Cúram 8.2

Working with Cúram Express Rules Guide

Note

Before using this information and the product it supports, read the information in Notices on page 37

Edition

This edition applies to Cúram 8.2.

Contents

Chapter 1 Working with Cúram Express Rules

Use this information to learn how to create rule sets with the CER Rules Editor and add business and technical logic to Cúram Express rule sets. The CER Rules Editor is a part of the application that facilitates setting up and maintaining rules and the results that are associated with those conditions.

1.1 Introduction

Overview

The CER Rules Editor is a part of the application which facilitates setting up and maintaining logical conditions (rules) and the results associated with those conditions. This includes creating and maintaining all Cúram Express Rule (CER) Sets.

The purpose of this guide is to cover the fundamentals you need to know when creating rule sets using the CER Rules Editor and adding business and technical logic to rule sets.

Audience

Writing CER rule sets requires a collaborative approach between business analysts and technical rules developers.

Therefore, this guide is intended for business analysts and developers responsible for designing and implementing rules.

The Role of the Business Analyst

Business Analysts have the knowledge and experience to translate legislative rules into a set of logical rules used as qualifying criteria for a social welfare program or service. These logical rules have to be converted into CER rules that can be understood by the rules engine during the execution of the ruleset. The role of the Business Analyst during the development of a given ruleset is to describe each rule within the editor to ensure it can be understood by both the business and technical community.

The Role of the Technical Rules Developer

The role of a Technical Rules Developer is to take what the business analyst has created and expand on it to implement the complete set of executable rules.

Related Reading

For detailed information on topics covered in this guide, see the *Cúram Express Rules Reference Manual*.

For information on Eligibility and Entitlement rules using CER Rules, see the *Inside Cúram Eligibility and Entitlement Using Cúram Express Rules*.

1.2 Start with the Basics

Introduction

The CER language is a means of expressing qualification criteria in terms of logical rules and combined with real world data, allow decisions to be made on what should happen next or what should be displayed. A ruleset contains a combination of rules that can be used anywhere but are designed and implemented to produce a specific outcome.

Each rule set has a unique name and can have a different status depending on where it is the development or maintenance cycle. For example Newly Created, Published or Published - In Edit. This chapter describes the basics of the CER Editor which include the Editors layout and steps to create a rule set through to executing a rule set. Other important basics include creating a rule, adding logic to its diagram, validating your changes and publishing the final rule set.

Creating a Simple Rule Set

A new rule set can be created from the Cúram Express Rule Sets area of the Cúram Administration Application. The following is an outline of the steps to create a new rule set.

1. Select the *Cúram Express Rule Sets* link in the *Rules and Evidence* section of the Administration Workspace. Select **Actions** > **New** menu option.
2. Enter a name and display name for your new rule set in the new rule set pop-up and select an appropriate category.

Refresh the list, and the new rule set can be opened from the **List Actions** > **Continue Editing** menu option.

> **Tip:** The **List Actions** menu option to open the editor will be **Continue Editing** when the status is *Published - In Edit* and *Newly Created*. When a rule set is *Published* the menu option to open the editor will be **Open Editor**.

To increase the readability of the ruleset within the editor, it is recommended that the browser is set to full screen. This can normally be achieved using the F11 key.

CER Editor Layout

The CER Editor provides a user-friendly environment and interface for both technical and business users to create, edit and validate a ruleset and its rules. It consists of the following components:

- Global menu
- Business and technical views
- Diagram canvas which contains pan and zoom controls to help the user navigate large and complex rules
- Rule outline view (business view) and class outline view (technical view)
- Pan and zoom controls
- Properties and validations panel
- Tools and templates palette

CER Editor Business View

This view is designed to assist business users with the creation of business rules. The text, structure and in some cases the data is required to ensure the rule is readable. The Rules structure can be simple or complex, therefore business view only contents information relevant to the business user and displays a business rule centric view of the ruleset.

CER Editor Technical View

This view provides the technical users with information relevant to their role in rules development. The implementation of the rules requires access to all the tools and templates available in the editor. More technical elements of the ruleset are presented such as classes, attributes and their associated properties.

Creating a Class

A technical user creates Rule Classes. A Rule Class contains one or more Attributes. The class name is not localizable and should not contain multibyte or accented characters.

1. Open the “New Rule Class” dialog by selecting the “Class” button at the top of the Rule Outline View

Table 1: Class Properties

Name	Explanation
Name	The name of the class you wish to create.

Creating an Attribute

A technical user creates attributes, an attribute is created to capture a piece of information. Attributes are grouped within classes.

The Attribute name is not localizable and should not contain multibyte or accented characters. If the user needs to localize the label displayed in the attribute add the localized version in the "Display Name" field in the Business Tab of the property panel.

Attributes can be renamed by updating the "Attribute" field in the Technical Tab of the property panel. If an attribute has been renamed, the user must manually resolve any dependencies to the attribute.

1. Open the “New Attribute” dialog by selecting the “Attribute” button at the top of the Rule Outline View

Table 2: Attribute Properties

Name	Explanation
Name	The name of the folder you wish to create.
Require Initialization	To initialize an attribute check the "Require Initialization" checkbox.

Creating a Folder

A business user creates folders in order to group their rules. For example a business user might create a folder to group all the rules related to the income of the household.

1. Open the “New Folder” dialog by selecting the “Folder” button at the top of the Rule Outline View

Table 3: Folder Properties

Name	Explanation
Name	The name of the folder you wish to create.

Creating a Rule

Typically a business user wants to create rules with text and structure that communicates their meaning. A diagram is the graphical representation of an individual rule. A business user will use this diagram to describe the rule structure and logic. For example, What is the total household income? The Rule name is localizable and can contain multibyte and accented characters. To rename the Rule name update the "Display Name" field in the Business Tab of the property panel.

1. Open the CER Editor Rule dialog by selecting the Rule button in the Rule Outline View.
2. In the Name field enter *Simple Calculation*.
3. From the Type dropdown, select the *Number* entry.

Table 4: Rule Properties

Name	Explanation
Name	The description to associate with the Rule and its Diagram.
Type	This is the type of data this rule will return. For example the rule that verifies the client is alive will return a Boolean value either true or false.

Adding a Simple Calculation

In the diagram for the rule which is opened when a new rule is created, a rule element is displayed. This is the starting point for any rule and elements from the palettes can be dropped onto this element. A description can be added to the rule in the properties panel that will describe this rule from the business perspective.

In the description property add *Simple Calculation* as the description for this rule.

1. From the **Business Logic** palette drag an **Arithmetic** element onto the rule element on the diagram. A **Golden Circle** will appear when the arithmetic element is correctly positioned over the rule element. Releasing the mouse will allow you to add the arithmetic to this rule. The default behavior for an arithmetic expression is to add two elements. Double click on the *Addition* text on the arithmetic element and enter *Adding 2 and 2*
2. From the Tools palette select the dropdown to change from the business Logic palette to the *Data Types* palette. Now drag the **Number** element onto the left *Empty Member* of the arithmetic element. In the property panel set the value to 2. Repeat this for the right side of the arithmetic operation.

The above example simply adds 2 numbers to answer the question “What's 2 + 2”. This is a example of a very basic calculation and rulesets used for eligibility and entitlement or for displaying information to application users will be more complex in structure and how they calculate their results.

Organizing the Business Rules

Once the Business user has completed their portion of the ruleset where the high level business rules are defined, the technical user can then provide the full implementation for each rule. The business rules from the business view are created on the default class, allowing them business meaning of the rules and not worry about the technicalities of the CER language. The editor provides a technical user with the ability to change the attribute associated with the rule allowing them to spread the rules across multiple classes.

1. From the Rules Outline View, select the appropriate rule and click on the context dropdown menu. From the list of options choose the **Edit Rule** option.
2. The dialog displays the name of the rule, a folder dropdown to move the rule and the attribute associate with the rule. To change the attribute select the change link.

Table 5: Edit Rule Properties

Name	Explanation
Name	Edit the description of a diagram.
Folder	Change the folder a diagram is grouped in.
Attribute	Change the attribute for the rule. The rule diagram can be copied to another attribute using the *Change* link.

Exporting Diagrams

The CER Editor allows users to export business rule diagrams. There are two types of export:

- Single Business Rule Diagram Export - where the current diagram can be exported as a PNG image file.
- All Business Rule Diagrams Export - where all the diagrams listed in the rule outline view are exported to PNG image files, presented in a HTML file and downloaded as a ZIP archive file.

Single Business Rule Diagram Export

The CER Editor allows users to export a single business rule diagram as a PNG image to the local hard disk. This functionality is accessed via the Export button on the top right hand corner of each diagram. The file name and location where the file is to be saved can be chosen by the user.

The image generated will reflect the current state of the diagram, for example if the diagram is in technical mode when the Export button is pressed, then the exported image will capture the technical mode details.

The steps to export a single business rule diagram are as follows:

1. Open the diagram to be exported.
2. Press the Export button on the top right hand corner of the diagram.
3. A Save dialog box appears allowing the user to enter the file name and location where the PNG file is to be saved.

All Business Rule Diagrams Export

The CER Editor also allows users to export all business rule diagrams in a ZIP archive which can be saved to the user's local hard disk. This functionality is accessed via the Export drop down option of the Actions button on the Global Menu. The ZIP archive contains the following:

- A PNG image file for each diagram listed in the rule outline view. The name of each file will be based on the diagram's class and attribute names.
- A HTML file which is used to view all the diagrams exported. The name of the HTML file will be the rule set name with a ".html" extension. The order the diagrams are listed in this file will exactly reflect the order of the diagrams in the rule outline view in the CER Editor. The following information is also displayed with each image; the diagram name, the diagram description and the diagram's class and attribute names.

The steps to export all business rule diagrams are as follows:

1. Open the rule set containing the diagrams that are to be exported.
2. Use the **Actions** > **Export** menu option to export the diagrams.
3. A dialog box appears showing the progress of the export process. When the process has been completed the Save button on the dialog is enabled. The user must press this button to save the zipped images to the local hard disk. The file name and location where the ZIP file is to be saved can be chosen by the user.

> **Note:** Unlike the Single Diagram Export above, the diagrams do not need to be opened in the editor in order to be exported. All diagrams listed in the rule outline view will be automatically exported.
>
> The images will be generated in business mode (i.e. the images will not contain information that is displayed when the diagram is in technical mode).

Validating the Rule Set

CER includes a comprehensive rule set validator that can detect errors in your rule set before your rule set is published or executed. You can use the CER editor to validate a rule set.

1. In the CER Editor, select the dropdown menu on the **Save** button.
2. Select the **Validate** option.

Validation messages are displayed in a validations panel, which is displayed under the Diagram canvas the first time that a rule set is validated.

> **Tip:** Double-click a validation error in this rule set to highlight the related element in red in the main content area.

Publishing the Rule Set

While a rule set is being modified in the editor it will have a status of *Published - In Edit* or *Newly Created*. Changes made in the editor will not be picked up the next time the rules are executed. A rule set can be published once a user is happy with the changes and any validation errors have been fixed.

1. Select the *Cúram Express Rule Sets* link in the *Rules and Evidence* section of the Administration Workspace. Select the **Actions** > **Publish** menu option.
2. Once the list is refreshed, a list of rule sets that have a status of either *Published - In Edit* or *Newly Created* will be displayed. Use the check box to select the rule sets you want to publish.

Executing the Rule Set

Running a rule set creates a rule session. A rule session controls the executing of rules, e.g. your application might create a rule session to determine John Smith's eligibility for child benefit,

by invoking the appropriate rule set and asking eligibility questions regarding John's personal circumstances.

CER supports you executing rule sessions in:

- Production environments, where CER integrates with your application to answer questions when needed.
- A stand-alone test environment where you create repeatable automated tests for your rule sets.

For more information, see the *Cúram Express Rules Reference Manual*.

1.3 Creating Point-in-time Business Rules

What Are Point-in-time Rules?

Point-in-time rules are rules that are run to answer questions on a particular day. The purpose of *Point-in-time* rules is to intentionally capture data which applies to a particular date only. For example, is a person eligible on a particular date?

Defining Business Requirements

An organization decides it needs a new program, for the purpose of this document it is called Sample Benefit. It is to be introduced in order to provide support for families with children and young students. A business user examines the relevant legislation and extracts a set of business requirements from that legislation. Here is an extract from the requirements.

Sample Benefit Requirements A household is deemed eligible for Sample Benefit if it contains either a child under 16 years of age, or a student between the ages of 16 and 22, and the household's total annual income is between 0 and 20,000. The household's total income is considered to be the total of the countable amounts for each income received by each member of the household over the age of 18.

Identify High-level Questions

A business user will extract basic questions that need to be answered in order to decide eligibility for Sample Benefit. The following are examples of questions which may need to be answered to determine eligibility.

- Does this household contain an eligible person?
- What age does a student in a household have to be in order to make the household eligible for Sample Benefit?
- What type of income should be counted?

Group Related Questions

Once you have identified the high-level questions that the “Sample Benefit” rule set needs to answer you should group the questions that are related to each other. The business rules that will be created for these questions can then be grouped into folders.

Creating a Point-in-time Rule Set

In Chapter 2 we described how to create a new rule set (see Creating a Simple Rule Set on page 10).

Creating Folders for Related Questions

A business user will want to group related rules together. The editor provides a mechanism for doing this through the use of folders. To start with create the two folders listed below. More information on this is available in the Creating a Folder on page 12.

- Sample Benefit Rules
- Person Rules

Creating a Business Rule for Each Question

To begin answering questions a business user will need to start creating rules. A business rule can be easily created without the user having to consider how its implemented or the associated attribute. They only need to consider the type of data this rule will use and calculate. Later in the rule set development life cycle the technical user will organize the rule set into an executable structure. See Organizing Rules into Classes and Attributes on page 22.

The steps to create a business rule are as follows:

1. From the Rules Outline view in the Business View click on the context menu on the “Sample Benefit Rules” folder and select the “New Rule” option to create a new Rule.
2. Name the Rule “Eligibility”
3. The default Type is set to Boolean so there is no need to change this.
4. Click on the “Save” button.
5. In the Rule properties panel add a description “Eligibility for Sample Benefit”.

Adding Business Logic For Rules

This section describes how a business user adds business logic onto the rules diagram. The CER editor allows business users to add business logic to a diagram without having to worry about any of the technical values usually associated with authoring a rule set. A business user provides meaningful descriptions for the rules they add.

Throughout these steps you will be asked to change or add descriptive text to rule elements within the diagram. To make a diagram element text editable double-click on its text. A text area will become highlighted and editable. A description can be split over multiple lines using Ctrl-ENTER.

Eligibility

Now that we have a `SampleBenefit` rule set with a Rule called “Eligibility” it's time to add some business logic.

You create eligibility rules as follows:

1. From the **Business (default)** palette on the right-hand side of the editor, drag an *AND Rule Group* element onto the rule element on the diagram (you will see a Golden circle appear when you move over the rule element). Change the name of the *AND Rule Group* to be “The household contains an eligible person and passes the income test”.
2. Drag a *Rule* element from the **Business (default)** palette onto the “Empty Member” element within the *AND Rule Group*. A dialog will appear, by default the “Empty Rule” is selected. For now just click the “Save” button to close the dialog. On the empty reference change the name of the to be “The household contains an eligible person”.
3. Drag another *AND Rule Group* element over this empty reference until you see arrows to the left and right of the *reference*. Move the mouse over the right-hand arrow until it turns green and drop it. Change the name of the *AND Rule Group* to be “The income is between 0 and 20000”.
4. Drag a *Compare* element onto the “Empty Member” of the new *AND Rule Group*. Change its name to be “Income is greater than 0”.
5. Drag another *Compare* element to the right of the first compare and change its name to be “Income is less than 20000”.
6. Click on the **Save** on the top right hand side of the CER Editor.

This rule has now sufficient text and structure that can be understood by both a business user and a technical user. The Rule has an empty reference with two compares with an “AND” conjunction between them. There is also an “AND” conjunction between the reference and the group of compares.

1. Create a new Rule in the *Sample Benefit Rules* folder called “Household Contains Eligible Person”. Again leave the type as Boolean.
2. Add a description to the rule: “Household Contains Eligible Person”.
3. Drag a *Repeating Rule* from the **Business (extended)** palette onto the rule. Change the name of the *Repeating Rule* to be “Any of the people in the household are eligible”.
4. Drag a *Rule* onto the *Empty List* element in the repeating rule. An empty rule is fine for now. Change its name to be “All the people in the household”.
5. Drag another *Rule* onto the *Empty Members* element within the repeating rule. Again an empty rule is fine here. Change its name to be “The current person is eligible”.
6. Using the context menu on the *repeating rule* element (click on the triangle on the *repeating rule* element), choose the “Succeed on Any” option.
7. Click on the **Save** on the top right hand side of the CER Editor.

This rule has now sufficient text and structure that can be understood by both a business user and a technical user. However if more information is required, add extra context to the description of the Empty rule elements.

1. Create a new rule in the “Person Rules” folder called “Eligible Person”.
2. Drag an *OR Rule Group* element from the **Business (default)** palette onto the rule element on its diagram and change its name to be “The person is either a child or a student”.
3. Drag a *Compare* element onto the *Empty Member* element within the *OR Rule Group* and change its name to be “The person is a child under the age of 16”.
4. Drag an *AND Rule Group* below the compare element and change its name to be “The person is a student in the right age range”.
5. Drag a rule onto the *Empty Member* element within the *AND Rule Group* and change its name to be “The person is a student”.
6. Drag another *AND Rule Group* to the right of this “The person is a student” rule and change its name to be “Their age is between 16 and 22”.
7. Drag a *Compare* element onto the *Empty Member* element within the *AND Rule Group* and change its name to be “Age is greater than 16”.
8. Drag another *Compare* element to the right of this *Compare* and change its name to be “Age is less than 22”.
9. Click on the **Save** on the top right hand side of the CER Editor.

This rule has now sufficient text and structure that can be understood by both a business user and a technical user. When reading this rule the user should see that this rule states: “ The person is under 16 *OR* is a student *AND* in the age range of 16 to 22 ”. However if more information is required, add extra context to the description of the Empty rule elements.

Household Income

Based on the requirements defined in the Defining Business Requirements on page 16 we identified high-level questions related to eligibility. We created rules to answer these questions. Next a business user will need to follow the same process to create business rules around a household's income.

You create household Countable Income Rules as follows:

1. Click on the *Sample Benefit Rules* folder, so it is highlighted. Click the **New Rule** option. Input the rule name “Household Income” in the *New Rule* field. Set the type as Number.
2. Drag a *Repeating Rule* element which is located in the **Business (Extended)** palette, onto this rule and change its name to be “The total income for each countable household member”. To change the name, double click on the text of the element on the diagram or enter a value in the *Name* field of the Business Properties panel.
3. Drag a *Rule*, which is located in the **Business (Extended)** palette, onto the *Empty List* element of the *Repeating Rule*. Select the **Empty Rule** option and change its name to be “All people in the household who are countable from an income perspective”.
4. Drag a *Rule* onto the *Empty Members* element of the *Repeating Rule*. Select the **Empty Rule** option and change its name to be “The current person's total income”.
5. From the context menu on the right side of the *repeating rule* element choose the **Sum Items** option from the menu.

6. Click on the **Save** on the top right hand side of the CER Editor.

This rule has now sufficient text and structure that can be understood by both a business user and a technical user. However if more information is required, add extra context to the description of the Empty rule elements.

1. Create a new Rule in the “Sample Benefit Rules” folder called “Countable Household Members”. Set the type as Number.
2. Drag a *Filter* element which is located in the **Business (Extended)** palette, onto the rule.
3. Drag a *Rule* onto the *Empty List* element of the filtered list. Select the option **Empty Rule Reference** . Click on the rule to change its name to be “All the people in the household”.
4. Drag a *Rule* onto the *Empty Members* element of the filtered list. Select the option **Empty Rule Reference** . Change its name to be “The person is countable”.
5. Click on the **Save** on the top right hand side of the CER Editor.

This rule has now sufficient text and structure that can be understood by both a business user and a technical user. However if more information is required, add extra context to the description of the Empty rule elements.

1. Create a new Rule in the “Person Rules” folder called “Countable Person”. Leave the type as Boolean.
2. Drag a *Compare* element onto the rule and change its name to be “The person's age is greater than or equal to 18”.
3. Click on the **Save** on the top right hand side of the CER Editor.

This rule has now sufficient text and structure that can be understood by both a business user and a technical user.

1. Create a new Rule in the “Person Rules” folder called “Person Income”. Set the type as Number.
2. Drag a *Repeating Rule* onto this rule element and change its name to be “The countable amount for each income”.
3. Drag a *Rule* onto the *Empty List* element of the repeating rule. Select the option **Empty Rule Reference**. Change its name to be “All the incomes for this person”.
4. Drag another *Rule* onto the *Empty Members* element of the repeating rule. Select the option **Empty Rule Reference**. Change its name to be “The countable amount for this income”.
5. From the context menu on the right side of the *Repeating Rule* choose the **Sum Items** option
6. Click on the **Save** on the top right hand side of the CER Editor.

This rule has now sufficient text and structure that can be understood by both a business user and a technical user.

1. Create a new Rule in the “Person Rules” folder called “Countable Income”. Set the type as *Number*.
2. The product needs to take into account a person may have multiple income types. In this example, there are two Income Types, Wages and Tips. To perform this check, a *Decision Table* is added.
3. Select the *Template* Tab, at the top of the pallet, at the right hand side of the Diagram Pane. Select *Decision Table* from the drop-down list. Drag the *Decision Table* on to the “Countable Income” rule. Set the *Number of Rows* to be 2. Set the *Result Type* to *Number*.

Click the *Next* button. Select the *Create New Rule* Option, and enter “type” as the name. Set the *Result Type* to *Number* . Click the *Save* button.

4. Change the name for the table to be “Countable Income” (the box at the top of the table).
5. Double click on the *0* beneath the “Condition” header. Change the value to “Wages” .
6. Double click on the *1* beside the “Wages” . Change the value to “The full amount”.
7. Double click on the *0* on the second row. Change the value to “Tips and Commission”.
8. Double click on the *1* beside the “Tips and Commission” . Change the value to “Half the amount”.
9. Double click on the *Empty Value* beside the *Otherwise* . Change the value to be “Zero”.
10. Click on the **Save** on the top right hand side of the CER Editor.

The decision table has sufficient information for other users to understand its structure and purpose.

Entitlement

Based on the requirements defined in the Defining Business Requirements on page 16 we identified high-level questions related to eligibility and income. We created rules to answer these questions. Next a business user will need to follow the same process to create business rules around a household's entitlement.

You create Entitlement Rules as follows:

1. In the example, the amount issued will depend on the number of eligible household members.
2. Create a new Rule in the “Sample Benefit Rules” folder called “Entitlement”. Set the type to be Boolean.
3. Select the *Template* Tab at the top of the palette, at the right hand side of the Diagram Pane. Select *Decision Table* from the drop-down list. Drag the *Decision Table* on to the “Entitlement” rule. Set the *Number of Rows* to be 3. Set the *Result Type* to *Number*. Click the *Next* button. Select the *Create New Rule* Option, and enter “memberCount” as the name. Set the *Result Type* to *Number* . Click the *Save* button.
4. Change the description for the table to be “Entitlement” (the box at the top of the table).
5. Double click on the *0* beneath the “Condition” header. Change the value to “One Person” .
6. Double click on the *1* beside the “One Person” . Change the value to “100”.
7. Double click on the *0* on the second row. Change the value to “Two People” .
8. Double click on the *1* beside the “Two People” . Change the value to “200”.
9. Double click on the *0* on the third row . Change the value to “Three People”.
10. Double click on the *1* beside the “Three People” . Change the value to “300”.
11. Double click on the *Empty Value* beside the *Otherwise* . Change the value to be “400”.
12. Click on the **Save** on the top right hand side of the CER Editor.

The decision table has sufficient information for other users to understand its structure and purpose.

Eligible Members

Based on the requirements defined in the Defining Business Requirements on page 16 we identified high-level questions related to eligibility income and entitlement. Next a business user will need to follow the same process to create business rules around the number of eligible members in a household.

You create rules for the number of eligible members as follows:

1. Create a new Rule in the “Sample Benefit Rules” folder called “Number of eligible members”. Change the description of the rule on this diagram to be “Number of eligible people in the household”. Set its type to be Number.
2. Drag a *Size* element from the **Business (extended)** palette onto the rule.
3. Drag a *Filter* element element from the **Business (extended)** palette, onto the *Empty Member* element within the *size*.
4. Drag a *Rule* onto the *Empty List* element of the filter. Select the option **Empty Rule Reference**. Change the name to be “All the people in the household”.
5. Drag a *Rule* onto the *Empty Members* element of the filter. Select the option **Empty Rule Reference**. Change its name to be “The person is eligible”
6. Click on the **Save** on the top right hand side of the CER Editor.

1.4 For the Technical Reader - Developing Point-in-time Rules

How Do Business and Technical Users Work Together?

In the previous chapter we showed how a business analyst can create the business logic for the product sample benefit. A technical user can take this rule set as input and create a rule set that can be run within the Application. The technical user will add technical logic based on a business users descriptions. In our sample benefit example the technical user would need to update the rule set in the following way.

- Organize the classes and attributes associated with the rules.
- Edit empty rules to point to the correct rules.
- Populate the arguments for *Compare* elements.
- Set the values of data types. For example *Numbers*, *Strings*.
- Update decision tables with values based on row description.
- Validate and test the rule set until it's ready to be published.

Organizing Rules into Classes and Attributes

Up to this point a business user has been creating diagrams on the default class for generated rules. The first task of a technical user is to organize rules into classes. Rules should be grouped

in classes that make sense. For example, all the rules related to income should go in an Income class. Organizing rules can be performed using the **Edit Rule** Wizards.

Adding Technical Logic to a rule set

Diagrams created by a business user must be associated with technical rules, also known as Attributes. This section details the steps involved in updating our `SampleBenefit` rule set so that it can be published.

Eligibility

1. Use the *Technical* tab to switch the Editor into Technical mode. Based on the Business Diagrams the example has a Benefit, a Person and an Income. Each of these will become a rule class in the CER Editor.
2. The Technical View lists rule classes. Click the **Class** button to create a new class called “SampleBenefit” button on the Class Outline View.
3. Click the **Class** button to create a new class called “Person” button on the Class Outline View
4. Click the **Class** button to create a new class called “Income” button on the Class Outline View
5. Use the *Business* tab to switch the Editor into Business mode to associate the diagram with a technical rule, also known as an *Attribute* .
6. In the Rules Outline View of the Business view of the editor, select the “Eligibility” rule and from the context menu on the right side select **Edit Rule**.
7. In the dialog which pops up, click the **Change** link beside the attribute name.
8. Click on the **Change** link beside the *Current Rule Class*.
9. Select the *SampleBenefit* rule class. Click **Save**.
10. Select the option **Create New Attribute**, enter “eligible” as the name. Click **Next**; choose *Boolean* as the type and click **Save**.
11. Click on the **Save** on the top right hand side of the CER Editor.
12. Select the “Number of Eligible Members” rule and from the context menu on the right side select **Edit Rule**.
13. In the dialog which pops up, click the **Change** link beside the attribute name.
14. Click on the **Change** link beside the *Current Rule Class*.
15. Select the *SampleBenefit* rule class. Click **Save**.
16. Select the option **Create New Attribute**, enter “numEligibleMembers” as the name. Click **Next**; choose *Number* as the type and click **Save**.
17. Click on the **Save** on the top right hand side of the CER Editor.
18. Select the “Household Contains Eligible Person” rule and from the context menu on the right side select **Edit Rule**.
19. Click on the **Change** link beside the *Current Rule Class*.
20. Select the *Person* rule class. Click **Save**.
21. Select the option **Create New Attribute**, enter “householdContainsAnEligiblePerson” as the name. Click **Next**; choose *Boolean* as the type and click **Save**.

22. Select the “Eligible Person” rule and from the context menu on the right side select **Edit Rule**.
23. Click on the **Change** link beside the *Current Rule Class*.
24. Select the *Person* rule class. Click **Save**.
25. Select the option **Create New Attribute**, enter “eligiblePerson” as the name. Click **Next**; choose *Boolean* as the type and click **Save**.
26. Click on the **Save** on the top right hand side of the CER Editor.
27. Select the “Household Income” rule and from the context menu on the right side select **Edit Rule**.
28. Click on the **Change** link beside the *Current Rule Class*.
29. Select the *Income* rule class. Click **Save**.
30. Select the option **Create New Attribute**, enter “householdIncome” as the name. Click **Next**; choose *Number* as the type and click **Save**.
31. Click on the **Save** on the top right hand side of the CER Editor.
32. Select the “Countable Household Members” rule and from the context menu on the right side select **Edit Rule**.
33. Click on the **Change** link beside the *Current Rule Class*.
34. Select the *SampleBenefit* rule class. Click **Save**.
35. Select the option **Create New Attribute**, enter “countableHouseholdMembers” as the name. Click **Next**; choose *Number* as the type and click **Save**.
36. Select the “Countable Person” rule and from the context menu on the right side select **Edit Rule**.
37. Click on the **Change** link beside the *Current Rule Class*.
38. Select the *Person* rule class. Click **Save**.
39. Select the option **Create New Attribute**, enter “isCountable” as the name. Click **Next**; choose *Boolean* as the type and click **Save**.
40. Click on the **Save** on the top right hand side of the CER Editor.
41. Select the “Person Income” rule and from the context menu on the right side select **Edit Rule**.
42. Click on the **Change** link beside the *Current Rule Class*.
43. Select the *Income* rule class. Click **Save**.
44. Select the option **Create New Attribute**, enter “totalIncome” as the name. Click **Next**; choose *Number* as the type and click **Save**.
45. Click on the **Save** on the top right hand side of the CER Editor.
46. Select the “Countable Amount” rule and from the context menu on the right side select **Edit Rule**.
47. Click on the **Change** link beside the *Current Rule Class*.
48. Select the *Income* rule class. Click **Save**.
49. Select the option **Create New Attribute**, enter “countableAmount” as the name. Click **Next**; choose *Number* as the type and click **Save**.
50. If an validation appears informing the user that a new attribute will be created. Click **OK**.
51. Click on the **Save** on the top right hand side of the CER Editor.
52. Select the “Entitlement” rule and from the context menu on the right side select **Edit Rule**.
53. Click on the **Change** link beside the *Current Rule Class*.

54. Select the *SampleBenefit* rule class. Click **Save**.
55. Select the option **Create New Attribute**, enter “entitlement” as the name. Click **Next**; choose *Boolean* as the type and click **Save**.
56. If an validation appears informing the user that a new attribute will be created. Click **OK**.
57. Click on the **Save** on the top right hand side of the CER Editor.

All the Business Diagrams have been associated with a Rule Class and an attribute in the Technical view.

1. Use the *Technical* tab to switch the Editor into Technical mode.
2. All the newly created diagrams are opened in the Diagram Pane. Hover over the tabs above the diagrams and the attribute names are displayed.
3. Select the “eligible” attribute in the *SampleBenefit* rule class, if the diagram is not already open.
4. Drag a Rule from the **Business (default)** palette over the left side element of the “Income” is greater than “0” comparison.
5. Click on the **Change** link beside the *Current Rule Class*.
6. Select the *Income* rule class from the drop-down menu. Click **Save**.
7. Choose the **Use Existing Rule** option, select “householdIncome” from the drop-down.
8. Drag a Number from the **Data Type** palette over the right side element of the “Income” is greater than “0” comparison. In the Value field of the properties panel enter the number “0”.
9. Drag a *Rule* from the **Business (default)** palette over the left side element of the “Income” is less than “20000” comparison.
10. Click on the **Change** link beside the *Current Rule Class*.
11. Select the *Income* rule class from the drop-down menu. Click **Save**.
12. Choose the **Use Existing Rule** option, select “householdIncome” from the drop-down.
13. Drag a Number from the **Data Type** palette over the right side element of the “Income” is less than “20000” comparison. In the Value field of the properties panel enter the number “20000”.
14. Update the comparison so that it becomes “householdIncome < 20000”.
15. Click on the context menu of the “The household contains an eligible person” select **Edit Reference** .
16. Click on the **Change** link beside the *Current Rule Class*.
17. Select the *Person* rule class. Click **Save**.
18. Choose the **Use Existing Rule**option, select “householdContainsAnEligiblePerson” from the drop-down.
19. Use the **Save** button at the top of the Diagram Pane to save the changes. It is advisable to save often.

The “eligible” rule is updated. Update the “householdContainsAnEligiblePerson” attribute.

1. Select the “householdContainsAnEligiblePerson” attribute in the *Person* rule class, if the diagram is not already open.
2. Click on the “All the people in the household” rule. Select the context menu on the right hand side and select **Edit Reference** from the menu.

3. Select **Create New Rule** option. Enter “household” as the name of the new rule and click **Next**; choose **Rule Class** and check the “List” checkbox. Click **Next**; choose “Person” as the type and click **Save**.
4. Click on the “current person is eligible” rule. Select the context menu on the right hand side and select **Edit Reference** from the menu.
5. Click on the **Change** link beside the *Current Rule Class*.
6. Select the *SamplBenefit* rule class from the drop-down menu. Click **Save**.
7. Select **Use Existing Rule** option. Enter “eligible” as the name of the new rule and click **Save**.
8. Use the **Save** button at the top of the Diagram Pane to save the changes. It is advisable to save often.

The “householdContainsAnEligiblePerson” rule is updated. Update the “eligiblePerson” attribute.

1. Select the “eligiblePerson” attribute in the *Person* rule class, if the diagram is not already open.
2. Drag a *Rule* from the **Business (default)** palette over the left side element of the “Age is greater than 16” compare. Select the option **Create New Rule**. Type *age*. Click **Next**. Change the Result Type to Number. Click **Save**.
3. Drag a *Number* from the **Data Type** palette over the right side element of the “Age is greater than 16” compare. In the Properties Panel beneath the Diagram Pane, set the *Value* to 16.
4. Drag a *Rule* from the **Business (default)** palette over the left side element of the “Age is less than 22” compare. Select the option **Use Existing Rule**. Select *age* from the drip-down list. Click **Save**.
5. Drag a *Number* from the **Data Type** palette over the right side element of the “Age is less than 22” compare. In the Properties Panel beneath the Diagram Pane, set the *Value* to 22.
6. Click on the context menu in the comparison element in the “Age is less than 22” compare and change the value to “<” .
7. Click on the **Save** on the top right hand side of the CER Editor.
8. Click on the context menu of the “The person is a student” select **Edit Reference** .
9. Click on the **Change** link beside the *Current Rule Class*.
10. Select the *Person* rule class. Click **Save**.
11. Select the option **Create New Attribute**, enter “isStudent” as the name. Click **Next**; choose *Boolean* as the type and click **Save**.

Household Income

1. Open the “householdIncome” diagram. If it is not already open, it is located in the *Income* folder.
2. Click on the “All people in the household who are countable from an income perspective” context menu (the triangle on the right hand side of the text). Select the option **Edit Reference**. Click the **Change** link, select “SampleBenefit” from the drop-down. Select the option **Use Existing Rule** and select “countableMembers”from the drop-down.
3. Click on the “The current person's total income” context menu (the triangle on the right hand side of the text). Select the option **Edit Reference**. Click the **Change** link, select “Income” from the drop-down. Select the option **Use Existing Rule** select “totalIncome”, click **Next** . Set the Return Type to Number.

4. Click on the **Save** on the top right hand side of the CER Editor.

The “householdIncome” rule is complete, the “countableHouseholdMembers” rule needs to be updated.

1. Open the “countableHouseholdMembers” rule diagram. If it is not already open, it is located in the *SampleBenefit* folder.
2. Click on the “All the people on the household” context menu (the triangle on the right hand side of the text). Select the option **Edit Reference**. Click the **Change** link, select “Person” from the drop-down. Select the option **Use Existing Rule** and select “household”from the drop-down.
3. Click on the “Person is countable” context menu. Select the option **Edit Reference**. Click the **Change** link, select “Person” from the drop-down. Select the option **Use Existing Rule** select “isCountable”from the drop-down.
4. Click on the **Save** on the top right hand side of the CER Editor.

The “countableHouseholdMembers” rule is complete, the “isCountable” rule needs to be updated.

1. Open the “isCountable” rule diagram. If it is not already open, it is located in the *Person* folder.
2. Drag a *Rule* from the **Business (default)** palette over the left *Empty Member* of the Compare. Select the option **Create New Rule**. Click **Next**. Set the Result Type to *Number*.
3. Drag a *Number* from the **Data Types** palette over the right *Empty Member* of the Compare. Click on the *Number*, so that the Properties Panel is displayed. Change the Value to 18. Click on the menu beside the >, and select >=.
4. Click on the **Save** on the top right hand side of the CER Editor.

The “isCountable” rule is complete, the “totalIncome” rule needs to be updated.

1. Open the “totalIncome” rule diagram. If it is not already open, it is located in the *Income* folder.
2. Click on the “The countable amount for each income” context menu (the triangle on the right hand side of the text). Select the option **Edit Reference**. Click the **Change** link, select “Income” from the drop-down. Select the option **Create New Rule** input the value “incomes”, click **Next** . Set the Return Type to Rule Class. Check the *List* box, select the *Income* rule class from the drop down.
3. Click on the “The countable amount for this income” context menu (the triangle on the right hand side of the text). Select the option **Edit Reference**. Select the option **Use Existing Rule** select “countableAmount”from the drop-down..

The “totalIncome” rule is complete, the “countableIncome” rule needs to be updated.

1. Open the “countableIncome” rule diagram. If it is not already open, it is located in the *Income* folder.
2. Open the context menu (the triangle on the left hand side of the text) beside the *Wages* entry to expand the diagram. Click on the context menu (the triangle on the right hand side) associated with the *0*. Select Delete.
3. Drag a *Codetable* from the **Data Type** palette onto the *Wages* entry. Click on the Codetable element, so the codertable properties appear in the properties panel. Enter the value

"income" into *CodeTable Name*, hit enter, and select *IncomeTypeCode* . Select *Wages and Salaries* from the *CodeTable Value* drop-down.

4. Repeat the steps above for the *Tips and Commission*, except select *Tips and Commision* from the *CodeTable Value* drop-down. .
5. Click on the context menu (the triangle on the right hand side) associated with the *1* on the *Wages* row. Select Delete.
6. Drag a Rule from the **Business (default)** palette over the icon to the left of the "Full Amount" description for the wages row. You should see a golden circle appear, allowing you to drop the rule. Select the option **Create New Rule** and enter "amount". Click **Next** and select *Number* from the drop down.
7. Click on the context menu (the triangle on the right hand side) associated with the *1* on the *Tips and Commision* row. Select Delete.
8. Drag an Arithmetic element onto the result for the Tips row. Click on the "operator" dropdown in the middle of the element and change it to "/" operator.
9. Drag a Rule from the **Business (default)** palette to the left of the operator. Select the option **Use Existing Rule** and select "amount" from the drop down.
10. Drag a Number from the **Data Type** palette onto the empty element on the right of the operator. Click on the Number, so so the property Panel is displayed beneath the Diagram Pane. Set its value to "2".
11. Open the context menu (the triangle on the left hand side of the text) beside the *Otherwise* entry to expand the diagram.
12. Drag a Number from the **Data Type** palette onto the empty value associated with the *Otherwise* . Click on the Number, so so the property Panel is displayed beneath the Diagram Pane. Set its value to "0".

Entitlement

1. Open the "entitlement" rule diagram. If it is not already open, it is located in the *SampleBenefit* folder.
2. Open the context menu (the triangle on the left hand side of the text) beside the *One Person* entry to expand the diagram. Click on the context menu (the triangle on the right hand side) associated with the *0*. Click on the *0*, so the property Panel is displayed beneath the Diagram Pane. Change the *Value* to *1*.
3. Click on the *Number* element beneath the "100" on the second row. Change the *Value* to *100*.
4. Open the context menu (the triangle on the left hand side of the text) beside the *Two People* entry to expand the diagram. Click on the context menu (the triangle on the right hand side) associated with the *0*. Click on the *0*, so so the property Panel is displayed beneath the Diagram Pane. Change the *Value* to *2*.
5. Click on the *Number* element beneath the "200" on the second row. Change the *Value* to *200*.
6. Open the context menu (the triangle on the left hand side of the text) beside the *Three People* entry to expand the diagram. Click on the context menu (the triangle on the right hand side) associated with the *0*. Click on the *0*, so tso the property Panel is displayed beneath the Diagram Pane. Change the *Value* to *3*.
7. Click on the *Number* element beneath the "300" on the second row. Change the *Value* to *300*.

8. Drag a Number from the **Data Type** palette onto the empty value associated with the *Otherwise* . Click on the Number, so the Property Panel appears and set its value to “400”.

Eligible Members

1. Open the “numEligibleMembers” rule diagram. If it is not already open, it is located in the *SampleBenefit* folder.
2. Click on the “All the people in the household” rule. Select the context menu on the right hand side and select **Edit Reference** from the menu.
3. Click on the **Change** link beside the *Current Rule Class*.
4. Select the *Person* rule class from the drop-down menu. Click **Save**.
5. Select **Use Existing Rule** option. Select “household”and click **Save**.
6. Click on the “The current person is eligible” rule. Select the context menu on the right hand side and select **Edit Reference** from the menu.
7. Click on the **Change** link beside the *Current Rule Class*.
8. Select the *Person* rule class from the drop-down menu. Click **Save**.
9. Select **Use Existing Rule** option. Select “eligiblePerson” and click **Save**.

The “numEligibleMembers” rule is updated. Remove old diagram references.

1. The search input field is located at the top right hand corner of the CER Editor. Input the words “newAttribute” Click the Search Icon. The CER Editor returns a list of all attributes starting with “newAttribute” Click on an attribute on the list.
2. The attribute opens up in a diagram, and is highlighted in the Rule Class view. Click on the context menu beside the attribute name, select **Delete** from the menu.

1.5 Creating Timeline Aware Rules

What Are Timeline Aware Rules?

Chapter 3 explained what CER point in time rules are. This chapter will explain what CER timeline aware rules are and how to create a timeline aware rule. A CER Timeline is simply a value that varies over time, and it is the simplicity of this concept that allows timelines to be used to great effect in the application.

Identifying Timeline Aware Rules

Anything that can change over time is potentially a timeline aware rule. To introduce the concept, here is an everyday example of data which can vary over time.

A person's total income will tend to vary over time as the person receives pay rises or moves between employments. Given that a person's income at a point in time can be represented as a Number, then a person's varying income over time can be represented as a timeline of Numbers.

To identify what rules in “Sample Benefit” should be timeline aware you need to decide which rules are required to be calculated on different days. Here is a list of some of the rules in “Sample Benefit” that we could make timeline aware

- Household Income
- Number of eligible members
- Person Income

For more information on identifying timeline aware rules see the Handling Data That Changes Over Time section of the *Cúram Express Rules Reference Manual*.

It is the job of a technical user to make a rule timeline aware. A rule diagram needs to be viewed in the technical view in order for timeline information and menu options to be available in the editor.

Making Expressions Timeline Aware by Setting Up Timeline Markers

Any rule that changes over time can be made timeline aware. Not every expression used in the derivation of a rule needs to be timeline aware. For example if we were calculating a person's income and we needed to deduct a fixed percentage of that income the fixed percentage would not need to be timeline aware but the person's income would.

In this scenario we can make the rule timeline aware and use timeline markers to mark the values that should be treated as timeline data. In the next example the rule “Total income for a person” is made timeline aware by setting up timeline markers.

You make the rule “Total income for a person” timeline aware as follows:

1. Open the rule diagram for the “Person Income” rule.
2. View the diagram in technical view. Remember this is the icon in the top right corner of the diagram.
3. In the Rules Outline View select the rule context menu and select **Make Timeline** from the menu. This rule is now timeline aware.
4. Next we need to mark the expressions in the rule diagram that need to be timeline aware. Open the menu on the rule “All the incomes for this person” and select **Make Timeline Interval**. Do the same for the rule “The countable amount for this income”. Notice the timeline icon appear on the element icon on the right.

Creating an Existence Timeline

We have seen how anything that can change over time is potentially a timeline aware rule. Existence timelines allow you to specify the dates that a rule can exist as well as what value to use before, during and after these dates. An existence timeline creates a timeline of a specified type from a pair of inclusive start and end dates, either of which is optional.

You create an existence timeline as follows:

1. Create a new rule called “Student Grants Amount” and set its type to Number. From the **Technical** palette on the right-hand side of the editor, drag an *existencetimeline* element onto the rule element on the diagram. Change the name of the *existencetimeline* to be “Student Grants Amount”.
2. View the diagram in technical view. See the CER Editor Layout on page 11.
3. Drag a *Date* from the **Data Types** palette to the start date for the *existencetimeline*. Repeat this step for the end date.
4. Set the dates to be the date a person started college and the date a person finished college.
5. Drag a *Number* from the **Data Types** palette to the before, during and after date ranges.
6. Set the “Value Before Date Range” to be 0. This means the value of the grant before the person started college evaluates to 0.
7. Set the “Value During Date Range” to be 1000. This means the value of the grant during the period the person attended college evaluates to 1000.
8. Set the “Value After Date Range” to be 200. This means the value of the grant after the person finished college evaluates to 200.

Testing Timeline Outputs

You should write tests for your timeline attributes.

See 1.6 Testing the rules on page 31 for details on how to write tests.

See *`Cúram Express Rules Reference Manual`*, *Testing Timeline Outputs* for approaches to testing timeline calculations.

1.6 Testing the rules

After you create a CER rule set, you can write some Java™ code to execute and test your rules.

Complete the following steps:

1. Validate the rule set.

   CER rule sets are XML files that adhere to the included CER rule schema, which enforces many structural validations. CER also includes a comprehensive rule set validator that can detect errors in your rule set before allowing your rule set to execute. See Validating the Rule Set on page 15.
2. Publish the rule set.

   CER provides a sandbox so you can change rule sets without affecting the products that are using those rule sets. Modifying a published rule set in the editor causes a published in-edit record to be created for that rule set. You must publish the rule set for your in-edit changes to be picked up the next time a rule session runs. See Publishing the Rule Set on page 15.
3. Extract your newly created rule set and related data from the database with the `extractdata` target.
4. Generate skeleton test classes with the `creole.generate.test.classes` target.
5. Implement and run unit tests.

Extracting rule sets from the database

Complete the following steps to extract your rule set and associated data from the database for testing.

> **Note:** You can also use these steps to extract a rule set that was modified directly in the database with the CER Editor to the file system. You can then place the XML files under source control to synchronize the XML files on the file system with the information on the database.

Use the `extractdata` build target to extract the contents of a table from the database and transform it into a database-independent XML file. For more detail about this target, see the *Server Developer's Guide*.

Complete the following steps to extract rule sets:

1. Open a command line in your *`Curam/EJBServer`* directory.
2. Run the **`build extractdata -Dtablename=CREOLERULESET`** command.
3. All rule sets for the specified table are extracted to the *`Curam\EJBServer\build\dataextractor\blob`* directory. Records are extracted to a file based on the table name. Find the rule set you are working with and rename it based on the rule set name with an XML file extension, for example *`RulSetName.xml`*.
4. Copy *`RulSetName.xml`* to the *`CREOLE_Rule_Sets`* directory of the component that you are developing the rule set for. You might need to create this directory.
5. Copy *`CREOLERULESET.dmx`* from the *`Curam\EJBServer\build\dataextractor`* directory to the *`data\initial`* directory of the component that you are developing the rule set for. You might need to create this directory.
6. Edit the file *`CREOLERULESET.dmx`*, which is located in the *`data\initial`* directory of the component, and delete all the entries except the entry that is related to your newly created rule set. This entry can be found by searching for your rule set name in the `<value>` tag in the *`CREOLERULESET.dmx`* file.
7. Set the rule set definition path as `./../build/svr/creole.gen/Rules/components/`*`your_component/your_ruleset_name.xml`* in the *`CREOLERULESET.dmx`*.

   Specifying this location ensures that the component order mechanism operates correctly:

   - The XML files are merged according to the SERVER_COMPONENT_ORDER environment variable to ensure that the contents of your custom component directories are given greater priority than the default components.
   - Any `<Include>` tags in the rule set XML are processed. If a ruleset XML file includes another XML file, the included file is expanded before it is loaded into the database.

Also, clear the `ruleSetVersion` value as shown in the following sample XML.

```
<attribute name="ruleSetDefinition">
   <value>./../build/svr/creole.gen/Rules/components/
     custom/SampleBenefit.xml
   </value>
 </attribute>

 <attribute name="ruleSetVersion">
   <value/>
 </attribute>
```

Complete the following steps to extract rule set properties:

1. Open a command line in your *`Curam/EJBServer`* directory.
2. Run **`build extractdata -Dtablename=APPRESOURCE`**
3. Copy *`APPRESOURCE.dmx`* from the *`Curam\EJBServer\build\dataextractor`* directory to the *`data\initial`* directory of the component that you are developing the rule set for.
4. Edit the file *`APPRESOURCE.dmx`* that is located in the *`data\initial`* directory of your component and delete all the entries except the entry that is related to your newly created rule set. This entry can be found by searching for `<value>RULESET-`*`your_ruleset_name_and_version`*`</value>` in *`APPRESOURCE.dmx`*.
5. Copy the resources files specified in the *`APPRESOURCE.dmx`* file, from the *`Curam\EJBServer\build\dataextractor\blob`* directory to the *`data\initial\blob`* directory of your component. The names of the resources files can be found in the tag `<attribute name="content"> <value>./blob/` *`resource file name`* `</value></attribute>` in *`APPRESOURCE.dmx`*. For example, `<attribute name="content"> <value>./blob/Appresource2289</value></attribute>`.
6. Set the resources path as `./` *`your component`* `/data/initial/blob/`*`resource_file_name`* in *`APPRESOURCE.dmx`* file as shown in the following sample XML.

   ```
   <attribute name="content">
     <value>./custom/data/initial/blob/Appresource2289</value>
   </attribute>
   ```
7. Rebuild the database.

Generating test classes

CER supports the generation of rule set test classes, which we can use to test our `Sample Benefit` rule set.

For example, look at the “Eligible Person” Rule. The `Person` class has two attributes that must be specified to calculate the eligible attribute for a person.

1. age - a number to hold a person's age.
2. isStudent - a Boolean to indicate whether the person is a student.

The `Person` has a derived attribute:

- eligible - a Boolean to indicate whether a person is eligible for “Sample Benefit”

The following steps show how to run the CER Test Code Generator on a rule set, such as the rule set extracted in Extracting rule sets from the database on page 32.

1. Open a command prompt in your *Curam/EJBServer* directory.
2. Run **build creole.generate.test.classes** to generate test classes from your rule set. This target runs on the rules sets in the *CREOLE_Rule_Sets* directory for each component.
3. Refresh your development environment to view the output, which the CER code generator places in the *EJBServer/build/svr/creole.gen/source* directory.

The generated code is only intended for use in test environments where it is a straightforward matter to recompile changes to code. The generated code is not portable across machines, as it contains absolute local paths to the rule sets. In particular, you must not use the generated code in any production environment where rule sets might change dynamically.

Tip: Regenerate your test classes if you make structural changes to your rule sets, such as:

- Creating a rule set or remove an existing rule set.
- Adding a rule class to a rule set or remove an existing rule class to a rule set.
- Adding a rule attribute to a rule class or remove an existing rule attribute from a rule class.
- Changing the “extends” value for an existing rule class.
- Changing an attribute's data type.

You do not need to regenerate the test classes if your changes are limited to the implementation of a rule attribute, that is, its derivation expressions. The derivations are always processed dynamically from the rule set at run time and are not present in the generated test classes.

Writing and running unit tests

The next step in testing a rule set is to write a JUnit test to test the logic in the rule set. You can run the test as a standard JUnit test through your integrated development environment or create an Apache Ant target to run the test.

The following example shows a unit test for the `Person` class. This test calculates the `eligible` attribute when the `isStudent` and `age` attributes are specified.

```
import curam.creole.calculator.CREOLETestHelper;
import curam.creole.execution.session.RecalculationsProhibited;
import curam.creole.execution.session.Session;
import curam.creole.execution.session.Session_Factory;
import curam.creole.execution.session.StronglyTypedRuleObjectFactory;
import curam.creole.ruleclass.SampleBenefit.impl.Person;
import curam.creole.ruleclass.SampleBenefit.impl.Person_Factory;
import curam.creole.storage.inmemory.InMemoryDataStorage;
import curam.test.framework.CuramServerTest;


/** Class tests the Person rule class.*/
public class TestPersonEligible extends CuramServerTest {

  private Session session;


  public TestPersonEligible(String arg0) {
    super(arg0);
  }


  /*
   * All tests in this class will use a newly-created session
   * that creates strongly-typed rule objects
   */
  @Override
  protected void setUpCuramServerTest() {
    session = Session_Factory.getFactory().newInstance(
      new RecalculationsProhibited(),
        new InMemoryDataStorage(
          new StronglyTypedRuleObjectFactory()));
  }


  /**
   * Tests that a person's eligibility is correctly calculated
   * when supplied a person's student status and age.
   */
  public void testPersonEligiblity() {

    /* Create a "bootstrap" rule object */
    final Person personObj =
      Person_Factory.getFactory().newInstance(session);

   /**
    * Specify a person with an age of 25.
    */
    personObj.age().specifyValue(25);

    /**
     * Specify a person who is a student.
     */
    personObj.isStudent().specifyValue(true);

    /**
     * Check that the person is eligible
     */
    CREOLETestHelper.assertEquals(
      true, personObj.eligible().getValue());
  }
}
```

Add the test to the test directory in the component that you are working on.

For more information about testing rules, see the *Cúram Express Rules Reference Manual*.

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