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Corticon Tutorial:
Using Enterprise Data Connector (EDC)

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See Table of Contents for location of Third party acknowledgements within this documentation.

Table of Contents

Preface

For details, see the following topics:

- Progress Corticon documentation
- Overview of Progress Corticon

Progress Corticon documentation

The following documentation, as well as a *What's New in Corticon* document, is included with this Progress Corticon release:

Corticon Tutorials	
Corticon Studio Tutorial: Basic Rule Modeling	Introduces modeling, analyzing, and testing rules and decisions in Corticon Studio. Recommended for evaluators and users getting started. *See also the PowerPoint-as-PDF version of this document that is accessed from the Studio for Analysts' **Help** menu.*
Corticon Studio Tutorial: Advanced Rule Modeling	Provides a deeper look into Corticon Studio's capabilities by defining and testing vocabularies, scope, collections, messages, filters, conditions, transient data, and calculations in multiple rulesheets that are assembled into a Ruleflow. *See also the PowerPoint-as-PDF version of this document that is accessed from the Studio for Analysts' **Help** menu.*
Corticon Tutorial: Using Enterprise Data Connector (EDC)	Introduces Corticon's direct database access with a detailed walkthrough from development in Studio to deployment on Server. Uses Microsoft SQL Server to demonstrate database read-only and read-update functions.

Corticon Studio Documentation: Defining and Modeling Business Rules	
Corticon Studio: Installation Guide	Step-by-step procedures for installing Corticon Studio and Corticon Studio for Analysts on computers running Microsoft Windows. Also shows how use other supported Eclipse installations for integrated development. Shows how to enable internationalization on Windows.
Corticon Studio: Rule Modeling Guide	Presents the concepts and purposes the Corticon Vocabulary, then shows how to work with it in Rulesheets by using scope, filters, conditions, collections, and calculations. Discusses chaining, looping, dependencies, filters and preconditions in rules. Presents the Enterprise Data Connector from a rules viewpoint, and then shows how database queries work. Provides information on versioning, natural language, reporting, and localizing. Provides troubleshooting and many *Test Yourself* exercises.
Corticon Studio: Quick Reference Guide	Reference guide to the Corticon Studio user interface and its mechanics, including descriptions of all menu options, buttons, and actions.
Corticon Studio: Rule Language Guide	Reference information for all operators available in the Corticon Studio Vocabulary. A Rulesheet example is provided for many of the operators. Includes special syntax issues, handling arithmetic and character precedence issues.
Corticon Studio: Extensions Guide	Detailed technical information about the Corticon extension framework for extended operators and service call-outs. Describes several types of operator extensions, and how to create a custom extension plug-in.
Corticon Server Documentation: Deploying Rules as Decision Services	
Corticon Server: Deploying Web Services with Java	Details installing the Corticon Server as a Web Services Server, and then and deploying and exposing Decision Services as Web Services on Tomcat and other Java-based servers. Presents the features and functions of the browser-based Server Console.
Corticon Server: Deploying Web Services with .NET	A step-by-step introduction to installing the Corticon Server as a Web Services Server and deploying and exposing decisions as Web Services with .NET. Provides installation and configuration information for the .NET Framework and Internet Information Services on various supported Windows platforms.
Corticon Server: Integration & Deployment Guide	An in-depth, technical description of Corticon Server deployment methods, including preparation and deployment of Decision Services and Service Contracts through the Deployment Console tool. Discusses relational database concepts and implementation of the Enterprise Data Connector. Goes deep into the server to discuss state, persistence, and invocations by version or effective date. Includes samples, server monitoring techniques, and recommendations for performance tuning.

Overview of Progress Corticon

Progress® Corticon® is the Business Rules Management System with the patented "no-coding" rules engine that automates sophisticated decision processes.

Progress Corticon products

Progress Corticon distinguishes its development toolsets from its server deployment environments.

- **Corticon Studios** are the Windows-based development environment for creating and testing business rules:
  - **Corticon Studio for Analysts.** is a standalone application, a lightweight installation that focuses exclusively on Corticon.
  - **Corticon Studio** is the *Corticon Designer* perspective in the **Progress Developer Studio** (PDS), an industry-standard Eclipse 3.7.1 and Java 7 development environment. The PDS enables integrated applications with other products such as Progress OpenEdge and Progress Apama.

  The functionality of the two Studios is virtually identical, and the documentation is appropriate to either product. Documentation of features that are only in the *Corticon Designer* (such as on integrated application development and Java compilation) will note that requirement. Refer to the *Corticon Studio: Installation Guide* to access, prepare, and install each of the Corticon Studio packages.

  Studio Licensing - Corticon embeds a time-delimited evaluation license that enables development of both rule modeling and Enterprise Data Connector (EDC) projects, as well as testing of the projects in an embedded Axis test server. You must obtain studio development licenses from your Progress representative.

- **Corticon Servers** implement web services for business rules defined in Corticon Studios:
  - **Corticon Server for deploying web services with Java** is supported on various application servers, and client web browsers. After installation on a supported Windows platform, that server installation's deployment artifacts can be redeployed on various UNIX and Linux web service platforms as Corticon Decision Services. The guide *Corticon Server: Deploying web services with Java* provides details on the full set of platforms and web service software that it supports, as well as installation instructions in a tutorial format for typical usage.
  - **Corticon Server for deploying web services with .NET** facilitates deployment of Corticon Decision Services on Windows .NET Framework 4.0 and Microsoft Internet Information Services (IIS). The guide *Corticon Server: Deploying web services with .NET* provides details on the platforms and web service software that it supports, as well as installation instructions in a tutorial format for typical usage.

  Server Licensing - Corticon embeds a time-delimited evaluation license that enables evaluation and testing of rule modeling projects on supported platform configurations. You must obtain server deployment licenses and server licenses that enable the Enterprise Data Connector (EDC) from your Progress representative.

1

Introduction

This *Enterprise Data Connector Tutorial* explores the key features and functionality of Progress Corticon with Enterprise Data Connector (EDC).

You will learn how to:

- Connect Corticon Studio to an external database, and then create a table based on a Vocabulary.
- Produce Rulesheets and Ruletests in Studio that interact with the database in read-only mode and then in read/update mode.
- Connect a Decision Service deployed on Corticon Server to an external database and access it during execution.

The format of this tutorial defines its requirements narrowly, and the procedures must be followed accurately and sequentially so that the exercises respond as intended. Once you have completed the tutorial, the concepts apply readily to other supported databases and platforms.

Purpose and intended audience

This tutorial is intended for use by professionals who want to integrate a commercial RDBMS with Corticon Decision Services.

At a minimum, this Tutorial assumes:

- You have installed Corticon Studio for Analysts, as described in the *Corticon Studio: Installation Guide*.
- You have installed Corticon Server, as described in the *Corticon Server: Deploying Web Services with Java*.
- You have completed both the *Basic Tutorial for Corticon Studio – Basic Rule Modeling* and *Tutorial for Corticon Server – Deploying Web Services*. This Tutorial builds on those two documents.

- You have some experience building and managing databases with relational database management systems (RDBMS) products or tools
- You are familiar with basic relational theory and terminology, such as primary and foreign keys, tables, columns, fields, and joins.

2

Overview

Corticon provides database access for Corticon rules. Corticon can read from a database to enrich its data, and can add or modify database records. This direct database access (DDA) functionality is referred to as the Corticon Enterprise Data Connector (EDC). Before we start the tutorial tasks, let's review a few of the concepts and features of EDC.

Note: The concepts introduced here are discussed in greater depth in the other areas of the Progress Corticon Documentation set. See Continuing to learn about Corticon's Enterprise Data Connector on page 79 for more information.

Consider the following concepts and features of Corticon EDC:

- **Technologies** - Corticon enables mapping to supported RDBMS brands using Progress Software's enterprise-grade Data Direct drivers, object/relational mapping in Hibernate, and the algorithms in C3P0's open-source JDBC connection pooling. Corticon creates Corticon Data Objects (CDOs) that are Hibernate-ready, and requests Hibernate to validate them against the database. These tools are embedded in the Corticon products, and maintained as product upgrades are applied. There is no initial need for configuring any of these supporting technologies, yet common tuning parameters are documented.
- **Corticon's Vocabulary binds to specified RDBMS metadata** - The Corticon Vocabulary stores the database connection and database metadata (tables, columns, primary keys, and foreign keys) that Corticon loads into its working memory as Corticon Data Objects (CDOs) for use in rule execution. Database metadata is used to infer the values of database-related fields based on rules. The import of database metadata imported into the Corticon Vocabulary can be constrained to specified entities to minimize the amount of metadata stored inside the Vocabulary asset. Dynamic validation tries to ensure that the Vocabulary always makes sense with respect to imported metadata. All Corticon assets that share a Vocabulary are relating to the same database.

- **Persistence -** Vocabulary entities can be *transient* or *datastore persistent* (that is, database-bound). Transient entities can have associations to persistent entities and vice versa. The user must supply instances of transient entities in the input message; conversely, datastore persistent entities are retrieved/updated in the database.
- **Database Keys -** Entities can use either *application identity* (that is, primary keys) or *datastore identity*. With application identity, the application supplies the key values to create new instances (which we will do in this tutorial), whereas with datastore identity, the key values can be established through predefined identity strategies (or the default `AutoGenID` mechanism.)

Those are the basic EDC concepts. Now let's set up and experience Corticon's Enterprise Data Connector in action!

3

Setting up the EDC Tutorial

Downloading and installing Corticon 5.3.2

1. Download and install Progress Corticon Studio for Analysts 5.3.0 for Windows, then download and apply its Service Pack 2.
2. Download and install Progress Corticon Server 5.3.0 for Windows, then download and apply its Service Pack 2.

Note: While you could use the full Corticon Studio (the Corticon Designer perspective in the Progress Developer Studio) and the Corticon Server for .NET, this tutorial demonstrates that the Corticon Studio for Analysts provides the required functionality. The variations that enable use of .NET as the server with EDC are discussed in that product's tutorial, *Corticon Server: Deploying Web Services with .NET*.

Tomcat web server

Your installation of Progress Corticon Java Server 5.3 for Windows includes Apache Tomcat. Once we have defined decision services that have database access, we'll have the Apache web server running to test the Decision Services ability to connect, and then read and write data from the database. See the *Corticon Server: Deploying Web Services with Java* for more information on deployment.

4

Enabling EDC in Corticon Studio

Progress Corticon embeds an evaluation license in its products to help you get started.

- Corticon Studio evaluation licenses let you use database access (Enterprise Data Connector or "EDC"), and are timed to expire on a preset date. While you typically do not need to acquire a license for Studio during evaluation and early stage development, in the event that you are alerted that your license is invalid or expired, contact your Progress Corticon representative to obtain a workable license.
- Corticon Server evaluation licenses do not enable use of Enterprise Data Connector, and limit the number of decision services, rules, and pools in use. They too are timed to expire on a preset date. You will need to obtain a license that enables EDC on Corticon Server for that section of this tutorial.

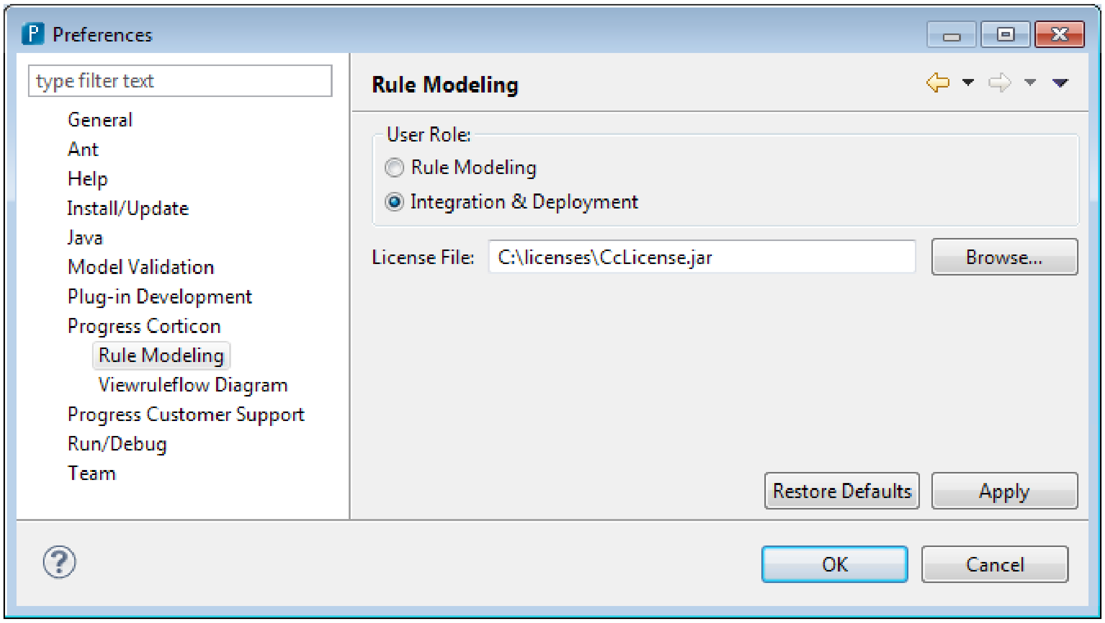
For this tutorial, the following procedure shows how to set Corticon Studio to enable EDC, and then proceed through all but the chapter Using database access in Corticon Server on page 73 where the procedures that enable EDC for Corticon Server are discussed.

To configure Corticon Studio for database access:

1. Start Corticon Studio by choosing **Start > All Programs > Progress > Corticon 5.3 > Corticon Studio for Analysts**.
2. Select the menu command **Window > Preferences**.
3. Expand the **Progress Corticon** group, then click on **Rule Modeling**.
4. Choose the **User Role** option **Integration and Deployment**.

5. If you have been issued a license file, enter its location into the **License File** entry area, or browse to its location, as in this example:

Figure 1: For Studio, Setting the User Role for EDC and the License Path



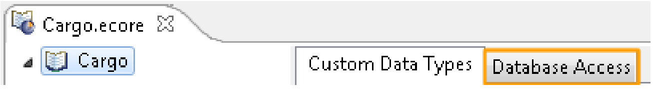
User Role:
○ Rule Modeling
● Integration & Deployment

License File: C:\licenses\CcLicense.jar

6. Click **OK**.

7. Restart the Studio.

When EDC is enabled, a Vocabulary in Corticon Studio displays its **Database Access** tab , as shown:



5

Sample Project

We will use the `Cargo` Project that we used in the *Corticon Studio: Basic Rule Modeling* and the *Corticon Server Tutorial for Deploying Web Services*. In the Corticon Studio for Analysts, those files are accessible (whether or not you did the other tutorials) in the installation's workspace directory `C:\Users\{username}\Progress\CorticonWork_5.3\Samples\Rule Projects\Tutorial\Tutorial-Done`. If you have not already completed those two tutorials, we highly recommend doing so before proceeding with this one.

Note: The samples in the full Corticon Studio are loaded into the workspace from the **Welcome** page's **Samples** selection: **Tutorial**.

6

Downloading and installing the database

Progress Corticon does not include tools for creating or managing a database. This tutorial uses the Microsoft SQL Server 2008 R2 database in its free Express edition. Microsoft SQL Server, an RDBMS brand Corticon supports in production, illustrates database setup and connection to both Corticon Studios and both Corticon Servers. Once setup, the database procedures intend to be generic yet they might vary when using another RDBMS brand (such as Oracle) or another platform (such as Linux.)

Microsoft SQL Server 2008 R2 RTM - Express with Management Tools

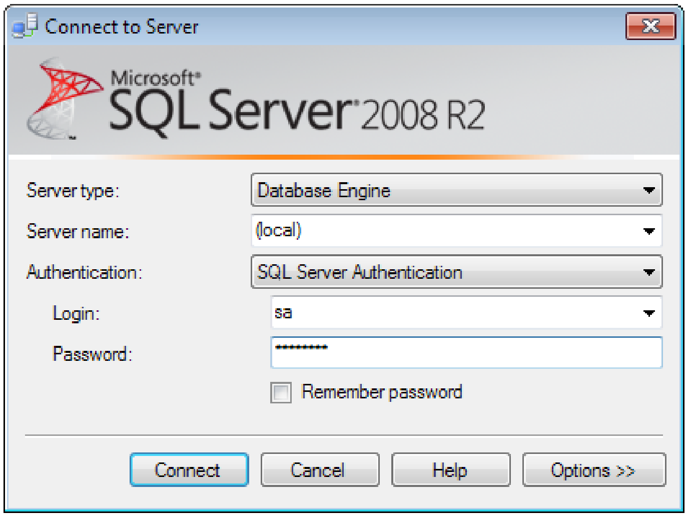
Access the Microsoft Download Center page `http://www.microsoft.com/en-us/download/details.aspx?id=23650` (at the time this tutorial was created.) Register and download this free product, then fulfill the system requirements, and installation instructions. (Be sure to install the .NET framework first.)

Note: When you create user credentials in an RDBMS product that you intend to use with Corticon's Enterprise Data Connector, the username and password must each contain at least one alphabetic character, even if the database supports only numbers.

Confirm that the installation is running by choosing the **Start** menu, path **All Programs > Microsoft SQL Server 2008 R2 > SQL Server Management Studio**.

In the **Connect to Server** dialog, you should be able to connect with the following default credentials and the password you specified, typically `Password1`:

Figure 2: Connecting the SQL Server Management Studio to the installed SQL Server instance



Server type: Database Engine

Server name: (local)

Authentication: SQL Server Authentication

Login: sa

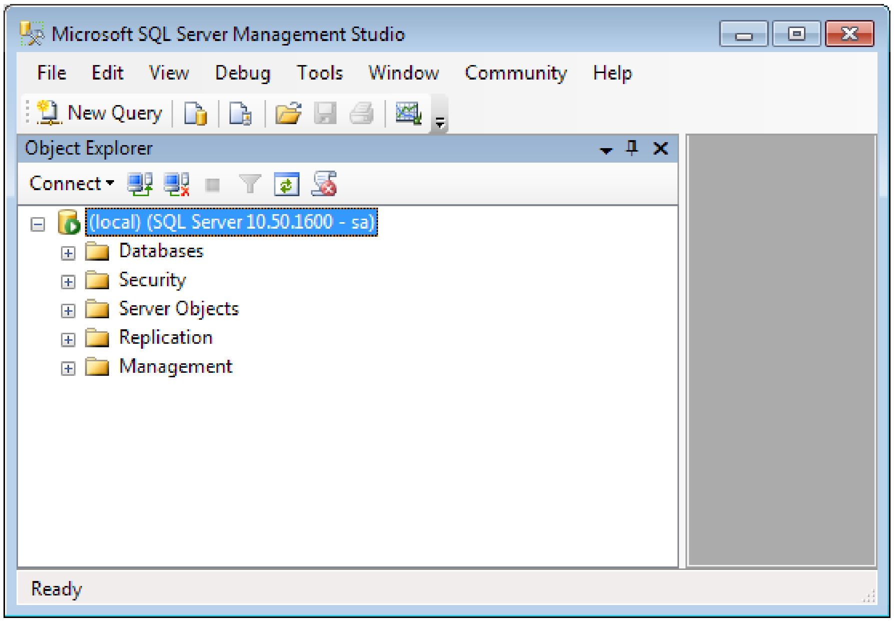
Password: *********

□ Remember password

Click **Connect**.

When you connect the initial window should look like this:

Figure 3: SQL Server Management Studio



Note: When you advance the rules projects toward production, it is good planning to create some user credentials that are constrained from dropping tables. A lead administrative user should retain that function and all other users should get an error if the try to create and update the schema.

READY!

That completes the software setup for this tutorial. Now let's get familiar with the concepts that we will explore.

7

Vocabularies and databases

It is not necessary to be an expert in any database product to work through this Tutorial successfully. However, it is certainly helpful to have knowledge of database relational theory or experience with building and managing databases using commercial relational database management systems (RDBMS).

We will step through the essential steps of configuring a set of tools (described in the next chapter); the concepts addressed are consistent with any supported RDBMS you choose.

Which comes first: the Vocabulary or the Database?

You have probably already recognized the fundamental relational nature of the Corticon Vocabulary. Those with database backgrounds are quick to see that the elements of a Vocabulary are conceptually equivalent to the elements of a typical relational database.

Table 1: Equivalent Studio—DB Concepts

Corticon Studio Element	Equivalent Database Concept
Vocabulary	Schema
Vocabulary Entity	Table
Vocabulary Attribute	Table Column or Field
Vocabulary Association	Relationship between Tables
Test Case or Use Case	Table Row(s) or Record(s)

You can choose which comes before the other. You can start with a pre-existing database schema and create a Vocabulary from it, or vice versa. In practice, you might:

- Start from the business perspective by converting a Vocabulary into a database. Because Studio is a powerful modeling environment, users often build Vocabularies “on-the-fly” in order to support their rule modeling. Assuming the Vocabulary design is acceptable to IT as the basis for a database, then Studio can be used to export schema information directly to a database engine and generate the necessary table structure within a defined tablespace.
- Start from an IT perspective by abstracting a data model from an existing database and using its terms and structure to create a Vocabulary for rule modelers to use in their rule building and testing.

We will use as our working example the scenario constructed in the *Basic Tutorial for Corticon Studio – Basic Rule Modeling*. Since we already have a Vocabulary named `Cargo.ecore`, that’s what we’ll use as the basis for our database.

Validation of names of entities, attributes and associations against SQL keywords and database restrictions

Commercial databases, such as Microsoft SQL Server and Oracle, use specific words for defining, manipulating, and accessing databases. These reserved keywords are part of the grammar used to parse and understand statements. Do not use database reserved words for Corticon Entity, Attribute, and Association names when creating the schema in Corticon. Your database support pages list reserved words -- for example, SQL Server 2012 -- that you should review as you prepare your Vocabulary for enterprise data connection.

Corticon makes a best-effort to validate the names against the SQL keywords (such as `Order`), validate names against the database restrictions for column and table naming (such as length of a table name length), and validate generated column names (such as Foreign Key (FK) columns) against SQL keywords and table/column name restrictions.

8

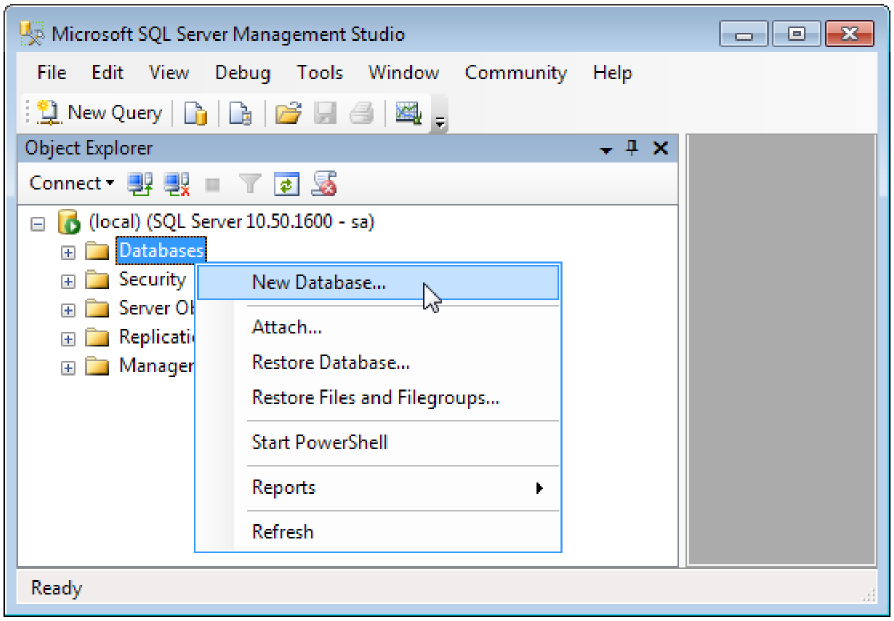
Creating a new database in SQL Server

In this section, we will create a new database in SQL Server. Because SQL Server set itself up as a Windows Service with automatic startup, it should always be running. You confirmed that by connecting to it through its Management Studio. We'll create a new table, `Cargo`, in this database, and then use it throughout the tutorial.

To create a new table in the SQL Server database:

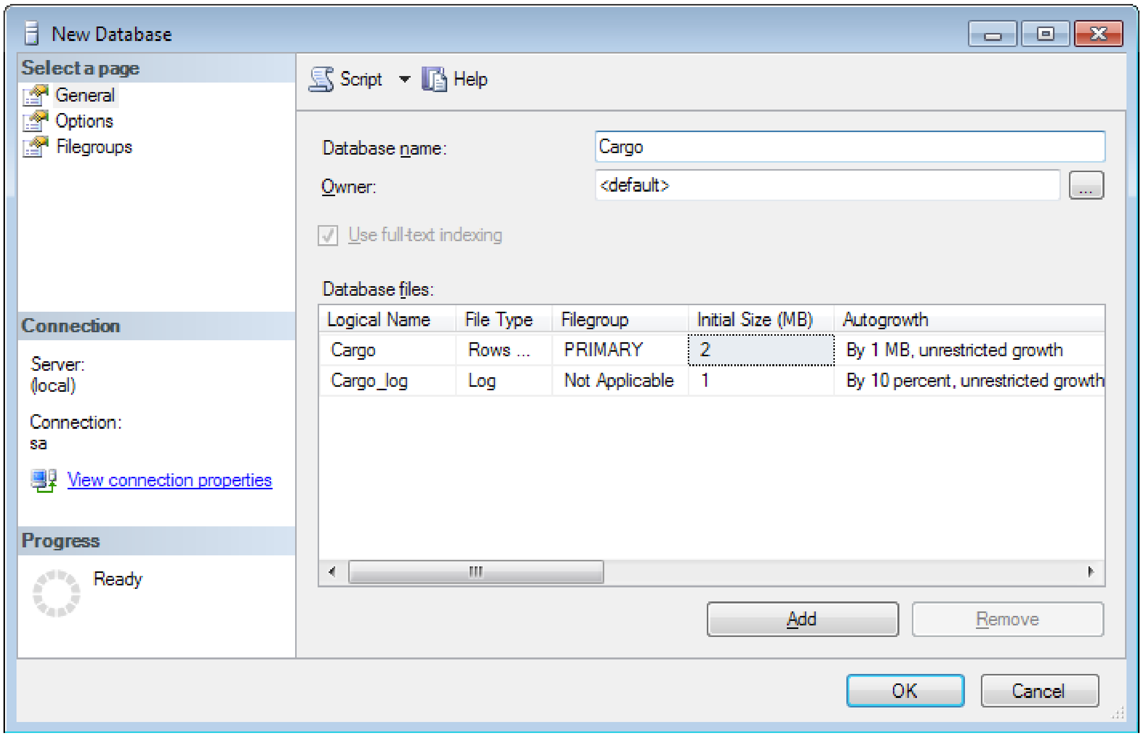
1. In your SQL Server Management Studio connection, right-click on **Databases**, and then choose **New Database**, as shown:

   Figure 4: Creating a Database



The **New Database** dialog opens, as shown:

Figure 5: New Database dialog



Database name: Cargo

Owner: <default>

☑ Use full-text indexing

Database files:

Logical Name	File Type	Filegroup	Initial Size (MB)	Autogrowth
Cargo	Rows ...	PRIMARY	2	By 1 MB, unrestricted growth
Cargo_log	Log	Not Applicable	1	By 10 percent, unrestricted growth

Connection

Server:
(local)

Connection:
sa

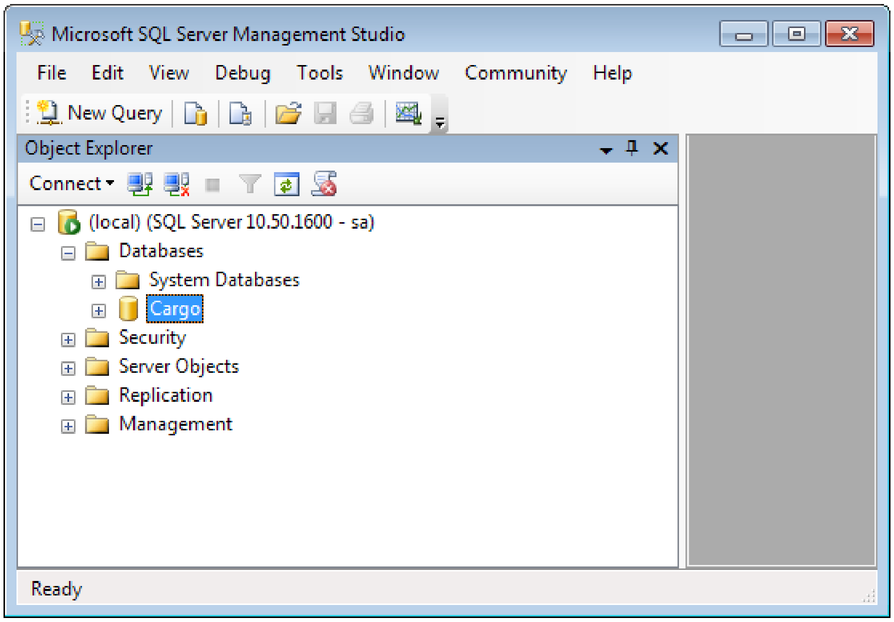
View connection properties

Progress

Ready

2. In the **Database name** entry area, type `Cargo`, and then click **OK**.
3. In the Object Explorer view, expand **Databases** to show the **Cargo** tablespace.

Figure 6: The New Database, `Cargo`



- (local) (SQL Server 10.50.1600 - sa)
  - Databases
    - System Databases
    - Cargo
  - Security
  - Server Objects
  - Replication
  - Management

The database is now ready to interact with the Corticon Studio.

9

Starting Corticon Studio

Launch Corticon Studio using one of the following methods:

- Double-click the Corticon Studio shortcut on your desktop.
- Choose Windows **Start>All Programs>Progress>Corticon5.3>Corticon Studio for Analysts**.
- Launch the **Studio.exe** application in `C:\Program Files(x86)\Progress\Corticon 5.3\Studio for Analysts`.

Setting up the Project

Note: If you are continuing after completing the *Basic Rule Modeling* tutorial, your project is fully . You can use your files instead the `tutorial-done` files if you prefer.

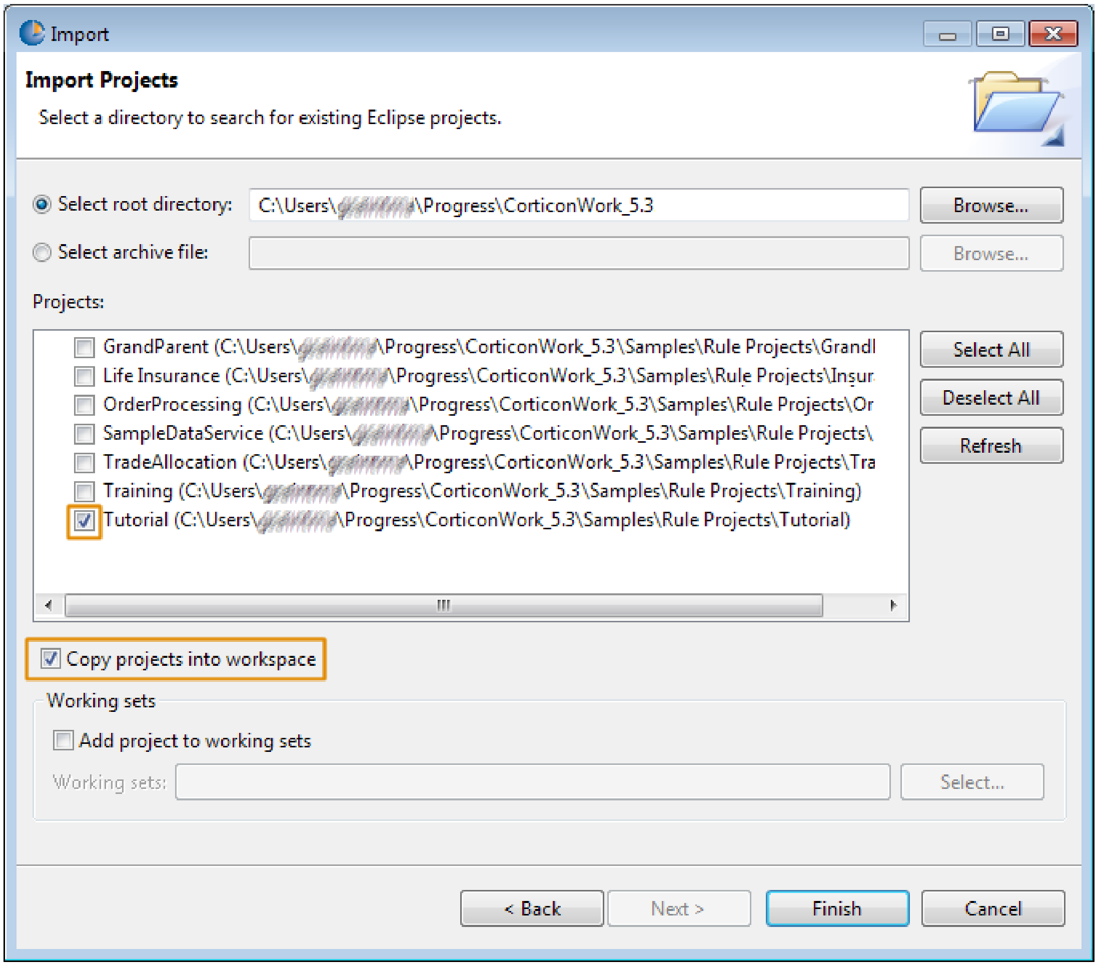
While you can open files in the editor, the files are inter-related through a Project. You can use the Rule Project you created in the Tutorial, or open the completed `Tutorial-Done` project. You should import the existing project into your workspace (thus leaving the original project intact.)

To set up the tutorial project:

1. In the Corticon Studio, choose **File > Import**.
2. Expand **General**, and then double-click **Existing Projects into Workspace**.
3. In the **Select root directory** option, click **Browse**.
4. Navigate to the work directory for your user name.

5. Click **Deselect All**, and then choose `Tutorial`, and the **Copy into workspace option**, as shown:

Figure 7: Importing the Tutorial Project



Import

Import Projects

Select a directory to search for existing Eclipse projects.

● Select root directory: C:\Users\[redacted]\Progress\CorticonWork_5.3

○ Select archive file:

Projects:

- □ GrandParent (C:\Users\[redacted]\Progress\CorticonWork_5.3\Samples\Rule Projects\Grandl
- □ Life Insurance (C:\Users\[redacted]\Progress\CorticonWork_5.3\Samples\Rule Projects\Insur
- □ OrderProcessing (C:\Users\[redacted]\Progress\CorticonWork_5.3\Samples\Rule Projects\Or
- □ SampleDataService (C:\Users\[redacted]\Progress\CorticonWork_5.3\Samples\Rule Projects\
- □ TradeAllocation (C:\Users\[redacted]\Progress\CorticonWork_5.3\Samples\Rule Projects\Tra
- □ Training (C:\Users\[redacted]\Progress\CorticonWork_5.3\Samples\Rule Projects\Training)
- ☑ Tutorial (C:\Users\[redacted]\Progress\CorticonWork_5.3\Samples\Rule Projects\Tutorial)

☑ Copy projects into workspace

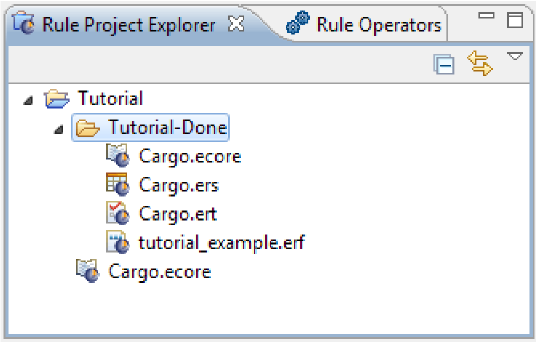
Working sets

□ Add project to working sets

Working sets:

6. You can review the project on the **Rule Project Explorer** tab, as shown:

Figure 8: The Tutorial Project in the Rule Project Explorer



- Tutorial
  - Tutorial-Done
    - Cargo.ecore
    - Cargo.ers
    - Cargo.ert
    - tutorial_example.erf
  - Cargo.ecore

7. Unless you completed the *Basic Rule Modeling* tutorial, delete `Cargo.ecore` that is outside the `tutorial-done` folder.

Note: IMPORTANT - A step in the basic rule modeling tutorial showed the addition of the `Cargo` attribute `needsRefrigeration`. The EDC tutorial and the sample data expect that attribute to exist in the Vocabulary and the Rulesheet. Your completed basic tutorial results and the `Tutorial-Done` folder provide that added attribute.

10

Connecting a Vocabulary to a database

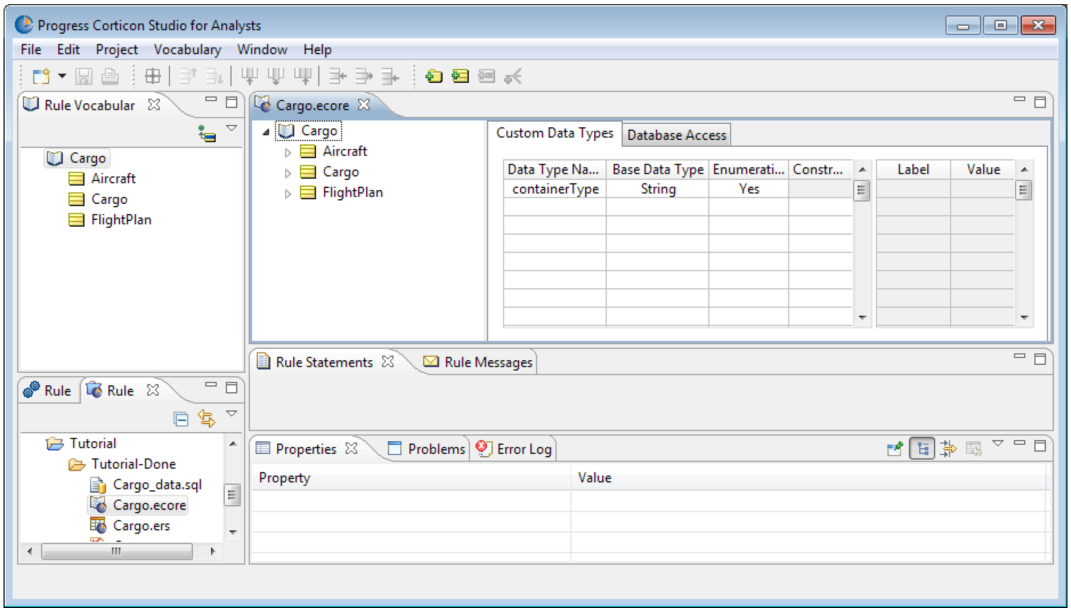
Let's open the `Cargo` Vocabulary file, set the entities that will persist in the database, and then create a new schema in our database that matches the structure of our Vocabulary.

Opening the Vocabulary

To connect a Corticon Vocabulary to our new `Cargo` database, choose Studio's **Rule Project Explorer** tab, and then double-click on `Cargo.ecore` inside the project

The Vocabulary `Cargo.ecore` opens in the Vocabulary Editor, as shown:

Figure 9: Vocabulary Database Enabled but with no Persistent Entities



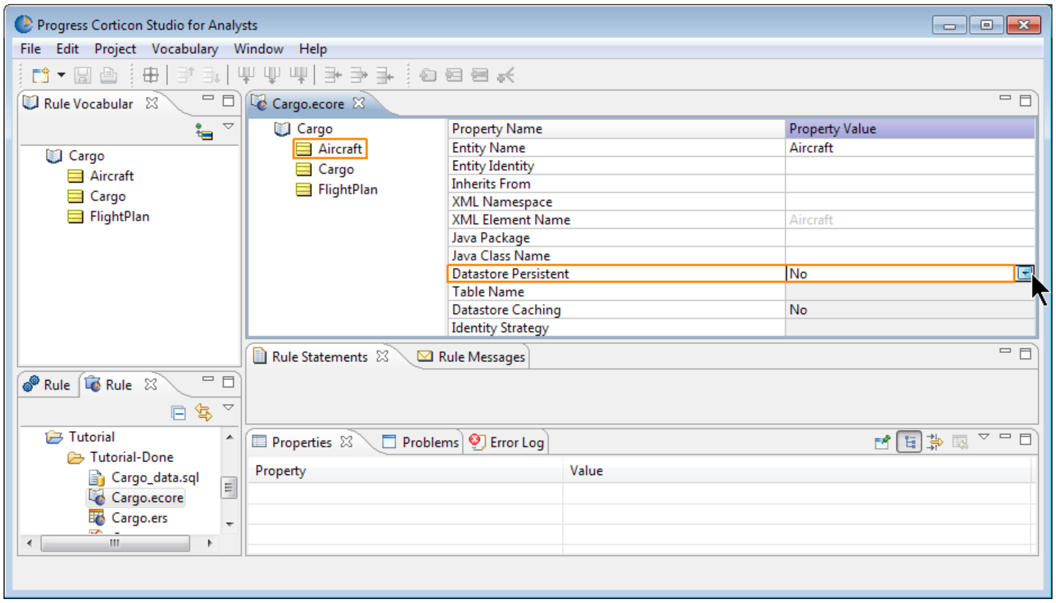
Data Type Na...	Base Data Type	Enumerati...	Constr...
containerType	String	Yes	

Setting entities to be database persistent

We set our role to **Integration & Deployment** in Enabling EDC in Corticon Studio on page 17 to expose the **Database Access** tab. That action also exposed properties on entities and attributes that extend its functionality. One in particular is important right now: We need to specify the entities that will be mapped to the database. If we do not, nothing happens when we create the database schema.

Click on the `Aircraft` entity to display its properties, then click on its **Database Persistent** Property Value dropdown menu, as shown:

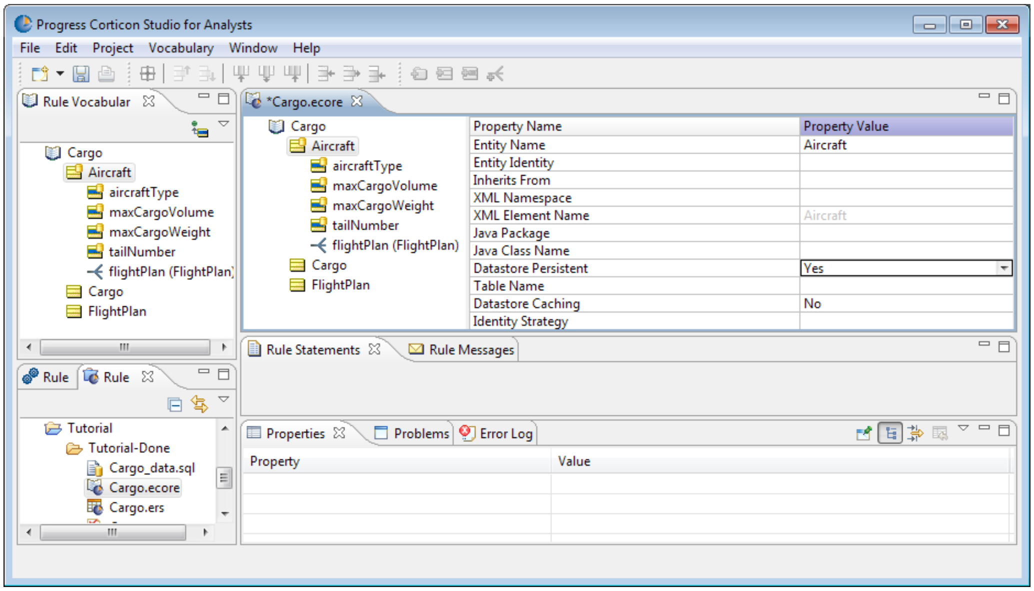
Figure 10: Setting an Entity to be Database Persistent



Property Name	Property Value
Entity Name	Aircraft
Entity Identity	
Inherits From	
XML Namespace	
XML Element Name	Aircraft
Java Package	
Java Class Name	
Datastore Persistent	No
Table Name	
Datastore Caching	No
Identity Strategy	

Choose **Yes**. The entity and all its attributes display their icon with a database 'decoration', as shown:

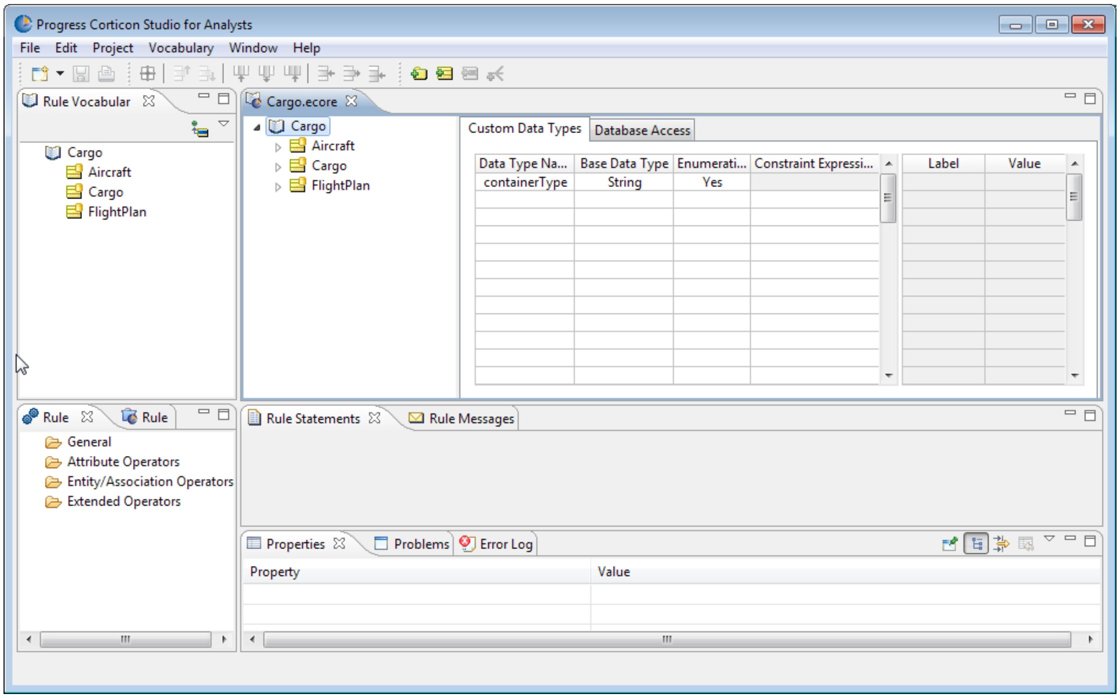
Figure 11: One entity and its attributes set to Database Persistent



Property Name	Property Value
Entity Name	Aircraft
Entity Identity	
Inherits From	
XML Namespace	
XML Element Name	Aircraft
Java Package	
Java Class Name	
Datastore Persistent	Yes
Table Name	
Datastore Caching	No
Identity Strategy	

Perform this action on the `Cargo` and `FlightPlan` entities. When all three entities display their database decoration, you are ready for database mapping.

Figure 12: Vocabulary ready for database mapping



Data Type Na...	Base Data Type	Enumerati...	Constraint Expressi...
containerType	String	Yes	

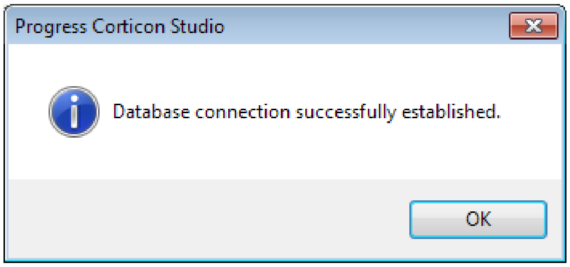
Label	Value

Specifying database access properties

To connect the Vocabulary to our new `Cargo` database tablespace running on SQL Server, choose the **Database Access** tab, and then enter the following connection parameters for this tutorial (including the credentials we defined for access to our RDBMS), as follows:

1. **Database Server**: Pull down to select **Microsoft SQL Server 2008**.
2. **Database URL**: Edit the default entry to replace (1) `<server>` with `localhost`, `127.0.0.1`, or the machine's DNS-resolvable hostname, and (2) `<database name>` with `Cargo`
3. **Username**: `sa`
4. **Password**: `Password1`
5. Click **Test Connection**. The following alert indicates success:

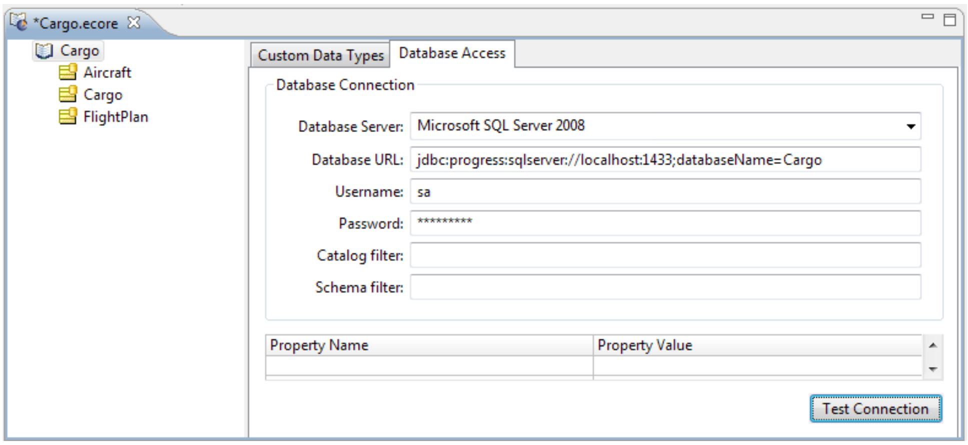
   Figure 13: Successful Connection



Database connection successfully established.

Note: The **Username** and **Password** are the credentials specified in Downloading and installing the database on page 21.

Figure 14: Database Access Configuration Settings



Database Connection

Database Server: Microsoft SQL Server 2008

Database URL: jdbc:progress:sqlserver://localhost:1433;databaseName=Cargo

Username: sa

Password: *********

Catalog filter:

Schema filter:

Troubleshooting

There are common reasons for not succeeding in connection. These are in order of likelihood plus complexity. Retest the connection as you work through these suggestions:

- *The database name is case-sensitive.* It must be `Cargo` in the Database Access parameters and in the database.
- *The hostname is not correct.* If you are on the same machine, `127.0.0.1` has a higher likelihood of avoiding problems.
- *The database needs to extend its authentication.* In SQL Server Management Studio, right-click on the database connection `(local) (SQL Server...`, and then choose **Properties**. In the **Properties** dialog, click Security, then set the **Server authentication** option to **SQL Server and Windows Authentication**.
- *The password is not correct.* In SQL Server Management Studio, expand **Security > Logins** and then choose the login name you used. Reset the password. Choose the **Status** page, and then confirm that the login name is **Enabled**.
- *The port, 1433, is not active or not listening.* In SQL Server Management Studio, you can see which port is active in **Management > SQL Server logs: Current** log items by locating the line `Server is listening on....`
- *Set the port and named pipes.* Launch SQL Server's **Configuration Tools > SQL Server Configuration Manager**, and expand **SQL Server Network Configuration**, and then click on **Protocols for SQLEXPRESS**.
  - *Port*: Double-click on **TCP/IP**. Click the **IP Addresses** tab, and then set **IPAll**'s **TCP Port** to `1433`. (You could instead set another IP configuration to **Active=Yes**, **Enabled=Yes** and the **TCP Port** to `1433`.) Click on the **Protocol** tab to confirm that **Enabled** is now **Yes**, and listed after you click **OK**.
  - *Named Pipes*: Click on **Named Pipes** then set **Enabled** to **Yes** and the **Pipe Name** to `\\.\pipe\sql\query`

Note: For more information about enumerations and retrieving values from databases, see:

- *"Enumeration" in the Rule Modeling Guide*
- *"Enumerated values" in the Quick Reference Guide.*
- *"Label and Value" in the Rule Modeling Guide*
- *"Importing an attribute's possible values from database tables" in the Using EDC Guide*
- *"Mapping database tables to Vocabulary Entities" in the Integration and Deployment Guide*

11

Using Studio to create a schema in the database

Once a connection between the Studio Vocabulary and SQL Server has been established, we can automatically create a new schema in our database that corresponds to the Vocabulary's structure.

When we use a Vocabulary to "forward-generate" a database schema, we need to make sure the database has enough information to create a complete schema. This means that some properties of the Vocabulary we might otherwise be able to ignore or leave empty when just modeling rules now need to be completed.

For example, when modeling rules, it may not be important which attributes act as an entity's identity. But when we use the Vocabulary to forward-generate a schema into a database, identity (also known as "key") information is required. So before we can generate the schema, we must first ensure the Vocabulary has all necessary properties.

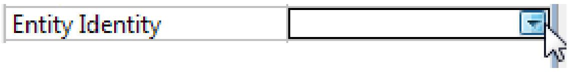
Completing the Vocabulary

Our `Cargo.ecore` Vocabulary already contains attributes that serve as unique identifiers for each entity.

Note: By assigning a Vocabulary attribute to serve as an entity identity, we are using "application" identity. Datastore identity, where a database table's identity is not present in the Vocabulary, is also possible but not described in this Tutorial. See the *Integration & Deployment Guide* for more details on all available identity types.

In the case of the `Aircraft` entity, the `tailNumber` attribute is the unique ID. To designate this attribute as the identity for `Aircraft`, select `Aircraft`, and then click on the right edge of the **Entity Identity** Property Value to expose its drop-down menu, as shown:

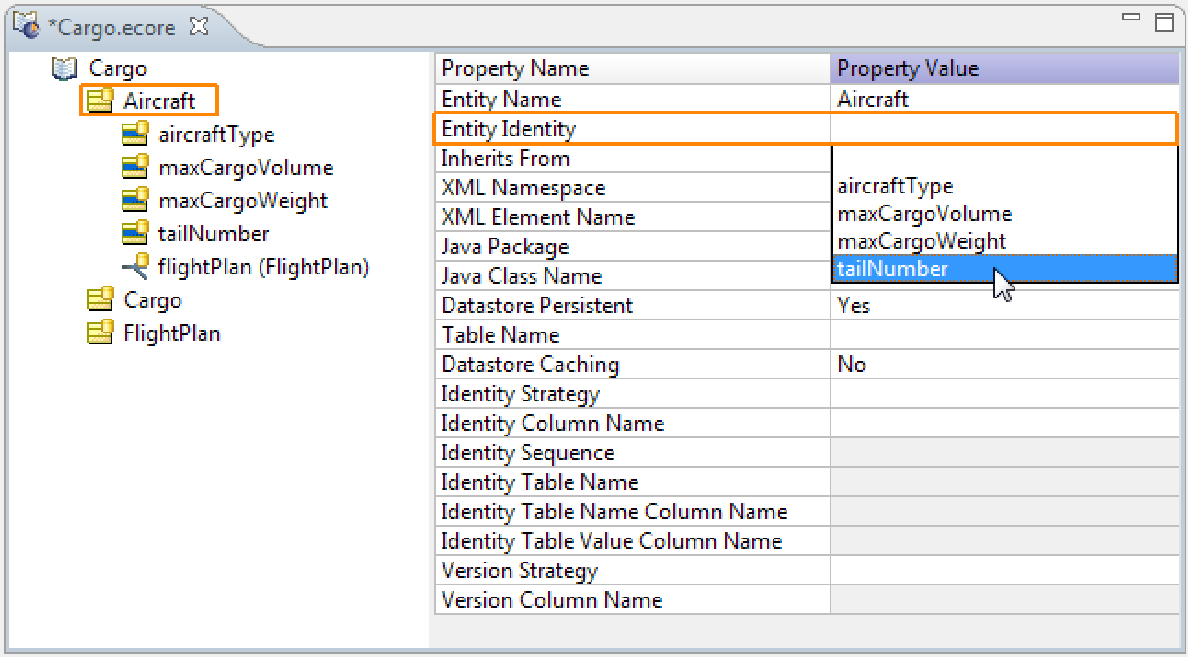
Figure 15: Accessing the Drop-down Menu



Entity Identity	

Select `tailNumber` from the drop-down menu, as shown:

Figure 16: Selecting the Entity Identity

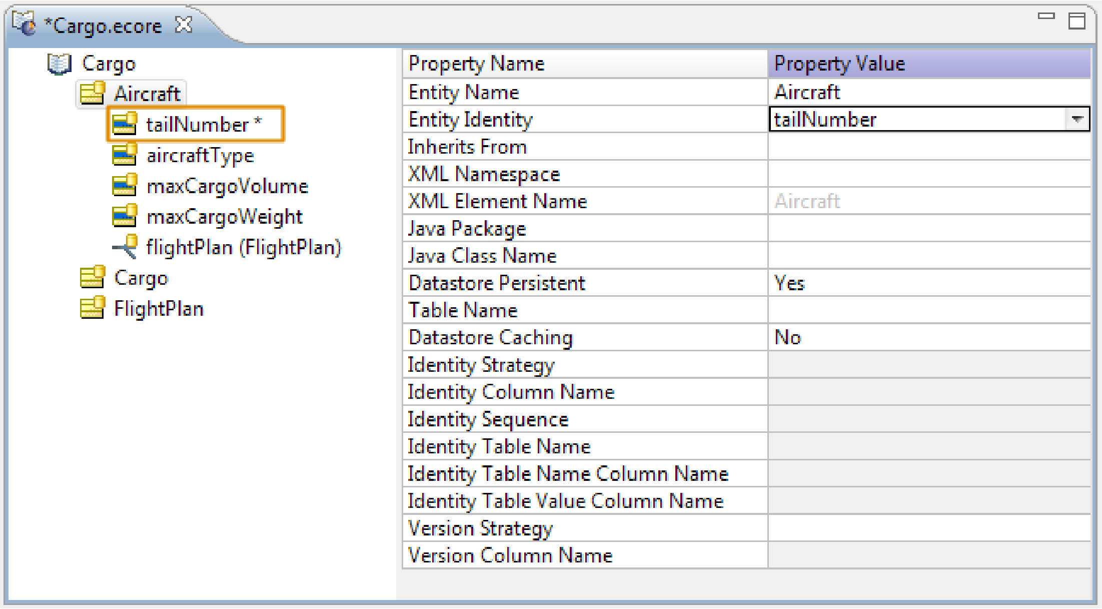


- Cargo
  - Aircraft
    - aircraftType
    - maxCargoVolume
    - maxCargoWeight
    - tailNumber
    - flightPlan (FlightPlan)
  - Cargo
  - FlightPlan

Property Name	Property Value
Entity Name	Aircraft
Entity Identity	
Inherits From	
XML Namespace	
XML Element Name	
Java Package	
Java Class Name	
Datastore Persistent	Yes
Table Name	
Datastore Caching	No
Identity Strategy	
Identity Column Name	
Identity Sequence	
Identity Table Name	
Identity Table Name Column Name	
Identity Table Value Column Name	
Version Strategy	
Version Column Name	

Once selected as the identity for the `Aircraft` entity, `tailNumber` displays an asterisk to the right of its attribute name in the Vocabulary tree-view, as shown:

Figure 17: `Aircraft` Entity with `tailNumber` Identity Selected



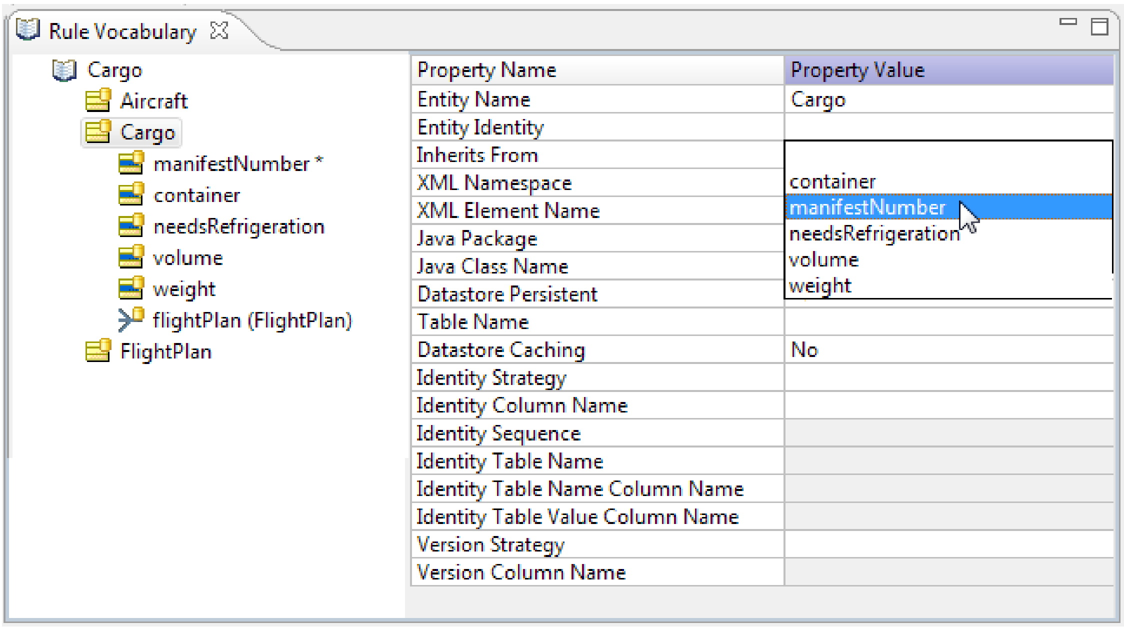
- Cargo
  - Aircraft
    - tailNumber *
    - aircraftType
    - maxCargoVolume
    - maxCargoWeight
    - flightPlan (FlightPlan)
  - Cargo
  - FlightPlan

Property Name	Property Value
Entity Name	Aircraft
Entity Identity	tailNumber
Inherits From	
XML Namespace	
XML Element Name	Aircraft
Java Package	
Java Class Name	
Datastore Persistent	Yes
Table Name	
Datastore Caching	No
Identity Strategy	
Identity Column Name	
Identity Sequence	
Identity Table Name	
Identity Table Name Column Name	
Identity Table Value Column Name	
Version Strategy	
Version Column Name	

Note: To expose the asterisk in the tree-view, you might need to “click away” from the field, or press **Enter** to remove focus from the field.

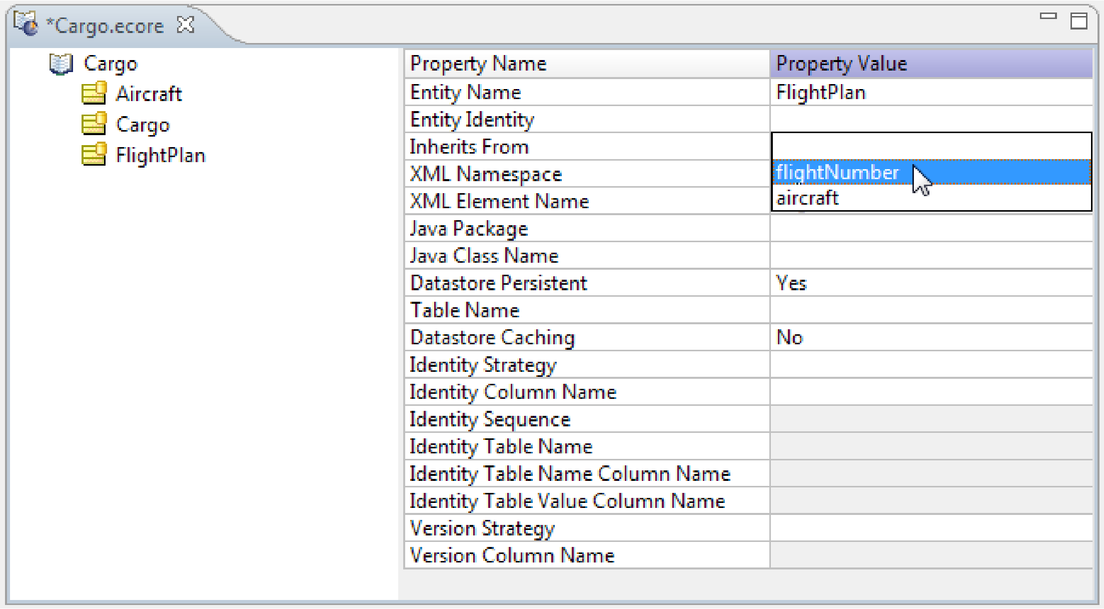
We need to repeat this for each entity in our Vocabulary because each entity will become a table in our database schema, and each table needs a defined identity.

Figure 18: `Cargo` Entity with `manifestNumber` Identity Selected



Property Name	Property Value
Entity Name	Cargo
Entity Identity	
Inherits From	
XML Namespace	
XML Element Name	
Java Package	
Java Class Name	
Datastore Persistent	
Table Name	
Datastore Caching	No
Identity Strategy	
Identity Column Name	
Identity Sequence	
Identity Table Name	
Identity Table Name Column Name	
Identity Table Value Column Name	
Version Strategy	
Version Column Name	

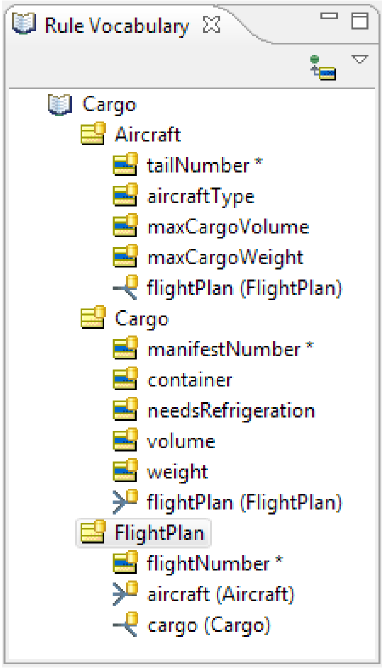
Figure 19: `FlightPlan` Entity with `flightNumber` Identity Selected



Property Name	Property Value
Entity Name	FlightPlan
Entity Identity	
Inherits From	
XML Namespace	
XML Element Name	
Java Package	
Java Class Name	
Datastore Persistent	Yes
Table Name	
Datastore Caching	No
Identity Strategy	
Identity Column Name	
Identity Sequence	
Identity Table Name	
Identity Table Name Column Name	
Identity Table Value Column Name	
Version Strategy	
Version Column Name	

Once an identity has been selected for each entity, our `Cargo.ecore` will have one attribute marked with an asterisk assigned in each entity, as shown:

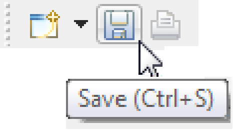
Figure 20: `Cargo.ecore` with Identities Designated for All Entities



Rule Vocabulary
- Cargo
  - Aircraft
    - tailNumber *
    - aircraftType
    - maxCargoVolume
    - maxCargoWeight
    - flightPlan (FlightPlan)
  - Cargo
    - manifestNumber *
    - container
    - needsRefrigeration
    - volume
    - weight
    - flightPlan (FlightPlan)
  - FlightPlan
    - flightNumber *
    - aircraft (Aircraft)
    - cargo (Cargo)

Our Vocabulary is now ready to generate a corresponding schema into our new database on SQL Server.

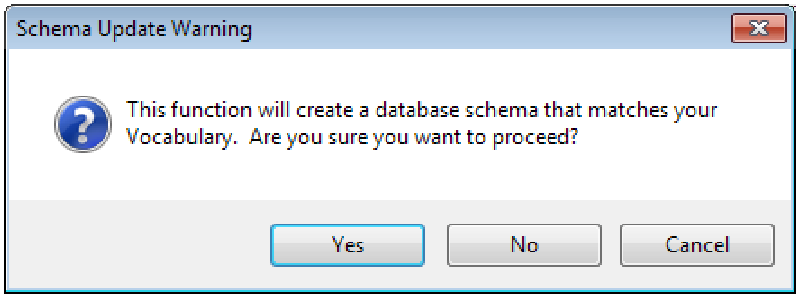
Before proceeding, save your changes to `Cargo.ecore` by choosing the menu command **File>Save**, clicking the **Save** button on the toolbar, or pressing **Ctrl+S**:



Forward-Generating a Schema into SQL Server

Now that our Vocabulary has its identities defined, we can use it to create a corresponding schema in the `Cargo` database running on SQL Server. On the Studio menubar, select **Vocabulary > Database Access > Create/Update Database Schema**. The following alert window opens:

Figure 21: Schema Update Warning Message



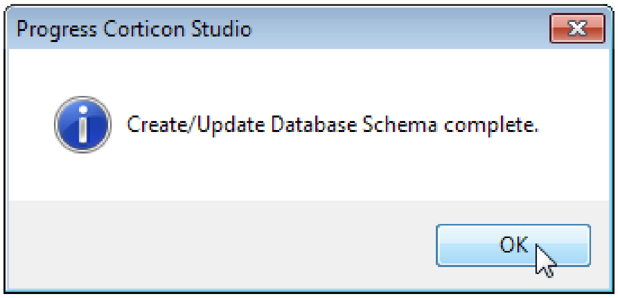
Schema Update Warning

This function will create a database schema that matches your Vocabulary. Are you sure you want to proceed?

The alert warns us that if a schema already exists in the database connected to this Vocabulary, the **Create/Update Database Schema** function may change it. Since our `tutorial` database is brand new and has no schema whatsoever (yet), we can safely continue with the creation process.

Click **Yes** to proceed. If the create/update process succeeds, we’ll see the following alert:

Figure 22: Database Schema Update Success Message



Create/Update Database Schema complete.

Click **OK** to dismiss the notification.

Let's see how that action changed the Vocabulary and the database !

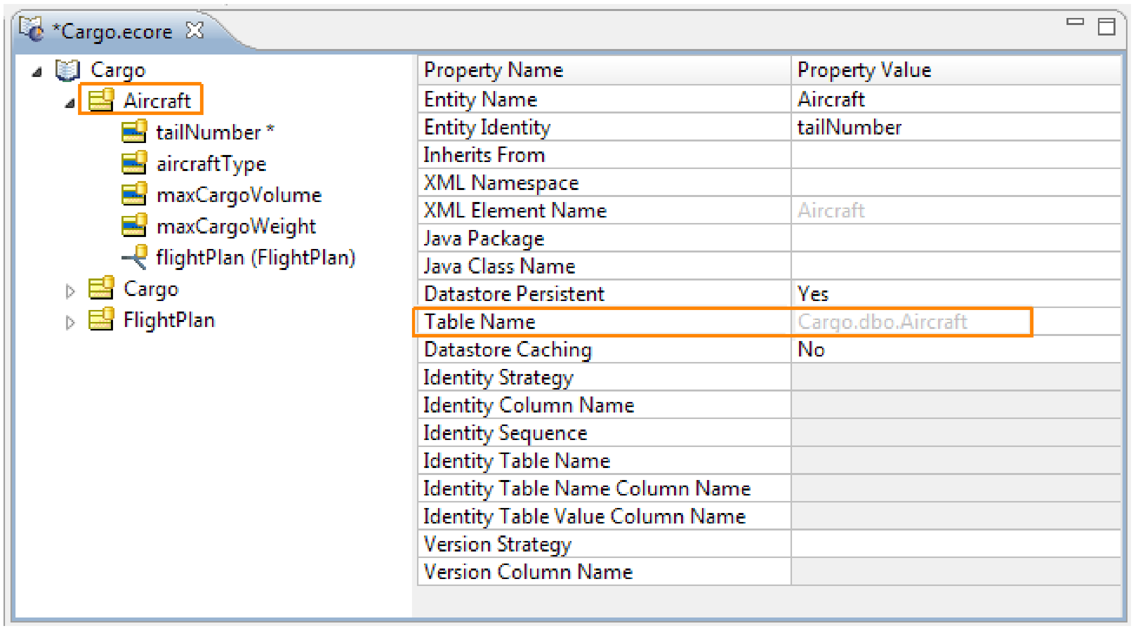
12

Verifying Vocabulary mappings

The **Create/Update Database Schema** function does more than just create a schema in the `Cargo` database. It also automatically maps the resulting tables and columns in the database *back into our Vocabulary*. We can see this by selecting any node in our Vocabulary.

Vocabulary entities correspond to database tables, therefore the new database table `Aircraft` has been automatically mapped to the `Aircraft` entity, as shown:

Figure 23: Entity Mapping



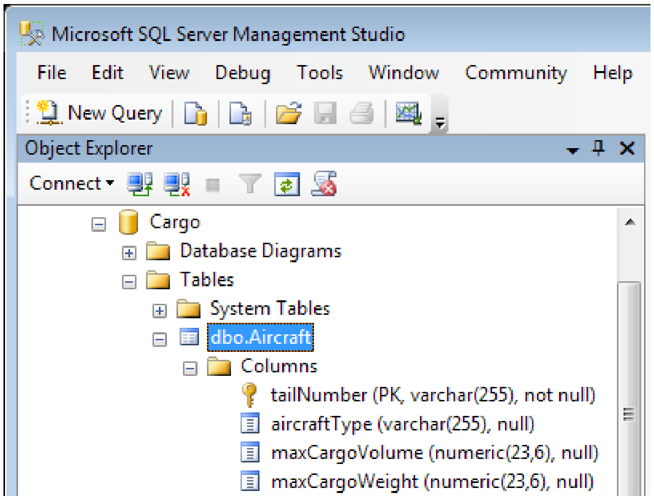
*Cargo.ecore

- Cargo
  - Aircraft
    - tailNumber *
    - aircraftType
    - maxCargoVolume
    - maxCargoWeight
    - flightPlan (FlightPlan)
  - Cargo
  - FlightPlan

Property Name	Property Value
Entity Name	Aircraft
Entity Identity	tailNumber
Inherits From	
XML Namespace	
XML Element Name	Aircraft
Java Package	
Java Class Name	
Datastore Persistent	Yes
Table Name	Cargo.dbo.Aircraft
Datastore Caching	No
Identity Strategy	
Identity Column Name	
Identity Sequence	
Identity Table Name	
Identity Table Name Column Name	
Identity Table Value Column Name	
Version Strategy	
Version Column Name	

The Entity is mapped in a corresponding SQL Server table, as shown:

Figure 24: Entity Mapping to SQL Server Table



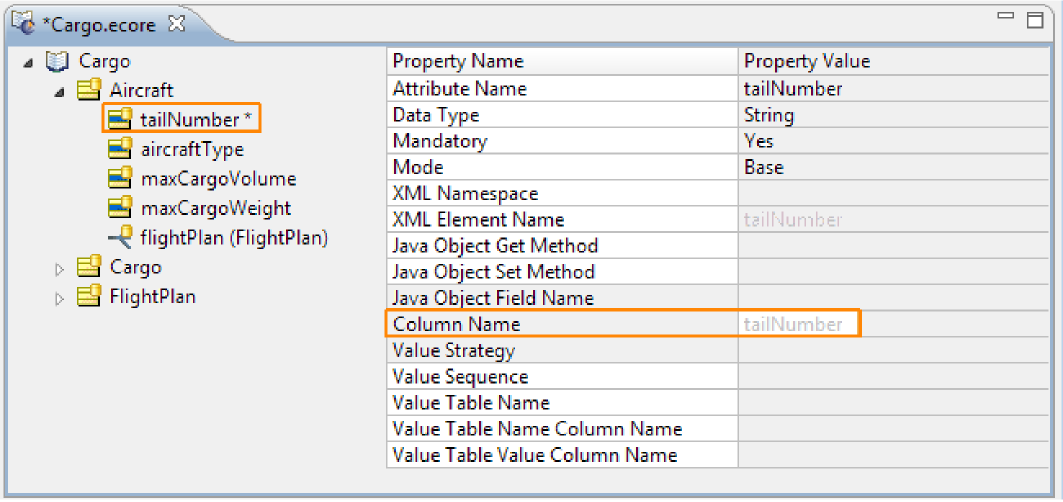
- Cargo
  - Database Diagrams
  - Tables
    - System Tables
    - dbo.Aircraft
      - Columns
        - tailNumber (PK, varchar(255), not null)
        - aircraftType (varchar(255), null)
        - maxCargoVolume (numeric(23,6), null)
        - maxCargoWeight (numeric(23,6), null)

Vocabulary attributes correspond to database columns (or fields), therefore new columns/fields in database table `Aircraft` have been mapped to the attributes of entity `Aircraft`. Attribute `tailNumber`, therefore, is mapped to column/field `tailNumber`. Again, the light gray text color indicates the mapping was assigned using Studio’s automatic mapping logic.

The characteristics of `tailNumber` show a key symbol and the text **PK** to indicate that it is the **Primary Key** to each row, just as we set it the Vocabulary's Entity Identity. Also it is declared as **not null** which means that the Primary Key must have a value.

Click on an `Aircraft` attribute such as `tailNumber` to see how it was mapped to the database:

Figure 25: Attribute Mapping

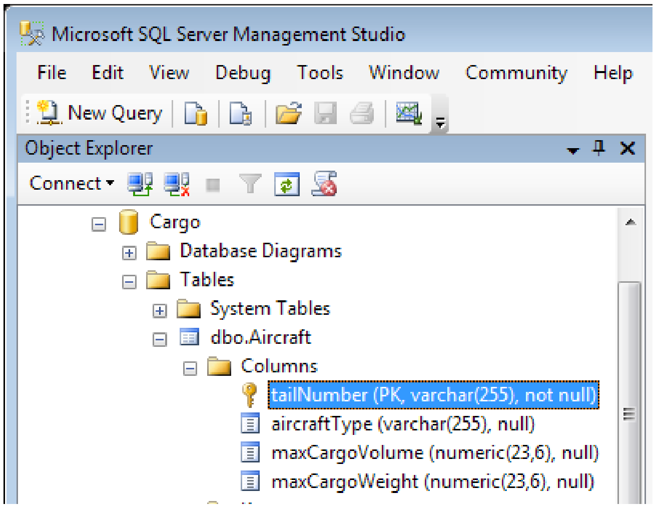


- Cargo
  - Aircraft
    - tailNumber *
    - aircraftType
    - maxCargoVolume
    - maxCargoWeight
    - flightPlan (FlightPlan)
  - Cargo
  - FlightPlan

Property Name	Property Value
Attribute Name	tailNumber
Data Type	String
Mandatory	Yes
Mode	Base
XML Namespace	
XML Element Name	tailNumber
Java Object Get Method	
Java Object Set Method	
Java Object Field Name	
Column Name	tailNumber
Value Strategy	
Value Sequence	
Value Table Name	
Value Table Name Column Name	
Value Table Value Column Name	

The Attribute is mapped in a corresponding column in the appropriate SQL Server table, as shown:

Figure 26: Attribute Mapping to Table Column in SQL Server

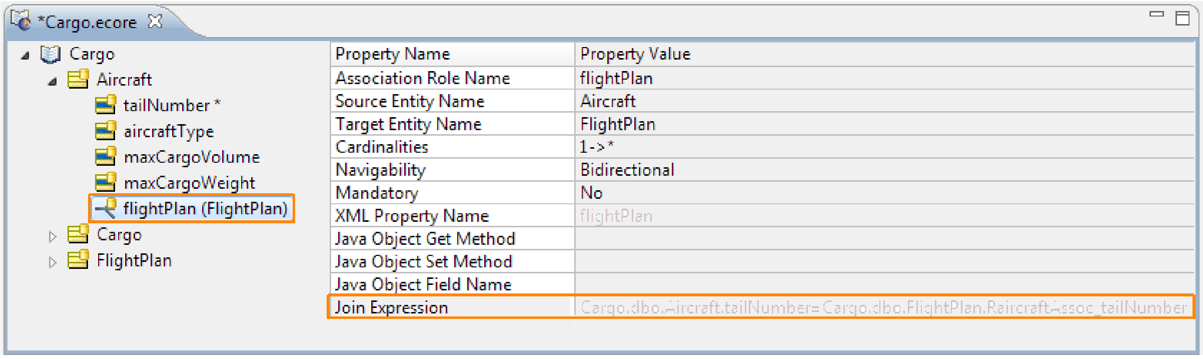


- Cargo
  - Database Diagrams
  - Tables
    - System Tables
    - dbo.Aircraft
      - Columns
        - tailNumber (PK, varchar(255), not null)
        - aircraftType (varchar(255), null)
        - maxCargoVolume (numeric(23,6), null)
        - maxCargoWeight (numeric(23,6), null)

Vocabulary associations correspond to database foreign key relationships, therefore the new relationship in the database between table `Aircraft` and table `FlightPlan` has been mapped to the association between Vocabulary entity `Aircraft` and `FlightPlan`. Again, the light gray text color indicates the mapping was assigned using Studio’s automatic mapping logic.

Click on the `Aircraft` association `flightPlan` to see how it was mapped to the database:

Figure 27: Association Mapping

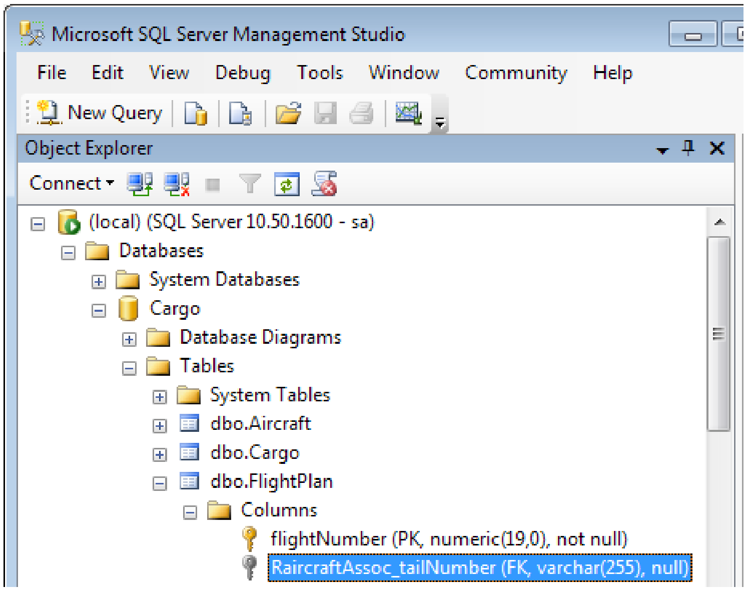


- Cargo
  - Aircraft
    - tailNumber *
    - aircraftType
    - maxCargoVolume
    - maxCargoWeight
    - flightPlan (FlightPlan)
  - Cargo
  - FlightPlan

Property Name	Property Value
Association Role Name	flightPlan
Source Entity Name	Aircraft
Target Entity Name	FlightPlan
Cardinalities	1->*
Navigability	Bidirectional
Mandatory	No
XML Property Name	flightPlan
Java Object Get Method	
Java Object Set Method	
Java Object Field Name	
Join Expression	Cargo.dbo.Aircraft.tailNumber=Cargo.dbo.FlightPlan.RaircraftAssoc_tailNumber

The Association is mapped in a corresponding relationship between SQL Server tables, as shown:

Figure 28: Association Mapping to relationship between tables in SQL Server



(local) (SQL Server 10.50.1600 - sa)
Databases
System Databases
Cargo
Database Diagrams
Tables
System Tables
dbo.Aircraft
dbo.Cargo
dbo.FlightPlan
Columns
flightNumber (PK, numeric(19,0), not null)
RaircraftAssoc_tailNumber (FK, varchar(255), null)

As you can see from the mapping, a Vocabulary association is implemented in a relational database as a SQL Join expression. This join expression requires that the `Cargo_dbo_Aircraft.TailNumber` (primary key or identity) match the `Cargo_dbo_FlightPlan.RaircraftAssoc_tailNumber`, which is the name of the foreign key in the `dbo_FlightPlan` table. In this case, the `FlightPlan` foreign key is the `Aircraft` primary key (identity). The cardinality of the association from `Aircraft` to `FlightPlan` in the Vocabulary is one-to-many, therefore the primary key of the “one side” of the relationship becomes the foreign key of the “many side”.

There should be no need to change any of these automatic mappings. Since the database was generated directly from the Vocabulary, all the mappings will be correct.

Before continuing, take a moment to save the Vocabulary so we retain these mappings.

13

Populating the database

We’ll now use SQL Server's Management Studio to populate the database.

Note: We could use a Ruletest to load the data but we are going look at read-only functions first so we'll preload the database with some data.

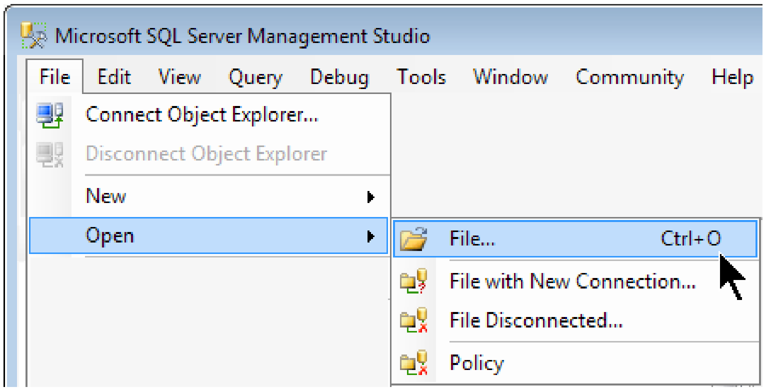
Loading Data into a Database

The Corticon sample provides you with a `.sql` text file, `Cargo_data.sql`, that has well-formed SQL `INSERT` statements that will add some data to the tables you created in the database.

To load the sample data into the RDBMS:

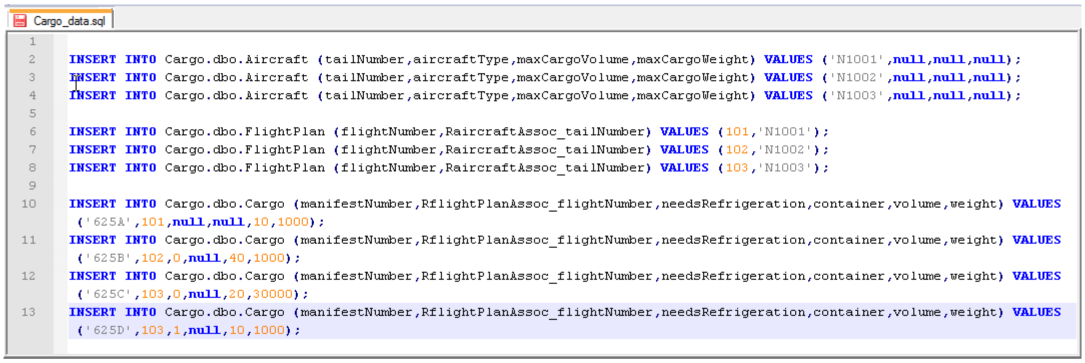
1. In the SQL Server Management Console (still connected to the `Cargo` database), click **File > Open**, as shown:

   Figure 29: Creating a New Query in SQL Server

   
   Microsoft SQL Server Management Studio
File
Edit
View
Query
Debug
Tools
Window
Community
Help
Connect Object Explorer...
Disconnect Object Explorer
New
Open
File...
Ctrl+O
File with New Connection...
File Disconnected...
Policy

2. Navigate to the file `Cargo_data.sql`, located at `[CORTICON_WORK_DIR]\Samples\Rule Projects\Tutorial\Tutorial-Done` Its contents look like this:

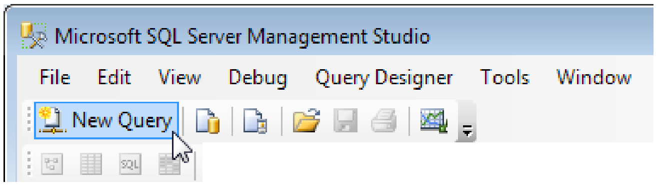
   Figure 30: Contents of `Cargo_data.sql` in a text editor

```

INSERT INTO Cargo.dbo.Aircraft (tailNumber,aircraftType,maxCargoVolume,maxCargoWeight) VALUES ('N1001',null,null,null);
INSERT INTO Cargo.dbo.Aircraft (tailNumber,aircraftType,maxCargoVolume,maxCargoWeight) VALUES ('N1002',null,null,null);
INSERT INTO Cargo.dbo.Aircraft (tailNumber,aircraftType,maxCargoVolume,maxCargoWeight) VALUES ('N1003',null,null,null);

INSERT INTO Cargo.dbo.FlightPlan (flightNumber,RaircraftAssoc_tailNumber) VALUES (101,'N1001');
INSERT INTO Cargo.dbo.FlightPlan (flightNumber,RaircraftAssoc_tailNumber) VALUES (102,'N1002');
INSERT INTO Cargo.dbo.FlightPlan (flightNumber,RaircraftAssoc_tailNumber) VALUES (103,'N1003');

INSERT INTO Cargo.dbo.Cargo (manifestNumber,RflightPlanAssoc_flightNumber,needsRefrigeration,container,volume,weight) VALUES ('625A',101,null,null,10,1000);
INSERT INTO Cargo.dbo.Cargo (manifestNumber,RflightPlanAssoc_flightNumber,needsRefrigeration,container,volume,weight) VALUES ('625B',102,0,null,40,1000);
INSERT INTO Cargo.dbo.Cargo (manifestNumber,RflightPlanAssoc_flightNumber,needsRefrigeration,container,volume,weight) VALUES ('625C',103,0,null,20,30000);
INSERT INTO Cargo.dbo.Cargo (manifestNumber,RflightPlanAssoc_flightNumber,needsRefrigeration,container,volume,weight) VALUES ('625D',103,1,null,10,1000);
```

3. Copy the contents of `Cargo_data.sql` in the text editor, and then paste it in the SQLQuery text area in the SQL Server Management Console.

Note: An alternative is to click **New Query**, as shown:



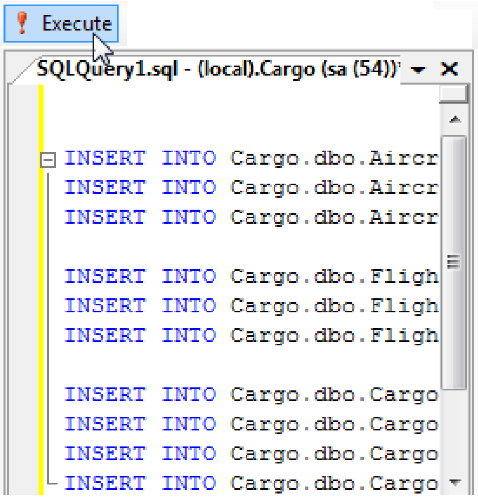
. Copy the following text, and then paste it in the SQLQuery text area:

```
INSERT INTO Cargo.dbo.Aircraft
(tailNumber,aircraftType,maxCargoVolume,maxCargoWeight) VALUES
('N1001',null,null,null);
INSERT INTO Cargo.dbo.Aircraft
(tailNumber,aircraftType,maxCargoVolume,maxCargoWeight) VALUES
('N1002',null,null,null);
INSERT INTO Cargo.dbo.Aircraft
(tailNumber,aircraftType,maxCargoVolume,maxCargoWeight) VALUES
('N1003',null,null,null);
INSERT INTO Cargo.dbo.FlightPlan (flightNumber,RaircraftAssoc_tailNumber)
VALUES (101,'N1001');
```

```
INSERT INTO Cargo.dbo.FlightPlan (flightNumber,RaircraftAssoc_tailNumber)
VALUES (102,'N1002');
INSERT INTO Cargo.dbo.FlightPlan (flightNumber,RaircraftAssoc_tailNumber)
VALUES (103,'N1003');
INSERT INTO Cargo.dbo.Cargo
(manifestNumber,RflightPlanAssoc_flightNumber,needsRefrigeration,container,volume,weight)
 VALUES ('625A',101,null,null,10,1000);
INSERT INTO Cargo.dbo.Cargo
(manifestNumber,RflightPlanAssoc_flightNumber,needsRefrigeration,container,volume,weight)
 VALUES ('625B',102,0,null,40,1000);
INSERT INTO Cargo.dbo.Cargo
(manifestNumber,RflightPlanAssoc_flightNumber,needsRefrigeration,container,volume,weight)
 VALUES ('625C',103,0,null,20,30000);
INSERT INTO Cargo.dbo.Cargo
(manifestNumber,RflightPlanAssoc_flightNumber,needsRefrigeration,container,volume,weight)
 VALUES ('625D',103,1,null,10,1000);
```

4. Click **Execute**, as shown:

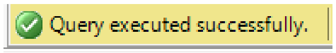
Figure 31: Executing the Query



```
INSERT INTO Cargo.dbo.Aircr
INSERT INTO Cargo.dbo.Aircr
INSERT INTO Cargo.dbo.Aircr

INSERT INTO Cargo.dbo.Fligh
INSERT INTO Cargo.dbo.Fligh
INSERT INTO Cargo.dbo.Fligh

INSERT INTO Cargo.dbo.Cargo
INSERT INTO Cargo.dbo.Cargo
INSERT INTO Cargo.dbo.Cargo
INSERT INTO Cargo.dbo.Cargo
```

When the query executes, it displays success in its status bar, as shown:

Figure 32: Successful Query Execution

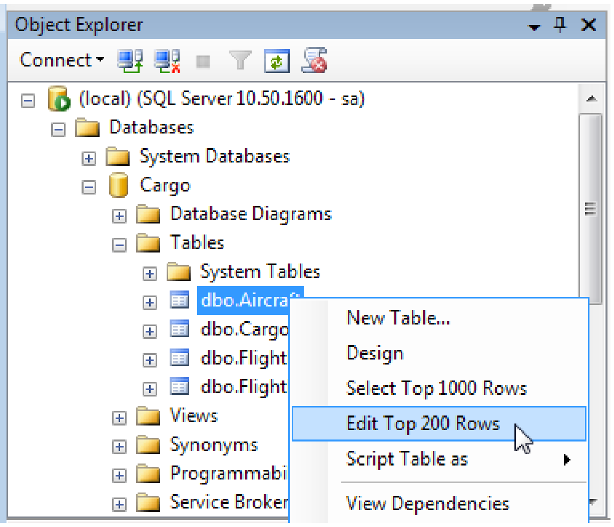


Query executed successfully.

Viewing Data in the Database

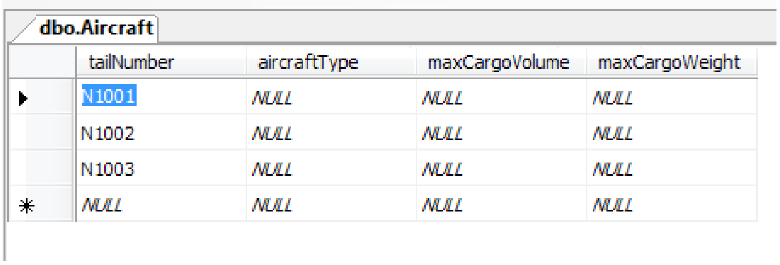
We can review the database *rows* that the `INSERT` commands created to see that they are as we expected. In the SQL Server Management Studio, expand the tree to **Databases: Cargo : Tables**, and then right-click on a table to choose **Edit Top 200 Rows**, as shown for the `dbo.Aircraft` table:

Figure 33: Choosing to view rows in the `dbo.Aircraft` table



The right panel opens a tab to display the following data:

Figure 34: Rows in the `Aircraft` table

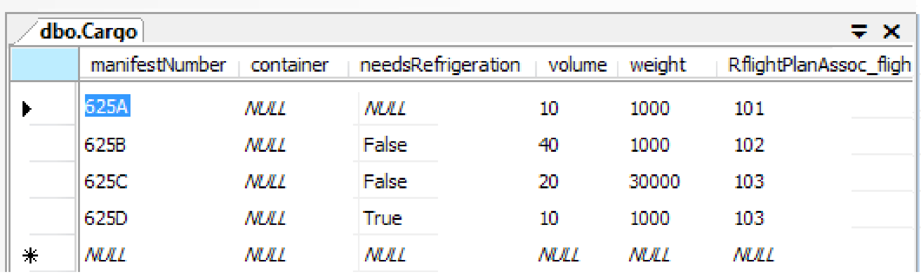


dbo.Aircraft

	tailNumber	aircraftType	maxCargoVolume	maxCargoWeight
▶	N1001	NULL	NULL	NULL
	N1002	NULL	NULL	NULL
	N1003	NULL	NULL	NULL
✳	NULL	NULL	NULL	NULL

Similarly, choosing the same command on the `dbo.Cargo` table, opens a tab to display the following data:

Figure 35: Data loaded into the `Cargo` table

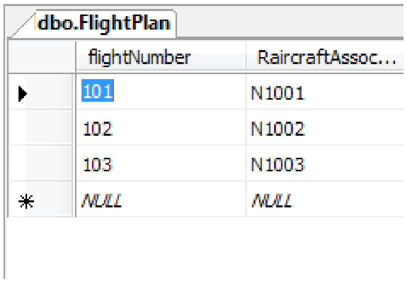


dbo.Cargo

	manifestNumber	container	needsRefrigeration	volume	weight	RflightPlanAssoc_fligh
▶	625A	NULL	NULL	10	1000	101
	625B	NULL	False	40	1000	102
	625C	NULL	False	20	30000	103
	625D	NULL	True	10	1000	103
✳	NULL	NULL	NULL	NULL	NULL	NULL

Then, choosing the same command on the `dbo.FlightPlan` table, opens a tab to display the following data:

Figure 36: Data loaded into the `FlightPlan` table



dbo.FlightPlan

	flightNumber	RaircraftAssoc...
▶	101	N1001
	102	N1002
	103	N1003
✱	*NULL*	*NULL*

14

Using database access in Studio tests

In this section of the EDC tutorial, we will learn how to configure and execute a Studio Test with read-only database access, and then with read/update database access.

For details, see the following topics:

- Read-only database access in a Studio test
- Read/Update database access in a Studio test

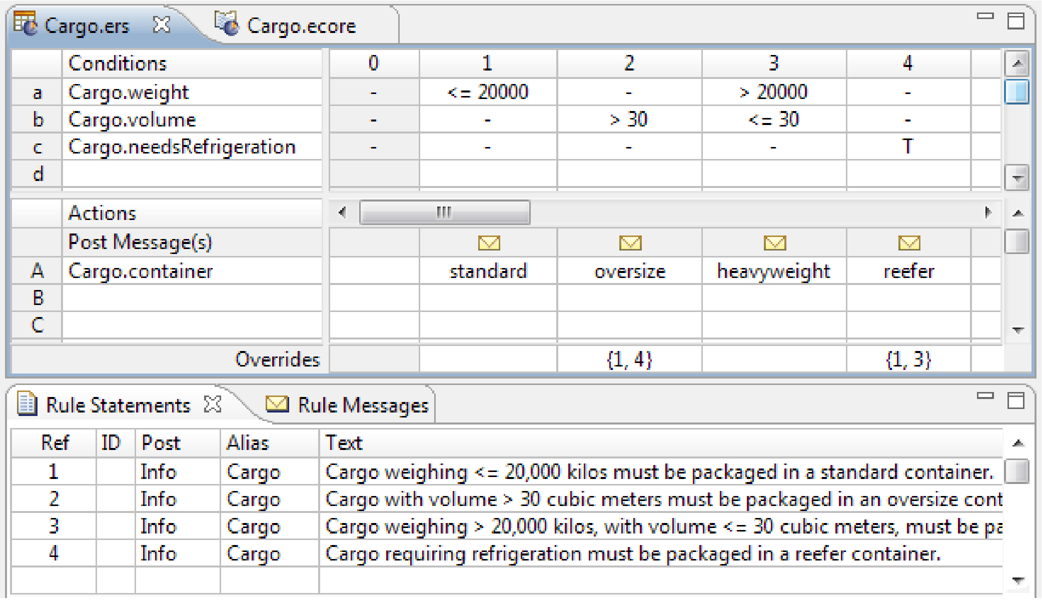
Read-only database access in a Studio test

To execute a Test in Studio, we will use the Rulesheet (`.ers` file) built from the Vocabulary we have been preparing. If you have previously completed the *Tutorial for Corticon Studio – Basic Rule Modeling*, then you are familiar with the rules in `Cargo.ers`. This basic Rulesheet applies well to this tutorial.

Opening a Rulesheet in Studio

In the **Rule Project Explorer**, double-click on `Cargo.ers`. The Rulesheet opens, as shown:

Figure 37: Rulesheet `Cargo.ers` as Completed in the Basic Rule Modeling Tutorial



	Conditions	0	1	2	3	4
a	Cargo.weight	-	<= 20000	-	> 20000	-
b	Cargo.volume	-	-	> 30	<= 30	-
c	Cargo.needsRefrigeration	-	-	-	-	T
d						
	Actions					
	Post Message(s)		✉	✉	✉	✉
A	Cargo.container		standard	oversize	heavyweight	reefer
B						
C						
	Overrides			{1, 4}		{1, 3}

Ref	ID	Post	Alias	Text
1		Info	Cargo	Cargo weighing <= 20,000 kilos must be packaged in a standard container.
2		Info	Cargo	Cargo with volume > 30 cubic meters must be packaged in an oversize cont
3		Info	Cargo	Cargo weighing > 20,000 kilos, with volume <= 30 cubic meters, must be pa
4		Info	Cargo	Cargo requiring refrigeration must be packaged in a reefer container.

Reflecting on the *Basic Rule Modeling Tutorial*, the business purpose of this Rulesheet is to examine the weight, volume, and nature of cargo to determine how it should be packaged for shipment. More accurately, for any given cargo, the rules test its weight, volume, and refrigeration requirements, and then assigns a value to its `container` attribute.

From our inspection of the database tables in **Viewing Data in the Database**, we know that the `Cargo` table in our database already contains weight and volume data for each record (we can see this data in Figure 35 on page 50).

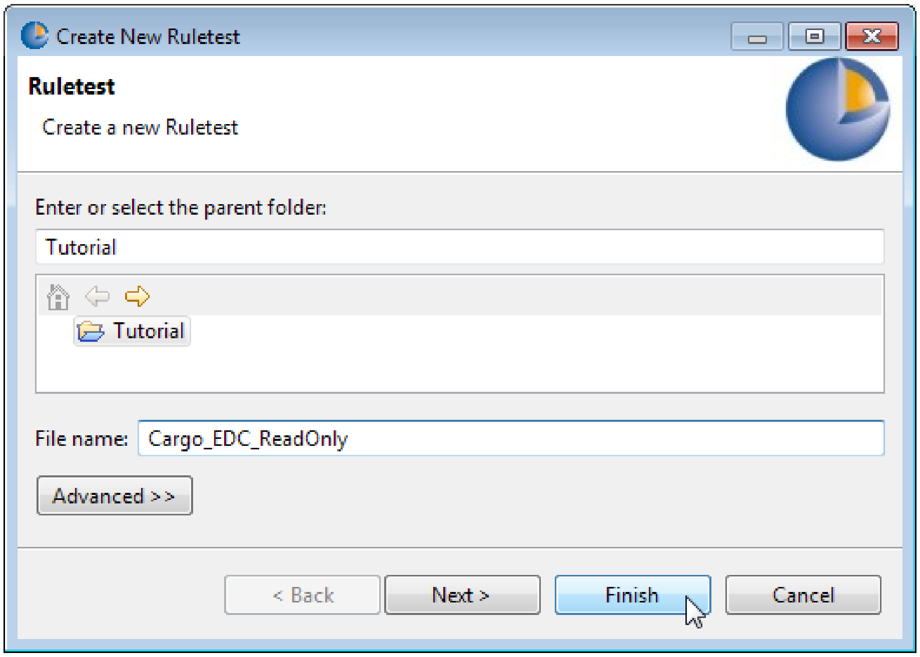
Given the structure of our Vocabulary and database, Studio should be able to “look up” a particular Cargo record if it knows its `manifestNumber` (primary key). To test this functionality, we create a simple Test that uses read-only database access to retrieve `Cargo` data from the database, and then use it to evaluate the rules in the previous figure.

Configuring a Studio Test for Read-Only Database Access

Open a new Ruletest, as follows:

1. Select the menu command **File > New > Ruletest**.
2. In the **Create New Ruletest** dialog, select the `Tutorial Project`, and enter a file name, such as `Cargo_EDC_ReadOnly`, as shown:

Figure 38: New Ruletest in the Tutorial Project



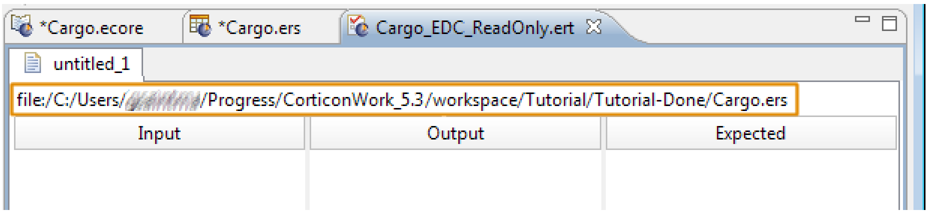
Enter or select the parent folder: Tutorial

File name: Cargo_EDC_ReadOnly

3. Click **Finish**.

By default, the new Ruletest will bind to the single Rulesheet in the project, `Cargo.ers` as its 'test subject', and displays its name and location the Testsheet's header, as shown:

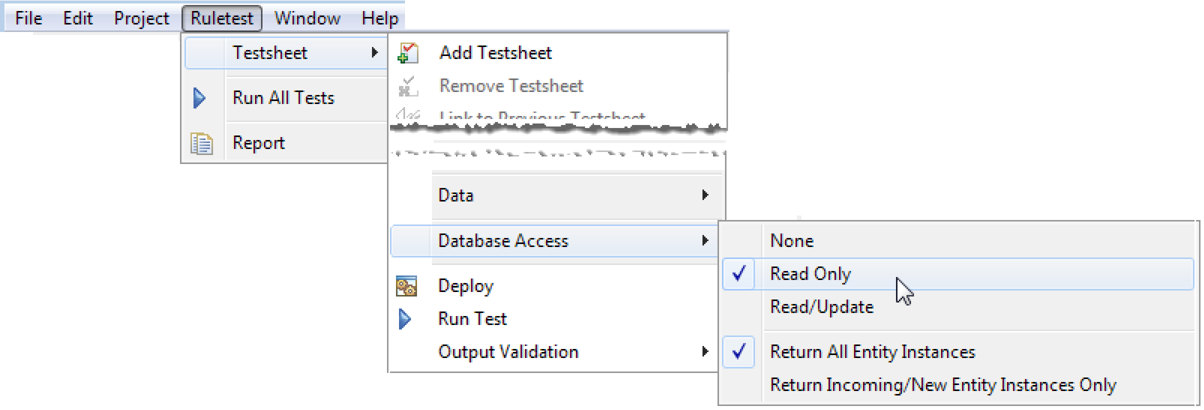
Figure 39: A New Testsheet with the Rulesheet to be Tested in its Header



file:/C:/Users/[redacted]/Progress/CorticonWork_5.3/workspace/Tutorial/Tutorial-Done/Cargo.ers

Input	Output	Expected

To set this Ruletest's Testsheet `Untitled-1` for read-only access to our database, select the menu option **Ruletest > Testsheet > Database Access > Read Only**, as shown:



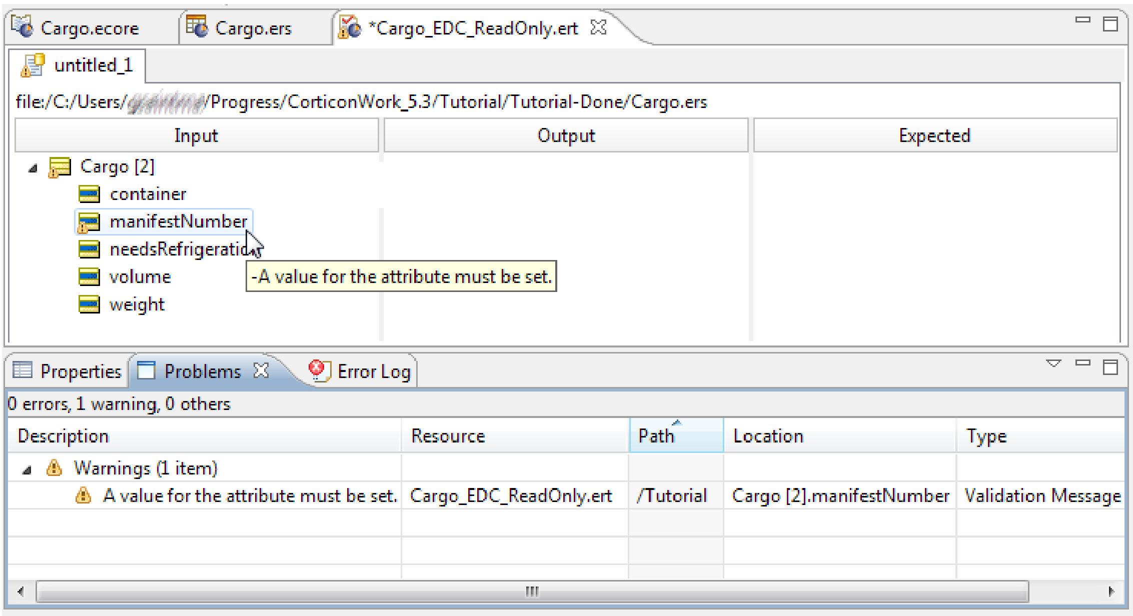
The Testsheet's tab displays a modified icon: -- a yellow cylinder representing a database. That shows that it is set to **Read Only** access, so we will be able to extract data as needed from the database to use in rule execution.

Defining and Executing the Read Only Test

Drag a new `Cargo` entity from the Vocabulary and drop it on the Ruletest's Input area.

Notice the alert symbol ⚠ that decorates the `Cargo` and its `manifestNumber` attribute, as shown:

Figure 40: Tooltip Indicating That Key Data is Missing



file:/C:/Users/[redacted]/Progress/CorticonWork_5.3/Tutorial/Tutorial-Done/Cargo.ers

-A value for the attribute must be set.

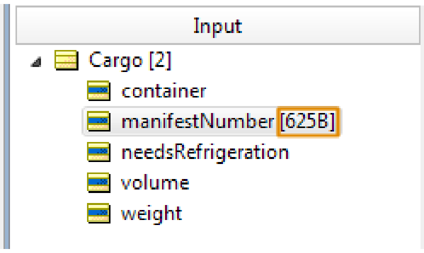
0 errors, 1 warning, 0 others

Description	Resource	Path	Location	Type
⚠ Warnings (1 item)				
⚠ A value for the attribute must be set.	Cargo_EDC_ReadOnly.ert	/Tutorial	Cargo [2].manifestNumber	Validation Message

Hovering your cursor over the attribute restates the warning message that we need to provide data for the `manifestNumber` attribute. That's because `manifestNumber` is the identity value for the `Cargo` entity and also the primary key for the `Cargo` table in our database.

Double-click on `manifestNumber` and then enter `625B`, a value in the `Cargo` table, in the entry area to the right of the attribute name, as shown:

Figure 41: Key Data Entered for `manifestNumber`



manifestNumber [625B]

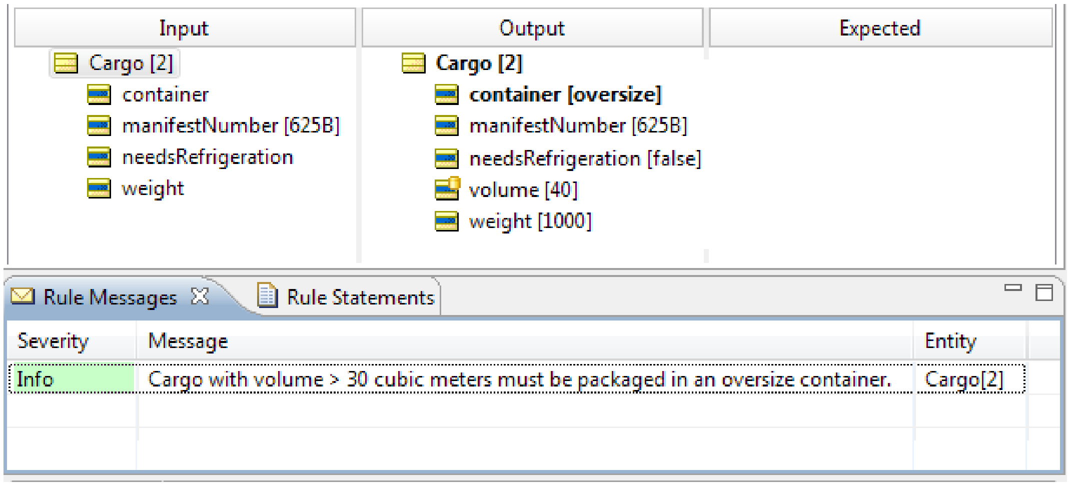
With key data entered, the text turns black, indicating that there are no further errors.

Finally, let's intentionally remove an attribute. That will compel Studio to retrieve the attribute and its value for the specified primary key. Click on `volume` in the Input column, and then press the **Delete** key.

Execute the Test by selecting the **Ruletest > Run All Tests** menu command.

The Output shows that the `volume` attribute was retrieved. Its icon is to show that it came from the database.

Figure 42: Read-Only Testsheet that Retrieved a Missing Attribute and All of the Record's Values



Input
- Cargo [2]
  - container
  - manifestNumber [625B]
  - needsRefrigeration
  - weight

Output
- **Cargo [2]**
  - **container [oversize]**
  - manifestNumber [625B]
  - needsRefrigeration [false]
  - volume [40]
  - weight [1000]

Expected

Severity	Message	Entity
Info	Cargo with volume > 30 cubic meters must be packaged in an oversize container.	Cargo[2]

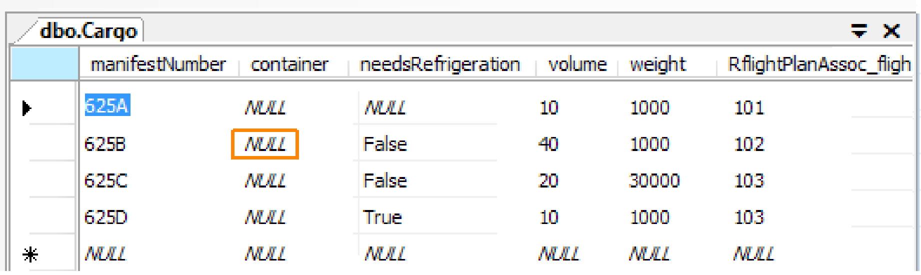
Understanding the Missing-attribute Test Example

The following sequence of events occurred when we executed this test:

1. Corticon attempted to execute the rules in `Cargo.ers` using the data provided in the Input Ruletest.
2. The rules expects `Cargo.volume` but that attribute is not in the Input Ruletest.
3. Because the Test is set to **Read Only** database access, Studio connects to the database configured in the Vocabulary `Cargo.ecore`.
4. Studio uses the “seed” data available to it to query the connected database. As we have specified a unique `Cargo` entity (identified by its primary key, the `manifestNumber`) that is manifest `625B`.
5. Studio executes an SQL query to retrieve all the attributes it needs for the rules, specifically `Cargo.volume`.
6. With necessary data in memory, Studio evaluates and fires the rules. We can see from the message posted in the **Rule Messages** window that one of the rules has fired.

This Test used **Read Only** database access, so even though the evaluated rules assigned a value to `container` (highlighted in bold text), that data is not written back to the database. The original `container` data (`null`) stays unchanged in the database, as shown:

Figure 43: Data in the `Cargo` Table after the Read-Only Test



	manifestNumber	container	needsRefrigeration	volume	weight	RflightPlanAssoc_fligh
▶	625A	NULL	NULL	10	1000	101
	625B	NULL	False	40	1000	102
	625C	NULL	False	20	30000	103
	625D	NULL	True	10	1000	103
*	NULL	NULL	NULL	NULL	NULL	NULL

Read/Update database access in a Studio test

A Testsheet that uses **Read/Update** access changes information in the database records.

We are moving beyond just inquiring the database while staying in the scope of Corticon Studio's working memory. We are taking on the responsibilities of maintaining database records -- adding, deleting, and modifying as determined by the execution of Corticon rules. To help ease into this transition, let's see how our rules will behave *before* we execute Tests in **Read/Update** database access mode.

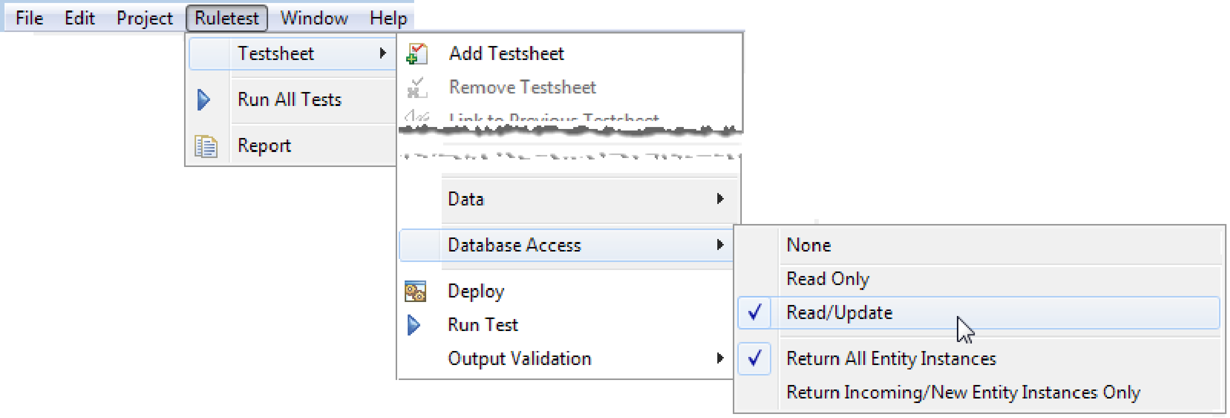
Configuring a Studio Test for Read/Update Database Access

Open a new Ruletest, as follows:

1. Select **File>New>Ruletest** on the Studio menubar.
2. In the **Create New Ruletest** dialog, select the `Tutorial Project`, and enter a file name, such as `Cargo_EDC_ReadUpdate`, and then click **Finish**.

The new Ruletest will bind to the single Rulesheet in the project, `Cargo.ers`.

To set this Ruletest for read/update access to our database, select the menu option **Ruletest > Database Access > Read/Update**, as shown:



The Testsheet's tab displays a modified icon: -- a red arrow pointing toward the yellow cylinder. That shows that it is set to **Read/Update** access, so that we will be able to extract data as needed from the database to use in rule execution, *and then write changes and additional data back to the database*.

Defining and Executing the Read/Update Test

Drag a new `Cargo` entity from the Vocabulary and drop it on the Ruletest. Just as we saw in Read-Only mode, the `Cargo` and its `manifestNumber` attribute are decorated with an alert because it requires a value (remember we set this attribute as the primary application identity key).

Double-click on `manifestNumber` and then enter `625B` in the entry area to the right of the attribute name.

With key data entered, the text turns black, indicating that there are no further errors.

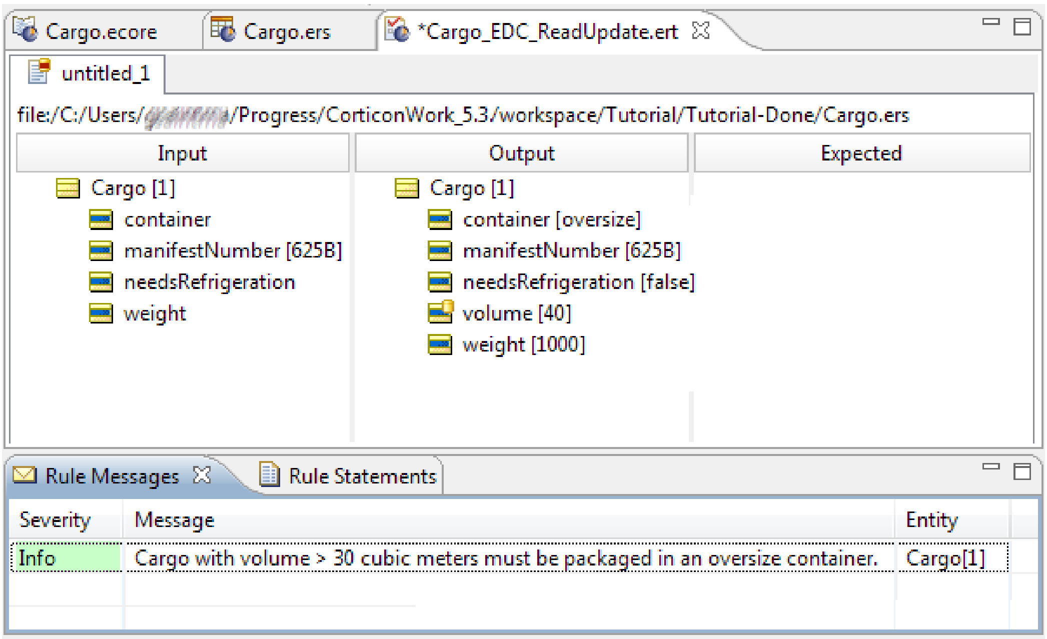
Let's do the added step we did in the previous test. In the Input column, select `volume`, and then press **Delete**.

Now let's run the test.

Executing the Read/Update Test

In Corticon Studio, execute the Testsheet by selecting the **Ruletest > Testsheet > Test > Run Test** menu command.

Figure 44: Read/Update Ruletest that Retrieved a Missing Attribute and All of the Record's Values



file:/C:/Users/[redacted]/Progress/CorticonWork_5.3/workspace/Tutorial/Tutorial-Done/Cargo.ers

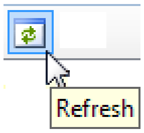
Input	Output	Expected
Cargo [1] container manifestNumber [625B] needsRefrigeration weight	Cargo [1] container [oversize] manifestNumber [625B] needsRefrigeration [false] volume [40] weight [1000]	

Severity	Message	Entity
Info	Cargo with volume > 30 cubic meters must be packaged in an oversize container.	Cargo[1]

The results, shown above, look a lot like they did before (Read-Only Testsheet that Retrieved a Missing Attribute and All of the Record's Values). The only difference is that the `container` attribute, and its value, `oversize`, is not in bold text.

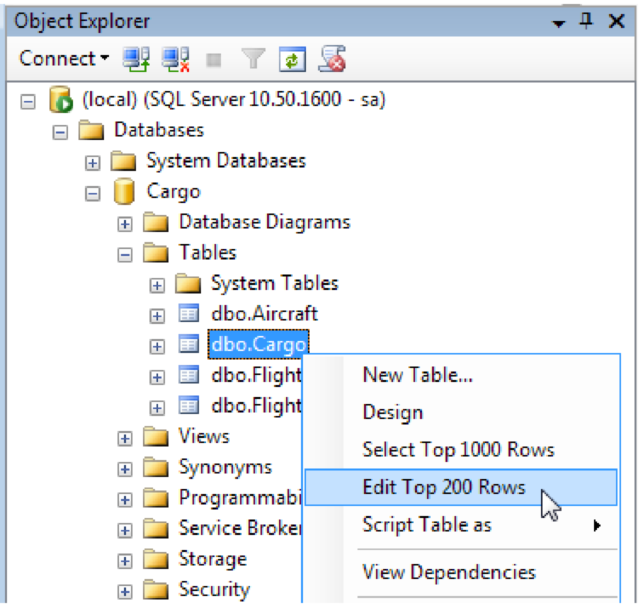
But what has happened in our database? What was the impact of the Read/Update Test on the database?

In the Microsoft SQL Server Management Studio, click **Refresh**, as shown:



Expand the tree to **Databases: Cargo : Tables**, right-click on **Cargo**, and then choose **Edit Top 200 Rows**, as shown:

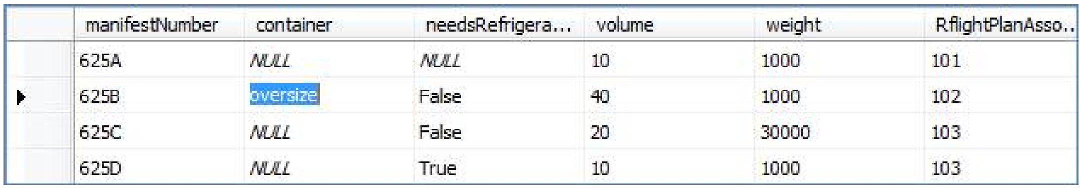
Figure 45: Accessing the Data in the `Cargo` table after Read/Update



The right panel lists the records in the `Cargo` table, as shown:

fig >

Data in the `Cargo` table after Read/Update



	manifestNumber	container	needsRefrigera...	volume	weight	RflightPlanAsso..
	625A	NULL	NULL	10	1000	101
▶	625B	oversize	False	40	1000	102
	625C	NULL	False	20	30000	103
	625D	NULL	True	10	1000	103

Why was only the second row updated? Because our test `Cargo` was only for `manifestNumber 625B`.

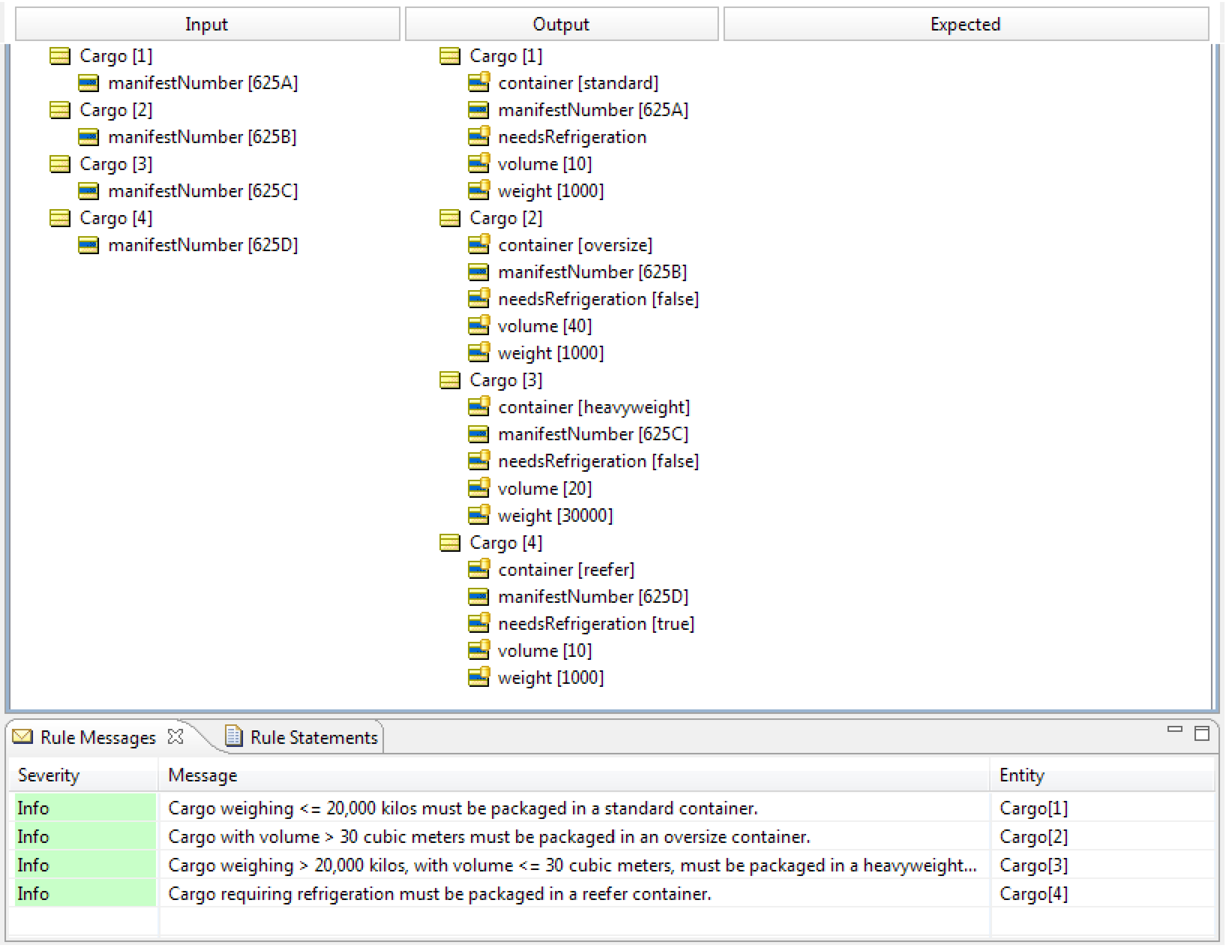
Performing a Test with Multiple Scenarios

One Corticon Studio Testsheet can contain many data scenarios. The following example shows how to perform multiple tests that also update the database.

1. Copy the `Cargo` entity onto the testsheet four times.
2. Delete all the attributes except each `manifestNumber`.
3. Run all tests.

The results show that the additional attributes were retrieved, and that the container type was decided:

Figure 46: Read/Update Testsheet that Retrieved Missing Attributes and Every Record's Values



Input

- Cargo [1]
  - manifestNumber [625A]
- Cargo [2]
  - manifestNumber [625B]
- Cargo [3]
  - manifestNumber [625C]
- Cargo [4]
  - manifestNumber [625D]

Output

- Cargo [1]
  - container [standard]
  - manifestNumber [625A]
  - needsRefrigeration
  - volume [10]
  - weight [1000]
- Cargo [2]
  - container [oversize]
  - manifestNumber [625B]
  - needsRefrigeration [false]
  - volume [40]
  - weight [1000]
- Cargo [3]
  - container [heavyweight]
  - manifestNumber [625C]
  - needsRefrigeration [false]
  - volume [20]
  - weight [30000]
- Cargo [4]
  - container [reefer]
  - manifestNumber [625D]
  - needsRefrigeration [true]
  - volume [10]
  - weight [1000]

Expected

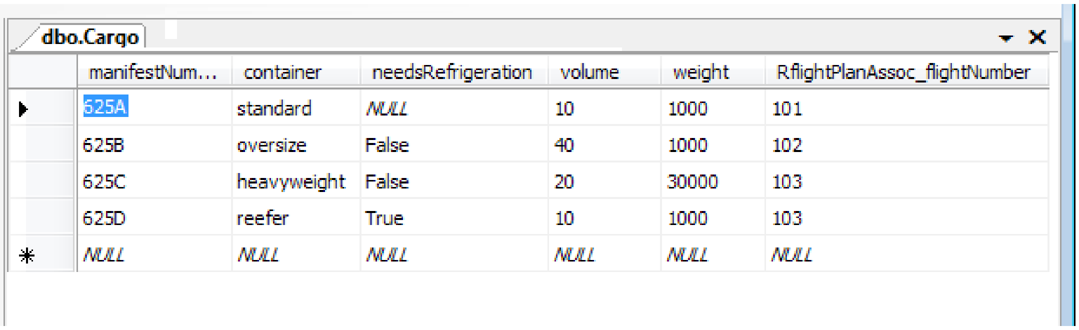
Severity	Message	Entity
Info	Cargo weighing <= 20,000 kilos must be packaged in a standard container.	Cargo[1]
Info	Cargo with volume > 30 cubic meters must be packaged in an oversize container.	Cargo[2]
Info	Cargo weighing > 20,000 kilos, with volume <= 30 cubic meters, must be packaged in a heavyweight...	Cargo[3]
Info	Cargo requiring refrigeration must be packaged in a reefer container.	Cargo[4]

In the Microsoft SQL Server Management Studio, click **Refresh**.

Expand the tree to **Databases: Cargo : Tables**, right-click on **Cargo**, and then choose **Edit Top 200 Rows**.

The records in the `Cargo` table show that all the `container` values were updated, as shown:

Figure 47: Data in the `Cargo` table after Read/Update of All Records



	manifestNum...	container	needsRefrigeration	volume	weight	RflightPlanAssoc_flightNumber
▶	625A	standard	NULL	10	1000	101
	625B	oversize	False	40	1000	102
	625C	heavyweight	False	20	30000	103
	625D	reefer	True	10	1000	103
*	NULL	NULL	NULL	NULL	NULL	NULL

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Importing an attribute's possible values from database tables

Your database connection can also provide designers and testers of Rulesheets and Ruletests with lists of possible values, also known as *enumerations*. While these lists can be created and maintained by hand on the Custom Data Types tab of a Vocabulary, you can retrieve lists from the connected database.

Consider the general behavior of enumerations, especially when retrieving labels and values from a database:

- There can be only one instance of any label and any value in the list, whether created manually or imported. An exception will make the Vocabulary invalid. The database retrieval will work as expected but you will have to groom the results to make the lists valid. You can get optimal results when your database source prevents duplicates in the table columns you are using for your values or label-value pairs.
- If you chose a label in a Rulesheet and that label is no longer available after an update, an error will occur. Any Rulesheet expressions that refer to the defunct label will be flagged as invalid. You must update the Rulesheet expressions to correct the problem.
- If you chose a label in a Rulesheet and that label takes on a different value after an update, the current value is what is evaluated.
- The value assigned - whether directly or as the label's value - at the time of deployment does not change thereafter on the server.

As you will see as we create some examples, it is good practice to ensure that the data types of the retrieved values in the database are consistent with the Custom Data Type, and then extend the corresponding base data value in the attribute.

Procedures

The steps to implement custom data types retrieved from a database are, in summary, as follows:

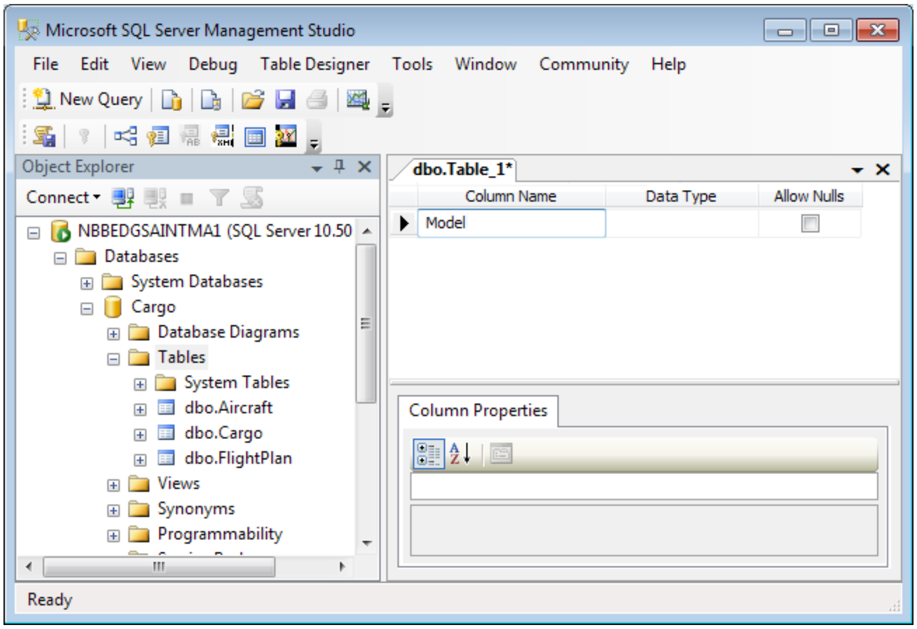
- A - Create or locate the database table and columns you want to retrieve.
- B - Verify the database connectivity, and then import its metadata.
- C - Define the Custom Data Type lookup information.
- D - Import the enumeration elements.
- E - Check the lists for duplicates.
- F - Set the Data Type of appropriate attributes to the Custom Data Type.
- G - Verify that the list functions correctly.

A - Create or locate the database table and columns you want to retrieve.

Note: This step uses the procedures detailed in Populating the database on page 47 when we set up the database.

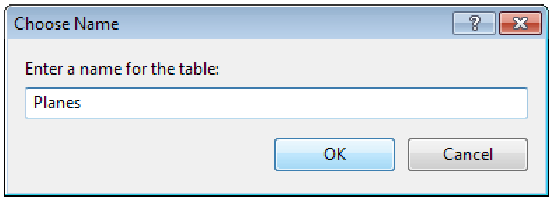
Continuing with our `Cargo` database in SQL Server, we'll add two tables to demonstrate both value-only and label+value enumerations:

1. Start the SQL Server Management Studio, and then expand the tree for **Databases : Cargo : Tables**. Right-click on **Tables** and choose **New Table**. Enter `Model` as the only column name, as shown:



Column Name	Data Type	Allow Nulls
Model		□

2. Choose the menu command **File > Save Table_1**, enter the name `Planes`, and then click **OK**.

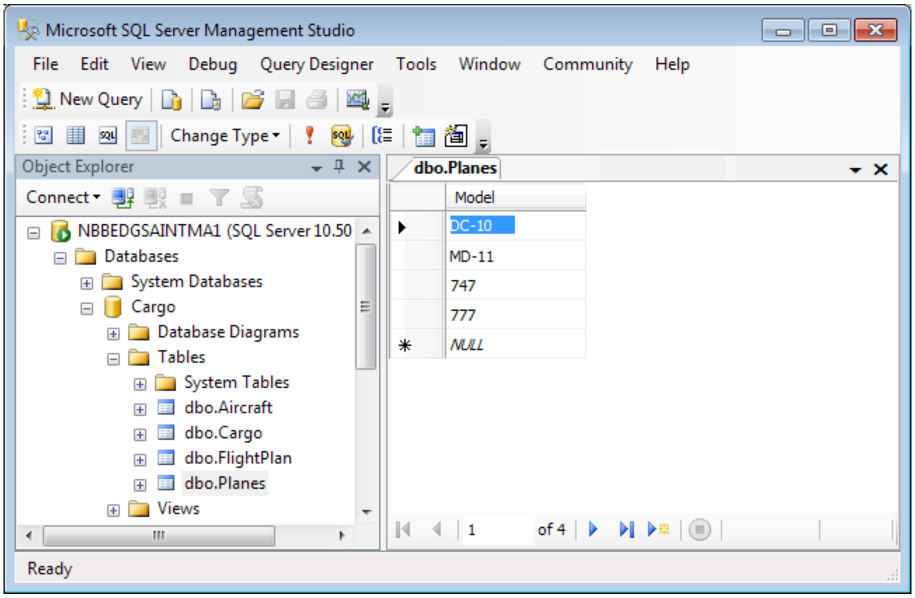


Enter a name for the table: Planes

3. Create another table, now with two columns named `planeCarrier` and `planeID`, saving it as `Carrier`.
4. Click **New Query**, copy/paste the following text, and then click **Execute**.

```
INSERT INTO Cargo.dbo.Planes (Model) VALUES ('DC-10');
INSERT INTO Cargo.dbo.Planes (Model) VALUES ('MD-11');
INSERT INTO Cargo.dbo.Planes (Model) VALUES ('747');
INSERT INTO Cargo.dbo.Planes (Model) VALUES ('777');
INSERT INTO Cargo.dbo.Carrier (planeCarrier,planeID) VALUES ('UPS','N1001');
INSERT INTO Cargo.dbo.Carrier (planeCarrier,planeID) VALUES ('FedEx','N1002');
INSERT INTO Cargo.dbo.Carrier (planeCarrier,planeID) VALUES ('DHL','N1003');
INSERT INTO Cargo.dbo.Carrier (planeCarrier,planeID) VALUES
('GreatWall','N1004');
INSERT INTO Cargo.dbo.Carrier (planeCarrier,planeID) VALUES
('Heavylift','N1005');
```

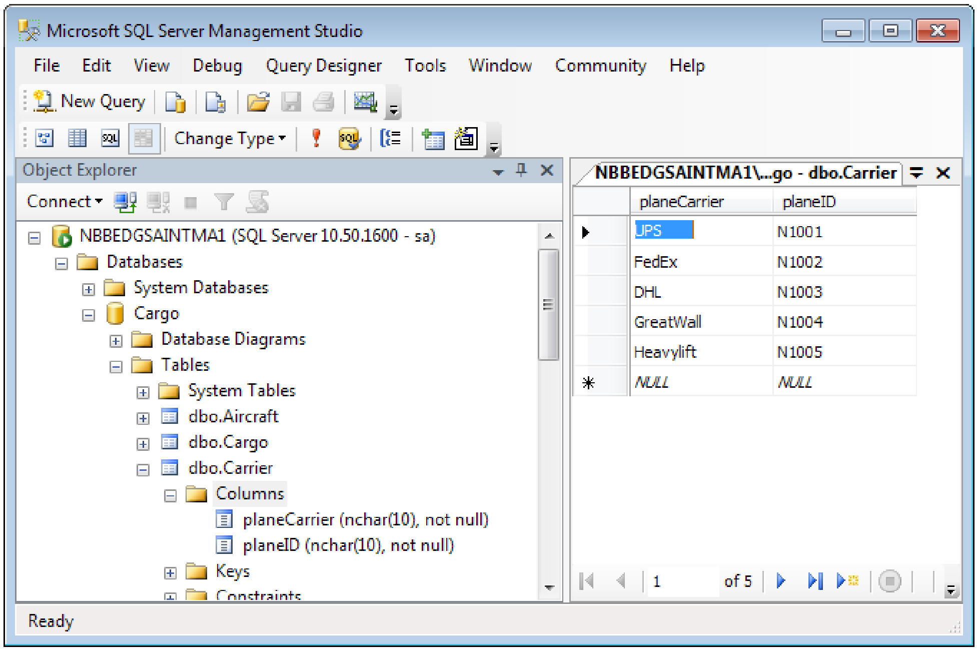
5. In the tree, right-click on **dbo.Planes**, and then choose **Edit Top 200 Rows**.



Model
DC-10
MD-11
747
777
NULL

The **Planes** data is as we intended. It is ready for our use in the Corticon Studio.

6. Similarly, right-click on **dbo.Carrier**, and then choose **Edit Top 200 Rows**.


Microsoft SQL Server Management Studio
File Edit View Debug Query Designer Tools Window Community Help
New Query
Change Type
Object Explorer
Connect
NBBEDGSAINTMA1 (SQL Server 10.50.1600 - sa)
Databases
System Databases
Cargo
Database Diagrams
Tables
System Tables
dbo.Aircraft
dbo.Cargo
dbo.Carrier
Columns
planeCarrier (nchar(10), not null)
planeID (nchar(10), not null)
Keys
Constraints
NBBEDGSAINTMA1\...go - dbo.Carrier
1 of 5
Ready

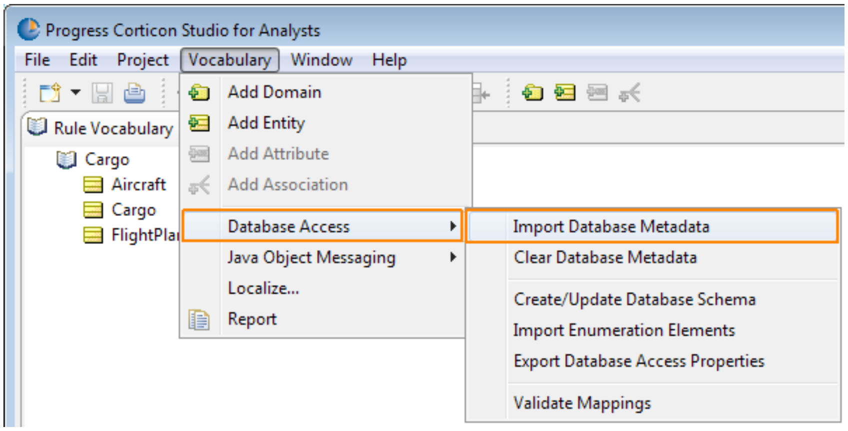
planeCarrier	planeID
UPS	N1001
FedEx	N1002
DHL	N1003
GreatWall	N1004
Heavylift	N1005
NULL	NULL

The **Carrier** data is as we intended. It is ready for our use in the Corticon Studio.

B - Verify the database connectivity, and then import its metadata.

We want to bring the information about the table definitions into the Studio:

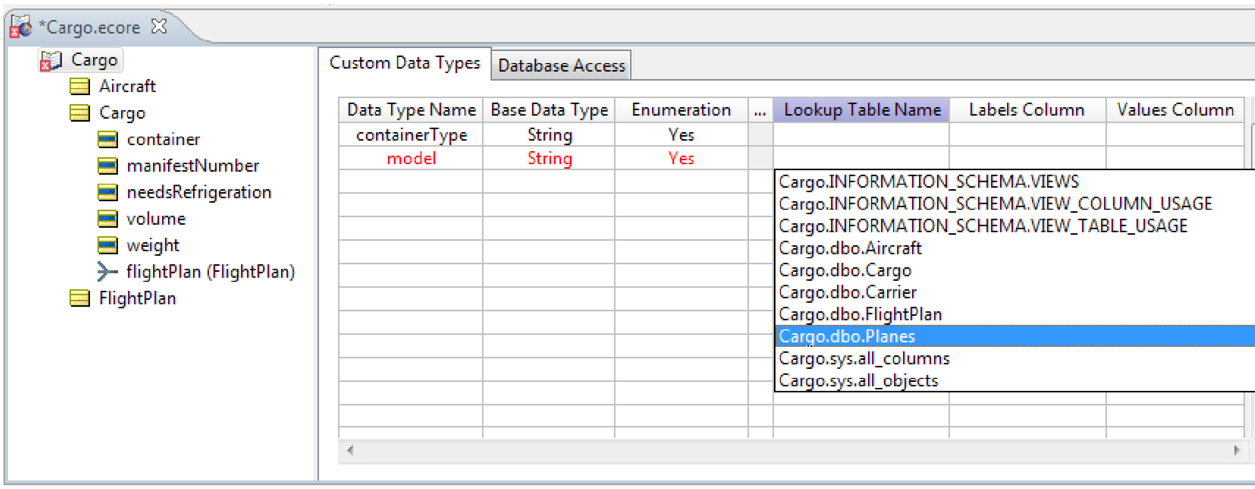
1. In Corticon Studio, confirm that you have the same good connection you achieved in Connecting a Vocabulary to a database on page 31
2. With `Cargo.ecore` open its editor, choose the menu command **Database Access > Import Database Metadata**, as shown:



C - Define the Custom Data Type lookup information.

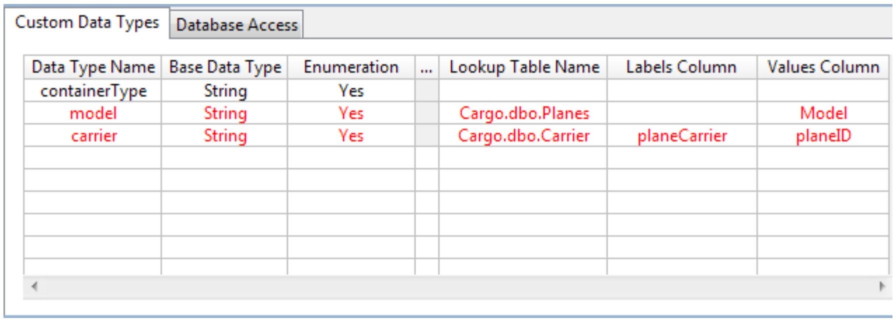
We now can specify how we want to use the data and then bind it to the appropriate database table and columns:

1. Click on `Cargo` to get to its top level, and then select the **Custom Data Types** tab.
2. Click on the next empty row, enter `model` as the Data Type Name, select `String` as the Data Type, and `Yes` as the Enumeration.
3. Click on the Lookup column in the row to expose its dropdown, and then choose `Cargo.dbo.Planes` that we imported in the database metadata.



Data Type Name	Base Data Type	Enumeration	...	Lookup Table Name	Labels Column	Values Column
containerType	String	Yes				
model	String	Yes				

4. We are using a values-only lookup, click on the row's Values Column to select its one database column, `Model`:
5. For the other table, click on the next empty row, enter `carrier` as the Data Type Name, select `String` as the Data Type, and `Yes` as the Enumeration.
6. Click on the Lookup Table Name in the row to expose its dropdown, and then choose `Cargo.dbo.Carrier` that we imported in the database metadata.
7. We are using a label-values lookup, so click on the row's Labels Column to select planeCarrier, and then in the Values Column to select `planeID`:



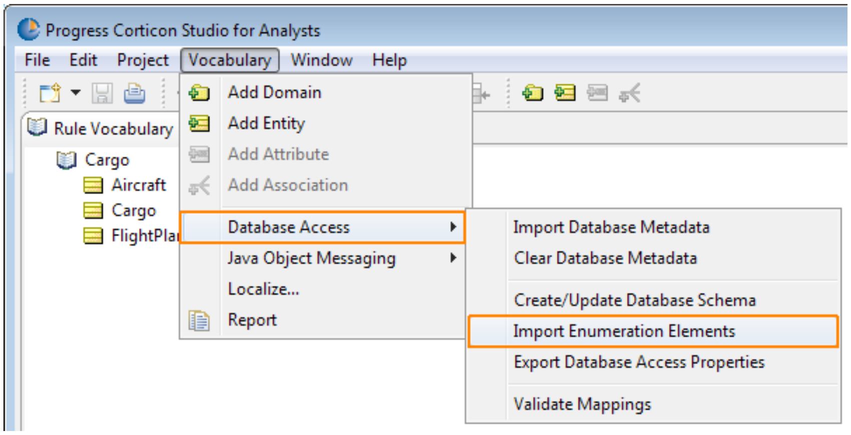
Data Type Name	Base Data Type	Enumeration	...	Lookup Table Name	Labels Column	Values Column
containerType	String	Yes				
model	String	Yes		Cargo.dbo.Planes		Model
carrier	String	Yes		Cargo.dbo.Carrier	planeCarrier	planeID

Everything we have entered is red! That's because Studio has no data for either of these enumeration sets.

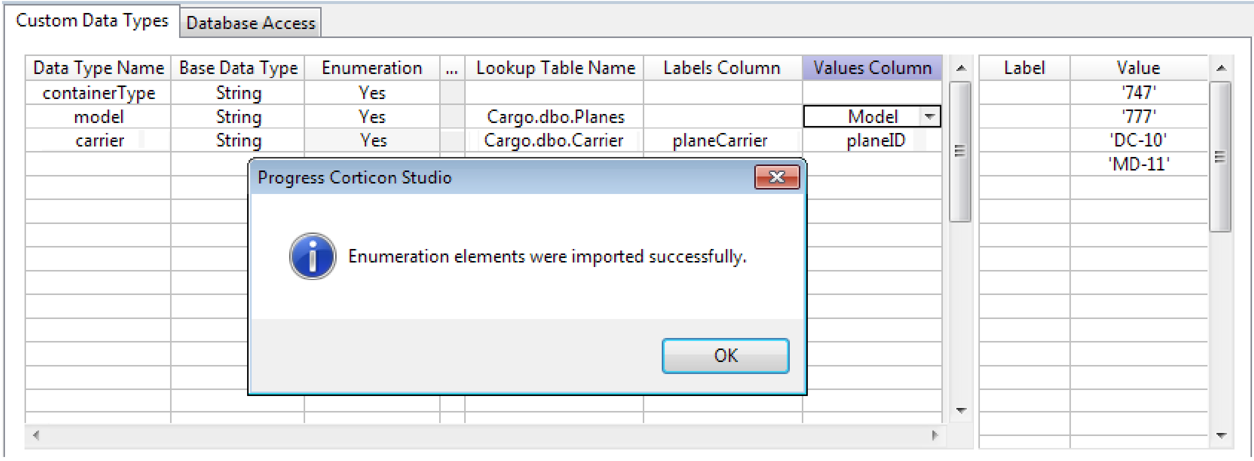
D - Import the enumeration elements.

Once you have defined the database table and columns you want, you can retrieve the data:

1. Choose the menu command **Database Access > Import Enumeration Elements**, as shown:



2. The retrieved values are displayed in the associated Labels and Values window to the right, as shown for the `model`:



Data Type Name	Base Data Type	Enumeration	...	Lookup Table Name	Labels Column	Values Column
containerType	String	Yes				
model	String	Yes		Cargo.dbo.Planes		Model
carrier	String	Yes		Cargo.dbo.Carrier	planeCarrier	planeID

Label	Value
	'747'
	'777'
	'DC-10'
	'MD-11'

Progress Corticon Studio

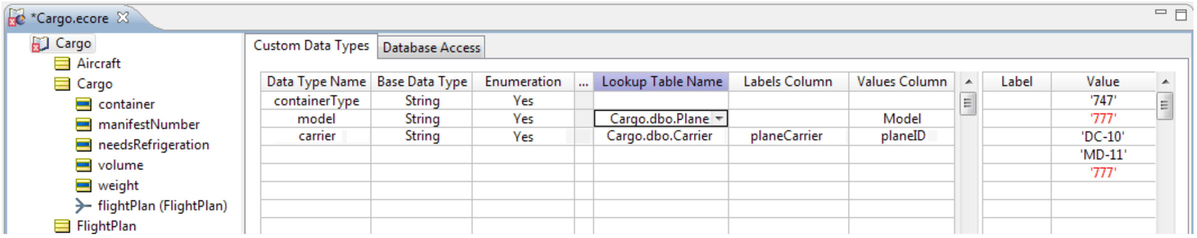
Enumeration elements were imported successfully.

OK

E - Check the lists for duplicates.

Unless you enforced uniqueness in the source database. To demonstrate what happens, we'll add an existing value to the `model` enumerations.

1. In the Values retrieved column, enter a new value that is already there, such as `777`, as shown:



Data Type Name	Base Data Type	Enumeration	...	Lookup Table Name	Labels Column	Values Column
containerType	String	Yes				
model	String	Yes		Cargo.dbo.Plane		Model
carrier	String	Yes		Cargo.dbo.Carrier	planeCarrier	planeID

Label	Value
	'747'
	'777'
	'DC-10'
	'MD-11'
	'777'

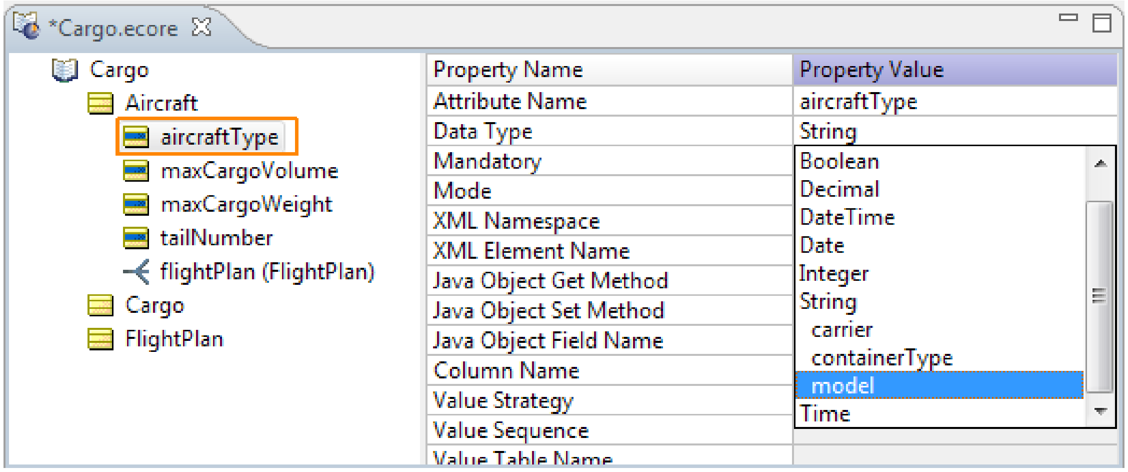
The duplicates are both highlighted in red, and the `Cargo.ecore` file is marked as being in an error state.

2. Remove the line (or change it to something unique) and the Vocabulary is again valid.

F - Set the Data Type of appropriate attributes to the Custom Data Type.

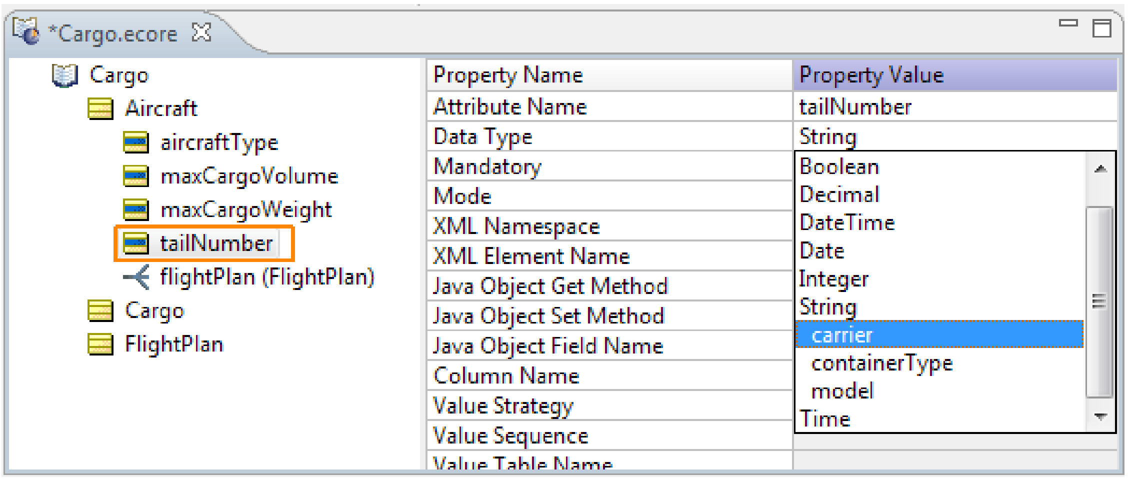
With our enumeration lists imported from the database and verified as free of duplicate labels or values, we can link them to the attributes that will use them:

1. Aircraft.aircraftType:



Property Name	Property Value
Attribute Name	aircraftType
Data Type	String
Mandatory	
Mode	
XML Namespace	
XML Element Name	
Java Object Get Method	
Java Object Set Method	
Java Object Field Name	
Column Name	
Value Strategy	
Value Sequence	
Value Table Name	

2. Aircraft.tailNumber:

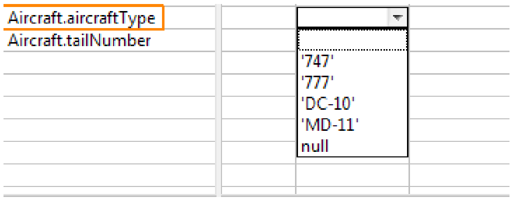


Property Name	Property Value
Attribute Name	tailNumber
Data Type	String
Mandatory	
Mode	
XML Namespace	
XML Element Name	
Java Object Get Method	
Java Object Set Method	
Java Object Field Name	
Column Name	
Value Strategy	
Value Sequence	
Value Table Name	

G - Verify that the list functions correctly.

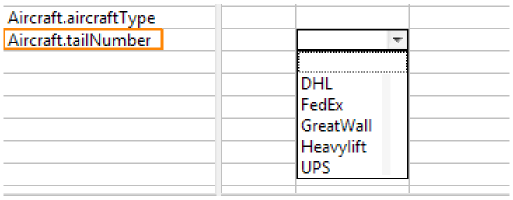
To verify that the lists perform as expected, use them in a Rulesheet or Ruletest :

1. In a Rulesheet Actions area, enter two new lines, one with the attribute syntax `Aircraft.aircraftType` and the other with `Aircraft.tailNumber`, as shown:
2. Click on the `aircraftType` where it intersects with column 1, as shown:


Aircraft.aircraftType
Aircraft.tailNumber

The pulldown displays our imported values, as well as blank and `null`.

3. Click on the `tailNumber` where it intersects with column 1, as shown:



The pulldown displays our imported label, as well as blank. The label is a place holder for its value.

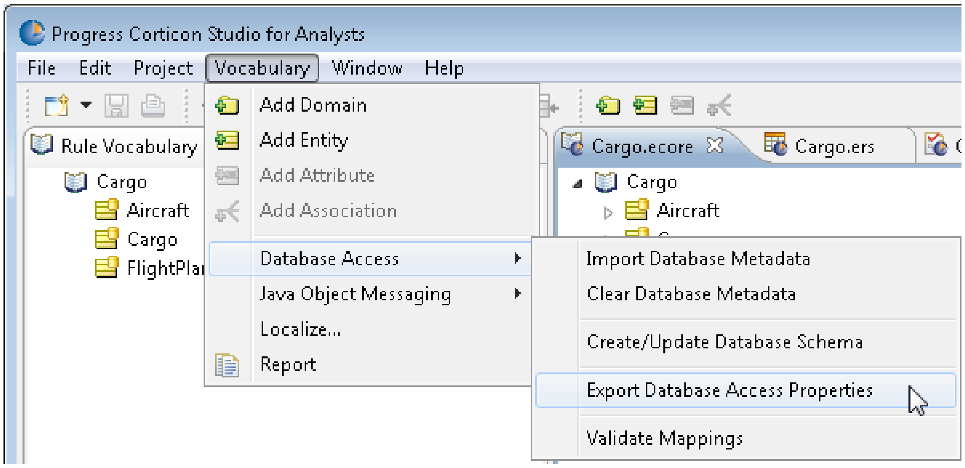
Note: For more information about enumerations and retrieving values from databases, see:

- *"Enumerated values" in the Quick Reference Guide.*
- *"Enumerations retrieved from a database" in the Rule Modeling Guide*

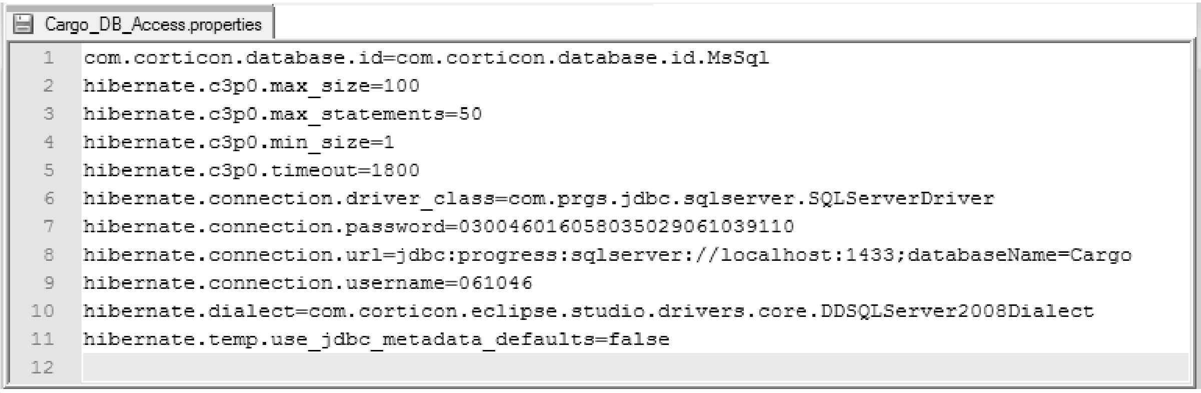
16

Creating a database access properties file

As a last step in the Studio before we move to the Deployment Console and the Corticon Server, we'll generate the database access properties from our Vocabulary. Take a moment to test the connection to ensure that the properties are correct. Then, all we need to do is choose the Vocabulary and then select **Vocabulary > Database Access > Export Database Access Properties**, as shown:



You can specify a preferred name and location for the file, although colocating it within its related project folder is a good idea. The generated properties file looks like this:



```
com.corticon.database.id=com.corticon.database.id.MsSql
hibernate.c3p0.max_size=100
hibernate.c3p0.max_statements=50
hibernate.c3p0.min_size=1
hibernate.c3p0.timeout=1800
hibernate.connection.driver_class=com.prgs.jdbc.sqlserver.SQLServerDriver
hibernate.connection.password=030046016058035029061039110
hibernate.connection.url=jdbc:progress:sqlserver://localhost:1433;databaseName=Cargo
hibernate.connection.username=061046
hibernate.dialect=com.corticon.eclipse.studio.drivers.core.DDSQLServer2008Dialect
hibernate.temp.use_jdbc_metadata_defaults=false

```

Notice that the username and password values are very different from our credentials. These values were encrypted when the database access file was created, and will be decrypted when they are implemented in a decision service.

You shouldn't have to edit this file but if the Server is not colocated with the Studio, you see why it was a good idea to use the explicit host identifier rather than `localhost`.

17

Using database access in Corticon Server

Note:

This portion of the EDC Tutorial expects that you have completed the *Corticon Server Tutorial: Deploying Web Services*. We will use the same methods for deploying a Decision Service, invoking it with test data, and inspecting the results as we did in that guide. If you have not completed that tutorial, we strongly recommend that you do so before continuing in this EDC deployment tutorial.

The tasks in this chapter include:

- A - Registering a license that enables EDC.
- B - Accessing our `Cargo` Ruleflow file to define its database access mode and properties in a Deployment Descriptor file.
- C - Starting Tomcat and monitoring the deployed Decision Service.
- D - Adjust the data in our database so we recreate our Studio test on a Server.
- E - Creating a Ruletest that uses the remote decision service.
- F - Running the test.
- G - Observing the results.

A - Installing your EDC-enabled Corticon Server license

Corticon 5.3.2 servers require a license that enables EDC to perform the tasks in this chapter. If you need to acquire a license, contact Progress Corticon Technical Support or your Progress Software representative.

Once you obtain a license file, you must replace the existing licenses in your Corticon Server installation.

To install an EDC-enabled license for Corticon Java Server:

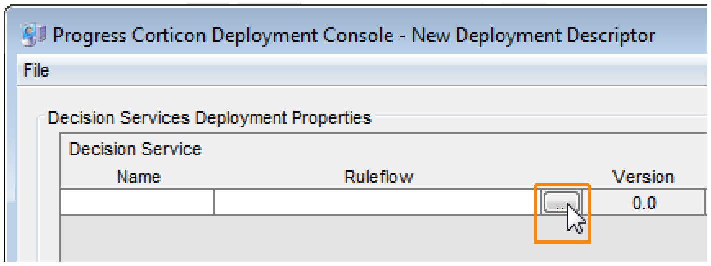
1. Copy your license JAR by its default name, `CcLicense.jar`.
2. Navigate to the installation's `Server\lib` directory to paste the file and overwrite the existing file in that location.
3. Navigate to the installation's `Server\Tomcat\webapps\axis\WEB-INF\lib` directory to paste the file and overwrite the existing file in that location.

Note: For .NET Server, the locations are `Server .NET\samples\lib` and `webservice\lib`

B - Creating a Deployment Descriptor file from the ruleflow

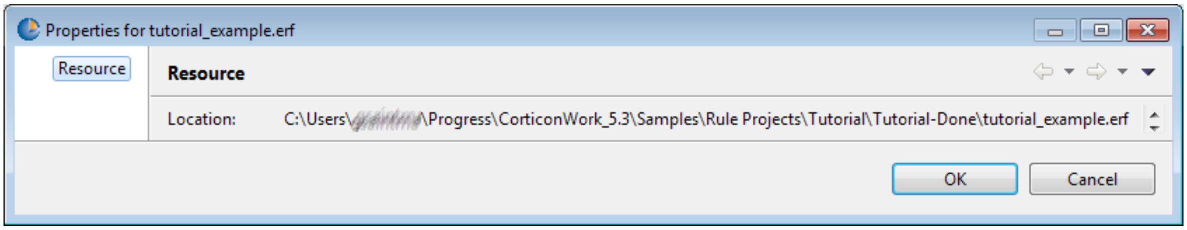
We'll use the Corticon Deployment Console to assemble our ruleflow with database access preferences and properties -- as well as the *location* of its supporting files -- into a Deployment Descriptor (`.cdd`. These dependent files must be the right ones and retained without change in their specified path. (Compiling these files into a Decision Service (`.eds`) would create a package of the dependent files that can be relocated for deployment.) , as follows:

1. Launch the Deployment Console by choosing the **Start** menu command **All Programs > Progress > Corticon 5.3 > Deployment Console**.
2. Click the **Select Ruleflow** button, as shown:


Progress Corticon Deployment Console - New Deployment Descriptor
File
Decision Services Deployment Properties
Decision Service
Name
Ruleflow
Version
...
0.0

3. Navigate to the Ruleflow file `tutorial_example.erf` in the `Cargo` project.

   Note: If you need to verify that you are getting the intended `.erf` file, click on the Ruleflow file you are working on in the Studio's Rule Project Explorer, and then click **Alt+Enter**. The **Properties** file shows its complete path, as in this example:

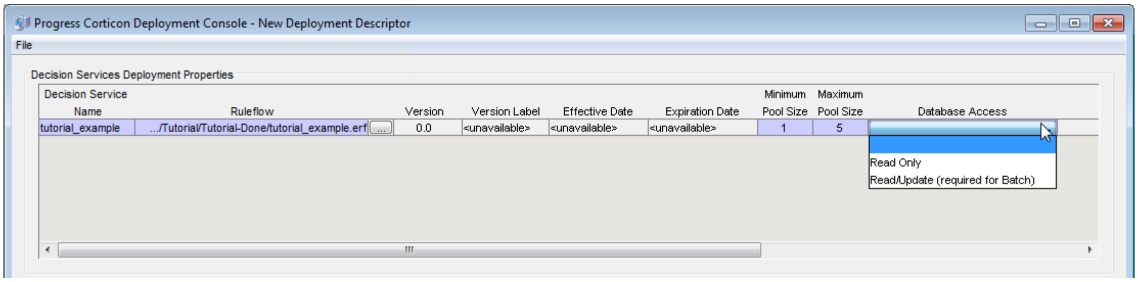


Location: C:\Users\[redacted]\Progress\CorticonWork_5.3\Samples\Rule Projects\Tutorial\Tutorial-Done\tutorial_example.erf

4. Enter or revise the **Name** on the line, especially if you are redeploying and want to differentiate it from a prior Deployment Descriptor.

5. Scroll across the panel, and then click the **Database Access** pulldown for this entry, as shown:

Figure 48: Deployment Console with Database Access Options


Progress Corticon Deployment Console - New Deployment Descriptor
File
Decision Services Deployment Properties

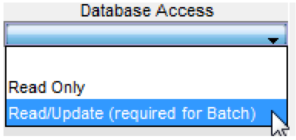
Decision Service Name	Ruleflow	Version	Version Label	Effective Date	Expiration Date	Minimum Pool Size	Maximum Pool Size	Database Access
tutorial_example	.../Tutorial/Tutorial-Done/tutorial_example.erf	0.0	<unavailable>	<unavailable>	<unavailable>	1	5	

Read Only
Read/Update (required for Batch)

Note: The pulldown is functional only when your Corticon 5.3.2 license enables EDC.

6. Select **Read/Update**.

Figure 49: Database Access Read/Update Mode Selected



7. Select an option for the **Entities Returned** to specify whether the Corticon Server response message includes *all* data used by the rules including data retrieved from a database (**All Instances**), or *only* data provided in the request and created by the rules themselves (**Incoming/New Instances**). For this example, select **All Instances**.

8. Click the **Select Database Access Properties** button, highlighted in the following screen, to locate and select the properties file you created.

   The required information for database access is now complete for this Deployment Descriptor file.

9. Choose **File > Save.** Save the `tutorial_example.cdd` file in the `[SERVER_WORK_DIR]\cdd` directory as that is where Corticon Server looks for `.cdd` files when it starts up.

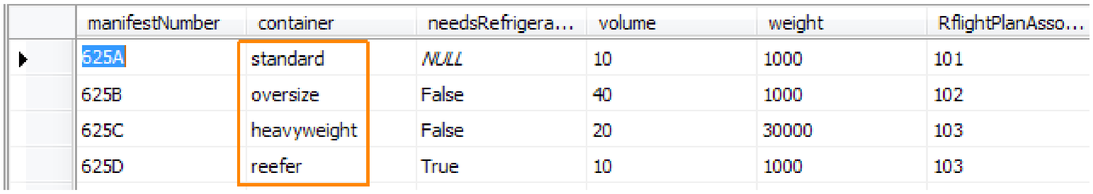
10. Choose **File > Exit** to close the Corticon Deployment Console.

C - Starting Tomcat and the Corticon web service

Choose **Start > All Programs > Progress > Corticon 5.3 > Corticon Server > Local Server (Tomcat) > Start Tomcat**. (During Corticon Server startup, our `.cdd` file will load the `tutorial_example` Decision Service in **Read/Update** database access mode.)

D - Resetting our sample data in the database

In the Read/Update test, our Ruletest updated the `Container` values in the Cargo table:

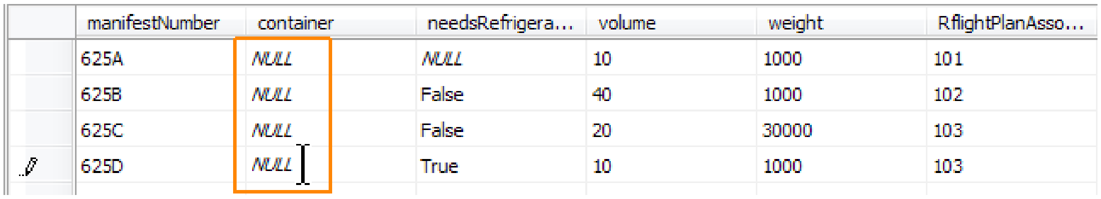


manifestNumber	container	needsRefrigera...	volume	weight	RflightPlanAsso...
625A	standard	NULL	10	1000	101
625B	oversize	False	40	1000	102
625C	heavyweight	False	20	30000	103
625D	reefer	True	10	1000	103

As we want to perform the identical test in Corticon Server, let's remove the updated data.

In the SQL Server Management Studio, expand the tree to **Databases : Cargo : Tables**, and then right-click on the `Cargo` table to choose **Edit Top 200 Rows** in the tab area.

In the `Container` column of the `Cargo` table, click on a line's container value, and then type `NULL`. (It is important that you type all capital letters.) If you type it correctly, the value displays in italics. Do the same for all the `Container` values, as shown:



	manifestNumber	container	needsRefrigera...	volume	weight	RflightPlanAsso...
	625A	*NULL*	*NULL*	10	1000	101
	625B	*NULL*	False	40	1000	102
	625C	*NULL*	False	20	30000	103
	625D	*NULL*	True	10	1000	103

E - Creating a New Test in Studio

Even though we are using Studio to run the test, we are using Studio's *remote* testing feature, which executes a Decision Service on Corticon Server ("remote"), not a Rulesheet open in Studio ("local"). To keep this distinction clear, we will **not** open `tutorial_example.erf` in Studio – it is not necessary since we are actually testing the Decision Service running on Corticon Server. This means we do not need to worry about the database access settings on the Vocabulary -- they only apply to tests of Rulesheets open in Studio.

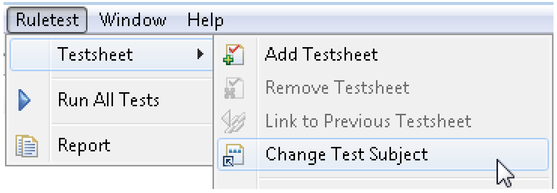
Note:

When Ruletest Editor operates against a remote decision service, database mode menu items and database mode icon decorations are not displayed. This is because these options have no effect on the remote decision service.

To create the test:

1. The database access settings for the Decision Service are specified in the Deployment Descriptor file (`.cdd`) loaded by the Corticon Server when it started up on Apache so you do not need to touch that in the Vocabulary.
2. In Corticon Studio, open `Cargo.ecore` and then, *without opening any Rulesheets*, choose **New > Ruletest**.
3. Select the menu command **Ruletest > Testsheet > Change Test Subject**, as shown:

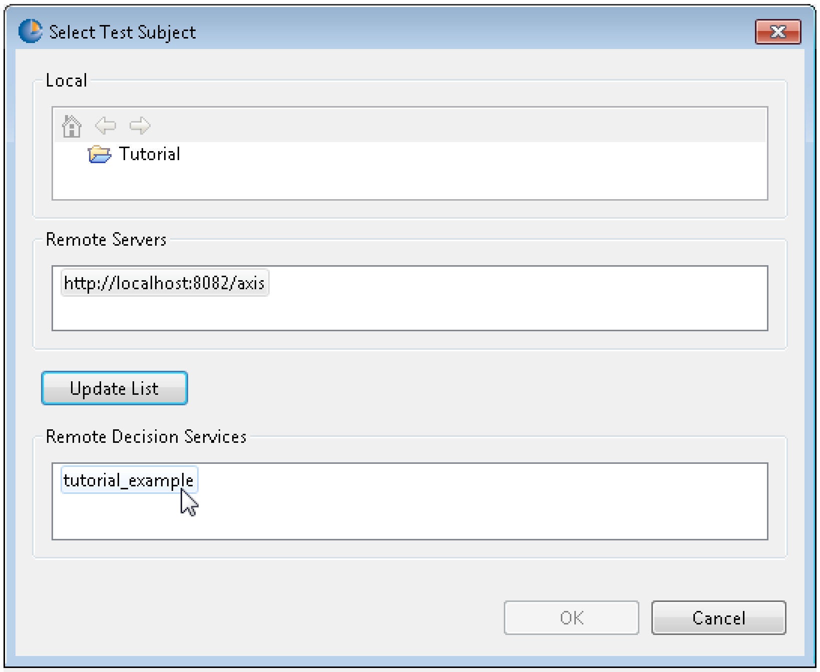
   Figure 50: Opening the Select Test Subject dialog

4. In the dialog box, click on the line item in the **Remote Servers** section, `http://localhost:8082/axis`, and then click **Update List**.

5. Select the name you entered for the Ruleflow line (not the saved file name). Here, our example accepted the default, `tutorial_example`, as shown:

Figure 51: Selecting a remote decision service



Select Test Subject

Local: Tutorial

Remote Servers: http://localhost:8082/axis

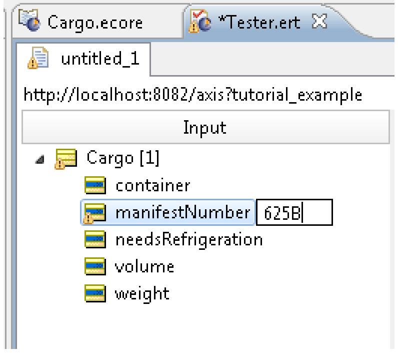
Remote Decision Services: tutorial_example

6. Click **OK**.

   Now let's set up the test itself.

7. Drag a `Cargo` entity from the Vocabulary, and then enter sample data for `manifestNumber`. Since we are trying to test a remote Decision Service connected to an external database using the Application identity strategy, we need to supply an existing primary key, `manifestNumber`, that is in our tutorial database. Click on `mainfestNumber` in the **Input** column to open its input area, and then enter the `625B`.

Figure 52: Sample Data in a Studio Remote Test



http://localhost:8082/axis?tutorial_example

Input

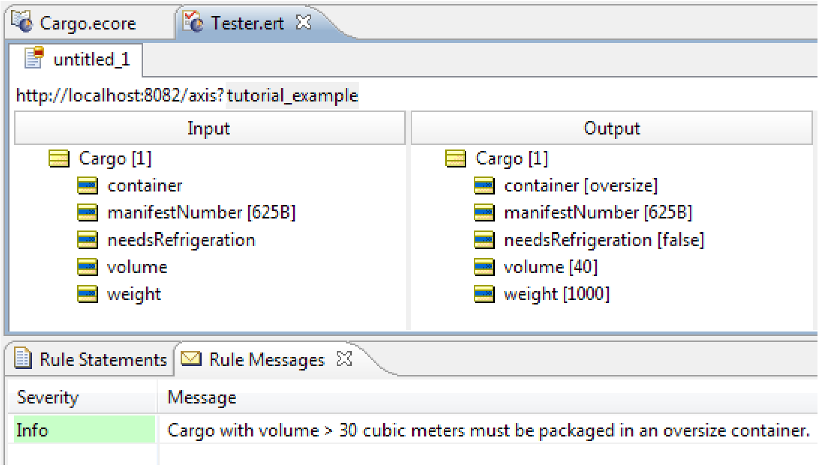
- Cargo [1]
  - container
  - manifestNumber 625B
  - needsRefrigeration
  - volume
  - weight

F - Running the Remote Server Test

Select the menu command **Ruletest > Testsheet > Run Test**.

We see a Results Ruletest similar to this:

Figure 53: Response from Remote Decision Service



http://localhost:8082/axis?tutorial_example

Input	Output
Cargo [1]	Cargo [1]
container	container [oversize]
manifestNumber [625B]	manifestNumber [625B]
needsRefrigeration	needsRefrigeration [false]
volume	volume [40]
weight	weight [1000]

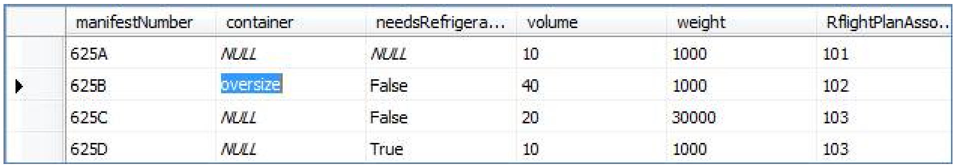
Severity	Message
Info	Cargo with volume > 30 cubic meters must be packaged in an oversize container.

Note: The `Cargo` database has been accessed, but it was Corticon Server that accessed it and retrieved the data it needed, not Corticon Studio.

G - Observing the Results in the Database

Return to SQL Server and view the **Content** of the `Cargo` table. Refresh the **Content** if necessary to see the changes. We should see the second row has now been updated to `container`, as shown:

Figure 54: Updated Container data in External Database



	manifestNumber	container	needsRefrigera...	volume	weight	RflightPlanAsso..
	625A	NULL	NULL	10	1000	101
▶	625B	oversize	False	40	1000	102
	625C	NULL	False	20	30000	103
	625D	NULL	True	10	1000	103

This indicates that Corticon Server successfully accessed the `Cargo` database in **Read/Update** mode during Decision Service execution.

18

Continuing to learn about Corticon's Enterprise Data Connector

Congratulations! You have completed the tutorial on the Enterprise Data Connector.

To continue learning about EDC, see these documentation locations:

- *Writing Rules to access external data* chapter in the *Rule Modeling Guide* extends the tutorial into scope, validation, collections, and filters.
- *Relational database concepts in the Enterprise Data Connector (EDC)* in the *Integration and Deployment Guide* discusses identity strategies, key assignments, catalogs and schemas, database views, table names and dependencies, inferred values, and join expressions.
- *Implementing EDC* in the *Integration and Deployment Guide* discusses the mappings and validations in a Corticon connection to an RDBMS.
- *Deploying Corticon Ruleflows* in the *Integration and Deployment Guide* describes the Deployment Console parameters for Deployment Descriptors and compiled Decision services that use EDC.
- *Vocabularies: Populating a New Vocabulary: Adding nodes to the Vocabulary tree view* in the *Quick Reference Guide* extends its subtopics to detail all the available fields for Entities, Attributes, and Associations.

A

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