Version 1

TALON COMPUTING

Rule Engine Express

User Manual

Talon Computing

RULE ENGINE EXPRESS USER MANUAL

http://www.taloncomputing.com

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INTRODUCTION

Welcome to the Talon Computing Rule Engine Express (REX) user manual. This manual will introduce step by step to the engine, from installation to how to use it effectively.

Why you should use REX

REX is a **lightweight** software utility that will help you to decouple your business rules from your application. By making use of an independent tool you are able to focus your software on providing the engine with a set of inputs and then writing code to handle very specific outcomes.

The advantage of this is **decoupling**. Your software focuses less on how decisions are made for certain business rules and rather concentrates on handling the desired outcome or decision. This frees the developer from hard coding business rules into the code. This **increases maintainability** and **productivity** in the long run. If new logic needs to be added or changed it can be done without necessarily having to make any code changes, thereby **reducing defects** from being introduced into the application.

Requirements

Currently the only system requirements that REX needs is **Microsoft .NET 4.5**. When you start using REX in your application, you need to simply incorporate the core Dynamic Link Libraries (DLL's) into your application. This will be detailed in later sections.

LICENSING

Model

Talon Computing licenses REX on an as-required basis; meaning that while you are busy with the development of your application you may need to build and edit your rules. If your business rules stay relatively stable there may not be a need to have a license. In the event that your business rules do change at some point and you need to maintain or make changes to your business rules, you would only need to purchase a license for the minimum period you require.

Redistribution

Talon Computing grants you the rights to re-distribute the REX DLL's with your application in unmodified form. When redistributing your application, you need to distribute your license key in your application configuration file also.

INSTALLATION PROCEDURE

In order to use REX, ensure that you have downloaded the latest copy from the Talon Computing website (http://taloncomputing.com). Also ensure that you have purchased the correct license as well. Talon Computing uses PayPal as our secure payment processor.

Download

You can download the latest version of REX by visiting http://taloncomputing.com/downloads/rex.zip.

Purchase License

Once you have downloaded REX we recommend that you purchase a license key for the development time period that you require. You won't be able to execute the application or use REX without a valid license. If you are only trying out REX and would like a *demo* license, complete the next two steps and then follow the procedure for ordering a *demo* license.

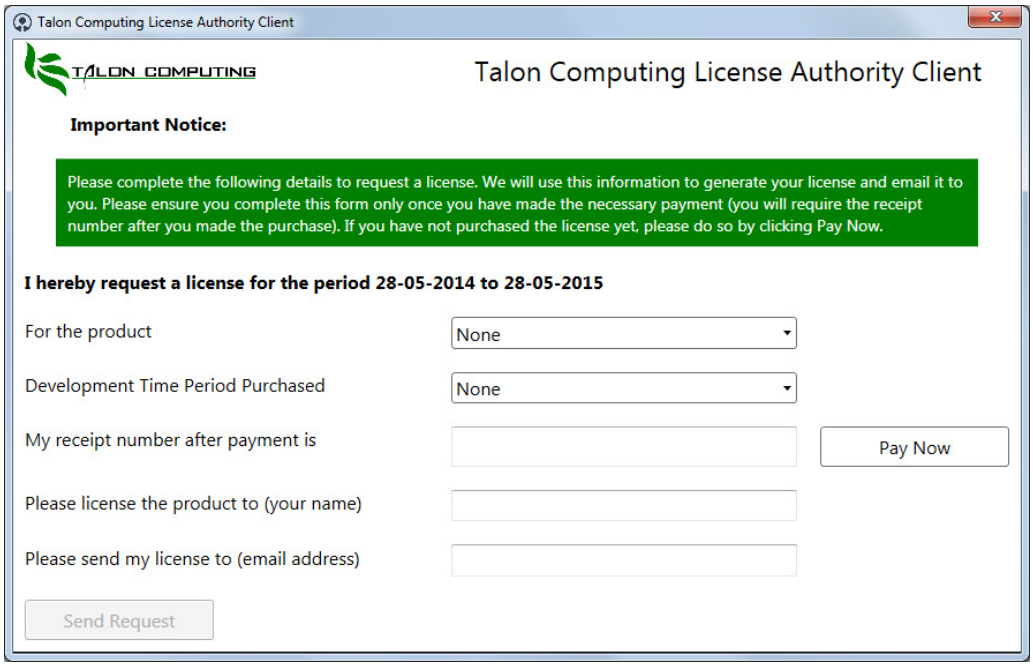
Unzip and install

Once you have downloaded REX, unpack it into a temporary folder and proceed with the installation application. We recommend using all the default settings for the installation process.

Order License Key

Once you have completed the installation procedure, you need to request a license key. If you have purchased a license you still need to complete the process by requesting a key to match your purchase. When your license has expired and you need to request a new license, use the following application to request a new license.

When ordering the license key you need to make use of the application titled: TalonComputing.DesktopApp.LicensingClient.exe.



Step 1: Select the product, in this case REX.

Step 2: Select the development time period purchased. If you are trying the product out, select the *Demo – 1 month development* option.

Step 3: Next provide the receipt number of your purchase. If you are requesting a demo account specify *0* as the receipt number. If you have not purchased a license yet, click on the *Pay Now* button. By clicking the *Pay Now* button, your default browser will be opened and you will be directed to the product page on the Talon Computing website. On the website you need to then select and purchase the appropriate development time period that you require.

Step 4: Next supply your full name as this is your personal license for your machine.

Step 5: Finally specify your email address. This is necessary for us to email your license keys to. Once you have completed all the fields click on the *Send Request* button. You will receive a confirmation message indicating that your request has been successfully submitted to our servers, thus you will require internet access in order to complete the procedure.

Installing Your License

After receiving your license request, we will verify that what you purchased matches that which you are requesting. If there are no discrepancies we will send you your license bundle. In the bundle you will receive three files:

1. rex-{your full name}-{expiry date}.license

   This file contains textual description of your license keys and indicates when your license expires. This file is for your information only.

2. app-rex-{your full name}-{expiry date}.config

   This file contains the application configuration setting you need to include in your app.config or web.config file. This should be incorporated as is, i.e.

   The key:

   ```
   <add key="TalonComputing.License.REX" value="D5E26CAF2C5E2B05D57ED7C755B1BBC3" />
   ```

Should be incorporated into your appSettings section in your app.config or web.config file. This is your redistributable client license.

3. rex--{your full name}-{expiry date}.reg

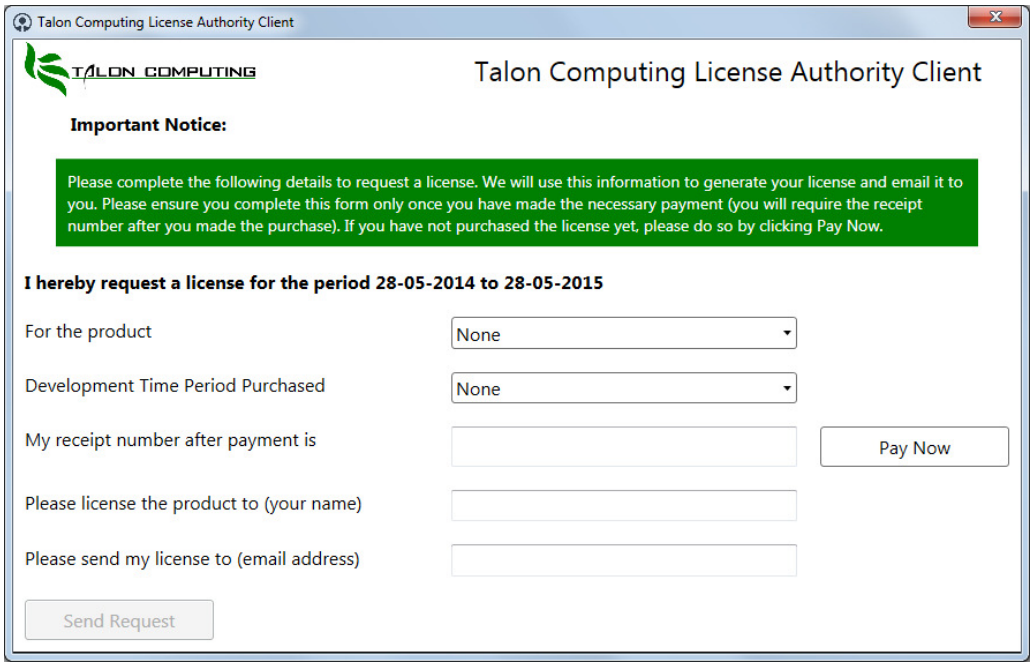
   This file contains your personal development license. This file should be executed to install the necessary settings in your Windows Registry and therefore will require administrator privileges.

APPLICATIONS

The installation of REX results in two applications being installed and accessible from the start menu under: Talon Computing/Talon Computing Rule Engine Express. The applications are the Talon Computing Licensing Client and the Talon Computing Rule Builder. In addition to these applications, the Rule Engine Core files are installed to the location (if you used the default installation paths) *C:\Program Files\Talon Computing\Talon Computing Rule Engine Express\Core*.

Licensing Authority Client

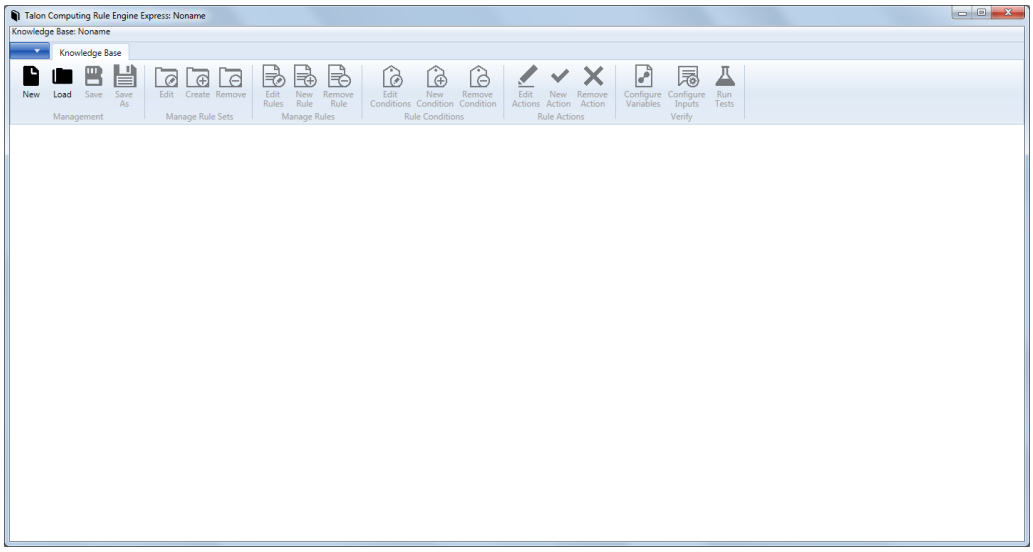
Known as:	Launch TalonComputing.DesktopApp.LicensingClient.exe
Menu Location:	Talon Computing / Talon Computing Rule Engine Express



As mentioned in the Order License Key section, the License Authority Client is used to request a license from Talon Computing. Once we receive the request made by the application we verify your request with your purchase unless you are requesting a demonstration license. **You will only be entitled to one demonstration license.**

Rule Builder

Known as:	Launch TalonComputing.DesktopApp.RuleEngine.exe
Menu Location:	Talon Computing / Talon Computing Rule Engine Express



The rule builder application is responsible for creating and maintaining your knowledge bases.

KNOWLEDGE BASE, RULE SETS AND RULES

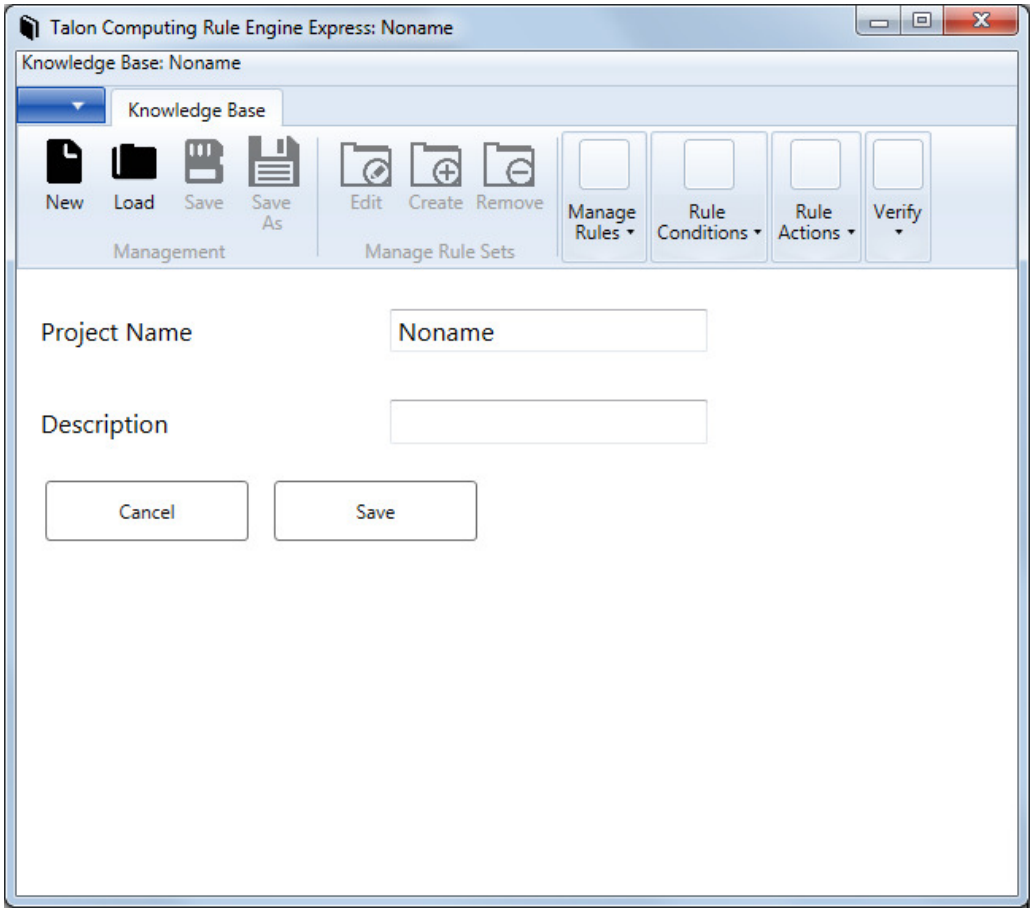
A knowledge base consists of a collection of rule sets. A rule set is a collection of rules. When applying certain rules in your application you will base it off a particular knowledge base rule set combination, i.e. your application uses the rule engine to apply rules from a specific rule set from a specific knowledge base.

Creating a new knowledge base

Step 1: Click on *New* from the menu.

Step 2: Enter your project name and a description.

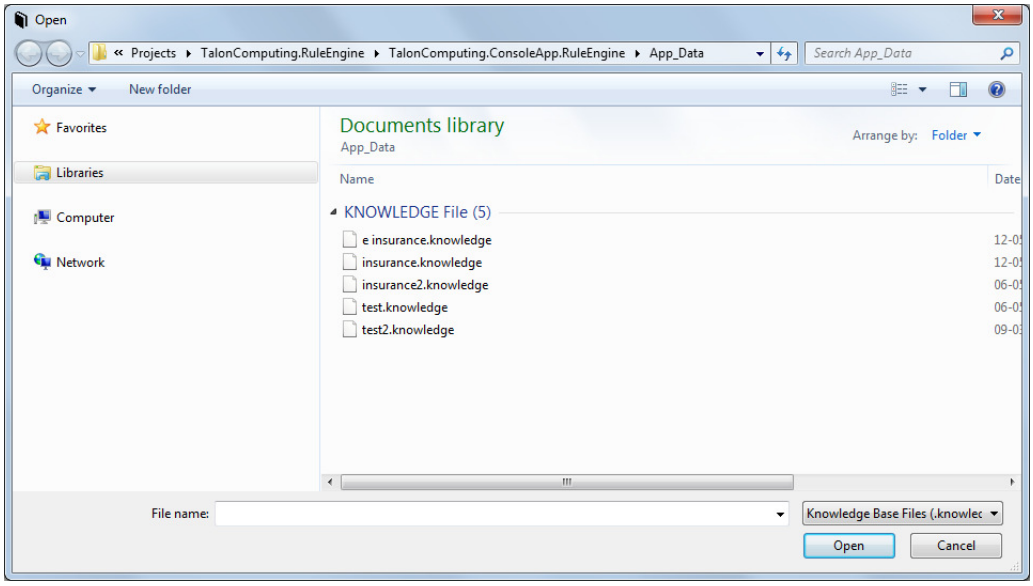
Step 3: Click on *Save.*



Loading an existing knowledge base

Step 1: Click on *Load* from the *Management* menu section.

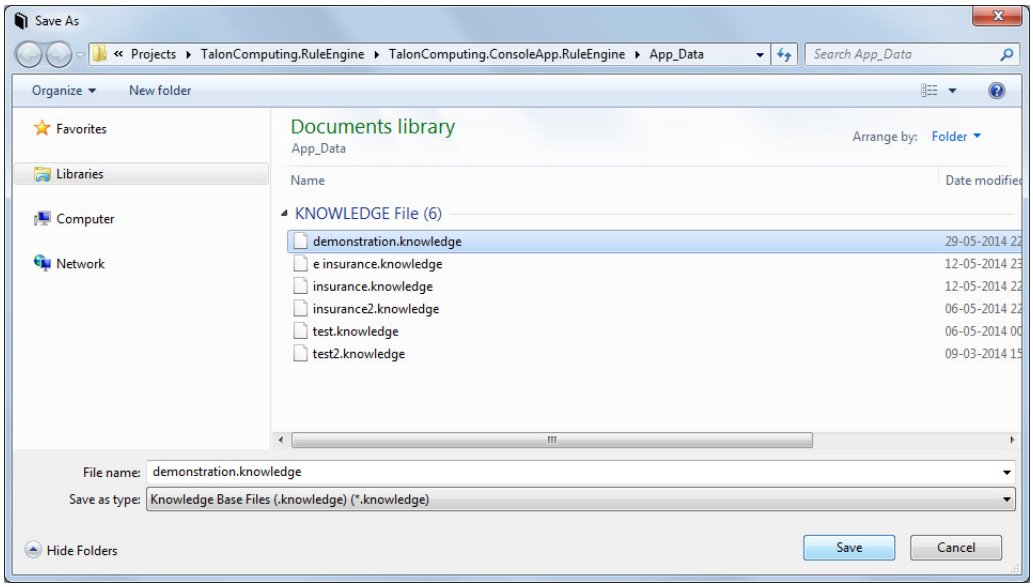
Step 2: Select the knowledge file and then click *Open.*



Saving your knowledge base

Step 1: Once you have created your knowledge base or made changes to it, click on the *Save* or *Save As* button.

Step 2: Specify the filename for the knowledge base.

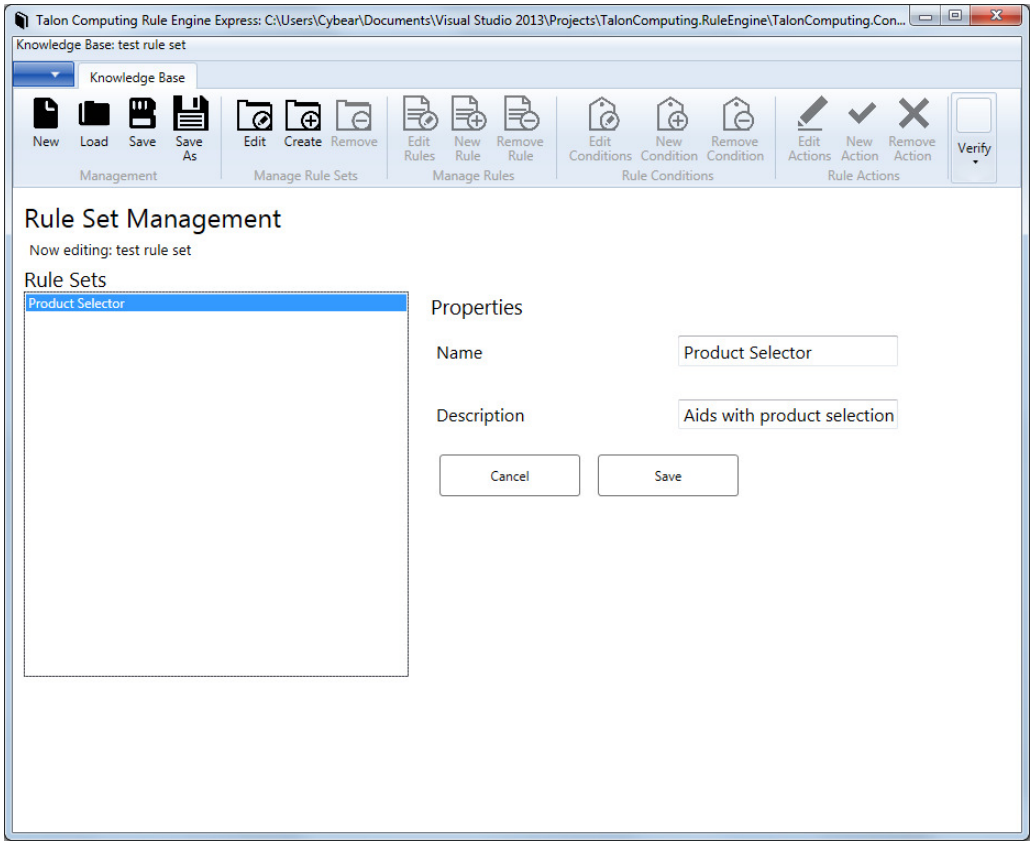


Creating a new rule set

Step 1: Under the *Manage Rule Sets* menu group, click on *Create.*

Step 2: Enter the name and description of the rule set in the *Properties* section.

Step 3: Click *Save.*



Editing a rule set

Step 1: In the *Rule Set Management* view, click on an existing rule set.

Step 2: Make changes to the Rule Set *Properties.*

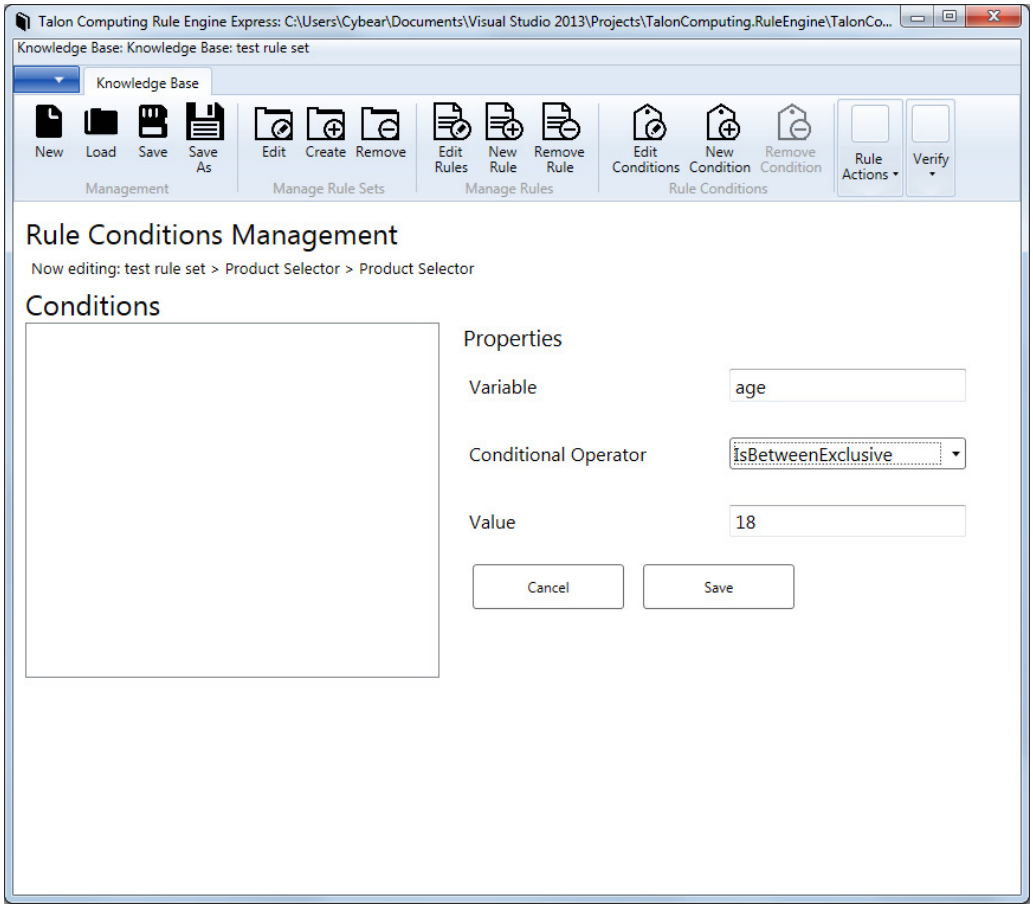
Step 3: Click *Save.*

Creating Conditions

Step 1: In the *Rule Conditions* menu group, click on *New Condition.*

Step 2: Complete the condition properties.

Step 3: Click *Save*.



About conditional operators

Operator	IsBetweenExclusive
Description	Determines if a numeric value is between two numeric values exclusively. The values must be separated by a comma.
Definition	$x > y \; and \; x < z$

Example	**Variable:** age **Conditional Operator:** IsBetweenExclusive **Value:** 18,34

Operator	IsBetweenMaxExclusive
Description	Determines if a numeric value is between two numeric values. The lower bound value is inclusive and the upper bound value is exclusive. The values must be separated by a comma.
Definition	$x \geq y \; and \; x < z$
Example	**Variable:** age **Conditional Operator:** IsBetweenMaxExclusive **Value:** 18,34

Operator	IsBetweenMinExclusive
Description	Determines if a numeric value is between two numeric values. The lower bound value is exclusive and the upper bound value is inclusive. The values must be separated by a comma.
Definition	$x > y \; and \; x \leq z$
Example	**Variable:** age **Conditional Operator:** IsBetweenMinExclusive **Value:** 18,34

Operator	IsBetween
Description	Determines if a numeric value is between two numeric values inclusively. The values must be separated by a comma.
Definition	$x \geq y \; and \; x \leq z$
Example	**Variable:** age **Conditional Operator:** IsBetween **Value:** 18,34

Operator	IsEqualTo
Description	Determines if a variable is equal to a particular value.
Definition	$x = y$
Example	**Variable:** age **Conditional Operator:** IsEqualTo **Value:** 18

Operator	IsFalse
Description	Determines if a Boolean variable is false.
Definition	$x = false$
Example	**Variable:** smokes **Conditional Operator:** IsFalse **Value:**

Operator	IsGreaterThan
Description	Determines if a numeric variable is greater than a specific value.
Definition	$x > y$
Example	**Variable:** age **Conditional Operator:** IsGreaterThan **Value:** 34

Operator	IsGeaterThanOrEqualTo
Description	Determines if a numeric variable is greater than or equal to a specific value.
Definition	$x \geq y$
Example	**Variable:** age **Conditional Operator:** IsGreaterThanOrEqualTo **Value:** 34

Operator	IsIn
Description	Determines if a value is in one of the values specified. The values must be separated by a comma.
Definition	$x \in \{y_1, \dots, y_n\}$
Example	**Variable:** age **Conditional Operator:** IsIn **Value:** 18,20,22,24,26

Operator	IsLessThan
Description	Determines if a numeric variable is less than a specific value.
Definition	$x < y$
Example	**Variable:** age **Conditional Operator:** IsLessThan **Value:** 18

Operator	IsLessThanOrEqualTo
Description	Determines if a numeric variable is less than or equal to a specific value.
Definition	$x \leq y$
Example	**Variable:** age **Conditional Operator:** IsBetweenLessThanOrEqualTo **Value:** 18

Operator	IsNotEqualTo
Description	Determines if a variable is not equal to a particular value.
Definition	$x \neq y$
Example	**Variable:** age **Conditional Operator:** IsNotEqualTo **Value:** 55

Operator	IsNot
Description	Evaluates to the opposite of a particular Boolean variable.
Definition	$!\,x$
Example	**Variable:** smokes **Conditional Operator:** IsNot **Value:**

Operator	IsTrue
Description	Determines if a variable is true.
Definition	$x = true$
Example	**Variable:** smokes **Conditional Operator:** IsTrue **Value:**

Creating actions

Step 1: Under the *Rule Actions* menu group, click on *New Action.*

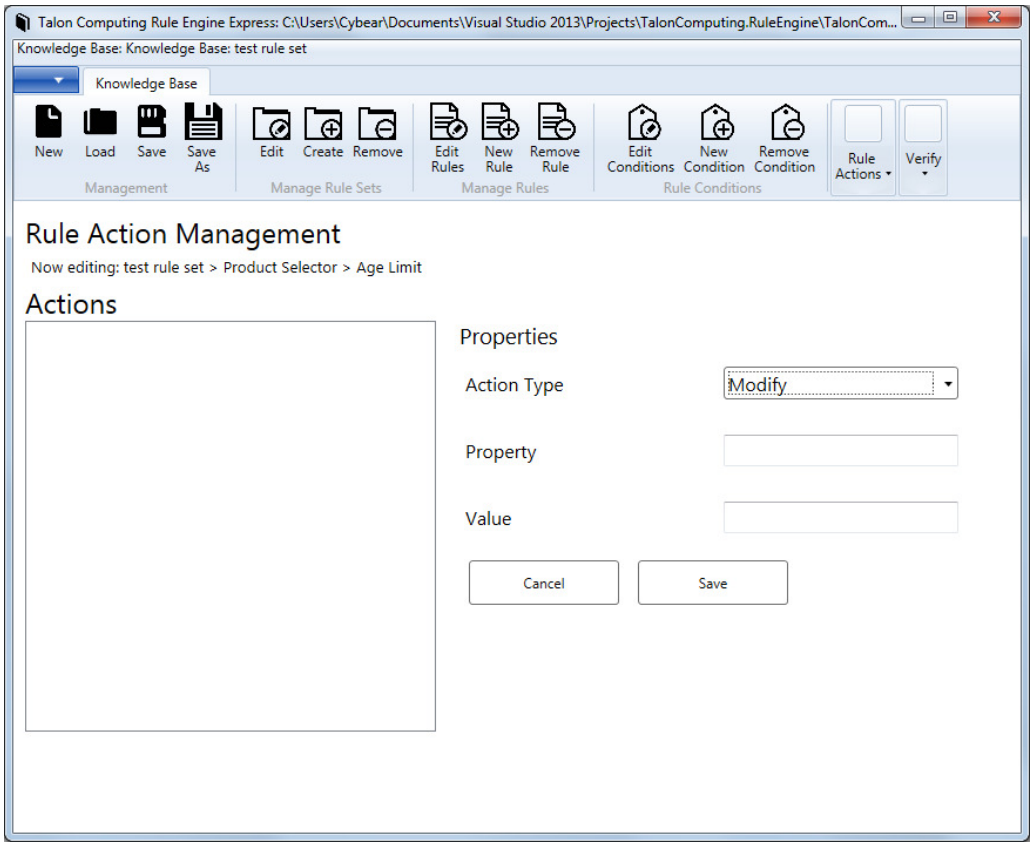
Step 2: Select the *Action Type* from the drop down list.

Step 3: Specify the name of the property or variable you want to modify or create conclusion for.

Step 4: Specify the value that the property should have when the action is executed.

Step 5: Click on *Save.*

ACTION TYPE	DESCRIPTION
MODIFY	A modify action allows you to change the value of a variable if a set of conditions are met.
CONCLUSION	A conclusion action allows you to make a decision when a particular set of conditions are met. Satisfied conclusions are collected when all rules have been executed. If no conclusion is returned by the engine then no conditions were satisfied based on the inputs that were provided.



Rule set verification

Once you have completed the creation of your rule set and rule specifications you may want to verify that you don't have conflicting rules or that your rules cover all scenarios.

REX provides you with a facility to test your rules against specific input values.

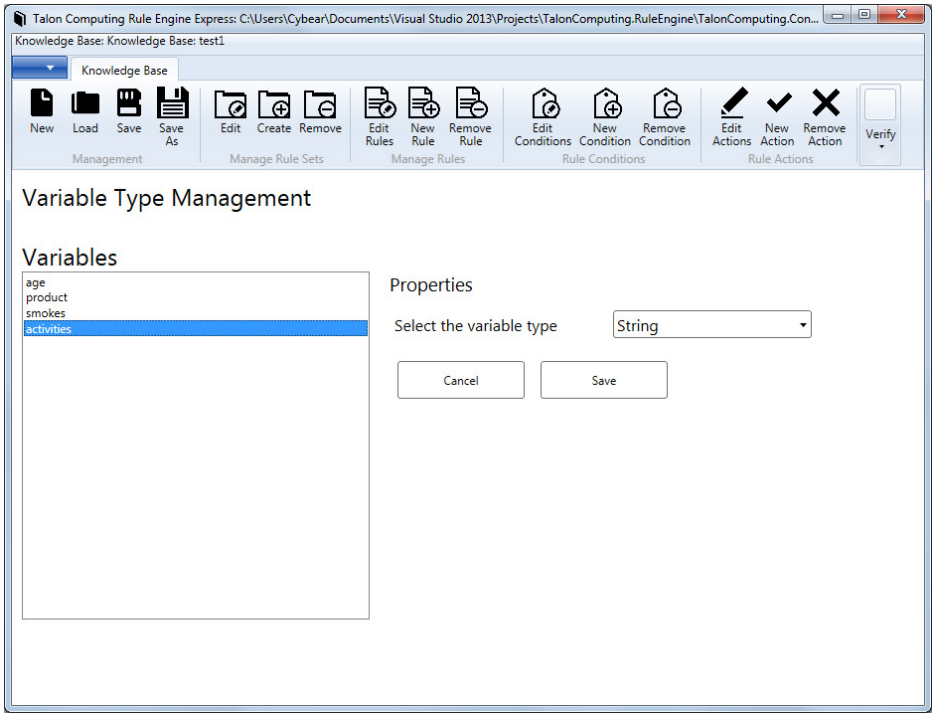
Step 1: On the *Verify* menu section, click on *Configure Variables*. Configuring the variables lets you assign types to variables used in your knowledge base. This will be necessary for the test harness. In the *Variables* list, a list of your variables are displayed.

Step 2: Click on a variable.

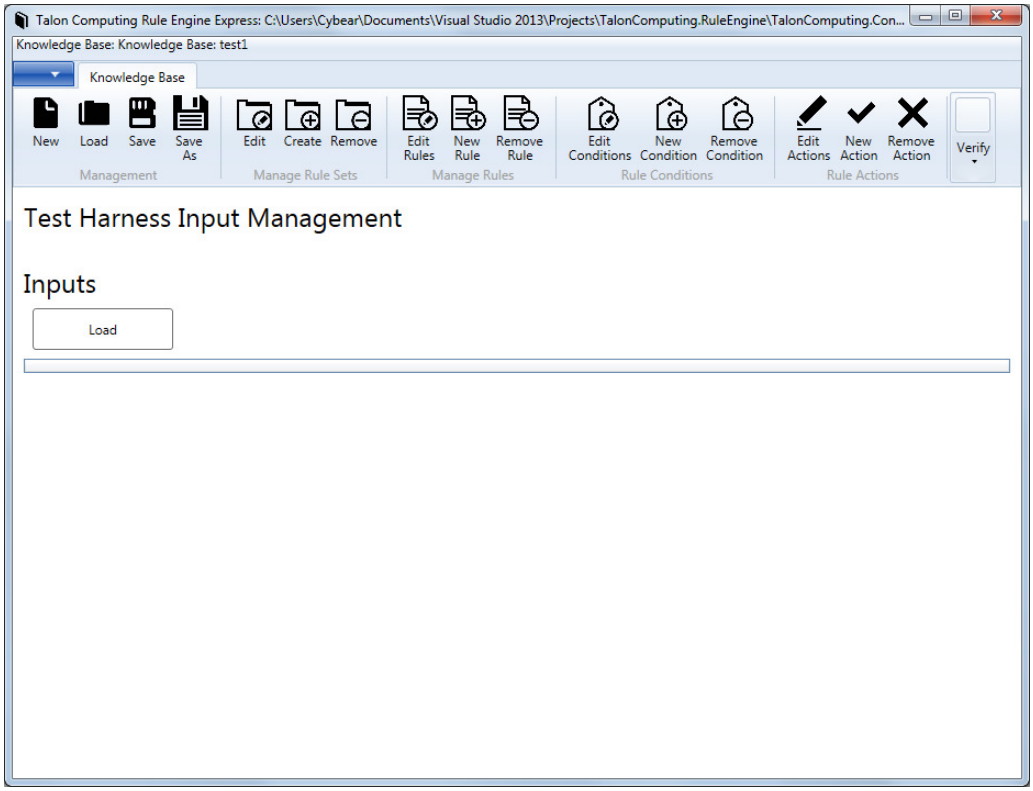
Step 3: Select the *Variable Type* from the drop down list in the property section.

Step 4: Click *Save*.

Step 5: Repeat Step 2-4 for all remaining variables.



Step 6: Configure the test harness inputs by clicking on *Configure Inputs* on the *Verify* menu section.



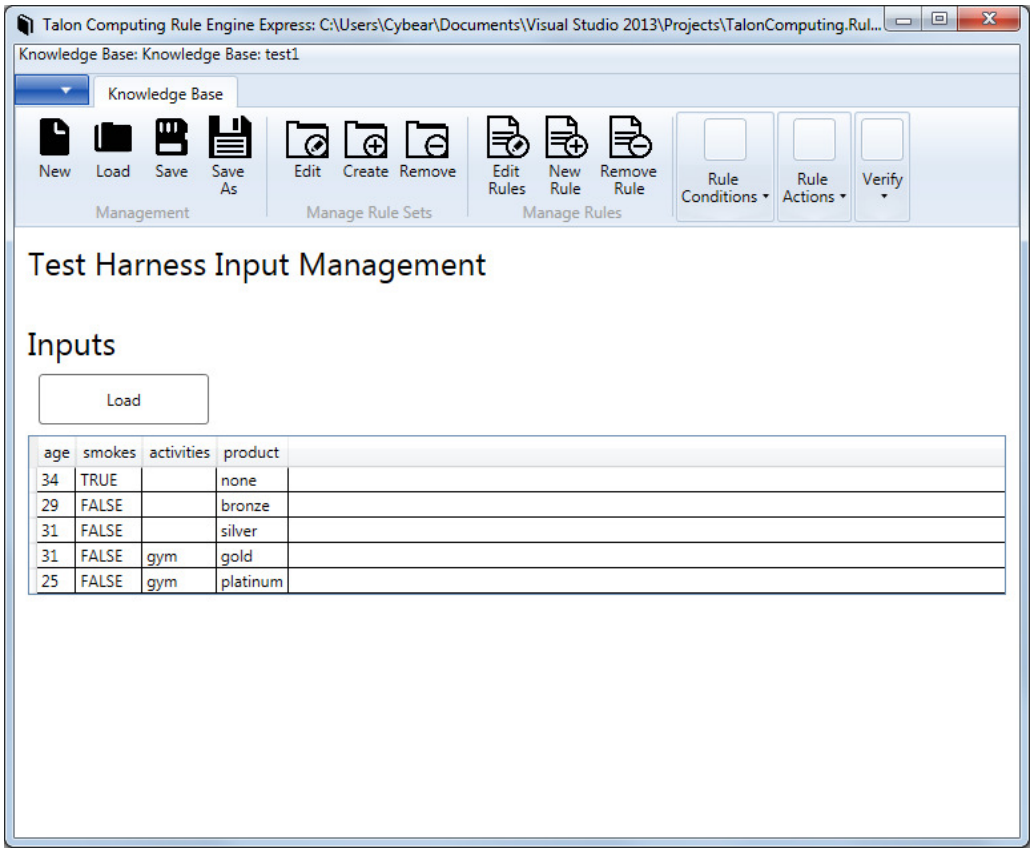
Step 7: Click on **Load** to load the inputs from a Comma-Separated Value (CSV) file.

CSV Format:

The first row is the header and represents the variable names. These names should be the same as the names identified in the Variable Configuration.

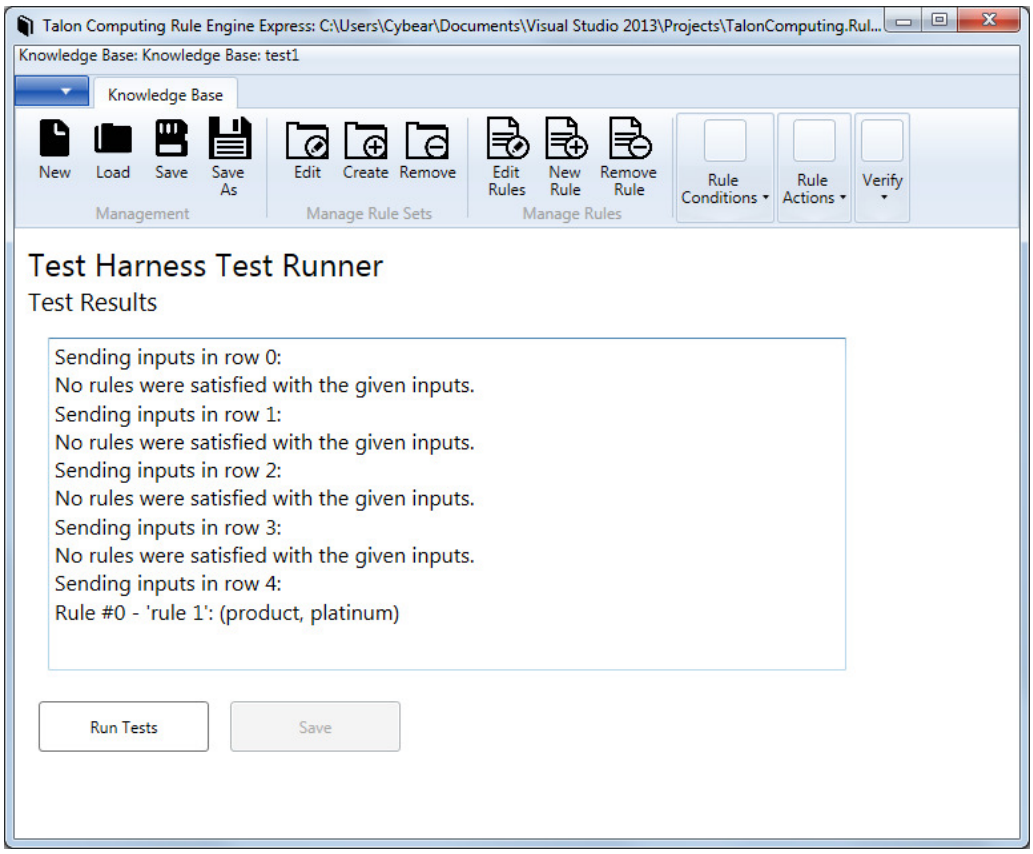
Example:

```
age,smokes,activities,product

34,TRUE,,none

29,FALSE,,bronze

31,FALSE,,silver

31,FALSE,gym,gold

25,FALSE,gym,platinum
```



Step 8: Run the tests by clicking on *Run Tests* on the *Verify* menu group. This will display the test harness view with a view of the test results.

Step 9: When you are ready to start executing the tests, click on *Run Tests*.



When the tests have run, the results will be displayed in the *Test Results* area.

RULE ENGINE API

Introduction

The rule engine has a very simple and easy to use programming interface. We will be describing only the classes you require to successfully integrate the rule engine into your application. We will also illustrate how to use the application programming interface by means of a coded example.

Linking References

The following references should be added to your project when starting to use the rule engine API. These references should be located in (if you used the default installation location) *C:\Program Files\Talon Computing\Talon Computing Rule Engine Express\Core*.

Dynamic Link Library
TalonComputing.Licensing.Core.dll
TalonComputing.Licensing.CoreModels.dll
TalonComputing.Licensing.Hardware.dll
TalonComputing.Licensing.Interfaces.dll
TalonComputing.Licensing.Utilities.dll
TalonComputing.RuleEngine.Core.dll
TalonComputing.RuleEngine.Interfaces.dll
TalonComputing.RuleEngine.Models.dll

Application or web configuration

Next configure your application with the client distributable key that was emailed to you. This is the file that has a *.config* file extension.

```
<?xml version="1.0" encoding="utf-8" ?>

<configuration>

	<appSettings>

		<add	key="TalonComputing.License.REX"
			value="D5E26CAF2C5E2B05D57ED7C755B1BBC3" />

	</appSettings>

</configuration>
```

Classes

The primary classes you need to be concerned with are:

Class Name	***FileLoader***
Overview	This class facilitates the loading of your knowledge base. You only need to use the constructor, specifying where to locate your knowledge base.
Usage	`FileLoader loader = new FileLoader( @"App_Data\insurance.knowledge" );`

Class Name	***RuleBaseProcessor***
Overview	This class is the key to the rule engine. Construct it using the file loader as a parameter. Add some inputs and call the *Process* method on the instance. This will generate a collection of outputs if one or more rules were triggered.
Usage	`var processor = new RuleBaseProcessor(loader);`

Class Name	***RuleInputs***
Overview	This class is a specialized **Dictionary** that allows you to add/update an input. Initially add inputs using the add method. Later you can simply modify the input by changing its value. The **key** identifies the name of the input property. The **value** is comprised of a **Tuple** identifying: **Item1**: as the input value. **Item2**: as the input type.

Usage	`processor.Inputs = new RuleInputs();`
	`insurance.Inputs.Add("age",`
	`new ObjectType(25, typeof(int)));`

Class Name	***RuleOutputs***
Overview	This class is specialized **Dictionary** that allows you to view the outcome of a particular processing of rule inputs. The **key** of the conclusions identifies the rule that was triggered. The **value** is comprised of a **Tuple** identifying: **Item1**: as the conclusion property. **Item2**: as the conclusion property value.

Usage	`foreach( var conclusions in insurance.Outputs )`
	`{`
	`foreach( var conclusion in conclusions )`
	`{`
	`Console.WriteLine( "{0}: {1}", conclusion.Key,`
	`conclusion.Value );`
	`}`
	`}`

Sample Program

This sample application demonstrates how to use the library with relative ease.

```
using System;
using TalonComputing.RuleEngine.Core;
using TalonComputing.RuleEngine.Core.Loaders;
using TalonComputing.RuleEngine.Interfaces.Models;
using TalonComputing.RuleEngine.Models;

namespace LoanApproval
{
    internal class Program
    {
        private static void Main( string[] args )
        {
            // specify where our knowledge base file is, the rule
            // processor will
            // automatically load the knowledge file when it needs
            // it using this loader
            var loader = new FileLoader(
                @"App_Data\insurance.knowledge" );

            // create a rule processor
            var insurance = new RuleBaseProcessor( loader );

            // add inputs
            insurance.Inputs = new RuleInputs();
            insurance.Inputs.Add( "age", new ObjectType( 25, typeof(
                int ) ) );
            insurance.Inputs.Add( "smokes", new ObjectType( false,
                typeof( bool ) ) );
            insurance.Inputs.Add( "activities", new ObjectType("gym",
                typeof( string ) ) );

            // run the processor
            insurance.Process();

            // process the outputs / handle the conclusions
            Console.WriteLine( "Conclusions: " );
            foreach( RuleOutputs conclusions in insurance.Outputs )
            {
                foreach( var conclusion in conclusions )
                {
                    Console.WriteLine( "{0}: {1}", conclusion.Key,
                        conclusion.Value );
                }
            }
```

```
            Console.WriteLine( "Done." );
            Console.ReadKey();
        }
    }
}
```