by a number of SQL-based database objects (Views, Procedures and Functions); it helps you to manage the various properties of the SQL-based object.

Option	Action
Database	If it has already been set, the default database type displays. If the default has not been set, or you want to change the database type for this Procedure, click on the drop-down arrow and select the target DBMS to model.
Notes	If necessary, type in a comment on the current Procedure.
Definition	Type the full SQL Procedure definition, including the CREATE PROCEDURE syntax. The code editor provides Intelli-sense for basic SQL keywords, functions and names of all objects in the current data model.

Operations in a Container

Database Procedures modeled as operations have a container object, this being a UML Class with the stereotype «procedures» (with an 's' on the end). Each Database Procedure is an operation with the stereotype «proc». The system provides a dedicated Maintenance window through which you can easily manage the Database Procedures defined as operations.



Database Functions

Database Functions provide you with a mechanism to extend the functionality of the database server. A Database Function is a routine that accepts parameters, performs an action (such as a complex calculation) and returns the result of that action as a value. Depending on the Function, the return value can be either a single value or a result set.

Once created, a Database Function can be used as an expression in an SQL statement.

In Enterprise Architect, Database Functions can be modeled in one of two ways:

- As individual objects (the default method) or
- As Operations in a container

Functionally the two methods result in the same DDL being produced. The main difference is visual - by having several Operations in one container, you have fewer elements and less clutter on the diagram.

Individual objects

Database Functions modeled as individual objects are UML Classes with the stereotype ?function?; you create these either:

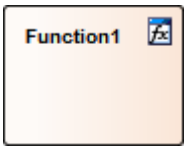
- Within the Database Builder or
- By dragging the Function icon from the Data Modeling Toolbox onto a diagram

Add a Database Function using the Database Builder

Step	Action
1	Open the Database Builder.
2	Load or create a Data model.
3	Right-click on the Functions Package and select 'Add New Function'.
4	Overtype the default name with the appropriate name for the Function, and press the Enter key.
5	Double-click on the new Function, or right-click on it and select 'SQL Object Properties'. The SQL Object Editor screen displays.

Add a Database Function to a diagram

Step	Action
1	Open your Data Modeling diagram and, if necessary, display the 'Data Modeling' page of the Diagram Toolbox (click on to display the 'Find Toolbox Item' dialog and specify 'Data Modeling').
2	Drag the 'Function' icon onto the diagram.

	Function This generates the Function element: 
3	Right-click on the new Function element and select 'SQL Object Properties'. The SQL Object Editor screen displays.

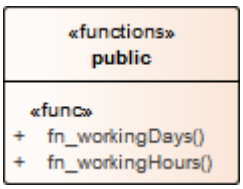
SQL Object Editor

The 'SQL Object Editor' dialog is shared by a number of SQL-based database objects (Views, Procedures and Functions); it helps you to manage the various properties of the SQL-based object.

Option	Action
Database	If it has already been set, the default database type displays. If the default has not been set, or you want to change the database type for this Function, click on the drop-down arrow and select the target DBMS to model.
Notes	If necessary, type in a comment on the current Function.
Definition	Type the full SQL Function definition including the CREATE FUNCTION syntax. The code editor provides Intelli-sense for basic SQL keywords, functions and names of all objects in the current data model.

Operations in a Container

Database Functions modeled as operations have a container object, this being a UML Class with the stereotype «functions» (with an 's' on the end). Each Function is an operation with the stereotype «func». The system provides a dedicated Maintenance window through which you can easily manage the Database Functions stored as operations.



Database Sequences

Sequences are a feature that some DBMS products implement to provide users with a mechanism to generate unique values - the Sequence ensures that each call to it returns a unique value. This is particularly important when the Sequence's result is used as a Primary Key. These can be generated with a schema for loading onto the DBMS server.

Sequences are provided so that database users are not forced to implement their own unique value generator. Not all DBMS products support Sequences; those that do not instead provide functionality for columns to be initialized with an incrementing value.

In Enterprise Architect, Sequences can be modeled in one of two ways:

- As individual objects (the default method) or
- As Operations in a container

Functionally the two methods result in the same DDL being produced. The main difference is visual - by having several Operations in one container, you have fewer elements and less clutter on the diagram.

Individual objects

Sequences modeled as individual objects are UML Classes with the stereotype ?dbsequence?; you create these either:

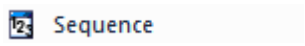
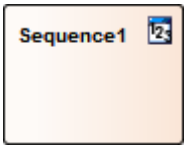
- Within the Database Builder or
- By dragging the 'Sequence' icon from the 'Data Modeling' Toolbox pages onto a diagram

Add a Database Sequence using the Database Builder

Step	Action
1	Open the Database Builder.
2	Load or create a Data model.
3	Right-click on the Sequences Package and select 'Add New Sequence'.
4	Overtype the default name with the appropriate name for the Sequence, and press the Enter key.
5	Double-click on the new Sequence, or right-click on it and select 'SQL Object Properties'. The 'SQL Object Editor' dialog displays.

Add a Database Sequence to a diagram

Step	Action
1	Open your Data Modeling diagram and, if necessary, display the 'Data Modeling' page of the Diagram Toolbox (click on to display the 'Find Toolbox Item' dialog and specify 'Data Modeling').

2	Drag the 'Sequence' icon onto the diagram.  This generates the Sequence element: 
3	Right-click on the new Sequence element and select 'SQL Object Properties'. The 'SQL Object Editor' dialog displays.

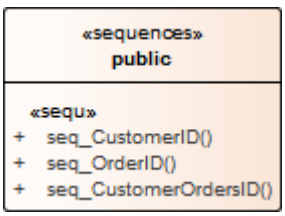
SQL Object Editor

The 'SQL Object Editor' dialog is shared by a number of SQL-based database objects (Views, Procedures and Functions); it helps you to manage the various properties of the SQL-based object.

Option	Action
Database	If it has already been set, the default database type displays. If the default has not been set, or you want to change the database type for this Sequence, click on the drop-down arrow and select the target DBMS to model.
Notes	If necessary, type in a comment on the current Sequence.
Definition	Type the full SQL Sequence definition including the CREATE SEQUENCE syntax. The code editor provides Intelli-sense for basic SQL keywords, functions and names of all objects in the current data model.

Operations in a Container

Database Sequences modeled as operations have a container object, this being a UML Class with the stereotype «sequences» (with an 's' on the end). Each Sequence is an operation with the stereotype «sequ». The system provides a dedicated Maintenance window through which the modeler can easily manage the Sequences defined as operations.



Database SQL Queries

An SQL Query object provides a convenient mechanism for storing an SQL Statement in the repository, for repeated execution on live database(s).

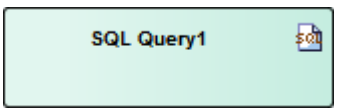
An SQL Query element is represented in the UML Data Modeling Profile as an Artifact element with the stereotype <<sqlquery>>. You can create these elements either:

- Within the Database Builder or
- By dragging the 'SQL Query' icon from the 'Data Modeling' Toolbox pages onto a diagram

Add a Database SQL Query using the Database Builder

Step	Action
1	Open the Database Builder.
2	Load or create a Data model.
3	Right-click on the Queries Package and select 'Add New SQL Query'.
4	Overtype the default name with the appropriate name for the Query, and press the Enter key.
5	Right-click on the new element and select 'Edit'. The 'SQL Scratch Pad' tab displays, on which you can create the SQL Query statement.
6	When you have finished the SQL statement, click on the Save to SQL Query button in the toolbar to save the changes to the query element.

Add a Database Function to a diagram

Step	Action
1	Open your Data Modeling diagram and, if necessary, display the 'Data Modeling' page of the Diagram Toolbox (click on to display the 'Find Toolbox Item' dialog and specify 'Data Modeling').
2	Drag the 'SQL Query' icon onto the diagram. This generates the SQL Query Artifact element: 
3	Double-click on the new element and update the element name and other properties as necessary. To edit the element's SQL statement, access the Database Builder, click on the element in the Queries Package and edit the Query on the 'SQL Scratch Pad' tab.

Create Operation Containers

Whilst the default method of modeling Database Functions, Procedures and Sequences is to create them as individual elements, you can also represent a number of each type of structure as operations of a container Class. You add a stereotype to the Class, which specifies:

- The type of data structure the Class will contain
- The stereotype that will be automatically assigned to each operation created in the Class (for a given data structure, the operations can only be of one stereotype)

Access

Toolbox	Drag the 'Class' icon onto the diagram

Create the Container Class

Step	Action
1	Right-click on the Class element on the diagram and select the 'Design > Element > Editors > Properties Dialog' option. The element 'Properties' dialog displays, showing the 'General' tab.
2	In the 'Name' field, type an appropriate name for the container.
3	In the 'Stereotype' field (in the table at the right edge of the dialog) type: • 'functions' for a Database Function container • 'procedures' for a Stored Procedure container • 'sequences' for a Sequence container The 's' at the end of the stereotype name is important.
4	Click on the OK button to save the setting and close the dialog.

Create database structures as operations of the Class

Step	Action
1	Click on the Class element on the diagram and press F10. The 'Database <Structure> container: <Classname>' dialog displays.
2	Right-click in the 'Functions' ('Procedures' or 'Sequences') list and select 'Add New <structure>'.

3	In the 'Name' field, type an appropriate name for the operation, such as: • fn_WorkDays • sp_AddOrder or • seq_AddressID
4	In the 'Notes' field type any supporting comments or explanation of the operation. In the 'Function definition' field (or 'Procedure definition', or 'Sequence definition') type the appropriate text.
5	Repeat steps 2 to 4 until you have defined all the operations you require.
6	Click on the list and then on the Close button to close the dialog and show the operations within the Class on the diagram and in the Browser window.

Oracle Packages

Oracle Packages are database objects that are unique to the Oracle DBMS. They are containers that group logically-related objects into a single definition. Packages have two parts - a specification and a body. The:

- Specification section declares the various components
- Body section provides the full definitions of the components

The Package components can consist of Types, Variables, Constants, Exceptions, Cursors and subprograms.

In Enterprise Architect, an Oracle Package is modeled as a UML Class with a stereotype of <<package>>. It has two operations:

- Specification
- Body

For each of these operations the complete SQL syntax is contained in the 'Initial Code' field.

Create an Oracle Package

Step	Action
1	Add a Class element to your data model.
2	Open the Properties window for the element and, in the 'Stereotype' field, type the value 'Package'.
3	Click on the element and press F10, to display the Features window at the 'Operations' page. For the Package specification, press Ctrl+N and create an operation with the name 'Specification' and with no return type.
4	The Properties window displays the properties of the operation; click on the 'Code' tab and type the entire Package specification into the text panel.
5	Return to the Features window at the 'Operations' page and, for the Package body, press Ctrl+N and create an operation with the name 'Body' and no return type.
6	On the Properties window, click on the 'Code' tab and type the entire Package body code into the text panel.

Database Connections

A Database Connection object provides a convenient way of storing the connection details of a live database. Enterprise Architect supports the definition of a number of different connection types:

- MS Access
- Firebird
- SQLite (introduced in Enterprise Architect v16)
- Native Connection (introduced in Enterprise Architect v16), and
- ODBC

For file based connections (MS Access, Firebird and SQLite) you only have to specify the full path to the database files. For Native connections you will be prompted for the connection details of a database server. For connections of type ODBC you are prompted to select from the list of pre-defined ODBC DSNs on your machine.

Create a Database Connection Element

A Database Connection element is represented in the UML Data Modeling Profile as an Artifact element with the stereotype <<database connection>>. You create these either:

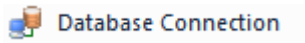
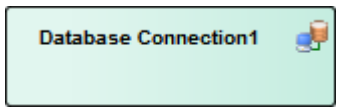
- Within the Database Builder or
- By dragging the 'Database Connection' icon from the 'Data Modeling' Toolbox pages onto a diagram

Add a Database Connection Using the Database Builder

Step	Action
1	Open the Database Builder.
2	Load or create a Data model.
3	Right-click on the Connections Package and select 'Add New DB Connection'.
4	Overtype the default name with the appropriate name for the Connection, and press the Enter key.
5	Double-click on the new Connection, or right-click on it and select 'DB Connection Properties'. The 'Database Connection Properties' dialog displays.

Add a Database Connection to a Diagram

Step	Action
1	Open your Data Modeling diagram and, if necessary, display the 'Data Modeling' page of the Diagram Toolbox (click on to display the 'Find Toolbox Item' dialog and specify 'Data Modeling').

2	Drag the 'Database Connection' icon onto the diagram.  This generates the Database Connection element. 
3	Double-click on the new element. The 'Database Connection Properties' dialog displays.

Database Connection Properties

Option	Action
DBMS Type	Click on the radio button for the appropriate type: • MS Access file based database • Firebird file based database • SQLite file based database • Direct Native connection, or • ODBC based database The 'Save Password?' checkbox is only enabled for ODBC connection types, and indicates if Enterprise Architect should store the password for the selected ODBC DSN. The checkbox defaults to selected; that is, passwords are saved. While all connection passwords are encrypted before being saved, there can be occasions when data modelers want to restrict access to only users that have the required permissions.
Filename/DSN	If you have selected a 'DBMS Type' of MS Access or Firebird, type in or browse for the location and name of a physical file. If the file does not already exist it will be created. If you have selected a 'DBMS Type' of ODBC, type in or select a defined ODBC DSN. Depending on the DBMS, you might be prompted for other details such as server, connection user ID and password.
Other Schemas	This field acts as a schema filter to limit the number of objects returned by enquiries made against the ODBC connection. Entering a value in this field is particularly important for Oracle databases to reduce the time it takes for making connections to the database, due to the large number of system objects. If you need to enter multiple schemas to be filtered on, separate them with commas.
OK	Click on this button to save the changes you have made.

Delete Connection

If a connection is no longer required, you can delete it as for any other element from the Database Builder, the Browser

window or a diagram. Right-click on the element and select the corresponding 'Delete <element name>' option.

Notes

- It is advisable that when working in a team environment (that is, multiple users sharing a single Enterprise Architect repository) all ODBC based Database Connection objects are defined as 'DSN-less' so that the Database Connection object contains all necessary details and can therefore be shared between all users, although a Native Connection does this and is easier to setup
- The DBMS type of a Database Connection object cannot be changed once the initial selection has been saved

Manage DBMS Options

Using the 'Manage DBMS Options' dialog, you can quickly change the DBMS Type and/or Owner of an individual database object or several objects within an individual Package or Package hierarchy. You can also create bulk Foreign Key Indexes on all Foreign Keys that do not already have an index.

Access

Ribbon	Design > Package > Manage > DBMS Options Develop > Data Modeling > Database Builder > Right-click on the required database | Load | right-click on the root node | Manage DBMS Options

Options

Option	Action
Package	Displays the name of the Package in the Browser window that you are currently working on. If necessary, click on the button and select a different Package using the Navigator window (a version of the 'Find Package' dialog).
Include Objects in Child Packages	Select this checkbox to include all the database objects in all sub-Packages. Selecting or deselecting this control will immediately refresh the list of objects.
List of Objects	This list control will display the names of all objects in the current Package (or Package hierarchy) along with its allocated DBMS and owner. By default every object has its checkbox selected whenever the list is loaded or refreshed.
All	Click on this button to select all deselected checkboxes in the 'List of Objects'.
None	Click on this button to deselect all selected checkboxes in the 'List of Objects'.
Change DBMS	Select this checkbox if you want to change the assigned DBMS of objects in the Package. Provide values for the 'Current DBMS' and 'New DBMS' fields in order to continue. The 'Current DBMS' drop-down list includes the option '<All>', which changes several different DBMS values all to the new value. Note: When performing this function, the data types of all Table columns are automatically converted to the closest match for the selected DBMS; therefore, you should perform a manual review of the data types after running the process.
Change Owner	Select this checkbox if you want to change the Owner of the selected objects in the 'List of Objects'. Specify the current Owner in the 'Current Owner' field in order to continue. Leaving the 'New Owner' field blank will remove the Owner property of all selected objects.
Create Indexes on Foreign Keys	Select this checkbox to create an index on all Foreign Keys in the Package, where one does not already exist.

OK	Click on this button to start the update process. The button is disabled unless at least one object in the list and one of the update options are selected.

Data Types

Every Table column that you define in your data model has a data type assigned that specifies the type of information that can be stored by the column. The available datatypes for a column are dependent on the selected DBMS for the Table, because each DBMS supports its own list of datatypes. Whilst each DBMS supports the same basic types, such as string, whole or decimal numbers, each DBMS calls them by different names and have different properties.

Each Enterprise Architect repository contains the definitions of the core datatypes for a number of standard DBMS products. However, since data types vary from one DBMS product to another, and from one version of a product to another, Enterprise Architect provides you with tools to:

- Define new data types for a new version of your DBMS product
- Define data types for a new, non-standard database product
- Automatically convert data types from one defined DBMS product to another
- Import and export datatypes between repositories

Map Data Types Between DBMS Products

Whilst modeling physical data models provides a great deal of detail about all Tables and their columns, this level of detail does make it harder to change the target technology or platform. For example, after reverse engineering your database into a physical data model, you must remap the data types before generating the schema for the new DBMS product.

Enterprise Architect provides a set of default mappings for standard, supported DBMS products, to help you automate the conversion process.

However, you might want to customize the default mappings to suit your specific project requirements, or where the mapping of one data type to another is not currently defined. For example, in your migration from one DBMS platform to another, one of the platforms might be non-standard or otherwise not supported by Enterprise Architect.

Access

Ribbon	Settings > Reference Data > Settings > Database Datatypes : Datatype Map

Database Data Types Mapping

Repeat this process for each of the data types to map.

Once you are satisfied with the data type mappings, you can convert either individual Tables or an entire Package of Tables to the new target DBMS product.

Field/Button	Action
From Product Name	Click on the drop-down arrow and select the DBMS product to map data types from.
Defined Datatypes for Databases	Displays all the defined data types for the product and, where appropriate, their sizes and values. Click on the data type to map - this must have a defined size unit and value. The 'Datatype' and 'Common Type' fields under the 'From Product Name' field display this data type.
To Product Name	Click on the drop-down arrow and select the DBMS product to map data types to. The 'Datatype' and 'Common Type' fields under this field display the values corresponding to those in the fields for the 'From' product.
Size	Click on the radio button for the appropriate size unit and type the default values in the corresponding data fields.
Save	Click on this button to save the mapping.

DBMS Product Conversion for a Package

Using the DBMS Package mapper, you can automatically convert a Package of database Tables from one supported DBMS type to another supported DBMS type. You can also change the DBMS type for individual Tables.

If one of the DBMS types is non-standard or otherwise not supported by Enterprise Architect, you should check that the mapping of datatypes from one DBMS type to the other has been defined.

Access

Ribbon	Design > Package > Manage > DBMS Options Develop > Data Modeling > Database Builder > Right-click on the required database | Load | right-click on the root node | Manage DBMS Options

Map the DBMS data types of a Package to the data types of another DBMS

Field/Button	Action
Include Objects in Child Packages	If there are objects in child Packages that also require changing, select the checkbox.
Change DBMS	Select the checkbox.
Current DBMS	Click on the drop-down arrow and select the current DBMS.
New DBMS	Click on the drop-down arrow and select the target DBMS.
OK	Click on this button to map all Tables in the selected Packages to the new DBMS.

Data Type Conversion For a Table

Once a database schema has been set up on an Enterprise Architect diagram (either by importing through ODBC or manually setting up the Tables), the DBMS can be changed to another type and the column datatypes are mapped accordingly for each Table.

You might use this procedure if you have copied a small number of Tables into the project from elsewhere, but if you have many Tables you can also convert all of them at once within their parent Package.

If one of the DBMS types is non-standard or otherwise not supported by Enterprise Architect, you should check that the mapping of datatypes from one DBMS type to the other has been defined.

Map the DBMS type of a Table to another DBMS type

Step	Action
1	Double-click on the Table element in a diagram. The Table 'Properties' dialog displays, with the 'Database' field showing the current DBMS for this Table.
2	To map the datatypes to another DBMS, click on the 'Database' drop-down arrow and select the target DBMS.
3	Click on the Apply button. The datatypes are converted to match those of the new DBMS, and these are reflected in any DDL generated from this Table.

Database Datatypes

Using Enterprise Architect's 'Database Datatypes' dialog, you can add to the set of data types that are available for a particular DBMS. You can:

- Identify the DBMS in use and, if required, set this as the model default
- Include any new data types that are supported by later versions of the DBMS and not yet included with Enterprise Architect
- Remove any previously-added data types that are no longer relevant
- Add a new DBMS product and its built-in data types if, for example, you want to create a physical data model for a DBMS product that is not yet supported natively by Enterprise Architect

Access

Ribbon	Settings > Reference Data > Settings > Database Datatypes or Develop > Data Modeling > Datatypes

Manage Datatypes

You can transport these database data types between Enterprise Architect models using the 'Export Reference Data' and 'Import Reference Data' options.

Field/Button	Action
Product Name	Click on the drop-down arrow and select an existing DBMS. Once a product is selected, all defined data types will be shown in the 'Defined Datatypes for Databases' list.
Add Product	If your DBMS is not listed, click on this button to add it. An 'Input' prompt displays, in which you type the DBMS name; click on the OK button to add the name to the drop-down list.
Set as Default	Select the checkbox to set the selected DBMS as the default for your database engineering and modeling. Once you set the default database, when you create any new Table elements the database type is automatically pre-set to this default. You can also set the default database type in the second data entry field of the Code Generation toolbar.
New	Click on this button to clear the data type fields on the dialog so that you can define another data type.
Datatype	Type a name for the data type.
Size	Select the appropriate radio button for the required size and, if appropriate, specify the default and maximum values: • None – for data types without a size component, such as INT

	• Length – for data types that require a single size that defines the Length, such as VARCHAR(10) • Precision & Scale – for data types that require two numeric values, such as DECIMAL(18,2)
Common Type	Click on the drop-down arrow and select the generic name of each data type. This is used when a Table's DBMS is changed.
Save	Click on the button to immediately save your data type to the repository (and add it to the 'Defined Datatypes for Databases' list).
Defined Datatypes for Databases	This panel lists the data types currently defined for the selected DBMS, either system-supplied or user-defined.
Delete	Select a data type in the 'Defined Datatypes for Databases' list and click on this button to remove the data type.
Datatype Map	If you have changed the DBMS or technology for which you have defined the data types from or to an unsupported DBMS type, click on this button to define how to automatically remap the data types to your new DBMS or technology.

MySQL Data Types

MySQL supports the ENUM and SET data types, which must be added to your Enterprise Architect model before you can use them as the types for columns.

Access

Ribbon	Settings > Reference Data > Settings > Database Datatypes

Add the ENUM and SET data types for MySQL

When using these data types later in a column's 'Initial' field, type the values as a comma-separated list, in the format:

('one','two','three')

If one value is the default, use the format:

('one','two','three') default 'three'

Step	Action
1	The 'Database Datatypes' dialog displays.
2	In the 'Product Name' field select 'MySQL'.
3	Add the data types ENUM and SET.

Oracle Data Types

The Oracle data types NUMBER and VARCHAR have additional properties that you can model.

Access

Ribbon	Settings > Reference Data > Settings > Database Datatypes

Data Types

Data Type	Detail
NUMBER	The NUMBER data type requires precision and scale properties. The 'Precision' and 'Scale' fields are displayed on the 'Attributes' page of the Features window when the data type is set to NUMBER; if you enter information into these fields, it is displayed on your diagrams. For example: create NUMBER by setting 'Precision' = 0 and 'Scale' = 0 create NUMBER(8) by setting 'Precision' = 8 and 'Scale' = 0 create NUMBER(8,2) by setting 'Precision' = 8 and 'Scale' = 2
VARCHAR	Oracle VARCHAR2(15 CHAR) and VARCHAR2(50 BYTE) data types can be created by adding the Tagged Value LengthType with the value CHAR or BYTE.

Data Modeling Settings

Enterprise Architect provides data modeling settings that can be used to configure the way database systems are modeled in Enterprise Architect. These include the ability to define the data modeling language, which determines the way that connectors are displayed, and settings to configure the naming of Primary Keys, Foreign Keys and Indexes. The settings are global and will affect any Enterprise Architect repository.

Access

Ribbon	Start > Appearance > Preferences > Preferences > Source Code Engineering > Code Editors > DDL

DDL Editor

In this field you browse for the full execution file path and name of an external program that Enterprise Architect should use to open files that are created by its Generate DDL functionality. If you leave this field empty, Enterprise Architect uses the default code editor.

Default Database

In this field you select the DBMS that will be automatically assigned to database objects that are created outside a Data Model workspace (see the *Create a Data Model from Model Pattern* Help topic).

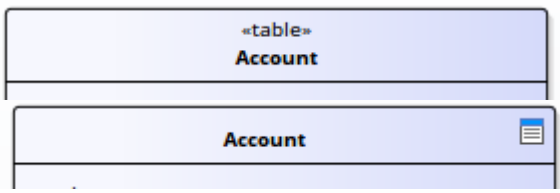
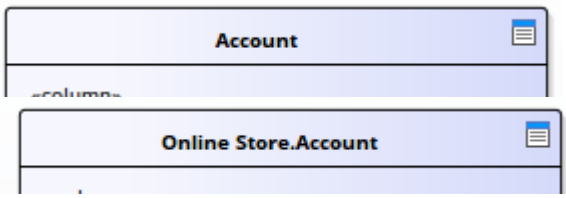
MySQL Storage

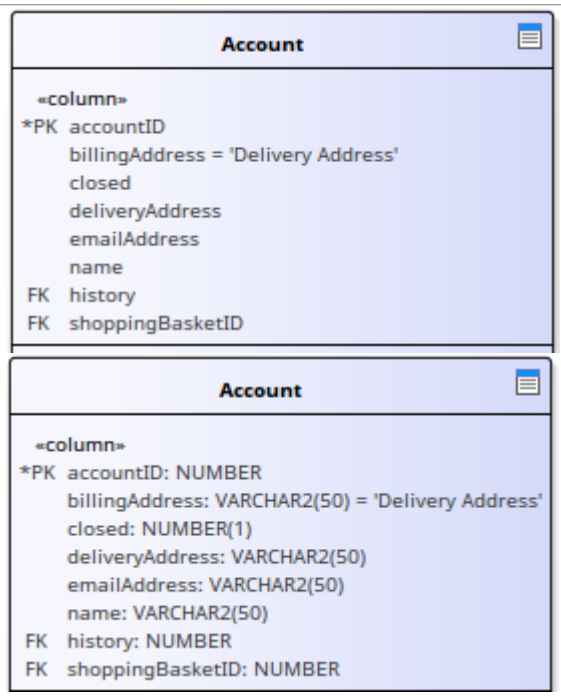
In this field you select the default storage engine to be assigned to MySQL Tables; from MySQL v 5.5 onwards the default value is InnoDB.

Data Modeling Notations

Enterprise Architect supports numerous settings related to data modeling that can influence how database objects are represented on diagrams. These settings, and how they can affect the representation of database objects, are described here.

Settings

Setting	Detail
Stereotype Icons	Access: 'Design > Diagram > Manage > Properties > Elements : Use Stereotype Icons' Default Value: True Enterprise Architect provides a diagram-level setting for the display of stereotyped objects. When the checkbox is selected, database objects on the diagram are displayed with an icon representing their stereotype instead of the stereotype name. 
Show Data Model Owner	Access: 'Design > Diagram > Manage > Properties > Elements : Show Data Model Owner' Default Value: True The system provides a diagram-level setting for the display of Owners. When the checkbox is selected, database objects on the current diagram will be displayed with their full name '{Owner.}ObjectName'. 
Show Column Details	Access: 'Design > Diagram > Manage > Properties > Features : Show Attribute Detail' Default Value: Name Only The system provides a diagram-level setting for the display of Table column names and datatypes. The available options are: 'Name Only' or 'Name and Type'.



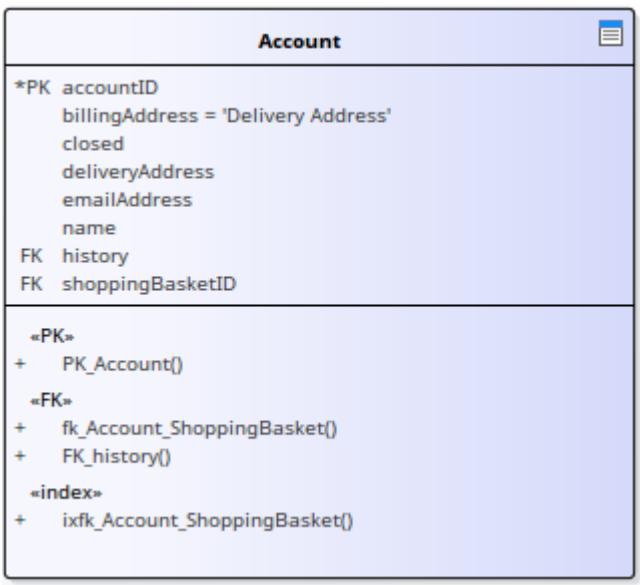
Show Involved Column Details

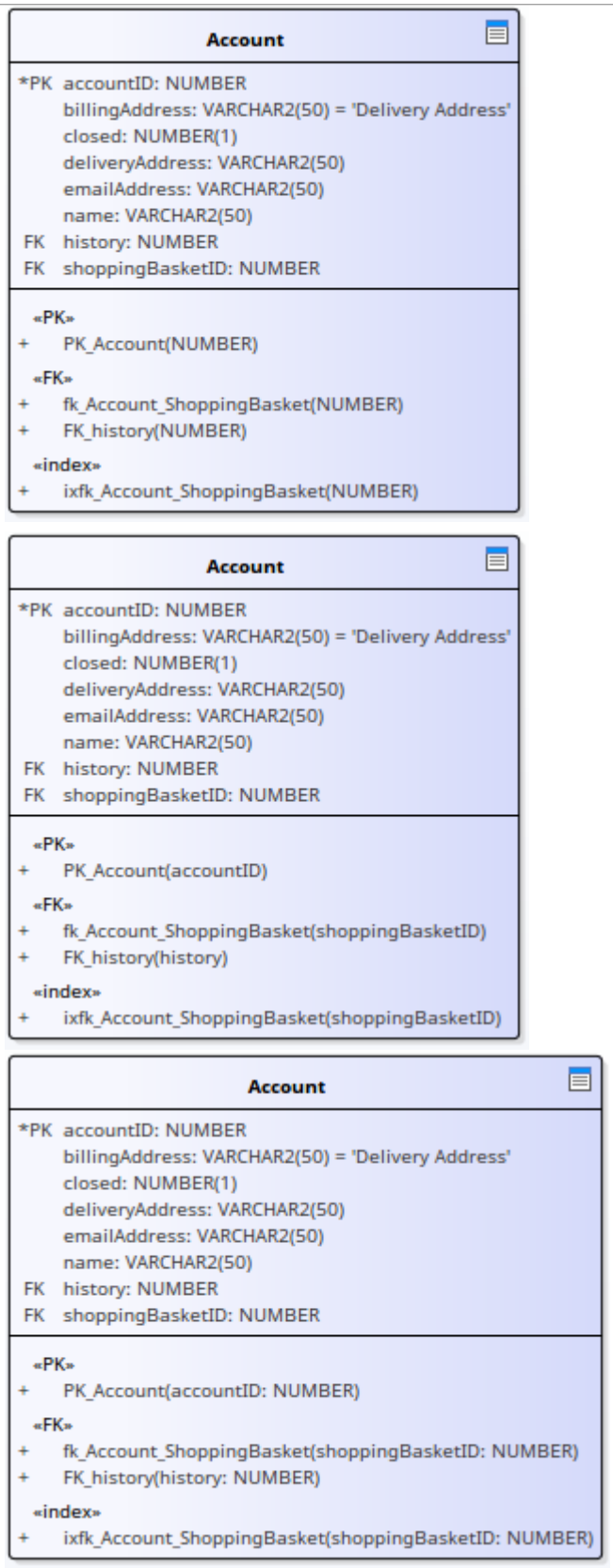
Access: 'Design > Diagram > Manage > Properties > Features | Show Parameter Detail'

Default Value: Type Only

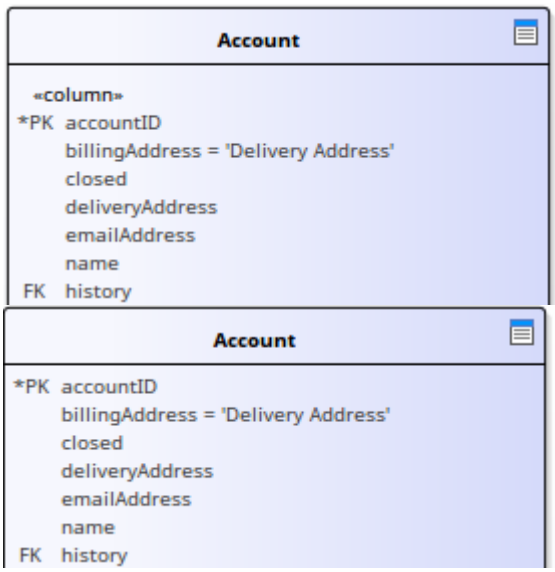
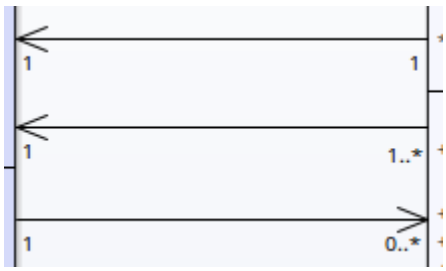
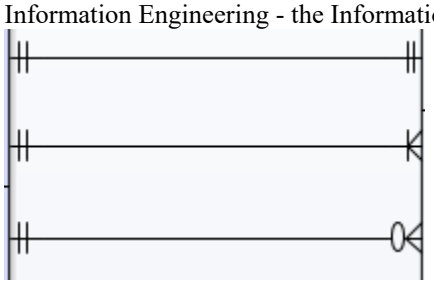
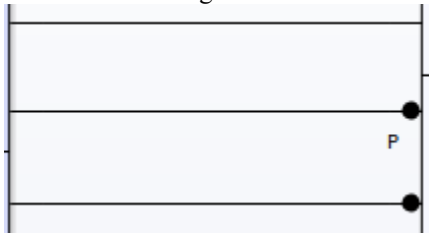
The system provides a diagram-level setting for the display of columns involved in a Table constraint. The available options are: 'None', 'Type Only', 'Name Only' and 'Full Details'.

In these examples, the Primary Key (PK) constraint 'PK_account' involves the column 'accountID'.





Show Column Stereotype	Access: Start > Application > Preferences > Preferences > Objects: Show <<column>> stereotype Default Value: True Enterprise Architect provides a global-level setting that controls whether or not the

	<<column>> stereotype is displayed above each Table's columns. You can therefore hide the stereotype if you prefer, considering that attributes with a stereotype of <<column>> are the only valid option for Tables. 
Connector Notation	Access: 'Design > Diagram > Manage > Properties > Connectors : Connector Notation' Default Value: UML 2.1 Enterprise Architect supports three diagram notations for data modeling: • UML 2.1 - the standard UML 2.1 notation for connectors  • Information Engineering - the Information Engineering (IE) connection style  • IDEF1X - the Integrated Definition Methods IDEF1X connection style  (These are the same three connectors using the different notations.) The default notation for the Data Modeling diagram is 'Information Engineering', whilst the default notation for models created from Database Engineering Patterns is 'IDEF1X'.

DDL Name Templates

At various times during the process of data modeling, Enterprise Architect is required to automatically generate Table constraints. The naming standard for these generated constraints is defined in and applied by the DDL Name Templates, which you are free to change at any time. These Name templates are defined at repository level, so whenever they are changed all users of the repository will use the new templates.

Access

Ribbon	Settings > Model > Options > Source Code Engineering : DDL Name Templates

DDL Name Templates

Option	Action
Primary Key	Define the name template used when Primary Key constraints are created.
Unique Constraint	Define the name template used when Unique Constraints are created.
Foreign Key	Define the name template used when Foreign Key constraints are created.
Foreign Key Index	Define the name template used when Foreign Key indexes are created.
Save	Click on this button to save the name template(s) you have defined.

Template Macros

These recognized macros will be replaced by name text during the creation of a constraint name.

Macro	Applies to
%tablename%	Primary Key Unique Constraint Description: The string that is replaced by the Table's name.
%columnname%	The string that is replaced by the constraint's column name(s).
%primarytablename%	Foreign Key Description: The string that is replaced by the primary (parent) Table's name.
%foreigntablename%	The string that is replaced by the foreign (child) Table's name.

%foreignkeyname%	Foreign Key Index Description: The string that is replaced by the Foreign Key name.

Import Database Schema

The power of model-based engineering is the ability to visualize, analyze and design all aspects of a system. Being able to view the database schemas alongside other models of a system provides great clarity and reduces the chance of error. Enterprise Architect can reverse engineer a DBMS schema and its objects into a model under a number of different standards, including UML, Information Engineering and IDEF 1X. A wide range of database objects are supported including Tables, Views, Procedures, Functions and Sequences. Enterprise Architect achieves this by interrogating the DBMS's information schema and importing the definition into a UML objects. As modifications are made to the Live database the changes can be synchronized into the model.

Once the schema is in Enterprise Architect, the database objects can be traced to other elements, ensuring the integrity of design and architecture. When systems target multiple DBMSs, these can all be reverse engineered into a model and elements and datatypes can be compared between these models. The sophisticated reporting engine can produce high quality documentation, including data dictionaries, diagrams and relationships back to other models such as architecture and information requirements, and ultimately to business goals and drivers.

Database schema information can be imported via the Database Builder (recommended) or from the 'Develop' ribbon.

Import Database Schema

Step	Action
1	Open the Database Builder (Develop > Data Modeling > Database Builder)
2	Load or create a Data Model.
3	• Right-click on the loaded Data Model in the Database Builder and select 'Import DB schema' or • From the ribbon select 'Develop > Data Modeling > Import' The 'Import DB Schema' dialog displays, showing the details of the current active database connection.

The Import DB Schema dialog

Option	Description
Database	This field shows a description of the current Live connection, in the format: dbms.database_server.database_name If necessary, click on the ... button and, select an alternative connection.
Import to	This field shows the target Package that the new objects will be saved to. If you want to specify a different Package, click on the button and select an alternative Package.
Only include objects from Schema(s)	If the database type supports multiple schemas (such as SQL Server, Oracle, PostgreSQL and DB2 Express) you can filter objects to be retrieved from the database by schema. The available schemas are automatically listed in this panel. Select the checkbox against each schema to include in the import.

	(You can click on the All button to select all the schemas, or the None button to clear all selected checkboxes.) If you suspect that the schema list might have changed since you loaded them, you can refresh the list by clicking on the Reload Schemas button.
Name Filter	The 'Name Filter:' field allows filtering of objects using SQL wildcards appropriate to the DBMS of the schema being imported. For example, for Oracle: • LIKE 'A%' - list objects with a name starting with the letter 'A' • NOT LIKE '%_%' ESCAPE '\' - list objects with a name that does not include an underscore (_) • IN ('TABLE1','TABLE2') - list objects with names that are included in the parentheses • NOT IN ('TABLE1','TABLE2') - list objects with names that are not included in the parentheses Note that only one filter can be entered. You cannot add a second filter using the AND clause. Filtering is not available for MS Access
Filter Options	The 'Filter Options' panel controls what object types and properties are read in from the database schema. Values changed on this screen are saved to the registry so that they are re-applied in the next work session. The available options are briefly described here; select the checkbox against an option to activate it. **Tables** • Tables - Select to import Tables • Table Primary Keys - Select to import Primary Key definitions on Tables • Table Foreign Keys - Select to import Foreign Key definitions on Tables • Table Indexes - Select to import Table Indexes • Unique Constraints - Select to import Unique Constraint definitions on Tables • Check Constraints - Select to import Check Constraint definitions on Tables • Table Triggers - Select to import Trigger definitions on Tables • Table Properties - Select to import extended Table properties • Constraint Properties - Select to import Constraint Properties for Tables • Length Semantics - Select to import length semantic definitions on Oracle string columns **Objects** • Views - Select to import Views • Procedures - Select to import Procedures - As Operations - Select to import Procedures as operations (methods) of a single Class; you can view and edit them through the Database object container 'Properties' dialog (the option defaults to unselected, where the selected items are imported as separate Classes) • Functions - Select to import Functions - As Operations - Select to import Functions as operations (defaults to unselected) • Sequences - Select to import Sequences - As Operations - Select to import Sequences as operations (defaults to unselected) • Package - Select to import Oracle Packages

	Advanced • System Objects - Select to import system Tables, Views and other system objects **Warning**: With the 'As Operations' option for Procedures, Functions and Sequences, if objects have been imported under one setting (selected or unselected) and then you change the setting and import further objects, the objects imported under the first setting are removed.
Synchronization	Select the appropriate radio button to indicate whether the existing Classes are to be updated, or the database objects imported as new objects. If you select the 'Synchronize existing classes' option, also select the appropriate checkboxes to determine whether model comments, column default values and/or Table constraints are to be retained or overwritten with the comments, values and constraints of the imported objects.
Import To	Select the appropriate radio button to indicate whether to update the Package and currently-open data model diagrams, or just the Package. If no diagrams are open, the 'Package Only' radio button defaults to selected and the options are disabled; if the open diagrams are in the selected Package, you can select either option.
Import	Click on this button to start the import. The 'Select Database Objects to Import' dialog displays, listing all the database objects found that match the selection criteria. Select the checkbox against each schema (or object type) to automatically select all objects in that group or to import each object individually. Click on the All button to select all types and objects, or on the None button to clear all selected checkboxes. When you have selected all the objects to import, click on the OK button to continue the import.

Notes

- Within Windows, ODBC DSN can be defined for either 32 or 64 bit applications, therefore care must be taken to ensure that all ODBC DSNs for Enterprise Architect's use are defined sharing the same architecture. This is particular important from Enterprise Architect version 16 onwards because it is now available in both 32 and 64 bit versions. An alternative solution (and what Sparx Systems recommend) is to make use of Native connections, since they work for both architectures.
- The ODBC connection should use the ODBC driver available from the DBMS vendor, such as MySQL's ODBC driver for MySQL, and Oracle's ODBC driver for Oracle; drivers provided by third-party vendors are not supported, including the Microsoft ODBC driver for Oracle
- You can import a suitable ODBC driver for SQLite from http://www.ch-werner.de/sqliteodbc/
- Due to the limitations of SQLite, round tripping of SQLite Table and column comments is not possible; to retain comments entered in an SQLite data model when importing from ODBC, deselect the 'Overwrite Object Comments' checkbox in the 'Synchronization' section of the 'Import DB Schema from ODBC Source' dialog
- If setting up an ODBC connection for reverse engineering, the default settings are sufficient
- The list of Data Modeling Data types is defined as static data (in each repository), so depending on the age of your repository, there could be additional data types available from the 'Data Modeling Data Types' section of the 'Resources' page on the Sparx Systems website

Generate Database Definition Language (DDL)

Once a physical model has been defined and the objects modeled, Enterprise Architect can generate Database Definition Language (DDL) for a variety of objects including database Tables, Views, Functions, Sequences and Procedures. This is a time saving mechanism and reduces the errors that can be introduced by doing this by hand in other tools. Forward engineering is governed by a set of templates that define how UML constructs are converted to the objects in the targeted DBMS. Standard templates are provided for all supported DBMSs, and these can be edited to customize the way the DDL is generated. In the case that a DBMS is not supported out-of-the-box, a new set of templates can be created using the existing ones as a starting point and reference.

When forward engineering DDL, the output can be directed to a file (or a series of files, one for each object) or to the DDL execution engine. The execution engine allows you to execute the DDL immediately, targeting a live database through the active connection. If you direct the output to a file you can execute the DDL against a live database later, at your convenience. The generated files can be opened using the code editor, by selecting F12, Ctrl+E or Alt+7, allowing you to view the DDL inside Enterprise Architect.

Generate DDL For Objects

As you create your database model, you can generate the DDL for an individual object, a Package of objects or the complete data model. The only difference is how you invoke the generate DDL process.

Access

Open the Database Builder window, then use the context menu and select 'Generate DDL'.

Ribbon	Develop > Data Modeling > Database Builder > Click on an object, Package or Data Model node : Generate DDL

Generate Tab

Field/Button	Action
Package	Click on the button and browse for the Package for which you want to generate DDL, using the Navigator window (a version of the 'Find Package' dialog). (Note: This field might not be displayed in all situations.)
Include All Child Packages	Select this checkbox to include the objects in sub-Packages in the 'Select Objects to Generate' list.
Delete Target Files	When objects are generated to single files, the full filename is stored with the object, and displayed in the 'Target File' column of the 'Select Objects to Generate' list. Click on this button to remove all the existing filenames and prompt for new ones.
Select Objects to Generate	This field displays the list of objects that DDL will be generated for, in the displayed order. If you need to change this order to resolve object dependencies, click on an object to move and click on the buttons to move that object one position up or down in the sequence. Select each object for which to generate DDL. Click on: • The All button to select every item • The None button to clear all selections • Each of several objects while you press Ctrl, to select a number of individual objects • The first and last objects in a block while you press Shift, to select every object in the block
Save Generated Order	If you have changed the order in which the objects are listed, select the checkbox to save the new sequence when you click on the Generate button.
Refresh	Reload the list of objects, restoring each object to their previous positions (if object positions have been changed).

Single File	Select this radio button if you want to save the generated DDL to a single file. Click on the button to browse for the file path and file name.
Individual file for each table	Select this radio button if you want to save the DDL generated for each object to a separate file. When you click on the Generate button, the system prompts you for the target file name for each object in turn (if it is not specified already).
Generate to DDL Execution Engine	Select this radio button if you want to save the DDL to the execution engine (the 'Execute DDL' tab of the Database Builder). The DDL Execution Engine provides the facilities for executing the generated SQL script and responding to errors in execution immediately, without having to create an external file and load it into another tool. 'Generate to DDL Execution Engine' is the default option if the Database Builder is open.
Generate	Click on this button to run the Generate DDL process with the options you have selected.
View	If you have generated the DDL to a single external file, click on this button to view the output. By default Enterprise Architect uses the default code editor. However, you can define an alternative default DDL editor on the 'Preferences' dialog ('Start > Application > Preferences > Preferences > Source Code Engineering > Code Editors > DDL').
Close	Click on this button to close the dialog. If you did not generate the DDL, this button also abandons DDL generation for the object.

Options Tab

Set any of these flags to False if you do not want to take the action they initiate.

Group	Options
Table Generation Options	**Tables** - indicates that DDL for Table elements should be generated (*) **Primary Keys** - indicates that DDL for Primary Keys should be generated ($) **Foreign Keys** - indicates that DDL for Foreign Keys should be generated ($) **Indexes** - indicates that DDL for Indexes should be generated ($) **Unique Constraints** - indicates that DDL for Unique Constraints should be generated ($) **Check Constraints** - indicates that DDL for Check Constraints should be generated ($) **Table Triggers** - indicates that DDL for Table Triggers should be generated ($) **Table properties** - indicates that DDL for extended table properties should be generated ($) **Length Semantics** - indicates that DDL for Oracle Length Semantic should be generated ($)

Object Generation Options	**Views** - indicates that DDL for View elements should be generated (*) **Procedures** - indicates that DDL for Procedure elements should be generated (*) **Functions** - indicates that DDL for Function elements should be generated (*) **Sequences** - indicates that DDL for Sequence elements should be generated (*) **Packages** - indicates that DDL for Oracle Packages elements should be generated (*)
Formatting	**Include pre/post queries** - indicates that the generated DDL should include the SQL statements defined in the '_PreStatements' and '_PostStatements' SQL Queries **Include Owners** - indicates that the generated DDL should include the schema/owner of all elements **Include Comments** - indicates that the generated DDL should include any comments **Include Header Comments** - indicates that the generated DDL should include any header comments (#) **Include Object Comments** - indicates that the generated DDL should include any object (such as Table or View) comments (#) **Include Column Comments** - indicates that the generated DDL should include any columns comments (#) **Generate DROP statements** - indicates that the generated DDL should include the DROP statement for objects **Use Database** - indicates that the generated DDL should include a USE Database statement **Use Alias** - indicates that the generated DDL makes use of any object or column aliases **Separate Constraint from Table** - indicates that the generated DDL should define the creation of constraints as separate statements from the Table definition **Include NULL in column definitions** - indicates that the generated DDL should apply the NULL keyword to each column definition that is defined as nullable; that is, columns with their 'NOT NULL' flag unchecked (this option only applies to the DBMSs that support the 'NULL' syntax)

Notes

- (*) - options with this mark will be automatically set to True if you have specified to generate DDL for an individual element of that type; that is, if you select a Table and your 'Generate Table' option is False, Enterprise Architect will change the option to True
- ($) - options with this mark will be disabled if the 'Tables' option is set to False
- (#) - options with this mark will be disabled if the 'Include Comments' option is set to False

- In the Corporate, Unified and Ultimate Editions of Enterprise Architect, if security is enabled you must have 'Generate Source Code and DDL' permission to generate DDL
- For a PostgreSQL database, you must set the 'Sequences' option to True to enable auto increment columns to be created
- If generating Oracle sequences, you must always set the 'Table Triggers' and 'Sequences' options to True, so that a pre-insert trigger is generated to select the next sequence value to populate the column; also, in the column properties, set the 'AutoNum' property to True
- You can edit the DDL templates that the system uses to generate the DDL; these are stored at the repository level so

that all other users of the same repository will automatically use the updated templates

Edit DDL Templates

The DDL Template Editor provides the ability to change the templates that the system uses while generating DDL from a data model. It applies 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* Help topic.

Access

Ribbon	Develop > Data Modeling > Templates

Select and Edit Templates

Option	Action
Language	Click on the drop-down arrow and select the database type (Database Management System).
New Database	Click on this button to create a new set of templates for a non-standard DBMS. The 'Input' dialog displays, on which you type the name of the new DBMS for which you are creating templates. This updates the 'Language' field.
Template	Displays the contents of the selected template, and provides the editor for modifying these contents.
Templates	Lists the base DDL templates, Click on a template name to display and edit the template contents; the name of the selected template is highlighted. The 'Modified' field indicates whether you have modified the default template originally supplied with the system.
Stereotype Overrides	Lists any stereotyped templates that exist for the currently-selected base template. The 'Modified' field indicates whether you have modified a default stereotyped template.
Add New Custom Template	Click on this button to display the 'Create New Custom Template' dialog, on which you select the template type from a drop-down list, and type in a name for the template. The template type becomes a prefix for the name; for example: Namespace_MyDDLTemplate
Add New Stereotyped Override	Select a base template and click on this button to display the 'New Template Override' dialog for adding a stereotyped template for the selected template. From the drop-down lists, select the Class and/or Feature stereotype for which to apply the override template.
Get Default Template	Click on this button to refresh the editor display with the default version of the

	selected template. (This does not delete the changed version of the template.)
Save	Click on this button to overwrite the selected template with the updated contents of the Template panel.
Delete	If you have overridden the selected template, click on this button to delete the overridden template and replace it with the corresponding default DDL template.

Notes

- User-modified and user-defined DDL Templates can be imported and exported as Reference Data (see the *Sharing Reference Data* topic)
- Any user-defined templates for a database type are listed in the 'Export Reference Data' dialog in the 'Code, DDL, Transformation & CSV Templates' table, identified by the DBMS name with the suffix _DDL_Template - if no user-defined templates exist for a DBMS, there is no entry for the DBMS in the dialog
- You must also define any appropriate data types for the DBMS and, if exporting the templates as Reference Data, you must export the 'Model Data Types - Code and DDL' table as well

DDL Template Syntax

DDL Templates are written using Enterprise Architect's Code Template Framework, but they have been extended to support DDL generation.

DDL Template Development

These aspects of DDL Template development are discussed in this section.

Aspect	See also
DDL Templates	DDL Templates
DDL Macros	DDL Macros
DDL Function Macros	DDL Function Macros
DDL Property Macros	DDL Property Macros
DDL Options in Templates	DDL Options in Templates

DDL Templates

The DDL Template Editor operates in the same way as the Code Template Editor, except that the DDL Template Editor displays templates for DDL Generation and templates for Alter DDL Generation at the same time. The Alter DDL Generation templates are shown at the bottom of the list, prefixed by 'DDL Diff'.

Base Templates for DDL Generation

The DDL Template Framework consists of a number of base templates for DDL Generation. Each base template generates a DDL statement (or a partial statement) for a particular aspect of the UML data model.

Templates

This table lists and briefly describes the base templates used for DDL generation.

Template	Description
DDL Check Constraint	Invoked by the DDL Table Constraint template to generate the Check Constraint statements for a Table object.
DDL Column Comment	Normally invoked by the DDL Create Table Extras template to generate COMMENT ON statements (or equivalent) for each Table column.
DDL Column Definition	Invoked by numerous templates to build the statement to create a single Table column, as it appears in the CREATE TABLE statement.
DDL Column Extras	Normally invoked by the DDL Create Table Extras template to generate any extended column properties for each Table column.
DDL Constraint Column Name	Invoked by each of the constraint templates to retrieve the correctly formatted column names involved in the current constraint.
DDL Constraint Comment	Normally invoked by the DDL Create Table Extras template to generate COMMENT ON statements (or equivalent) for each Table constraint.
DDL Create Foreign Keys	Invoked by the DDL Create Table Constraints template to generate Foreign Key constraints for a Table object.
DDL Create Function	Invoked by the DDL Script File template to generate the CREATE FUNCTION statement for a Function object.
DDL Create Package	Invoked by the DDL Script File template to generate the CREATE PACKAGE statements for a Package object (Oracle only).
DDL Create Procedure	Invoked by the DDL Script File template to generate the CREATE PROCEDURE statement for a Procedure object.
DDL Create Schema	Currently not used.
DDL Create Sequence	Invoked by the DDL Script File template to generate the CREATE SEQUENCE statement for a Sequence object.
DDL Create Table	Invoked by the DDL Script File template to generate the CREATE TABLE statement for a Table object.
DDL Create Table Constraints	Invoked by the DDL Script File template to generate Table constraints and Indexes for a Table object.

DDL Create Table Extras	Invoked by the DDL Script File template to generate extended Table properties for a Table object.
DDL Create View	Invoked by the DDL Script File template to generate the CREATE VIEW statement for a View object.
DDL Data Type	Invoked by the DDL Column Definition template to generate the correctly formatted data type statement for a Table column.
DDL Drop Column Extras	Invoked by the DDL Drop Table Extras template to generate any specialized drop statements for column extended properties.
DDL Drop Foreign Keys	Invoked by the DDL Script File template to generate the statements to DROP all Foreign Keys for a Table object.
DDL Drop Function	Invoked by the DDL Script File template to generate the DROP FUNCTION statement for a Function object.
DDL Drop Procedure	Invoked by the DDL Script File template to generate the DROP PROCEDURE statement for a Procedure object.
DDL Drop Sequence	Invoked by the DDL Script File template to generate the DROP SEQUENCE statement for a Sequence object.
DDL Drop Table	Invoked by the DDL Script File template to generate the DROP TABLE statement for a Table object.
DDL Drop Table Extras	Invoked by the DDL Script File template to generate the statements to DROP all extended properties for a Table object.
DDL Drop View	Invoked by the DDL Script File template to generate the DROP VIEW statement for a View object.
DDL Foreign Constraint	Invoked by the DDL Table Constraint template to generate the ADD FOREIGN KEY CONSTRAINT statements for a Table object.
DDL Grant	Invoked by the DDL Create Table Extras template to generate the GRANT statement for the current object (Oracle only).
DDL Index	Invoked by the DDL Table Constraint template to generate the CREATE INDEX statements for a Table object.
DDL Left Surround	Used to define the character (or characters) used as the left-hand delimiter on the name of an object (or object component).
DDL Name	Used by most templates to provide a common way of formatting the name of an object (or object feature). This template accepts four parameters: • Object Location (values: EA or LIVE) • Object Type (values: OWNER, TABLE, VIEW, PROCEDURE, FUNCTION, SEQUENCE, PACKAGE, COLUMN, CONSTRAINT, CONSTRAINT_COLUMN, REFERENCE_TABLE, REFERENCE_COLUMN) • Include Owner flag; controls if the name should be prefixed by the Owner name (values: INCLUDE_OWNER or {blank})

	• Include Surround flag; controls if the name should be delimited by the left and right surround characters (values: INCLUDE_SURROUND or {blank})
DDL Primary Constraint	Invoked by the DDL Table Constraint template to generate the ADD PRIMARY KEY CONSTRAINT statement for a Table object.
DDL Reference Column Name	Normally invoked by the DDL Name templates to retrieve the correctly formatted reference column names involved in a Foreign Key.
DDL Reference Definition	Invoked by the DDL Foreign Constraint template to generate the ON DELETE/ON UPDATE statements for a Foreign Key constraint.
DDL Right Surround	Used to define the character (or characters) used as the right-hand delimiter on the name of an object (or object component).
DDL Script File	A top-level template to generate DDL; all other templates are invoked from this one.
DDL Script Header	Invoked by the DDL Script File template to add a header comment at the start of each DDL file.
DDL Script Separator	Used by all templates that must include a statement separator in the generated DDL.
DDL Statement Term	Used to define the character (or characters) used as the statement terminator. For example, semi-colon (';') for most DBMSs.
DDL Statement Term Alt	Used to define the character (or characters) used as the alternative statement terminator. For example, some DBMSs must have the statement terminator changed in order to not cause problems with DDL statements generated for SQL-based objects, such as Views and Procedures.
DDL Synonym	Invoked by the DDL Create Table Extras template to generate the CREATE SYNONYMS statement (Oracle only).
DDL Table Constraint	Invoked by the DDL Create Table Constraints template to generate the Table constraints and Indexes for each Table object, taking into account the generation options.
DDL Table Level Comment	Invoked by the DDL Create Table Extras template to generate COMMENT ON statements (or the equivalent) for an object.
DDL Trigger	Invoked by the DDL Table Constraint template to generate the CREATE TRIGGER statements for a Table object.
DDL Unique Constraint	Invoked by the DDL Table Constraint template to generate the ADD UNIQUE CONSTRAINT statements for a Table object.
DDL Use Database	Invoked by the DDL Script File template to include a USE DATABASE statement at the start of each DDL file.

Base Templates for Alter DDL Generation

The DDL Template Framework consists of a number of base templates for Alter DDL generation. Each base template generates DDL statement(s) based on the detected *Action* that must be undertaken to synchronize the data model and live database.

Templates

This table lists and briefly describes the base templates used for Alter DDL generation.

Template	Description
DDL Diff Column	Invoked directly by Enterprise Architect for each Table Column difference that was detected.
DDL Diff Constraint	Invoked directly by Enterprise Architect for each Table Constraint difference that was detected.
DDL Diff Table	Invoked directly by Enterprise Architect for each Table difference that was detected.
DDL Diff View	Invoked directly by Enterprise Architect for each View difference that was detected.
DDL Diff Procedure	Invoked directly by Enterprise Architect for each Stored Procedure difference that was detected.
DDL Diff Function	Invoked directly by Enterprise Architect for each Function difference that was detected.
DDL Diff Sequence	Invoked directly by Enterprise Architect for each Sequence difference that was detected.

DDL Macros

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

- Database objects (such as Tables and Views)
- Columns
- Constraints
- Constraint Columns

Field substitution macros are named according to Camel casing. By convention, all DDL macros are prefixed with 'ddl'.

Macros that represent checkboxes or Boolean values return a string value of 'T' if the checkbox/boolean is true. Otherwise an empty string is returned.

Internal Field Macro - ddlAction

The ddlAction macro is an internal macro available in the 'Alter DDL' templates, providing direct access to Enterprise Architect's internal fields; it has no direct mapping to any stored data.

ddlAction represents the action that must be undertaken to synchronize the live database with the current repository. For example, 'Create Table', 'Drop Table' or 'Change Owner'.

Element Field Macros

This list identifies the macros that are available in DDL templates to access element-level fields, where (in Enterprise Architect) the fields are editable, such as 'Table Name' and 'Table Alias'.

ddlFunctionAlias

Function 'Properties' dialog: 'Main' tab: 'Alias' text field.

ddlFunctionName

Function 'Properties' dialog: 'Name' text field.

ddlOwner

{Table element} 'Properties' dialog: {element} 'Table Detail' tab: 'Owner' text field.

ddlPackageAlias

Package 'Properties' dialog: 'Main' tab: 'Alias' text field.

ddlPackageName

Package 'Properties' dialog: 'Name' text field.

ddlProcedureAlias

Procedure 'Properties' dialog: 'Main' tab: 'Alias' text field.

ddlProcedureName

Procedure 'Properties' dialog: 'Name' text field.

ddlSchemaFunctionName

The name of the Function element's definition read in from the live database.

ddlSchemaOwner

The 'Owner' property of the element's definition read in from the live database.

ddlSchemaProcedureName

The name of the Procedure element's definition read in from the live database.

ddlSchemaSequenceName

The name of the Sequence element's definition read in from the live database.

ddlSchemaTableName

The 'Table Name' property read in from the live database.

ddlSchemaViewName

The name of the View element's definition read in from the live database.

ddlSequenceAlias

Sequence 'Properties' dialog: 'Main' tab: 'Alias' text field.

ddlSequenceName

Sequence 'Properties' dialog: 'Name' text field.

ddlTableAlias

Table 'Properties' dialog: 'Main' tab: 'Alias' text field.

ddlTableDBMS

Table 'Properties' dialog: 'Main' tab: 'Database' drop down list field.

ddlTableLevelComment

Table 'Properties' dialog: 'Notes' text field.

ddlTableName

Table 'Properties' dialog: 'Name' text field.

ddlViewAlias

View 'Properties' dialog: 'Main' tab: 'Alias' text field.

ddlViewName

View 'Properties' dialog: 'Name' text field.

Column Field Macros

This list identifies the macros that are available in DDL templates to access column-related fields, where (in Enterprise Architect) the fields are editable, such as 'Column Name' and 'Column Alias'.

ddlColumnName

'Columns and Constraints' dialog: 'Column' tab: 'Name' cell.

ddlColumnAlias

'Columns and Constraints' dialog: 'Column' tab: 'Alias' cell.

ddlColumnComment

'Columns and Constraints' dialog: 'Column' tab: 'Notes' text field.

ddlSchemaColumnName

The Column **Name** property read in from the live database.

Note: This field is not editable directly in Enterprise Architect.

Constraint Field Macros

This table lists the macros that are available in DDL templates to access constraint-related fields, where (in Enterprise Architect) the fields are editable, such as 'Constraint Name' and 'Constraint Type'.

ddlConstraintAlias

'Columns and Constraints' dialog: 'Constraints' tab: 'Alias' cell.

ddlConstraintColumnAlias

'Columns and Constraints' dialog: 'Constraints' tab: 'Involved Columns: Assigned' list.

ddlConstraintColumnName

'Columns and Constraints' dialog: 'Constraints' tab: 'Involved Columns: Assigned' list.

ddlConstraintComment

'Columns and Constraints' dialog: 'Constraints' tab: 'Notes' text field.

ddlConstraintName

'Columns and Constraints' dialog: 'Constraints' tab: 'Name' cell.

ddlPKColumnCount

Only relevant if the current constraint has a type of Primary Key, this macro will return a count of assigned columns to the Primary Key.

'Columns and Constraints' dialog: 'Constraints' tab: 'Involved Columns: Assigned' list.

ddlReferenceColumnAlias

Only relevant if the current constraint has a type of Foreign Key, this macro will return the column alias from the reference table.

'Columns and Constraints' dialog: 'Constraints' tab: 'Alias' cell.

ddlReferenceColumnName

Only relevant if the current constraint has a type of Foreign Key, this macro will return the column name from the reference table.

Foreign Key 'Constraint' dialog: 'Involved Columns' list: 'Parent' column.

ddlReferenceTableAlias

Only relevant if the current constraint has a type of Foreign Key, this macro will return the reference table's alias.

Table 'Properties' dialog: 'Main' tab: 'Alias' text field.

ddlReferenceTableName

Only relevant if the current constraint has a type of Foreign Key, this macro will return the reference table's name.

Foreign Key 'Constraint' dialog: 'Involved Columns' list: 'Parent' column header.

ddlReferenceTableOwner

Only relevant if the current constraint has a type of Foreign Key, this macro will return the reference table's owner.

Foreign Key 'Constraint' dialog: 'Involved Columns' list: 'Parent' column header.

ddlSchemaConstraintColumnName

The column names involved in the current constraint read in from the live database.

Note: this field is not editable directly in Enterprise Architect.

ddlSchemaConstraintName

The Constraint **Name** property read in from the live database.

Note: this field is not editable directly in Enterprise Architect.

ddlSchemaConstraintType

The Constraint **Type** property read in from the live database.

Note: this field is not editable directly in Enterprise Architect.

DDL Function Macros

The DDL Function macros provide a convenient way of manipulating, retrieving or formatting element data relevant to DDL generation. These macros, along with the code function macros, are available to the DDL templates. Each Function macro returns a result string and is used in the same manner as a Code Template Function macro.

The available function macros are described here. All parameters have a type of String and are denoted by square brackets; that is: FUNCTION_NAME([param]).

DDL_DATATYPE_SIZE ([productName], [datatype])

Returns the fully formatted datatype of the current column in DDL syntax.

Parameters

- productName - the current Table's assigned DBMS, such as SQL Server 2012, Oracle or PostgreSQL
- datatype - the current column's datatype name, such as VARCHAR or INT

Remarks

Within an Enterprise Architect Table column, datatypes are defined with a Length Type (0, 1 or 2) property that influences the DDL syntax; this function macro takes the Length Type (and other factors) into consideration when building the return value.

DDL_GET_DEFINITION_PARAS ([definition])

Returns a string representation of the parameters from the supplied function/procedure definition.

Parameters

- definition - the complete SQL definition of the procedure/function

Remarks

Some DBMSs (such as PostgreSQL) support multiple definitions of the same procedure/function name. The definitions differ only in their parameter list, therefore to manipulate such objects the DDL must specify the name and parameters. This function macro gives the DDL templates the ability to extract the parameters so that they can then be used to identify individual objects.

DDL_INCLUDE_SQLQUERY([objectName])

Returns the SQL statement defined in the SQLQuery object.

Parameters

- objectName - the name of the SQL Query object defined in the current data model

Remarks

None.

DDL_INDEX_SORT([product],[columns])

Returns the sort order of a given index.

Parameters

- product - the DBMS (currently, Firebird)
- columns - a CSV of column names involved in the index

Remarks

This macro currently only applies to Firebird indexes.

DDL_RESOLVE_NAME ([productName], [name], [leftSurround], [rightSurround])

Returns the supplied name delimited (with the supplied left and right characters) if the name is a reserved word for the current DBMS.

Parameters

- productName - the current Table's assigned DBMS, such as SQL Server 2012, Oracle or PostgreSQL
- name - the object/column name
- leftSurround - the left character of the pair used to surround the name; for example, single quote {'}
- rightSurround - the right character of the pair used to surround the name; for example, single quote {'}

Remarks

The DDL syntax of some DBMSs requires names that are reserved words to be delimited in a different manner; this function macro can be used to safely format all names for DB2 and Firebird.

DDL_TABLE_TAGVALUE ([tagName])

Returns the value for the supplied tag name in the repository's version of the current Table.

Parameters

- tagName - the tag item's name that is to be retrieved

Remarks

None.

EXECUTE_CURRENT ([objectName], [actionName], [priority])

Adds the return string from the current template to the Execution Engine's execution queue.

Parameters

- objectName - the value that will be shown in the 'Object' column of the execution queue, which indicates the name of the object being updated
- actionName - the value that will be shown in the 'Action' column of the execution queue, which indicates the action that resulted in the generation of this statement
- priority - a numeric value that represents the priority of the statement; the higher the number, the lower in the queue the statement is placed

Remarks

This function macro can be called at any point throughout the template, but will not execute until the end. Once the template is complete, the DDL it has generated is sent to the execution queue.

This function macro has no effect if the user has elected to generate DDL to a file.

EXECUTE_STRING ([objectName], [actionName], [priority], [ddlStatement])

Adds the supplied DDL statement to the Execution Engine's execution queue.

Parameters

- objectName - the value that will be shown in the 'Object' column of the execution queue, which indicates the name of the object being updated
- actionName - the value that will be shown in the 'Action' column of the execution queue, which indicates the action that resulted in the generation of this statement
- priority - a numeric value that represents the priority of the statement; the higher the number, the lower in the queue the statement is placed
- ddlStatement - a single DDL statement that performs the required action

Remarks

This function macro has no effect if the user has elected to generate DDL to a file.

EXIST_STRING ([ddlStatement])

Searches the Execution Engine's execution queue for the supplied DDL Statement and returns 'T' if the statement is found.

Parameters

- ddlStatement - a single DDL statement

Remarks

None.

GET_FIRST_SQL_KEYWORD([statement])

Returns the first keyword of the provided SQL statement.

Parameters

- statement - the SQL statement

Remarks

None.

ODBC_TABLE_TAGVALUE ([tagName])

Returns the value for the supplied tag name in the live database's version of the current table.

Parameters

- tagName - the tag item's name that is to be retrieved

Remarks

None.

PROCESS_DDL_SCRIPT ([type], [parameter2], [parameter3], [parameter4])

A generic function macro that returns a formatted string for a specific purpose.

Parameters

- type - specifies the special action to be undertaken
- parameter2 - generic parameter 2, will have a different purpose for each type
- parameter3 - generic parameter 3, will have a different purpose for each type
- parameter4 - generic parameter 4, will have a different purpose for each type

Remarks

For Oracle Synonyms use these parameters:

- type = "SYNONYMS"
- parameter2 = the table name; for example, TBL_EMPLOYEES
- parameter3 = a delimited string of values, separated by semi-colons, specifying the synonym owner and name with full colon between; for example, OE:EMPLOYEES;PUBLIC:PUB_EMPLOYEES;
- parameter4 = the statement terminator

Return Result

Of the format:

```
CREATE SYNONYM OE.EMPLOYEES FOR TBL_EMPLOYEES;
CREATE PUBLIC SYNONYM PUB_EMPLOYEES FOR TBL_EMPLOYEES;
```

REMOVE_LAST_SEPARATOR ([ddlStatement], [separator])

Returns the supplied DDL statement with the last separator removed (if it exists).

Parameters

- ddlStatement - a partial DDL statement
- separator - the separator character that should be removed

Remarks

When building a string that represents a DDL statement, it is common practice to append the separator character after each item; however, the separator is not required after the last item, so this function macro is provided to remove the trailing separator.

REMOVE_STRING ([ddlStatement])

Removes the supplied DDL statement from the Execution Engine's execution queue.

Parameters

- ddlStatement - a single DDL statement

Remarks

None.

SUPPRESS_EXECUTE_CURRENT ([boolean])

A function macro to enable/disable subsequent calls to EXECUTE_CURRENT.

Parameters

- boolean - True or False

Remarks

The default state for this flag is False; that is, calls to EXECUTE_CURRENT are not ignored.

DDL Property Macros

The DDL Property macros provide a convenient way of retrieving element property values (that is, Tagged Values). In the scope of data modeling there are two groups of properties:

- Internal properties (those that Enterprise Architect recognizes and uses in its compares) and
- User-defined properties

These property macros provide access to properties defined against the various elements. All property macros have the same syntax, return a string and require the name of the property to be specified.

Syntax: propertyMacroName:"propertyName"

INTERNAL PROPERTIES

tableBoolProperty:"propertyName"

Returns a Boolean representation ("T" or "") of the value for the internal property in the repository's version of the current Table.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

tableProperty:"propertyName"

Returns the value for the internal property in the repository's version of the current Table.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

columnProperty:"propertyName"

Returns the value for the internal property in the repository's version of the current Column.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

columnBoolProperty:"propertyName"

Returns a Boolean representation ("T" or "") of the value for the internal property in the repository's version of the current Column.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

constraintProperty:"propertyName"

Returns the value for the internal property in the repository's version of the current Constraint.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

constraintBoolProperty:"propertyName"

Returns a Boolean representation ("T" or "") of the value for the internal property in the repository's version of the current Constraint.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

constraintColumnProperty:"propertyName"

Returns the value for the internal property in the repository's version of the current Constraint Column.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

constraintColumnBoolProperty:"propertyName"

Returns a Boolean representation ("T" or "") of the value for the internal property in the repository's version of the current Constraint Column.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

viewProperty:"propertyName"

Returns the value for the internal property in the repository's version of the current View.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

procedureProperty:"propertyName"

Returns the value for the internal property in the repository's version of the current Procedure.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

functionProperty:"propertyName"

Returns the value for the internal property in the repository's version of the current Function.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

sequenceProperty:"propertyName"

Returns the value for the internal property in the repository's version of the current Sequence.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

packageProperty:"propertyName"

Returns the value for the internal property in the repository's version of the current database Package.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

odbcTableProperty:"propertyName"

Returns the value for the internal property in the ODBC's version of the current Table.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

odbcConstraintProperty:"propertyName"

Returns the value for the internal property in the ODBC's version of the current Constraint.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

USER DEFINED PROPERTIES

tableUserProperty:"propertyName"

Returns the value for the user-defined property in the repository's version of the current Table.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

columnUserProperty:"propertyName"

Returns the value for the user-defined property in the repository's version of the current Column.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

constraintUserProperty:"propertyName"

Returns the value for the user-defined property in the repository's version of the current Constraint.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

constraintColumnUserProperty:"propertyName"

Returns the value for the user-defined property in the repository's version of the current Constraint Column.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

viewUserProperty:"propertyName"

Returns the value for the user-defined property in the repository's version of the current View.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

procedureUserProperty:"propertyName"

Returns the value for the user-defined property in the repository's version of the current Procedure.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

functionUserProperty:"propertyName"

Returns the value for the user-defined property in the repository's version of the current Function.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

sequenceUserProperty:"propertyName"

Returns the value for the user-defined property in the repository's version of the current Sequence.

Parameters

- propertyName - the property name that is to be retrieved

Remarks

None.

DDL Options in Templates

The DDL Generation Options macros provide a convenient way for the DDL templates to access the generation options.

This list identifies and briefly describes each of the available option macros. Each option has a value of either 'T' for true or an empty string for false.

ddlGenerateToExecuteEngine

Directs the generated DDL to the Execution Engine.

ddlOptionColumnComments

Include column comments in the generated DDL.

ddlOptionGenerateCheck

Include Check constraints in the generated DDL.

ddlOptionGenerateDrop

Include DROP statements in the generated DDL.

ddlOptionGenerateForeign

Include Foreign Keys in the generated DDL.

ddlOptionGenerateFunction

Include Functions in the generated DDL.

ddlOptionGenerateIndex

Include Indexes in the generated DDL.

ddlOptionGenerateLengthSemantic

(Oracle only) Include length semantics syntax on text columns in the generated DDL.

ddlOptionGenerateNullable

Include the keyword NULL against each column if it hasn't been flagged as a NOT NULL column in the generated DDL.

ddlOptionGeneratePackage

(Oracle only) Include Packages in the generated DDL.

ddlOptionGeneratePrimary

Include Primary Key constraints in the generated DDL.

ddlOptionGenerateProcedure

Include Procedures in the generated DDL.

ddlOptionGenerateSeparateConstraint

Generate Table constraints separately to the CREATE TABLE statement; that is, using an ALTER TABLE statement. Note: Some DBMSs do not support separate constraints in all conditions.

ddlOptionGenerateSequence

Include Sequences in the generated DDL.

ddlOptionGenerateTable

Include Tables in the generated DDL.

ddlOptionGenerateTableProperty

Include extended properties on Tables in the generated DDL.

ddlOptionGenerateTrigger

Include Table Triggers in the generated DDL.

ddlOptionGenerateUnique

Include Unique Constraints in the generated DDL.

ddlOptionGenerateView

Include Views in the generated DDL.

ddlOptionHeaderComments

Include header comments in the generated DDL.

ddlOptionTableComments

Include Table comments in the generated DDL.

ddlOptionUseAlias

Use Aliases instead of Names for all objects (object components) as specified on the Generate DDL screen.

ddlOptionUseDatabaseName

Include the USE DATABASE statement at the beginning of each generated file.

ddlUseAlias

Use Aliases instead of Names for all objects (object components) as specified on the Database Builder 'Database Compare' tab.

DDL Limitations

A fundamental feature of a Database Management System (DBMS) is to allow the definition of database objects via a structured language; this language is called DDL (for data definition language, or data description language). The DDL syntax of each DBMS is unique. While there are common DDL statements and keywords across all DBMSs, there are differences that require each DBMS to have its own set of DDL templates within Enterprise Architect.

This page summarizes the main limitations for each of the supported Database Management Systems.

MS Access

- Comments cannot be applied to (or changed in) Tables, Table Columns, Table Constraints or Views, therefore Enterprise Architect ignores these differences
- The CREATE TABLE statement does not support the definition of column defaults, therefore Enterprise Architect excludes the Default definition from all generated DDL; however, it does highlight a Default difference in the comparison logic
- Generally object names in DDL can be enclosed in square brackets ([ ]) so that they can include spaces and other non standard characters, however the CREATE VIEW DDL statement does not support the square bracket notation; the 'Create View' DDL template replaces all spaces with underscore ('_') characters

MySQL

- Comments can only be applied to Indexes and Unique Constraints, when the MySQL version is greater than 5.5.3
- Comments can only be applied to Indexes and Unique Constraints when they are created, therefore changing an Index or Unique Constraint's comment causes the constraint to be dropped and recreated
- Check Constraints are not supported; whilst the MySQL DDL engine can parse such statements, it simply ignores them
- Comments cannot be applied to (or changed in) Views, Procedures or Functions, therefore Enterprise Architect ignores these differences

Oracle

- Comments cannot be applied to (or changed in) Procedures, Sequences or Functions, therefore Enterprise Architect ignores these differences

PostgreSQL

- Currently Enterprise Architect does not support function parameters, therefore any statements (COMMENT ON or DROP) that refer to a function by name will fail because they must use a combination of function name and parameters

SQL Lite

- Constraints cannot be added to an existing Table; the Table must be dropped and created (including the new Constraint in the Create statement)

- Comments are not supported on any object type, therefore Enterprise Architect ignores all remark differences

Import DDL Script

This feature allows you to import DDL scripts from a specified directory in your file system, to create Database Model objects in your Enterprise Architect model. All of the scripts in the directory, whose filename extensions match with those specified will be imported.

The script files will be imported into the currently selected Enterprise Architect package, creating Tables, Views, Columns, Constraints, Procedures, Functions, Sequences and so forth, as defined by the DDL scripts.

Access

Ribbon	Develop > Data Modeling > Import DDL

Import DDL Scripts dialog

Directory	Type in or browse for the name of the directory to import.
Process Subdirectories	Select this check box to include the contents of the subdirectories as well.
DBMS	Select from the drop-down list the DBMS type for which the DDL scripts are applicable.
File Extensions	Type in or select from the drop-down list, the filename extensions to be included in the import. Use a ";" to separate values.
Import	Click the '**Import**' button to begin the import.

Supported Database Management Systems

Enterprise Architect has built in support for a comprehensive range of database management systems, but it also provides the flexibility to extend the product to support other DBMSs. The DDL template editor can be used to define how to generate DDL for an unsupported DBMS, the transformation templates can be used to define a new transformation to a physical model for an unsupported DBMS, and new datatypes can be defined for an existing or new DBMS.

Enterprise Architect provides the modeling constructs and the ability to forward and reverse engineer a database schema for these Database Management Systems:

- DB2 (*)
- Firebird
- MS Access 97, 2000, 2003, 2007, 2013
- MS SQL Server from 2005, all editions including Express and Azure SQL Database
- MariaDB
- MySQL v4, v5
- Oracle from 9i (all editions)
- PostgreSQL (including version 12)
- SQLite
- Informix (#)
- Ingres (#)
- InterBase (#)
- Sybase Adaptive Server Anywhere (Sybase ASA) (#)
- Sybase Adaptive Server Enterprise (Sybase ASE) (#)

(*) - Only compatible for DB2 when hosted in Windows and Linux environments.

(#) - No further development will be undertaken on these DBMSs, as these products are not commonly used by the Enterprise Architect user base. This will allow Sparx Systems to concentrate its efforts on the other areas of Database modeling which are used extensively.

Notes

- To perform data modeling for a particular DBMS, you must have the appropriate data types for that DBMS in your repository; you can download the most up-to-date data definitions from the 'Resources' page of the Sparx Systems web site

More Information

Sparx Systems Enterprise Architect provides information modelers, data modelers, and architects practical tools for creating models that span abstraction levels within an organization: conceptual, logical, and physical.

Conceptual Models: These are technology-independent and aid in discussions with business and domain experts to represent and agree on basic domain concepts.

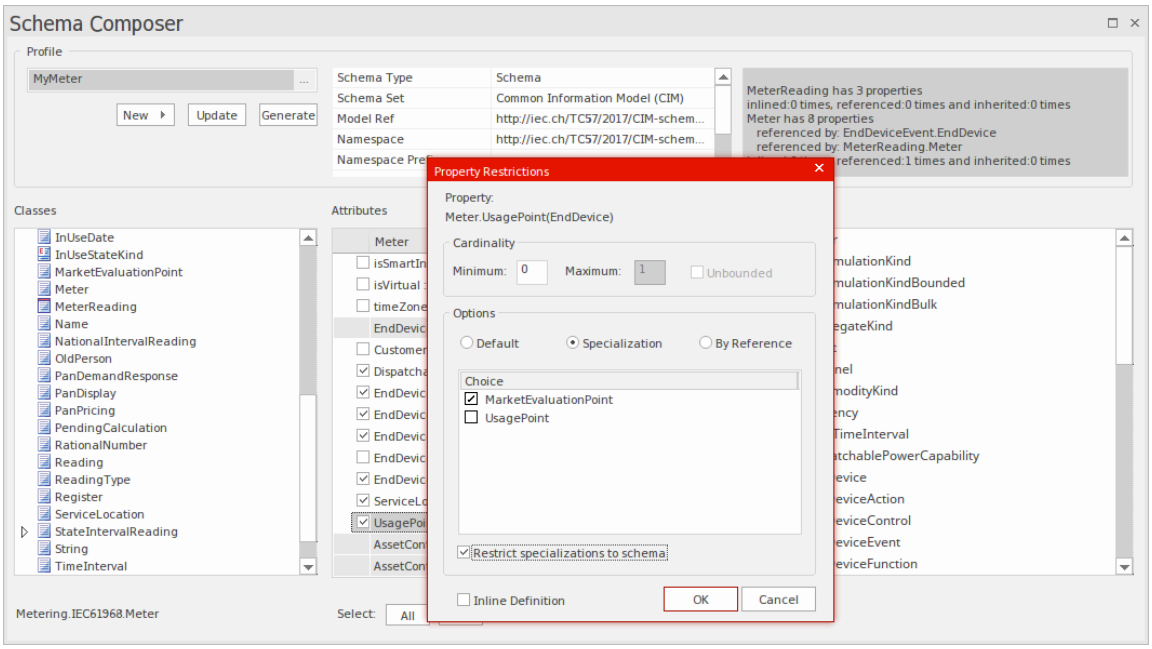
Logical Models: These add detail and precision to conceptual models while remaining technology-neutral, facilitating discussions among information analysts on logical structures.

Physical Models: These apply technology-specific data to models, aiding engineers in making technology decisions for deployment in target environments like database management systems.

Edition Information

The Database Builder is available in the Corporate, Unified and Ultimate Editions of Enterprise Architect.

XML Schema (XSD)



Structural models in Enterprise Architect, especially Class models, are frequently used to define the meta-model of some domain of interest. For example a meta-model can be defined using a Class model to rigidly define the objects, data, relationships and types that make up the domain of Geospatial information. Likewise, models can be (and are) built to describe domains such as Water Management, Health, Retail, Insurance, Car Registration, Entertainment and many more.

These models are extremely valuable and frequently represent a significant investment in time and money by either commercial or standards based organizations. An important part of realizing the benefit of these models, in particular where information must be exchanged between multiple parties, is in the definition of schema (often XSD based) that codify how a message should be formed to be conformant to the underlying meta-model. Traditionally, such message schema are written by hand, based on the meta-model. This is generally a laborious and error prone exercise.

Enterprise Architect has a long history of being associated with the development of both commercial and standards based meta-models, and there are many examples of models defined in Enterprise Architect model files that are used to specify the exact construction of an information domain of interest.

The Schema Composer in Enterprise Architect has been built to take maximum advantage of models stored in an Enterprise Architect model file or repository (or Cloud based server) by streamlining the conversion of model information into schemas that comply with the naming standards and format of a variety of popular industry meta-models. This approach drastically reduces the time taken to form a valid schema and eliminates human error in transcribing model information into schema text.

The current version of the Schema Composer supports XSD generation for a number of technologies, and in addition supports the customization of output by integrating tightly with both the Automation Interface and the Add-In framework. In this manner it is possible to use one of the schema generators supplied 'As-Is' or to write a custom generator using JavaScript, or to go further and fully customize the process by writing a suitable Add-In in a language of choice.

In addition to the new Schema Composer, Enterprise Architect also supports the modeling of XSD and WSDL definitions using UML Profiles that support explicit modeling of the relevant types. This is sometimes necessary when building a complex XSD or WSDL from scratch and needing to have a fully worked out visual model of the final schema. Note that as Enterprise Architect also supports the import of XSD documents, it is possible to produce a schema using the Schema Composer, and then for documentation and visualization purposes (or even for further customization), import that schema back into either the current or a different model.

Additional topics included in the Schema Engineering section are devoted to the Meta Object Facility (MOF), the Ontology Definition Metamodel (ODM) and the National Information Exchange Model (NIEM). The section on NIEM is quite extensive, as Enterprise Architect includes many features necessary to model and work with NIEM domains and

schema. As with some of the other technologies, there is in addition a downloadable version of the NIEM core as an Enterprise Architect model.

The Schema Composer

Seamlessly Model Schema Compliant Message Definitions in a Simple and Productive Tool

The Schema Composer is a versatile tool for quickly and easily defining a variety of formal schema from a model. Due to the unique nature of the Schema Composer, it is not necessary to use a profile or stereotyped elements when building the definition of an XSD (or other) document. This greatly enhances the re-usability of the underlying model and helps alleviate the complexity that arises when dealing directly with XSD or other element types and restrictions.

Many industries have worked hard over the last decade to define shared meta-models specific to their industry, and it is these models that now form the basis for contractual information sharing across organizations and across geographic borders. A typical usage scenario of the Schema Composer is in the creation of message definitions (schema) to exchange information between organizations, ensuring that such messages comply with the underlying meta-model that has been adopted by the involved parties.

When information is shared between organizations, it is frequently the case that only a subset of the full meta-model is required, but it is essential that what is shared conforms precisely to the agreed meta-model. In this case the Schema Composer is the perfect tool for deriving contractual schema based on sub-sets and restricted data sets that take a 'slice' through the meta-model as a whole.

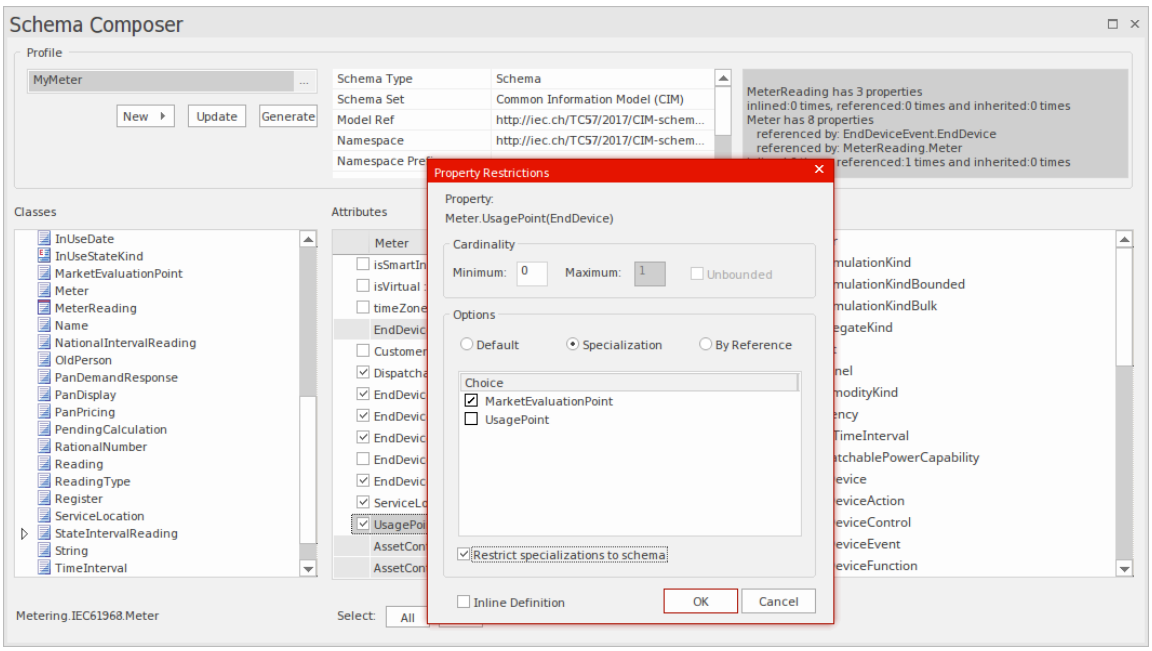
The Schema Composer avoids the common 'pain points' of working with XSD and other schema languages directly:

- There is no need to create a relatively complex XSD model composed of specific XSD elements, in addition to your 'normal' business and data models, to define the required data, its associations and references, and any restrictions or conditions
- You do not need to understand how to use the XSD elements and apply the XSD naming rules and conventions to correctly construct such models; formatting and naming rules as specified by the supported standards are automatically taken care of

The Schema Composer greatly simplifies the process of creating standards compliant schema in a re-usable and accessible manner. In this illustration, you can see how a simple Class diagram is used as the source for the Schema Composer to generate XML Schema.

The Schema Composer is supported in the Corporate, Unified and Ultimate Editions of Enterprise Architect

Schema Composer



This figure shows a Schema Composition for the Process Order domain in the Example model.

Access

Ribbon	Develop > Schema Modeling > Schema Composer > Open Schema Composer

Benefits

The Schema Composer:

- Operates on a Class model rather than an XML schema profile
- Relieves you of the XSD-specific design and schema generation decisions, whilst still ensuring consistency across the profile
- Can operate on a generic Class model to provide generic XSD documents
- Is most useful when operating on industry standard Class models that have specific domain based meaning
- In most circumstances operates on a full model from which a subset of properties from selected Classes are drawn to build specific messages, to communicate only what is necessary for the information to send or request
- For standards such as NIEM, will generate a new sub-model as part of a broader NIEM compliant schema definition

Standards that the Schema Composer currently supports include:

- The Common Information Model (CIM)
- National Information Exchange Modeling (NIEM)
- United Nations Center for Trade Facilitation and Electronic Business (UN/CEFACT) Modeling Methodology (UMM), specifically the Naming and Design Rules (NDR) 2.1 and 3.0
- Universal Business Language (UBL), specifically the Naming and Design Rules (NDR) 3.0

The Schema Composer also helps you to build a definition of the same message using different formats such as:

- XSD
- RDFS
- JSON

In addition the Schema Composer:

- Supports formats implemented using a custom Add-In that takes advantage of the Schema Composer automation interface
- Has built-in support for various serialization formats and styles used by different industry models

Schema Composer Profiles

Schema Composer profiles are the configuration files that describe the elements and restrictions that will make up a particular schema or sub-model. Profiles are generally tied to a particular technology such as the Common Information Model (CIM) or the UML Profile for Core Components (UPCC), and the interpretation of the material within the Profile and the nature of the schema or sub-model published will be dependent on the technology-specific generator used. While Enterprise Architect supports a number of technologies 'out of the box' (and more are planned), it is also possible to customize the process by taking advantage of the extensive automation interface in Enterprise Architect to leverage the rich content of Schema Composer Profiles under your own terms, either in an Add-In or script.

Schema Profiles

A Schema Composer profile comes in two forms. Each form fulfills a particular system requirement - Schema generation (xsd, rdfs, json) and sub model creation. When you create a profile in the Schema Composer you choose which form to use based on your needs. A single profile in the Schema Composer can be used to either compose a schema, *in its common forms,* or create a UML sub-model from a core model.

Profile Types

Type	Description
Model Transform	A profile of this type is used to generate a sub-model from a core model.
Schema	A profile of this type is used to generate a schema; typically an XSD schema representing messages, but also other formats such as JSON object notation and resource descriptor formats.

Schema Composition Methodologies

National Information Exchange Model (NIEM)

Enterprise Architect provides a NIEM framework and Schema Composer for generation of sub-model and XML schemas.

Common Information Model (CIM)

Enterprise Architect Schema Composer supports provides the CIM standard out of the box, for composition of CIM compliant schema.

Universal Business Language (UBL)

Enterprise Architect provides a Universal Business Language framework, and the Schema Composer which provides the UBL standard for schema generation.

Core Component Technical Specification (CCTS) UN/CEFACT

Enterprise Architect provides a UML Profile for Core Components framework and Schema Composer. The Composer can generate business components libraries from core component libraries and simplifies the composition / publication of schema from message assemblies / business information entities.

Generic

Where a standard does not meet your requirements, the generic option provides a simpler choice for quick schema composition from your UML model. Typically you will model your own data library using UML Classes with attributes, associations, Aggregation and Inheritance. You can then use this model as the input to the Schema Composer.

EA Script Engine

Enterprise Architect provides a scripting engine that supports JavaScript, VBScript and JScript languages. The scripting engine is also integrated with the Schema Composer. When generating a schema, either for a particular standard or generic scheme, a script can be employed to perform the operation on its own or as a supplement to the options provided by the standard.

EA Add-In

Enterprise Architect provides Add-In integration with the Schema Composer. An Add-In can participate in the generation of the sub model or schema by registering its interest with Enterprise Architect. The Add-In can provide options and alternatives to be listed in the 'Schema Generation' dialog, and will be invoked should its options be chosen. The Add-In can access the content of the profile using the Schema Composer automation interfaces.

Create a Schema Profile

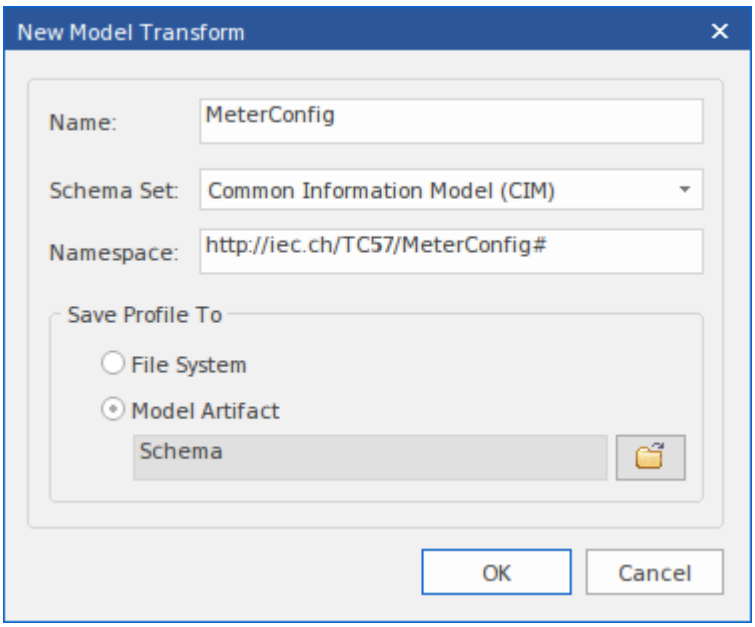
A schema profile identifies the name, technology and content of the schema as a precursor to defining how the schema is generated. You can create and edit as many schema profiles as you need. Schema profiles are bound to a single technology and will either map to a generated schema or a sub-setting transform.

Access

Ribbon	Develop > Schema Modeling > Schema Composer > Open Schema Composer

Creating a new Profile

If you are creating a schema for a particular technology, start by opening a model that has the required meta-model loaded. Sparx Systems make a number of meta-models available when using the Model Builder and/or the Sparx RAS/Cloud services. Follow these steps to build a new Profile. With the Schema Composer displayed, click on the 'New' button and select the profile type, either Schema or Transform.



The New Profile Screen

Option	Action
Schema Set	Select the standard to use, or choose the 'Generic' option.
Namespace	Depending on the standard you have selected this field might take an automatic value or remain blank. Provide a relevant namespace if blank. Refer to the next section for a description of how namespaces are managed in the Schema Composer.

Save profile To:	Profiles can be stored in the file system or in the model. Profiles stored in the model can be shared with others, while file system profiles are private.
OK	Click on this button to edit the new schema in the Composer.

Namespaces

When a new profile is created, you specify the target namespace and the namespace prefix. Schemas typically involve multiple namespaces and the Schema Composer provides support for this within a single model. The scheme by which namespaces are identified is the presence of two specific properties on a Package. The properties are 'URI', which specifies the namespace, and 'Alias', which provides the namespace prefix. The properties can be present on the immediate Package or a parent Package. When present, elements of the Class will take that namespace. Where no namespace exists, Classes will take the target namespace specified when the profile was created.

Save the profile

Click the Update button to save the profile you have just created.

Notes

- The process of creating and generating schema for NIEM has additional notes in the *NIEM* Help topic
- The Schema Composer is supported in the Corporate, Unified and Ultimate Editions of Enterprise Architect

Schema Compositions

A schema composition refers to a restricted set of elements taken from the model that together describe a unique entity that has no equivalent in the model. Commonly, schema compositions are used to generate schema files such as XSD files. In contrast, model compositions are used to configure the material as the basis of a subset 'transform' - for example when creating a NIEM model subset.

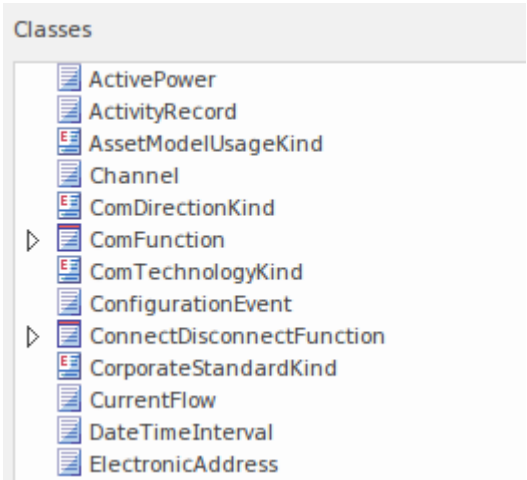
Define Schema Content

These steps walk you through the basic procedure of composing types in a Schema profile and show how you can restrict the content of elements to meet the message requirements.

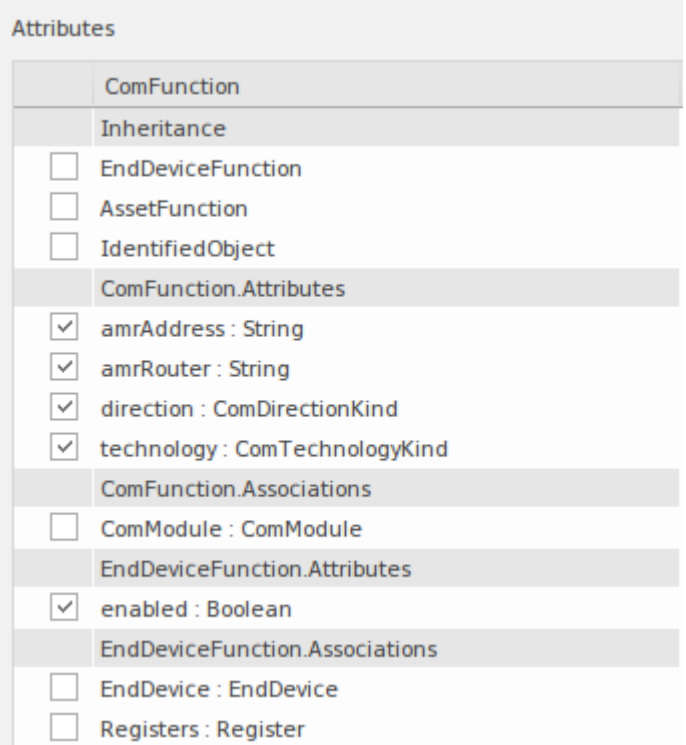
Add Classes

Drag the required Class elements from the Browser window into the 'Classes' panel. As you add a Class:

- Its ancestry is listed in the 'Inheritance' section in the middle panel
- Its attributes are listed under the 'Inheritance' section, with a blank checkbox against each one; Association and Aggregation entries are named according to the role name on the connector
- Its model structure path is shown underneath the 'Classes' panel

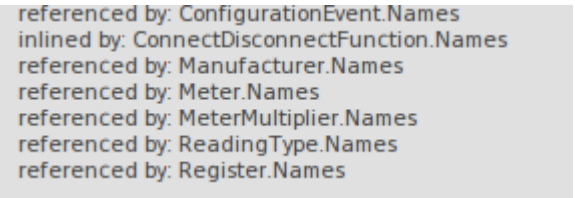


Select Properties



Any time you select a Class in the 'Classes' list, its attributes and model ancestry are listed in the 'Attributes' list. Select the checkbox against each attribute to define the elements of this type. When chosen, the attribute's type is added automatically to the schema, appearing in the 'Classes' list and the 'Schema' panel to the right.

When an attribute is unchecked, the type is not automatically removed. Types can be removed using the Class context menu. It is worth noting that each time a Class is selected, all references to the Class are displayed in the status panel, enabling you to quickly review any Class usage.



Inheritance

If you favor or foresee a need for inheritance in the schema you are preparing, it would make sense to begin the composition with ancestors first, then re-use these as child Classes are added. The method is not set in stone. You can switch from an inheritance model to an aggregated composition or vice-versa at any time. Here is a brief description of the provision of inheritance in the Schema Composer.

The Schema Composer offers flexibility in dealing with inheritance. For example, you can choose to aggregate selected attributes from the Class and its parent, while choosing to inherit the grandparent. However, when you choose to use inheritance, you choose to inherit the restricted form of that type as well. When an ancestor is selected in this list, the generated XML schema would show an extension element identifying this ancestor. Only one ancestor can be selected.

Click on the Update button to validate and save your schema profile.

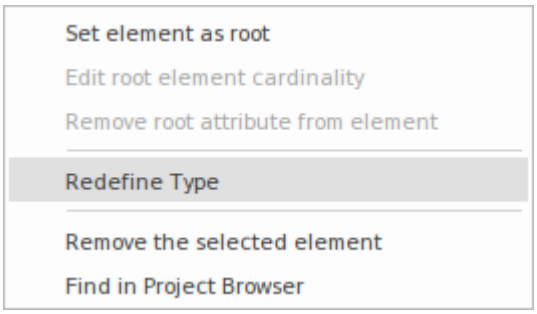
If there are any problems with the profile, they are identified in the status panel in the top right of the screen.

Redefined Types

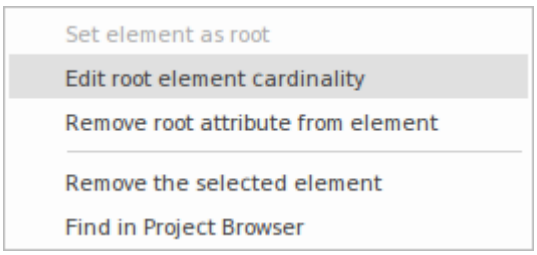
One of the common issues with schema composition is the requirement to be able to vary a type description to meet various demands of the instances a schema describes. A vehicle, for example, might be described by its *brand, model*

and price by an element of a *Truck* type, but by its *year, model and color* by an element of a *Sedan* type. The issue is that we might only have one actual *Vehicle* Class at our disposal. To address this the Schema Composer allows you to clone the *Vehicle* Class and give it another name. You can then assign this version of *Vehicle* to any property that has *Vehicle* as its type. The type created is only available within the domain of the schema - the model is untouched.

To create a new definition of a type, select the Class first in the 'Classes' list, then right-click on it and choose the 'Redefine Type' option. Enter a unique name for this type and press the Enter key. You can then define or restrict this type independently, the way you would for any Class.



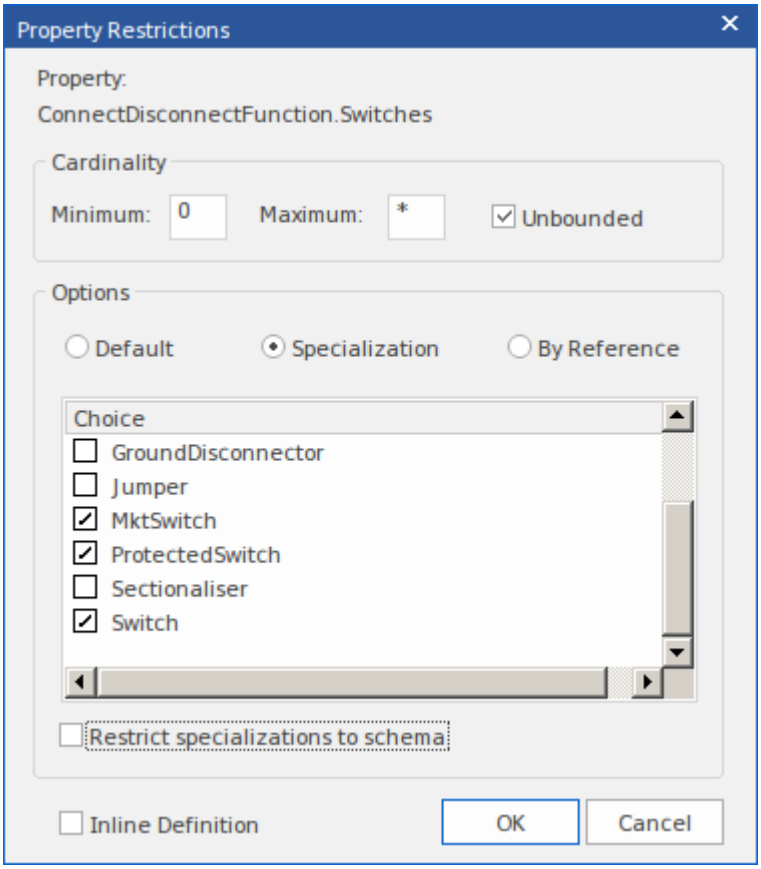
Root elements



When the schema is generated, a single top level element representing the message is generated. The body or elements of this top level element are the Classes marked as root elements. The cardinality of these root elements can be adjusted. To mark a Class as a root element or restrict its cardinality, right-click on the Class in the list and use these context menu options:

- Set element as root - root elements form the body of the top level element representing the message / profile
- Edit root element cardinality - set the minimum and maximum number of instances
- Remove root attribute from element - removes the root mark from the Class
- Remove the selected element - delete the selected element from the schema
- Find in Project Browser - locate and highlight the element in the Browser window

Property Restrictions



In the 'Attributes' list, right-click on a selected property and use the context menu to add, edit or remove a property restriction. Use this feature to:

- Modify the property cardinality
- Redefine the type of the property
- Enable and limit the choices available for this property
- Mark a property to be emitted as an inline element definition
- Mark a property to be emitted 'By Reference'

Cardinality

The cardinality of a property can be further restricted from its model counterpart, but it cannot be less restrictive. The cardinality can be changed for any root element Class and any Class property.

Type redefinition

When a Class is redefined within the Schema Composer it creates a new type. The new type is a clone of the original, but has a name that is unique to the schema. A Payment enumeration type, for example, might be redefined as a CardPayment to better suit the schema purpose. The new type is a restriction of the original in that no new attributes can be added to it. Other properties that share this type and be similarly restricted by specifying the new type in their restriction dialog. Redefined types such as sub types can be offered as additional choice elements in the restriction of other properties.

Specializations

Where specializations of a property's type are present, those subtypes will be available in the 'Restriction' dialog. When more than one specialization is selected, these will appear as choice elements in the schema. When only one is chosen, the property will exhibit this subtype in the schema.

Inline Elements

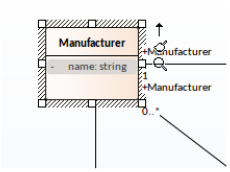
A property type will be emitted as an inline definition when this box is checked.

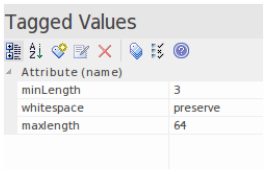
By Reference

A property will take the 'By reference' form when emitted in the schema. The 'By reference' form emits an inline complexType that defines a single attribute named 'ref' of type 'string'.

Property Constraints - Facets

Facets are supported in the Schema Composer Generic Profile. The sources of facets are the Tagged Values on a property. Tagged Values are recognized as facets if they name a constraining facet from the XML Schema specification; JSON validation keywords are also recognized.






```
<xs:complexType name="Manufacturer">
    <xs:sequence>
        <xs:element name="name" minOccurs="1" maxOccurs="1">
            <xs:simpleType>
                <xs:restriction base="xs:string">
                    <xs:maxLength value="64"/>
                    <xs:minLength value="3"/>
                    <xs:whiteSpace value="preserve"/>
                </xs:restriction>
            </xs:simpleType>
        </xs:element>
```

Constraining Facets from XML Schema:

- length
- minLength
- maxLength
- pattern
- enumeration
- whiteSpace
- maxInclusive
- maxExclusive
- minExclusive
- minInclusive
- totalDigits
- fractionDigits

Validation keywords in JSON:

- Number and integer
  - multipleof
  - minimum
  - maximum
  - exclusiveMinimum
  - exclusiveMaximum
- strings
  - minLength
  - maxLength
  - pattern

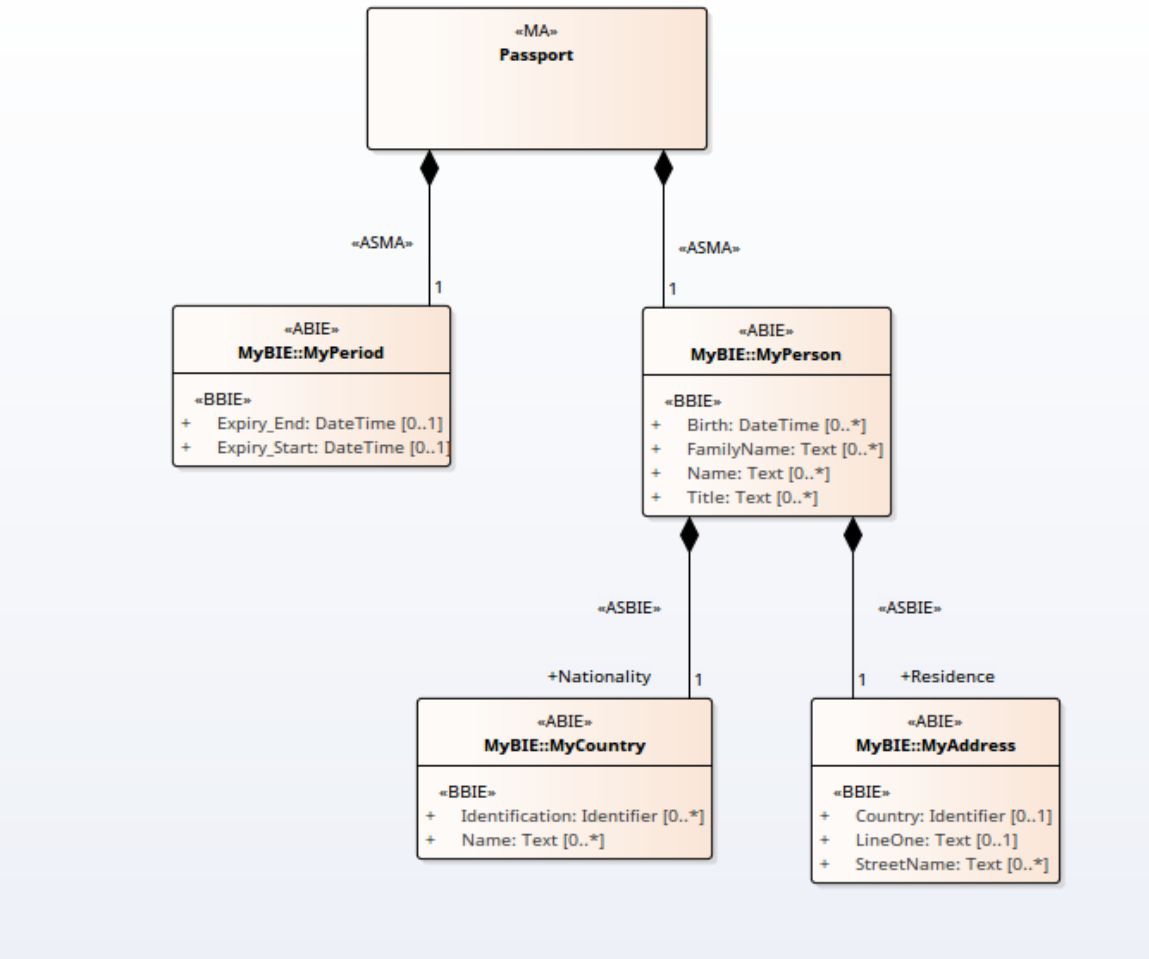
- arrays
  - minItems
  - maxItems
  - uniqueItems

Class Diagrams

The Schema Composer also supports the creation of simple XSD and other formats from generic UML Classes. This is particularly useful when there is a need to export a Class definition in a generic manner for consumption by a script or web based tool, for example.

Generating schema from Class diagram

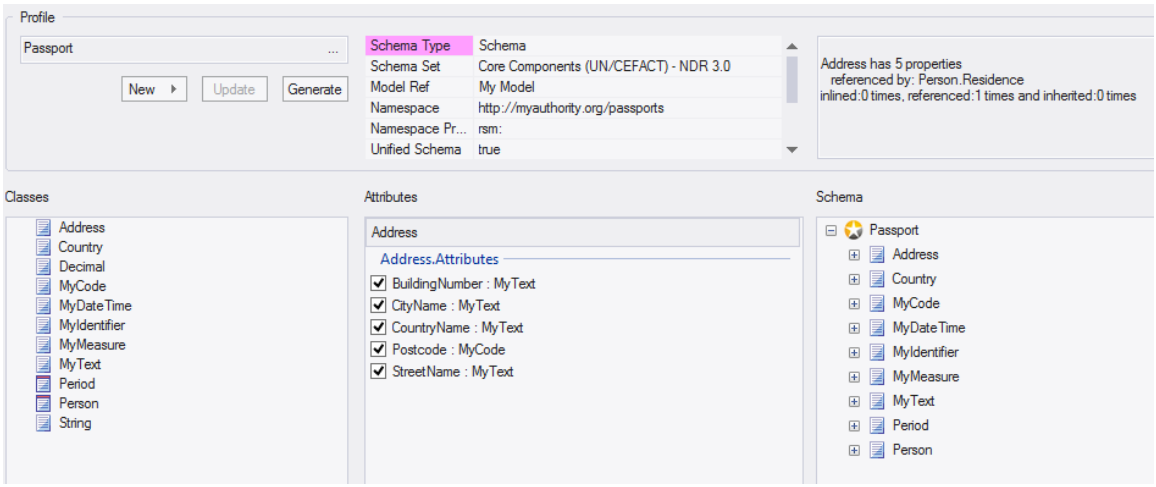
Users who prefer to use a modeling approach in composition can also use the Schema Composer for the generation of their chosen format(s). Any Class diagram can be loaded into the Schema Composer. This image illustrates a message composed using the UML Profile for Core Components, but it is not necessary for the message to be modeled according to a particular UML profile.



Loading the message into the Composer

The message is loaded into the Composer by selecting a Class on the diagram that represents the message and using its context menu to present the diagram as a schema in the Schema Composer. The selected Class will become the root element of the message and its relationships will shape the schema that is loaded.

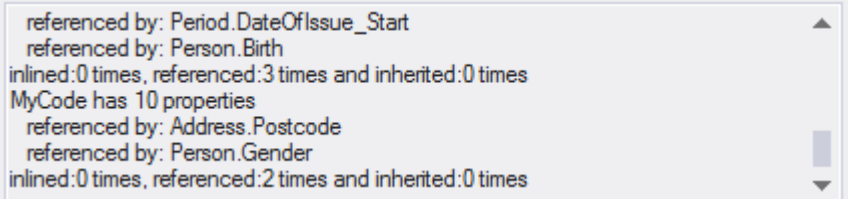
This is the Class diagram loaded into the Schema Composer


Profile
Passport
New
Update
Generate
Schema Type
Schema
Schema Set
Core Components (UN/CEFACT) - NDR 3.0
Model Ref
My Model
Namespace
http://myauthority.org/passports
Namespace Pr...
rsm:
Unified Schema
true
Address has 5 properties
referenced by: Person.Residence
inlined:0 times, referenced:1 times and inherited:0 times
Classes
Address
Country
Decimal
MyCode
MyDateTime
MyIdentifier
MyMeasure
MyText
Period
Person
String
Attributes
Address
Address.Attributes
BuildingNumber : MyText
CityName : MyText
CountryName : MyText
Postcode : MyCode
StreetName : MyText
Schema
Passport
Address
Country
MyCode
MyDateTime
MyIdentifier
MyMeasure
MyText
Period
Person

Schema Analysis

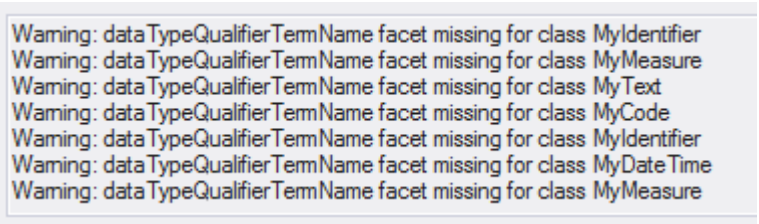
Analysis on the go

The Schema Composer performs analysis of each type as it is added to the schema, and whenever the Class is selected. The System Output window will show how many, if any, references exist for the type, the number of times it is inherited and other helpful information. This illustration shows a message detailing the elements that are referencing the selected Class.



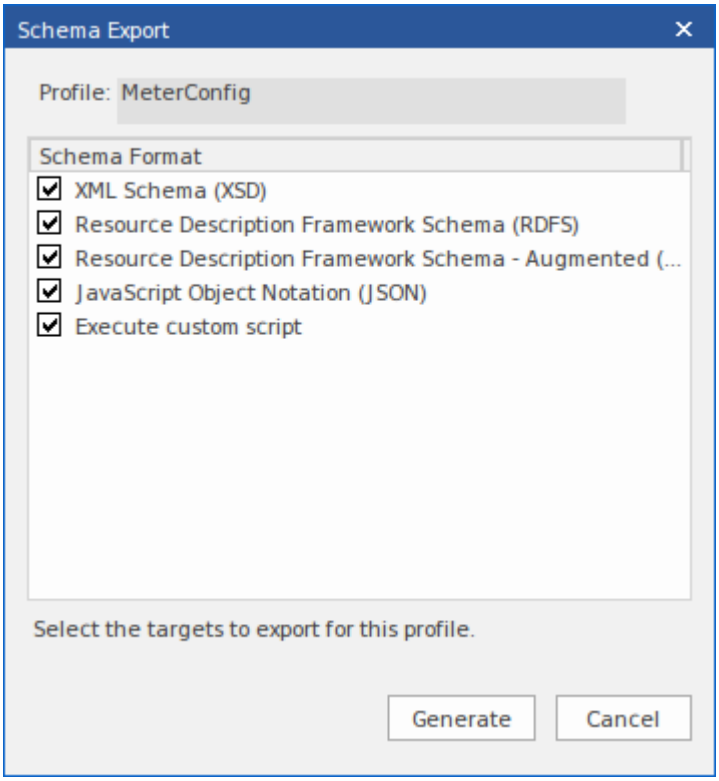
Validation on the go

The Schema Composer performs specific validation for a technology should one be assigned. This image shows warnings about missing Tagged Values for Classes in a schema built on the UN/CEFACT Core Components standard.



Generate Schema

Having designed a profile, at any stage, with a minimum of definitions and customizations, you can quickly and easily generate the schema or sub-model. Depending on the technology chosen and the profile type (schema or transform), the formats presented to you will vary. Note multiple formats can often be generated at once. And, of course, you can repeat the process easily, as the composition evolves or after design changes to the model.



Access

Ribbon	Develop > Schema Modeling > Schema Composer > Open Schema Composer : Generate

Notes

- The Schema Composer is supported in the Corporate, Unified and Ultimate Editions of Enterprise Architect

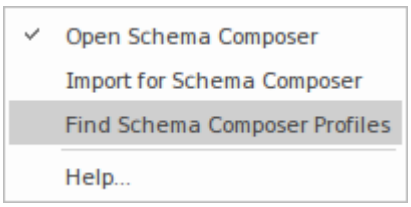
Select a Schema Profile

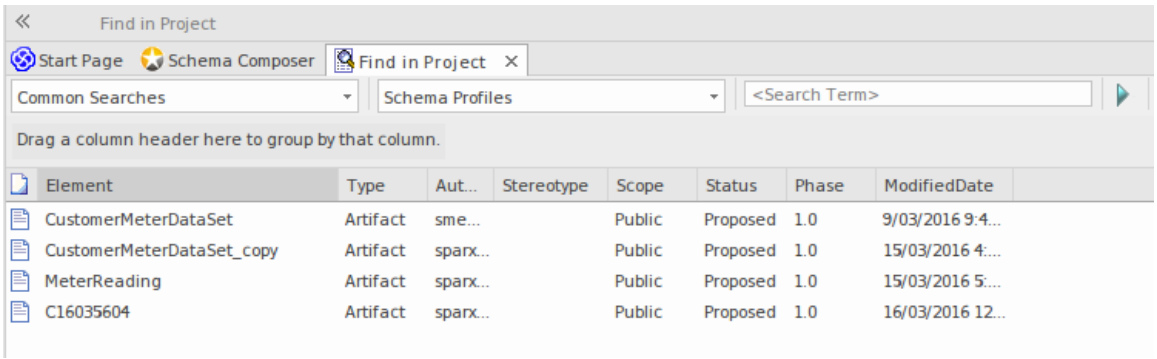
Access

Ribbon	Develop > Schema Modeling > Schema Composer > Find Schema Composer Profiles Develop > Schema Modeling > Schema Composer (icon)

Locating Schema Profiles in the Model

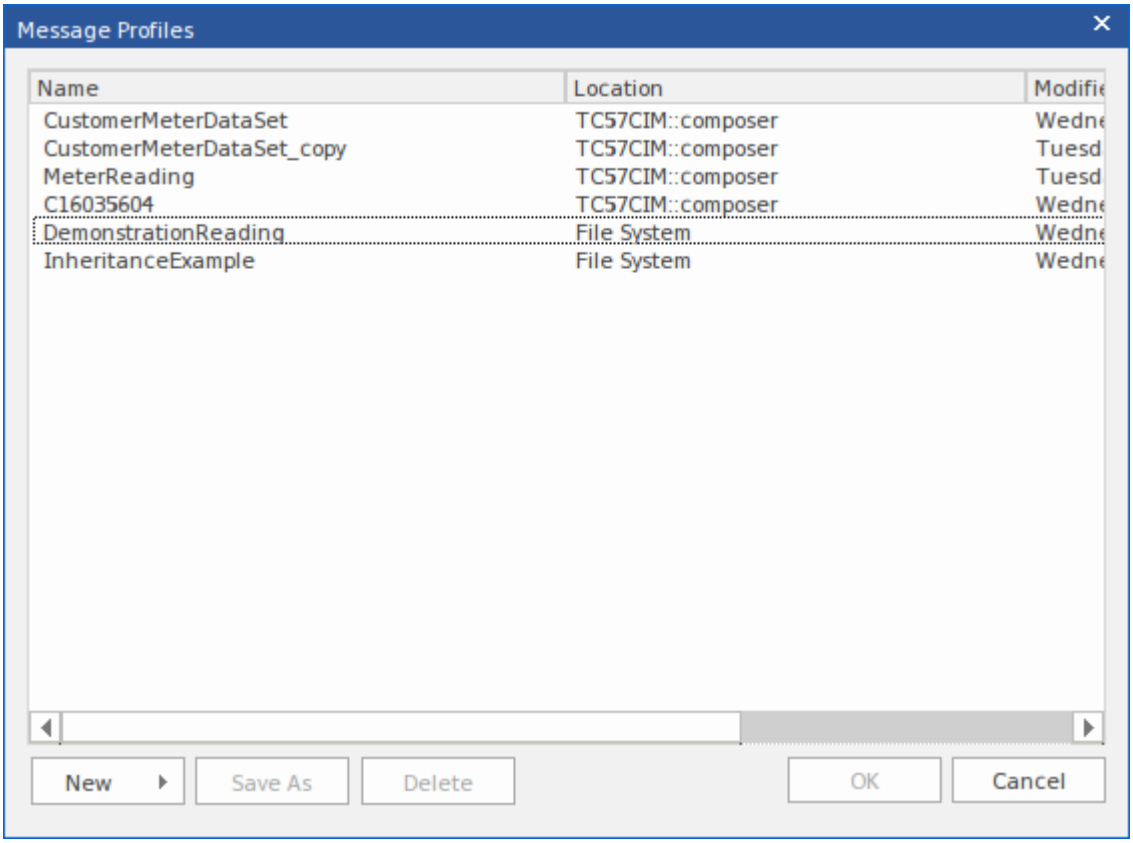
Schema profiles can be located quickly from the Schema Composer drop-down menu in the ribbon. The menu provides quick access to the existing profiles in the model.





Locating Schema Profiles in the Schema Composer

Schema profiles can stored in either the model and file system. You can easily locate every profile by authored in your model by opening the Schema Composer and clicking the select profile button (the button with the ellipsis '...') This brings up a list of all the profiles for this model and indicates where they live; the model or the file system. You might have many Enterprise Architect models that you work with, but only those file system profiles that relate to the open model will be listed.


Message Profiles
Name
Location
Modifie
CustomerMeterDataSet
TC57CIM::composer
Wedne
CustomerMeterDataSet_copy
TC57CIM::composer
Tuesd
MeterReading
TC57CIM::composer
Tuesd
C16035604
TC57CIM::composer
Wedne
DemonstrationReading
File System
Wedne
InheritanceExample
File System
Wedne
New
Save As
Delete
OK
Cancel

Generate Schema File

Having defined a schema profile and added the necessary elements and restrictions, you can quickly and easily generate the schema(s). XML schema generation is available in all technologies, but each technology might support additional formats.

Access

Ribbon	Develop > Schema Modeling > Schema Composer > Open Schema Composer : Generate

Schema Formats

Select the checkbox against each schema format to export.

Schema Format	Details
CIM	• XML Schema (XSD) • Resource Description Framework Schema (RDFS) • Resource Description Framework Schema - Augmented (RDFS) • JavaScript Object Notation (JSON) • Execute Custom Script
UN/CEFACT NDR 3.0	• XML Schema (XSD) • Execute Custom Script
UN/CEFACT NDR 2.1	• XML Schema (XSD) • Execute Custom Script
Generic	• XML Schema (XSD) • Resource Description Framework Schema (RDFS) • JavaScript Object Notation (JSON) • Execute Custom Script
UBL 2.1	• XML Schema (XSD) • Execute Custom Script
Execute Custom Script	Although the Schema Composer can generate schema for a number of recognized standards, it also features a scripting solution for those users who want control over the format and medium of the schema. When you specify a script to the generator, it is referring to a language script such as JavaScript that exists in your model. How and what the script produces is pretty much up to you. How the script accesses the schema in the Schema Composer is documented in the Schema Composer Scripting Integration.

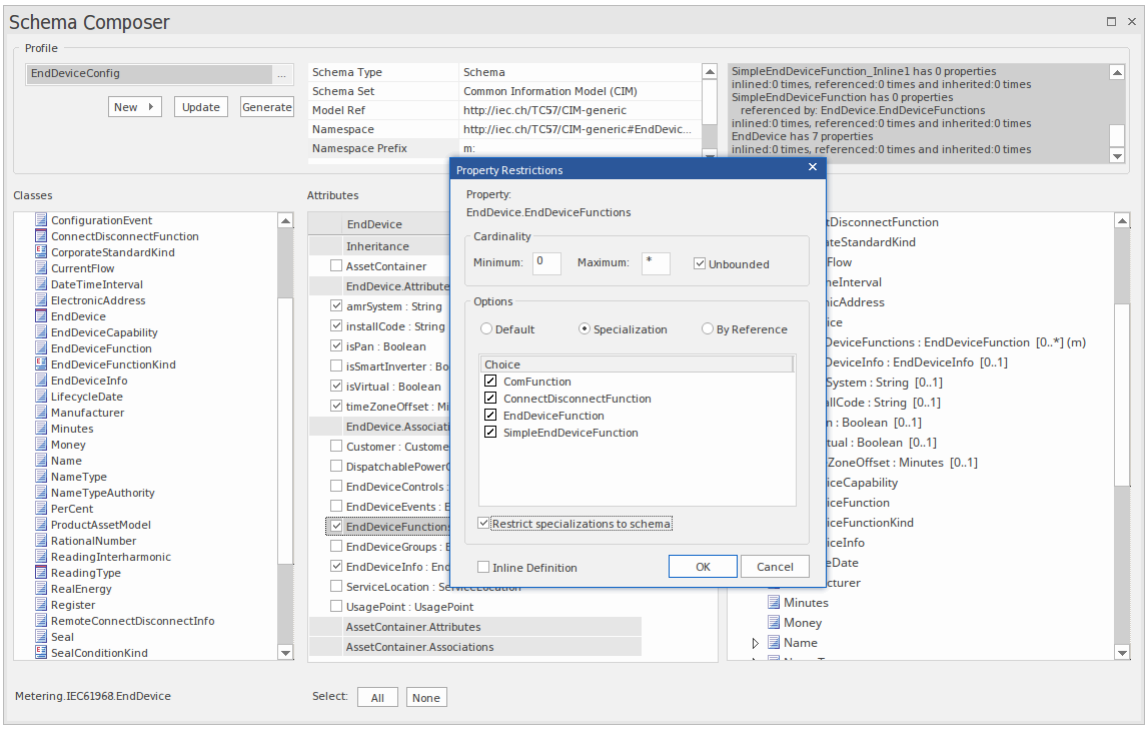
Generate

Click on this button to generate the schema.
Use a file browser to locate and open the schema files.

Notes

- You can edit and validate XML documents including XSD schema, using Enterprise Architect
- You can set Enterprise Architect as the default document handler for XML documents

CIM Schema Guide



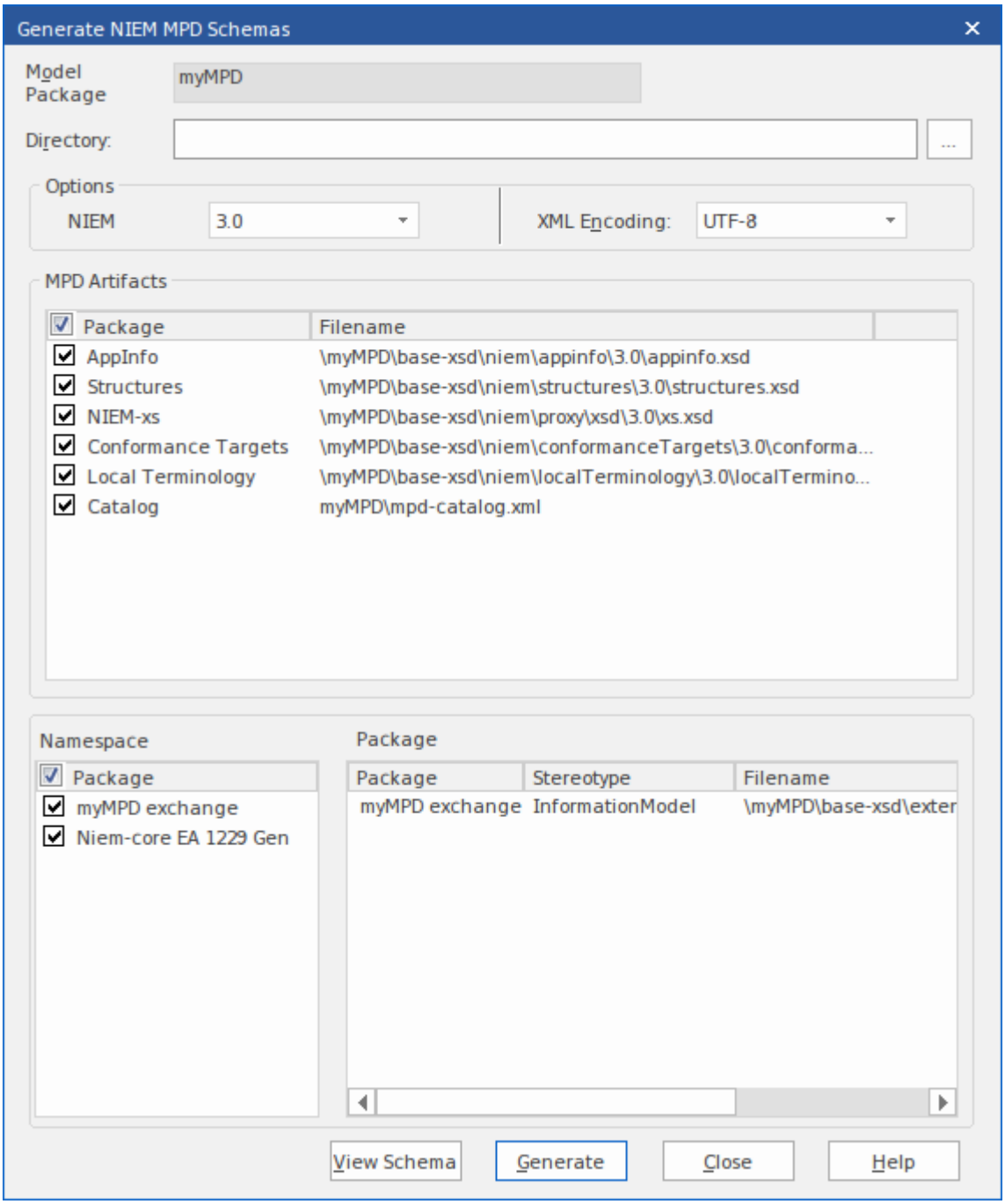
This guide describes the creation and generation of a CIM compliant XML Schema.

Create a CIM message

Step	Action
1	Display the Schema Composer.
2	Click 'New | Schema'.
3	Enter a unique name for this CIM schema (message).
4	Select the Common Information Model.
5	Drag the initial CIM Class(es) into the Class window that best represents the message. Set *root* elements appropriately using the context menu.
6	If you want to compose this type using inheritance, select a single ancestor from the inheritance list.
7	Use the checkboxes on the attributes of each Class to define the set of properties that will describe this message or schema.
8	Apply restrictions to elements using the context menu on the property.
9	Click update to save the message.
10	Click the Generate button and choose the schema formats to export.

NIEM Schema Guide

Generation of schema for NIEM is accomplished on either an instance of a ModelPackageDescription Class (NIEM 3.0 and above) or a «ModelPackageDescription» stereotyped component (NIEM 2.1). In either case a dialog is presented that allows you to configure the schema produced.



Generate NIEM Schemas (NIEM 2.1)

Click on a component with a «ModelPackageDescription» stereotype and select one of these options:

Ribbon	Specialize > Technologies > NIEM 2.1 > Generate NIEM 2.1 Schema or

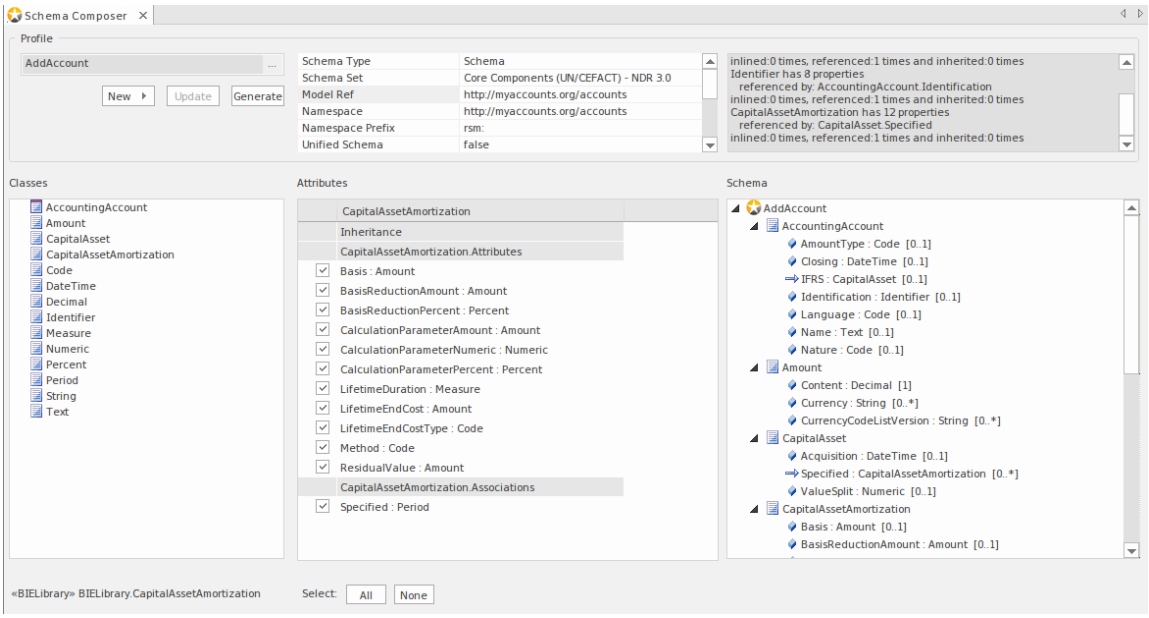
Context Menu	Right-click on the element | Specialize | NIEM 2.1 | Generate NIEM 2.1 Schema

Generate NIEM Schemas (NIEM 3.0 and above)

Click on any object instance of a ModelPackageDescription Class and select one of these options:

Ribbon	Specialize > Technologies > NIEM > Generate NIEM Schema
Context Menu	Right-click on the element | Specialize | NIEM | Generate NIEM Schema

UPCC Schema Guide



This guide describes the composition and generation of a UPCC compliant XML schema.

Creation of UPCC Schema

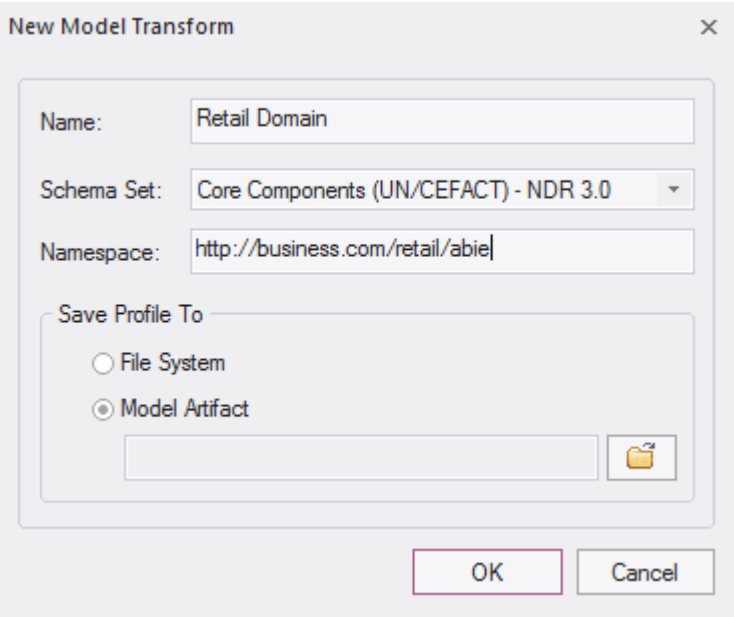
Step	Action
1	Display the Schema Composer.
2	Click 'New | Schema'.
3	Enter a unique name for the schema.
4	Select the UPCC Naming and Design rules to use, from the list of standards.
5	Drag one or more <ABIE> components from a <BIE library> into the Class list.
6	Set the Class as a root element using the context menu.
7	Select required attributes (Referenced types are added to the schema).
8	Click on the Update button to save changes.
9	Click on the Generate button and select 'XML Schema'. Click on the OK button.

Model Compositions

The model composition feature of the Schema Composer is useful for creating a sub-model from a core model. This can be as simple as generating a single business Package from a core Package (*CDT library to BDT library transform in UN/CEFACT Core Components standard)* or creating a complete sub-model from a large core model.

The enormity of such a task can be daunting and error prone; *ensuring every type that is referenced by the sub-model is included by the sub-model,* for example. The Schema Composer addresses this problem by automatically working out the dependencies and adding them to the schema for you where necessary.

Create Transform

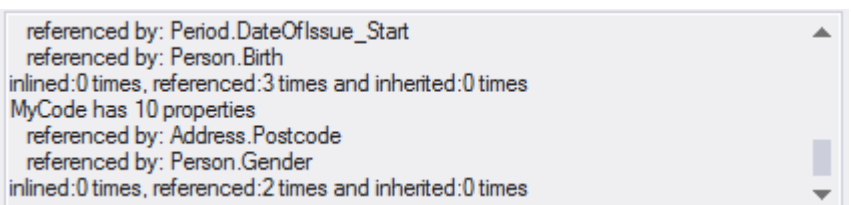


Define Model Content

Content is added to the model by dropping Classes from the model on to the Schema Composer Class window and choosing which properties to include. The resultant type can mirror the core type or a provide a simpler classification. When a property is included, the Schema Composer will check the property type and if the type is missing will add it to the schema automatically.

Reference checking

When a property is excluded that was previously included in the schema and is no longer referenced, the property type is not automatically removed. However, the Schema Composer will always show the number of references for a type if you select it in the Class window. Types that show no references at all can easily be removed.



Summary

The process of composing a sub-model is summarized here:

1. Create a Schemer Composer Transform Profile
2. Create elements by dropping Classes from the model into the schema.
3. Include / exclude required properties.
4. Generate the sub model.

Access

Ribbon	Develop > Schema Modeling > Schema Composer > Open Schema Composer : New > Transform

Generate a Model Subset (Transform)

Having defined the content of your sub-model or library and applied any restrictions, you can now generate the model. The model transforms that can be performed depend on the technology associated with the profile. Each technology and the transforms it supports are listed here:

Access

Ribbon	Develop > Schema Modeling > Schema Composer > Open Schema Composer : Generate

Model Transform

Select the model transform(s) to run.

Transform Option	Description
NIEM	**NIEM Model Subset** This option will generate a NIEM Model Subset containing the schema described by the profile. When you click on the OK button, you will be prompted to select the target Package for creation of the subset. The <<Namespace>> Packages that make up the subset will then be created at this location. If any of the subset Packages already exist at this location, their content will be added to. All subset Packages will have the 'defaultPurpose' Tagged Value set to 'subset'. **Execute custom script** A user defined language script such as JavaScript will be executed. The script can obtain access to the profile using the Schema Composer automation interfaces.
Generic	**Generic model Subset** You will be prompted for a target Package. This will be populated with the types from the schema. If a qualifier is entered this will be applied to the Classes generated. Any restrictions in the schema will also be applied. Types that exist in the target Package will be overwritten. New properties will be added. Types or properties that exist in the target but that no longer exist in the profile will not be removed by this process. **Execute custom script** A user defined language script such as JavaScript will be executed. The script can obtain access to the profile using the Schema Composer automation interfaces.
UN/CEFACT NDR 3.0	**BDT Library** A Business Datatype Library will be populated from core datatypes listed in the profile. Stereotypes will be transformed according to the CCTS specification. The types could be more restricted than their core counterparts. Properties of datatypes that exist will be overwritten. New properties and types will be added to the library. Types are matched by name and stereotype.

	Types or properties that exist in the target but no longer exist in the profile will not be removed by this process. **BIE Library** A Business Information Entity library will be populated from aggregated core components. listed in the profile. Stereotypes will be transformed according to the CCTS specification. Properties of datatypes that exist will be overwritten. New properties and types will be added to the library. Types are matched by name and stereotype. Types or properties that exist in the target but no longer exist in the profile will not be removed by this process. **Execute custom script** A user-defined language script such as JavaScript will be executed. The script can access the profile using the Schema Composer automation interfaces.
UN/CEFACT NDR 2.1	**UDT Library** Performs an unqualified copy of selected core datatypes to a UDT library. **QDT Library** A Qualified Business Datatype Library will be populated from core datatypes listed in the profile. The names of the resultant types will be qualified by the named qualifier in the profile. Stereotypes will be transformed according to the CCTS specification. Properties of datatypes that exist will be overwritten. New properties and types will be added to the library. Types are matched by name and stereotype. **BIE Library** A Business Information Entity library will be populated from aggregated core components listed in the profile. Stereotypes will be transformed according to the CCTS specification. Properties of datatypes that exist will be overwritten. New properties and types will be added to the library. Types are matched by name and stereotype. **Execute custom script** A user-defined language script such as JavaScript will be executed. The script can obtain access to the profile using the Schema Composer automation interfaces.

Generate

Click on the OK button to generate the schema. When the generation is complete, the message *Export of profile <name> completed* displays.

You can then expand the Package in the Browser window to see the generated UML model.

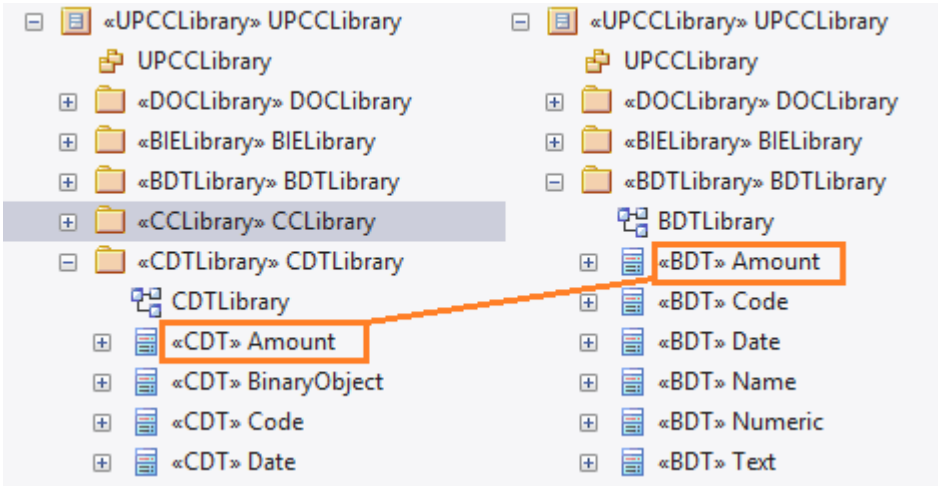
Notes

- The Schema Composer is supported in the Corporate, Unified and Ultimate Editions of Enterprise Architect

UML Profile for Core Components (UPCC)

The UPCC framework provides core component and core data type libraries and is available to Enterprise Architect users through the Model Builder. Whether you model according to the UMM specification, or want to leverage the advantages this standard brings, or have a compliance requirement, to model with this technology you will require - as a minimum - a Business datatype library and a Business Information Entity library. The Schema Composer can generate these libraries for you.

This image shows a BDT library created from a UPCC Core CDT Library



Common Libraries

Libraries shared by both versions of the UML Profile for Core Components.

Library	Description
CCLibrary	The CCTS core component library.
CDTLibrary	The CCTS core datatype library. It contains basic datatypes such as Amount, Code, Text and Graphic.
BIELibrary	A Business library containing ABIE entities based on CCLibrary components. The entities can be composed using the Schema Composer. These can also be modeled using the UML modeling tools available for the technology.
DOCLibrary	A Package typically used for the modeling of Message Assemblies. You can generate the schema for a Message Assembly by loading it into the Schema Composer.-

UPCC Libraries

The UML Profile for Core Components is available in two versions, NDR 3.0 and NDR 2.1. Both profiles describe a common set of libraries, with some differences, as described here:

NDR 3.0

Library	Description
BDTLibrary	A Business library containing BDT types based on CDTLibrary types. The Schema Composer can be used to easily generate the content of a BDTLibrary from selected types in the core library.

NDR 2.1

Library	Description
UDTLibrary	An unqualified datatype library. Basically a mirror of the CDTLibrary for use in a business context. The Schema Composer can be used to easily generate the content of a UDTLibrary from selected types in the core library.
QDTLibrary	A qualified datatype library. The library contains restricted types based on the CDTLibrary with qualified type names. The Schema Composer can easily generate the content of a QDTLibrary from selected types in the core library.

UPCC Diagrams

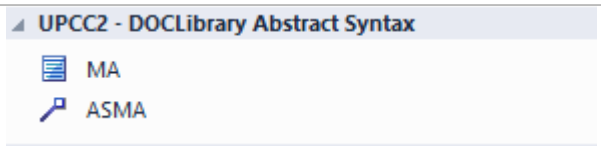
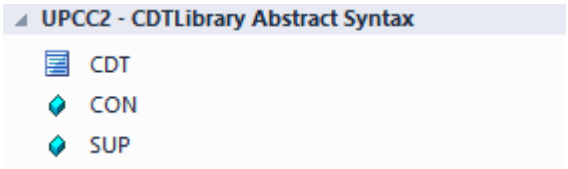
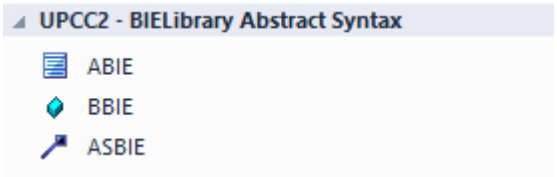
The UML profile for Core Components uses UML Class diagrams for composition of components. There are however specific Toolbox pages provided by the technology for each of its libraries.

UPCC Toolbox Pages

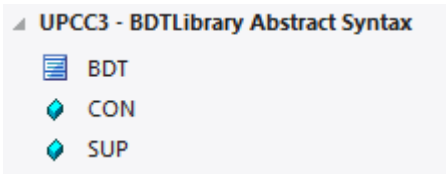
Common

In this notation, UPPCx represents the UPCC profile and x is the version of the NDR

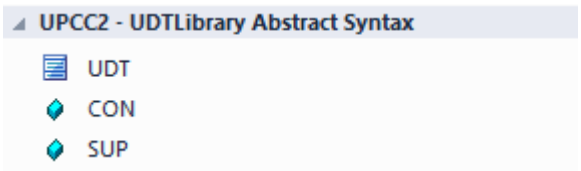
Common	Description
UPCCx - CCLibrary Abstract Syntax	
UPCCx - DOCLibrary Abstract Syntax	

	
UPCCx - CDTLibrary Abstract Syntax	
UPCCx - BIELibrary Abstract Syntax	

NDR 3.0

Library Syntax	Description
UPCC - BDTLibrary Abstract Syntax	

NDR 2.1

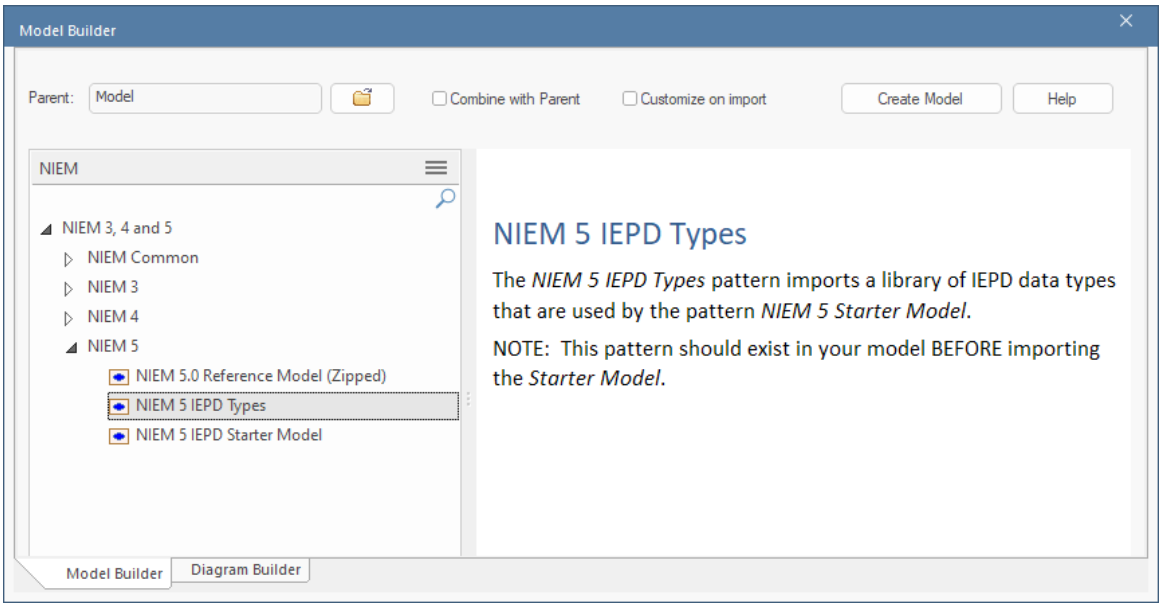
Library Syntax	Description
UPCC - UDTLibrary Abstract Syntax	
UPCC - QDTLibrary Abstract Syntax	

Available Frameworks

Using the Enterprise Architect Model Builder you can deploy any of the frameworks supported by the Schema Composer - such as NIEM, CIM and CCTS - to your model in minutes, providing a multi-featured UML medium for modeling in those technologies.

The frameworks are also available directly from the Sparx Systems Reusable Asset Service (via the Cloud Server 'Cloud Connection' dialog and then 'Frameworks' on the Model Builder).

Note: In addition to the custom frameworks such as CIM and NIEM, it is possible to use standard Class models to rapidly build generic Schemas, so if you are not targeting a particular meta-model, it might be simplest to model your data in UML and use the resultant model as input to the Schema Composer.



National Information Exchange Model (NIEM)

This is the National Information Exchange Model published by the NIEM Program Management Office (PMO).

Enterprise Architect provides these resources for modeling in NIEM:

- Provided Frameworks including NIEM core, NIEM domains, code lists and external schema adapters:
  - NIEM 3.0 modeled using NIEM-UML 1.1
  - NIEM 3.1 modeled using NIEM-UML 1.1
  - NIEM 4.0 modeled using NIEM-UML 1.1
  - NIEM 5.0 modeled using NIEM-UML 1.1
- NIEM subset creation:
  - The Schema Composer helps you create a subset of a NIEM conformant namespace
- NIEM schema generation:
  - Generation of complete NIEM IEPDs from a model Package description in either NIEM 3, NIEM 4 or NIEM 5 formats

Common Information Model (CIM)

This is the CIM specification published by International Electrotechnical Commission (IEC) Technical Committee 57.

Enterprise Architect provides these resources for modeling in CIM:

- Schema Composition

- XML schema (XSD)
- Resource Descriptor format (RDFS)
- Resource Descriptor augmented format
- JavaScript Object notation (JSON)
- Add-In integration
- Scripting integration

Universal Business Language (UBL)

UBL is a CCTS implementation published by OASIS that is proving popular with European governments for consolidating information exchange between agencies.

Enterprise Architect provides these resources for the composition of business documents using UBL:

- UML Framework
  - UBL 2.1 Main Document Libraries
  - UBL 2.1 Common Component Libraries
- Business Document Composition
  - Schema Composer for component composition
  - Schema Composer for document composition
  - Schema Composer for schema generation
  - Add-In integration
  - Scripting integration

Core Component Technical Specification (CCTS)

This is the CCTS specification published by UN/CEFACT.

Enterprise Architect provides these resources for modeling in CCTS:

- UML Frameworks:
  - UPCC 2.1 core component libraries
  - UPCC 3.0 core component libraries
  - UMM 2.0 business requirements, choreography and information views.
- Business Component Library Creation / Management
  - Schema Composer for ABIE and BDT composition
  - Add-In integration
  - Scripting integration
- Business Component Schema Composition
  - Schema Composer for XSD, JSON
  - Add-In integration
  - Scripting integration

Add-In Framework (Custom)

In addition to these methodologies, the Schema Composer integrates with the Enterprise Architect Automation Interface to support any individual or group in implementing their own. An Add-In that registers its interest to Enterprise Architect in offering Schema generation capabilities will have the opportunity to offer any of its products in the Schema Composer Generation tool.

Scripting Framework (Custom)

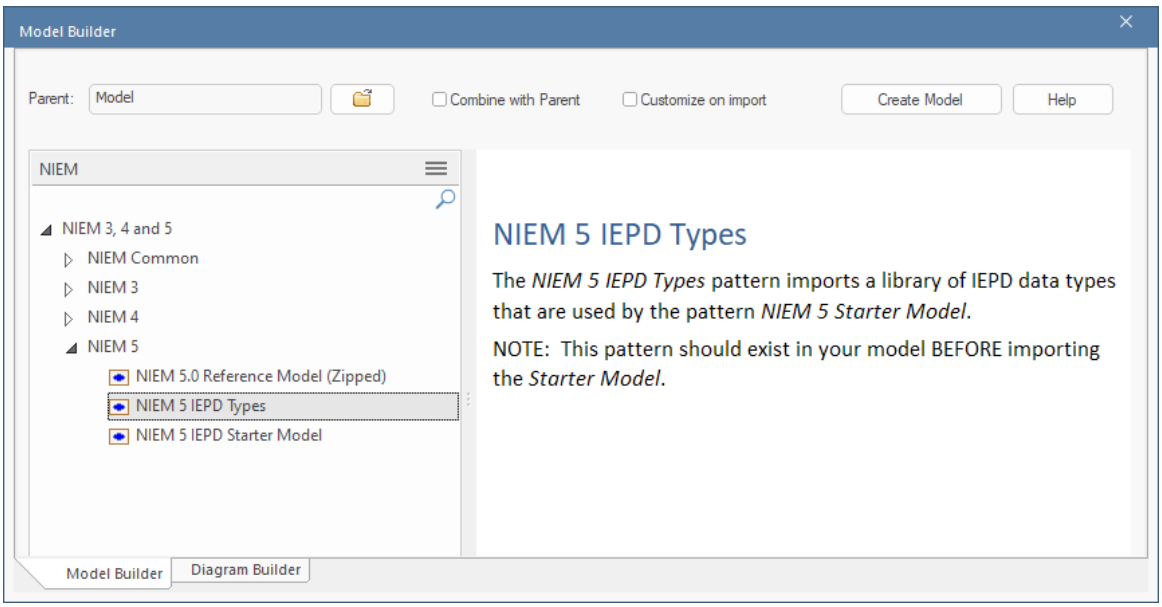
The Schema Composer also offers unconditional control over generation of schema for any profiles created with it. By writing their own script an author can access the definition of any schema and ultimately produce whatever documents they want, in a format of their choosing.

Install a Core Framework

Enterprise Architect provides a rich and diverse range of modeling technologies including every standard listed in the Schema Composer. These frameworks are available as UML models and/or MDG Technologies using Enterprise Architect's Model Builder. The models themselves are also directly accessible from Enterprise Architect's Reusable Asset Service.

Note: If you are modeling a generic solution and not directly using a core framework such as CIM or UBL, you do not need to install a core framework/model. In that case you are best served creating a data model using simple UML Classes with attributes.

Model Builder



Access

Ribbon	Start > Personal > Model Builder Design > Package > Model Builder
Context Menu	Right-click on Package | Model Builder (pattern library)
Keyboard Shortcuts	Ctrl+Shift+M
Other	Browser window 'Hamburger' icon > Model Builder (pattern library)

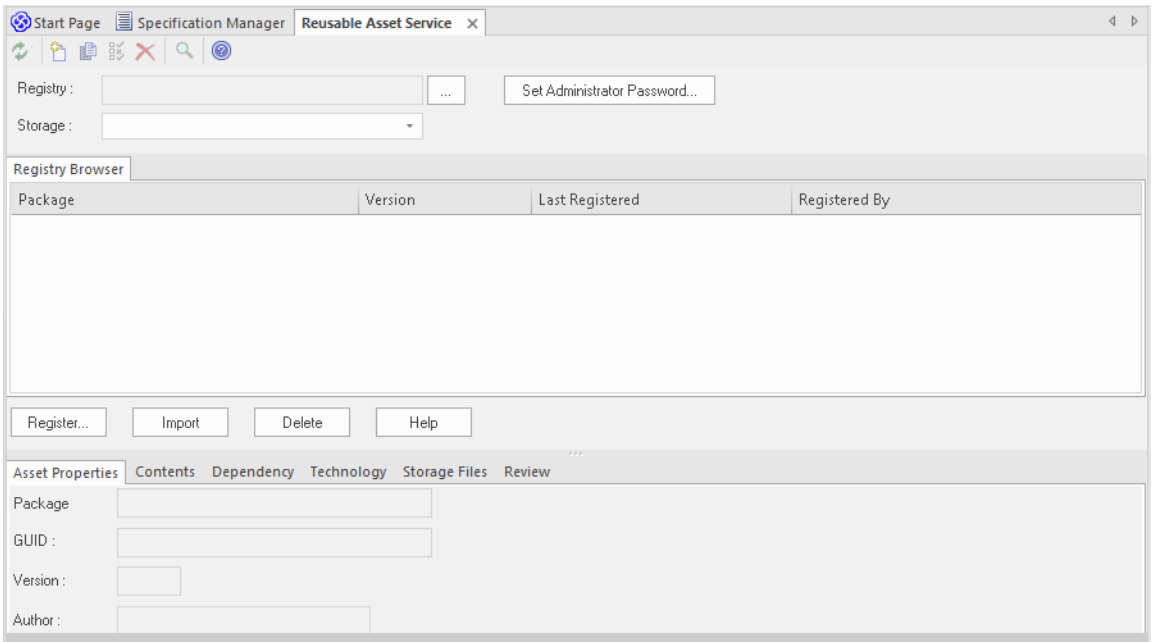
Note

You can limit the MDG Technologies to use by selecting the ribbon option: 'Specialize > Technologies > Manage Technology'. Here you can see which technologies are currently enabled.

Import Model

Step	Action
1	Display the Model Builder dialog.
2	Click on the <perspective name> button and select the required technology.
3	Highlight the Technology.
4	Select the Technology standards to import.
5	Click on the Create Model button to import the framework to your model.

Reusable Asset Service



Access

Ribbon	Publish > Model Exchange > Reusable Assets

Import Model

Step	Action
1	Connect to the Reusable Asset Service.
2	Choose from the available list of Repositories
3	Select the UML model Package
4	Click OK to import the selected Package to your model.

The Schema Importer

You can import Schemas compatible with the Schema Composer, into Enterprise Architect using the Schema Importer. The Schema Importer validates the Schema and creates a *Schema* type Schema Composer Profile upon successful validation, that can be viewed directly in the Schema Composer.

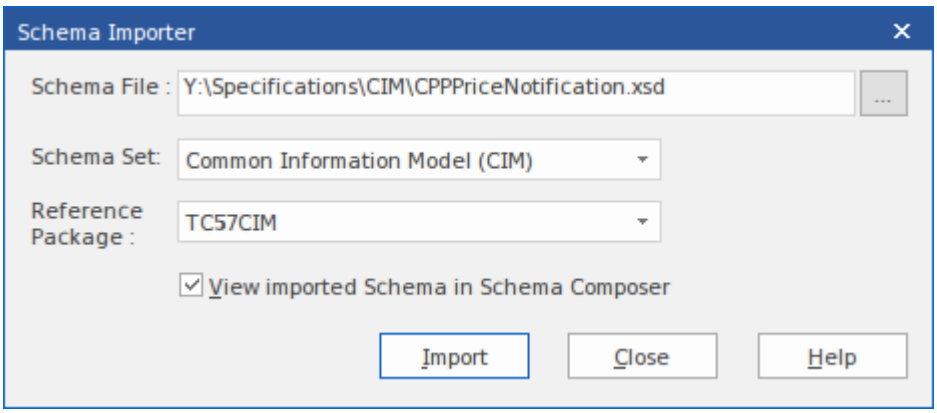
Currently, you can use the Schema Importer to import these Schemas:

- Common Information Model (CIM) specific XML Schema
- Common Information Model (CIM) specific RDFS XML

Access

Ribbon	Develop > Schema Modeling > Schema Composer > Import for Schema Composer

Import a Schema using the Schema Importer



Option	Action
Schema File	Type the directory path and filename from which to import the Schema file.
Schema Set	Select the type of Schema being imported. Currently the Schema Importer supports importing CIM specific: • XML Schema and • RDFS XML
Reference Package	Select the Package containing the common elements specific to the schema set. The Schema Importer will validate the elements in the Schema being imported against the elements in the reference Package.
View imported Schema in Schema Composer	Select this option to open the imported Profile in the Schema Composer.
Import	Click on this button to start the import process.

Close	Click on this button to close the 'Schema Importer' dialog.

Notes

- The progress of import will be displayed in the System Output window
- The Schema Composer will validate the Schema against the elements in the Reference Package before importing the Schema; if validation fails, the Schema elements that fail validation will be displayed in the System Output window and the import process will stop
- Double-click on a validation error entry in the System Output Window to open the Schema in Enterprise Architect's internal file editor and go to the source of the error
- If validation succeeds, the 'New Schema Definition' dialog displays, through which you can save the imported Profile in the file system or as an Artifact in the current model

Schema Composer Automation Integration

The Schema Composer can be accessed from the Enterprise Architect Automation Interface. A client (script or Add-In) can obtain access to the interface using the 'SchemaComposer' property of the 'Repository' object. This interface is available when a Schema Composer has a profile loaded.

Schema Composer Addin Integration

Enterprise Architect Add-Ins can integrate with the Schema Composer by providing alternatives to offer users for the generation of schemas and sub models.

Schema Composer Scripting Integration

Although the Schema Composer provides out-of-the-box schema composition based on a variety of popular technologies, its scripting integration provides you with some flexibility in how you might go about implementing your own requirements. There are three ways in which you might leverage scripting within the Schema Composer:

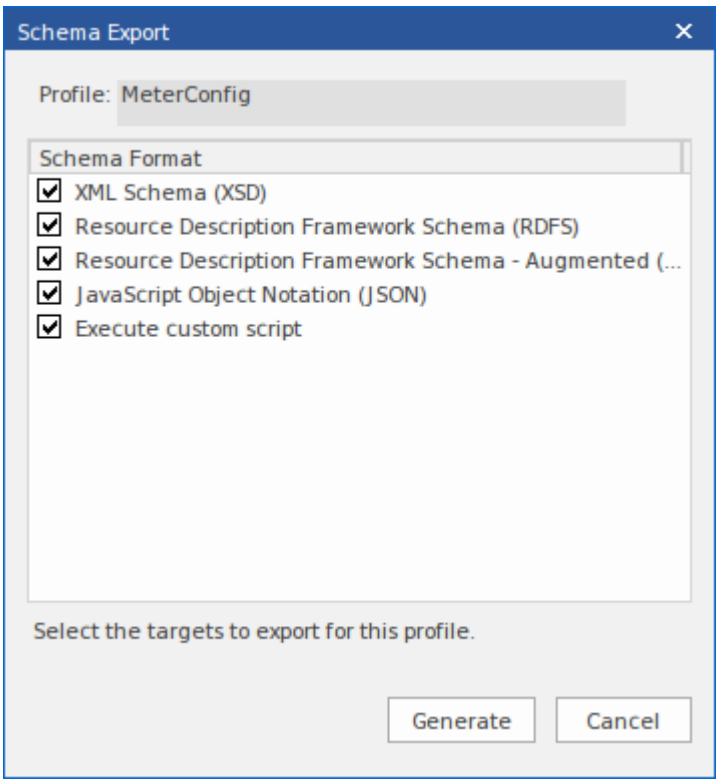
- Provide custom schema generation using a scripting language
- Provide custom model transformation using a scripting language
- Provide custom stereotype mapping to any standard model transform (such as UPCC)

Model Transformation by script

While the Schema Composer provides in-built transforms for various frameworks, you can always write your own, using the composition tools of the Composer to design the schema, then performing a custom transform with a hand crafted script.

Schema Generation by script

When you select a message in the Schema Composer and click generate, you are presented with a number of export formats. One of those choices is 'Execute custom script'



Schema Iteration Scripting Example

This example demonstrates accessing the Schema Composer in an Enterprise Architect script written in JavaScript. The

script first obtains an interface to the Schema Composer and then traverses the schema, printing out the types and each of its properties.

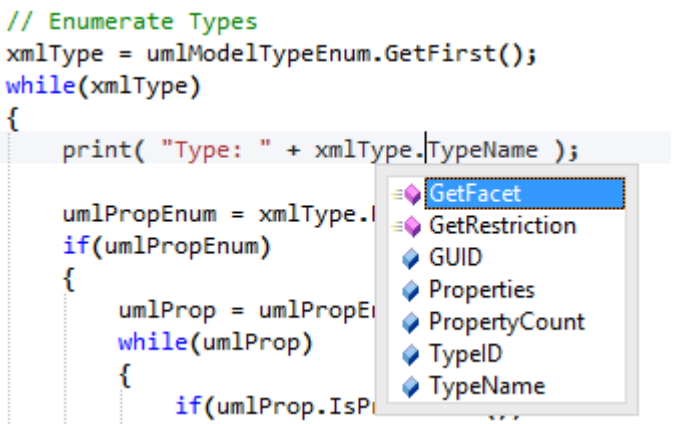
```
/*
* Script Name: Example Schema Composer Script
* Author:  Sparx Systems
* Purpose: Demonstrate access to Schema Composer using automation and JavaScript
* Language: JavaScript
* Date:  2020
*/
function printType( xmlType, xmlns, uri)
{
	var xmlProp as EA.SchemaProperty;
	var xmlPropEnum as EA.SchemaPropEnum;
	var xmlChoiceEnum1 as EA.SchemaTypeEnum;
	var xmlChoiceEnum2 as EA.SchemaTypeEnum;

	Session.Output("Type: " + xmlType.TypeName + " in namespace: "  + xmlns + ":" + uri);
	xmlPropEnum = xmlType.Properties;
	if(xmlPropEnum)
	{
		xmlProp = xmlPropEnum.GetFirst();
		while(xmlProp)
		{
			if(xmlType.IsEnumeration())
			{
				Session.Output("   " + xmlProp.Name);
			}
			else
			{
				var sPropDesc = xmlProp.Name;
				sPropDesc += "::"
				if(xmlProp.IsPrimitive())
					sPropDesc += xmlProp.PrimitiveType;
				else
					sPropDesc += xmlProp.TypeName;

				if(xmlProp.IsByReference())
				{
					sPropDesc += "(by reference)";
				}
				if(xmlProp.IsInline())
```

```
                                {
                                        sPropDesc += "(inline)";
                                }
                                Session.Output("    " + sPropDesc + ", cardinality: " + xmlProp.Cardinality);

                                xmlChoiceEnum1 = xmlProp.Choices;
                                xmlChoiceEnum2 = xmlProp.SchemaChoices;
                                var count = xmlChoiceEnum1.GetCount() + xmlChoiceEnum2.GetCount();
                                if(count>1)
                                {
                                        Session.Output("   choice of: ");
                                        xmlChoice = xmlChoiceEnum1.GetFirst();
                                        while(xmlChoice)
                                        {
                                                Session.Output("     " + xmlChoice.TypeName);
                                                xmlChoice = xmlChoiceEnum1.GetNext();
                                        }
                                        xmlChoice = xmlChoiceEnum2.GetFirst();
                                        while(xmlChoice)
                                        {
                                                Session.Output("     " + xmlChoice.TypeName);
                                                xmlChoice = xmlChoiceEnum2.GetNext();
                                        }
                                }
                        }
                        xmlProp = xmlPropEnum.GetNext();
                }
        }
}

function main()
{
        var schema as EA.SchemaComposer;
        var xmlType as EA.SchemaType;
        var xmlTypeEnum as EA.SchemaTypeEnum;
        var xmlNamespaceEnum as EA.SchemaNamespaceEnum;
        var xmlNS as EA.SchemaNamespace;

        // Get SchemaComposer
        schema = Repository.SchemaComposer;

        // print the namespace references
```

```
        xmlNamespaceEnum = schema.Namespaces;
        if(xmlNamespaceEnum)
        {
                xmlNS = xmlNamespaceEnum.GetFirst();
                while(xmlNS)
                {
                        Session.Output( "xmlns:" + xmlNS.Name + " URI=" + xmlNS.URI);
                        xmlNS = xmlNamespaceEnum.GetNext();
                }
        }
        // Get Schema Types Enumerator
        xmlTypeEnum = schema.SchemaTypes;
        xmlType = xmlTypeEnum.GetFirst();
        while(xmlType)
        {
                var xmlns = schema.GetNamespacePrefixForType( xmlType.TypeID );
                uri = schema.GetNamespaceForPrefix(xmlns);
                printType(xmlType, xmlns, uri);
                xmlType = xmlTypeEnum.GetNext();
        }
}

main();
```

Intelli-sense help in scripting

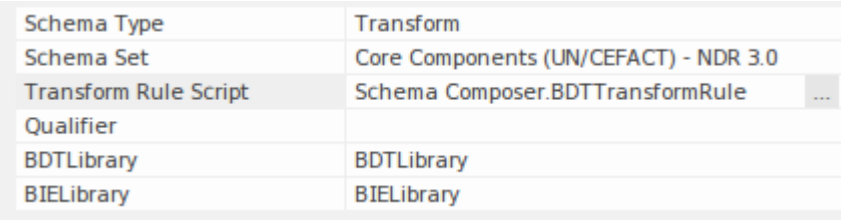
The Scripting editor in Enterprise Architect will help you write script that interacts with the Schema Composer, by providing Intelli-sense on the properties and methods of its Automation Interface.



Stereotype mapping in Model Transformation

Stereotyping forms a large part of the MDG Technology approach. Individual UML profiles for an MDG Technology define stereotypes to offer useful classifications for its elements. It is a common requirement when going from a core framework to a business model or sub-domain to reassign the stereotype. When you work with a CCTS framework the business components you generate have their stereotype automatically generated by Enterprise Architect according to a mapping defined by the CCTS specification (ACC to ABIE, for example).

When you open or create a model transform profile in the Schema Composer you can specify a script to perform this mapping for you. The script can be selected from the Properties window.



The script can be written in either JavaScript, JScript or VBScript, and only has to implement this function (described here in JavaScript notation):

```
function TranslateStereotype(srcStereo)
{
    var destStereo = srcStereo
    if (srcStereo == "BDT")
    {
        destStereo = "My_BDT"
    }
    return destStereo;
}
```

MDG Technologies - UML Profile Extensions

The Schema Composer works with MDG technologies. The standards it uses for schema generation, *other than Generic,* are only meaningful for models that adhere to that framework. However, it is quite easy to extend an existing MDG Technology. Make sure that elements authored in your business specific domain or sub-domain provide consistently named metadata or 'Tagged Values'.

The Schema Composer supports extensions to UML profiles / frameworks through its scripting integration. When a script is assigned in the Schema Composer, the transform process will invoke this script and ask it to translate keywords. These keywords are usually UML stereotypes. If a particular technology is associated with the profile, the Schema Composer will invoke this function, passing it the name of the MDG Technology.

The script can return the input name, and no mapping will take place, or it can return the name of another MDG Technology. When this occurs, the Schema Composer will again ask for the function to optionally map any UML profiles. Finally it will ask the script to translate the stereotypes from the core technology.

The result of the model transform would then be that any UML elements of the sub model will show the extended Tagged Values in addition to any core Tagged Values.

Example script that maps MDG Technology

```
function TranslateStereotype (stereo)
{
  var newStereo = stereo;
  if (stereo == "UPCC3")
  {
     newStereo = "XXX UPCC3"
  }
  return newStereo;
}
```

Example script that maps UML profile

```
function TranslateStereotype (stereo)
{
  var newStereo = stereo;
  if (stereo == "UPCC3 - BIE Library Abstract Syntax")
  {
     newStereo = "UPCC3 - BIE Library XXX Syntax"
  }
  return newStereo;
}
```

Example script that maps UML Stereotype

```
function TranslateStereotype (stereo)
```

```
{
  var newStereo = stereo;
  if (stereo == "ABIE")
  {
      newStereo = "XXX ABIE";
  }
  return newStereo;
}
```

XSD Models

XML Schema Definition (XSD), also known as XML Schema, is a World Wide Web Consortium (W3C) XML technology that is used to specify the rules to which an XML document must adhere. XSD 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 specifying, constructing and deploying XML-based SOA artifacts within an organization.

The UML Profile for XSD specifies a set of stereotypes, Tagged Values and constraints that can be applied to the UML model in order to change specific aspects of the resulting schema. Enterprise Architect provides native support for the XSD Profile through the XML Schema page of the Diagram Toolbox. The XSD Profile supported by Enterprise Architect is an adaptation of the profile defined in the publication Modeling XML Applications with UML.

Working with the XSD Profile through Enterprise Architect, you can rapidly model, forward engineer and reverse engineer XML Schema.

You can also quickly define and generate XSD and other schema using the Enterprise Architect Schema Composer.

Modeling XSD

You can model XML schemas at two levels, using UML Class diagrams that:

- Have no XML schema-specific implementation details, to be generated directly by Enterprise Architect's Schema Generator; the generator applies a set of default mappings to convert the abstract model Package to a W3C XML Schema (XSD) file
- Are refined with XML schema-specific definitions using the 'XML Schema' pages of the Diagram Toolbox, which provides the structures of the UML profile for XSD

Model an XML Schema

Step	Action
1	In the Browser window, create the top-level project structure you need (Model and Views), and click on the appropriate View.
2	Click on the 'New Package' option in the Browser window header drop-down menu. The 'New Model Package' dialog displays.
3	In the 'Name' field type the name of the new Package, and select the 'Create diagram' radio button. Click on the OK button. The 'New Diagram' dialog displays.
4	In the 'Name' field type the name of the new diagram. In the 'Select From' panel select 'UML Structural', and in the 'Diagram Types' panel select 'Class'.
5	Click on the OK button. In the Browser window, double-click on the icon next to the new diagram's name; the diagram opens in the Diagram View, with the 'Class' pages displaying in the Diagram Toolbox. At this point you can either: • Create a Class diagram using the Class Toolbox icons, or • Create a tailored XML Schema diagram using the 'XML Schema' pages of the Diagram Toolbox (continue to step 6)
6	Click on to display the 'Find Toolbox Item' dialog and specify 'XML Schema' to display the 'XML Schema' Toolbox pages.
7	Click on the 'Schema' icon from the Toolbox and drag it into the Class diagram. The 'XSD schema Properties' dialog displays. Complete this dialog, and click on the OK button. The 'New Diagram' dialog displays.
8	Again, in the 'Name' field type the name of the new diagram. In the 'Select From' panel select 'UML Structural', and in the 'Diagram Types' panel select 'Class'. Click on the OK button.
9	An XSDschema stereotyped Package is created in the Browser window and on the diagram, with a child Class diagram. Double-click on the Package on the diagram to open the child Class diagram, and use the constructs from

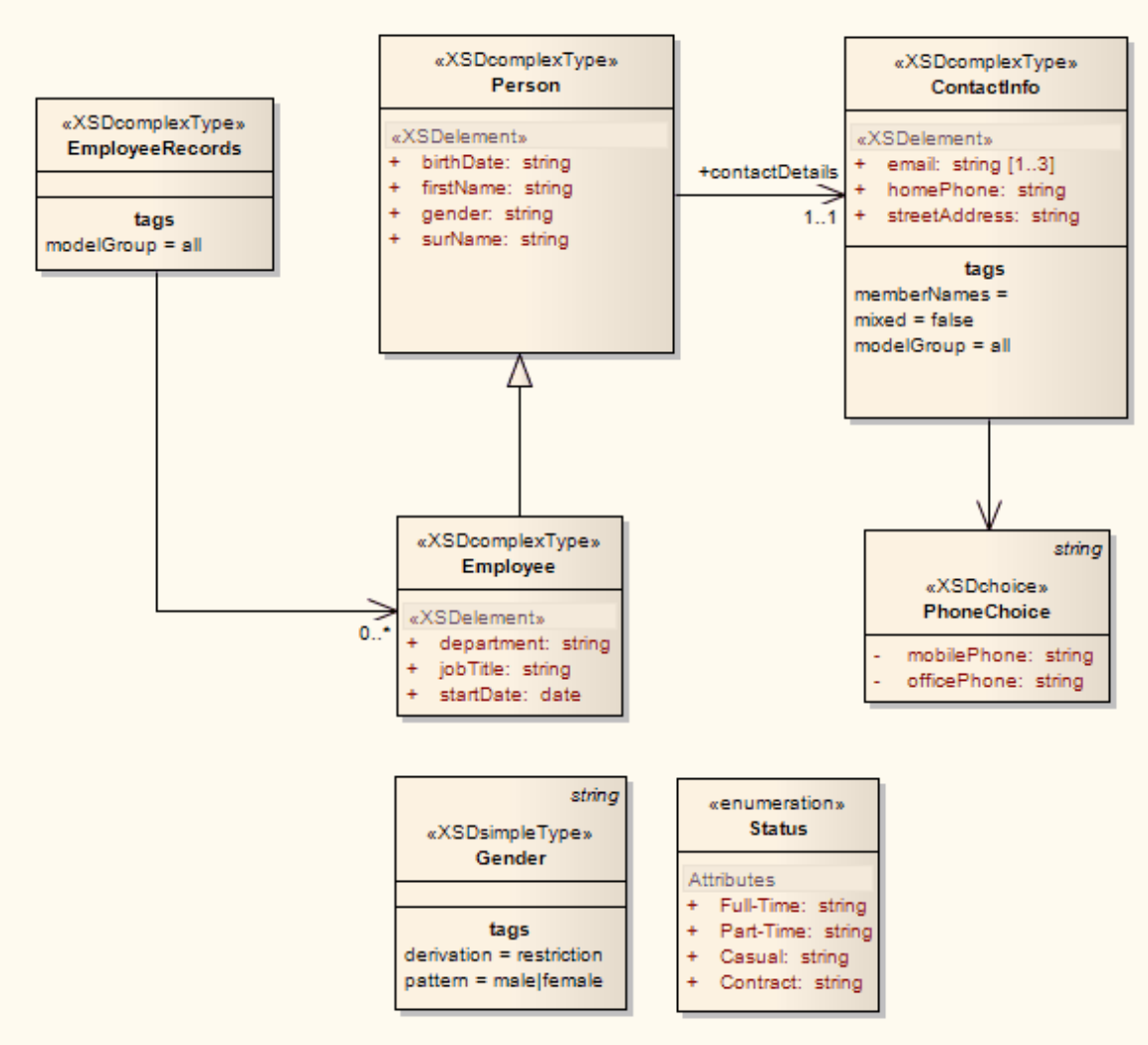
	the XML Schema Toolbox to model the XML Schema.

Notes

- The UML attributes of the Classes map directly to XML elements or attributes
- If you have modeled your XSD Schema as a straight Class diagram, you can define and generate schema from it using the Schema Composer
- Classes in an XML Schema model have no methods since there is no meaningful correspondence between Class methods and XSD constructs
- Modeling Restrictions - these XML Schema constructs cannot be modeled in Enterprise Architect:
  - appinfo
  - field
  - key
  - keyref
  - notation
  - redefine
  - selector
  - substitutionGroup
  - unique

XSD Diagrams

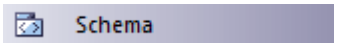
This example diagram shows a Class diagram containing XSD-specific elements created using the 'XSD Schema' pages of the Diagram Toolbox. The diagram models an employee records system.



Schema Package

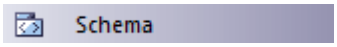
An «XSDschema» stereotyped Package acts as a container for the XSD constructs, from which XML Schema can be generated. All Classes in the Package are defined within one schema; the Schema element provides the default schema-wide settings. You can create an «XSDschema» Package by dragging the Schema icon from the XML Schema Toolbox and dropping it directly onto a diagram.

Toolbox Icon



Access

To display the XSD schema 'Properties' dialog for the selected «XSDschema» stereotyped Package, use one of the methods outlined here:

Ribbon	Design > Package > Manage > Properties
Context Menu	Right-click on «XSDschema» stereotyped Package | Properties
Other	In Browser window, double-click on existing «XSDschema» stereotyped Package, or Drag  icon from toolbox onto diagram (this creates a new «XSDschema» stereotyped Package)

Define Properties

Field/Button	Action
Schema Name	If you do not want to use the default name of the schema Package, overtype it with another name.
Target Namespace	(Optional) Type in the target namespace for this Schema Package.
Prefix	(Optional) Type in the abbreviated text to represent the Target Namespace.
Default Namespace	(Optional) Type in the default namespace for all non-prefixed XSDelements and XSDattributes.
Schema File	Type in or browse for (click on) the file path where the XML Schema file for this Package is to be generated.
XMLNS	Identify the additional namespace or namespace-prefix pairs used in this Schema Package. To add a namespace or namespace-prefix pair, click on the New button; to edit an

	existing entry, double-click on it. In either case, the 'Namespace Details' dialog displays. • Prefix - Type in the abbreviated text to represent the Namespace • Namespace - Type in the name of the Namespace • OK - Click on this button to save the new information and close the 'Namespace Details' dialog • Cancel - Click on this button to discard the new information and close the 'Namespace Details' dialog • Help - Click on this button to display this Help topic To remove an entry from the list, click on it and click on the Delete button.
OK	Click on this button to save the schema data entered and close the XSD schema 'Properties' dialog.
Cancel	Click on this button to discard the schema data entered and close the XSD schema 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing Schema Package information. Click on the button to open the UML element 'Properties' dialog for the Schema element.

Notes

- The default schema-wide settings are defined by Tagged Values, which you can review on the 'Tags' tab of the schema element 'Properties' dialog, or the Properties window for the element; you can edit the schema-wide settings if you need to, or provide element-specific overrides in the properties and Tagged Values of the individual XSD construct elements

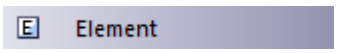
Global Element

An «XSDtopLevelElement» stereotyped Class acts as a XSD global element. You can create it by dragging the 'Element' icon from the XML Schema Toolbox and dropping it directly onto a diagram.

Toolbox Icon

Access

To display the 'XSD element Properties' dialog for the selected «XSDtopLevelElement» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «XSDtopLevelElement» stereotyped Class | Properties
Keyboard Shortcuts	Alt+Enter
Other	In Browser window, double-click on «XSDtopLevelElement» stereotyped Class, or Drag  icon from toolbox onto diagram (this creates a new «XSDtopLevelElement» stereotyped Class)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the global element, overtype it with another name.
Type	Either: • Type the name of a data type, or • Click on the drop-down arrow and select an XSD built-in dataType from the list, or • Click on the button and browse for an existing XSD classifier element, or • Select one of these two checkboxes
Nested complexType	Select this checkbox to create an XSDcomplexType as a child of this global element.
Nested simpleType	Select this checkbox to create an XSDsimpleType as a child of this global element.

Value	(Optional) If you have entered an XSD built-in data type in the 'Type' field, type in a value.
Default	Select this radio button to set the Value as a default value.
Fixed	Select this radio button to set the Value as a fixed value.
Annotation	(Optional) Type in any notes you need for this element.
OK	Click on this button to save the element data entered and close the XSD element 'Properties' dialog.
Cancel	Click on this button to discard the element data entered and close the XSD element 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing XSD element information. Click on the button to open the UML element 'Properties' dialog for the global element.

Notes

- The fields 'Type', 'Nested complexType' and 'Nested simpleType' are mutually exclusive; selecting one disables the others
- The fields 'Nested complexType' and 'Nested simpleType' are available in the dialog only when creating a new global element (and not when editing the global element)
- A Global element:
  - Cannot contain any UML attributes
  - Cannot be the source of an Association connector
  - Can be the target of an Association connector from a Complex Type Class or Group Class element
  - Cannot be the target of a Generalization connector
  - Can be the source of one Generalization connector to a Complex Type Class or Simple Type Class

Local Element

A Local element is an «XSDelement» stereotyped UML attribute that acts as a local XSD element. You can create it by dragging the 'Element' icon from the XML Schema Toolbox and dropping it onto an «XSDcomplexType» or «XSDgroup» stereotyped Class.

Toolbox Icon

Access

To display the 'XSD element Properties' dialog for the selected «XSDelement» stereotyped UML attribute, use one of the methods outlined here.

Ribbon	With a specific ?XSDelement? stereotyped attribute selected in a diagram: Design > Element > Features > Attributes
Context Menu	With a specific ?XSDelement? stereotyped attribute selected in a diagram : Right-click on attribute | View Properties
Keyboard Shortcuts	With a specific ?XSDelement? stereotyped attribute selected in a diagram : F9
Other	Double-click on ?XSDelement? stereotyped attribute, or Drag icon onto ?XSDcomplexType? or ?XSDgroup? stereotyped Class, (this creates a new ?XSDelement? within the Class)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the local element, overtype it with another name.
Type	Either: • Type the name of a data type, or • Click on the drop-down arrow and select an XSD built-in dataType from the list, or • Click on the button and browse for an existing XSDcomplexType or XSDsimpleType element as a classifier

Reference	(Optional) Specify whether to use the ref attribute (instead of the type attribute) to refer to the XSDcomplexType or XSDsimpleType element you selected in the 'Type' field, in the generated XSD.
Value	(Optional) If you have entered an XSD built-in data type in the 'Type' field, type in a value.
Default	Select this radio button to set the Value as a default value.
Fixed	Select this radio button to set the Value as a fixed value.
MinOccurs	(Optional) Type the minimum number of times this element must occur in the Class. Type '0' to indicate that the element is optional. The default value is '1'.
MaxOccurs	(Optional) Type the maximum number of times this element can occur in the Class. Type unbounded to indicate that there is no limit to the number of times the element can occur. The default value is 1.
Form	(Optional) Click on the drop-down arrow and select whether or not to qualify the element: • qualified - Use the Prefix defined in the Schema Package to qualify this element • unqualified - Do not qualify this element
Annotation	(Optional) Type in any notes you need for this local element.
OK	Click on this button to save the element data entered and close the XSD element 'Properties' dialog.
Cancel	Click on this button to discard the element data entered and close the XSD element 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing XSD element information. Click on the button to open the attribute properties for the local element.

Notes

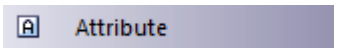
- Only ?Complex Type?, ?Group? and ?Model Group? stereotyped elements can have this UML Attribute

Global Attribute

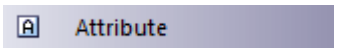
A Global Attribute is an «XSDtopLevelAttribute» stereotyped Class. You can create it by dragging the 'Attribute' icon from the XML Schema Toolbox and dropping it directly onto a diagram.

Access

To display the 'XSD attribute Properties' dialog for the selected «XSDtopLevelAttribute» stereotyped element, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «XSDtopLevelAttribute» stereotyped element| Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on ?XSDtopLevelAttribute? stereotyped Class, or Drag  icon from toolbox and drop directly onto the diagram (this creates a new ?XSDtopLevelAttribute? stereotyped Class)

Toolbox Icon



Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the global attribute, overtype it with another name.
Type	Either: • Type the name of a data type, or • Click on the drop-down arrow and select an XSD built-in dataType from the list, or • Click on the button and browse for an existing XSDsimpleType element as a classifier Alternatively, select the 'Nested simpleType' checkbox.
Nested simpleType	Select this checkbox to create an XSDsimpleType element as a child of this global attribute element.
Value	(Optional) If you have selected an XSD built-in dataType in the 'Type' field, type in

	a value.
Default	Select this radio button to set the 'Value' field as a default value.
Fixed	Select this radio button to set the 'Value' field as a fixed value.
Form	(Optional) Click on the drop-down arrow and select: • qualified to use any Prefix supplied on the Schema Package to qualify this attribute, or • unqualified to show no qualifying prefix on the attribute name
Annotation	(Optional) Type in any notes you need for this attribute.
OK	Click on this button to save the attribute data entered and close the XSD attribute 'Properties' dialog.
Cancel	Click on this button to discard the attribute data entered and close the XSD attribute 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing XSD element information. Click on the button to open the UML element 'Properties' dialog for the global attribute Class.

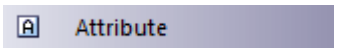
Notes

- The field 'Nested simpleType' is available in the dialog only when creating a new global attribute (and not when editing the global attribute)
- The fields 'Type' and 'Nested simpleType' are mutually exclusive; selecting one disables the other
- A Global attribute:
  - Cannot contain any UML attributes
  - Cannot be the source of an Association connector
  - Can be the target of an Association connector from a Complex Type Class
  - Cannot be the target of a Generalization connector
  - Can be the source of one Generalization connector to a Simple Type Class

Local Attribute

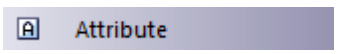
A local attribute is an «XSDattribute» stereotyped UML attribute. You can create it by dragging the 'Attribute' icon from the XML Schema Toolbox and dropping it onto an «XSDcomplexType» or «XSDattributeGroup» stereotyped Class.

Toolbox Icon



Access

To display the 'XSD attribute Properties' dialog for the selected «XSDattribute» stereotyped UML attribute, use one of the methods outlined here.

Ribbon	With a specific ?XSDattribute? stereotyped UML attribute selected on a diagram: Design > Element > Features > Attributes
Context Menu	With a specific ?XSDattribute? stereotyped UML attribute selected on a diagram: Right-click on attribute | View Properties
Keyboard Shortcuts	With a specific ?XSDattribute? stereotyped UML attribute selected on a diagram: F9
Other	Double-click on the ?XSDattribute? stereotyped UML attribute, or Drag  icon from the Toolbox and drop it onto an ?XSDcomplexType? or ?XSDattributeGroup? stereotyped Class (this creates a new ?XSDattribute? stereotyped UML attribute)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the local attribute, overtype it with another name.
Type	Either: • Type the name of a data type, or • Click on the drop-down arrow and select an XSD built-in dataType from the list, or • Click on the button and browse for an existing XSDsimpleType element as a classifier
Reference	(Optional) Specify whether to use the ref attribute (instead of the type attribute) to

	refer to the XSDsimpleType element you selected in the 'Type' field, in the generated XSD.
Value	(Optional) If you have entered an XSD built-in data type in the 'Type' field, type in a value.
Default	Select this radio button to set the Value as a default value.
Fixed	Select this radio button to set the Value as a fixed value.
Form	(Optional) Click on the drop-down arrow and select whether or not to qualify the attribute: • qualified - Use the Prefix defined in the Schema Package to qualify this attribute • unqualified - Do not qualify this attribute
Annotation	(Optional) Type in any notes you need for this local attribute.
OK	Click on this button to save the attribute data entered and close the XSD attribute 'Properties' dialog.
Cancel	Click on this button to discard the element data entered and close the XSD attribute 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing XSD attribute information. Click on the button to open the attribute properties for the local attribute.

Notes

- Only Complex Types and Attribute Groups can have this UML attribute

Attribute Group

An Attribute Group Class is used to group a set of «XSDattribute» stereotyped UML attributes and Simple Type Classes that can be referenced from an «XSDcomplexType» stereotyped Class. You can create it by dragging the 'Attribute Group' icon from the XML Schema Toolbox and dropping it directly onto a diagram.

Toolbox Icon

Access

To display the 'XSD Attribute Group Properties' dialog for the selected «XSDattributeGroup» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «XSDattributeGroup» stereotyped Class | Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on ?XSDattributeGroup? stereotyped Class, or Drag icon from toolbox onto diagram (this creates a new ?XSDattributeGroup? stereotyped Class)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the Attribute Group, overtype it with another name.
Annotation	(Optional) Type in any notes you need for this Attribute Group.
OK	Click on this button to save the attribute group data entered and close the XSD Attribute Group 'Properties' dialog.
Cancel	Click on this button to discard the attribute group data entered and close the XSD Attribute Group 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing XSD attribute group information. Click on the button to open the UML element 'Properties' dialog for the attribute

	group.

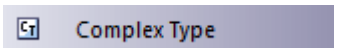
Notes

- An Attribute Group element:
  - Cannot be the child of any other XSD Class
  - Can contain only «XSDattribute» stereotyped UML attributes and Simple Type Classes
  - Can be the source of an Association connector to another Attribute Group
  - Can be the target of an Association connector from a Complex Type Class
  - Cannot be the source or target of a Generalization connector

Complex Type

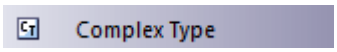
An «XSDcomplexType» stereotype is applied to a generic UML Class, to tailor the generation of a complexType definition in the Schema. You can create an «XSDcomplexType» stereotyped Class by dragging the Complex Type icon from the XML Schema Toolbox and dropping it directly onto a diagram.

Toolbox Icon



Access

To display the 'XSD complexType Properties' dialog for the selected «XSDcomplexType» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «XSDcomplexType» stereotyped Class | Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on ?XSDcomplexType? stereotyped Class, or Drag  icon from toolbox onto diagram (this creates a new ?XSDcomplexType? stereotyped Class)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the complexType Class, overtype it with another name.
Model Group	Click on the down-arrow and select the option that defines how the child elements of this complexType should occur in the Schema. • 'sequence' - the child elements must occur in the specified order • 'choice' - only one of the child elements can occur • 'all' - the child elements can occur in any order
MinOccurs	(Optional) Type the minimum number of times this element must occur in the Class. Type 0 to indicate that the element is optional. The default value is 1.
MaxOccurs	(Optional) Type the maximum number of times this element can occur in the Class.

	Type unbounded to indicate that there is no limit to the number of times the element can occur. The default value is 1.
Annotation	(Optional) Type any notes you need for this element.
Abstract	(Optional) Select this checkbox to use this complexType in an instance XML file.
Mixed	(Optional) Select this checkbox to allow character data to display among the child elements.
OK	Click on this button to save the complexType data entered and close the XSD complexType 'Properties' dialog.
Cancel	Click on this button to discard the complexType data entered and close the XSD complexType 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing XSD complexType information. Click on the button to open the UML element 'Properties' dialog for the complexType Class.

Notes

- A complexType can:
  - Contain both XSDelement and XSDattribute stereotyped UML attributes
  - Contain other complexTypes as child elements
  - Be a child of a Global Element
  - Be the source of Association connectors to other complexTypes, Simple Types, Attribute Groups, Groups and Model Groups
  - Be the source of a maximum of one Generalization connector to either another complexType or a Simple Type Class

Simple Type

An «XSDsimpleType» stereotype is applied to a generic UML Class, to tailor the generation of a simpleType definition in the Schema. You can create an «XSDsimpleType» Class by dragging the Simple Type icon from the XML Schema Toolbox and dropping it directly onto a diagram.

Toolbox Icon

Access

To display the 'XSD simpleType Properties' dialog for the selected «XSDsimpleType» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «XSDsimpleType» stereotyped Class | Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on ?XSDsimpleType? stereotyped Class, or Drag icon from toolbox onto diagram (this creates a new ?XSDsimpleType? stereotyped Class)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the simpleType element, overtype it with another name.
Type	Either: • Type the name of a data type, or • Click on the drop-down arrow and select an XSD built-in dataType from the list, or • Click on the button and browse for an existing ?XSDsimpleType? element as a classifier
Restriction	Select this radio button to restrict the value of this simpleType to that of the selected Type. The various restrictions (facets) on the simpleType are available as Tagged Values on this Class.

List	Select this radio button to specify this simpleType as a list of values of the selected Type.
Annotation	(Optional) Type any notes you need for this element.
OK	Click on this button to save the simpleType data entered and close the XSD simpleType 'Properties' dialog.
Cancel	Click on this button to discard the simpleType data entered and close the XSD simpleType 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing XSD simpleType information. Click on the button to open the UML element 'Properties' dialog for the simpleType Class.

Notes

- A simpleType:
- Cannot contain any ?XSDelement? or ?XSDattribute? stereotyped UML attributes
- Cannot contain any child Classes
- Cannot be the source of an Association connector
- Can be the target of a Generalization connector
- Can have at the most one Generalization connector to another simpleType Class

Group

The Group Class is used to group a set of «XSDelement» stereotyped UML attributes, Complex Type Classes and Simple Type Classes that can be referenced from an «XSDcomplexType» Class. You can create this type of element by dragging the Group icon from the XML Schema Toolbox and dropping it directly onto a diagram.

Toolbox Icon

Access

To display the 'XSD group Properties' dialog for the selected «XSDgroup» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «XSDgroup» stereotyped Class | Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on ?XSDgroup? stereotyped Class, or Drag icon from toolbox onto diagram (this creates a new ?XSDgroup? stereotyped Class)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the Group element, overtype it with another name.
Model Group	Click on the drop-down arrow and select the value that defines how the child elements of this group should occur in the Complex Type Class: • sequence - to specify that the child elements must occur in the specified order • choice - to specify that only one of the child elements can occur • all - to specify that the child elements can occur in any order
Annotation	(Optional) Type any notes you need for this element.
OK	Click on this button to save the Group data entered and close the XSD group 'Properties' dialog.
	Click on this button to discard the Group data entered and close the XSD group

Cancel	'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing XSD Group information. Click on the button to open the UML element 'Properties' dialog for the Group Class.

Notes

- A Group element can:
- Contain only ?XSDelement? stereotyped UML attributes
- Contain Complex Types and Simple Types as child elements
- Be the source of Association connectors to other Complex Types, Simple Types and Groups
- Be the target of an Association connector from a Complex Type element
- Not be the source or target of a Generalization connector

Any

An «XSDany» stereotyped Class allows a Complex Type Class to contain elements that are not specified in the Schema Package. You can create it by dragging the Any icon from the XML Schema Toolbox and dropping it directly onto a diagram.

Toolbox Icon

Access

To display the 'XSD any Properties' dialog for the selected «XSDany» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «XSDany» stereotyped Class | Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on ?XSDany? stereotyped Class, or Drag icon from toolbox onto diagram (this creates a new ?XSDany? stereotyped Class)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the Any element, overtype it with another name.
Namespace	(Optional) Type the namespace to contain the elements that can be used in the Complex Type.
ProcessContents	(Optional) Click on the drop-down arrow and select the value that defines how the XML Parser should validate these elements: • lax - to attempt to validate the elements against their Schema; no error is flagged when the Schema cannot be obtained • skip - to skip validating the elements • strict - to validate the elements against their Schema and flag an error if the Schema is unobtainable
Annotation	(Optional) Type any notes you need for this element.

OK	Click on this button to save the 'Any' element data entered and close the XSD Any 'Properties' dialog.
Cancel	Click on this button to discard the Any element data entered and close the XSD group 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing ?XSDany? element information. Click on the button to open the UML element 'Properties' dialog for the Any Class.

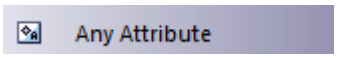
Notes

- An Any Class:
- Cannot contain any UML Attributes or child XSD Classes
- Cannot be the child of any XSD Class
- Cannot be the target of a Generalization connector
- Cannot be the source of an Association or Generalization connector
- Can be the target of Association connectors from Complex Types, Groups and Model Groups
- Must be the target of at least one incoming Association connector

Any Attribute

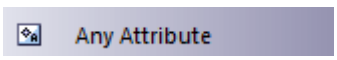
The «XSDany» stereotyped UML attribute allows a Complex Type element or an Attribute Group element to contain attributes that are not specified in the Schema Package. You can create it by dragging the 'Any Attribute' icon from the XML Schema Toolbox and dropping it onto an «XSDcomplexType» or «XSDattributeGroup» stereotyped Class.

Toolbox Icon



Access

To display the 'XSD anyAttribute Properties' dialog for the selected «XSDany» stereotyped UML attribute, use one of the methods outlined here.

Ribbon	With a specific ?XSDany? stereotyped UML attribute selected on a diagram: Design > Element > Features > Attributes
Context Menu	With a specific ?XSDany? stereotyped UML attribute selected on a diagram: Right-click on attribute | View Properties
Keyboard Shortcuts	With a specific ?XSDany? stereotyped UML attribute selected on a diagram: F9
Other	Double-click on the ?XSDany? stereotyped UML attribute, or Drag  icon from the Toolbox and drop it onto an ?XSDcomplexType? or ?XSDattributeGroup? stereotyped Class (this creates a new ?XSDany? stereotyped UML attribute)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the attribute, overtype it with another name.
Namespace	(Optional) Type the namespace to contain the attributes that can be used in the Complex Type or Attribute Group elements.
ProcessContents	(Optional) Click on the drop-down arrow and select the value that defines how the XML Parser should validate these attributes: • lax - to attempt to validate the attributes against their Schema; no error is flagged when the Schema cannot be obtained • skip - to skip validating the attributes

	• strict - to validate the attributes against their Schema and flag an error if the Schema is unobtainable
Annotation	(Optional) Type any notes you need for this attribute.
OK	Click on this button to save the attribute data entered and close the XSD anyAttribute 'Properties' dialog.
Cancel	Click on this button to discard the attribute data entered and close the XSD anyAttribute 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing ?XSDany? attribute information. Click on the button to open the attribute properties for the ?XSDany? attribute.

Notes

- Only Complex Type and Attribute Group elements can have this UML attribute

Union

A Union Class is a Simple Type element that defines a collection of Simple Types. You can create it by dragging the Union icon from the XML Schema Toolbox and dropping it directly on a diagram.

Toolbox Icon

Access

To display the 'XSD union Properties' dialog for the selected «XSDunion» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «XSDunion» stereotyped Class | Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on ?XSDunion? stereotyped Class, or Drag icon from toolbox onto diagram (this creates a new ?XSDunion? stereotyped Class)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the Union, overtype it with another name.
Member Types	Click on the button to display the 'XSD Union Members' dialog, and select built-in XSD datatypes and Simple Type elements to be members of the collection. • Choose - Instead of typing or selecting values in the 'Class Name' field, click on this button to display the 'Select Classifier' browser and locate and select a Simple Type element; click on the OK button to close the browser and immediately add the selected element to the 'Type Details' list This option is generally used to specify objects that are in the same Package as the Union element, but you can select objects in any other Package also • Add - Click on this button to add the data type or element specified in the 'Class Name' field to the 'Type Details' list • Accept classifier even if not in model - Select this checkbox to include elements or data types that have been named but that are not present in the same model Package as the Union element

	• Type Details - Review the list of selected elements or data types; if you intend to remove an object from the list, highlight it and click on the Delete Selected button • Delete Selected - Click on this button to remove the currently-selected Classifier from the 'Type Details' list • Close - Click on this button to close the 'XSD Union Members' dialog and to list the selected elements and data types in the 'Member Types' field
Annotation	(Optional) Type any notes you need for this element.
OK	Click on this button to save the attribute data entered and close the XSD union 'Properties' dialog.
Cancel	Click on this button to discard the attribute data entered and close the XSD union 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing ?XSDunion? element information. Click on the button to open the UML element 'Properties' dialog for the ?XSDunion? element.

Notes

- When you click on the Close button on the XSD union 'Properties' dialog, a Generalization connector is added to the diagram from the XSD Union element to each of the member elements on the same diagram; any elements not on the same diagram are listed in the top right corner of the XSD Union element
- If the Member Types that are not on the same diagram as the Union element are not listed, select 'Start > Appearance > Preferences > Preferences > Diagram > Behavior' and select the 'Show Hidden Parents' checkbox
- A Union element:
  - Cannot contain any child Classes
  - Cannot contain any «XSDelement» or «XSDattribute» stereotyped UML attributes
  - Cannot be the source of an Association connector
  - Can be the target of an Association connector from a Complex Type element
  - Can be the target of a Generalization connector from a Simple Type element

Model Group

You can create an «XSDsequence», «XSDchoice» or «XSDall» stereotyped Class by dragging the Model Group icon from the XML Schema Toolbox and dropping it directly onto a diagram.

An «XSDsequence» model group (the default model group type) is a container for the attributes and associations owned by the Class. The model group is in turn added to the model groups of the Class's respective owners. Tagged Values specified by owners of the Class persist through to the child elements of the model group; if memberNames are unqualified for a complexType, so are the children of this model group when added to that complexType.

Toolbox Icon

Access

To display the 'XSD Model Group Properties' dialog for the selected «XSDsequence», «XSDchoice» or «XSDall» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «XSDsequence», «XSDchoice» or «XSDall» stereotyped Class | Properties
Keyboard Shortcuts	Alt+Enter
Other	• Double-click on ?XSDsequence?, ?XSDchoice? or ?XSDall? stereotyped Class, or • Drag the icon from the Toolbox onto the diagram (this creates a new Model Group element; you can choose from the ?XSDsequence?, ?XSDchoice? or ?XSDall? stereotypes, of which ?XSDsequence? is the default)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the Model Group, overtype it with another name.
Model Group	Click on the drop-down arrow and select the value that defines how the child elements of this group should occur in the Complex Type Class: • sequence - to specify that the child elements must occur in the specified order; creates an ?XSDsequence? stereotyped Class • choice - to specify that only one of the child elements can occur; creates an

	?XSDchoice? stereotyped Class • all - to specify that the child elements can occur in any order; creates an ?XSDall? stereotyped Class
MinOccurs	(Optional) Type the minimum number of times this element must occur in the Class. Type 0 to indicate that the element is optional. The default value is 1.
MaxOccurs	(Optional) Type the maximum number of times this element can occur in the Class. Type unbounded to indicate that there is no limit to the number of times the element can occur. The default value is 1.
Annotation	(Optional) Type any notes you need for this element.
OK	Click on this button to save the Model Group data entered and close the XSD element 'Properties' dialog.
Cancel	Click on this button to discard the Model Group data entered and close the XSD element 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing Model Group element information. Click on the button to open the UML element 'Properties' dialog for the Model Group Class.

Notes

- A Model Group:
- Can contain only ?XSDelement? stereotyped UML attributes
- Can contain Complex Types and Simple Types as child elements
- Can be the source of Association connectors to Complex Type, Simple Type, Group and Model Group elements
- Must be the target of least one incoming Association connector from a Complex Type
- Cannot be the source or target of a Generalization connector

Enumeration

An Enumeration defines a list of acceptable values for the Class. You can create an Enumeration element by dragging the Enum icon from the XML Schema Toolbox and dropping it directly onto a diagram.

Toolbox Icon

Access

To display the 'XSD enumeration Properties' dialog for the selected «enumeration» stereotyped element, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «enumeration» stereotyped element | Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on ?enumeration? stereotyped element, or Drag icon from toolbox and drop directly onto the diagram (this creates a new ?enumeration? stereotyped element)

Define Properties

Field/Button	Action
Name	If you do not want to use the default name of the Enumeration, overtype it with another name.
Type	Either: • Type the name of a data type, or • Click on the drop-down arrow and select an XSD built-in dataType from the list, or • Click on the button and browse for an existing XSDsimpleType element
Values	Type each of the values, separated by commas, for the selected Type. These values are listed on the element as attributes.
Annotation	(Optional) Type any notes you need for this element.
OK	Click on this button to save the Enumeration element data entered and close the

	XSD enumeration 'Properties' dialog.
Cancel	Click on this button to discard the Enumeration element data entered and close the XSD enumeration 'Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing Enumeration element information. Click on the button to open the UML element 'Properties' dialog for the Enumeration Class.

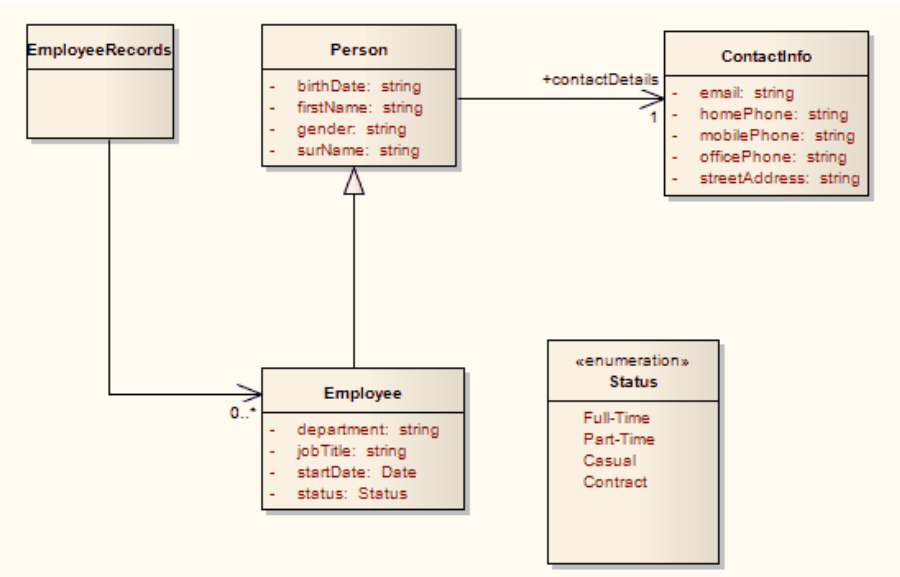
Notes

- An Enumeration:
- Cannot contain any ?XSDelement? or ?XSDattribute? stereotyped UML attributes
- Cannot contain any child Classes
- Cannot be the source of an Association connector
- Can be the target of a Generalization connector
- Can have at most one Generalization connector to a Simple Type Class

XML from Abstract Class Models

You can model XML schemas using only simple, abstract Class models. This makes it possible for an architect, for example, to start working at a higher level of abstraction without concern for the implementation details of a Schema. Whilst such an abstract model can subsequently be refined using the 'XML Schema' pages of the Toolbox, it can be also be generated directly by Enterprise Architect's Schema Generator, in which case the Schema Generator applies a set of default mappings to convert the abstract model to an XSD file.

Example

Structure	Detail
Diagram	This is a simple Class element version of the earlier Employee Details example model. It does not use XSD-specific stereotypes or Tagged Values. 
Schema	This schema fragment can be generated from the example model: <?xml version="1.0"?> <xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"> <xs:simpleType name="Status"> <xs:restriction base="xs:string"> <xs:enumeration value="Full-Time"/> <xs:enumeration value="Part-Time"/> <xs:enumeration value="Casual"/> <xs:enumeration value="Contract"/> </xs:restriction> </xs:simpleType> <xs:element name="Person" type="Person"/> <xs:complexType name="Person"> <xs:sequence>

```
<xs:element name="firstName" type="xs:string"/>
<xs:element name="surName" type="xs:string"/>
<xs:element name="birthDate" type="xs:string"/>
<xs:element name="gender" type="xs:string"/>
<xs:element name="contactDetails" type="ContactInfo"/>
</xs:sequence>
</xs:complexType>
<xs:element name="Employee" type="Employee"/>
<xs:complexType name="Employee">
<xs:complexContent>
<xs:extension base="Person">
<xs:sequence>
<xs:element name="status" type="Status"/>
<xs:element name="jobTitle" type="xs:string"/>
<xs:element name="startDate" type="xs:date"/>
<xs:element name="department" type="xs:string"/>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="EmployeeRecords" type="EmployeeRecords"/>
<xs:complexType name="EmployeeRecords">
<xs:sequence>
<xs:element name="Employee" type="Employee" minOccurs="0"
maxOccurs="unbounded"/>
</xs:sequence>
</xs:complexType>
<xs:element name="ContactInfo" type="ContactInfo"/>
<xs:complexType name="ContactInfo">
<xs:sequence>
<xs:element name="homePhone" type="xs:string"/>
<xs:element name="mobilePhone" type="xs:string"/>
<xs:element name="officePhone" type="xs:string"/>
<xs:element name="email" type="xs:string"/>
<xs:element name="streetAddress" type="xs:string"/>
</xs:sequence>
</xs:complexType>
</xs:schema>
```

Default UML to XSD Mappings

When you are defining simple schemas using abstract Class models, the Enterprise Architect Schema Generator translates the UML information to XSD using a default mapping of UML to XSD constructs. These defaults are also used by the Schema Generator to generate unstereotyped elements in an abstract model.

When you model XML Schema using the 'XML Schema' pages of the Diagram Toolbox, the stereotypes and Tagged Values of the Toolbox elements override the default mappings.

Constructs

UML Construct	Default XSD Production Rules
Package	A Schema element is generated for the target Package. If the target Package includes Classes from another Package, which has the Tagged Values targetNamespace and targetNamespacePrefix set, these are included as attributes of the Schema element. In addition, an import or include element is created for each referenced Package: • An include element is used if the external Package shares the same targetNamespace Tagged Value as the target Package • An import element is used where the targetNamespaces differ
Class	A root-level element declaration and complexType definition are generated. The element name and type are the same as the Class name. An XSD sequence Model Group is also generated, to contain UML attributes generated as elements.
Attribute	An element is declared for each Class attribute. The element name is set to that of the UML attribute name. This is prefixed with the Class name to make the element unique. The minOccurs and maxOccurs attributes are set to reflect the attribute cardinality. If the attribute refers to another Class, the element declaration is followed by a complexType definition, which contains a reference to the appropriate complexType.
Association	An element is declared for each Association owned by a Class. The element name is set to that of the Association role. The minOccurs and maxOccurs attributes reflect the cardinality of the Association.
Generalization (Inheritance)	For single inheritances, an extension element is generated with the base attribute set to the base Class name. The UML attributes of the child Class are then appended to an XSDall Model Group within the extension element.
Enumeration	A simpleType element is declared for the Enumeration with the name attribute set to the Enumeration name. A Restriction element is generated with base set to string. Each of the Enumeration attributes is appended to the Restriction element as XSD Enumeration elements with value set to the UML attribute name. Any type specification for the UML attributes is ignored by the schema generator.

Notes

- If left unspecified, the minOccurs and maxOccurs attributes default to 1
- If the direction of the Association is unspecified, the owner is assumed to be the source

Generate XSD

When you have developed your XML Schema model, either as an abstract Class model or a tailored XSD Class model, you can forward-engineer it into W3C XML Schema (XSD) files using the Generate XML Schema feature. As an XML Schema corresponds to a UML Package in Enterprise Architect, XML Schema generation is a Package-level operation.

You define the location of the file into which the XML Schema is to be generated, in the Schema Package element in your model.

Access

Ribbon	Develop > Schema Modeling > Export XSD

Generate Schema files

Option	Action
Encoding	Either: • Click on the drop-down arrow and select the XML encoding scheme to use, or • Click on the Default button to apply the default encoding scheme (UTF-8)
Generate global element for all global ComplexTypes ('Garden of Eden' style)	Selected by default to generate Schema in the Garden of Eden style, containing a global element. Clear the checkbox if you want to omit the global element.
Generate XSD for Referenced Packages	Select the checkbox to generate Schema for Packages that are referenced by any of the Packages selected on this dialog.
Prompt when missing Filename	Select the checkbox to prompt, during Schema generation, for a filename for a referenced Package if the path into which to generate the Schema file is missing. This option is not available if the 'Generate XSD for Referenced Packages' option is not selected.
Use relative-path to reference XSDs (if 'schemaLocation' tag is empty)	Select the checkbox to use a relative-path in the XSD import (or XSD include) statement when referencing external Packages, provided that the schemaLocation tag is empty on the referenced Packages. You set the 'Schema File' field on the 'XSD Schema Properties' dialog (the element 'Properties' dialog for a Schema element) for the referenced and referencing XSDschema stereotyped Packages, so that the relative-path is correctly determined.
Generate XSD for Child packages	Select the checkbox to generate schema for child Packages of the selected Package, and then select either: • Include all packages - to list all child Packages under the parent Package in the list box, or • Include <XSDschema> packages - to list only those Packages that have the stereotype ?XSDschema?

	The list-box shows, for each Package, the Package name and the file path into which the schema file can be generated (if set). To change the file path for a Package, double-click on the entry in the list-box and type in or browse for the new file path in the prompt field. If the Package has a filepath already set, its checkbox is selected by default, to generate an XSD schema; if you do not want to generate an XSD schema from that Package, you can deselect the checkbox. If you select the checkbox against a Package that does not have a filepath set, the prompt automatically displays for the filepath.
Generate	Click on this button to generate the Schema for each of the Packages selected in the list-box.
Close	Click on this button to close the dialog, without saving your option selections.
View Schema	Click on this button to view the generated Schema for a Package highlighted in the list-box.
Progress	Check the progress of Schema generation.

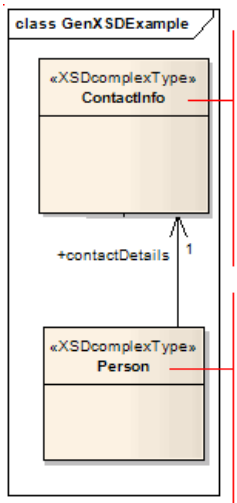
Generate Global Element

Enterprise Architect, by default, generates XML Schema in the Garden of Eden style. For every global XSDcomplexType stereotyped Class, the system generates a global element.

Example

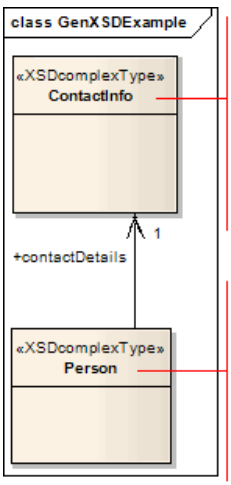
You can change the specified default behavior by de-selecting the 'Generate global element for all global ComplexTypes' checkbox on the 'Generate XML Schema' dialog. Then, the generated XSD no longer contains the global element; that is, it no longer has the lines:

- <xs:element name="ContactInfo" type="ContactInfo"/> and
- <xs:element name="Person" type="Person"/>




```
<xs:element name="ContactInfo" type="ContactInfo"/>
<xs:complexType name="ContactInfo">
        <xs:sequence>
                <xs:element name="email" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="homePhone" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="mobilePhone" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="officePhone" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="streetAddress" type="xs:string" minOccurs="1" maxOccurs="1"/>
        </xs:sequence>
</xs:complexType>
```

```
<xs:element name="Person" type="Person"/>
<xs:complexType name="Person">
        <xs:sequence>
                <xs:element name="birthDate" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="firstName" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="gender" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="surName" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="contactDetails" type="ContactInfo" minOccurs="1" maxOccurs="1"/>
        </xs:sequence>
</xs:complexType>
```




```
<xs:complexType name="ContactInfo">
        <xs:sequence>
                <xs:element name="email" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="homePhone" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="mobilePhone" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="officePhone" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="streetAddress" type="xs:string" minOccurs="1" maxOccurs="1"/>
        </xs:sequence>
</xs:complexType>
```

```
<xs:complexType name="Person">
        <xs:sequence>
                <xs:element name="birthDate" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="firstName" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="gender" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="surName" type="xs:string" minOccurs="1" maxOccurs="1"/>
                <xs:element name="contactDetails" type="ContactInfo" minOccurs="1" maxOccurs="1"/>
        </xs:sequence>
</xs:complexType>
```

Import XSD

To reverse engineer a W3C XML Schema (XSD) file to create or overwrite a Package of your UML Class model, you can use the XML Schema Import facility.

Access

Ribbon	Develop > Schema Modeling > Import XSD

Import Schema files

Option	Action
Package	Displays the name of the selected target Package.
Directory	Type in or browse for (click on) the directory containing the source XSD file(s).
Selected File(s)	Lists the XML Schema(s) currently available for import. • To select a single file, click on it • To select several individual files Ctrl+click on each file • To select a range of files, press Shift and select the first and last file in the range
Import global elements with "Type" postfix	Select this checkbox to treat the global element and the ComplexType it is referring to as two separate entities.
Import referenced XML Schema(s)	Select this checkbox to import any XML Schema that is being referenced by any of the files selected in the 'Selected File(s)' field.
Create Diagram for XML Schema(s)	Select this checkbox to create a Class diagram under each imported XSDschema Package.
Import XSD Elements/Attributes as	Select the appropriate radio button to indicate how the inline XSDelements and XSDattributes are to be imported into a Class, either as: • UML Associations or • UML attributes
Import	Click on this button to begin the XSD import.
Close	Click on this button to close the dialog, without saving your option selections.
Progress	Displays system messages indicating the progress of the Schema import. On imports containing a large number of external references, it can be useful to capture the progress messages to check exactly what has been imported. To do this,

	right-click on the messages and: • Copy the selected messages to the clipboard (select the 'Copy Selected to Clipboard' menu option) • Copy all the messages to the clipboard (select the 'Copy All to Clipboard' menu option), or • Save all the messages to a file (select the 'Save to File' menu option)

Notes

- If an XML Schema file being imported already exists in the model, Enterprise Architect skips importing the file
- References to XSD Primitive Types are always imported as UML attributes
- References to XSD constructs in external Schema files are always imported as UML attributes
- Enterprise Architect uses the schemaLocation attribute in the XSD Import and XSD Include elements of an XML Schema to determine the dependencies between the files; this attribute must be set to a valid file path (and not a URL) for the dependent XML Schema(s) to be imported correctly

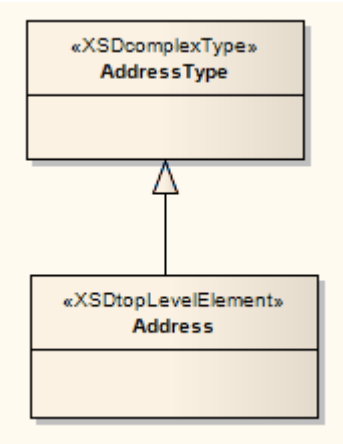
Global Element and ComplexType

Some XML Schemas have ComplexType elements with the same name as the referring global elements, but with the suffix 'Type', as shown:

```
<xs:element name="Address" type="AddressType"/>
<xs:complexType name="AddressType">
    <xs:sequence/>
</xs:complexType>
```

On XSD import, by default, Enterprise Architect treats this global element and its bounding ComplexType as a single entity, and creates a single XSDcomplexType stereotyped Class with the same name as the global element, as shown:

You can change this default behavior by selecting the 'Import global elements with "Type" postfix' checkbox on the 'Import XML Schema' dialog. When you select this option, the system treats the global element and the ComplexType it is referring to as two separate entities. For the example, the system creates an ?XSDtopLevelElement? stereotyped Class for the global element and an ?XSDcomplexType? stereotyped Class for the ComplexType, connected as shown:



Notes

- Enterprise Architect treats these two definitions as separate entities irrespective of whether the 'Import global elements with "Type" postfix' checkbox is selected or unselected:

```
<xs:element name="HomeAddress" type="AddressType"/>
<xs:complexType name="AddressType">
    <xs:sequence/>
</xs:complexType>
```

XSL Transforms

Model, Author and Execute XSLT Transforms and Stylesheets with XML Documents

Enterprise Architect provides facilities for modeling and executing XSL Transformations. XSLT is a technology that can be used to convert XML input documents into other types of document. Stylesheets are the XSL components used to transform the content. Facilities include:

- Specialized diagram and toolbox for modeling XSLT transformations
- Specialized editor for Stylesheet authoring, debugging and execution.
- XML document validation
- XML Schema validation

You model a transformation using the XML Transform diagram. On this diagram you can create xml documents and stylesheets, link them to a transformation (Activity) and then execute or debug the transformation. Inputs to the XSL Transform model are the XSLT and XML File Artifacts, which can be selected from the toolbox. These artifacts are most commonly created by dragging appropriate xml and xsl files on to the diagram. Output from the Transformation is described using the Output Artifact. The progress and success/failure of the transformation is shown on the 'XSLT' tab of the System Output window.

Create the XML Transform Diagram

Step	Action
1	In the Browser window, right-click on the appropriate Package and select the 'New Diagram' option.

Artifact Elements in the XML Transformation Toolbox

Artifact	Description
XML Transform	The model reference for the transformation, providing inputs and optional outputs. Used to run or debug the transformation. Inputs: XML File, XSLT Outputs: Output Artifact (Optional)
2	In the 'New Diagram' dialog, type an appropriate diagram name in the 'Name' field (if necessary) and click on 'Extended' in the 'Select From' list and 'XML Transform' in the 'Diagram Types' list. Click on the OK button. The new diagram opens, with the Diagram Toolbox showing the 'XML Transformation' page.
XSLT	Identifies the stylesheet to execute. Inputs: N/A Outputs: N/A
XML File	Identifies the input document to transform. Inputs: N/A

	Outputs: N/A
XSD	Identifies the schema that can be used, optionally, to automatically perform XML validation on the output document. Inputs: Output Artifact, XML File, (or optional both) Outputs: N/A
Output Artifact	Use this Artifact to define the output of an XSLT operation. The Artifact provides the file path to use when output is created by the transform. To select or name the output file, double-click on the Artifact to display its properties and enter the file path under the 'Files' tab. To make use of the Artifact, draw a trace connector to it from the transform element.

Manually Validate documents

Using Enterprise Architect, you can perform XML validation both of documents to be transformed and of XSLT stylesheets.

To run the validation, right-click in the XML document or stylesheet in the XSL Debugger and select 'XML Validation'. A prompt displays to confirm if you are validating against a document type definition or an XML Schema.

- For a document type definition, simply click on the OK button; the validation proceeds
- For an XML schema, select the appropriate radio button to identify if the validation grammar is defined within the document or elsewhere; if elsewhere, enter the namespace and URL or file path for the grammar

If errors are found during a debugging run, they will be output to the Debug window (press Alt+8 to display this window).

If errors are found during a normal validation run, they will be output to the 'XSL' tab of the System Output window (press Alt+1 and select 'System Output' if this window does not display automatically). To locate the error in the document, double-click on the error message.

XSLT Processor and Version

The XSL Processor used in these features is built from the Apache Xalan Project (C++ version 1.11)

Model an XSL Transformation

When you model an XSL Transformation, you can either draw on files that already exist in your file system, or you can create the contents of the stylesheet and source within the model elements.

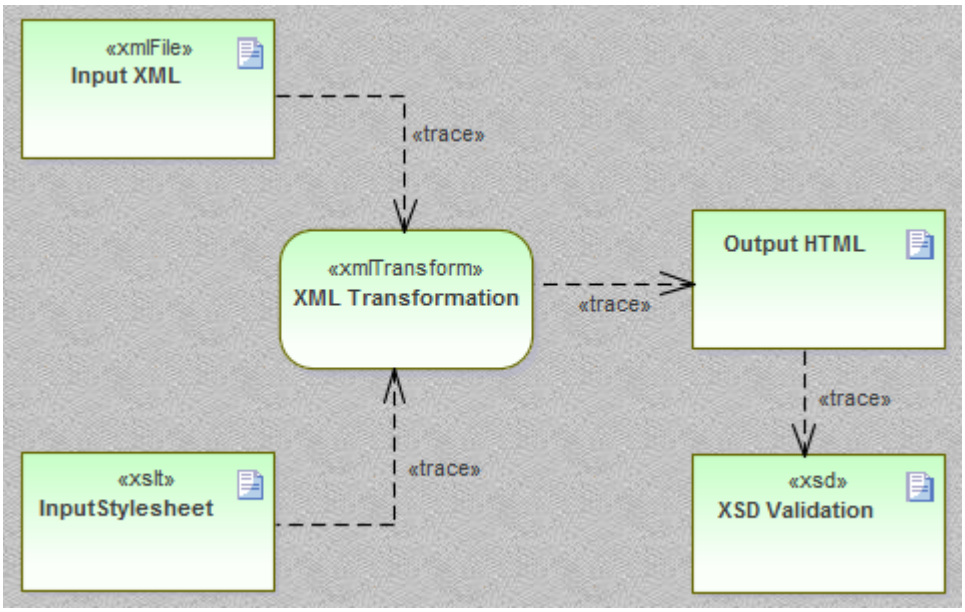
Model elements from existing files

This is the simplest and most common method for modeling transformations. When you drag a file on to the XML Transform diagram, the appropriate Artifact element is generated for you. You can then use the Quick Linker to link the file Artifact elements as inputs to the XML Transform element, using Trace connectors.

Optionally, you can:

- Specify an alternative output location (file) by linking an XML File or Output Artifact to a Trace connector from the XML Transform Artifact
- Validate the output document by dragging an XSD schema file on to the diagram and connecting the resulting XSD element to any Output Artifact of the XML Transform element

Step	Action
1	Open your file browser and the XML Transform diagram.
2	In the file browser, click on the input file and drag it onto the XML Transform diagram. A prompt displays to save the file as an: • External Artifact, where the XML File Artifact serves as a shortcut to the file in the file system • Internal Artifact, where the file content is read into the XML File Artifact and stored inside the model; you would select this option to make the source file contents available to other users of the model
3	Select the 'External Artifact' option. An XML File Artifact element is generated for the input file.
4	In the file browser, click on the XSL stylesheet file and drag it onto the XML Transform diagram. In response to the prompt, select the 'External Artifact' option. An XSLT element is generated for the stylesheet file.
5	Drag the XML Transform icon from the Toolbox onto the diagram, to create an XML Transform Activity element. If you prefer, give this element a new name.
6	Dragging the Trace icon from the 'Common' Toolbox page, create relationships between the: • Input XML file element and the transformation Activity element • XSLT Stylesheet file element and the transformation Activity element
7	(Optional.) • If you want to capture the output in a file, locate the appropriate file in the file browser and drag it onto the diagram to generate another File Artifact; link it to the XML Transform element with a Trace connector • If you want to validate the output document, locate the XSD schema file in the file browser and drag it on to the diagram to generate an XSD element; link this to the output File Artifact (or any Output Artifact) of the Transform element

8	Press Ctrl+S to save the diagram contents. If the output is intended to be HTML, your diagram might resemble this: 

Modeling elements from scratch

When you use the 'XML Transformation' Toolbox to create XSLT and XML File elements, the system stores these as model documents. You double-click on the elements on the XML Transform diagram to open the model documents in Enterprise Architect's XSLT Debugger, where you can write and edit the file contents. When the document is saved, the contents will be saved back to the model.

Otherwise, the process of modeling a transformation is the same as described in *Modeling elements from existing files*.

Edit Documents with the XML Editor

Enterprise Architect provides a robust and useful XML editor with many features including:

- Intelli-sense
- Contextual structure tree providing quick alternative navigation (tip: press Ctrl+1 to toggle document tree view)
- Custom icons for XSL and XSD document elements
- Code completion and
- Validation of document and referenced schemas

The XML Editor will open when any document with an XML declaration is opened within Enterprise Architect. (Alternatively, press Ctrl+Shift+O.) The XSLT Debugger uses two XML editors side-by-side, to display both the stylesheet and the document being transformed.

Execute an XSL Transformation

After you have modeled an XSL Transformation, you can execute it directly from the model diagram. You can also perform the transformation directly from the XSL Stylesheet and input files.

Execute the Transformation From the Diagram

Step	Action
1	On the XML Transform diagram, right-click on the XML Transform Activity element and select the 'Run XSL Transformation' option. The XSLT Debugger view displays, showing the stylesheet (.xsl) file and XML document used in the transformation. The System Output window also displays, showing the error or success messages in the 'XSL' tab. (Press Ctrl+Shift+8 if the System Output window does not display.) If you have set up validation of the output, the System Output window also shows the validation comments.
2	If you have directed the output to a file via an Output or File Artifact, press F12 to view the output.

Debug an XSL Transformation

When you use the XSLT debugger to run a transformation you can control the process and inspect the state of the transformation using Enterprise Architect's debugger in combination with breakpoints. The XSLT Debugger provides a Run button and various Step buttons. You set breakpoints by clicking in the left margin of the stylesheet.

When a step completes or a breakpoint is encountered, the context of the transformation - including any parameters to template calls - can be viewed in the Locals window ('Execute > Windows > Local Variables'). You can also display the Call Stack ('Execute > Windows > Call Stack) to see how the current state of the transformation was reached.

Debug the Transformation

Step	Action
1	On the XML Transform diagram, right-click on the XML Transform Activity element and select the 'Debug XSL Transformation' option. The XSLT Debugger view displays, showing the stylesheet (.xsl) file and XML document used in the transformation, which is automatically initiated. The currently executing statement in the stylesheet is highlighted. Across the top of the view is a debugger toolbar, providing the normal debugging options to Start, Pause, Step Over, Step In, Step Out and Stop the debugging process. The final icon in the toolbar provides the option of hiding or showing the '.xml source' tab in the view. You can use these buttons to repeat and control the debugging process. The System Output window also displays, showing the debugger progress messages on the 'XSLT Transformation' tab. (Press Alt+1 and select 'System Output' if the System Output window does not display.) Error messages are directed to the Debug window (press Alt+8). You can also use the Debug window toolbar buttons and options to control debugging of the XSL Transformation.
2	If necessary, select to display the Locals window and the Call Stack. Click on the left margin of the XSLT Debugger stylesheet panel and set any Breakpoints you want to use to check processing.
3	Run the debugger again and examine the execution as indicated by the System Output window, Call Stack, Locals window, and any other Debugger or Execution Analysis tools you want to apply.

XML Validation

Enterprise Architect provides validation of XML documents. Documents can be verified against XML schema or Data Type Definitions (DTD). Validation is performed from within an Enterprise Architect editor using its context menu. Often an XML document will contain information relating to the schema that it conforms to. You can, however, choose to override this, validating the document against any schema, either at a path on your local machine or at a URL. This example demonstrates the use of the feature for a document that contains an incorrect attribute.

Access

Context Menu	Accessible from context menu of any editor window displaying xml content. Right-click in editor window and choose 'XML Validation'

XML Document Validation

Step	Action
1	Open the XML document to be validated.
2	Use the editor context menu and select the 'XML Validation' option.
3	Select the grammar of choice from the available options: • XML Schema (default) • Data Type Definition
4	Select the schema location. 'Defined in document' is selected by default. It is usual for an XML document to specify the schemas that govern its content. To choose a different schema from that defined in the document, select 'External' and provide either a URL or a file path. Examples: • http://mydomain/myschema.xsd • c:\mydomain\myschema.xsd
5	Click OK. The output of the validation will be displayed in the 'XML Validation' tab of the System Output window.

XML Document Validation Example

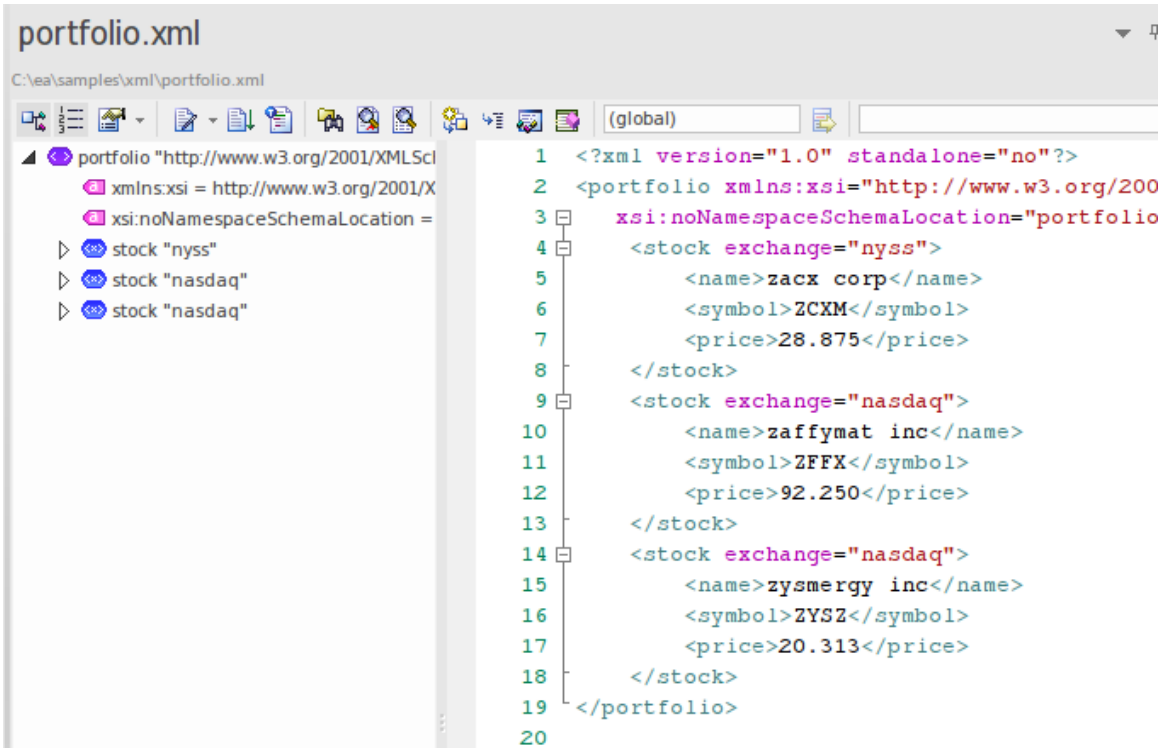


Figure 1: The XML document with an invalid attribute value 'nyss'

In this example, the document describes a stock item that has an invalid exchange code 'nyss'. As can be seen from this schema, the only valid values for the 'exchange' attribute are 'nyse', 'nasdaq' or 'ftsi'.

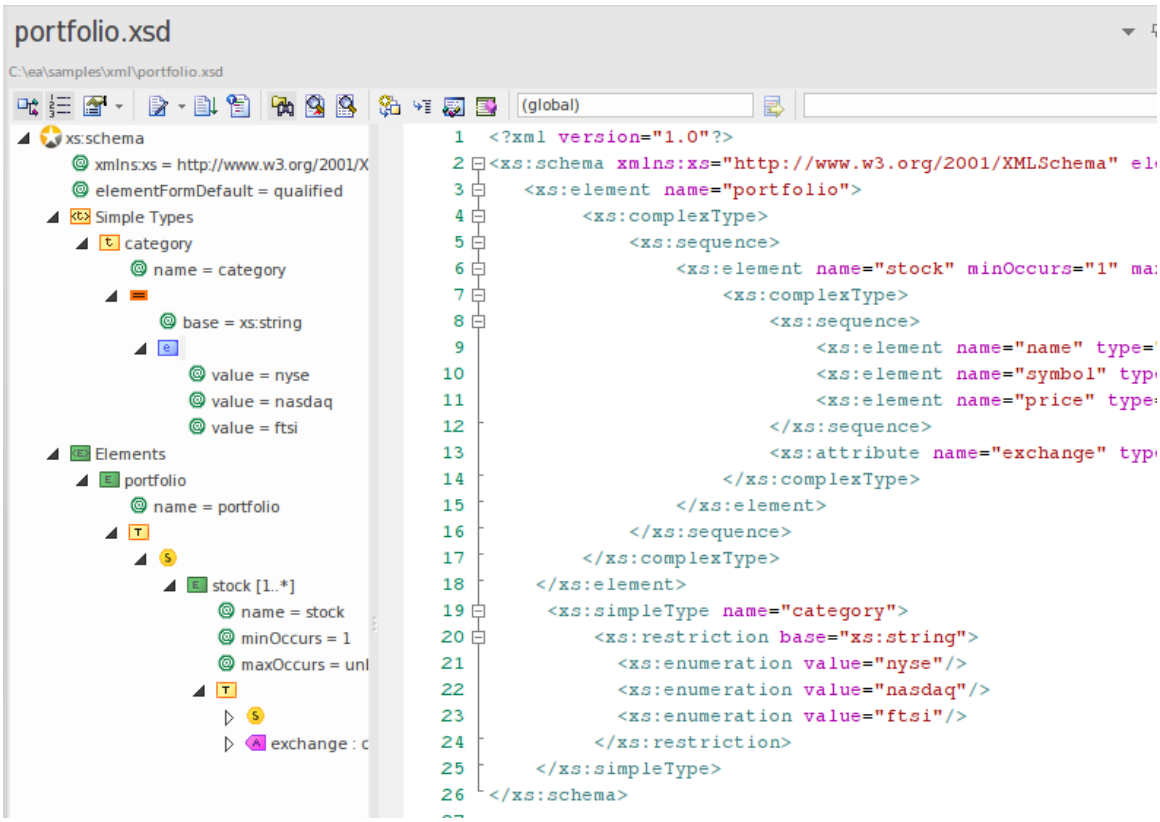


Figure 2: The XML Schema describing permitted stock exchange codes

This image shows the schema used in the validation. The declaration of a 'portfolio' element can be seen here to be made up of one or more 'stock' elements. Each stock element in turn, requires an 'exchange' attribute naming a code for the stock exchange in question.

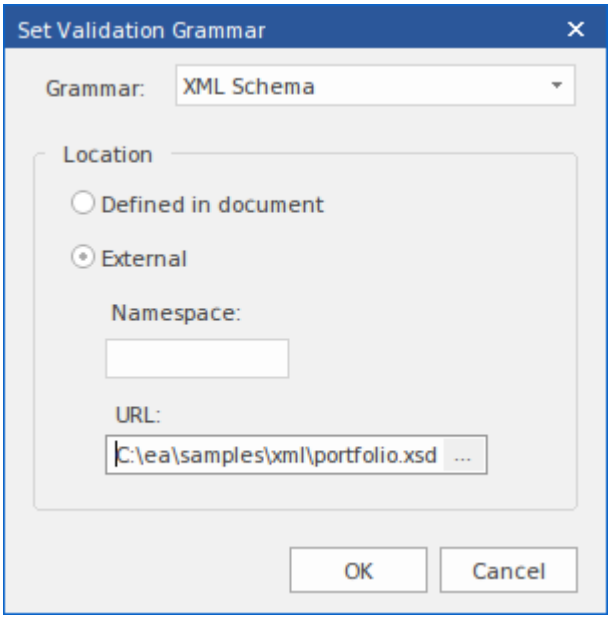


Figure 3: The 'XML validation' dialog naming a local schema file

This is the 'XML Validation' dialog. It is accessible from the context menu of any editor in Enterprise Architect that holds XML content. Here you can select the schema to use in the validation. In the example the processor will validate the document using a local schema file. This just happens to be the same schema named by the document, but it could be any schema (a development or later version of the schema for example).

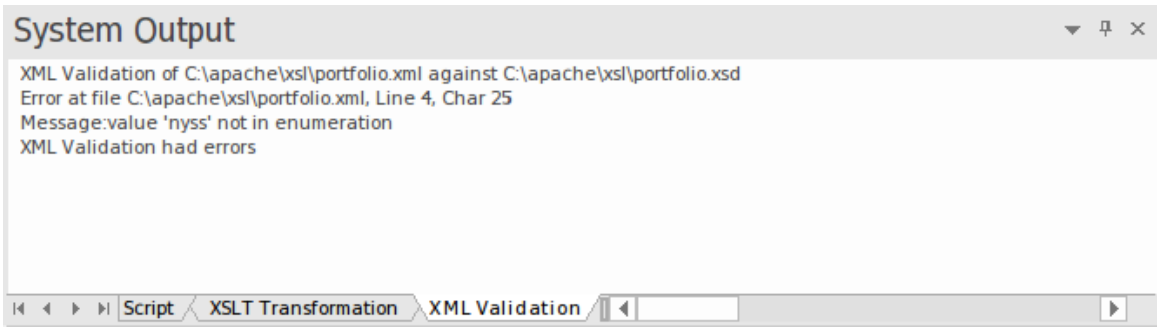


Figure 4: The System Output window showing validation error

This image shows the results of the validation. The attribute value 'nyss' has been identified as being incorrect according to the enumeration described by the schema. Double-clicking the error will display the line of code in the editor where it can easily be corrected.

XML Service Oriented Architecture

Model Organizations, Communities and Systems to Maximize Agility, Scale and Interoperability

Service Oriented Architecture (SOA) is an architectural paradigm for defining how people, organizations and systems provide and use services to achieve results.

A service is an offer of value to another through a well-defined interface, available to a community (which could be the general public). A service results in work provided to one by another.

Service Oriented Architecture (SOA) is a way of organizing and understanding (representations of) organizations, communities and systems to maximize agility, scale and interoperability. The SOA approach is simple - people, organizations and systems provide services to each other. These services allow us to get something done without doing it ourselves or even without knowing how to do it - enabling us to be more efficient and agile. Services also enable us to offer our capabilities to others in exchange for some value - thus establishing a community, process or marketplace. The SOA paradigm works equally well for integrating existing capabilities as for creating and integrating new capabilities.

(Derived from *Service oriented architecture Modeling Language (SoaML) - Specification for the UML Profile and Metamodel for Services (UPMS)* (OMG document ad/2008-11-01); pp. 25-26.)

In modeling and developing a complete Service Oriented Architecture in Enterprise Architect, you can work with any or all of:

- XML Schema Definition (XSD), also known as XML Schema - an XML technology that is used to specify the rules to which an XML document must adhere; Enterprise Architect provides a Schema Composer interface to help you model and generate XML schema
- XSL Transformations to convert input documents into XML or other types of document using XSL stylesheets, for which you use the XSLT Editor and Debugger for modeling and executing the transformations
- Web Services Description Language 1.1 (WSDL) - a key XML-based language for describing web services
- Service oriented architecture Modeling Language (SoaML) - a standard method of designing and modeling SOA solutions using the Unified Modeling Language (UML)
- Service-Oriented Modeling Framework (SOMF) - a service-oriented development life cycle methodology, offering a number of modeling practices and disciplines that contribute to successful service-oriented life cycle management and modeling
- National Information Exchange Modeling (NIEM) - a common framework that is used to define how information can be shared between systems, government agencies and departments
- Meta-Object Facility (MOF) - an Object Management Group (OMG) standard developed as a meta-modeling architecture to define the UML, and so provide a means to define the structure or abstract syntax of a language or of data

WSDL

Web Services Description Language 1.1 (WSDL) is a key XML-based, World Wide Web Consortium (W3C) language for describing web services. 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 specifying, constructing and deploying XML-based SOA artifacts within an organization.

Using Enterprise Architect, you can rapidly model, forward engineer and reverse engineer WSDL files.

WSDL 1.1 Model Structure

A Web Service Description Language (WSDL), under specification 1.1, is defined within a ?WSDLnamespace? stereotyped Package, which represents the top-level container for the WSDL elements. Conceptually it maps to the targetNamespace in a WSDL definition element.

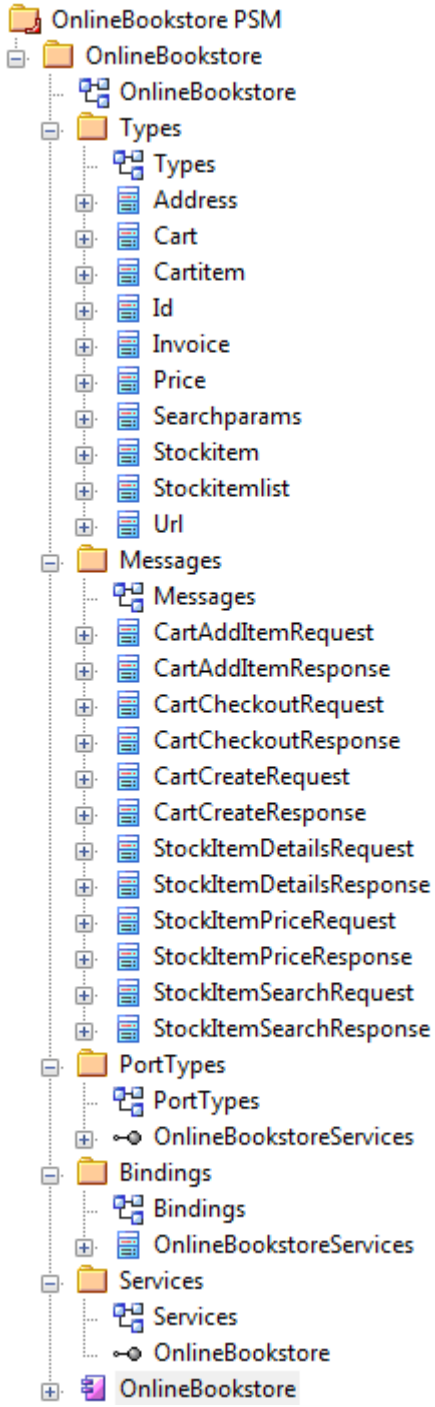
When you create a WSDL model, Enterprise Architect creates the Namespace and provides a set of sub-Packages, each containing a diagram on which to define the constituent elements of the model, with an Overview diagram to navigate between the sub-Packages. You work through the sub-Packages in sequence, to define the objects that are used by later objects, themselves called into still later objects.

WSDL Structure Development

WSDL Element Type	Description
Types	Defined in an XSD Schema, these are the XSD data types used by the web service and communicated by WSDL Messages; you drag «XSDelement», «XSDsimpleType» and «XSDcomplexType» stereotyped elements onto the Types diagram from the 'XML Schema' page of the Diagram Toolbox.
Messages	WSDL Messages identify the data being communicated by a web service. Each Message element contains one or more Message Parts, which are attributes that each identify an XSD data type being communicated.
Port Types	WSDL Port Types are the essential core of the web service, defining the interfaces of the service. Each Port Type consists of a set of Port Type Operations, each of which identifies an exchange of Messages (data input to and output from the interface as that operation). The Port Type Operation can also identify Messages acting as Fault indicators.
Bindings	A Binding specifies the protocol and data format for the operations and messages defined for of a particular Port Type. Each «WSDLbinding » Class implements (realizes) the operations specified by the «WSDLportType» Interface - the Port Type Operations in the Port Type element are automatically copied into the Binding element as Binding operations.
Services	A WSDL Service defines a formal interface of the web service. It describes the collection of Port Types that expose a particular Binding, having an Association to each exposed Binding. It therefore encapsulates a set of the other data structures - if not all the data structures - defined in the model.
Documents	WSDL Documents are represented by Components having the stereotype «WSDL». This is the element from which you generate the WSDL file. You can create more than one Document to re-use the schema Types, Messages, Port Types, Bindings and Services of a Namespace across multiple physical WSDL documents, either in the same configuration or in different configurations.

Example

This figure shows an example WSDL namespace, OnlineBookstore PSM, which includes a single WSDL document, OnlineBookstore (at the bottom of the hierarchy).



Notes

- You can also generate a WSDL Package structure from a UML Interface using the WSDL Model Transformation

Model WSDL

You can quickly and easily model the elements in a Web Service Definition using the WSDL page of the Diagram Toolbox. As a first step, you can create an example WSDL Package structure in the Browser window, using the Namespace icon from the WSDL page. You can use this example Package structure as a template for developing your WSDL.

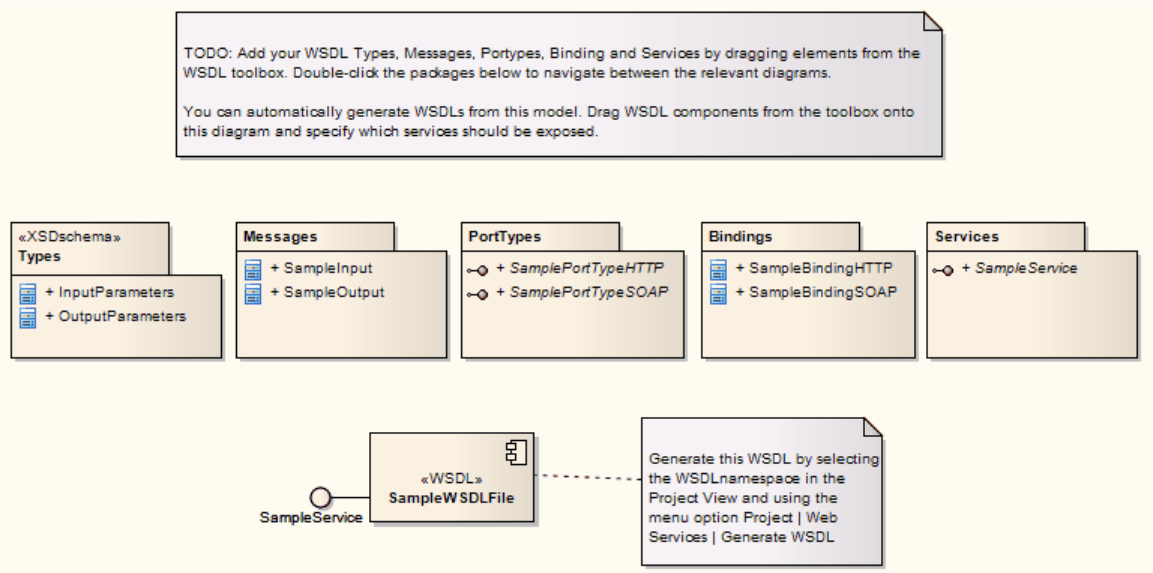
Create a new WSDL Package structure

Step	Action
1	In the Browser window, create the top-level project structure you need (Model and Views), and click on the appropriate View.
2	Click on the 'New Package' option in the Browser window header drop-down list. The 'New Model Package' dialog displays.
3	In the 'Name' field type the name of the new Package, and select the 'Create Diagram' radio button.
4	Click on the OK button. The 'New Diagram' dialog displays.
5	In the 'Name' field type the name of the new diagram. In the 'Select From' panel select 'UML Structural', and in the 'Diagram Types' panel select 'Class'.
6	Click on the OK button. In the Browser window, double-click on the icon next to the new diagram's name; the diagram opens in the Diagram View, with the Class pages displaying in the Diagram Toolbox.
7	In the Toolbox, click on to display the 'Find Toolbox Item' dialog and specify 'WSDL', then select the Toolbox page from the results. The 'WSDL' Toolbox page displays.
8	Click on the 'Namespace' icon from the Toolbox and drag it into the Class diagram. The 'WSDL Namespace Properties' dialog displays. Type in a WSDL Package name and the URL of the Target Namespace. You can edit these values later.
9	Click on the OK button. The sample «WSDLnamespace» stereotyped Package structure is created on the diagram, and the full model structure is displayed, expanded, in the Browser window. The model structure consists of these sub-Packages, with an Overview diagram to navigate between them: • Types: Contains the XSD types for the data communicated by the web service, on a Types diagram • Messages: Contains the WSDL Messages, modeled as UML Classes marked with the stereotype «WSDLmessage» • PortTypes: Contains the WSDL Port Types, modeled as UML interfaces marked with the stereotype «WSDLportType» • Bindings: Contains the WSDL Bindings, modeled as UML Classes that realize the PortTypes • Services: Contains the WSDL Services, modeled as UML interfaces with Associations to each

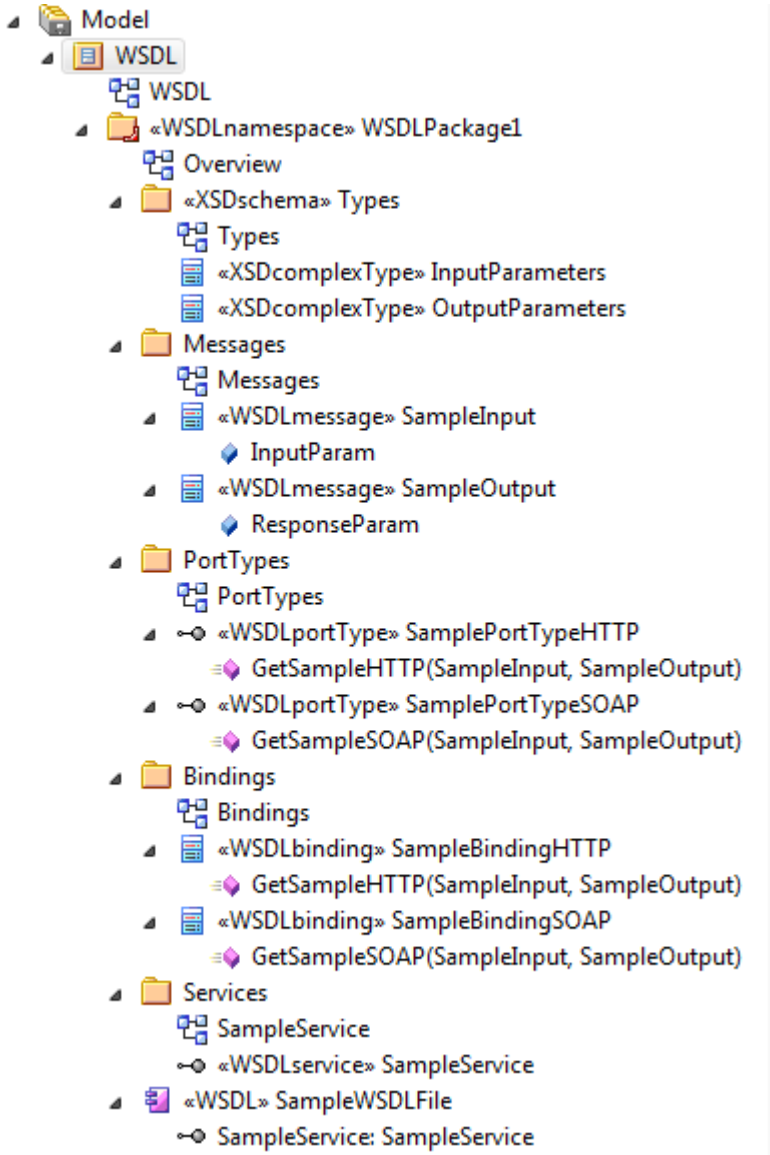
	exposed Binding
10	Model each of the WSDL constructs in their corresponding Packages.

Template WSDL Model - Diagram

The WSDLnamespace Package acts as a container for the WSDL structure.



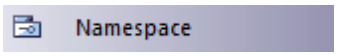
Template WSDL Model - Browser Window Hierarchy


Model
WSDL
WSDL
«WSDLnamespace» WSDLPackage1
Overview
«XSDschema» Types
Types
«XSDcomplexType» InputParameters
«XSDcomplexType» OutputParameters
Messages
Messages
«WSDLmessage» SampleInput
InputParam
«WSDLmessage» SampleOutput
ResponseParam
PortTypes
PortTypes
«WSDLportType» SamplePortTypeHTTP
GetSampleHTTP(SampleInput, SampleOutput)
«WSDLportType» SamplePortTypeSOAP
GetSampleSOAP(SampleInput, SampleOutput)
Bindings
Bindings
«WSDLbinding» SampleBindingHTTP
GetSampleHTTP(SampleInput, SampleOutput)
«WSDLbinding» SampleBindingSOAP
GetSampleSOAP(SampleInput, SampleOutput)
Services
SampleService
«WSDLservice» SampleService
«WSDL» SampleWSDLFile
SampleService: SampleService

WSDL Namespace

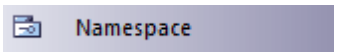
A «WSDLnamespace» stereotyped Package represents the top-level container for the WSDL constructs in Enterprise Architect. You can create the Namespace Package by dragging the Namespace icon from the WSDL Toolbox page and dropping it directly onto a diagram.

Toolbox Icon



Access

To display the 'WSDL Namepace Properties' dialog for the selected «WSDLnamespace» stereotyped Package, use one of the methods outlined here.

Ribbon	Design > Package > Manage > Properties
Context Menu	Right-click on «WSDLnamespace» stereotyped Package | Properties
Other	In Browser window, double-click on «WSDLnamespace» stereotyped Package, or Drag  icon from toolbox onto a diagram (this creates a new «WSDLnamespace» stereotyped Package)

Define Properties

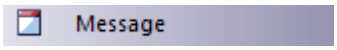
Option	Action
WSDL Package Name	Type in the name of the WSDL Namespace Package element.
Target Namespace	(Optional) Type in the URL for the WSDL Namespace Package.
OK	Click on this button to save the values entered and close the WSDL Namespace 'Properties' dialog. If you have just created the Namespace, a new Package diagram opens containing the sample template WSDL model.
Cancel	Click on this button to discard the data entered and close the 'WSDL Namespace Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing WSDL Namespace element information. Click on the button to open the UML element 'Properties' dialog for the Namespace

	Package element.

WSDL Message

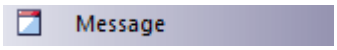
A «WSDLmessage» stereotyped Class represents a WSDL Message and acts as a container for one or more WSDL Message Parts. You can create WSDL Messages by dragging the Message icon from the WSDL Toolbox and dropping it directly onto the Messages diagram (under the Messages Package in the WSDL Package structure).

Toolbox Icon



Access

To display the 'WSDL Message' dialog for the selected «WSDLmessage» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «WSDLmessage» stereotyped Class| Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on a ?WSDLmessage? stereotyped Class, or Drag  icon from the toolbox and drop directly onto the Messages diagram, under the Messages Package in the WSDL Package structure. (This creates a new ?WSDLmessage? stereotyped Class.)

Define Properties

Option	Action
Name	Type in the name of the WSDL Message.
Documentation	(Optional) Type in any notes you need for this element.
OK	Click on this button to save the data entered and close the WSDL Message dialog.
Cancel	Click on this button to discard the data entered and close the 'WSDL Message' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing WSDL Message element information.

	Click on the button to open the UML Class 'Properties' dialog for the element.

Notes

- WSDL Messages can only be created under the Messages Package in the WSDL Package structure
- The name of the WSDL Message should be unique amongst all WSDL Messages within the WSDL

WSDL Message Part

A WSDL Message Part is the segment of a WSDL Message that identifies the XSD data type of the data communicated by the Message. If a Message communicates data of more than one data type, each data type is identified in a separate Message Part.

In Enterprise Architect, a WSDL Message Part is represented by a UML attribute of the WSDL Message Class. You can create the Message Part attribute by dragging the 'Message Part' icon from the WSDL Toolbox and dropping it onto a ?WSDLmessage? stereotyped Class.

Toolbox Icon

Access

To display the 'WSDL Message Part' dialog for the selected Message Part, use one of the methods outlined here.

Ribbon	With a specific Message Part (attribute) selected within a WSDL Message on a diagram: Design > Element > Features > Attributes
Context Menu	With a specific Message Part (attribute) selected within a WSDL Message on a diagram: Right-click on attribute | View Properties
Keyboard Shortcuts	With a specific Message Part (attribute) selected within a WSDL Message on a diagram: F9
Other	Double-click on the Message Part (attribute) within the ?WSDLmessage? stereotyped Class, or Drag icon from toolbox and drop onto a ?WSDLmessage? stereotyped Class (This creates a new Message Part (as an attribute) within the ?WSDLmessage? stereotyped Class.)

Define Properties

Option	Action
Name	Type in the name of the WSDL Message Part attribute.
Type	Either: • Type the name of a data type, or • Click on the drop-down arrow and select an XSD built-in dataType from the

	list, or • Click on the button and browse for an existing ?XSDelement?, ?XSDcomplexType? or ?XSDsimpleType? element as a classifier The XSD Types can be defined in: • The Types Package under the WSDL Package Structure or • Any other Package in the model
OK	Click on this button to save the data entered and close the 'WSDL Message Part' dialog.
Cancel	Click on this button to discard the data entered and close the 'WSDL Message Part' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing WSDL Message Part attribute information. Click on the button to open the attribute properties for the Message Part.

Notes

- WSDLmessage stereotyped Classes can effectively contain Message Part attributes only; if you add other attributes to the Class element, they are re-cast as Message Parts

WSDL Port Type

A «WSDLportType» stereotyped Interface represents a WSDL PortType. It describes the operations exposed by the WSDL, acting as a container for one or more WSDL Port Type Operations. You can create a WSDL PortType element by dragging the Port Type icon from the WSDL Toolbox and dropping it directly onto the PortTypes diagram (under the PortTypes Package in the WSDL Package structure).

Toolbox Icon

Access

To display the 'WSDL PortType' dialog for the selected «WSDLportType» stereotyped Interface, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «WSDLportType» stereotyped Interface| Properties
Keyboard Shortcuts	Alt+Enter
Other	• Double-click on a ?WSDLportType? stereotyped Interface, or • Drag icon from the toolbox and drop directly onto the PortTypes diagram, under the PortTypes Package in the WSDL Package structure (This creates a new ?WSDLportType? stereotyped Interface.)

Define Properties

Option	Action
Name	Type in the name of the WSDL PortType.
Documentation	(Optional) Type in any notes you need for this element.
OK	Click on this button to save the data entered and close the WSDL PortType dialog.
Cancel	Click on this button to discard the data entered and close the 'WSDL PortType' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing WSDL PortType element

	information. Click on the button to open the UML element 'Properties' dialog for the element.

Notes

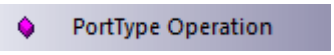
- WSDL PortTypes can only be created under the PortTypes Package in the WSDL Package structure
- The name of the WSDL PortType should be unique amongst all the WSDL PortTypes within the WSDL

WSDL Port Type Operation

A Port Type Operation identifies an exchange of Messages (data input to and output from the interface as an operation). The Port Type Operation can also identify Messages acting as Fault indicators.

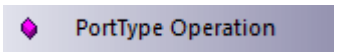
In Enterprise Architect, a WSDL PortType Operation is represented by a UML Operation of the WSDL PortType Interface. You can create a PortType Operation by dragging the PortType Operation icon from the WSDL Toolbox and dropping it onto a ?WSDLportType? stereotyped Interface.

Toolbox Icon



Access

To display the 'WSDL PortType Operation' dialog for the selected PortType Operation, use one of the methods outlined here.

Ribbon	With a specific PortType Operation selected within a ?WSDLportType? stereotyped Interface on a diagram: Design > Element > Features > Operations
Context Menu	With a specific PortType Operation selected within a ?WSDLportType? stereotyped Interface on a diagram: Right-click on attribute | View Properties
Keyboard Shortcuts	With a specific PortType Operation selected within a «WSDLportType» stereotyped Interface on a diagram: F10
Other	Double-click on the PortType Operation within the ?WSDLportType? stereotyped Interface, or Drag  icon from toolbox and drop onto a ?WSDLportType? stereotyped Interface. (This creates a new PortType Operation (as a UML operation) within the ?WSDLportType? stereotyped Interface.)

Define Properties

Option	Action
Name	Type in the name of the WSDL PortType Operation.
Documentation	(Optional) Type in any notes you need for this operation.
Operation Type	Click on the drop-down arrow and select one of the supported PortType Operation

	types: • OneWay • Request-Response • Solicit-Response • Notification
Input	This section is grayed out if you have selected Notification as the operation type. • Name - Defaults to a name that parallels theOperation Type. If you do not want to use the default, type an alternative name for the input Message. • Message - Click on the drop-down arrow and select one of the WSDL Messages previously created in theMessagePackage. • Documentation - (Optional) Type in any notes you need for this input Message.
Output	This section is grayed out if you have selected OneWay as the operation type. • Name - Defaults to a name that parallels theOperation Type. If you do not want to use the default, type an alternative name for the output Message. • Message - Click on the drop-down arrow and select one of the WSDL Messages previously created in theMessagePackage. • Documentation - (Optional) Type in any notes you need for this output Message.
Faults	Review the details of the WSDL Messages that can act as Faults. Faults display in this list with the most recently-created at the top and the oldest at the end. If more than four Fault Messages are defined, use the vertical scroll bar to display the rest of the list. To add a Message, click on the New button. The 'WSDL PortType Operation Fault' dialog displays. • Name - Defaults to 'Fault<n>'; if you do not want to use the default, type an alternative name for the fault Message • Message - Click on the drop-down arrow and select one of the WSDL Messages previously created in the Message Package • Documentation - (Optional) Type in any notes you need for this fault Message • OK - Click on this button to save the data entered and close the 'WSDL PortType Operation Fault' dialog • Cancel - Click on this button to discard the data entered and close the 'WSDL PortType Operation Fault' dialog • Help - Click on this button to display this Help topic To remove a Message from the list, click on it and click on the Delete button.
OK	Click on this button to save the data entered and close the 'WSDL PortType Operation' dialog.
Cancel	Click on this button to discard the data entered and close the 'WSDL PortType Operation' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing WSDL Port Type Operation information. Click on the button to open the UML operation 'Properties' dialog for the element.

Notes

- WSDL PortType Operations can only be contained by WSDL PortTypes
- The name provided for an Input, Output or Fault Message in a PortType Operation must be unique amongst the Input, Output and Fault Messages, respectively, across the WSDL PortType
- In the UML operation 'Properties' dialog, the Messages identified as Input, Output and Fault can be examined as the parameters of the operation

WSDL Binding

A WSDL Binding element implements the operations specified by a particular ?WSDLportType? stereotyped Interface and describes the message format and protocol details for the operations and messages defined by this WSDL PortType. A WSDL Binding element is represented by a ?WSDLbinding? stereotyped Class.

You create a WSDL Binding element by dragging the Binding icon from the WSDL Toolbox directly onto the Bindings diagram under the Bindings Package in the WSDL Package structure.

Toolbox Icon

Access

To display the 'WSDL Binding' dialog for the selected «WSDLbinding» stereotyped Class, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «WSDLbinding» stereotyped Class | Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on a ?WSDLbinding? stereotyped Class, or Drag icon from the toolbox and drop directly onto the Bindings diagram, under the Bindings Package in the WSDL Package structure. (This creates a new ?WSDLbinding? stereotyped Class.)

Define Properties

Option	Action
Name	Type in the name of the WSDL Binding element.
PortType	Click on the drop-down arrow and select the WSDL PortType to be implemented by this WSDL Binding.
Protocol	Click on the drop-down arrow and select the protocol for the transmission of the selected WSDL PortType's operations. The supported protocols are: • SOAP • HTTP
Transport	This field is disabled if you have selected the HTTP protocol.

	Defaults to http://schemas.xmlsoap.org/soap/http. If necessary, type in an alternative URL for the SOAP protocol.
Style	This field is disabled if you have selected the HTTP protocol. Click on the drop-down arrow and select the style of SOAP protocol.
Verb	This field is disabled if you have selected the SOAP protocol. Click on the drop-down arrow and select the appropriate HTTP verb. The supported verbs are: • GET • POST
Documentation	(Optional) Type in any notes you need for this element.
OK	Click on this button to save the data entered and close the 'WSDL Binding' dialog.
Cancel	Click on this button to discard the data entered and close the 'WSDL Binding' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing WSDL Binding element information. Click on the button to open the UML element 'Properties' dialog for the element.

Notes

- A WSDL Binding must implement a WSDL PortType; therefore, WSDL PortTypes should be defined before you create WSDL Bindings
- WSDL Bindings can only be created under the Bindings Package in the WSDL Package structure
- The name of the WSDL Binding should be unique amongst all the WSDL Bindings within the WSDL

WSDL Binding Operation

When you save a newly-created ?WSDLbinding? stereotyped Class, the system:

1. Adds to the Binding diagram, the WSDL Port Type element implemented by the WSDL Binding.
2. Draws a Realization connector from the Binding to the PortType.
3. Automatically populates the Binding with all the UML operations from the PortType, as the WSDL Binding Operations.

Access

To display the 'WSDL Binding Operation Details' dialog for the selected Binding Operation, use one of the methods outlined here.

Ribbon	With a specific Binding Operation selected within a ?WSDLbinding? stereotyped Class on a diagram: Design > Element > Features > Operations
Context Menu	With a specific Binding Operation selected within a ?WSDLbinding? stereotyped Class on a diagram: Right-click on attribute | View Properties
Keyboard Shortcuts	With a specific Binding Operation selected within a ?WSDLbinding? stereotyped Class on a diagram: F10
Other	Double-click on the Binding Operation within the «WSDLbinding» stereotyped Class

Define Properties

Option	Action
Operation Name	Displays the name of the Operation copied from the WSDL PortType element. The value in this field cannot be edited.
Action	If the protocol of the parent WSDL Binding element was defined as HTTP, this field is grayed out. Type in the SOAP Action header (URL) for this operation.
Style	If the protocol of the parent WSDL Binding element was defined as HTTP, this field is grayed out. Click on the drop-down arrow and select the SOAP style of the operation.
Location	If the protocol of the parent WSDL Binding element was defined as SOAP, this field is grayed out.

	Type in the relative URL of this Operation.
Documentation	(Optional) Type in any notes you need for this operation.
Parameters	Click on this button to define the parameters for this operation. The 'WSDL Binding Operation Parameters' dialog displays, showing the names of the operation Input, Output and Faults. You cannot change these names. Click on the Details button to specify the details for Input, Output and Fault operation (Message) parameters. Note that the Details button in the: • Input section is disabled for the Notification Operation Type • Output section is disabled for the One-way Operation Type • Fault section is disabled if there are no Fault Messages • Use - If the protocol of the parent WSDL Binding element was defined as HTTP, this field is grayed out; click on the drop-down arrow and select the encoding that is to be used • Encoding Style - If the protocol of the parent WSDL Binding element was defined as HTTP, this field is grayed out; if 'Use' is set to 'encoded', type in the style (URL) to apply • Namespace - If the protocol of the parent WSDL Binding element was defined as HTTP, this field is grayed out; (Optional) type in the namespace • Parts - If the protocol of the parent WSDL Binding element was defined as HTTP, this field is grayed out; this field is also not applicable to Faults - (Optional) type in the Message Part attributes that appear within the SOAP Body portion • Header - This field is not applicable to Faults; (Optional) type in the text of the SOAP/HTTP Header • Documentation - (Optional) Type in any notes you need for this message • OK - Click on this button to save the data entered and close the 'WSDL Binding Parameter Details' dialog • Cancel - Click on this button to discard the data entered and close the 'WSDL Binding Parameter Details' dialog • Help - Click on this button to display this Help topic
OK	Click on this button to save the data entered and close the 'WSDL Binding Operation Details' dialog.
Cancel	Click on this button to discard the data entered and close the 'WSDL Binding Operation Details' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing WSDL Binding Operation information. Click on the button to open the UML operation 'Properties' dialog for the element.

Notes

- If you subsequently change the WSDL Port Type operations, you can refresh the Binding Operations by deleting the

Realization connector and re-establishing it; the 'Overrides & Implementations' dialog displays, on which you select the updated operations to establish

- You can review the parameters of a Binding Operation by highlighting the operation in the diagram or Browser window and expanding the entries in the Properties window

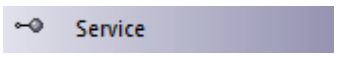
WSDL Service

A WSDL Service is represented by a ?WSDLservice? stereotyped Interface; it describes a collection of Ports that expose a particular Binding. You can create a WSDL Service element by dragging the Service icon from the WSDL Toolbox and dropping it directly onto a diagram in the Services Package of your WSDL model.

When you save a newly-created ?WSDLservice? stereotyped Interface, the system:

1. Adds the WSDL Binding elements exposed by the WSDL Service to the Service diagram.
2. Draws an Association connector from the Service element to each Binding element.
3. Labels each connector with the corresponding Port name.

Toolbox Icon



Access

To display the 'WSDL Service' dialog for the selected «WSDLservice» stereotyped Interface, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «WSDLservice» stereotyped Interface| Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on a ?WSDLservice? stereotyped Interface, or Drag the icon from the toolbox and drop directly onto the SampleService diagram, under the Services Package in the WSDL Package structure. (This creates a new ?WSDLservice? stereotyped Interface.)

Define Properties

Option	Action
Name	Type in the name of the WSDL Service.
Documentation	(Optional) Type in any notes you need for this element.
Ports	Identify the Ports (or endpoints) for this WSDL Service. To add a Port to the list, click on the New button. The 'WSDL Port' dialog displays. • Port Name - Type in the name of the Port • Binding - Click on the drop-down arrow and select a Binding element from the list of all the WSDL Bindings created in theBindingsPackage

	• Location - Type in the URL for the Port • Documentation - (Optional) Type in any notes you need for this Port • OK - Click on this button to save the values entered and close the 'WSDL Port' dialog • Cancel - Click on this button to discard the values entered and close the 'WSDL Port' dialog • Help - Click on this button to display this Help topic The Ports are organized in the list with the most recent at the top and the oldest at the end. To remove an entry from the list, click on it and click on the Delete button.
OK	Click on this button to save the data entered and close the WSDL Service dialog.
Cancel	Click on this button to discard the data entered and close the 'WSDL Service' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing WSDL Service element information. Click on the button to open the UML element 'Properties' dialog for the element.

Notes

- WSDL Services can only be created under the Service Package in the WSDL Package structure
- The name of the WSDL Service should be unique amongst all the WSDL Services within the WSDL

WSDL Document

A WSDL Document encapsulates a Web Service defined within the ?WSDLnamespace? stereotyped Package, and is the source from which the WSDL file is generated. It is represented by a ?WSDL? stereotyped Component element as a direct child element of the ?WSDLnamespace? stereotyped Package. You can have multiple WSDL Documents under a single WSDL Namespace, to reuse and expose the WSDL Services for that namespace across multiple WSDLs.

One ?WSDL? stereotyped Component element is automatically created when you create the Namespace Package structure. You can add further WSDL elements by dragging the WSDL icon from the WSDL Toolbox and dropping it directly onto the namespace Overview diagram.

Toolbox Icon

Access

To display the 'WSDL Document Properties' dialog for the selected «WSDL» stereotyped Component, use one of the methods outlined here.

Ribbon	Design > Element > Editors > Properties
Context Menu	Right-click on «WSDL» stereotyped Component | Properties
Keyboard Shortcuts	Alt+Enter
Other	Double-click on a ?WSDL? stereotyped Component, or Drag icon from the toolbox and drop directly onto the Overview diagram, under the ?WSDLnamespace? stereotyped Package in the WSDL Package structure. (This creates a new WSDL Document, represented by a ?WSDL? stereotyped Component.)

Define Properties

Option	Action
Name	Type in the name of the WSDL document.
File Name	Type the file path into which the WSDL 1.1 file is to be generated.
Documentation	(Optional) Type in any notes you need for this element.
XMLNS	Identify the additional namespace or namespace-prefix pairs used in this WSDL Document. To add a namespace or namespace-prefix pair, click on the New button; to edit an existing entry, double-click on it. In either case, the 'Namespace Details' dialog

	displays. • Prefix - Type in the abbreviated text to represent the Namespace • Namespace - Type in the name of the Namespace • OK - Click on this button to save the new information and close the 'Namespace Details' dialog • Cancel - Click on this button to discard the new information and close the 'Namespace Details' dialog • Help - Click on this button to display this Help topic To remove an entry from the list, click on it and click on the Delete button.
Services	Review the WSDL Services that exist in the Services Package. Select the checkbox against the services to be included in the current WSDL file.
OK	Click on this button to save the data entered and close the WSDL Document 'Properties' dialog.
Cancel	Click on this button to discard the data entered and close the 'WSDL Document Properties' dialog.
Help	Click on this button to display this Help topic.
UML	This button is displayed when you are editing existing WSDL Document element information. Click on the button to open the UML element 'Properties' dialog for the element.

Generate WSDL

If you have developed a WSDL model in UML, you can forward-engineer it into WSDL 1.1 files using the Generate WSDL feature. This feature acts on either a «WSDLnamespace» stereotyped Package or a «WSDL» stereotyped Component (Document), and generates any or all of the WSDL Components owned by the target «WSDLnamespace» structure.

Access

Ribbon	Develop > Schema Modeling > Export WSDL

Generate WSDL 1.1 files

Option	Action
WSDL Package	Displays the name of the WSDL Namespace containing the source Component(s) from which the WSDL file is to be generated.
Encoding	Either: • Click on the drop-down arrow and select the XML encoding scheme you need, or • Click on the Default button to apply the default encoding scheme (UTF-8)
Select Components To Generate	Click on the ?WSDL? stereotyped Component(s) in the list for which the WSDL file is to be generated. To: • Select multiple individual Components use Ctrl+click • Select a range use Shift+click • Select all entries in the list click on the Select All button • Clear all entries in the list click on the Select None button • Provide a file path and name into which to generate the WSDL file for a component, double-click on the component name; the 'Component File Name' dialog is displayed, see the table for a description
Generate	Click on this button to generate the WSDL files for the selected ?WSDL? stereotyped Components. A message displays when the generation is complete; click on the OK button on the message to close it.
View WSDL	Click on this button to display the most recently generated WSDL.
Close	Click on this button to close this dialog.
Help	Click on this button to display this Help topic.

Progress	Monitor the progress of the WSDL file generation.

Component File Name dialog

Field/Button	Description
Name	Displays the name of the selected «WSDL» stereotyped Component.
Prefix	If multiple prefixes have been specified, click on the drop-down arrow and select the appropriate prefix for the WSDL Namespace.
File Name	Type in or browse for (click on) the file path and name into which the WSDL file is to be generated.
OK	Click on this button to save the data entered and close the 'Component File Name' dialog.
Cancel	Click on this button to discard the data entered and close the 'Component File Name' dialog.
Help	Click on this button to display this Help topic.

Notes

- You can also generate WSDL files through the Automation Interface

Import WSDL

If you have WSDL 1.1 files external to Enterprise Architect that you want to reverse engineer into UML Class models, you can import them into the system using the WSDL Import facility.

Access

Browser window | Click on root Package to contain imported file, then:

Ribbon	Develop > Schema Modeling > Import WSDL

Import a WSDL File

Option	Action
Package	Displays the name of the root Package under which the WSDL file is to be imported.
Filename	Type in or browse for (click on) the name and path of the WSDL file to import.
Target Package	Defaults to the name of the WSDL file being imported, as the name of the Package to represent the imported file. If you do not want to use the default name, type in a different name.
Import	Click on this button to start the WSDL Import. A message displays when the import is complete; click on the OK button on the message to close it.
Close	Click on this button to close this dialog.
Progress	Monitor the progress of the WSDL Import.

Notes

- Enterprise Architect cannot import a WSDL file that references WSDL constructs existing outside that file; if there are referenced constructs in other files, combine all files into a single file and import that combined file
- Example of an importable file: http://www.w3.org/TR/wsdl.html#_wsdl
- Example of a non-importable file: http://www.w3.org/TR/wsdl.html#_style; attempts to import this file result in the error message Cannot Import Split Files

SoaML

Service oriented architecture Modeling Language (SoaML) is a standard method of designing and modeling SOA solutions using the Unified Modeling Language (UML).

This text is derived from Service oriented architecture Modeling Language (SoaML) - Specification for the UML Profile and Metamodel for Services (UPMS) (OMG document ad/2008-11-01); pp. 25-26:

"A service is an offer of value to another through a well-defined interface and available to a community (which may be the general public). A service results in work provided to one by another."

"Service Oriented Architecture (SOA) is a way of organizing and understanding (representations of) organizations, communities and systems to maximize agility, scale and interoperability. The SOA approach is simple - people, organizations and systems provide services to each other. These services allow us to get something done without doing it ourselves or even without knowing how to do it - enabling us to be more efficient and agile. Services also enable us to offer our capabilities to others in exchange for some value - thus establishing a community, process or marketplace. The SOA paradigm works equally well for integrating existing capabilities as for creating and integrating new capabilities."

"SOA ... is an architectural paradigm for defining how people, organizations and systems provide and use services to achieve results. SoaML ... provides a standard way to architect and model SOA solutions using the Unified Modeling Language (UML). The profile uses the built-in extension mechanisms of UML to define SOA concepts in terms of existing UML concepts."

"... the highest leverage of employing SOA comes from understanding a community, process or enterprise as a set of interrelated services and ... supporting that service oriented enterprise with service-enabled systems. SoaML enables business oriented and systems oriented services architectures to mutually and collaboratively support the enterprise mission. ... SoaML depends on Model Driven Architecture® (MDA®) to help map business and systems architectures, the design of the enterprise, to the technologies that support SOA, such as web services and CORBA®."

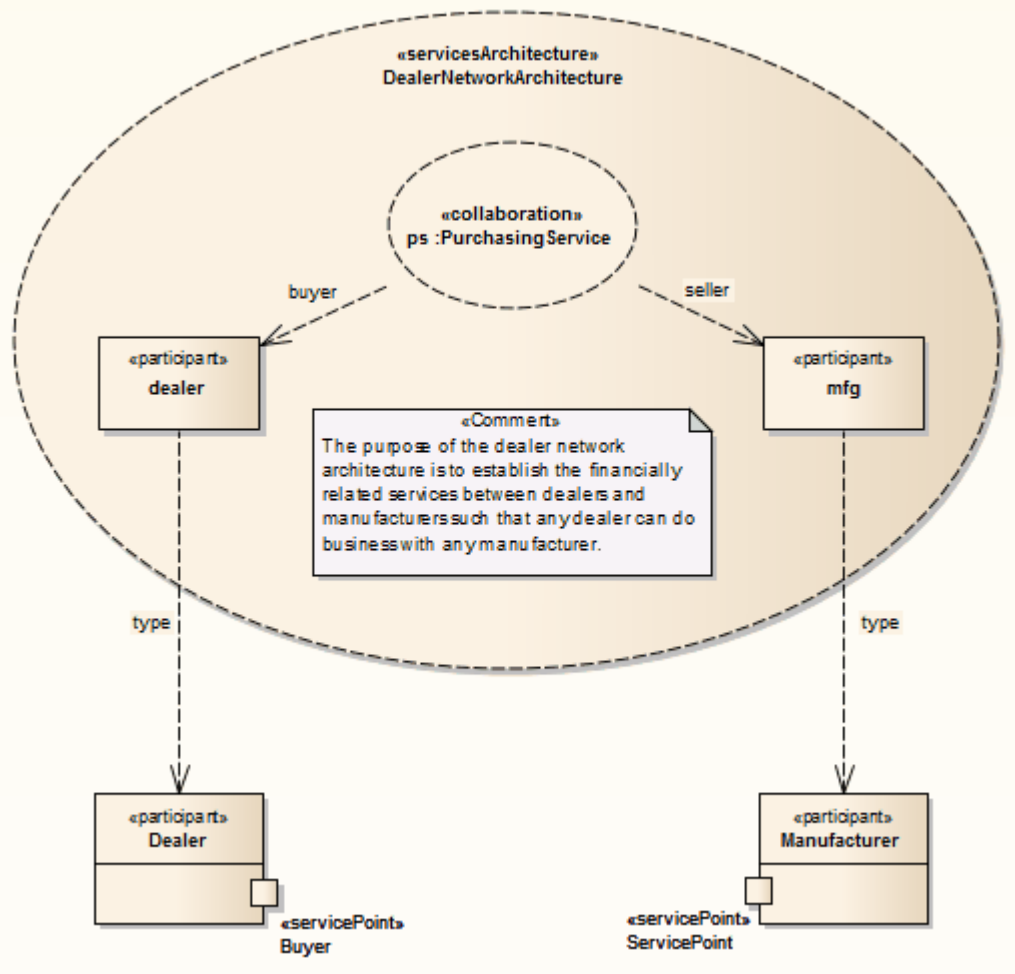
"For further information on the concepts of SoaML, see the specification document on the OMG website SoaML document page."

SoaML in Enterprise Architect

In Enterprise Architect you can model services architectures quickly and simply through use of an MDG Technology integrated with the Enterprise Architect installer. The SoaML facilities are provided in the form of:

- Two SoaML diagram types - SoaML Component diagram and SoaML Sequence diagram - accessed through the 'New Diagram' dialog
- SoaML pages in the Diagram Toolbox
- SoaML element and relationship entries in the 'Toolbox Shortcut' menu and Quick Linker

Example SoaML Diagram



Notes

- Service Oriented Architecture Modeling Language (SoaML) is supported in the Corporate, Unified and Ultimate Editions of Enterprise Architect

SoaML Toolbox Pages

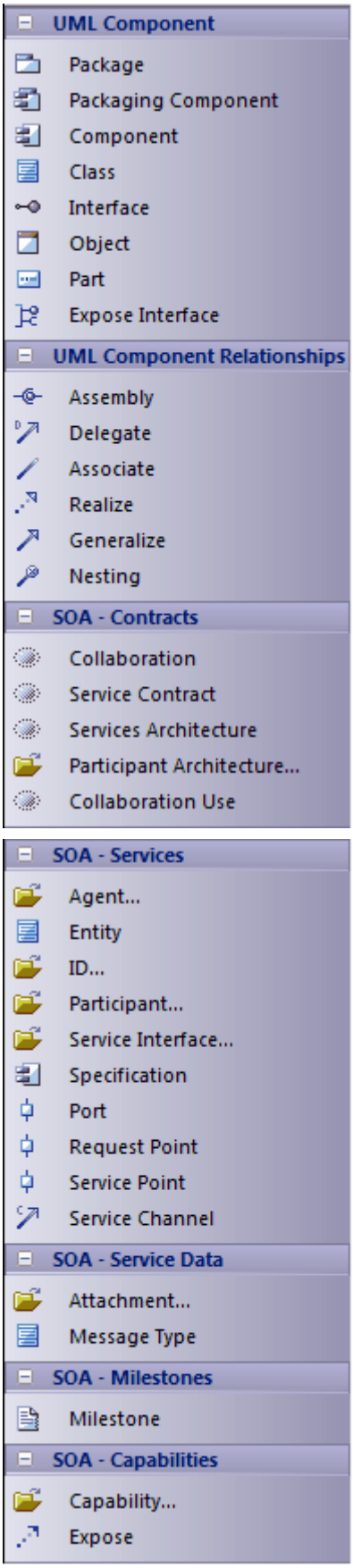
You can create the elements and relationships of the SoaML model using the 'SoaML' pages of the Diagram Toolbox. Each of the two SoaML diagram types has a separate set of pages, although the last five (SOA-specific) pages in the two sets are identical.

Access

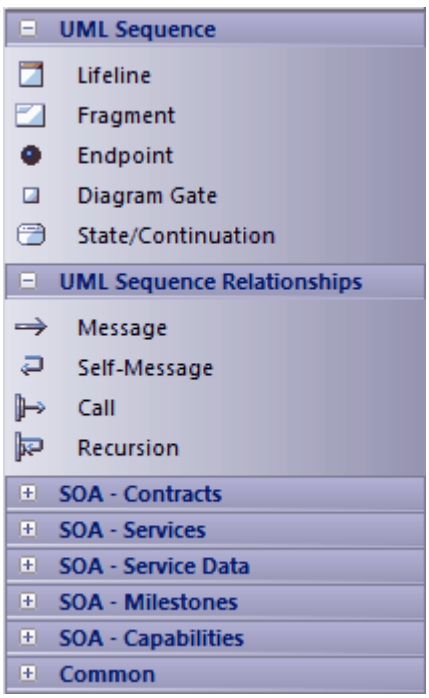
Ribbon	Design > Diagram > Toolbox : to display the 'Find Toolbox Item' dialog and specify 'SoaML Component' or 'SoaML Sequence'
Keyboard Shortcuts	Ctrl+Shift+3 : > Specify 'SoaML Component' or 'SoaML Sequence' in the 'Find Toolbox Item' dialog
Other	Diagram caption bar | Click the icon to display the Diagram Toolbox : > Specify 'SoaML Component' or 'SoaML Sequence' in the 'Find Toolbox Item' dialog

Toolbox Pages

SoaML Component Diagram Toolbox



SoaML Sequence Diagram Toolbox


UML Sequence
Lifeline
Fragment
Endpoint
Diagram Gate
State/Continuation
UML Sequence Relationships
Message
Self-Message
Call
Recursion
SOA - Contracts
SOA - Services
SOA - Service Data
SOA - Milestones
SOA - Capabilities
Common

SOMF 2.1

The Service-Oriented Modeling Framework (SOMF) is a service-oriented development life cycle methodology, offering a number of modeling practices and disciplines that contribute to successful service-oriented life cycle management and modeling. This text is derived from the extensive Wikipedia entry on Service Oriented Modeling:

'The Service-Oriented Modeling Framework (SOMF) has been proposed by author Michael Bell as a holistic and anthropomorphic modeling language for software development that employs disciplines and a universal language to provide tactical and strategic solutions to enterprise problems. The term "holistic language" pertains to a modeling language that can be employed to design any application, business and technological environment, either local or distributed. This universality may include design of application-level and enterprise-level solutions, including SOA landscapes or Cloud Computing environments. The term "anthropomorphic", on the other hand, affiliates the SOMF language with intuitiveness of implementation and simplicity of usage.'

'SOMF ... illustrates the major elements that identify the “what to do” aspects of a service development scheme. These are the modeling pillars that will enable practitioners to craft an effective project plan and to identify the milestones of a service-oriented initiative—either a small or large-scale business or a technological venture.'

SOMF in Enterprise Architect

In Enterprise Architect, SOMF 2.1 is implemented as a profile within an MDG Technology that is integrated with the Enterprise Architect installer. The SOMF 2.1 facilities are provided in the form of:

- Eleven SOMF diagram types, accessed through the 'New Diagram' dialog:
  - Conceptual
  - Analysis
  - Cloud Computing
  - Logical Design Relationship
  - Logical Design Composition
  - Business Integration
  - Conceptual Architecture
  - Asset Utilization
  - Transaction
  - Transaction Directory
  - Reference Architecture
- SOMF pages in the Toolbox - Enterprise Architect includes several Toolbox pages of modeling structures for each SOMF 2.1 diagram type, located through the Toolbox search facilities; these provide a wide breadth of SOMF modeling capabilities
- SOMF element and relationship entries in the Toolbox Shortcut menu and Quick Linker

National Information Exchange Modeling (NIEM) 2.1

National Information Exchange Modeling (NIEM) provides a common framework that is used to define how information can be shared between systems, government agencies and departments. The NIEM UML Profile helps you to:

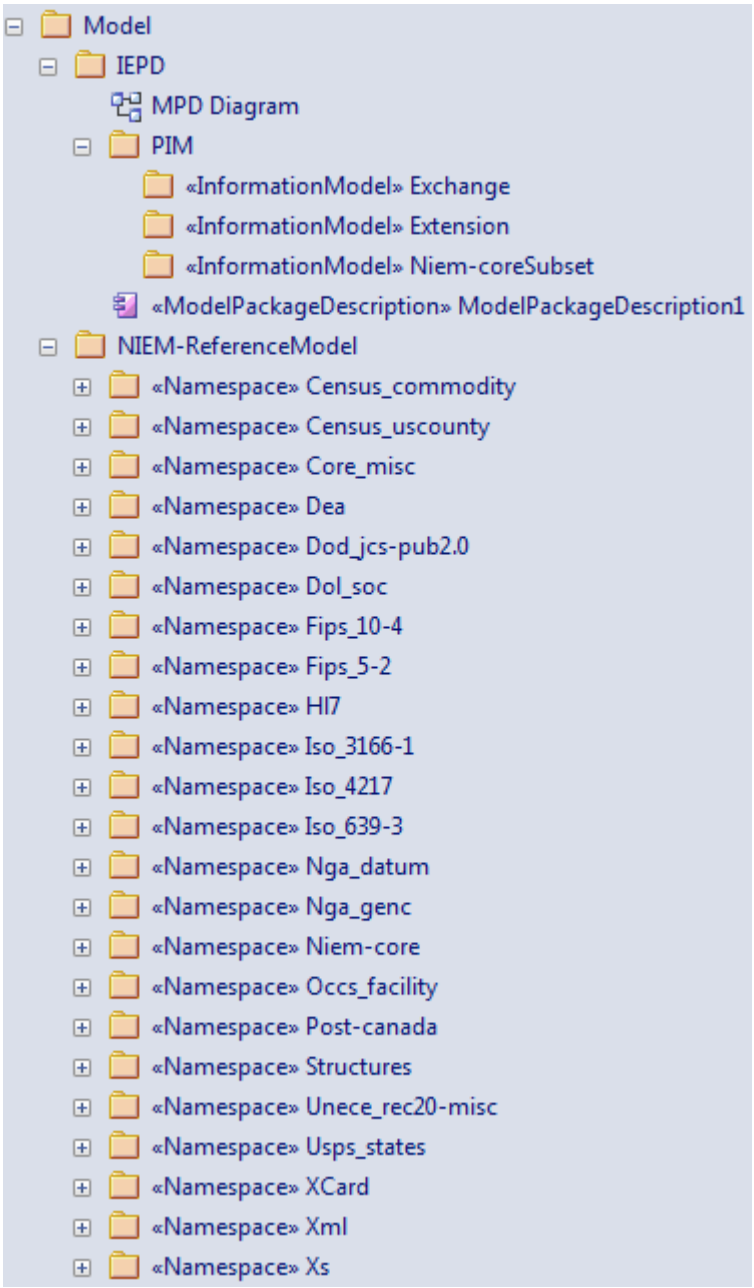
- Create and develop UML-based Information Exchange Package Documentation (IEPD) models, either:
  - Generating an IEPD from an Enterprise Architect Pattern to produce all necessary exchange files, static artifacts, metadata and catalog files, or
  - Using the Schema Composer to generate your own NIEM subset namespaces, automatically detecting inter-dependencies, and using the resulting subset schema to build your own IEPD
- Create PIM, PSM and Model Package Description (MPD) diagrams, using the NIEM Toolbox pages
- Import NIEM Reference Schema into your model
- Generate NIEM Schema from your model

Create a NIEM IEPD Model from a Pattern

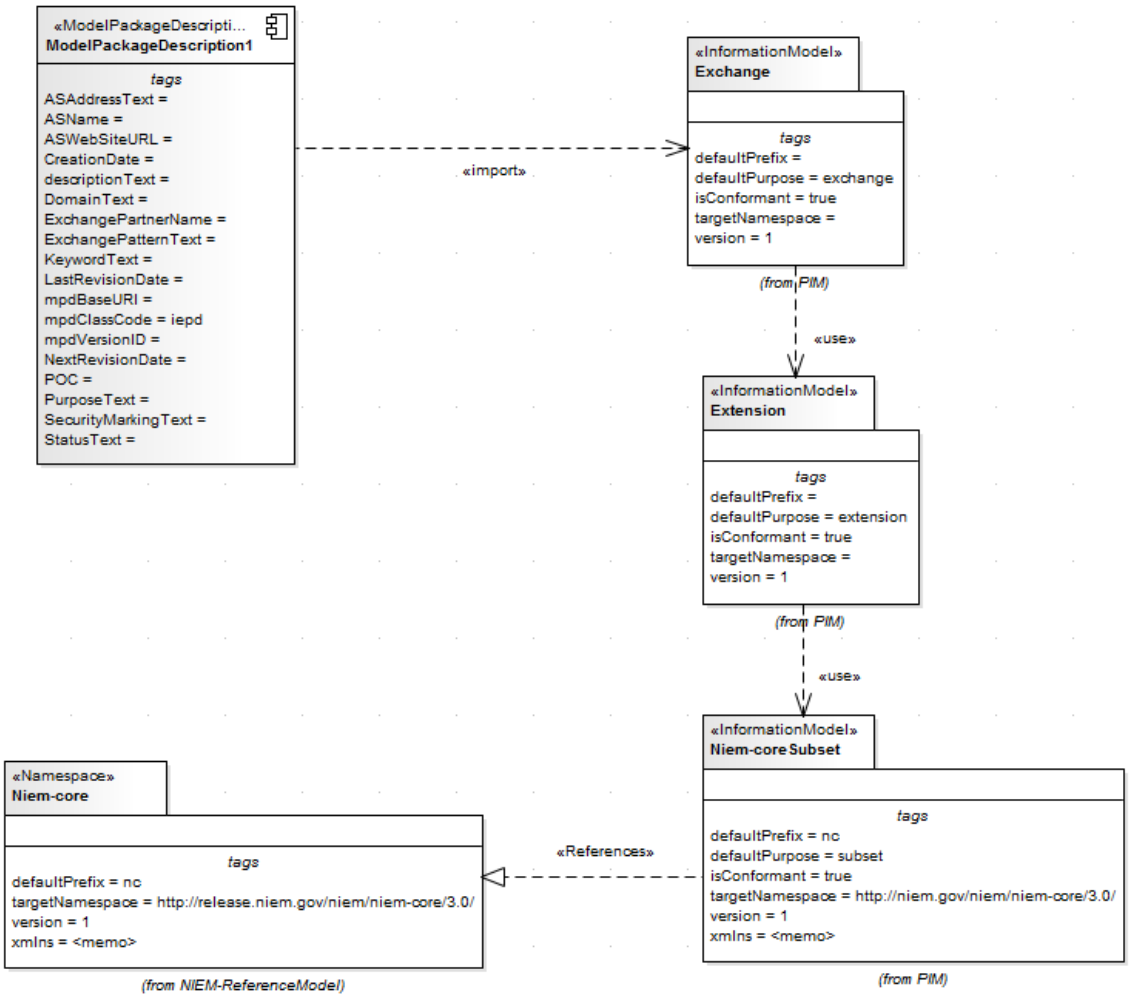
The NIEM UML Profile provides a model Pattern from which to build IEPD models. You can apply this Pattern in your NIEM project, using the Model Builder.

1. Open the Model Builder (Ctrl+Shift+M), then select 'Information Exchange > NIEM' in the '<<perspective>>' field.
2. In the 'NIEM 3 and 4' list, scroll through the technologies and click on the required 'NIEM *n.n* Reference Model', then Ctrl+Click on the corresponding 'NIEM *n* IEPD Starter Model'.
3. Click on the Create Model(s) button.

The system generates a new model containing an IEPD Package (itself containing a PIM Package), and a NIEM ReferenceModel Package. The Reference Model can take some time to download.



The IEPD Package contains a top-level Model Package Description (MPD) diagram (as shown), which contains the MPD Component and all the namespaces and files related to it.



The PIM Package consists of all the namespaces and subset namespaces for the IEPD. The relationships between the namespaces and the MPD Component is shown in the MPD diagram. The MPD Component must import at least one namespace for successful NIEM schema generation.

The NIEM ReferenceModel Package includes all the NIEM reference schema models for the selected NIEM version.

NIEM Diagrams

You can also create all of the appropriate diagrams from the NIEM diagram set and from the corresponding NIEM Diagram Toolbox pages. These diagrams are of three types:

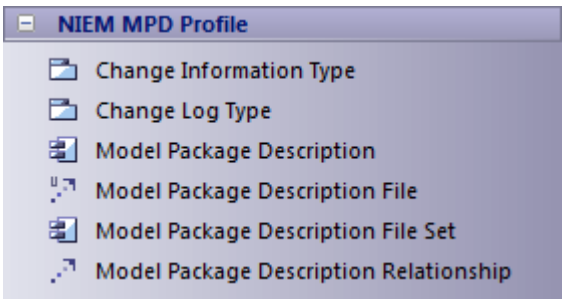
- NIEM Platform Independent Model (PIM) diagram
- NIEM Platform Specific Model (PSM) diagram
- NIEM Model Package Description (MPD) diagram

The templates from which to develop these diagrams are available through the 'New Diagram' dialog.

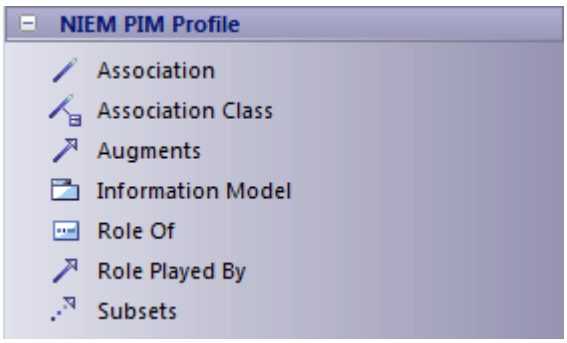
NIEM Toolbox Pages

Each diagram type has its own page of elements and connectors in the Diagram Toolbox. The NIEM UML Profile also provides a page of elements and connectors common to all three diagram types.

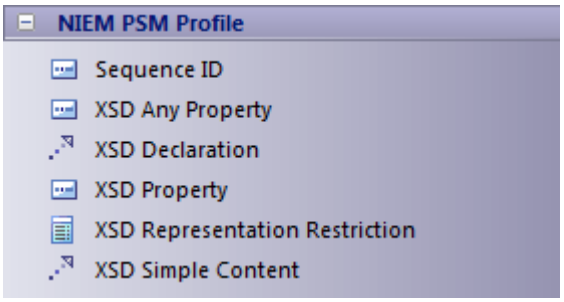
NIEM Model Package Description (MPD) Profile toolbox



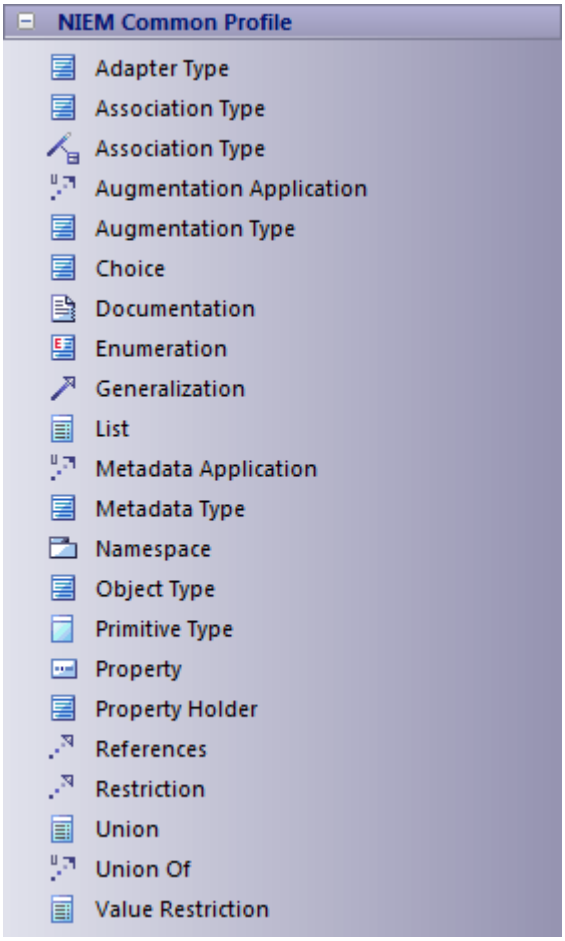
NIEM Platform Independent Model Toolbox



NIEM Platform Specific Toolbox



NIEM Common Profile Toolbox



Import NIEM Reference Schema

Step	Action
1	In the Browser window, right-click on the target Package and select the 'Specialize | NIEM 2.1 | Import NIEM 2.1 Schema' menu option.
2	On the 'Import XML Schema' dialog, in the 'Directory' field, type in or browse for the directory containing the schema to be imported, and select the .xsd schema files to import.
3	Under 'Import XSD Elements/Attributes as:' select the 'UML Attributes' radio button.
4	Click on the Import button. The NIEM model for the schema will be imported into the selected Package.

Generate NIEM Subset Namespaces

You can generate a subset namespace using the Enterprise Architect Schema Composer. This requires the NIEM Reference Model to be available in the model, as it is part of the IEPD Model Pattern.

Step	Action

1	Select the 'Develop > Schema Modeling > Schema Composer > Open Schema Composer' ribbon option.
2	Click on the New button to the right of the 'Profile' field. The 'New Message' dialog displays.
3	In the 'Name' field, type the name of the subset, and in the 'Namespace' field type the http address of the namespace.
4	In the 'Schema Set' field click on the drop-down arrow and select the 'National Information Exchange Model (NIEM)' option.
5	In the 'Save In' panel, select the 'Model Artifact' radio button.
6	Click on the icon and use the Navigator to select the namespace/information Model Package in IEPD | PIM, under which to generate the subset.
7	In the Browser window, open the NIEM ReferenceModel Package NIEM-core. Drag the Activity from this Package onto the left hand column of the Schema Composer. The attributes of this element are listed in the middle column of the Schema Composer.
8	Click on the checkbox for each of the attributes you require - for example, ActivityName and ActivityDateRepresentation. The corresponding Classes/NIEM object types are added to the left-hand column, whilst the right-hand column displays them as subset items.
9	Click on the Update button to save the subset profile. The status of the subset items displays against the item name in the left hand column and in the panel at the foot of the column.
10	Click on the Generate button. The 'Schema Export' dialog displays.
11	Select the checkbox against the items to generate, in the 'Technologies' panel. 'NIEM Model Subset' must be selected.
12	Click on the Generate button and, on the 'Find Package' dialog, select the namespace/ information model in which to generate the subset.
13	Click on the OK button, and on the second OK button. The subset model is generated.

NIEM Schema Generation

Once your NIEM IEPD model with its Extension information model, Exchange information model and Subset information model is complete, you can generate schema from it.

Step	Action
1	Right-click on the MPD Component, which imports the Exchange model, and select the 'Specialize|

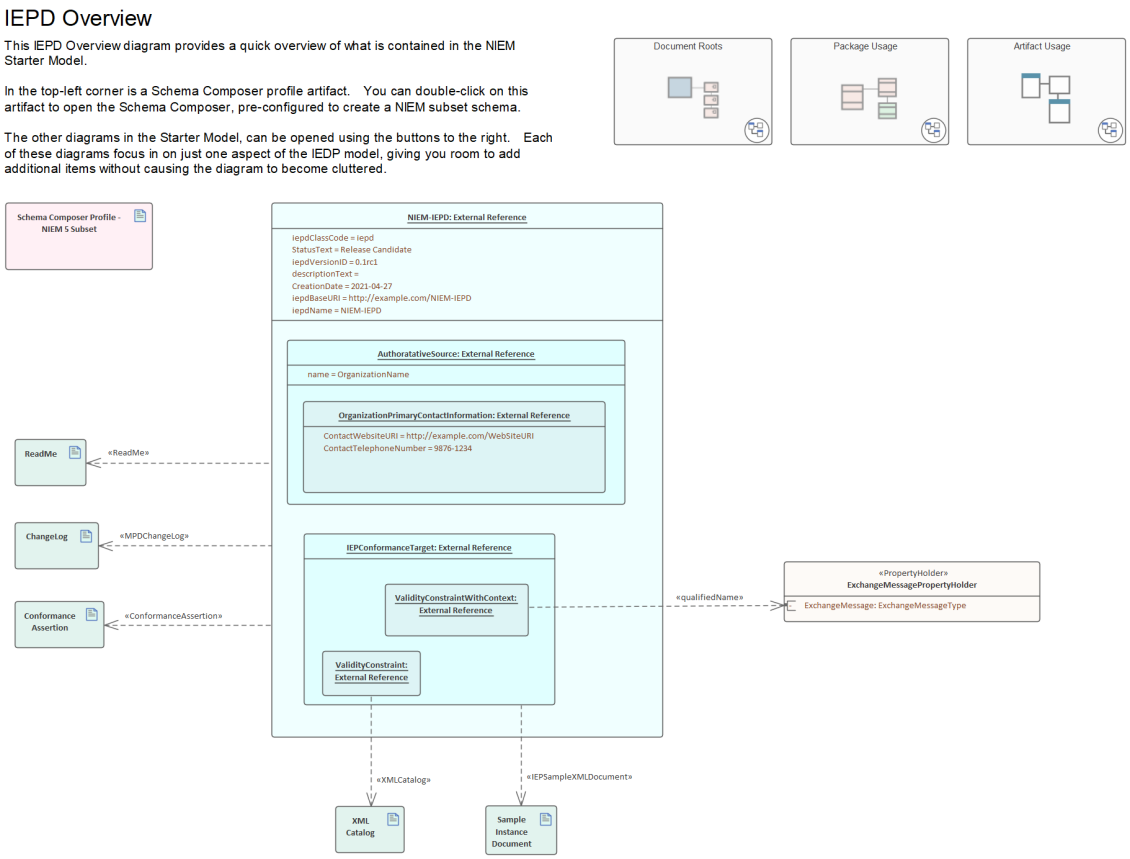
	NIEM 2.1 | Generate NIEM 2.1 Schema' option. The 'Generate NIEM MPD Schemas' dialog displays.
2	In the 'Directory' field, type or browse for the directory path into which to generate the schema.
3	In the 'NIEM Version' field, click on the drop-down arrow and select the NIEM version for which to generate the schema. The static MPD artifacts and common artifacts (Catalog, Metadata) that will be generated are listed in the 'MPD Artifacts' panel, each with its relative path. The 'Namespace Schema(s)' panel shows the schema files that will be generated for the information models.
4	Click on the Generate button. Once the generation has completed successfully, click on the View Schema button to access the catalog file.

National Information Exchange Modeling (NIEM)

National Information Exchange Model (NIEM) provides a common framework that is used to define how information can be shared between systems, government agencies and organizations. Enterprise Architect's NIEM UML Profile helps you to:

- Create and develop UML-based Information Exchange Package Documentation (IEPD) models, by providing starter models, model Patterns and a number of Toolbox pages for creating IEPD models and schema models
- Generate complete IEPDs from your IEPD model
- Generate NIEM conformant schemas from your information models
- Import NIEM Reference Schema into your model
- Create NIEM subset namespaces, composed from elements of the NIEM Reference Schemas
- Create PIM, PSM and Model Package Description (MPD) diagrams, using the NIEM Toolbox pages

This illustration shows the NIEM 5.0 starter model, a Pattern provided as a part of NIEM in Enterprise Architect. (See the *Creating a NIEM IEPD* Help topic.)



UML Profile for NIEM

Enterprise Architect integrates with a UML Profile for NIEM (supporting NIEM 5, 4 and 3), along with a number of model Patterns to help you get started in modeling your NIEM project.

The profile defines a collection of stereotypes for use in building NIEM models. It also defines three different diagram types: Model Package Description (MPD) diagram, Platform Independent Model (PIM) diagram and Platform Specific Model (PSM) diagram. Each of these diagram types has corresponding Diagram Toolbox pages, from which you can select items to add to your model by dropping them onto a diagram.

Access

Use any of the methods outlined here to display the Diagram Toolbox, then click on to display the 'Find Toolbox Item' dialog and specify 'NIEM 3.0 MPD' (or 'PIM' or 'PSM').

The Diagram Toolbox that corresponds to a particular diagram type becomes active whenever you open a diagram of that type. However, you can also access any Diagram Toolbox at any time, using this method:

- From the top of the Diagram Toolbox, click on to display the 'Find Toolbox Item' dialog and specify '<profile> <toolbox>'

To reset the Toolbox to the default type for the current diagram, simply close then reopen the diagram.

Ribbon	Design > Diagram > Toolbox
Keyboard Shortcuts	Ctrl+Shift+3
Other	Click the icon on the Diagram caption bar to display the Diagram Toolbox

Diagram Toolbox Pages

The NIEM Diagram Toolboxes provide quick access to the elements and connectors that you commonly use in a particular type of diagram.

The MPD Diagram Toolbox is grouped into a number of separate pages: Model Patterns, Relationships, File Type Usage and Schema Document Usage. The PIM and PSM diagrams share a common Toolbox page, as well as each having their own specific Toolbox page.

Common Toolbox Items

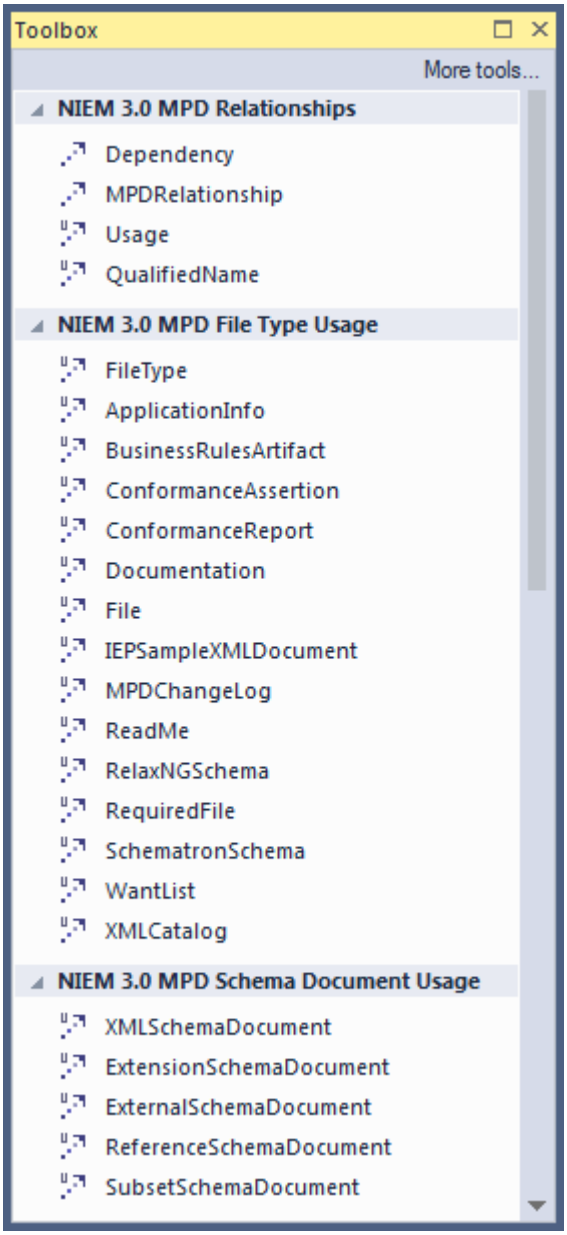
The NIEM Common Profile consists of stereotypes that are used in both the NIEM PIM Profile and the NIEM PSM Profile.

Icon	Description
AdapterType	A NIEM adapter type is a NIEM object type that adapts external components for use within NIEM.
AssociationType	A NIEM association type establishes a relationship between objects, along with the properties of that relationship.

AssociationType	A NIEM association type establishes a relationship between objects, along with the properties of that relationship.
AugmentationType	A NIEM augmentation type is a complex type that provides a reusable block of data that can be added to object types or association types.
Choice	A Choice Class groups a set of attributes whose values are mutually exclusive.
Documentation	A Documentation comment is the data definition of the element that owns it.
Generalization	A UML Generalization
List	A List is a DataType whose values consist of a finite length (possibly empty) sequence of values of another DataType, which is the item type of the List.
LocalVocabulary	Local vocabulary defines a set of domain specific terms or abbreviations that then can be used in NIEM names and definitions.
LocalTerm	The LocalTerm stereotype defines a domain-specific word, phrase, acronym, or other string of characters used in a LocalVocabulary.
MetadataApplication	The «MetadataApplication» stereotype applies to a Usage between a «MetadataType» Class and either another «MetadataType» Class or a Property. It represents a constraint on a NIEM «MetadataType» that limits the application of the NIEM «MetadataType» to specific schema types or schema elements.
MetadataType	A NIEM metadata type describes data about data, that is, information that is not descriptive of objects and their relationships, but is descriptive of the data itself.
Namespace	A Namespace Package represents a NIEM namespace identified by a target namespace URI.
NIEMType	A NIEMType is a Class that represents one of the specific semantic kinds of NIEM complex types (that is, types that can have attributive structure). NIEMType is abstract.
ObjectType	A NIEM object type represents some kind of object: a thing with its own lifespan that has some existence.
PrimitiveType	The NIEM Primitive Type Library defines a predefined set of UML primitive types to be used in NIEM-UML models. To insure integrity and consistency of the type system used at the PIM level with the generation of NIEM compliant schema, the primitive types in this library are based on XML schema primitive types.
Property	
PropertyHolder	A PropertyHolder is a Class holding global Properties that are not the subject of any specific NIEM type. Property declarations of this kind define the object type of the property without restricting its use to a specific type of subject.
References	The References stereotype applies to a Realization between Properties, Classes or

	Packages. It allows for Properties in one Class to be defined by reference to Properties in another class.
Representation	The NIEM Representation Pattern, allows for a type to contain a representation element, and the various representations for that element type are in the substitution group for that representation element.
Restriction	A Restriction Realization represents a relationship between two type definitions: the first is derived by restriction from the second.
Union	A Union is a DataType whose value space is the union of one or more other DataTypes, which are the member types of the Union.
UnionOf	The UnionOf stereotype is applied to a Usage dependency, the client of which must be a Union DataType and the supplier of which must be a DataType that represents a legal union member type. A UnionOf dependency specifies that the supplier DataType is a member type of the client Union.
ValueRestriction	

NIEM 3.0 MPD Toolbox



MPD Toolbox Items

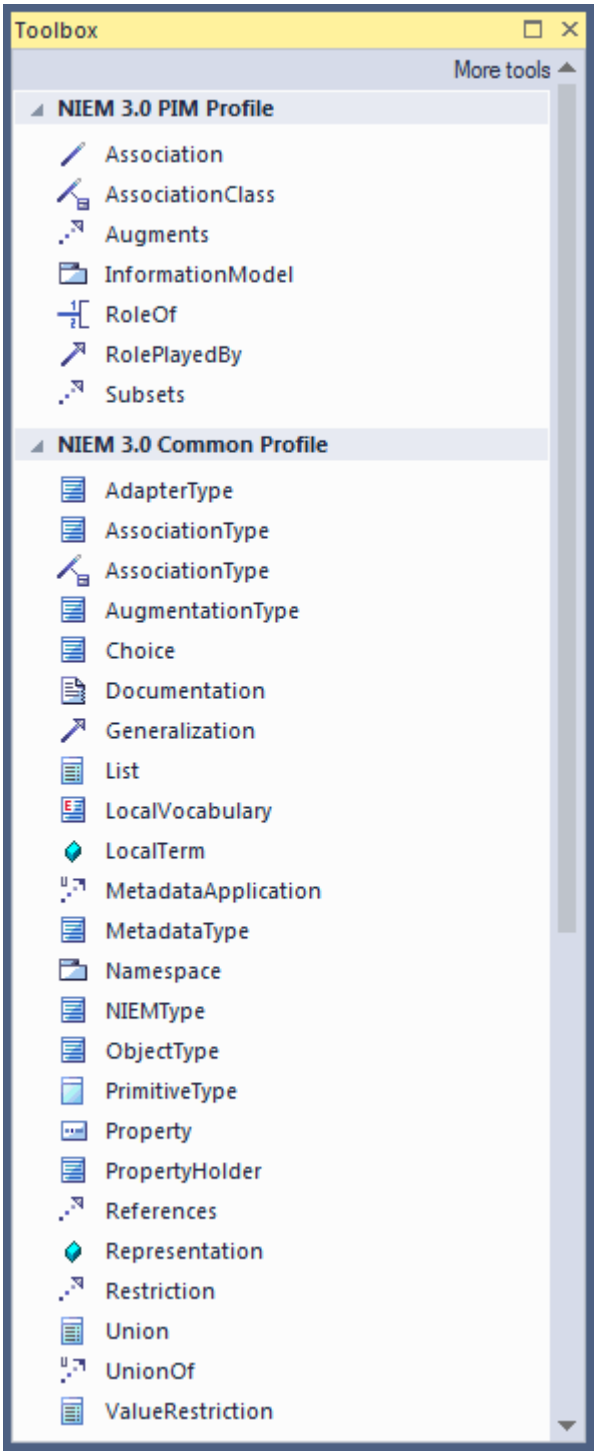
The Model Package Description Profile comprises stereotypes and artifacts that are used to model NIEM MPDs.

Icon	Description
Relationships	
Dependency	A UML Dependency relationship.
MPDRelationship	The ModelPackageDescriptionRelationship stereotype applies to a Dependency that represents a relationship between MPDs or between an MPD and another resource (such as a NIEM specification; as in the case of conforms-to).
Usage	A UML usage relationship

QualifiedName	The <<qualifiedName>> Usage connector is used to specify the Document Element of an IEP. To identify a Document Element of an IEP in UML: • Add an instance of IEPConformanceTargetType to the IEPConformanceTarget slot of the ModelPackageDescription Artifact instance • Add a QualifiedNamesType instance to the ValidityConstraintWithContext slot of the new IEPConformanceTargetType instance • Add a Usage with applied Stereotype ?qualifiedName? where the client is the new QualifedNamesType instance and the supplier is a Property representing an XSD Element
File Type Usage	
FileType	The <<FileType>> Usage connector is a data type for describing an MPD file artifact. It is also the base type from which many other <<FileType>> Usage connectors are derived.
ApplicationInfo	The <<ApplicationInfo>> connector extends the <<FileType>> usage connector. It is used to specify an MPD artifact that is used by a software tool (for example, import, export, input and output).
BusinessRulesArtifact	The <<BusinessRulesArtifact>> connector extends the <<FileType>> usage connector. It is used to specify an MPD artifact that contains business rules and constraints on exchange content.
ConformanceAssertion	The <<ConformanceAssertion>> connector extends the <<FileType>> usage connector. It is used to specify an MPD artifact that represents a declaration that a NIEM IEPD is NIEM-conformant.
ConformanceReport	The <<ConformanceReport>> connector extends the <<FileType>> usage connector. It is used to specify an MPD artifact either auto-generated by a NIEM-aware software tool or manually prepared that checks NIEM conformance and/or quality and renders a detailed report of results.
Documentation	The <<Documentation>> connector extends the <<FileType>> usage connector. It is used to specify an MPD artifact that is a form of explanatory documentation.
File	The <<File>> connector extends the <<FileType>> usage connector. It is used to specify a generic electronic file artifact in an MPD; a file stored on a computer system.
IEPSampleXMLDocument	The <<IEPSampleXMLDocument>> connector extends the <<FileType>> usage connector. It is used to specify an example MPD instance XML document or IEP artifact.
MPDChangeLog	The <<MPDChangeLog>> connector extends the <<FileType>> usage connector. It is used to specify an MPD artifact that contains a record of the MPD changes.
ReadMe	The <<ReadMe>> connector extends the <<FileType>> usage connector. It is used to specify an MPD read-me artifact.
RelaxNGSchema	The <<RelaxNG>> connector extends the <<FileType>> usage connector. It is used to specify a RelaxNG schema.

RequiredFile	The <<RequiredFile>> connector extends the <<FileType>> usage connector. It is used to specify an MPD file artifact that another artifact depends on and should not be separated from.
SchematronSchema	The <<SchematronSchema>> connector extends the <<FileType>> usage connector. It is used to specify a Schematron schema document.
WantList	The <<WantList>> connector extends the <<FileType>> usage connector. It is used to specify an MPD artifact that represents a NIEM schema subset and is used as an import or export for the NIEM SSGT.
XMLCatalog	The <<XMLCatalog>> connector extends the <<FileType>> usage connector. It is used to specify an MPD artifact that is an OASIS XML catalog.
Schema Document Usage	
XMLSchemaDocument	The <<XMLSchemaDocument>> connector extends the <<FileType>> usage connector. It is used to specify an MPD artifact that is an XML schema document (that is, an XSD that is not necessarily a NIEM subset, extension, or reference schema).
ExtensionSchemaDocument	The <<ExtensionSchemaDocument>> connector extends the <<XMLSchemaDocument>> usage connector. It is used to specify an MPD artifact that is a NIEM extension schema document.
ExternalSchemaDocument	The <<ExternalSchemaDocument>> connector extends the <<XMLSchemaDocument>> usage connector. It is used to specify an MPD artifact that is a schema document external to NIEM.
ReferenceSchemaDocument	The <<ReferenceSchemaDocument>> connector extends the <<XMLSchemaDocument>> usage connector. It is used to specify an MPD artifact that is a reference schema document (from a release, domain update, or core update).
SubsetSchemaDocument	The <<SubsetSchemaDocument>> connector extends the <<XMLSchemaDocument>> usage connector. It is used to specify an MPD artifact that is a subset schema document.

NIEM 3.0 PIM Toolbox



PIM Toolbox Items

The NIEM PIM Profile comprises stereotypes that are used in NIEM PIMs but not NIEM PSMs.

Icon	Description
Association	A UML Association.
AssociationClass	A UML Association Class.

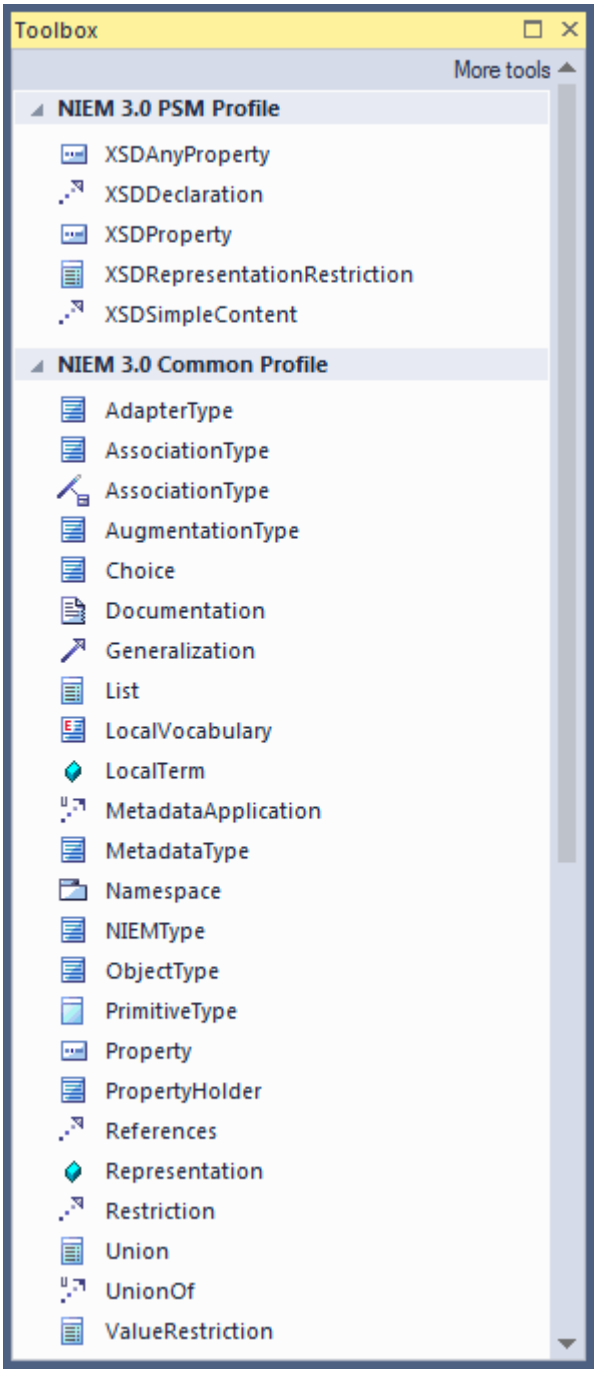
Augments	A stereotyped Realization connector, used to specify that one Class (the supplier) Augments another Class (the client).
InformationModel	InformationModel is a stereotyped Package that provides a platform-independent perspective on the structure of information to be exchanged in NIEM messages. It represents a NIEM namespace, but can also specify a default purpose, such as subset, exchange or extension.
RoleOf	The RoleOf stereotype is applied to an AssociationEnd to specify the type of the role of the associated property.
RolePlayedBy	A stereotyped Generalization connector specifying that the role played by instances of the general Class will be the type of the special Class.
Subsets	The Subsets connector is a stereotyped realization that specifies a subset relationship between a subset client (the derived element) and its reference supplier (the base element).

PSM Toolbox Items

The NIEM PSM Profile comprises stereotypes that are used in NIEM PSMs. These stereotypes need not be used with a NIEM PIM, but they can be in order to provide additional platform-specific markup.

Icon	Description
XSDAnyProperty	XSDAnyProperty stereotype represents a property that is unrestricted with respect to its type, which is implemented in XML Schema as the xs:any particle.
XSDDeclaration	The XSDDeclaration stereotype is a specialization of the common References stereotype.
XSDProperty	An XSDProperty Property represents a NIEM property, which is implemented in XML Schema as either an attribute declaration and use or an element declaration and particle
XSDRepresentationRestriction	XSDRepresentationRestriction specifies a restriction on the representation in an XML schema of the values of a base DataType.
XSDSimpleContent	The «XSDSimpleContent» stereotype represents a relationship between two type definitions: the first is a complex type definition with simple content, the second is a simple type.

NIEM 3.0 PSM Toolbox


Toolbox
More tools
NIEM 3.0 PSM Profile
XSDAnyProperty
XSDDeclaration
XSDProperty
XSDRepresentationRestriction
XSDSimpleContent
NIEM 3.0 Common Profile
AdapterType
AssociationType
AssociationType
AugmentationType
Choice
Documentation
Generalization
List
LocalVocabulary
LocalTerm
MetadataApplication
MetadataType
Namespace
NIEMType
ObjectType
PrimitiveType
Property
PropertyHolder
References
Representation
Restriction
Union
UnionOf
ValueRestriction

Download the NIEM Reference Model

The NIEM 5 Reference Model is a UML representation of the content of the NIEM 5 Release Package XSD files.

It contains Packages representing NIEM-core, as well as the various Domain schemas included in the NIEM 5 release, their associated Codes lists and other associated Packages. The NIEM 5 reference model is available for download into your Enterprise Architect project, from the Sparx Systems Reusable Asset Server.

Earlier versions of NIEM reference models are also available for download from the Sparx Systems Reusable Asset Server.

Access

Display the Model Builder using any of the methods outlined here.

In the Model Builder dialog, select the Perspective "Information Exchange > NIEM" and then select 'NIEM 3, 4 and 5'.

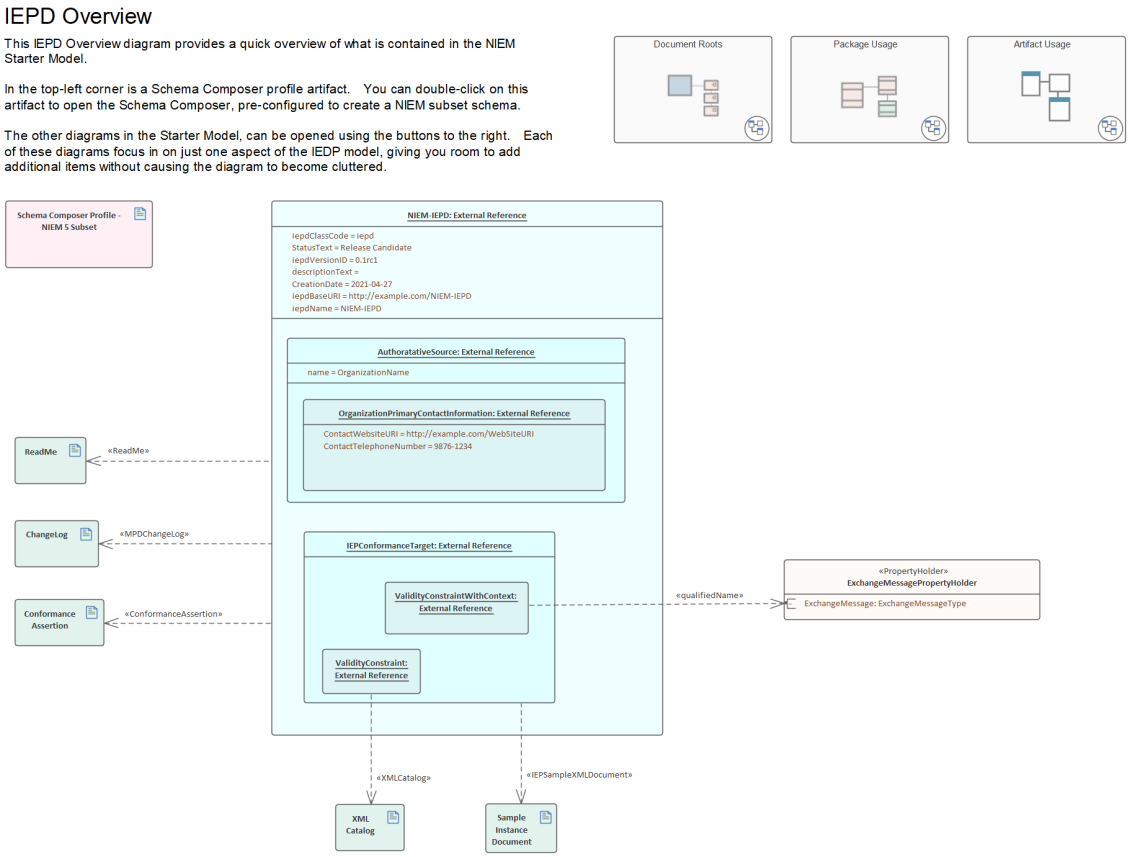
Select a Reference Model, MPD Types and Starter Model, as required.

Ribbon	Start > Personal > Model Builder Design > Package > Model Builder
Context Menu	Right-click on Package | Model Builder (pattern library)
Keyboard Shortcuts	Ctrl+Shift+M
Other	Browser window caption bar menu | Model Builder (pattern library)

Creating a NIEM IEPD

Enterprise Architect's NIEM profile provides a basic IEPD model as a starting point from which you can build your own IEPD model.

You can add the IEPD starter model to your project using the Model Builder.



The IEPD Starter Model Pattern, available from the Model Builder.

This topic provides an overview of the steps required to create a new NIEM IEPD model in Enterprise Architect, and to generate an IEPD from that model.

Creating a NIEM IEPD model and generating a NIEM IEPD

Steps	Description
Create a new Enterprise Architect project	Launch Enterprise Architect and create a new project. From the ribbon choose "Design > Package > Model Builder". In the Model Builder dialog, click on the <perspective name> button and select 'Information Exchange | NIEM' and expand the 'NIEM 3, 4 and 5' Perspective. It is essential that your NIEM project contains the NIEM IEPD Types and at least one of the NIEM Reference Models. Select the 'NIEM 5.0 Reference Model' as well as 'NIEM 5 IEPD Types'. Click on the Create Model button to download and import the selected models into your project.

	Also available in the Model Builder is a model pattern for a basic NIEM IEPD. This is intended as a starting point for your NIEM project. Optionally, select the 'NIEM 5 IEPD Starter Model' and click on the Create Model button.
Create an IEPD model	If you chose not to include the IEPD model in the previous step, you can create your own model now. In the Browser window, create a new Package or (View node) to hold your IEPD model. Within the new Package, create a NIEM IEPD diagram. You can add instances of the types available in the NIEM IEPD Types Package to your diagram (and to your IEPD model), by dragging them onto your IEPD diagram. Use the Browser window to locate the Class types that you require, then press Ctrl as you drag the element into position on your diagram. The system prompts you to choose an action; either: • Place a link to the Class on the diagram, or • Create and add a new instance specification of the Class For the IEPD model, you would generally use Object Instances. To begin with, create an object instance of the IEPD Class. (As you will see shortly, you need an instance of the IEPD class to drive the generation of your IEPD.)
Customize your model	The instance of the IEPD class carries information that identifies the IEPD. The links between it and the various other model artifacts determine what is generated (and where it is generated to) when generating the schema files and catalog files. Whether you choose to download the IEPD Starter Model, or create your own IEPD model by dragging instances from the Browser window, you must set values for the properties of the Object instances that are appropriate to the model you are creating. This is achieved by setting the run-state properties of the various object instances used in your IEPD model. For detailed information on setting values for the IEPD instance objects, see the Help topic *Customize Your IEPD Model*
Create your data model	This is where you model the data that will be sent in your information exchange message. In NIEM, this is typically modeled within Packages that have the <<InformationModel>> stereotype, representing the different namespaces used in the model. These Packages typically include a NIEM-core Package that is a subset of the NIEM-core Reference Model Package, and two extension Packages that extend what is available from NIEM-core, one of which represents the exchange message. Your project might also require subsets of other NIEM schemas, such as those from the Biometrics or EmergencyManagement domains. For further information on creating data models, see the Help topics *Creating a NIEM Data Model* and *Subsetting NIEM with the Schema Composer.*
Generate the IEPD	Your NIEM model does not have to be complete before you generate an IEPD from it. Generating the IEPD can be considered an iterative process. You might perform a generation of just your namespace schemas before you have completed your IEPD, and before you have defined your conformance targets. You might generate with a fully described IEPD instance and conformance targets before you have defined your Information Models. You can continue to update your model and generate

	your IEPD however you see fit. To generate your IEPD, select the IEPD instance specification, either on the diagram or in the Browser window. Go to the 'Specialize' ribbon and select the option 'Technologies > NIEM > Generate NIEM Schema'. The Generate NIEM IEPD Schemas window opens. This window lists the Namespace Schemas that are used in your model, and you can select which of these to generate. You can also choose which of the NIEM infrastructure schemas to include in the generation. In this window you can also set the root directory for generation of the output files. Once you have made your selection and specified the output folder, click on the Generate button to commence generation of the IEPD. For detailed information on the Generate NIEM IEPD Schemas window, see the Help topic *NIEM IEPD Generation*.

Notes

- ALL projects containing NIEM models must include the NIEM IEPD Types Package downloaded via the Model Builder; the IEPD instance is central to your NIEM model
  The instance and the relationships to <<InformationModel>> Packages and other artifacts are used to drive the IEPD Generation; without an IEPD instance in your model, you will not be able to generate an IEPD
- Usually, you must have at least one of the NIEM Reference Models imported into your project; the reference models contain UML representations of the NIEM-core reference schema, as well as the many domain specific reference schemas, which must be available in your project if you intend to create subset schemas using Enterprise Architect's Schema Composer

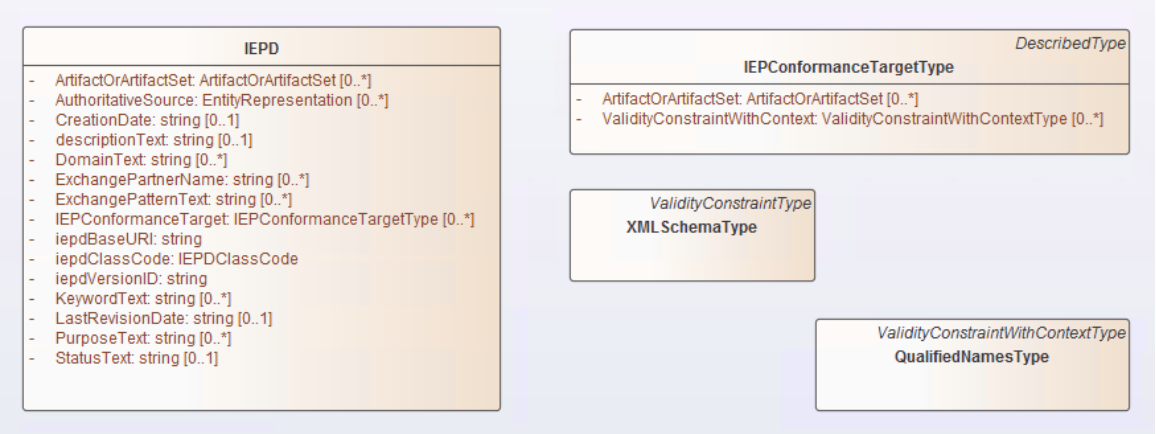
Customize Your IEPD Model

Whether you choose to download the IEPD Starter Model, or create your own IEPD model by dragging instances from the Browser window, you must set values for the properties of the Object instances that are appropriate to the model you are creating. This is achieved by setting the run-state properties of the various object instances used in your IEPD model.

NIEM IEPD Types

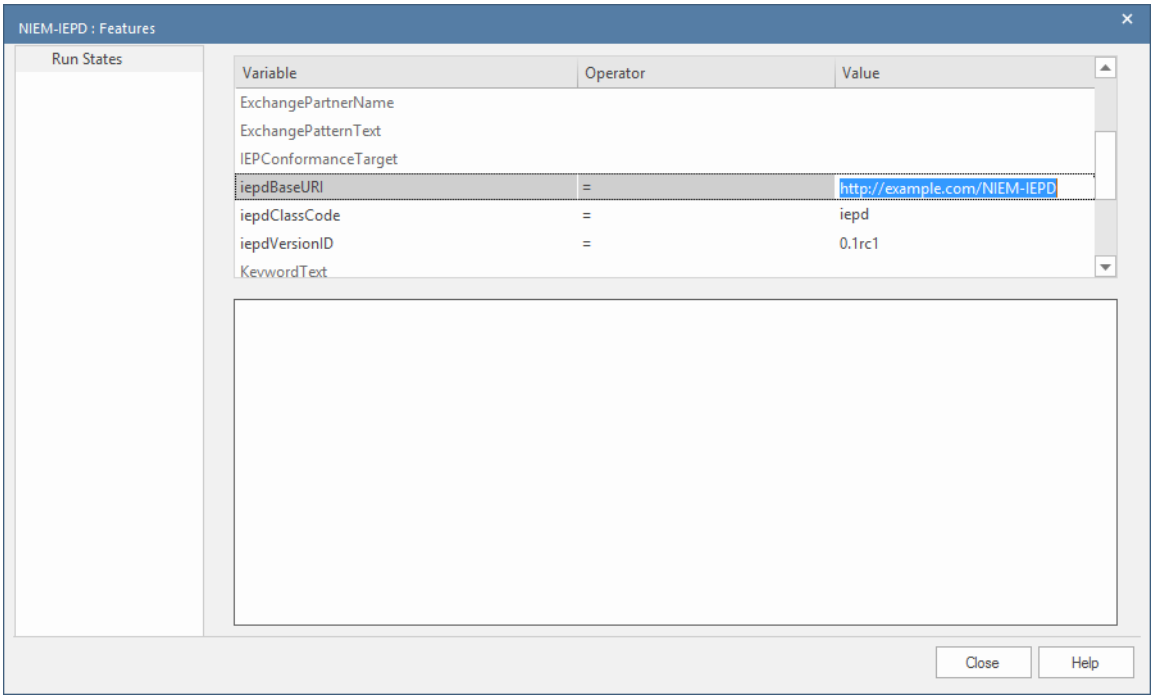
The Package 'NIEM IEDP Types' contains definitions for the Class 'IEPD', as well as a number of other Classes. These other Classes are referenced as classifiers for attributes of the 'IEPD' Class. Relationships between the various Classes defined in this Package can be viewed on the diagram 'NIEM-UML IEPD Types'.

The 'IEPD' Class has a number of attributes that are simple string types, as well as some attributes that are classified by types that are defined within the 'NIEM IEDP Types' Package.



Setting the Run-States of IEPD Objects

When setting the run state values for properties with simple types in the IEPD object, you can use the 'Set Run State' command. This can be accessed by right-clicking the Object on a diagram, then choosing 'Features | Set Run State...' (or by pressing Ctrl+Shift+R).

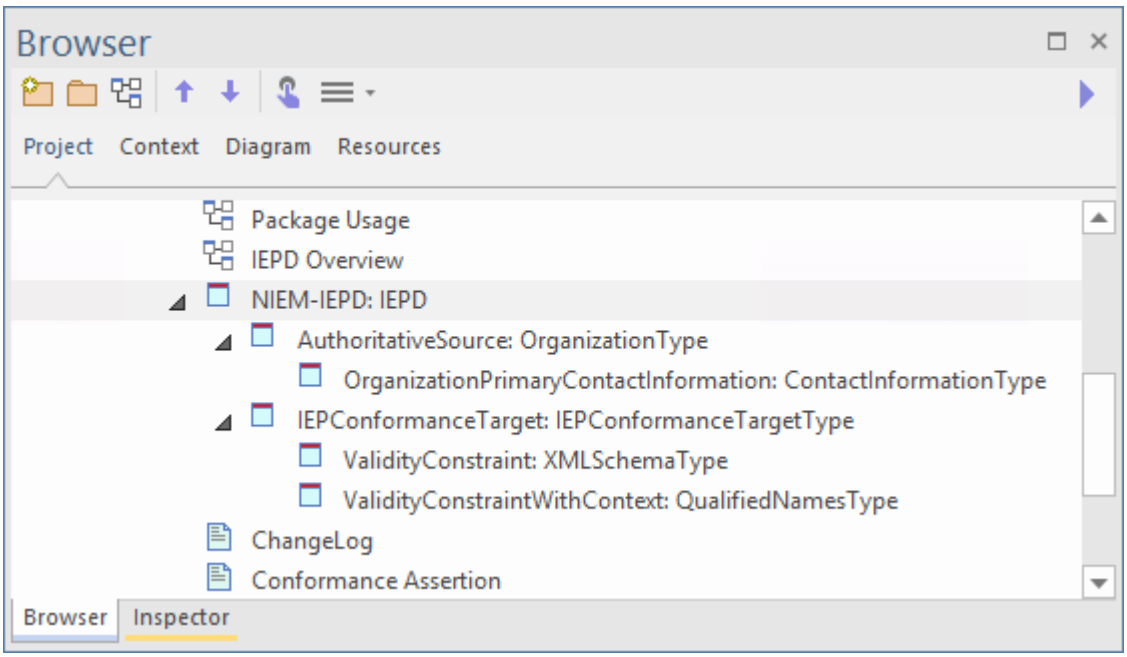


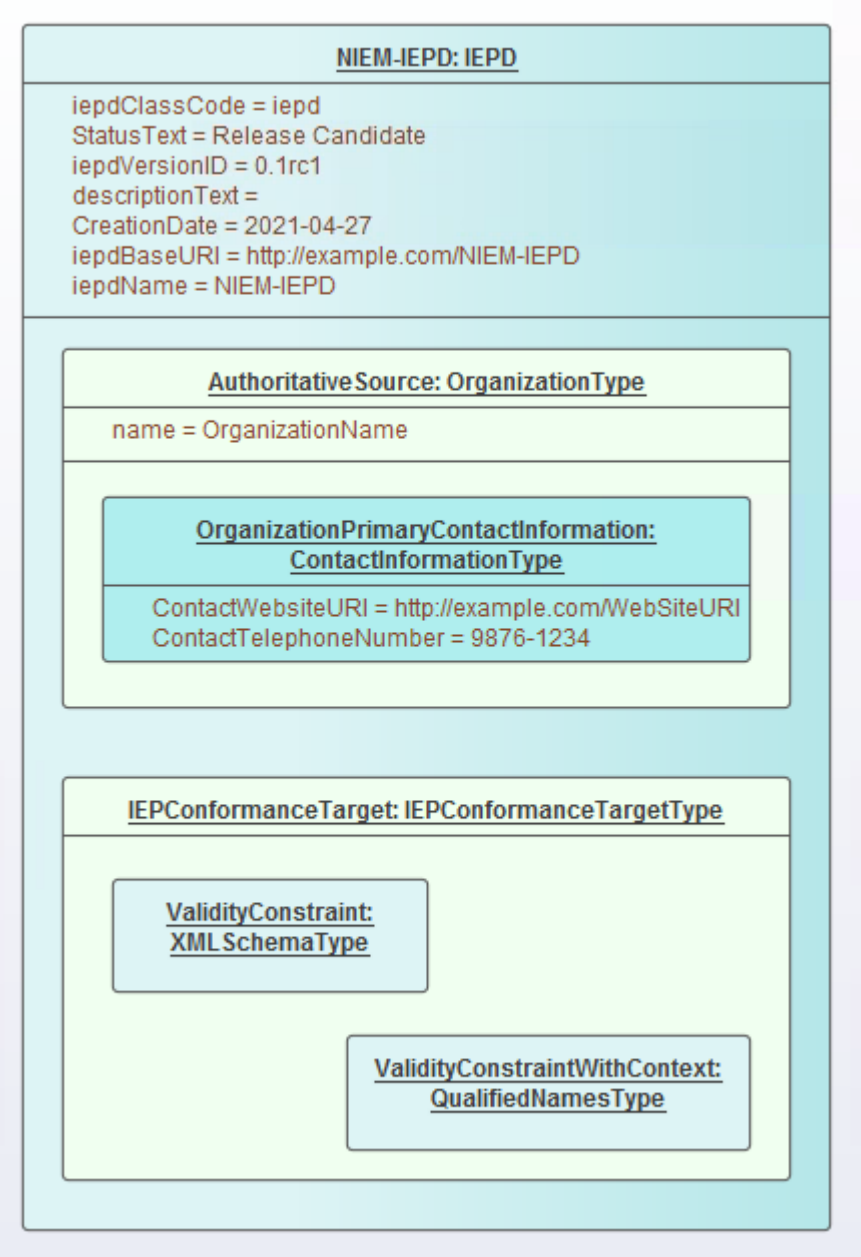
Where properties reference other Classes as their types, you cannot simply enter a run state value.

Enterprise Architect supports two methods of specifying values for these properties, each method requires creation of an Object instance of the referenced Class.

You should create an Object instance of the type corresponding to the property, then either create an Association between the two objects and set a role name for the property being set, or nest the Object as a child within the Object whose properties are being set and name the child Object using the name of the property being set. When associating an Object, the Object's name is not important, but the role name must match the name of the property being set.

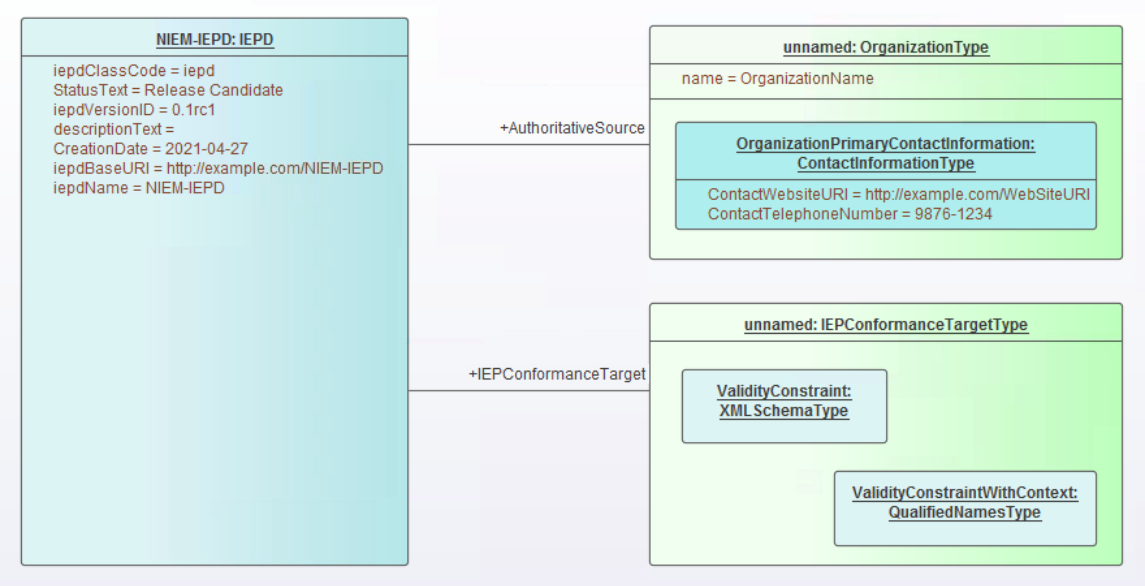
For example, you might create an Object instance of the type IEPConformanceTargetType and nest it within the IEPD Object. In this case, the child Object must be named 'IEPConformanceTarget' to correspond with the attribute of that name in the Class definition. Ensure that the child Object is indeed nested within the parent, by inspecting the hierarchy shown in the Browser window.





If using a role name on an Association, create the 'property' Object as a separate (non-nested) Object instance, then create an Association from the 'owner' to the 'object' and finally specify a role name for the target Object. For example, create an Association from the Model Package Description Object to an Object instance of IEPConformanceTargetType. Open the 'Properties' dialog for the Association and name the role of the target as 'IEPConformanceTarget', to correspond to the name of the attribute in the 'IEPD' Class. Again, in this scenario, the name of the Object itself is not important, it could even be anonymous, but the role name must match the name of the attribute whose value you are setting.

Note that an IEPD Object might specify many IEPConformanceTargets. You must create an Object instance for each one and each one must be named 'IEPConformanceTarget'.

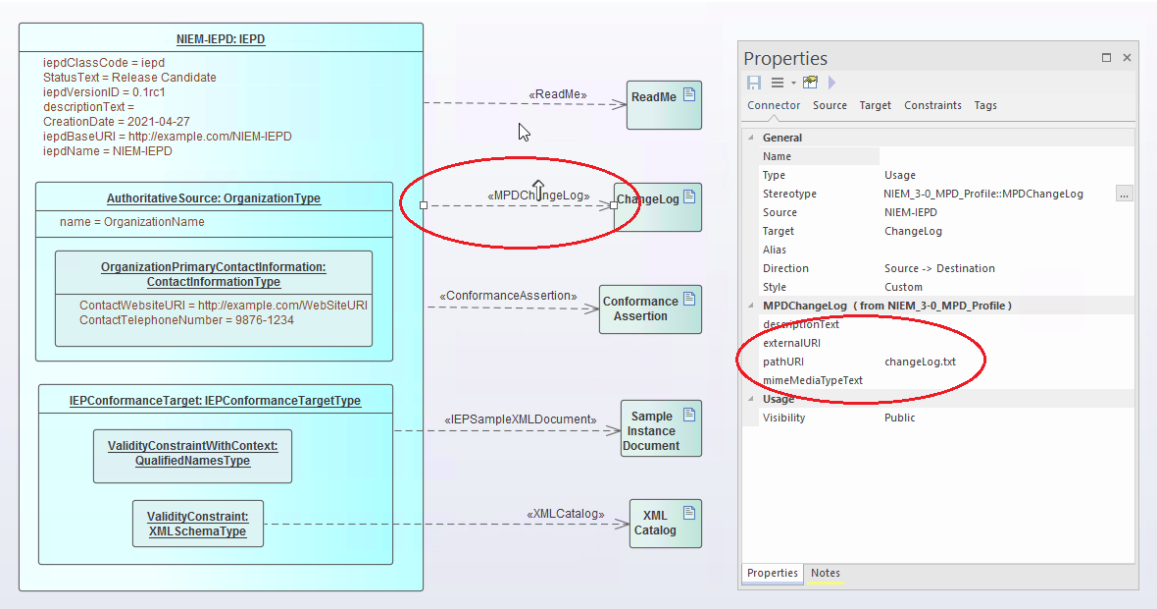


Either of these techniques can then be used to set properties within the IEPConformanceTargetType Object. For example, to set the value of the ValidityConstraintWithContext attribute, create an Object instance of the Class ValidityConstraintWithContextType (which might be an instance of the derived type QualifiedNamesType) and either name it and nest it, or associate it and name the role.

Modeling File Usage

File use can be modeled by adding Artifact elements to the diagram and linking with the required File Type Usage connector from the toolbox.

The various filenames are generated into the IEPD's XML catalog files, using values that are specified in the Properties of the relevant Usage connectors.



NIEM IEPD Generation

Generating the IEPD can be considered an iterative process. You do not have to wait until your NIEM model is complete before you generate an IEPD from it.

Your NIEM 'IEPD OVerview' diagram should contain an instance specification of an IEPD. The IEPD instance and its relationships to Conformance Target instances as well as other artifacts, is a representation of the IEPD catalog. When you generate an IEPD from your model, Enterprise Architect will generate a catalog file and other artifacts, based on the items in your IEPD model. It will also generate NIEM schemas for the <<InformationModel>> Packages referenced by your model. The result will be a collection of files output into the directory you specify for the generation process.

Steps for generating an IEPD

Step	Action
1	Your NIEM IEPD diagram should contain an Instance Specification of an IEPD. Select the IEPD instance, either on the diagram or in the Browser window.
2	From the 'Specialize' ribbon, choose the option 'Technologies > NIEM > Generate NIEM Schema'. The 'Generate NIEM IEPD Schemas' dialog displays.
3	In the 'Directory' field, type or browse for the directory path into which to generate the IEPD.
4	The 'NIEM Version' field defaults to '5.0'. If generating a NIEM 3 or 4 IEPD, set this field to the appropriate value. The 'IEPD Artifacts' panel lists the static IEPD Artifacts and common Artifacts (such as Structures and Catalog) used in this model, each with its relative path. Select or deselect the checkboxes beside these items to generate or skip these items. The 'Namespace Schema(s)' panel shows the schema files that will be generated for the information models. Select or deselect the checkbox beside a Namespace Schema to generate or skip that schema. Select a Namespace Schema to display Package details for that schema.
5	Click on the Generate button. Once the generation has completed successfully, clicking the View Schema button opens Windows Explorer, showing the contents of the output directory used for generation. If the Catalog Artifact has been deselected, then clicking the View Schema button will open an editor to view the schema file associated with the currently selected Namespace Package.

Notes

- The output location of the schema file generated for a Package is specified by the 'pathURI' tag value on the Usage connector that relates the Package to the IEPD instance specification; default values are set by the Schema Composer when the subset Packages are created, but the values can be overridden by the user

Creating a NIEM Data Model

One of the underlying principles behind NIEM is re-use of a common reference vocabulary - a predefined set of data elements and definitions used to define information exchanges. To this end, one of the core tasks in building a NIEM data model is creating a subset of the NIEM reference schema. The goal is to model as much of your data exchange as is practical, by re-using types and elements that are already defined in the NIEM reference model.

A NIEM data model usually consists of a number of Packages with the <<InformationModel>> stereotype applied.

Typically, a model will have one Package representing a NIEM-core subset schema, some other Packages representing subsets of particular Domain schemas, and one or more Packages representing extension schemas. The extension schema Packages provide those elements required by the model that are not available from the NIEM Reference Model. Often, the root element of the exchange message is separated from more general elements, and modeled in an extension schema Package dedicated to the specific exchange.

Steps for Creating a NIEM Data Model

Step	Detail
Import the NIEM Reference Model	Many of the activities involved in creating NIEM models, rely on using the NIEM Reference Model. If you haven't already done so, import the Reference Model into your Enterprise Architect project before proceeding further. For more information, see the Help topic Download the NIEM Reference Model.
Create a Subset of the NIEM-core Reference Package	There are a number of reasons for creating subsets of the NIEM namespace schemas when creating NIEM IEPDs, but the two most important reasons are: • The reference schemas are very large; subsetting produces much smaller schema files that, in turn, leads to faster validation of the schemas • Elements within the reference schemas are very loosely constrained; the subsetting process allows modelers to impose much tighter constraints, such as restricting cardinality and allowed values, to more closely reflect actual business requirements In Enterprise Architect, the subsetting process is performed using the Schema Composer. The Schema Composer allows the modeler to select the subset of required Classes from the source Package and, for each of the selected Classes, select a subset of required attributes. The selected Classes with their reduced attribute sets are then copied to a target Package. Most often the source Package will be the NIEM-core namespace Package from the NIEM Reference Model. In this case, the target Package will also be a namespace Package named 'NIEM-core', but it will be part of your NIEM IEPD model. Other namespace Packages from the Reference Model, such as the Domain Packages, can also be subsetted in the same way. Use Enterprise Architect's Schema Composer tool to copy a subset of the NIEM-core reference Package to the NIEM-core subset Package that is part of your IEPD model. The goal is to model as much of your data exchange as is practical, by re-using types and elements that are already defined in the NIEM-core Reference Model. In cases where your model will also make use of NIEM Domain Packages, this subsetting process should be repeated for each domain Package that you use. For more information, see the Help topic *Subsetting NIEM with the Schema Composer*.

Create Extension Packages	When creating a NIEM data model, the aim is to model as much of your data exchange as possible using types and elements from the NIEM Reference Model. What cannot be modeled by re-using existing NIEM elements is then modeled in 'extension' namespace Packages, by creating new types and elements using elements from the NIEM-UML profiles, with all types ultimately deriving from XML schema primitive types. Both the NIEM Starter Model (from the Model Builder) and the IEPD Starter Model Pattern (from the Diagram Toolbox) provide <<InformationModel>> Packages in which to model the various schemas. Using PIM diagrams within these Packages, you can build models of your different schemas, by adding elements from the Diagram Toolbox. It is suggested that you use the diagram in the 'exchange' Package, to assemble the high-level model of your exchange, using types and elements from other schema Packages as required. Most IEPDs require extension schemas to define specific types and properties that are unique to the data exchange being defined. However, the NIEM model does not define specific message types or structures for assembling all of the objects in an exchange. It is therefore up to the creator of the IEPD to write an extension schema that declares the root element and the basic structure of the messages. The root element of the exchange brings together all of the objects and associations defined in the exchange. Whilst you are not required to create a separate schema to declare the root element and basic structure of the message, it can be beneficial to separate message-specific extensions into an 'exchange' schema and more generic extensions into 'extension' schemas. Exchange schemas contain definitions that are unique to a message type or group of message types. This generally includes only the root element and its type and possibly some structural elements that form the basic framework of the message. Organizing schema elements into 'exchange' and generic 'extension' groupings also offers the possibility of sharing the more generic schema across multiple IEPDs, whereas the 'exchange' schema is usually specific to one particular IEPD. You can also have multiple 'exchange' schemas in order to represent different message types or groups of different message types.

Subsetting NIEM with the Schema Composer

Enterprise Architect's Schema Composer is a tool that can greatly simplify the process of creating subsets from the NIEM Reference Model namespace Packages.

Access

Use either of the methods outlined here to display the Schema Composer window and then display the 'New Model Transform' dialog,

Enter a name for the new model transform, then from the 'Schema Set' drop-down list choose 'National Information Exchange Model (NIEM)'.

Save the profile as a Model Artifact within a suitable Package in your project (the root Package of your IEPD is suitable - then the Artifact will be easy to find).

Ribbon	Develop > Schema Modeling > Schema Composer > Open Schema Composer : New > Model Transform

Creating a Subset Model

NIEM experts suggest that a good first step is to create a UML model of your XML exchange, as it allows you to capture your business requirements without being unduly influenced by how things are done in NIEM.

Once you have a first draft of a UML model for your exchange, you can then begin to re-create that model using NIEM.

Initially, finding appropriate types and properties within the NIEM Reference Model can seem to be an impossible task. This will become much easier as you gain experience and familiarity with the content of the NIEM model.

Most of the NIEM types that you will commonly use, such as PersonType, OrganizationType, DocumentType or ActivityType, have numerous attributes, of which you will generally require only a few. This is where subsetting becomes useful.

If you are trying to model a person, using their name, address and birthdate, you would choose PersonType and AddressType from NIEM-core. From those types, select only the properties that you require for your model.

Where the selected properties reference other types, those types will be automatically added to the Schema Composer.

When you 'generate' your subset, Enterprise Architect creates the target schema Packages required by the subset, then copies the selected types with their reduced attribute sets into the target Packages.

Further Refining Your Subset

Once you have created your subset, you can further refine it by making adjustments to the cardinalities of the properties within the types or by restricting the allowed values of the properties.

To adjust the cardinality or restrict the permissible values of a property, select that property in the center pane of the Schema Composer, then right-click and choose 'Restrict this property'. The 'Property Restrictions' dialog is displayed, where you can adjust the cardinality or apply restrictions to the property as required.

Click on 'Update' to save the changes to your model transform profile, then click on 'Generate' to regenerate the subset model with the restrictions applied.

NIEM subsetting is often an iterative process. Using the saved model transform profile, you can reload, update and regenerate your subset as you require, throughout the various stages of IEPD development.

Subsetting NIEM Using the Schema Composer

Step	Action
1	Open the Schema Composer. (See *Access: Ribbon*)
2	Create a new Schema Composer profile. Click on the New button and select 'Model Transform'. In the dialog that opens, specify a name for the profile and select 'NIEM' in the 'Schema Set' field. (The 'Namespace' field on this dialog is not used for NIEM, as NIEM uses Tagged Values on its Model Packages to specify namespaces.) Choose a location to save your new profile, then click on the OK button.
3	In the Browser window, locate the required types PersonType and AddressType, in the NIEM-core Package of the Reference Model. Drag and drop the required types from the Browser window onto the 'Classes' pane of the Schema Composer.
4	Now select one of the types, say PersonType, in the Schema Composer's 'Classes' pane. The full list of attributes for PersonType is shown in the 'Attributes' pane.
5	Use the checkboxes in the 'Attributes' list to select the attributes of 'PersonType' to use in your exchange model. In this case, select the checkboxes for 'PersonBirthDate' and 'PersonName'. As you select these attributes, the Schema Composer automatically adds the types 'DateType' and 'PersonNameType' to the list of Classes, as these types are referenced by the attributes you just selected.
6	Now select 'DateType' in the 'Classes' pane. 'DateType' has four attributes, DateAccuracyAbstract, DateAugmentationPoint, DateMarginOfErrorDuration and DateRepresentation. The first three of these attributes are date metadata - they do not hold a date value. The fourth, DateRepresentation, is an abstract attribute, so it does not directly hold date values either. It is used as a placeholder for the attribute that will ultimately hold the date value. The NIEM model commonly uses XML Schema abstract elements and substitution groups. The abstract elements add some complexity to the creation of a subset, because you are required to add the abstract element, as well as those elements that will be substituted in place of the abstract element. For example, most date-related types contain the abstract element nc:DateRepresentation that can be substituted by nc:Date, nc:DateTime, and so on.
7	Select the attribute DateType.DateRepresentation. You will notice that another type, DateRepresentationPropertyHolder has been added to the 'Classes' list.
8	Select DateRepresentationPropertyHolder in the 'Classes' list. The untyped attribute DateRepresentation is known as the 'head' of a substitution group. This attribute must be selected in the client of the substitution, DateType, as well as in the supplier of the substitution, DateRepresentationPropertyHolder. The attribute that is the head of the substitution group is pre-selected for you, so you only need to select the attribute that will eventually be substituted for DateRepresentation in DateType. Select the attribute Date:date - it will be used as the DateRepresentation that will actually hold a data value. Where substitution groups are involved, it is a common mistake to simply add the abstract element

	without also adding the substitutable element from the related PropertyHolder type.
9	Repeat the process for the PersonName attribute, by selecting PersonGivenName, PersonMiddleName and PersonSurName from the PersonNameType class.
10	To save your current selection of Classes and attributes to the profile you are creating, click on the Update button. This updates the profile with your current selection, allowing it to be reloaded at a later date if you need to perform further work on it. This facilitates an iterative process of creating the subset Package.
11	Now click on the 'Generate' option. Choose 'NIEM Model Subset' in the 'Schema Export' dialog and click on the Generate button. Navigate to the Package hierarchy containing the IEPD that you are building. Select the parent Package that will contain the subset Packages, then click on the OK button.
12	The Classes you have selected in the Schema Composer will be copied to the target Packages, with just the subset of attributes that you have selected.

Notes

- Please read through each of the walk-through examples - each one contains important information
- The Schema Composer functionality that supports NIEM development, assists in creating Subset Schemas; it does not assist in producing Extension Schemas

Walk Through Examples

If you are new to using the Schema Composer for NIEM, please take the time to read through these examples. Each example contains important information that will help to ensure that your models use valid NIEM subsets, which will ultimately produce valid XML schema files.

Example 1: Adding Classes and Selecting Attributes

This 'walk-through' example demonstrates how to use Enterprise Architect's Schema Composer to perform basic operations of adding Classes and selecting attributes to be included in a NIEM subset Package.

Step	Description
1	Open an Enterprise Architect project that contains the NIEM 5.0 Reference Model and also the NIEM IEPD Types. If you don't have such a project, then open a new project and load the Reference Model and IEPD Types, using the Model Builder (Ctrl + Shift + M).
2	Using the Model Builder, add a fresh copy of the NIEM 5 IEPD Starter Model to your project. You should rename the object instance 'NIEM-IEPD' to something more meaningful. When generating the IEPD, the name of this object instance is used to name the root folder in which the IEDP is created. If you wish, rename the Package 'NIEM 5 Starter Model' to something more appropriate as well.
3	The starter model contains a Schema Composer artifact named 'Schema Composer profile - NIEM 5 subset'. Locate this artifact in the Browser window, then double-click on it. This will open the Schema Composer and load the profile 'Schema Composer profile - NIEM 5 subset'. The lower part of the Schema Composer contains three columns. From left to right, they are labelled 'Classes', 'Attributes' and 'Schema'.
4	Using the Browser window, locate the Package 'niem-core' in the NIEM 5.0 Reference Model. Within that Package, locate the Class 'AircraftType'. Drag and drop 'AircraftType' onto the left-hand column of the Schema Composer (labelled 'Classes'). You will notice that Classes 'ConveyanceType' and 'ItemType' are added automatically to the list of Classes. 'ItemType' and 'ConveyanceType' are supertypes from which 'AircraftType' is derived.
5	Select AircraftType in the 'Classes' column. You will notice that the center column, 'Attributes', displays the full list of attributes belonging to this Class. The attributes of the parent Classes are also listed. To include an attribute in the subset schema, you simply place a checkmark beside it. (You should choose only attributes of the Class that is currently selected in the 'Classes' list. If you require attributes of a parent Class, select that Class, then select its attributes.) Place a checkmark beside AircraftTailIdentification. The type of AircraftTailIdentification is IdentificationType. Notice that IdentificationType has been added to the list of Classes. Enterprise Architect automatically adds to the 'Classes' list, those classifiers that are referenced as types of the attributes you select.

6	Select the Class IdentificationType in the left-hand column of the Schema Composer. In the center column, place a check mark beside the attribute IdentificationID. The type of IdentificationID is 'string'. The type 'string' is a Primitive type - it is not added to the list of Classes.
7	Now, select the Class ConveyanceType in the left-hand column of the Schema Composer. Place a check mark beside the attribute ConveyanceMotorizedIndicator. The type 'boolean' is a Primitive type - it is not added to the list of Classes.
8	Select the Class ItemType in the left-hand column of the Schema Composer. Place check marks beside the attributes ItemMakeName, ItemModelName and ItemModelYearDate. The types ProperNameTextType and TextType are automatically added to the list of Classes. TextType is the base Class for ProperNameTextType.
9	Click on the Update button to save the selected Classes and attributes to the profile, then click on the Generate button. In the window that opens, select 'NIEM Model Subset', then click on the Generate button. You will be prompted to select a Package within which the subset model will be created. Typically, you would choose the Package that is the parent of the Exchange schema Package. In the starter model, the exchange Package is named 'IEPD-Exchange' and its parent Package is named 'NIEM 5 Starter Model', although you might have renamed these earlier in step 2. Select the Package 'NIEM 5 Starter Model', then click on the OK button. Note: When creating more complex models, your subset might include Classes from several different <<InformationModel>> Packages. Enterprise Architect's Schema Composer will automatically create the required target Packages and copy the Classes you are subsetting into the target Packages whose Tagged Value 'targetNamespace' matches that of the source Package from which the original Class was drawn. The subset <<InformationModel>> Packages will be created as children of the Package you choose as the generation target.
10	Once the generation is complete, expand the target <<InformationModel>> Packages. You will see the Classes you selected with their reduced sets of attributes.

Example 2: Using Association Types

This 'walk-through' example demonstrates how to use Enterprise Architect's Schema Composer to add Association Types and the types they reference, to your NIEM subset Package.

Step	Description
1	Open an Enterprise Architect project that contains the NIEM 5.0 Reference Model and also the NIEM IEPD Types. If you don't have such a project, then open a new project and load the Reference Model and IEPD Types using the Model Builder (Ctrl + Shift + M).
2	Using the Model Builder add a fresh copy of the NIEM 5 IEPD Starter Model to your project. You should rename the object instance 'NIEM-IEPD' to something more meaningful. When generating the IEPD, the name of this object instance is used to name the root folder in which the IEDP is created. If you wish, rename the Package 'NIEM 5 Starter Model' to something more appropriate as well.
3	The starter model contains a Schema Composer artifact named 'Schema Composer profile - NIEM 5 subset'. Locate this artifact in the Browser window, then double-click on it. This will open the Schema

	Composer and load the profile 'Schema Composer profile - NIEM 5 subset'. The lower part of the Schema Composer contains three columns. From left to right, they are labeled 'Classes', 'Attributes' and 'Schema'.
4	Using the Browser window, locate the Package 'niem-core' in the NIEM 5.0 Reference Model. Within that Package, locate the Class 'PersonLocationAssociationType'. Drag and drop 'PersonLocationAssociationType' onto the left-hand column of the Schema Composer (labelled 'Classes'). You will notice that the center column 'Attributes' displays PersonLocationAssociationType.Attributes and also PersonLocationAssociationType.Associations. Place check marks beside both of the associations, Location and Person. The types LocationType and PersonType are automatically added to the Schema Composer's 'Classes' list.
5	The Class PersonLocationAssociationType is derived from the supertype 'nc:AssocationType', but in this case the supertype is not automatically added to the Classes list. If you want to include any attributes of the supertype 'nc:AssociationType' in your generated subset, you must add 'nc:AssociationType' to the Schema Composer's Class list manually, then select the required attributes. If you don't want to specifically include attributes of 'nc:AssociationType', then there is no need to add it to the Classes list. When the schema file is eventually generated from the subset Package, Enterprise Architect will generate an element and type definition for 'nc:AssociationType' if and when it is required, even if it is not explicitly modeled.
6	Click on the Update button, then click on the Generate button. In the window that opens, select 'NIEM Model Subset', then click on the Generate button. You will be prompted to select a Package within which the subset model will be created. Typically, you would choose the Package that is the parent of the Exchange schema Package. In the starter model, the exchange Package is named 'IEPD-Exchange' and its parent Package is named 'NIEM 5 Starter Model', although you might have renamed these earlier in step 2. Select the Package 'NIEM 5 Starter Model', then click on the OK button.
7	Locate the <<InformationModel>> Package named 'niem-core' within the subset model. Create a NIEM PIM diagram within this Package, then drag and drop the three Classes in this Package onto the diagram. You will notice that the properties 'Person' and 'Location' are modeled as AssociationEnds on the Associations between PersonLocationAssociationType and the types PersonType and LocationType.

Example 3: Using Substitution Groups and Property Holders

This 'walk-through' example demonstrates how to use Enterprise Architect's Schema Composer to correctly add substitution groups and property holders to your NIEM subset Package.

Step	Description
1	Open an Enterprise Architect project that contains the NIEM 5.0 Reference Model and also the NIEM IEPD Types. If you don't have such a project, then open a new project and load the Reference Model and IEPD Types using the Model Builder.
2	Using the Model Builder, add a fresh copy of the NIEM 5 IEPD Starter Model to your project.

	You should rename the object instance 'NIEM-IEPD' to something more meaningful. When generating the IEPD, the name of this object instance is used to name the root folder in which the IEDP is created. If you wish, rename the Package 'NIEM 5 Starter Model' to something more appropriate as well.
3	The starter model contains a Schema Composer artifact named 'Schema Composer profile - NIEM 5 subset'. Locate this artifact in the Browser window, then double-click on it. This will open the Schema Composer and load the profile 'Schema Composer profile - NIEM 5 subset'. The lower part of the Schema Composer contains three columns. From left to right, they are labeled 'Classes', 'Attributes' and 'Schema'.
4	Using the Browser window, locate the Package 'niem-core' in the NIEM 5.0 Reference Model. Within that Package, locate the Class 'AircraftType'. Drag and drop 'AircraftType' onto the left-hand column of the Schema Composer (labeled 'Classes'). You will notice that the Classes ConveyanceType and ItemType are added automatically to the list of Classes. ItemType and ConveyanceType are supertypes from which AircraftType is derived.
5	Select the Class 'AircraftType' in the left-hand column of the Schema Composer. In the center column, place a check mark beside the attribute AircraftWingColorAbstract (notice that this attribute has no type specified). The Class AircraftWingColorAbstractPropertyHolder is automatically added to the list of Classes.
6	Select the Class 'AircraftWingColorAbstractPropertyHolder' in the left-hand column. Notice that this Class also has an attribute named 'AircraftWingColorAbstract' that has no type specified. This attribute is pre-selected for you - it should remain selected. Simply place a check mark beside AircraftWingColorText.
7	In this case, the attribute AircraftWingColorAbstract is the head of the substitution group and provides the connection between the client Class AircraftType and the supplier Class AircraftWingColorAbstractPropertyHolder. AircraftWingColorText is the actual attribute (of type TextType) that will be added to AircraftType.
8	Some PropertyHolder types will have several attributes - the substitution group head, plus a number of others. The attribute that is the head of the substitution group must always be selected in both the client and the supplier Classes. Enterprise Architect pre-selects this attribute for you in the supplier Class (the PropertyHolder). You then only need to select the attribute(s) from the supplier that you want to substitute in place of the head of the substitution group.

Example NIEM Schema

This page provides an overview of defining a new NIEM compliant schema, from start to finish.

The framework Packages that are required for NIEM modeling have been described in previous topics. The Model Builder also provides a Package that acts as a convenient starting point for defining your IEPD. When this is imported to your model you will find diagrams containing instances of the IEPD types, with the run-state set to show the core properties that you are most likely to need to set.

This section describes the process of taking the sample IEPD from the Pattern, and creating a 'Hello World' style message, where a request is made for a personalized message based on a facial image. The response will be the identity of the pictured person and a personalized message for them.

Import NIEM framework Packages

Modeling with NIEM in Enterprise Architect starts with the standard types defined by the NIEM Technical Architecture Committee and the Object Management Group NIEM-UML specification, as described here. These are available from our Reusable Asset Server and the Model Builder.

To import these into your model:

- Open the Model Builder (Ctrl+Shift+M)
- In the Model Builder dialog, click on the <perspective name> button, then select the perspective 'Information Exchange > NIEM'
- Expand the item 'NIEM 3, 4 and 5'
- Select the Packages required for your model
- Click on the Create Model button to import the selected patterns into your model

Note:

- All NIEM 5 models require the NIEM IEPD Types Package as well as one of the NIEM Reference Model Packages
- All NIEM 3 and 4 models require the NIEM MPD Types Package as well as one of the NIEM Reference Model Packages
- All NIEM 2.1 models require the NIEM 2.1 Reference Model Package but not an MPD Types Package, as the NIEM 2.1 MPD elements are available from the NIEM 2.1 MPD Diagram Toolbox

Component	Details
NIEM Framework	The power of NIEM comes primarily from the extensive library of types that you can use to build your own schemas. Enterprise Architect provides complete NIEM frameworks for NIEM 5, as well as all versions of NIEM 3 and NIEM 4. These frameworks are all available from the Model Builder. This tutorial is using the NIEM 5.0 framework, so select that pattern for import.
IEPD Types from NIEM-UML	A user-defined NIEM schema is built around an IEPD that defines, for consumers of the schema, how to use the various XSD files that are included and what message types are being defined. When modeling in UML, an IEPD is created using instances of a number of Classes defined in the UML Profile. Enterprise Architect provides these Classes in a Package that is available from the Model Builder. All NIEM 5 models will require these IEPD types, so select the 'NIEM 5 IEPD Types' pattern for import.

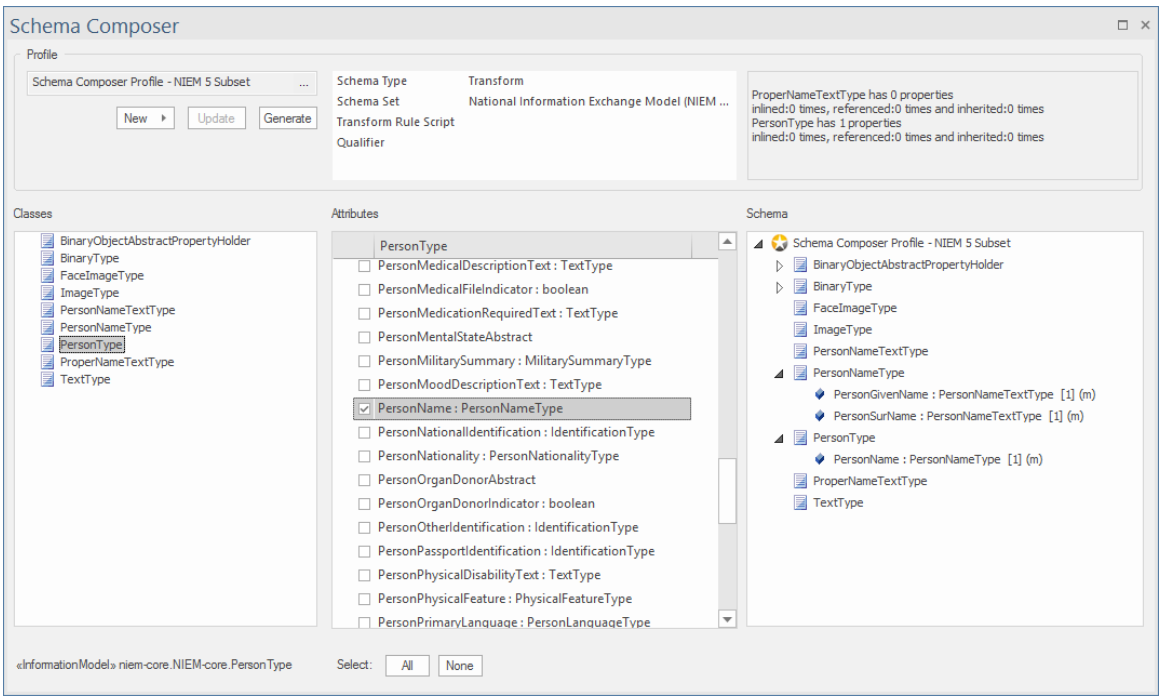
Subset NIEM Namespaces

The Starter Model pattern includes a Schema Composer Artifact to use for specifying a subset. Double-click on it to open the Schema Composer and begin the subsetting process.

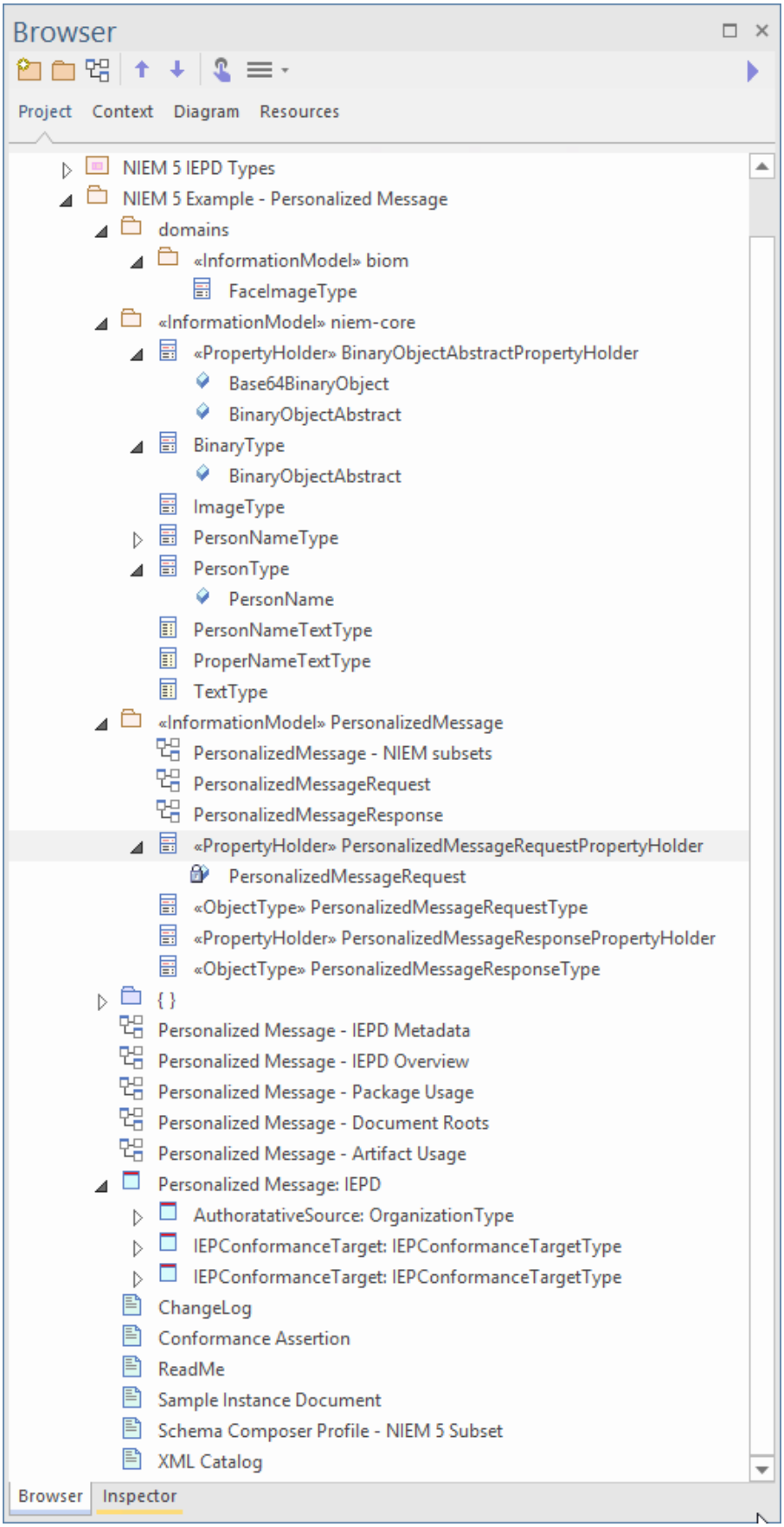
We want our request message to send a facial image to be used for facial recognition. To do that, we need to subset the appropriate types from the Biometrics Package. Start by locating the type FaceImageType in the Domains\Biom Package within the NIEM 5.0 Reference Model. Drag this type into the Schema Composer. The super-types from which this type inherits are automatically added to the Schema Composer.

Our response message requires PersonType from the 'niem-core' Package. Drag this type onto the Schema Composer as well.

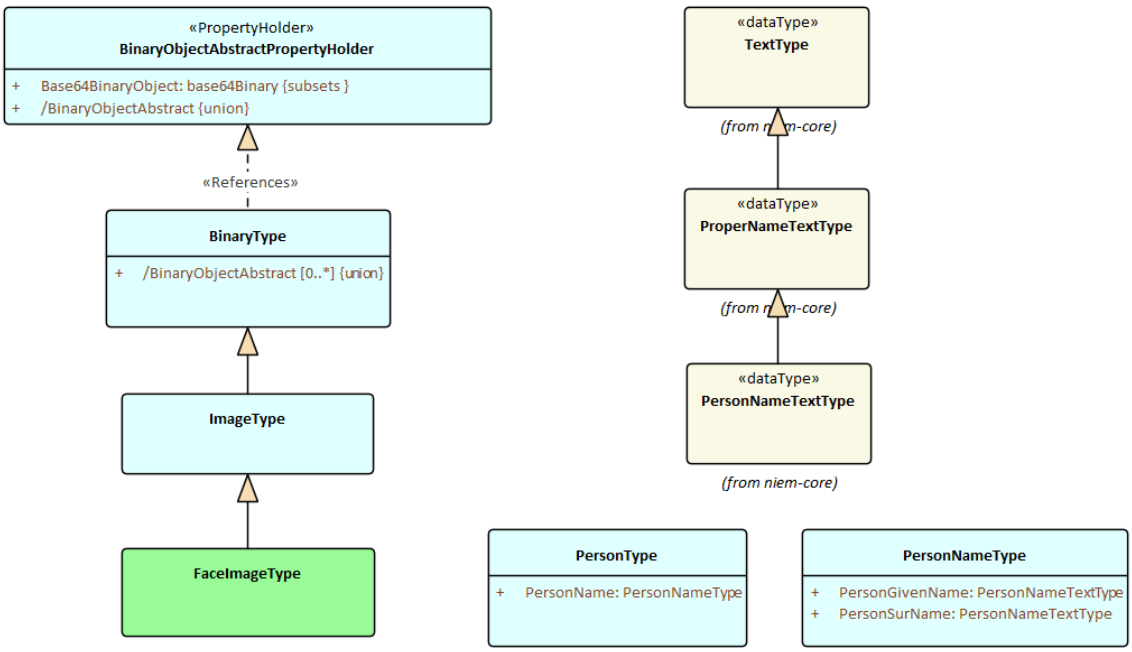
This image shows the selection of a subset of the types and properties across a number of namespaces within the NIEM 5.0 Reference Model:



Once the required types are selected, you can generate the subset. When prompted, select the **parent** Package into which the subset namespace Packages will be generated. After generation, the Classes in the subset Packages should resemble this:

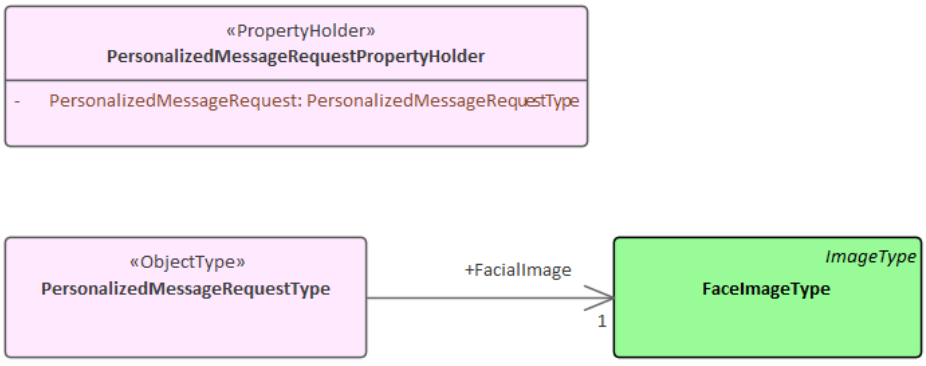


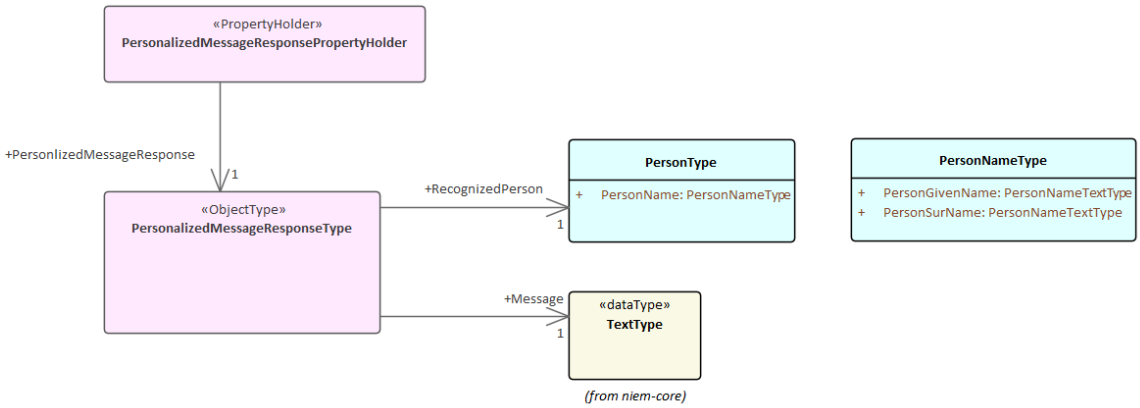
We can now create a NIEM PIM diagram and place all our subset Classes on that diagram, to produce something that resembles this:



Create extension types

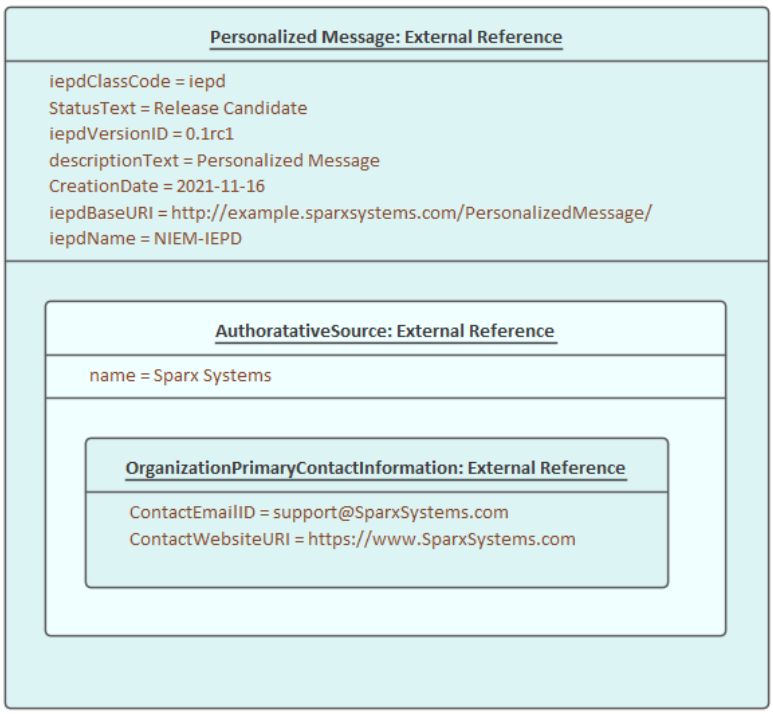
We will be defining two messages, a request and a response. For each of these messages, we need to define the document root elements. These will be modeled as extensions to the NIEM schema. Now that we have defined our subset Packages we can define these document roots. Because we are only creating two simple document types, all that is needed is a PropertyHolder and ObjectType for each message. The ObjectTypes link to the types we've selected from the NIEM framework, to describe the contents of each message as shown:

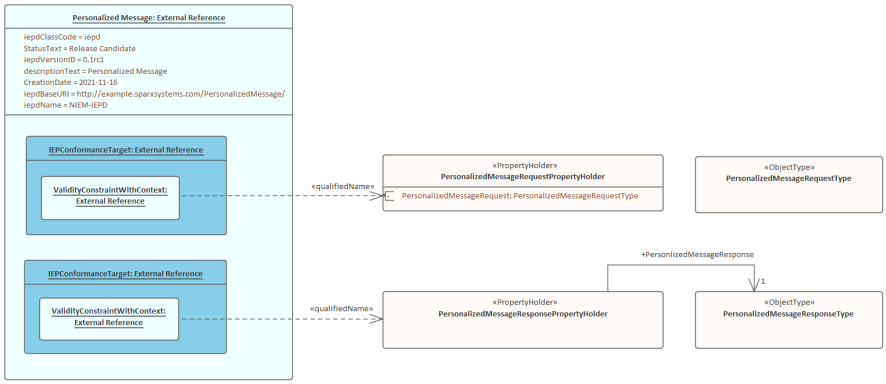




Customize the IEPD

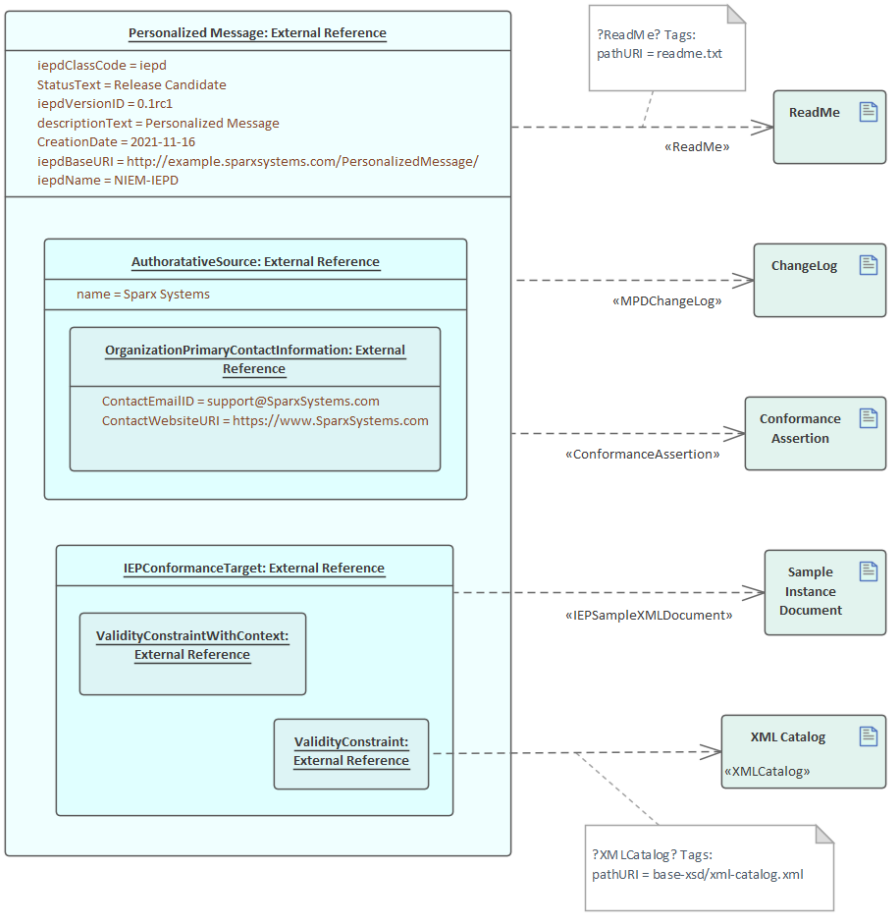
The instance of the IEPD Class carries information that identifies the IEPD, and the links between it and the various other model artifacts determine what is generated (and where it is generated to) when generating the schema files and catalog files. The main points are described here.

Component	Description
IEPD Metadata	The top level object in the Pattern is an instance of the IEPD class. The name of the IEPD is the name of the Object itself. All other properties are in the Run-State of the object. This figure shows how the IEPD might look after providing real information.  NIEM-UML recommends the last section of iepdBaseURI matches the name of the IEPD, and specifies that the iepdVersionID will be appended to the iepdBaseURI to produce the generated iepdURI. This example follows that convention. The Pattern defaults the value of iepdClassCode to 'iepd'. This means that the IEPD is intended to represent an Information Exchange Package Document (IEPD). This

	is the most common type of IEPD, and it is what we want to create, so it has been left with the default value.
Defined Document Types	An IEPD is expected to define one or more document types. Each one will be an instance of IEPConformanceTargetType named 'IEPConformanceTarget'. The provided model Pattern already includes one of these, but we need a second one as shown here:  Note the instances of QualifiedNamesType, with the qualifiedName relationship to a PropertyHolder. This specifies that the top level of the document being described will be an element from one of the contained attributes. The section *Create Extension Packages* in the topic *Creating a NIEM Data Model* describes how this is defined.
Package Usage	The relationships connecting the IEPD instance to the Information Models specify which schema files are to be generated with this IEPD. In this example we use types from two different NIEM namespaces. The sub-setting process has created an InformationModel Package for each, where the Namespace Tagged Values match the original, and the purpose is set to subset. We also create an extension Package where we define our own types and how the NIEM types will be used. This figure shows how this looks: The relationships used also specify how the Package is used and the relative path to the schema defined by that Package.
Additional Files	All IEPD Packages are expected by NIEM to contain - at a minimum - a change log and a readme, but there are several other types of Artifact that are also supported. In

Enterprise Architect, each is defined using a stereotyped relationship to an Artifact. As with the Package use, the relationship specifies where the file will be located.

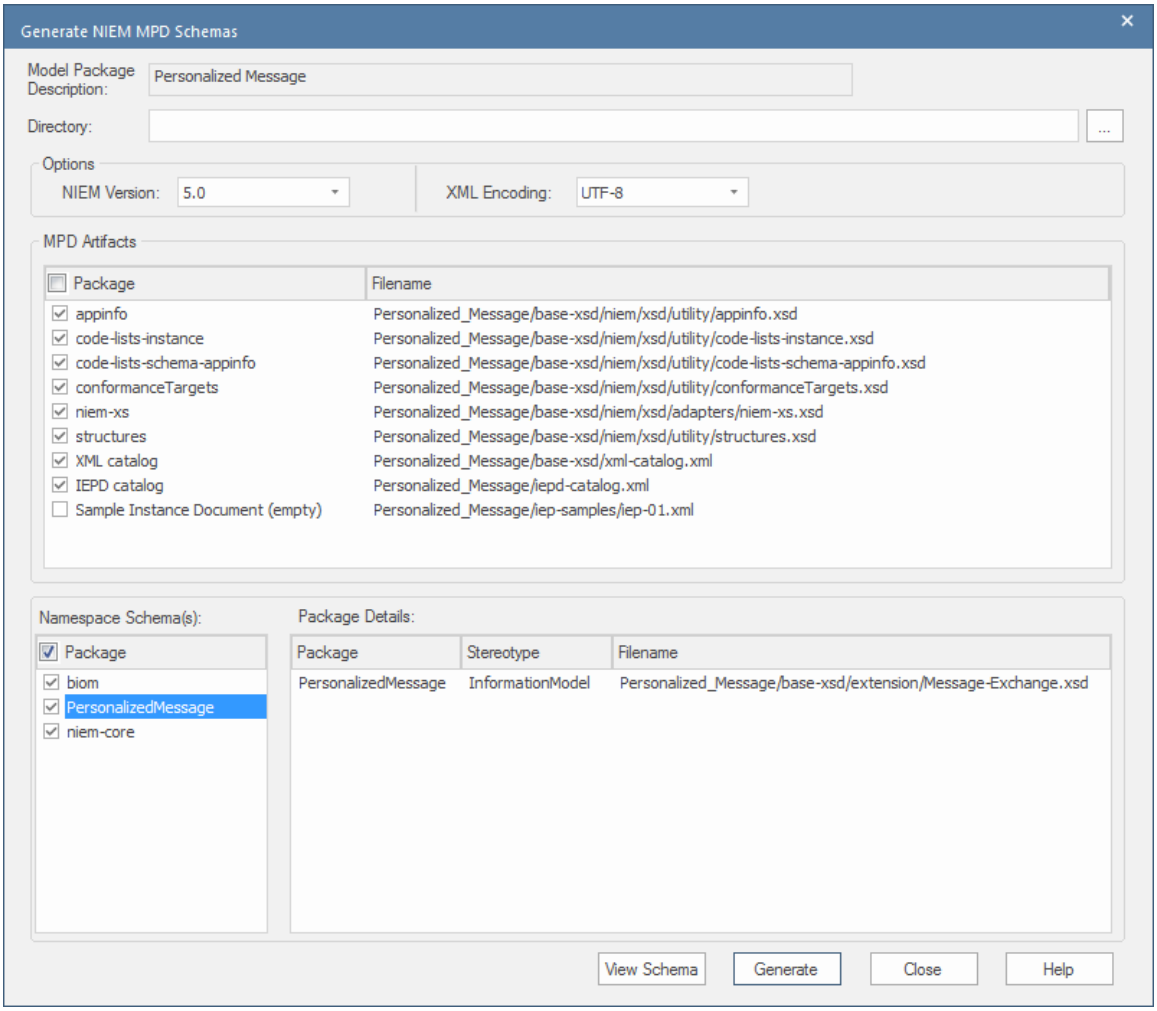
In this image a ReadMe, ChangeLog and a sample document are described for each of the document types. This will add information about those files to the target catalog file. The files will not be created by Enterprise Architect, and their content is beyond the scope of this tutorial.



Generate IEPD

To generate your IEPD:

- Select the IEPD instance specification, either on the diagram or in the Browser window.
- From the 'Specialize' ribbon, select the option 'Technologies > NIEM > Generate NIEM Schema'



The dialog shows the standard NIEM artifacts and the list of linked namespaces that can be generated as schemas. Set the target directory and click on the Generate button to create the modeled IEPD.

Import NIEM XML Schema

As well as generating NIEM schema in Enterprise Architect, you can import (reverse engineer) an external NIEM-specific XML Schema file into your Enterprise Architect project as a UML model.

Access

Ribbon	Specialize > Technologies > NIEM > Import NIEM Schema Specialize > Technologies > NIEM 2.1 > Import NIEM 2.1 Schema
Context Menu	In the Browser window: Right-click Package | Specialize | NIEM | Import NIEM Schema Right-click Package | Specialize | NIEM 2.1 | Import NIEM 2.1 Schema

Import a NIEM specific XML Schema

Option	Action
Package	Displays the name of the currently-selected Package in the Browser window, as the Package into which to import the NIEM schema. You can verify that you are using the appropriate Package by clicking on the button and checking the 'Navigator' dialog; select a different Package if necessary.
Directory	Click on the button and browse for the directory containing the source NIEM Schema file(s). Click on each file to import, and then click on the browser Open button.
Selected File(s)	Lists the XML Schema file(s) selected for import.
Import referenced XML Schema(s)	Select this checkbox if you want to import any other XML Schema that is referenced by any of the files listed in the 'Selected File(s)' field.
Skip Schema if Namespace in Model	Select this checkbox if you want to skip importing an XML Schema if it already exists in the model. Enterprise Architect will use the Schema namespace and name to determine if it exists in the Model.
Create Diagram for XML Schema(s)	Select this checkbox to create a Class diagram (a NIEM PIM diagram) under each imported Namespace Package.
Layout created Diagram	(Enabled only if the 'Create Diagram for XML Schema(s)' option is selected.) Select this checkbox to automatically lay out the created Class diagram(s).
Import	Click on this button to start the import process.

	The progress of the import is reported in the 'NIEM Importer' tab of the System Output window. A message box also displays to indicate when the import is complete; click on the OK button to clear the message.
Close	Click on this button to close the 'Schema Importer' dialog.
Help	Click on this button to display this Help page.

Notes

- Enterprise Architect uses the *schemaLocation* attribute in the XSD Import and XSD Include elements of an XML Schema, to determine the dependencies between the files; this attribute must be set to a valid file path (and not a URL) for the dependent XML Schema(s) to be imported correctly
- The 'Create Diagram for XML Schema(s)' option generates a diagram for each imported schema file, but displays the diagrams only for the schema files specifically selected by the user; it does not display the diagram for a referenced schema file
- If you import large schema files, it is recommended that you deselect the 'Create Diagram for XML Schema(s)' option, as this considerably increases the time taken by the import

Geospatial Models

The popularity of the internet, the ever-present mobile phone and the prevalence of location-based services have resulted in almost everyone interacting with location-based information in some form in their daily lives. It has also become critical for governments and organizations to embrace this type of information as part of strategic decision making. Geospatial information can be modeled in Enterprise Architect and also integrated with other data to form a single and comprehensive view of information not possible in other tools.

Enterprise Architect, through the use of MDG Technologies, supports the Geography Markup Language (GML) application schemas and the modeling of ArcGIS geodatabases. The information precursors to these models - such as community conceptual models - can also be modeled, and traceability can be used to connect the models together.

Modeling Tools

Tool	Description
ArcGIS Profile	Enterprise Architect supports the design of geodatabases for the ArcGIS 10.0 suite of tools developed by Esri Inc.
Geography Markup Language	Geography Markup Language (GML) in Enterprise Architect is the implementation of the Open Geospatial Consortium's Geography Markup Language 3.3, which provides an XML grammar for geographical feature modeling capabilities within Enterprise Architect.

Getting Started

Enterprise Architect partitions the tool's extensive features into perspectives. This helps you to focus on a specific task and work with the tools you need without the distraction of other features. To work with the ArcGIS Geodatabases or Geography Markup Language features you first need to select these perspectives:

Database Engineering > ArcGIS

Information Exchange > Geographic GML

Setting the perspective ensures that the ArcGIS Geodatabases and Geography Markup Language diagrams, their Toolbox pages and other features of the perspective will be available by default.

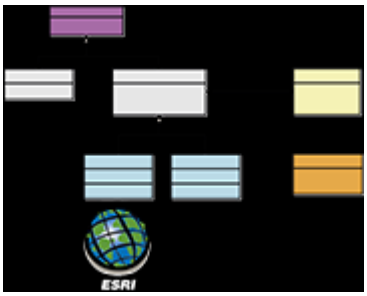
ArcGIS Geodatabases

Using the ArcGIS features in Enterprise Architect you can visualize geodatabases with ease. This allows you to unify teams working in traditional software centric and engineering systems with your geospatial teams defining features and domains. Teams defining the strategy business rules and requirements for a system or the components that deliver the system functionality can share models with the geospatial teams creating an integrated model that will help with integration and risk reduction.

Geography Markup Language (GML)

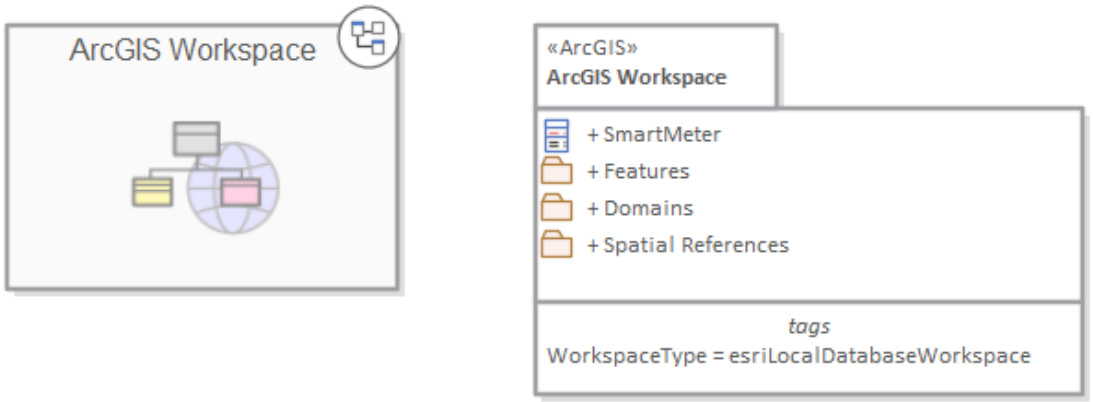
Using the Geography Markup Language (GML) facility you can model organization or community based application schemas. The models can be used to show the relationship between Features and these elements in turn can contain any number of Properties that qualify their characteristics. These can be based on defined Types, DataTypes, CodeLIsts or Enumerations.

ArcGIS Geodatabases



Exchange, Model and Visualize ArcGIS Geodatabases

Enterprise Architect supports the import and export of ArcGIS geodatabases, allowing you to visualize Features and Domains within this multi-featured collaboration platform. In the recent past there has been a separation of the disciplines between system software development and geospatial development. In this age of social architecture and digital disruption almost every project and endeavor requires some aspect of location information, from simple delivery services to agricultural, mining, exploration, weather, real estate and disaster recovery systems.



Package diagram showing a Navigation Cell and a Package containing Features Domains and a Geospatial Reference

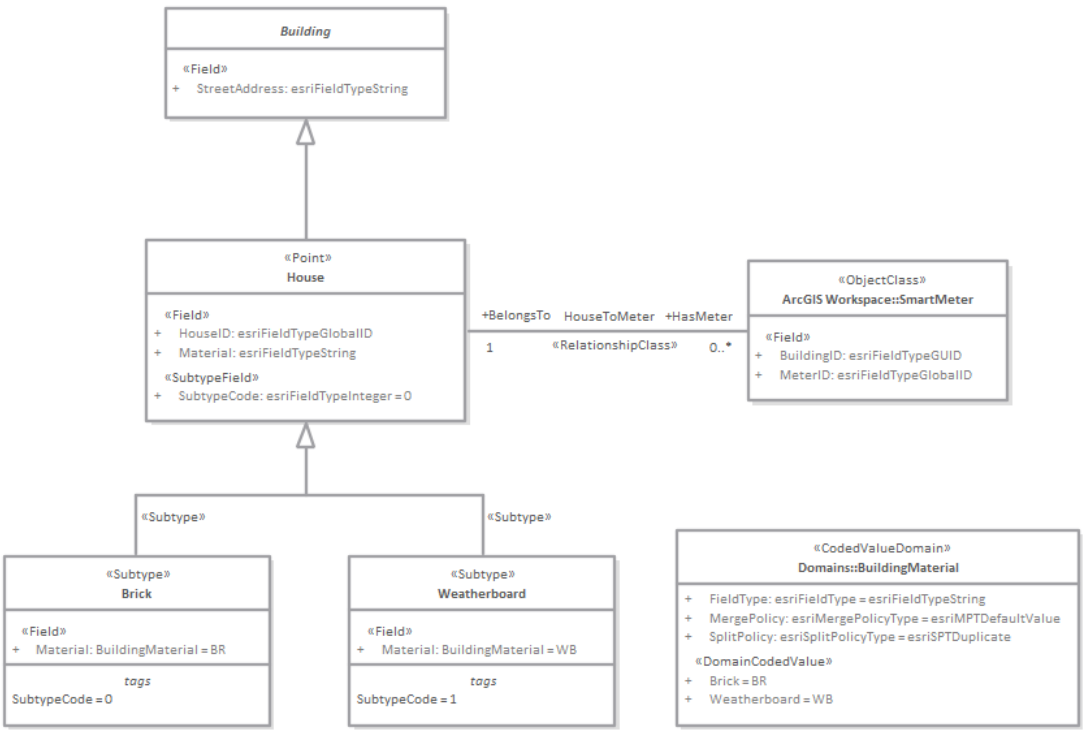
The ArcGIS system, developed by Esri, supports the development and management of geodatabases. As it is for other databases, it is useful to model the design of a geodatabase using a standard notation such as UML. You can perform such modeling in Enterprise Architect, using the UML profile for ArcGIS. Once you have modeled an ArcGIS schema in Enterprise Architect, you can export the model to ArcGIS as an XML Workspace document. You can also visualize an existing ArcGIS geodatabase schema, by importing the ArcGIS XML Workspace document into Enterprise Architect.

Example Diagram

ArcGIS diagrams allow you to visualize the geographic features, domains and other elements that make up a geodatabase schema. In this example a Building has been sub-typed as a house, the house in turn is sub-typed based on the material type. The subtypes of the House references a Coded Value Domain also presented in the diagram with two Domain Code Values:

- Brick
- WeatherBoard

A Smart Meter is associated with the house. The House is a type of Building and the Building contains the property of Street Address



Exporting ArcGIS XML Workspaces

When you have modeled your Geodatabase Workspace XML Document (containing the ArcGIS schema), you can export it to an external directory (using the Publish Model Package facility), from which you can then import it to the Esri ArcCatalog.

Access

Click on an ArcGIS stereotyped Package (your ArcGIS Workspace Package) in the Browser window.

Ribbon	Specialize > Technologies > ArcGIS > Export to ArcGIS Workspace XML or Publish > Model Exchange > Publish As...
Context Menu	Right-click on Package | Specialize | ArcGIS | Export to ArcGIS Workspace XML
Keyboard Shortcuts	Ctrl+Alt+E : Publish

Export the Workspace

Option	Action
Root Package	Display the name of the selected ArcGIS Workspace Package.
Filename	Type in or browse for the file path into which the XML file is to be generated.
XML Type	Select 'ArcGIS' as the XML/XMI version to export the Package to.
Format XML Output	Format the output into readable XML (this takes a few more seconds at the end of the run).
Write Log File	Write a log of the export activity (recommended). The log file is saved to the directory into which the XML file is exported.
View XML	Click on this button to view the exported XML file.
Export	Click on this button to initiate the XML export.
Close	Click on this button to close this dialog.
Progress	Observe the progress of the XML export.

Notes

- ArcGIS is available in the Professional, Corporate, Unified and Ultimate Editions of Enterprise Architect

- In the Corporate, Unified and Ultimate Editions of Enterprise Architect, if security is enabled you must have 'Export XMI' permission to export to XML
- Before exporting your model to an ArcGIS schema, you must define at least one Spatial Reference element; Spatial Reference elements are referred to by other schema elements via a dynamically linked Tagged Value, named SpatialReference
- The DefaultSpatialReference tag on an ArcGIS Package is used to specify a Spatial Reference that can be applied to all Feature Datasets and Feature Classes in the workspace; therefore, you do not need to apply a Spatial Reference element to each Feature Dataset or Feature Class
- If you do not reference a Spatial Reference Class from any Feature Dataset or Feature Class in your ArcGIS model, Enterprise Architect by default will generate an XML schema with Unknown type of Spatial Reference for these elements

Importing ArcGIS XML Workspaces

If you have a Geodatabase Workspace XML Document (containing the ArcGIS schema) you can import it into your Enterprise Architect project as a UML model.

Before running the import, deselect the 'Sort Features Alphabetically' checkbox on the 'Objects' page of the Preferences window (Start > Appearance > Preferences > Preferences). This ensures that the fields are imported and organized in Enterprise Architect in the same order as in the source.

Access

Click on the target Package in the Browser window.

Ribbon	Publish > Model Exchange > Import > ArcGIS
Context Menu	Right-click on Package | Specialize | ArcGIS | Import ArcGIS Workspace XML

Import a Geodatabase Workspace XML document

Option	Action
Filename	Type in or browse for the name of the ArcGIS XML file to import.
Create Diagrams	Select the checkbox to create Class diagrams under the imported Packages.
Hide System-Level ArcGIS Fields on Diagrams	Select the checkbox to hide these stereotyped attributes: • RequiredField • AttributeIndex • SpatialIndex on these stereotyped Classes: • Point • Polyline • Polygon • MultiPatch The 'RequiredField' and 'AttributeIndex' attributes are also hidden for the Table (Object Class) Class. This option is enabled only when the 'Create Diagrams' checkbox is selected.
Strip GUIDs	The 'Strip GUIDs' feature is currently mandatory for ArcGIS imports, which means that elements are created 'as new' each time an ArcGIS schema is imported.
Write Log File	Select the checkbox to write a log of import activity (recommended). The log file is saved in the directory from which the file is being imported, with the same name as the imported file plus the suffix _import.log.
View XML	Click on this button to view the XML before import.

Import	Click on this button to import the ArcGIS XML file.
Close	Click on this button to close this dialog.
Help	Click on this button to display this Help page.
Import Progress	This field indicates the progress of the import.

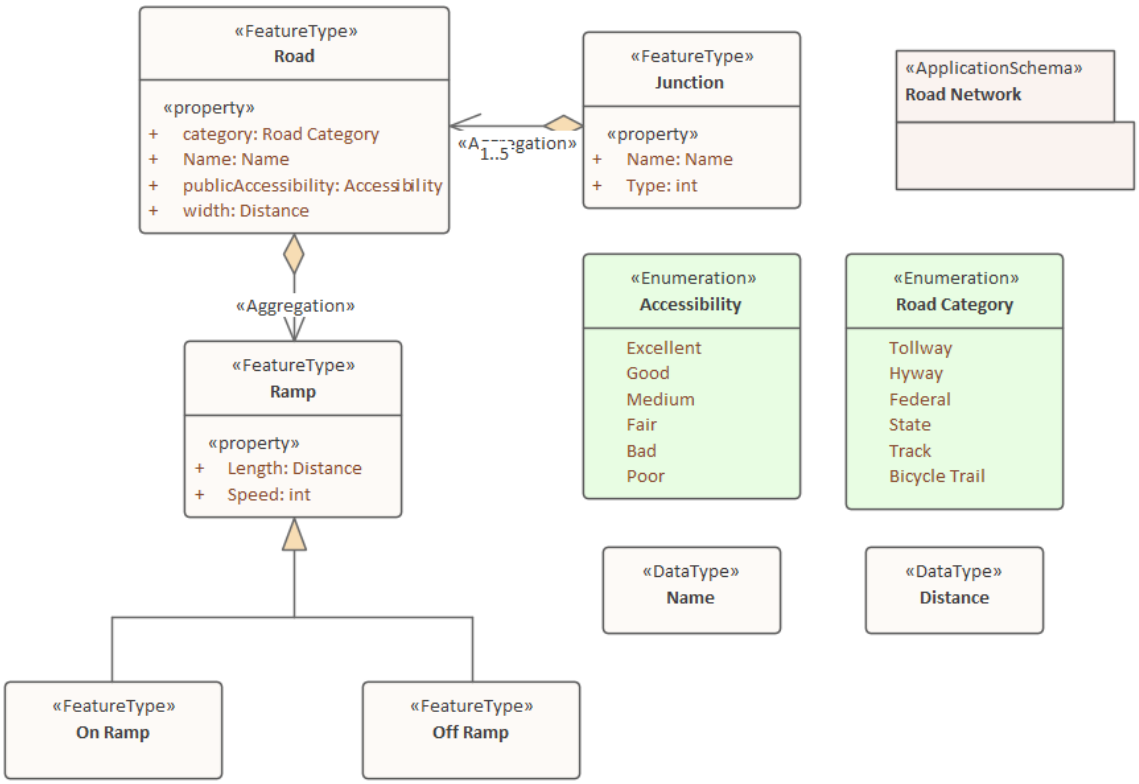
Notes

- ArcGIS is available in the Professional, Corporate, Unified and Ultimate Editions of Enterprise Architect

Geography Markup Language (GML)

Model Geographic Features and Generate Application Schemas

You can create expressive and collaborative models of the important features in your domain and use these to generate Geography Markup Language (GML) compliant application schemas that can be consumed by other applications. Many of the disruptive forces and technologies that have changed the way we interact with each other and the world we inhabit, involve geographic locations and features. We drive along roads and stop at lookouts to view coastal features or cityscapes, we travel abroad to view monuments and buildings such as churches and museums, we rely on wind farms for energy and we take off and land at airports to name a few. You can model any geographic features of interest using Enterprise Architect's implementation of the Geography Markup Language which is fundamental for geographic information systems as well as its use as an open interchange format for geographic transactions on the Internet.



GML Model of roads showing two Features with properties that access two Data Types and Enumerations

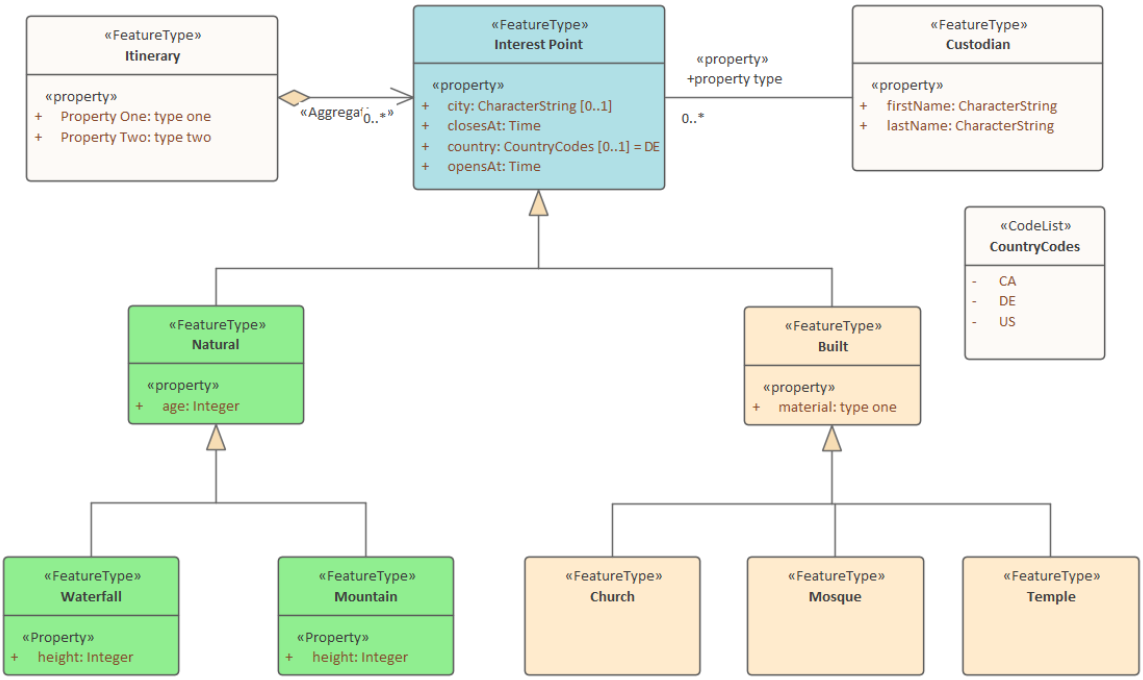
GML for Enterprise Architect is an implementation of the Open Geospatial Consortium's Geography Markup Language (GML) 3.3 , which provides an XML grammar for geographical feature modeling capabilities within Enterprise Architect at or later than Release 10.

Through GML, you can:

- Apply a UML Profile for the Geography Markup Language (GML) 3.3
- Make use of customized diagram types and toolbox pages, for convenient access to elements and relationships to model geographical features effectively
- Generate GML Application Schema files

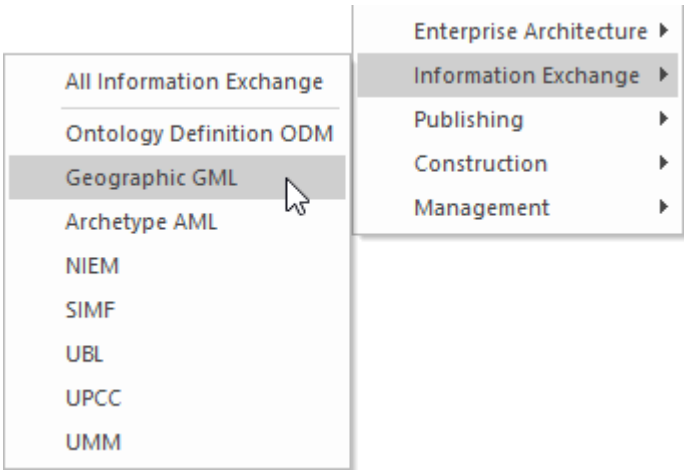
Example Diagram

Using the Geography Markup Language (GML) facility you can model organization or community based application schemas. The models can be used to show the relationship between Features Types that contain any number of Properties that qualify their characteristics. These can be based on defined Types, Data Types, Code Lists or Enumerations. You can collaborate with other geospatial colleagues or with people working in traditional systems implementations in disciplines that manage artifacts including: Strategies, Goals, Requirements, Data Models, Software Models, Deployment Descriptions and more.



Modeling with GML

You can create GML models using the comprehensive diagramming and modeling facilities in Enterprise Architect. First you need to select the GML or Information Exchange Perspective. Perspectives are a useful focusing tool facility that ensure you remain focused and can concentrate on GML modeling.



Perspective menu - GML Perspective Selection

This activates the UML Profile for GML, allowing you to create models with elements and connectors that describe your organization or community domains.

Access

Ribbon	Specialize > Technologies > GML
Context Menu	Right-click on Package | Specialize | GML

Features

Feature	Detail
Profile Support	You can develop GML constructs quickly and simply, through use of the built-in GML facilities provided in the form of: • A GML diagram type, accessed through the 'New Diagram' dialog • GML pages in the Diagram Toolbox that map GML concepts to appropriately stereotyped UML elements • GML element and relationship entries in the 'Toolbox Shortcut Menu' and 'Quick Linker'
GML Toolbox Page	The GML Toolbox pages contain elements and connectors to model geographical features effectively.
	(Optional) You can download the UML Classes implemented in ISO/TC 211 as an

UML Classes from ISO	XMI file, then import the XMI file into Enterprise Architect as a Package containing diagrams and standard UML Classes, which you can reuse in your model. • Not all UML Classes implemented in ISO/TC 211 have a corresponding mapping in GML; the Classes that have a mapping (as specified in the GML 3.2.1 specification) are specified in the configurable file GMLClassMapping.xml in the 'Sparx Systems > EA > Config > GML' folder • The Namespace information for these Classes is specified in the configurable file GMLNamespaces.xml in the 'Sparx Systems > EA > Config > GML folder'
GML Application Schema Generation	Any model you create using GML in Enterprise Architect can be exported as a GML Application Schema. Using the configurable file GMLStereotypes.xml in the 'Sparx Systems > EA > Config > GML' folder, you can specify aliases for the standard GML stereotypes. The GML Application Schema Generator will also consider these aliases during Schema generation.

Notes

- GML is available in the Professional, Corporate, Unified and Ultimate Editions of Enterprise Architect

More Information

Geospatial modeling can be explored in more detail by accessing these topics:

- ArcGIS Geodatabases
- Geography Markup Language (GML)