Oracle® Retail Predictive Application Server

Configuration Tools User Guide
Release 13.0.2

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Oracle® Retail Predictive Application Server Configuration Tools User Guide, Release 13.0.2

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Value-Added Reseller (VAR) Language

Oracle Retail VAR Applications

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(vi) the software component known as **Access Via™** licensed by Access Via of Seattle, Washington, and imbedded in Oracle Retail Signs and Oracle Retail Labels and Tags.

(vii) the software component known as **Adobe Flex™** licensed by Adobe Systems Incorporated of San Jose, California, and imbedded in Oracle Retail Promotion Planning & Optimization application.

(viii) the software component known as **Style Report™** developed and licensed by InetSoft Technology Corp. of Piscataway, New Jersey, to Oracle and imbedded in the Oracle Retail Value Chain Collaboration application.

(ix) the software component known as **DataBeacon™** developed and licensed by Cognos Incorporated of Ottawa, Ontario, Canada, to Oracle and imbedded in the Oracle Retail Value Chain Collaboration application.

Contents

Preface

Oracle Retail Configuration Guides are designed so that you can view and understand the application's "behind-the-scenes" processing, including such information as the following:

- Key system administration configuration settings
- Technical architecture
- Functional integration dataflow across the enterprise
- Batch processing

Audience

This document is intended for the users and administrators of Oracle Retail Predictive Application Server. This may include merchandisers, buyers, and business analysts.

Related Documents

For more information, see the following documents in the Oracle Retail Predictive Application Server Release 13.0.2 documentation set:

- *Oracle Retail Predictive Application Server Release Notes*
- *Oracle Retail Predictive Application Server Licensing Information*
- *Oracle Retail Predictive Application Server Administration Guide*
- *Oracle Retail Predictive Application Server User Guide*
- *Oracle Retail Predictive Application Server Online Help*
- *Oracle Retail Predictive Application Server Configuration Tools Online Help*

Customer Support

- https://metalink.oracle.com

When contacting Customer Support, please provide:

- Product version and program/module name.
- Functional and technical description of the problem (include business impact).
- Detailed step-by-step instructions to recreate.
- Exact error message received.
- Screen shots of each step you take.

Review Patch Documentation

For a base release (".0" release, such as 13.0), Oracle Retail strongly recommends that you read all patch documentation before you begin installation procedures. Patch documentation can contain critical information related to the base release, based on new information and code changes that have been made since the base release.

Oracle Retail Documentation on the Oracle Technology Network

In addition to being packaged with each product release (on the base or patch level), all Oracle Retail documentation is available on the following Web site:

http://www.oracle.com/technology/documentation/oracle_retail.html

Documentation should be available on this Web site within a month after a product release. Note that documentation is always available with the packaged code on the release date.

Conventions

Navigate: This is a navigate statement. It tells you how to get to the start of the procedure and ends with a screen shot of the starting point and the statement "the Window Name window opens."

> **Note:** This is a note. It is used to call out information that is important, but not necessarily part of the procedure.

```
This is a code sample
    It is used to display examples of code
```

A hyperlink appears like this.

1
Introduction

Overview

The Oracle Retail Predictive Application Server (RPAS) Configuration Tools provide a flexible means to configure and build RPAS-based applications with retailer-specific business parameters. The configuration tools provide a streamlined, user-friendly interface to leverage RPAS functionality. Once a configuration is created, an installer script is used to build an RPAS domain.

The Configuration Tools consist of an integrated set of task-specific configuration aids that are used to configure a solution template or to modify an existing solution template.

RPAS functionality is exposed to the Configuration Tools via Application Programming Interfaces (APIs).

A configuration is typically created and maintained by an application administrator or solution expert. Details of the configuration are stored locally on the administrator's PC or on the network. Once the configuration is complete, the administrator uses the configuration to create a new domain or update an existing domain.

Users of the configured solution will access the RPAS domain by using the RPAS Client that is installed on their machines. The domain accessed represents the business process and environment that was configured in the solution together with the appropriate data.

Once the domain is created, administrative RPAS processes (such as hierarchy maintenance and user administration) are accomplished by an RPAS administrator using the utilities on the server.

> **Note:** For more information on RPAS administration and installation, refer to the *RPAS Administration Guid*e and the *RPAS Installation Guide*.

Configuration Tools Business Process

1. Set up system properties
2. Create a project
3. Create solutions
4. Configure hierarchies and dimensions
5. Configure measures and measure components
6. Configure rules sets, rule groups, and rules
7. Configure workbooks, workbook tabs, and worksheets
8. Configure wizards
9. Define interfaces used to import data
10. Build an RPAS domain

Sample Configurations

Some examples in this document use the sample configuration, which is delivered with the RPAS platform and can be installed along with the RPAS software and Configuration Tools. The sample configuration may not match every illustration because RPAS software and Configuration Tools software versions might vary between users. The examples are meant to provide a context to the reader. For information about the sample configuration provided with the RPAS platform, refer to the *RPAS Installation Guide*.

Using the Configuration Tools Online Help

This Help site provides step-by-step procedures and other information about using RPAS Configuration Tools. We have implemented some tools to assist your navigation of this Help site. This page explains these tools.

About the Online Help

The online Help system uses JavaScript for some of its functionality. Make sure you have enabled JavaScript for your Web browser. Refer to the online Help in your Web browser for instructions on enabling JavaScript.

Formatting Conventions

This section provides information about the documentation conventions used in the online Help.

> **Note:** Notes are displayed using this convention. Notes contain additional information about the process or procedure that you are performing.

Navigate: The navigation sections of a procedure provide information about how to access the window that is the starting point of a procedure.

Navigate the Online Help

This Help site provides several ways for you to navigate to your topic.

Use the Table of Contents

The table of contents is the most common way that you will navigate to your topic.

1. Select the **Table of Contents** tab to display the table of contents on the left side of your screen.
2. Select the **+** sign in front of a book to expand it and view the topics.
3. Select a topic from the table of contents to view it.

Using the Search Feature

Use the search feature to explore the contents of your topics and find matches to queries that you define. There are some basic rules for making queries in full-text searches.

- You can type your search in uppercase or lowercase characters. Searches are not case sensitive.
- You can search for any combination of letters (a-z) and numbers (0-9).
- Punctuation marks such as the period, colon, semicolon, comma, and hyphen are ignored during a search.

- Group the elements of your search using double quotes or parentheses to set apart each element.
- You cannot search for quotation marks.

Use the following procedure to search the online Help:

1. Select the **Search** tab to display the search feature on the left side of your screen.
2. In the **Search** field, enter the word or words that you want to find.
3. Press the **Enter** key. Topics that match your search criteria display in the left pane.
4. Select a topic to view it.

Using the Business Process

The business process typically provides links to procedures that you need to perform to complete a task. You can select any link in the business process to view that topic.

Using the Index

Some Help sites may have an index. The index provides another way for you to navigate to information. There are two ways to use the index to search.

Browse the Index Entries

1. Select the **Index** tab. Words and phrases that are listed in the index display in alphabetical order.
2. Scroll up or down to find a word or phrase.
3. Select the word or phrase to view additional information.

Search the Index

1. Select the **Index** tab. Words and phrases that are listed in the index display in alphabetical order.
2. In the keyword field, type the word or phrase. Words and phrases that match your entry are displayed.
3. Select the word or phrase to view additional information.

Using Links

There may be two different types of links in this online Help. Select the link type below to learn more about it.

Some topics contain hyperlinks that open a new page.

Many topics have information that appears using a drop-down text link.

Drop-down text typically provides additional steps or sub-steps for a process or procedure and displays under the linked word or phrase.

- Select the link once to view the text.
- Select the link again to hide the text.

Using Hyperlinks

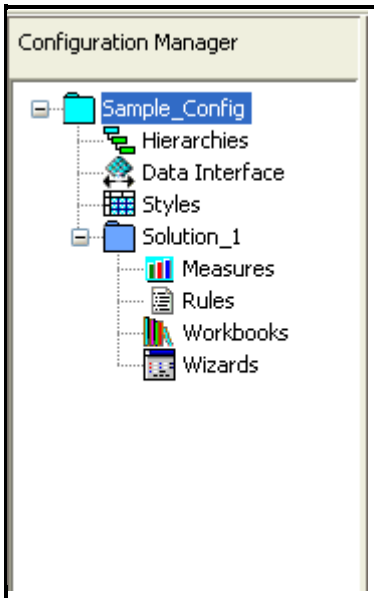
Hyperlinks bring you to another page in the online Help or to a Web page on the Internet. There are two things to remember when using hyperlinks:

- Hyperlinks always display a brief description of where the hyperlink takes you.
- If your browser controls are turned off, follow these steps to return to the previous page:

1. Display the shortcut menu by perform one of the following actions:
   - Right-click with your mouse.
   - Press the Application key.
2. From the shortcut menu, select **Back**. The previous page appears.

Know the Configuration Manager

As a new configuration is created, you assign a name to the configuration, the project, and the solution. You can drill down through the configuration to work in specific areas. The icons in the Configuration Manager help you navigate the Configuration Tools. If an area of the configuration has been modified, its icon will contain a modification flag icon. The configuration must be saved if the modifications are to be retained.



Icon Name	Window Displayed in the Workspace
Project	None
Hierarchies	Hierarchy Definition window
Data Interface	Data Interface Manager window
Styles	Style Definition Window
Solution	None
Measures	Measure Manager window
Rules	Rule Definition window
Workbooks	Workbook Designer window
Wizards	Wizard Designer window

Navigating the Configuration Tools

Starting the Program

Once the Configuration Tools are installed, it can be accessed from the following default location by selecting **Start – Program Files – Oracle – RPAS – Configuration Tools**.

The executable file (ConfigTools.exe) can also be used to start the program. It is accessed in the following default location:

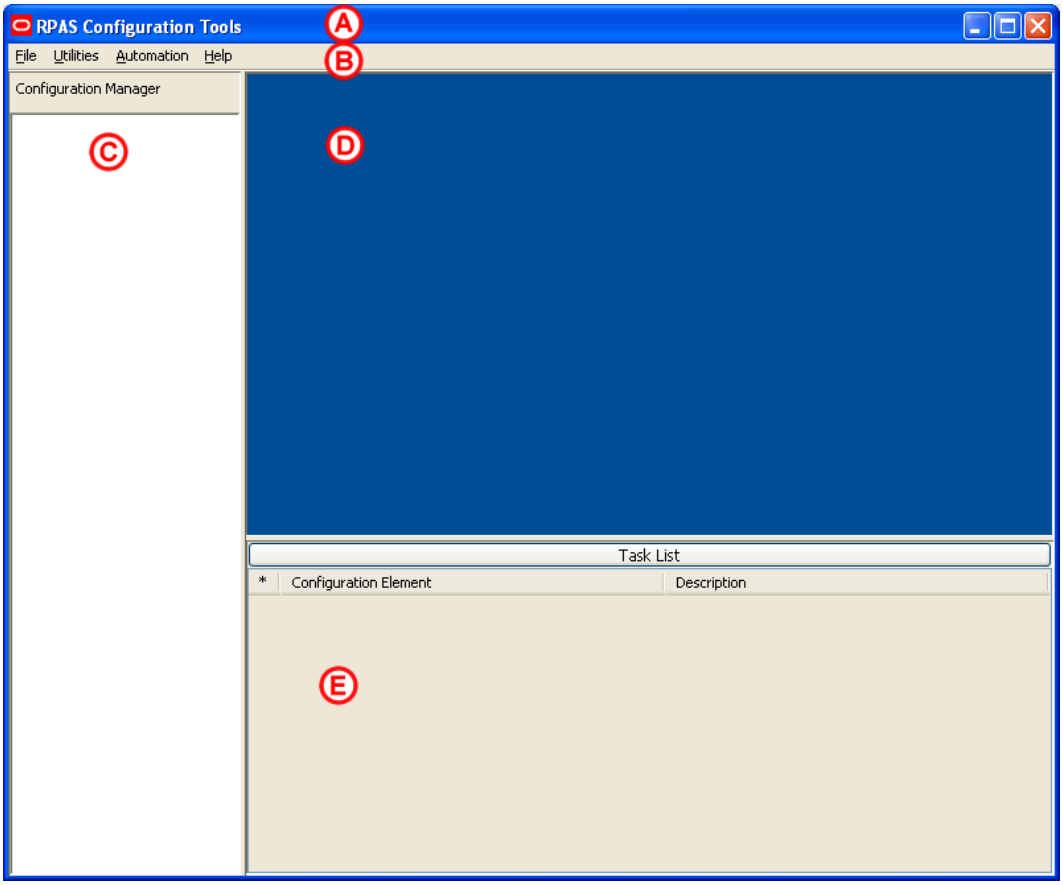
C:\Oracle\RPAS\ConfigTools\bin\ConfigTools.exe

Shortcuts may be created here and placed wherever they provide convenient access.

About the Configuration Tools Windows

All tasks are performed through the RPAS Configuration Tools window, which provides the following features:

- Drop-down menus
- Toolbars
- Active buttons
- Right-click functionality



Configuration Tools Window

The primary elements in the application window are described in the table below.

Element	Purpose
Title Bar (A)	▪ Displays the product name. ▪ The three buttons at the far right on the title bar allow for the application window to be minimized, restored, maximized, and closed.
Menu Bar (B)	▪ Contains the menus that are used in the Configuration Tools. ▪ Each menu contains a set of commands that allow you to operate the Configuration Tools.
Configuration Manager (C)	▪ Displays information about configurations, projects, and solutions that are currently in use. ▪ Configuration information is not displayed until a configuration is opened.
Workspace (D)	▪ As different configuration elements are selected in the Configuration Manager, the related windows are displayed in the workspace.
Task List (E)	▪ Displays errors and warnings within the configuration.

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Configuration Manager

Overview

The Configuration Manager is the starting point for creating a new configuration or for opening an existing configuration. It provides a high-level view of all the components that are necessary to configure an RPAS application, and it is used to navigate to the various tools that are used to configure those components.

The configuration manager is the core of the RPAS Configuration Tools, and it provides an overall view of the configuration components. Each configuration contains one project and one or more solutions.

Projects

 Each project represents a single, logical RPAS domain although it may become several physical domains in a 'global domain' environment. The hierarchies, dimensions, and styles are defined within a project and are available for use within all solutions in the project. The RPAS Configuration Tools allows for multiple projects to be viewed and modified (the limit is 3 projects).

Solution

 Each solution represents a grouping of measures, rules, and workbooks to support a business process as defined by the retailer. A project may have multiple solutions and a solution may use a subset of the hierarchies and dimensions defined within the project.

Hierarchy

 The user may access the Hierarchy Definitions window by either selecting the icon or **Hierarchy** from the Configuration Manager. For each project, a single or multiple hierarchies may be created and dimensions are defined within each hierarchy. Hierarchies are the structures used by an organization to describe the relationships that exist between the dimensions. The following hierarchies are automatically created when a new project is defined:

- Calendar
- Product
- Location

Users may create and define the individual dimensions for these hierarchies and for any additional hierarchies that may be desired.

> **Note:** The RPAS (system) names for the default hierarchies (CLND, PROD, LOC, and ADMU) cannot be changed, but the default labels (Calendar, Product, and Location) can be changed. The ADMU label cannot be changed.

Data Interface

 The user may access the Data Interface Manager by either selecting the icon or **Data Interface** from the Configuration Manager. The data interface tool is used to define the format of data interface files and provide some data interface parameters, such as directions to RPAS on how to deal with data that is sourced below its base intersection. The tool sets measure attributes that are referenced when loading measure data into the domain. The information entered into the data interface will be referenced when the `loadmeasure` utility is used to load data for a measure.

Styles

 The user may access the Style Definition window by either selecting the icon or **Styles** form the Configuration Manager. The style tool is used to define styles that specify how the data for a measure is to be displayed within the RPAS Client. Styles consist of a number of attributes; such as text font, size, and color as well as specifications of precision, alignment of text within the cell. These styles may then be assigned to measures within the Measure and Workbook Tools.

Solutions

 A solution corresponds to an application configuration (for example, Financial Planning or Item Planning). For each solution, the following are configured:

- Measures
- Rule sets / rule groups / rules
- Workbooks / worksheets
- Wizards (optional)

Measures

 Measures (multidimensional variables) are any item of data that can be represented on a grid in a worksheet. Measures are the data points used in the retailer's business process.

Rule Sets, Rule Groups, and Rules

 Rules are collections of expressions (the basis of all calculations) that describe the relationships between measures. They are evaluated by the RPAS calculation engine during a calculation. Rules can consist of multiple expressions as the following example represents:

- Expression 1: ReceiptUnits = ReceiptValue / ReceiptPrice
- Expression 2: ReceiptValue = ReceiptUnits * ReceiptPrice
- Expression 3: ReceiptPrice = ReceiptValue / ReceiptUnits

The collection of expressions represents a rule. These three expressions state the relationship between ReceiptUnits, ReceiptValue, and ReceiptPrice. Each expression solves for a different measure.

A rule group is a collection of rules that are treated as a unit by the calculation engine. The rules in the rule group must be considered together to satisfy the calculation requirements for a specific business process. The sequence of rules in a rule group determines the calculation sequence unless the sequence is forced.

A rule set is a collection of rule groups that is used for organizational purposes by the Configuration Tools.

Workbooks and Worksheets

 A workbook is the multidimensional framework that is used to perform specific business functions, such as creating a merchandise plan and reviewing available data. Workbooks are easily viewed and manipulated.

A workbook can contain any number of multidimensional spreadsheets (called worksheets) to present data. Measures and rules are used to define and calculate the measure data. All of these components work together to facilitate the viewing and analysis of business functions. The Configuration Tools allow you to configure workbook templates incorporating these various components.

Wizards

 A wizard is a feature that guides the user through the process of building a new workbook. A wizard displays successive dialogs that require the user to answer a sequence of questions or enter information regarding the content of the workbook. Responses to these questions are used to format and populate the workbook. The layout of these wizard dialogues could be defined using the wizard tool. However, each workbook may use a standard wizard configuration, eliminating the need for you to access the Wizard Designer.

The main purpose of the wizard is to allow the end user to make choices regarding the scope of the workbook. For example, the first wizard might ask the user to select the SKUs to include in the workbook. The second might ask the user to select the stores to include in the workbook, and the third wizard might ask the user to select the dates to include in the workbook. At the end of the series of wizards, a workbook will be created that has data for the SKUs, stores, and dates that the user selected.

Task List

The Task List provides a centralized view of errors and warnings that are issued as a result of information input by the user. Use the information in the Task List as a guide for correcting errors or omissions in the project.

The Task List title bar serves as a status indicator. If the title Task List is displayed in red, the Task List contains items that need the user's attention. If there are no errors or warnings, the title will be displayed in black.

The title bar can also be used to show or hide the Task List. If the Task List is visible, click anywhere on the title bar to hide the list and move the title bar to the bottom of the window. If it is hidden, click anywhere on the title bar to display the Task List. The amount of space used by the task list sub-pane can also be changed by dragging the separator above the task list title bar.

The Task List displays the following columns:

- The first column indicates the nature of the Task List item. A indicates an error. A  indicates a warning.
- The second column identifies the configuration element involved.
- The third column provides a description of the issue.

Errors typically indicate definite validation problems, which are shown in red in the tool where the configuration setting is made. When the user fixes the erroneous condition, the Task List automatically removes the error listing for that condition. Warnings indicate the possibility of a problem occurring, and the user is advised to inspect the suspected element to ensure that everything is in order. Since warnings are more general than errors the Task List will not remove them automatically. The user is provided with options to remove errors and warnings via a right-click menu.

How RPAS Uses Solution Configurations

The RPAS Calculation Engine

The RPAS calculation engine is a very powerful and flexible engine that is built to support On-Line Analytical Processing (OLAP) type calculations against a multi-dimensional model.

In the OLAP model individual pieces of data (called cells) correspond to a single position in one or more hierarchies or dimensions. Cells typically reference:

- A measure
- A calendar or time hierarchy
- Other hierarchies, such as product and location

The measure is fundamentally different to the other hierarchies, because measures represent the events or measurements that are being recorded. The positions in the other hierarchies provide a context for the measurement: where, when, what, and so on. Measures relate to one another through rules and expressions. Positions in all the other hierarchies relate to each other through hierarchical relationships.

Aggregation and Spreading

The RPAS calculation engine is designed to be robust and extensible, but in complete control of the calculation process. It enforces integrity of the data by ensuring that all known relationships between cells are always enforced. Much of the logic of the processing of rules and rule groups depends on this basic principal. RPAS supports two different forms of relationships between cells:

- Hierarchical relationships that require aggregation and spreading
- Measure relationships that require rules and expressions

Aggregation and spreading are basic capabilities of the engine that do not require coding by the implementer, other than the selection of aggregation and spreading types to use for a measure. Hierarchical relationships, such as weeks rolling up to months or stores rolling up to regions, require the aggregation of data values from lower levels in a hierarchy to higher levels by using a variety of methods as appropriate to the measure.

To enable such data to be manipulated at higher levels, RPAS supports spreading the changes, which also uses a variety of methods.

The inherent relationships between measures can be modeled through a rich rule and expression syntax. Modeling these relationships takes most of the effort in configuring an application model.

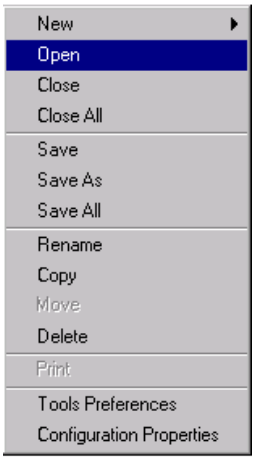
RPAS Functions

- RPAS Functions are mechanisms for performing operations within an expression that are controlled and executed by the calculation engine.
- Most functions have only one output.
- The calculation engine controls and executes the evaluation of a function.
- Functions may be used in long expressions with other functions and keywords.
- The data that can be referenced is limited to the scope of the workbook.

> See Appendix: Calculation Engine Users Guide for a comprehensive definition of the RPAS calculation engine and how it is used when configuring a solution.
>
> See Appendix: Rules Function Reference Guide for details about standard RPAS functions.

Right-Click Menus in the Configuration Manager

The right-click menu may be accessed by right-clicking in any location within the Configuration Manager. Each available selection from the right-click menu is described in the following sections.

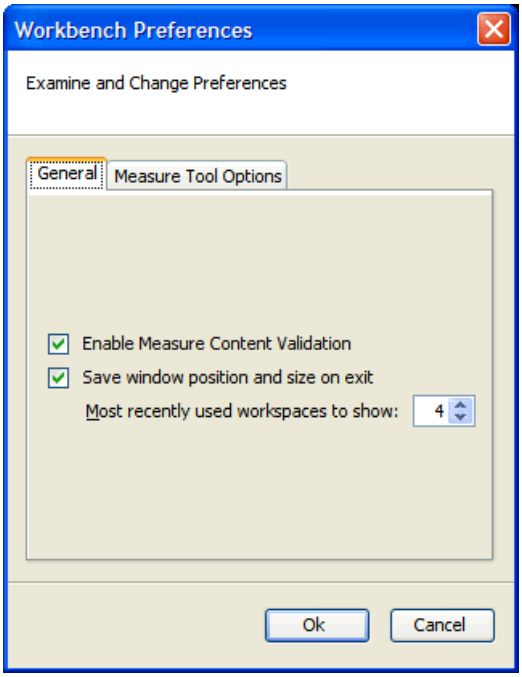


Example: Right-click Menu

Setting Tools Preferences

Settings made here will apply to all configuration projects created or viewed with the tool.

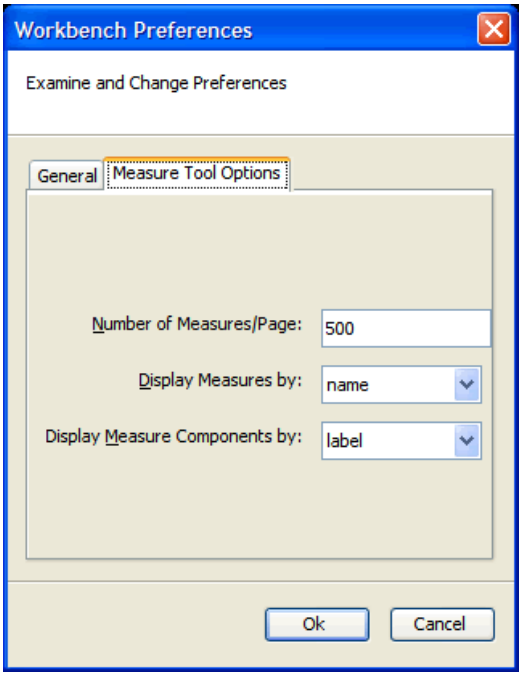
Navigate: From the **File** menu, select **Tools Preferences**. The Workbench Preferences window opens.



Workbench Preference Window

1. Select the **General** tab.
   - **Enable Measure Content Validation –** Activating this checkbox enables the immediate validation of measure properties when configuration measure information is created or modified. This process can impact the performance of the RPAS Configuration Tools. If this box is not checked, the manual Measure Content Validation icon is enabled on the Rule Definition toolbar. See the Rule Definition Tool for details.
   - **Save window position and size on exit –** Selecting this option opens the RPAS Configuration Tools in the same view state (full or minimized view) in which the configuration was lasted viewed. If the application is exited in a minimized view, the size of the window is also maintained when the RPAS Configuration Tools is re-launched.
   - **Most Recently used workspaces to show –** Use the up and down arrows to specify the number of configurations to be displayed in the Most Recently Used list displayed in the File menu dialog. This list allows you to view and select recently viewed configuration.

2. Select the **Measure Manager Options** tab.



Workbook Preferences - Measure Tool Options

- **Number of Measures/Page –** Select the number of measures to display per page in the Measure Manager Tool. The default value is **500**.
- **Display Measures by –** Displays measures either by their name or label in various locations of the Tools. The default setting is **name**.
- **Display Measure Components by –** Display measure components (in the Measure Manager tool) either by name or by label. The default setting is **label**.

3. Click **OK** to save any changes and close the window.

3

Projects

Working with Projects

Overview

A project is used to configure the structure of a domain. Each project represents a single, logical RPAS domain although it may become several physical domains in a "global domain" environment. The hierarchies, dimensions, and styles are defined within a project and are available for use within all solutions in a given project.

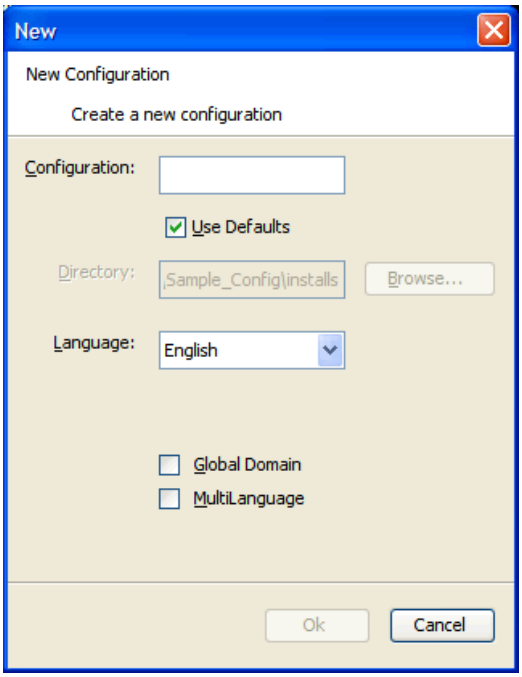
> **Note:** A solution can use a subset of the hierarchies and dimensions defined within the project. Within a project, you can additionally define certain properties (which are part of the Data Interface Tool) that describe how measures will be loaded into the domain.

Hierarchies are “domain-specific,” which means that they are defined at the project (domain) level and can be used by all solutions that are defined within that project (domain). There is no requirement that each solution use all of the hierarchies defined in the project.

For example, a project may contain five hierarchies and three solutions, but each solution might only use four of those hierarchies in the base intersections of its measures, so even though five hierarchies exist, each solution may not use all of them.

Create a Project

Navigate: From the **File** menu, select **New – Project**, or right-click in the Configuration Manager and select **New – Project**. The New dialog box appears.



New Dialog Box

1. In the **Configuration** field, enter the name of the configuration/project.

   The **Use Defaults** option under the **Configuration** field points the user to a default path for storing the configuration. Deselect the **Use Defaults** option to enable the user to navigate to the appropriate directory using the **Browse** button.
2. Select the default language for the domain in which this configuration will be used to create. The default is English.
3. Select the options for Global Domain and MultiLanguage as necessary. The possible settings for these boxes are as follows:
   - **Global Domain –** Selecting this option overrides the default setting of "Simple Domain." A Global Domain allows the user to create workbooks from multiple domains and to administer and update multiple domains from a single master domain. Whether a domain should be Global is a technical decision that should be made with the consultation of Oracle Services. This setting cannot be changed after the domain is built.
   - **MultiLanguage –** If this option is selected the resulting domain will be enabled to support multiple languages. Multi-lingual domains allow for most data elements (measures, labels, and so on) in an RPAS domain to be translated into other languages. More information on Multi Language support can be found in the "Translation Administration" chapter of the RPAS Administration Guide.

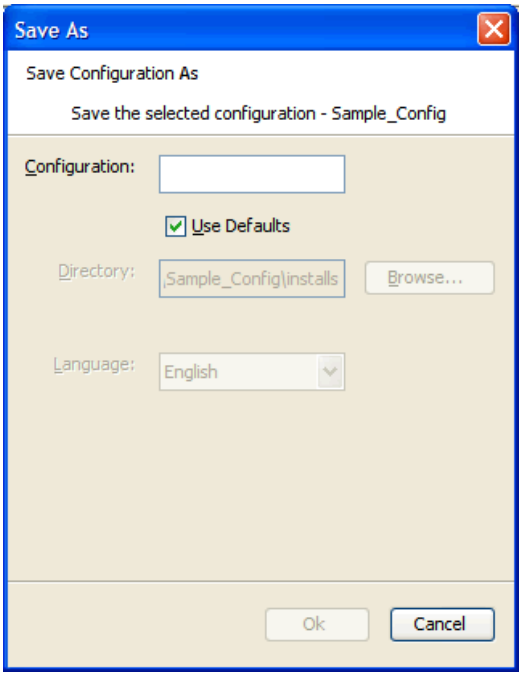
     Note: The Global Domain and Multi-Language settings must be defined before the domain is built. Changes to the Global Domain and MultiLanguage properties are ignored when modifying the configuration of an existing domain.
4. Click **OK** to save any changes and close the window.

Save Changes to a Project

Navigate: From the **File** menu, select **Save**, or right-click in the Configuration Manager window and select **Save**. This will save the project under the same name that was used to create it and within the same directory.

Using "Save As" to Save a Project Using a Different Name

Navigate: From the **File** menu, select **Save As**, or right-click in the Configuration Manager window and select **Save As**. The Save As dialog appears.



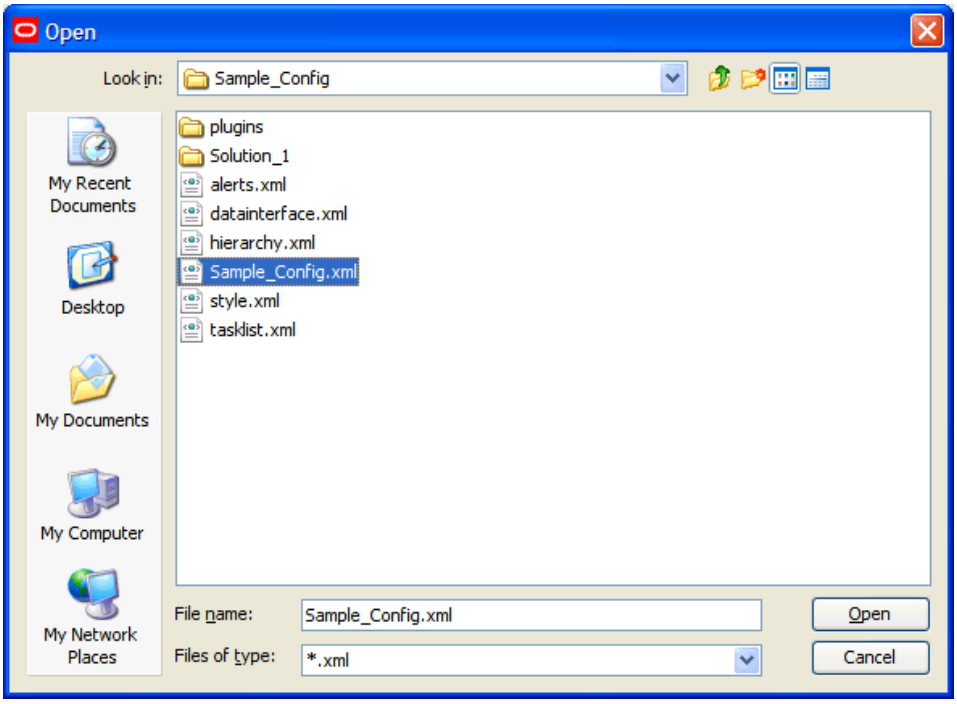
Save As Dialog Box

1. In the **Configuration** field, enter the new project name.
2. If **Use Defaults** is selected, click **OK** to save the project to the path displayed in the **Directory** field. If **Use Defaults** is selected and you want to save the project to a different location, deselect **Use Defaults** and either enter the appropriate path in the **Directory** field, or click **Browse** to navigate to the appropriate location where you want the project saved.
3. Click **OK** to save the project.

Open an Existing Project

Navigate: From the **File** menu, select **Open**, or right-click in the Configuration Manager window and select **Open**. The Open dialog box appears.

1. Choose one of the following methods:
   - Browse to the directory where your project is saved. Select the file whose name is the same as the project with an ".xml" extension and click Open. The project appears in the Configuration Manager.



Open Dialog Box

   - To open a project that was recently opened, select the project from the recently used projects list in the File menu. These projects appear as a numbered list where the most recently used project is first in the list. Select the project, and it will open in the Configuration Manager. The number of projects that appears in the most recently used list may be changed from the Workbench Preferences dialog box, which is accessed by selecting Tools Preferences from the File menu.

Open an Existing Project from an Older Version of the Configuration Tools

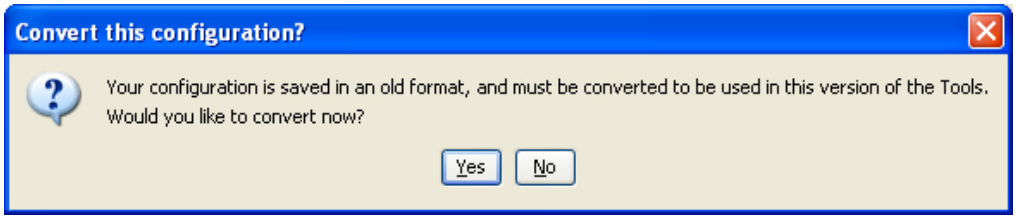
If you attempt to open a project saved in a previous version of the RPAS Configuration Tools, a dialog box may appear which allows you to convert the configuration to the new version.

Navigate: From the File menu or right-click from the Configuration Manager, select **Open**. The Open dialog box appears.

1. Choose one of the following methods:
   a. Browse to the directory where your project is saved. Select the file whose name is the same as the project with an XML file extension and click **Open**. The project opens in the Configuration Manager.
   b. To open a project that was recently opened, select the project from the recently used projects list in the File menu. These projects will be in a numbered list

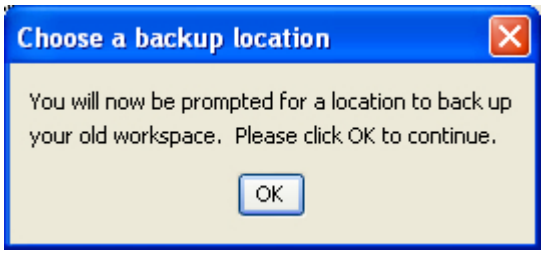
where the most recently used project is first in the list. Click on the project, and it opens in the configuration manager. The number of projects that appears in the most recently used list may be changed by using the **Tools Preferences** option of the File menu.

A message box appears:



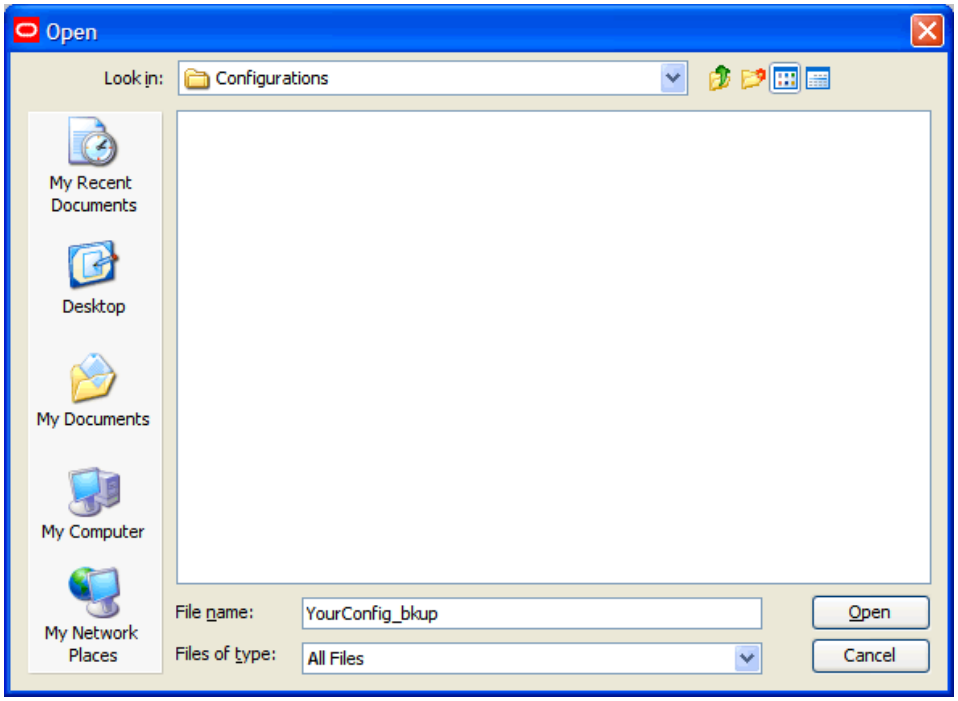
Convert This Configuration Message Box

2. To convert at a later time without currently viewing or modifying the project, click **No**. Click **Yes** to convert the project so it can be viewed or modified. If **Yes** is selected, the Choose a backup location message box appears.



Choose a Backup Location Message Box

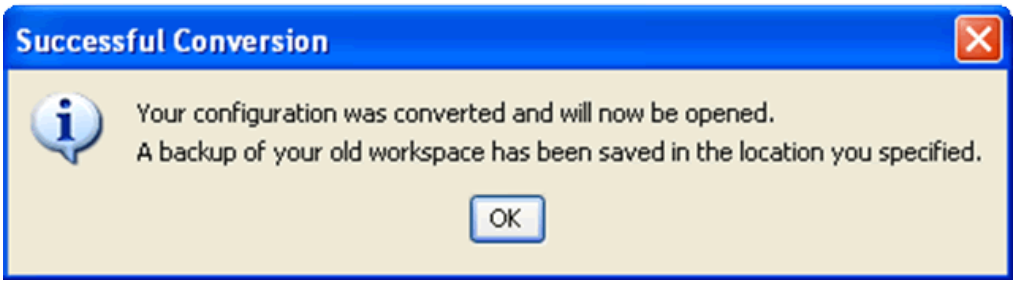
3. Click **OK**. The Open dialog box appears and prompts you for a location to store a backup of the project that is to be converted.



Open Dialog for Saving Configuration Backup

Note: You may either rename the original configuration that is to be backed up or specify a new directory to store the original.

4. Select the directory to store the backup, and click **Open**. The conversion process begins. If the conversion successfully completes the following message will be displayed. Select **OK** to continue and view the project.

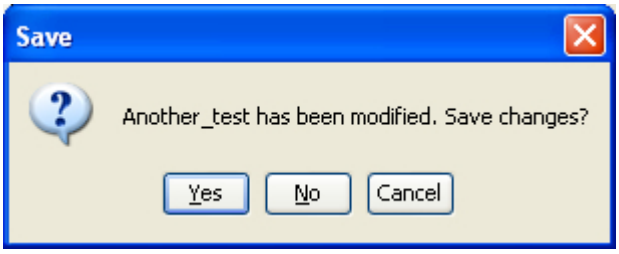


Successful Conversion Dialog Box

An error message appears if this process fails. The original project will remain untouched and it will not open.

Close a Project

Navigate: From the File menu or right-click from the Configuration Manager, select **Close**. If no changes were made to the Project, the project will be closed. If changes were made, the Save dialog box appears.



Perform one of the following options:

- Click **Yes** to save the changes made to the project and close it.
- Click **No** to discard the changes made to the project since the last save and close it.
- Click **Cancel** to return to the configuration manager without closing the project.

Hierarchies

Overview

A hierarchy is a top-to-bottom set up of parent-child relationships between elements of the same type. Hierarchies provide a means to define relationships between dimensions (aggregates, roll-ups, and alternate roll-ups) and groups belonging to the same entity (for example; Time = years, months, weeks, and days).

The following hierarchies are automatically created and cannot be deleted within the Configuration Tools:

- CLND (Calendar)
- PROD (Product)
- LOC (Location)
- ADMU (ADMU)

These hierarchies are required by RPAS-based solutions and cannot be removed, but additional hierarchies can be added to support the required business process.

Hierarchies define the path of data aggregation and spreading. In a workbook, you can view data at any required level of detail by drilling down or rolling up through dimensions in the hierarchy.

> **Note:** ADMU is not a configurable hierarchy, so no one can create or modify it. ADMU is built by RPAS, and the configuration tools make it available for use in configurations. ADMU is the user hierarchy, and it exists to allow a measure to use the dimension "user" as part of its base intersection.

You can create and define dimensions for each of these hierarchies and for any additional hierarchies that are added to the project.

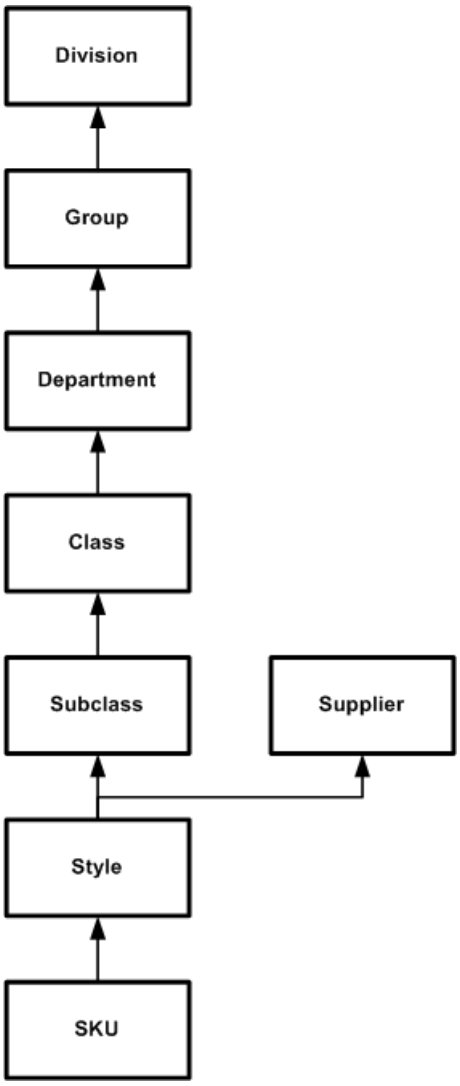
> **Note:** The names for the automatically generated hierarchies (CLND, PROD, LOC, and ADMU) cannot be changed, but the default user labels for CLND, PROD, and LOC (Calendar, Product, and Location) can be changed. The user label of ADMU cannot be changed. The CLND and ADMU hierarchies must exist in all domains, but PROD and LOC are not mandatory. If there are no dimensions created for these hierarchies, the hierarchies will not be created in the resulting domain.
>
> RPAS does not impose any limit on the number of hierarchies that can be configured in a Project.

The Hierarchy Definition Window

The Hierarchy Definition window allows you to define and construct hierarchies, dimensions for each hierarchy, and the relationships between dimensions. It also offers the following features:

- Provides a visual representation of a hierarchy and its dimensions
- Provides a means to define the hierarchy data load file
- Allows existing hierarchies/dimensions to be reused in a new solution in the same project

The following diagram represents a typical structure of an organization's product hierarchy.

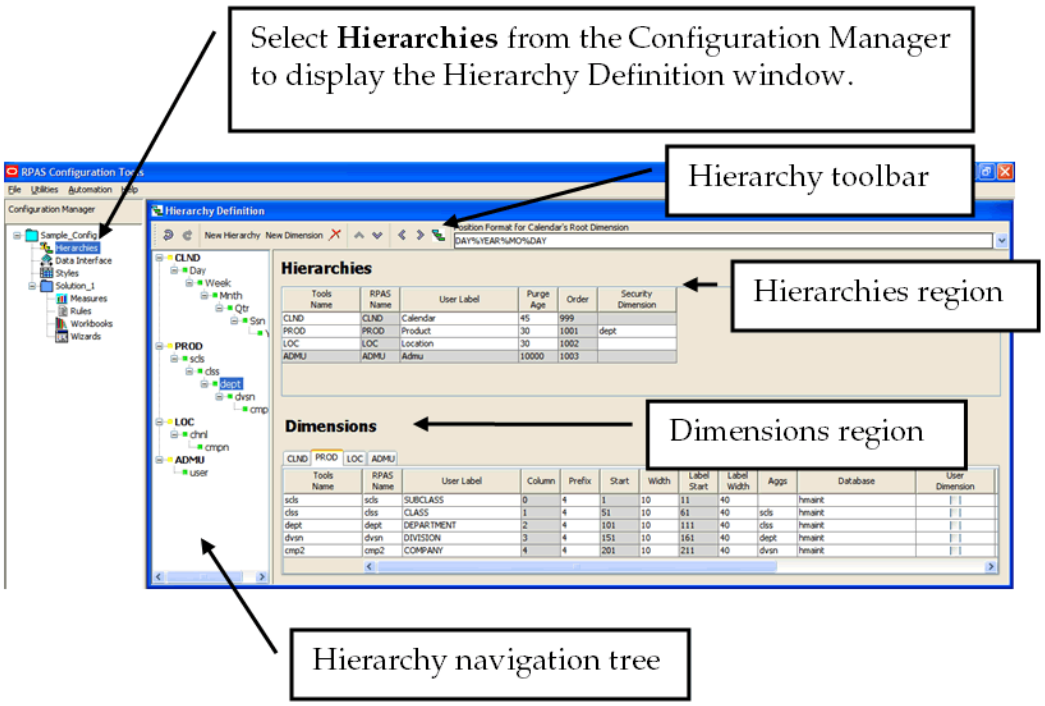


Example of Product Hierarchy

In this example, the Style dimension has two parents: Subclass and Supplier. Each position in the Style dimension will have a parent position in both the Subclass and Supplier dimension.

About the Hierarchy Definition Window

To access the Hierarchy Definition window, select **Hierarchies** from the Configuration Manager navigation tree. The Hierarchy Definition window appears in the workspace.



Example of Hierarchy Definition Window

The Hierarchy Definition window contains the following elements:

- The Hierarchy Definition toolbar - This toolbar displays options that can be performed. Buttons are enabled or disabled based on the item selected on screen.
- The Hierarchy navigation tree - The navigation tree provides a visual representation of your hierarchies. Bold elements at the top of the tree structure represent the hierarchies. The items listed below each bolded hierarchy are the dimensions defined in that hierarchy. Click the plus sign (+) or minus sign (-) to expand the tree. The Hierarchy tree is also used to select a hierarchy or hierarchy dimension. Once an item is selected, you can modify its properties from the **Dimension** region in the Hierarchy Definition window. The Hierarchy navigation tree also provides a context menu when you right-click a tree item. The available options in the context menu depend on whether a hierarchy or dimension is selected. This context menu can be used to create a new hierarchy or dimension at the selected level. It also allows you to rename the selected item. When an item is renamed from the tree, it is the **Tools Name** that is being modified, which appears in the **Dimensions** region of the window.
- The Hierarchies region - This area displays the defined hierarchies and their properties.
- The Dimensions region - This area contains hierarchy tabs and allows you to define the dimension properties for your hierarchies. The tabs represent the hierarchies defined. Select the appropriate hierarchy tab to display its dimensions and modify dimension properties.

Gray fields in the Hierarchy Definition window indicate fields that cannot be modified. Any elements that appear in red indicate problems or issues, which should also appear in the Task List pane along with a brief description of the issues identified.

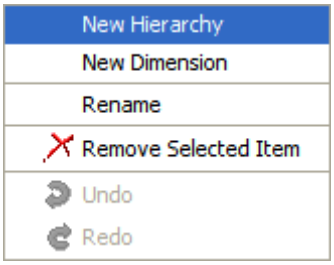
Working with Hierarchies

Overview

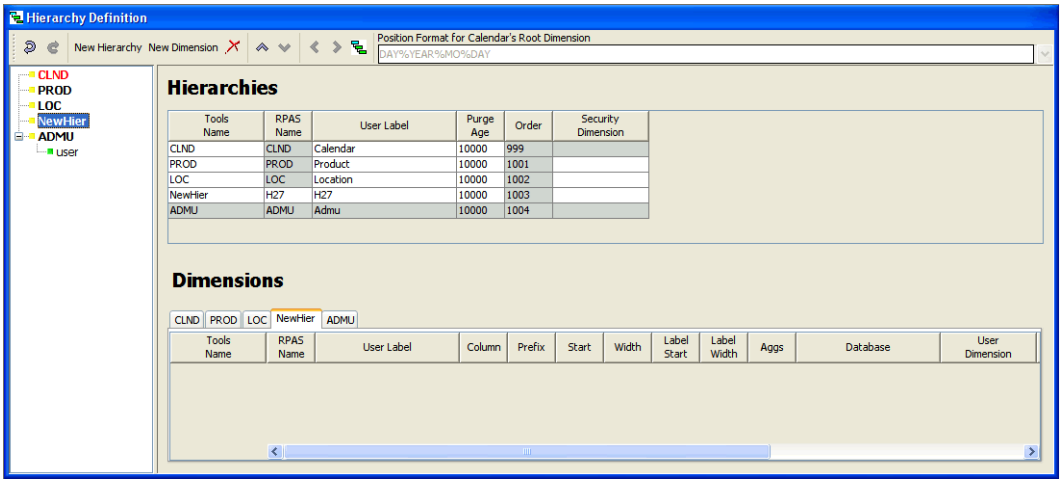
When a new project is created, following default hierarchies are automatically created: Calendar (CLND), Product (PROD), Location (LOC), and User (ADMU). Additional hierarchies and dimensions can be created to meet your business needs.

Create a New Hierarchy

Navigate: Select **New Hierarchy** from Hierarchy Definition toolbar, or from the Hierarchy Definition tree, right-click and select **New Hierarchy** from the menu.



Note: If multiple projects are open, make sure you are working from the desired project before adding a new hierarchy.



Hierarchy Definition Window

1. To change the Tools Name of the newly created hierarchy in the Hierarchy navigation tree of the Hierarchy Definition window, choose one of the following methods:
   - Right-click on the hierarchy name, and select **Rename**.
   - Double-click the hierarchy name.
2. Enter the new name.

> **Note:** The RPAS Name can only be up to four (4) characters long.

3. Press **Enter** or click outside the hierarchy name.

Specify Hierarchy Properties

Hierarchy properties are defined from the Hierarchies region on the Hierarchy Definition window.

Hierarchies

Tools Name	RPAS Name	User Label	Purge Age	Order	Security Dimension
CLND	CLND	Calendar	10000	999	
PROD	PROD	Product	10000	1001	
LOC	LOC	Location	10000	1002	
NewHier	H27	H27	10000	1003	
ADMU	ADMU	Admu	10000	1004	

Hierarchy Properties Window

From this location you can modify the following hierarchy properties:

- **Tools Name** – The name of the hierarchy that appears within the RPAS Configuration Tools. This field is less restrictive than the RPAS Name field, allowing you to view and select a meaningful label for hierarchies and dimensions while working with the configuration rather than using the RPAS Name.
- **RPAS Name** – The RPAS internal name of the hierarchy. This hierarchy name is used only by RPAS (not the user) within the domain.

  > **Note:** The RPAS Name of a hierarchy cannot be edited if it is shaded gray; however, you can change other properties, such as User Label.
  >
  > CLND is always the innermost dimension and ADMU is always the outermost dimension.
  >
  > The order of the other hierarchies (PROD, LOC, etc.) can be changed.

- **User Label** – The hierarchy label that is displayed to RPAS users within the domain.
- **Purge Age –** The purge age determines when a position and its corresponding measure data are removed from a domain. Specifically, it represents the number of days before the data is purged from the last time the position was included in the hierarchy input file that is loaded with the `loadHier` utility during a batch run (most commonly on a nightly or weekly basis). Setting this value to zero means that a position and all of its data will be immediately purged if it is not included in the hierarchy file.

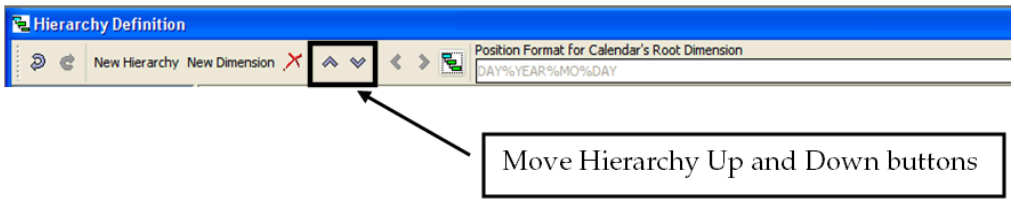
> **Note:** The value set in this field serves as the default value to use when loading the corresponding hierarchy. This value can be overwritten by one of the arguments of the `loadHier` utility each time the utility is called. See the *RPAS Administration Guide* for more information on the `loadHier` utility.

Example 1: A purge age of "0" will purge positions the first night they are not in the input file.

Example 2: A purge age of "1000" will purge the positions the 1000th night after they are last seen on the input file.

- **Order –** Hierarchy order determines the ordering of dimension fields in the physical storage of data in the RPAS domain. This ordering is the traversal order of data for calculations, which relates to how RPAS iterates over data when performing calculations. Data in the domain is stored in multi-dimensional arrays with each dimension belonging to a different hierarchy.

  To change the order of a hierarchy, select the hierarchy from the **Hierarchies** region or from the Hierarchy navigation tree and use the up/down buttons located on the Hierarchy Definition toolbar to move the hierarchy to the desired location.



Hierarchy Definition Toolbar

The hierarchy can also be arranged by dragging and dropping in the Hierarchy navigation tree. The order numbers are automatically changed and generated regardless of the utilized reordering technique.

For performance reasons, the Calendar hierarchy (and therefore all of its dimensions) is always the "innermost" dimension and defaults to an uneditable number of 999. The ordering of any hierarchy can be changed with the exception of Calendar (CLND). The lower the order number, the nearer the hierarchy is to the innermost dimension.

Consider the following example for the Calendar, Product, and Location hierarchies:

CLND order = 999

PROD order = 1001

LOC order = 1002

Two products: P1 and P2

Two locations: L1 and L2

Two calendar periods: C1 and C2

The sequence of physically storing and iterating over the data with calendar as the innermost dimension and location as the outermost dimension would be:

L1/P1/C1

L1/P1/C2

L1/P2/C1

L1/P2/C2

L2/P1/C1

L2/P1/C2

L2/P2/C1

L2/P2/C2

With Calendar being the innermost dimension, data is first processed for all positions in the Calendar hierarchy and for the first position of the other hierarchies. In this example; data would be processed for all calendar positions for the first product and first location. This is followed by all calendar positions for the second product and first location, and so on.

It is recommended that retailers order their hierarchies with Calendar as the innermost dimension (required), followed by other hierarchies in their order of importance/traversal – most commonly Product, Location, and then other hierarchies (if applicable).

> **Note:** Certain RPAS-based solutions (such as Advanced Inventory Planning and Demand Forecasting) have additional hierarchies that are in a pre-defined order that should not be changed.

The Order column also indicates the order in which the hierarchy information is expected in the file used for measure data loading purposes.

> **Note:** The values "1000" or "1020" are not used as a hierarchy order as they are used internally by RPAS.
>
> CLND is always the innermost dimension and ADMU is always the outermost dimension.
>
> The order of the other hierarchies (PROD, LOC, etc.) can be changed.

- **Security Dimension –** Selecting a Security Dimension for a hierarchy enables position-level security in the domain for the corresponding hierarchy. Any dimension along any hierarchy except the Calendar hierarchy is valid. For example, if the security dimension for the product hierarchy is set to "Dept" (Department Level Security); within the domain, access to departments can be granted or denied by the administrator for individual users, user groups, or all users. If position-level security is to be enabled in RPAS, select the security level. Refer to the *RPAS Administration Guide* for additional information about position-level security.

Delete a Hierarchy

Navigate: In the Configuration Manager, select **Project – Hierarchies**. The Hierarchy Definition window opens in the workspace.

1. Select the hierarchy to delete.
2. Choose one of the following methods:
   - Click the **Delete** button. The hierarchy is removed.
   - Press the **Delete** key from your keyboard.
   - Use the right-click menu to select **Remove Selected Item**.

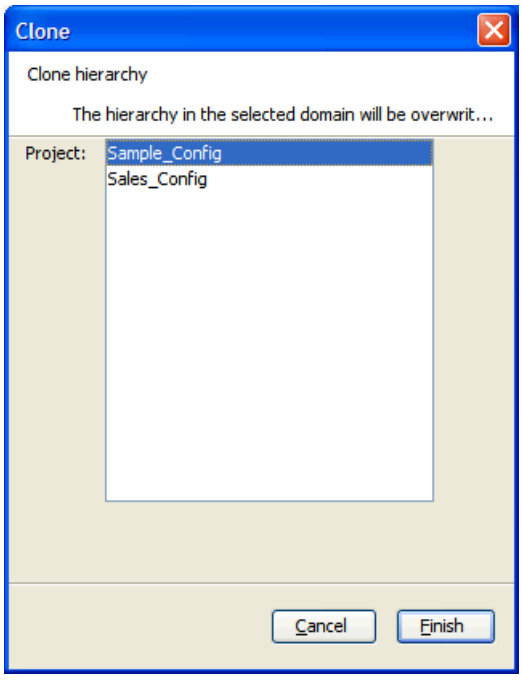
> **Note:** The CLND, PROD, LOC, or ADMU hierarchies CANNOT be deleted from the configuration.

Copy (Clone) Hierarchies

The RPAS Configuration Tools allows for the hierarchies of an existing project to be copied into a new or existing project.

Navigate: In the Configuration Manager, select **Project – Hierarchies**. The Hierarchy Definition window opens in the workspace.

1. Right-click **Hierarchies** in the Configuration Manager, and select **Copy**. The Clone dialog box appears.



Clone Dialog Box

2. Select the destination project for the hierarchies to be copied.
3. Click **Finish**. The hierarchies in the selected project are overwritten.

Note: Each project has a single set of hierarchies. Hierarchies can only be copied from one project to another, thus multiple projects must be open in the RPAS Configuration Tools before the copy process is initiated.

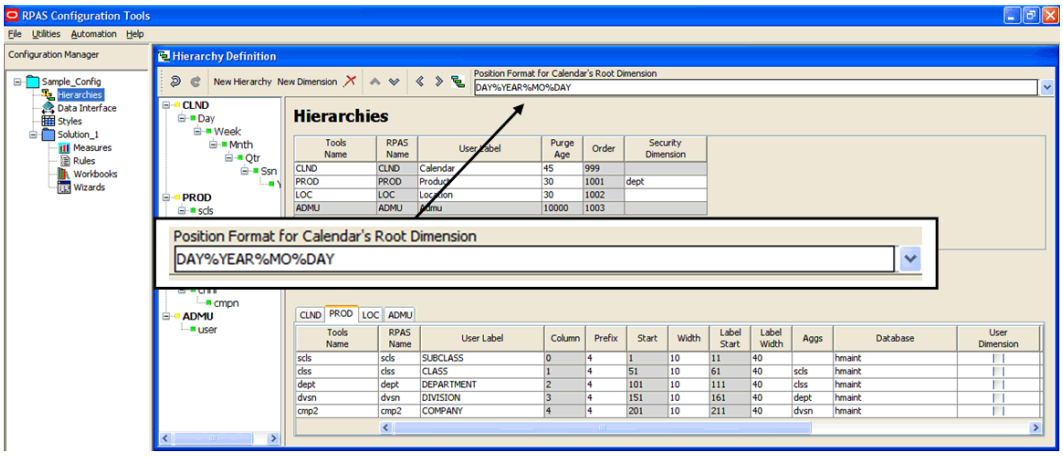
Working with Position Formats

The Position Format is the date/time format used for the names of positions in the root dimension of the CLND (Calendar) hierarchy (typically "day"). Positions in the root dimension of the CLND hierarchy need names in a special format for RPAS to map abstract positions to actual dates and times in order to support time-aware calculations.

Note: See "Appendix B - Calculation Engine Users Guide" and "Appendix C - Rules Function Reference Guide" for more information.

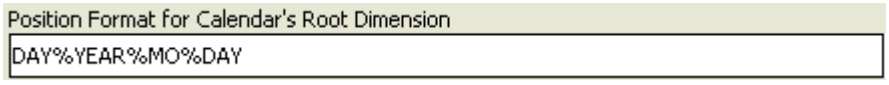
Specifying the Position Format

Navigate: In the Configuration Manager, select **Project – Hierarchies**. The Hierarchy Definition window opens in the workspace.



Example of Position Format in Hierarchy Definition Window

The Position Format field is located in the upper right hand side of the Hierarchy Definition toolbar.



This is a combo box that is populated with some of the more commonly used formats. However, you may also type directly in the combo box if a different format is desired.

Specify the position format as a concatenated sequence of strings and arguments using the appropriate syntax. Refer to "Position Format Syntax" for more information.

Position Format Syntax

The Position Format field uses the following syntax conventions:

- %YEAR – Four digit Gregorian calendar year.
- %YR – Two east significant digits of the year (for example, 05 is 2005).
- %MO – Two digit representation of month (for example, 01 is January).
- %MON – Three character abbreviation of the month name.
- %MONTH – Varying length full name of the month, displays up to nine characters.

> **Note:** Even when configuring a solution in another language, RPAS expects the month names and abbreviations (%MONTH and %MON) used in the position names to be in English (for example, Jan, Feb, Mar, and so on).

- %DAY – Two digit representation of the day of the month (for example, 01 is the first day of the month)
- %HR – Two digit representation of the hour of the day (for example, 22 is 10 p.m.).
- %MIN – Two digit representation of minutes past the hour.
- %SEC – Two digit representation of seconds past the current minute.
- %MSEC – Three digit milliseconds past the current second.

The Position Format is NOT case sensitive, so %YEAR is the same as %year.

> **Note:** The resulting position names in the root dimension of the CLND hierarchy must start with an alphabetic character. So the Position Format must either start with a literal string like "DAY," or it must start with %MONTH or %MON.

The length of the position name should not exceed 24 characters. The Position Format field performs validation on the Position Format in order to enforce this limitation. For example, the Position Format DAY%YEAR%MONTH%DAY evaluates to a total of 18 characters (3 for the literal, 4 for the year, 9 for month, and 2 for day).

Examples:

- Format: DAY%YEAR%MO%DAY

  A position that represents the 31st January 2006 would have the name DAY20060131.
- Format: d%YR%MON%DAY

  A position that represents the 31st January 2006 would have the name d06Jan31.

Working with Dimensions

Overview

Dimensions are the components within a hierarchy that define the structure and roll up within a hierarchy. For example, the dimensions for a calendar hierarchy can be day, week, month, and year; or they can be accounting periods.

Create a Dimension

Navigate: In the Configuration Manager, select **Project – Hierarchies**. The Hierarchy Definition window opens in the workspace.

1. Select the hierarchy or dimension under which to create the new dimension.

   > **Note:** When this document uses terms like "top" and "bottom" level dimensions; or "over" and "under," these terms are to be interpreted visually. The bottom level is at the top of the hierarchy, and the top levels are at the end of the hierarchy branches. For example, the top dimension visually is the root dimension, which is the lowest dimension in the hierarchy. The highest dimensions in the hierarchy are at the bottom end of the hierarchy branches. For instance, Day is the bottom level of a Calendar hierarchy, but it falls directly beneath CLND.

2. Choose one of the following methods:
   - From the Hierarchy Definition right-click menu, select **New Dimension**.
   - Click the **New Dimension** button on the toolbar.

   Create the first dimension, which becomes the root dimension, for a new hierarchy when positioned on the hierarchy. Once the root dimension is defined, new dimensions cannot be defined directly under the hierarchy. New dimensions are added under other dimensions. For example, after "Day" is added to the CLND hierarchy, CLND cannot be selected again to add "Hour." However, "Week" can be added under the "Day" dimension. There can only be one root dimension created per hierarchy.

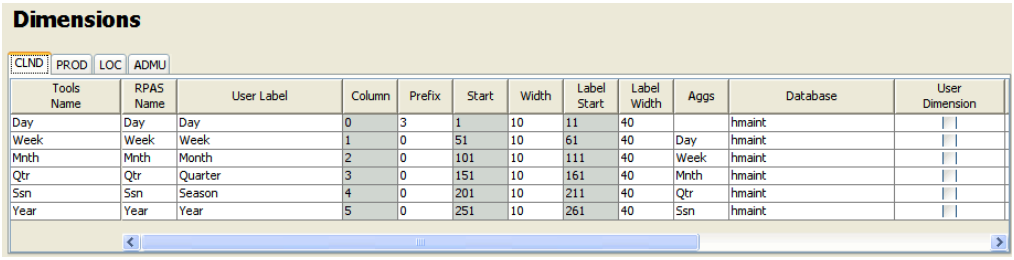
   > **Note:** Certain processes that support the purging of data or positions and the mapping of real dates/times to positions require a dimension in the CLND hierarchy that is named "day" and represents the day level. Such a dimension should be defined, although the user label can be changed from "day" if needed for localization purposes.
   >
   > There is no limit on the number of dimensions that may be created for a hierarchy.

Define the dimension as necessary. Refer to "Defining Dimension Properties" for more information.

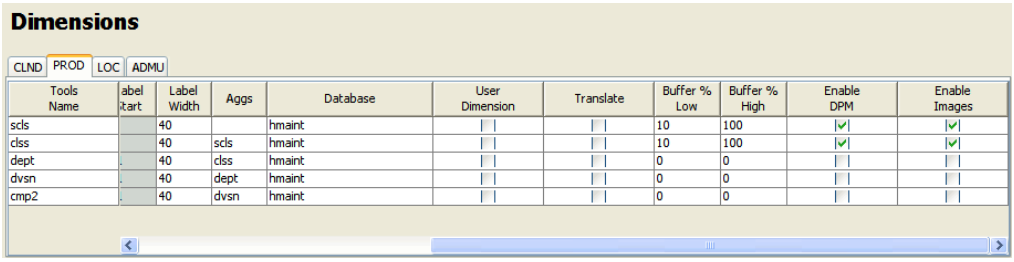
Defining Dimension Properties

Navigate: In the Configuration Manager, select **Project –** **Hierarchies**.

1. Select a dimension using one of the following methods:
   - From the Hierarchy tree, select the dimension you want to modify.
   - From the **Dimensions** region of the Hierarchy Definition window, select the hierarchy tab that contains the dimension you want to define or modify.



Example Dimensions Properties Window – CLND Tab Selected



Example Dimensions Properties Window – PROD Tab Selected

2. In the Dimensions properties region, select or double-click in the field to edit. Scroll to the right to see all of the fields. You can resize the columns by placing the cursor over the column until the double-sided arrow appears and then drag the column to the desired width.

   Other than the RPAS Name, the columns can be reordered by dragging and dropping the headings. The column positions will return to the default order when the session is closed.

   You can specify the following dimension information:

   - **Tools Name –** The name of the dimension that is displayed within the RPAS Configuration Tools. This field allows you to assign meaningful labels while working with a configuration in the Configuration Tools. For example, the Tools Name appears in Select Intersection dialog box, making it easier for you to assign the appropriate intersections.
   - **RPAS Name –** The RPAS internal name of the dimension. This dimension name is used only by RPAS (not the user) within the domain.
   - **User Label –** The dimension description that is displayed to RPAS users in the RPAS Client.

     Note: Any alpha-numeric characters are allowed. Single or double quotes are not allowed.

- **Column –** Identifies the order in which the dimension's positions fall in the meta-data load file. Use the left  and right  buttons to change the order and the column value of the dimensions. Changing the column value will not impact the hierarchy structure or aggregation paths.

  Note: The up  and down  buttons are used for defining the sequence of hierarchies.

  Example:

  Change the column values if the dimensions in the data load file are not in the same order as in the tree structure. Dimensions will be moved up or down in the table without impacting the aggregates.
- **Prefix –** The number of characters (0 to 4) for an automatic prefix to be put on all position names loaded and stripped from all position names exported. The prefix is taken from the internal dimension name. If the number of characters is greater than the dimension name, an underscore is used to pad the prefix. If the number of characters is less than the dimension name, the left-most characters from the dimension name are used. The default is 4. For example, if data loads and exports use numeric SKU identifiers, such as 123456, the internal representation in RPAS could be to prefix this identifier with "SKU," such as SKU123456.

  Note: Use of a prefix is optional. If a prefix of zero (0) is defined, then there is no prefix.
- **Start** – This is a read-only, calculated field. This field identifies the start position of the position names for this dimension in the hierarchy load file.
- **Width** – This field identifies the width of position names for this dimension in the hierarchy load file.
- **Label Start** – This is a read-only, calculated field. This field identifies the start position of the position label for this dimension in the hierarchy load file. The sum of the dimension Start and Width fields determines the value of the Label Start.
- **Label Width** – This field identifies the width of position labels for this dimension in the hierarchy load file.

  Note: When using comma separated value (CSV) files to load data into RPAS, the following dimension are ignored: Column, Prefix, Start, Width, Label Start, and Label Width. See the *RPAS Administration Guide* for more information on Comma Separated Value (CSV) flat file format data load and export.
- **Aggs** – This field establishes the relationship of the dimension to the other dimensions in the same hierarchy. Specifically, this field references the child dimension that aggregates up to this dimension (the parent dimension). It can be edited by using the drop-down list, or you can drag and drop dimensions in the left hand side hierarchy pane.

- **Database** – This field identifies the name of the database in which the dimension information is stored. The default value is **hmaint**. For each position in the dimension, dimension information stored by RPAS includes its internal and external names, label, and the name of parent positions in all higher dimensional positions.

  Note: The database property for a dimension cannot be patched once the domain is built. It is therefore important to establish the databases to hold dimension information correctly prior to the creation of the domain.

  Note: The size of any RPAS database should be limited to ~2 GB for contention and performance purposes.

- **User Dimension** –When selected (checked), this field indicates that the dimension is user maintained. Positions and position mappings (parent-child relationships) for user-defined dimensions are established in the RPAS Administrative workbook template, "Hierarchy Maintenance." This metadata cannot be loaded like regular (non-user-defined) dimensions in the hierarchy load process.

  Note: The `exportHier` and `loadHier` utilities will skip any user defined dimensions. This is true for both fixed width and CSV formats. At this time, there is no way to export or import user-defined dimensions.

- **Translate** – When selected, this field enables the position labels for the dimension to be translated into multiple languages (if using a multi-lingual environment, which is set as a Workspace Property for a given project). Positions are loaded into the domain in the native language of the domain via the standard hierarchy load process. Position labels for additional languages are loaded into special measures that are used in multi-lingual domains. With the proper setup, these translated position labels can be displayed in workbooks in the RPAS Client instead of the loaded position labels.

  Note: This option must be selected before building a domain for it to take effect.

- **Buffer % Low** and **Buffer % High** – These properties are used to enable "dummy positions" for the dimension and to establish the size of the buffer of dummy positions. The appropriate values to use for the Buffer % Low and Buffer % High depend on the rebuffering policy for the implementation. Using the `dimensionMgr` utility, you can define an absolute minimum size (`-minBufferSize minSize`) for a dimension buffer. Refer to the *RPAS Administration Guide* for more information.
- **Enable DPM** – Dynamic Position Maintenance (DPM) allows informal positions to be added to a dimension on-the-fly from the RPAS Client. Select the **Enable DPM** option for the dimensions that will be enabled to support DPM. For each enabled dimension, a **Buffer % Low** and **Buffer % High** must also be specified. Once Enable DPM is defined for the dimension, you must also specify workbooks and the dimensions in each workbook that will use DPM (see the Workbook Designer window for more details).

Note: DPM can be enabled for all hierarchy dimensions except for CLND and ADMU.

When **Enable DPM** is selected for a specified dimension, it is also selected for all dimensions that roll up to it.

For more information on DPM, see the *RPAS Administration Guide* and *RPAS User Guide*.

- **Enable Images –** Select this option to enable the association of images (image paths) to positions along the specified dimension. To disable this feature, deselect the option for the appropriate dimensions. This option is available for all hierarchy dimensions, except the calendar hierarchy. For the calendar hierarchy, the **Enable Images** column is disabled or grayed. RPAS supports GIF, BMP, and JPEG image formats. Once **Enable Images** is defined for a dimension, you must also specify the workbook that will use this feature (see the Workbook Designer window for more details). See the *RPAS Administration Guide* for more information on loading image paths.

Delete a Dimension

Navigate: In the Configuration Manager, select **Project – Hierarchies**. The Hierarchy Definition window opens in the workspace.

1. From the Dimensions region or from the Hierarchy navigation tree, select the dimension to be deleted.
2. Perform one of the following options:
   - Click the **Delete** icon.
   - Press the **Delete** key.
   - Select **Delete** from the right-click menu in navigating in the Hierarchy navigation tree.

Note: Deleting a dimension causes all of the dimensions that are structurally dependant on it (its parents, grandparents, and so on) to also be deleted.

Note: The user dimension contained in the ADMU hierarchy cannot be deleted.

Edit a Dimension

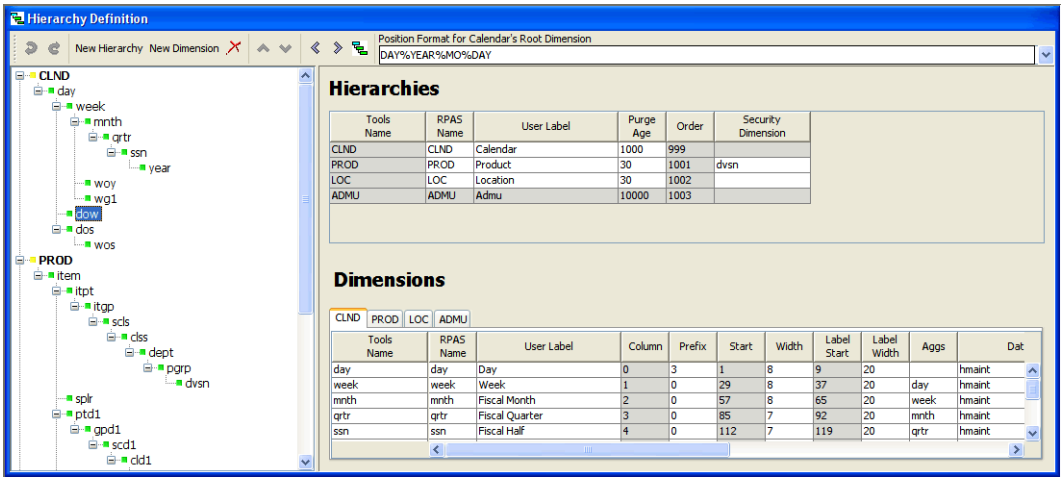
Navigate: In the Configuration Manager, select **Project – Hierarchies**. The Hierarchy Definition window opens in the workspace.

1. Select the hierarchy in which a dimension will be edited.
2. From the Dimensions region, select the dimension to edit.
3. Update the dimension property as necessary. Refer to "Defining Dimension Properties" for more information.
4. To change the order of the dimension, click the left button or right button to change the order of the dimensions. Re-ordering dimensions only affects the file, not the parent/child relationship of data.

> **Note:** The up button and the down button are used to change the order of hierarchies only.

Create a Branch in a Hierarchy

Navigate: In the Configuration Manager, select **Project – Hierarchies**. The Hierarchy Definition window opens in the workspace.

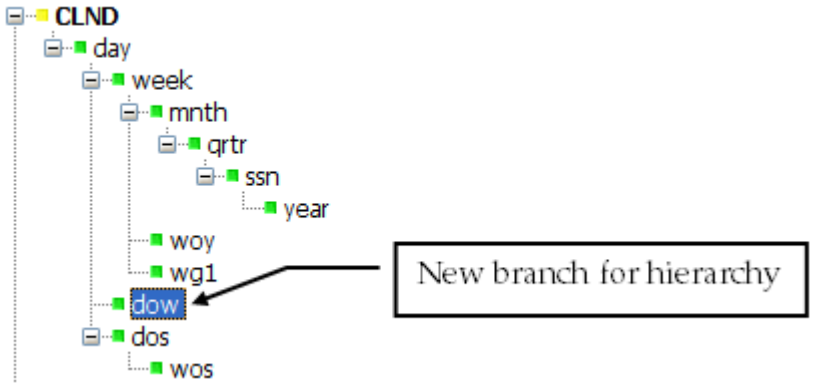


1. From the Dimensions region or from the hierarchy navigation tree, select the dimension that will be the base of the branched hierarchy. The base of the branched hierarchy is the root dimension.

> **Note:** Ensure that the root dimension will have more than one parent (that is, where the branch starts), and create another parent dimension. Branches can never join together (for example, both style-subclass-class and style-supplier-class roll-ups in the same hierarchy are invalid).

2. Choose one of the following methods:
   - From the Hierarchy Definition right-click menu, select **New Dimension**.
   - Click the **New Dimension** button on the toolbar.
   - Press the **Insert** key on the keyboard.

The new dimension is created below the selected dimension.



Example of Branch Hierarchy

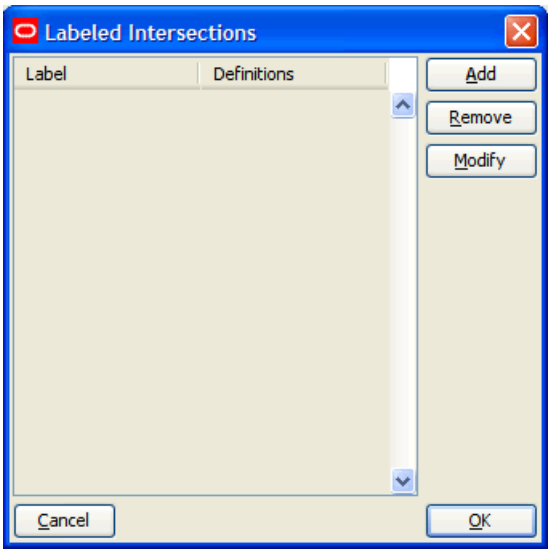
Labeled Intersections

The Labeled Intersections window supports the addition, removal and modification of hierarchy intersections. A hierarchy intersection defines the dimensionality at which data is defined. An intersection may be defined as using no dimension (scalar), using a single dimension from a hierarchy, or multiple dimensions from different hierarchies.

> **Note:** See the section on "Measures and Base Intersections" for more information on defining intersections for data.

Navigate: In the Configuration Manager, select **Project – Hierarchies**. The Hierarchy Definition window opens in the workspace.

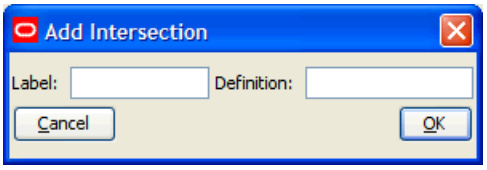
1. From the Hierarchy Definition toolbar, select the **Labeled Intersection** icon . The Labeled Intersections dialog box appears. This dialog box allows you to add new intersections or remove or modify existing intersections.



Labeled Intersections Dialog Box

Adding a Labeled Intersection

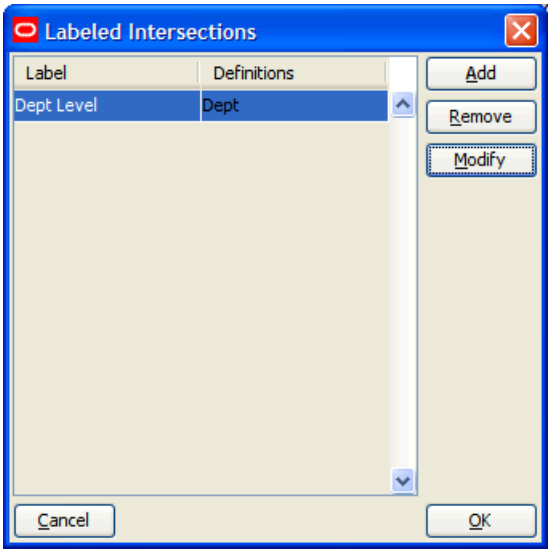
1. Click **Add** from the Labeled Intersection dialog box. The Add Intersection dialog box appears.



Add Intersections Dialog Box

2. Perform the following:
   a. In the **Label** field, enter a label for the Labeled Intersection.
   b. In the **Definition** field, enter the dimension name(s) for the intersection.
   c. Click **OK**. The dialog box closes and the new entry appears in the Labeled Intersection dialog box.

> **Note:** If the Definition field is left empty, the measure is assumed to be Scalar. If the level is non-scalar, dimension names are used to define the intersection. If multiple dimension names are to be specified, each dimension name must be separated by an underscore (_). The last dimension specified SHOULD NOT have an underscore following the dimension name. As well, there is no required order of dimensions.



Example of New Labeled Intersections

3. Click **OK**.
4. Once the labeled intersection is added, you can perform the following:
   - Define or update the Base Intersection of major or minor measure component using the labeled intersection.
   - Define or update the Load Intersection of a measure using the labeled intersection.
   - Define or update the Base Intersection of a worksheet using the labeled intersection.

Note: RPAS imposes a limit of 5 dimensions that can be defined in a measure or worksheet's base intersection.

Modifying a Labeled Intersection

1. Select a labeled intersection.
2. Click **Modify** from the Labeled Intersection menu.

   Only the **Definition** field can be modified.
3. Click **OK**. If the change is undesired, select **Cancel**.

   When the Definition of an existing labeled intersection is modified, the base intersections of measures and worksheets, and load intersections of measures that are currently assigned the labeled intersection are automatically updated. No action is required.

Removing a Labeled Intersection

1. Highlight a labeled intersection.
2. Click **Remove** from the Labeled Intersection dialog box.
3. Click **OK**.

   When an existing labeled intersection is removed, the base intersections of measures and worksheets, and load intersections of measures that are currently assigned the labeled intersection will be displayed as invalid (red). Warning messages will also appear in the Task List, indicating the intersections that must be updated. These intersections must be corrected prior to installing or patching a domain.

Data Interface Tool

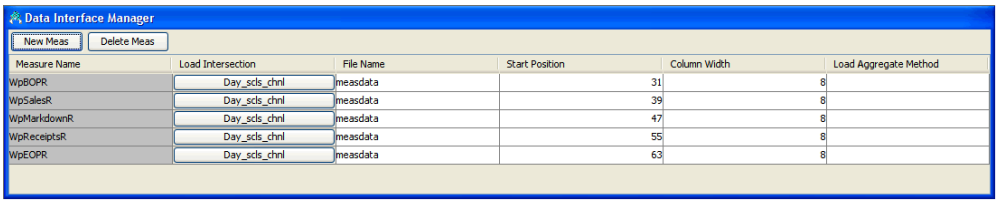
Overview

The Data Interface Manager tool is used to specify information about how data will be loaded into the domain. This includes properties of the file to be loaded and the intersection at which data will be loaded into the domain.

Data can only be loaded into stored, realized measures in the domain. Therefore, only such measures can be used in the Data Interface Manager. Refer to the "Working with Measures" section of this document.

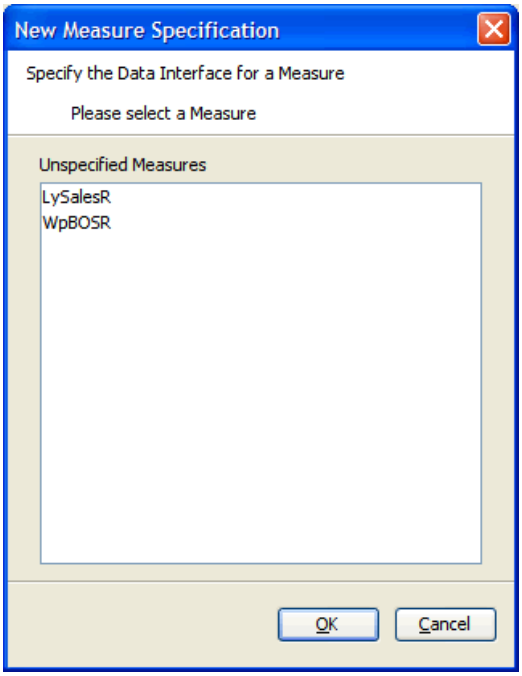
Specify the Data Interface for a Measure

Navigate: In the Configuration Manager, select **Project – Data Interface**. The Data Interface Manager window opens in the workspace.



Example of Data Interface Manager Window

1. Click **New Meas**. The New Measure Specification window opens.



Example of New Measure Specification Window

> **Note:** This is a filtered list of all possible measures in the configuration. Measures will be displayed in this list if they are: realized, stored (has a defined database), and not already defined in the data interface tool.

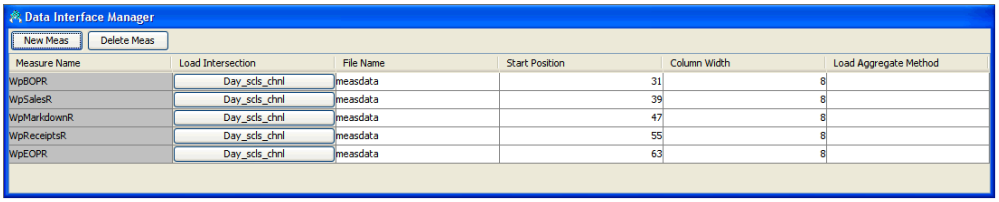
2. Select the measure requiring a data interface definition.
3. Click **OK**. The measure appears in the Data Interface Manager window.

Add/Edit Data Interface Properties for a Measure

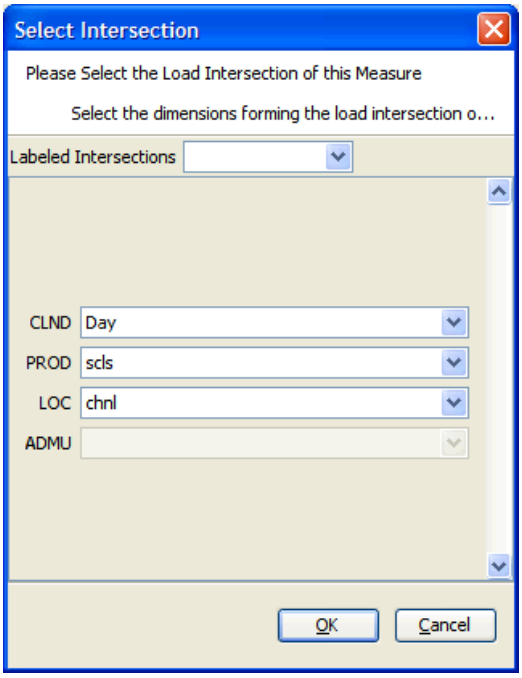
Navigate: In the Configuration Manager, select **Project – Data Interface**. The Data Interface Manager window opens in the workspace.

By default, the Load Intersection field is populated with the base intersection of the measure. If the data for a given measure is being loaded at a lower intersection than the base intersection of the measure, this value can be overridden to specify the intersection

> **Note:** Data can be loaded at the same intersection or lower than the base intersection of a measure. Data cannot be loaded at a higher intersection than the base intersection.



1. Click the **Load Intersection** field to change its value. The Select Intersection window opens.



Select Intersection Window

2. To specify the load intersection:
   a. Using the list options, select the appropriate dimensions or Labeled Intersection.

   > **Note:** Only those dimensions that are at the same level as the base intersection or below will be displayed for the load intersection.

   b. Click **OK** to save any changes and close the window.
3. In the **File Name** field, enter the file name from which data for the measure will be loaded.

4. In the **Start Position** field, enter the character position in the file where the measure data starts. The start position defaults to the sum of all the dimension widths in the load intersection of the measure +1, and the value specified in the field must be that default or higher.
5. In the **Column Width** field, enter the number of characters in the file that will contain the measure data.

> **Note:** The Column Width defaults to 8, but it can be changed.

6. If the Load Intersection was overridden to specify that the data is to be loaded from an intersection below the measure's base intersection, the measure's default aggregation method is used to aggregate the data unless the Load Aggregate field is populated to specify an alternate aggregation method. Click the **Load Aggregation Method** field and select the appropriate aggregation method from the option list.

> **Note:** Hybrid is not supported for the load aggregation for a measure.

Delete Data Interface Information for a Measure

Navigate: In the Configuration Manager, select Project – Data Interface. The Data Interface Manager window opens in the workspace.

1. Select the measure you want to remove from the Data Interface Manager.
2. Click **Delete Meas**.
3. Click **Yes**. The measure is removed from the table.

Working with Styles

Overview

It is possible for the RPAS Client user to modify the appearance of the data displayed for a given measure in a grid. Text font, size, and color may all be changed. Many attributes, such as precision (for decimal data types), alignment of the value in the cell, and the cell border may also change.

Using the Style Tool, it is possible to define styles that may be applied to measures. These predefined styles may specify any of a body of attributes that determine the appearance of the data within the client. It is then possible to specify a measure as using one of these pre-defined styles. The measure will then be displayed according to the specifications for that style.

> **Note:** The RPAS Client is not aware of styles which are a configuration convenience. In the client, the individual properties are maintained individually. A style can therefore be thought of as a mechanism to easily set many individual properties.

The Style Definition Tool

The Style Definition Tool provides the following functionality:

- Allows the creation and management of named styles. New styles are generated as sub-styles of existing styles.
- Allows the specification of the attributes of named styles. Style attributes follow an inheritance scheme in which any unspecified attribute will inherit a value from its parent style if that style has a specification.
- Allows the specified styles to be visible to the Measure and Workbook Tools where measures are marked as using a style.

Style Attributes

A number of attributes may be specified for a style. These attributes will determine how the data for a measure that uses the style is displayed within the RPAS Client. Style attributes follow an inheritance framework in which an attribute defined in one style is also defined for all of the children of that style unless a style is defined for a child. The attributes of a style that may be specified are as follows:

- **Name** – The name of the style. This is used in the Measure and Workbook Tools to assign a style to a measure. Since styles are a configuration convenience, style names are not visible in the RPAS Client.
- **Prefix** – A cell value in the RPAS Client will be prefixed with this string. For example, a prefix could be "$" to denote U.S. currency values. The prefix can be any character sequence, but cannot exceed seven characters.
- **Suffix** – A cell value in the RPAS Client will be suffixed with this string. For example, a suffix could be "%" to denote that the value in the field is a percentage of something. The suffix can be any character sequence, but cannot exceed seven characters.
- **Scale Factor** – A cell value in the RPAS Client could use a scale factor for display purposes. A value that is calculated as a fraction could be displayed as a percent by selecting the scale factor to be 0.01 (The UI divides by the scale factor).

  For example, if the value in a cell is 0.5, the scale factor would have to be 0.01 for the cell to display 50.

  The value entered in the field should be greater than zero.
- **Precision** – Precision is the number of significant digits to be displayed in the cell of the RPAS Client. If this number is set to 3, the client must always display 3 positions after the decimal. For example, the measure value is 1, with a Precision setting of 3, it will be displayed as 1.000. The value entered in the field should be greater than zero.
- **Separator** – A cell value in the RPAS Client could be formatted to have separators in the value. The separator and the format come from the regional settings on the computer. For example, when a separator is used, a value of 1000 would be displayed as 1,000 or 1.000. It can also be displayed in other formats depending on the regional settings.
- **Text Font** – Sets the font of cell value in the RPAS Client ("Times New Roman," "Arial," and so on).
- **Text Style** – Sets the display style of the text value in the RPAS Client ("Bold," "Italic," and so on).
- **Text Size** – Sets the font size in which the cell value in the RPAS Client is to be displayed.
- **Text Color** – Sets the color of the cell values in the RPAS Client.

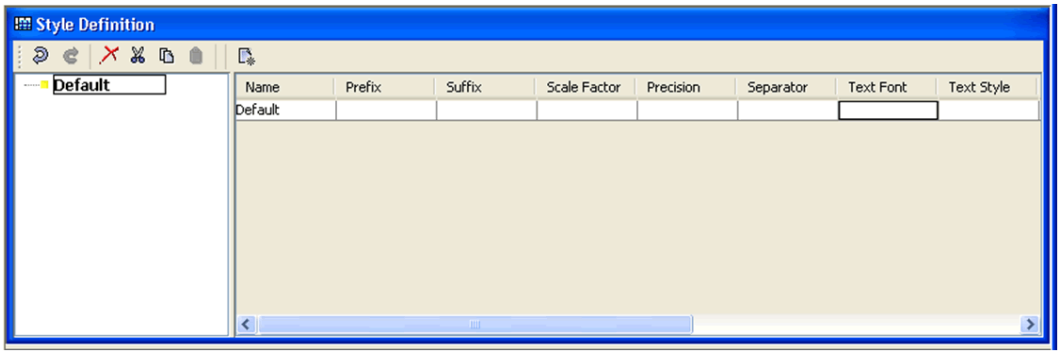
- **Background** – Sets the background color of the cells in the RPAS Client.

> **Note:** In the RPAS Client, the measure formatting background color for a measure takes priority over the 'read/write' background color that can be set for the application. Therefore, the RPAS Client "read/write" color will not be seen if styles are used through the Configuration Tools. If a specific read/write color is desired for all measures, set it as the background color of the default style, and do not override it for any other styles. On the other hand, the RPAS Client "read only" background color takes priority over the measure formatting background color so that "protection processing" will be visible.

- **Alignment** – Sets the alignment of values within the cells when viewed in the RPAS Client (Left, Center, and Right).
- **Border Style** – Sets they style of border of cells. Border style determines the kind of borders (for example, single line, dotted line, and so on) and where the borders should be relative to the cell value (top, bottom, left, right, or any combination of these).
- **Border Color** – Sets the color of the border lines for cell values.

Create a Style

Navigate: In the Configuration Manager, select Project – Styles. The Style Definition window opens in the workspace.



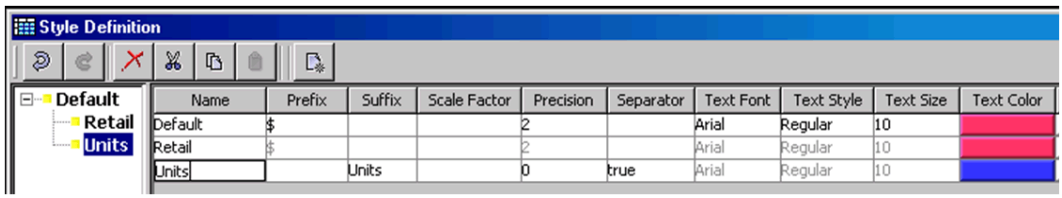
Style Definition Window

1. Select or create the Style that will be the parent of the new style. All styles must ultimately be descendents of the Default style.
2. Choose one of the following methods:
   - Click the **Create a new style** button in the toolbar.
   - Select **New Style** from the right-click menu.
   - Press the **Insert** key.

   If the Style Attributes for Default are populated, all of its descendants will inherit the same attributes unless you specify new attributes for the new styles. A new style will be created with inherited attribute values for all the properties set in its parent style.

The inherited style attribute values are displayed with lighter shade (gray) to differentiate from the un-inherited values (black). Notice that the style attributes for the style **Default** -are shown in black while the style attributes for the style "Percent" are in gray.

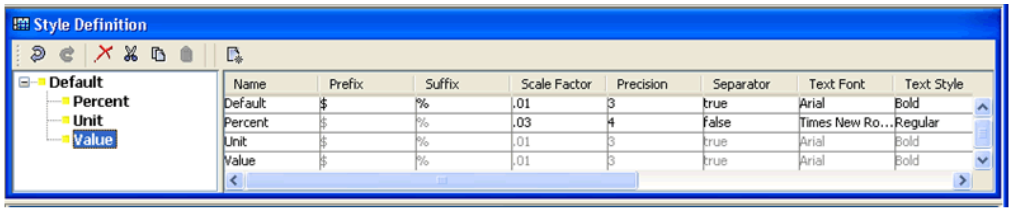
3. Change the values of any of the new style's attributes where a different value is required than that which has been inherited. For those attributes that have been overwritten from the "Default" value will be display in black while those that have not been changed will remain gray to indicate they are inherited.



Remove a Style

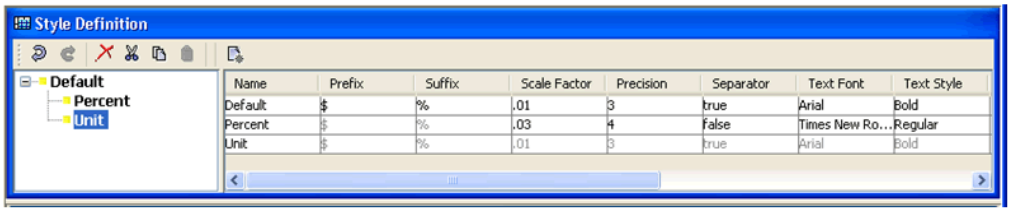
Navigate: In the Configuration Manager, select **Project** – **Styles**. The Style Definition window opens in the workspace.

1. Select the style to be removed.



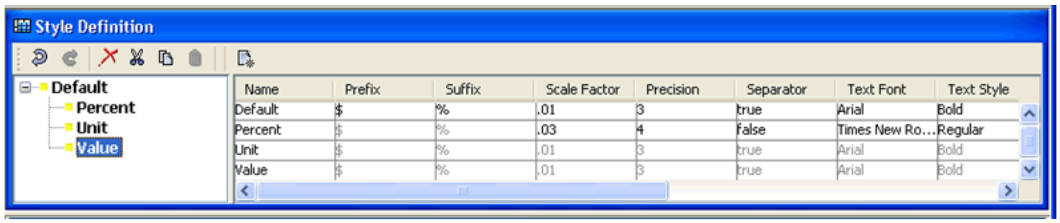
2. Choose one of the following methods:
   - Click the **Delete Style** button in the toolbar
   - Select **Remove** from the right-click menu.
   - Press the **Delete** key.

   The selected style and all of its child styles will be removed from the style description tool. Any measures using a deleted style will be displayed as invalid.



Edit a Style

Navigate: In the Configuration Manager, select **Project** – **Styles**. The Style Definition window opens in the workspace.



1. Select the style to be edited.
2. Select the property of the style to be edited. Depending on the property selected, one of the following will be displayed:
   - a pop-up color chooser (for all color selection properties like font color, background color, and so on)
   - a pop-up dialogue (for Borders)
   - a drop-down (for alignment, font, and text style)
   - a free flow text cursor (for all other properties)
3. Make the selection, and enter the value for the property.

   If the edited value is changed to the same as its parent's value for an attribute, the value is automatically changed to inherit from the parent, and it is displayed as gray rather than black.
4. If the value is to be deleted (does not contain any value), select the property, and press the **Delete** key.

4

Solutions

Working with Solutions

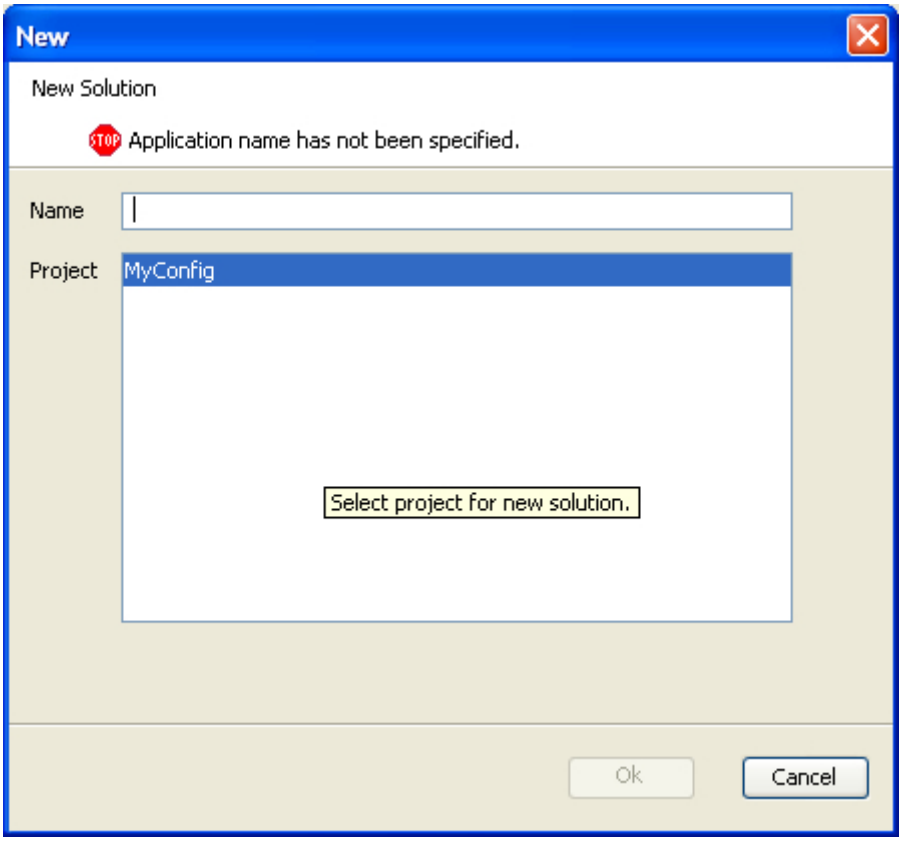
Overview

A solution corresponds to an application configuration (for example, Merchandise Financial Planning or Item Planning). Each project can contain one or more solutions. For each solution, measures, rules, workbooks, and wizards are defined. Once a solution is created, it can be moved from one project to another.

> **Note:** Some solutions; such as Curve, Grade, and RDF have configuration steps that are specific to those solutions. For more information, see the corresponding configuration guide for the solution.

Create a Solution

Navigate: From the File menu, select **New** – **Solution**. The New window opens.



New Window

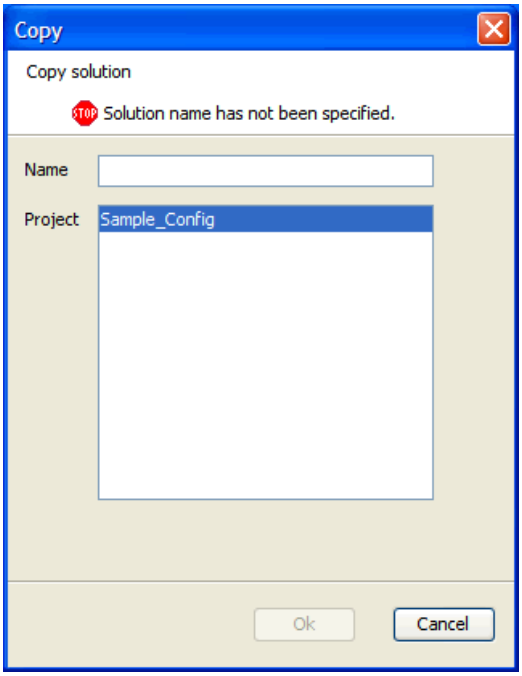
1. In the **Name** field, enter the name of the solution.

2. In the **Project** field, select the project in which the solution is to belong. There will be multiple projects listed if multiple projects are currently open.
3. Click **OK** to save any changes and close the window.

Copy a Solution

Perform the following procedure to copy a solution:

1. Select the solution to be copied.
2. Right-click in the Configuration Manager, and select **Copy**. The Copy solution dialog box appears.



Example of Copy Solution Dialog Box

3. Type the new name for the solution in the text box.

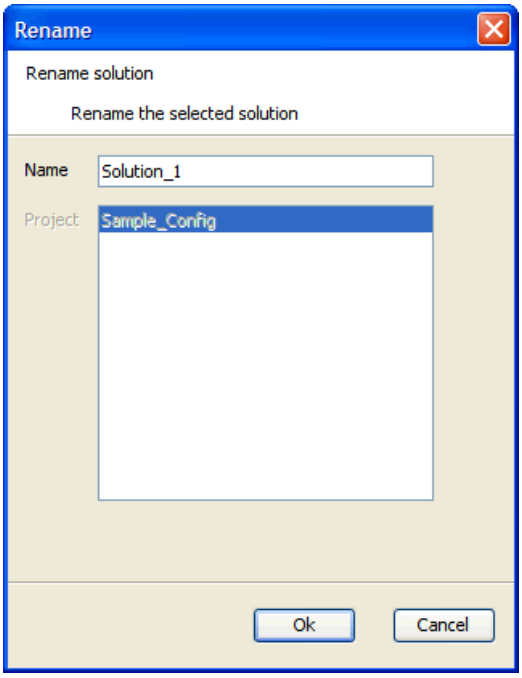
> **Note:** This is the name that the solution is called after it has been copied.

4. Select the project where the solution is to be copied.
5. Click **Finish** to save the copied solution in the specified project.

Rename a Solution

Perform the following procedure to rename a solution:

1. Select the solution to be renamed.
2. Right-click in the Configuration Manager, and select **Rename**. The Rename dialog box appears.



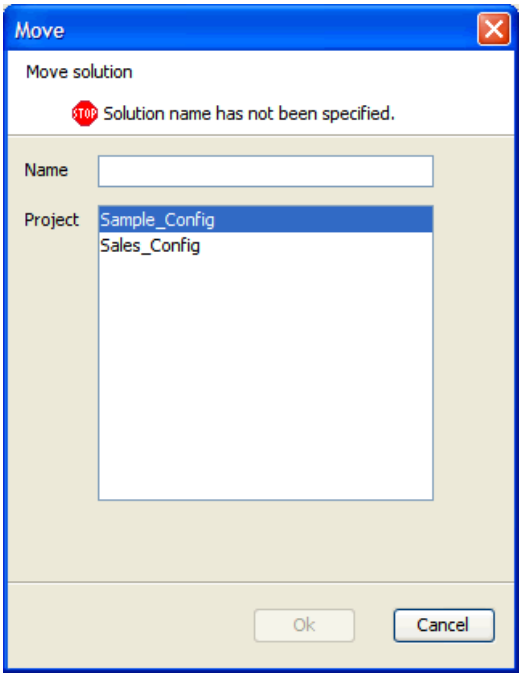
Rename Dialog Box

3. Delete the old name from the resulting field, and type the new name.
4. Click **OK** to save the new name.

Move a Solution

Perform the following procedure to move a solution:

1. Select the solution to be moved.
2. Right-click in the Configuration Manager, and select **Move**. The Move dialog box appears.



Example of Move Dialog Box

3. Type the name of the solution in the text box.

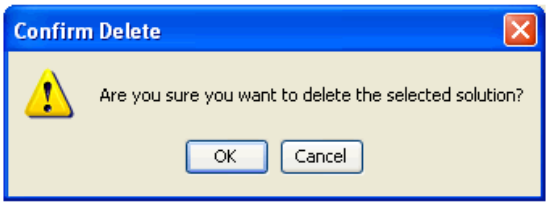
> **Note:** This is the name that the solution is called after it has been moved.

4. Select the destination project for the solution from the resulting **Project** list.
5. Click **OK** to move the solution to the specified project.

Delete a Solution

Perform the following procedure to delete a solution:

1. Select the solution to be deleted.
2. Right-click in the Configuration Manager. The Confirm Delete dialog box appears.



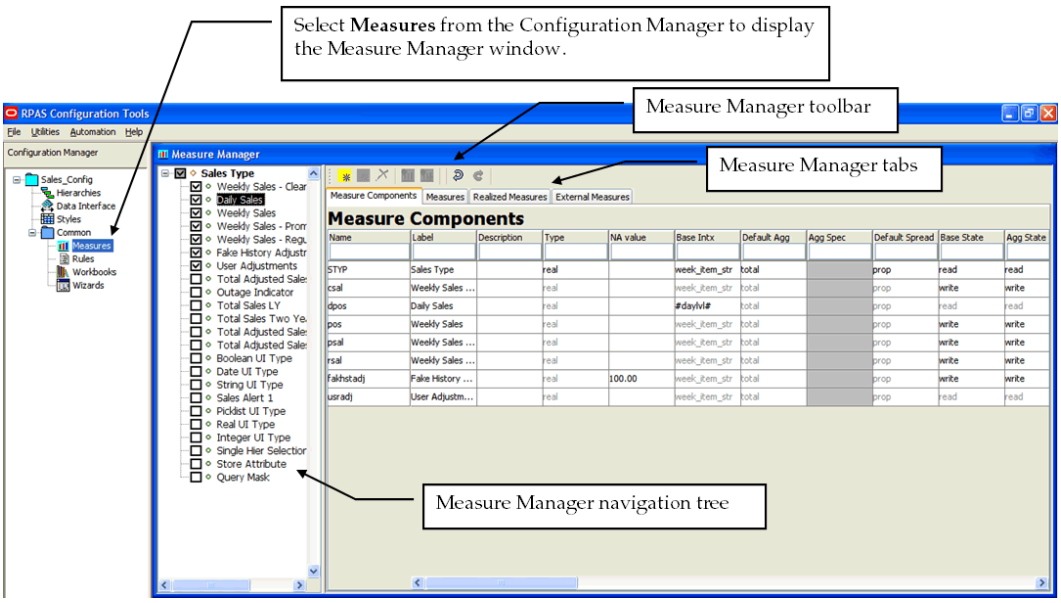
3. Click **OK** to complete the deletion.

Measures and Components

Measure Manager

Overview

The Measure Manager window allows you to define major and minor components of measures and to specify properties for each component. Once the component structure is defined, the Measure Manager generates measures by combining the components that are selected. You may then select (realize) the valid measures and further update the properties for individual measures.



Example of Measure Manager Window

Measure Properties

Inheritance

Measure properties are inherited at the component level. The properties defined for a component are inherited by the minor components that belong to that component and to the measures that are associated with that component unless it is overridden at a lower level.

When a measure can inherit a property from more than one of the components that construct it, the measure inherits from the component that belongs to the highest major component in the component tree. For many properties, it is a good practice to set the properties for just one major component or for minor components in just one major component branch.

Overriding

Measure property inheritance can be overridden at the minor component or at the measure level. Once a property is set at a lower level, changes made to that property at a higher level will no longer be inherited at that lower level.

Measure Components

A major component is the highest level in the component inheritance hierarchy. Properties defined at this level are inherited by all minor components that are created under the major component.

Within each major component, you can create one or more minor components. You can also create a minor component under a minor component and also modify properties at the minor component level.

Once major and minor components are defined, the Measure Manager generates measures that are based on the combination of selected components. These measures cannot be used elsewhere in the Configuration Tools until the valid prototype measures are Realized (see the following section on Realizing and Unrealizing measures for more information).

Component Process
Create major components, from which measures are composed.
Create minor components, which are sub-groupings or specific items in a major component.
Define measure properties at the major component level. The minor components will inherit the properties associated with the major component they belong within.
If necessary, modify the measure properties at the minor component level.

Note: Components have no structural impact on the built solutions, and they are not exposed to end users. Components are intended to be a convenience to aid you in easily grouping measures together and setting measure properties at higher levels.

Measure Naming Conventions

All components used in RPAS configurations must adhere to the following naming convention:

Characters allowed:

- Capital and lowercase letters (A, b…Z)
- &
- $
- %
- Numerals (1, 2, 3…)
- Underscore (_)
- Measure component Names must start with a letter
- No spaces are allowed

Note: Since the names of realized measures are limited to 15 characters, and those names are constructed by concatenating the names of the components from which the measure is built, it is usually good practice to abbreviate the names of components where necessary.

There is no limit on the number of characters for Measure Labels.

Measure Component Design

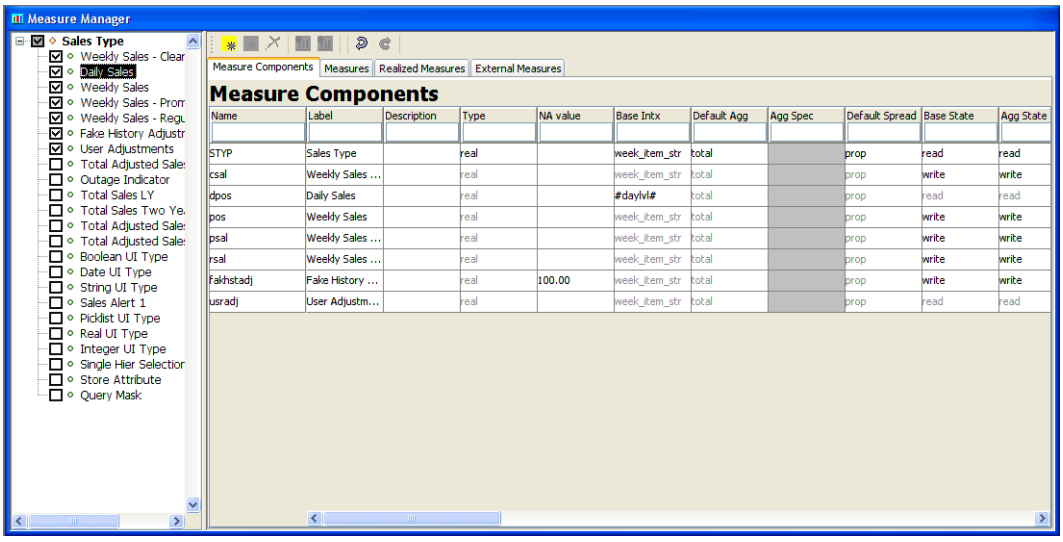
The following two basic principles should be kept in mind to make the Measure Manager as powerful as possible.

1. Major and minor components should be designed with the idea of maximizing the inheritance of properties, and minimizing the amount of property overriding.
2. Use minor components to make measure definition manageable.

For example, consider a configuration that has 2000 measures and 1500 of the measures are of data type real. Avoid grouping all 1500 measures into a single minor component because smaller subgroups of 1500 measures cannot be easily edited. Minor components can also have minor components, so within the 1500 measures, you may break them out further. This could be based on the aggregation method, such as total, max, recalc, and base intersections. Ideally, filtering by the "checking" of a lowest level minor component should allow you to easily view and manage every resulting measure for that minor component.

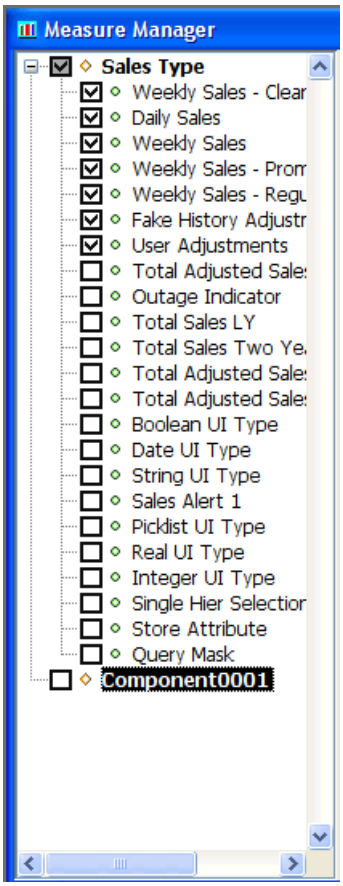
Create a Major Component

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures** – **Measure Components** tab. The Measure Manager window opens in the workspace.



Example of Measure Manager Window - Measure Components Tab

1. Right-click in the left-hand pane of the Measure Manager window and select **Add Major Component**, or click the **Add Major Component** button. The major component is displayed in the Measure Manager navigation tree with a default name.

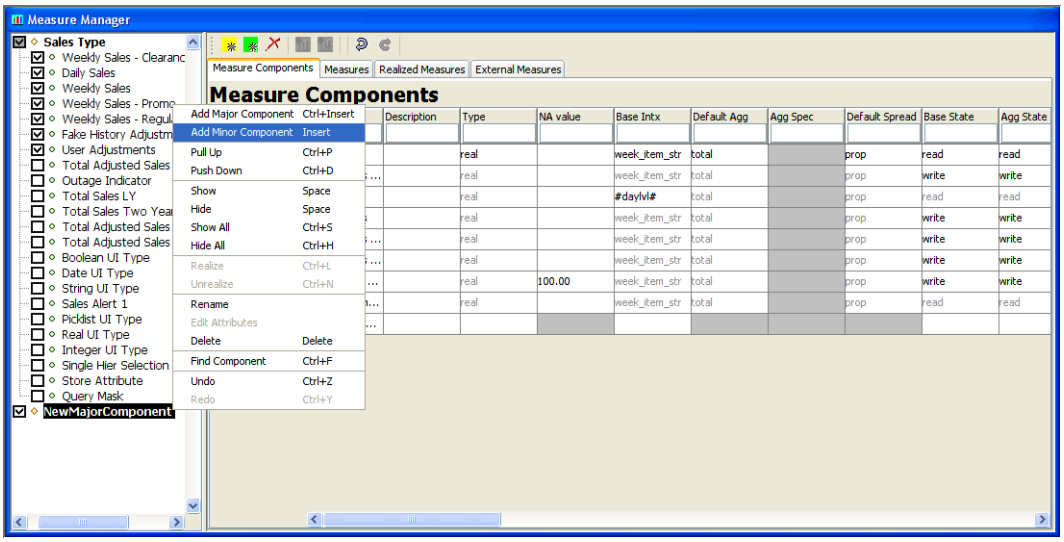


Example of New Major Component

2. To change the component name, select right-click on the component and select **Rename**, or select the component from the navigation tree and then modify its **Label** field from the **Measure Components** tab.

Create a Minor Component

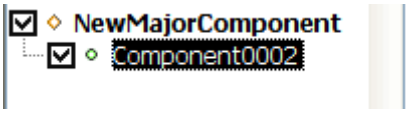
Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures** – **Measure Components** tab. The Measure Manager window opens in the workspace.



Example of Major Measure "NewMajorComponent" Selected

1. Select the major or minor component that the new minor component is to be added beneath. In the example above, **NewMajorComponent** is selected.
2. Choose one of the following methods:
   - Right-click the Measure Definition navigation tree, and select **Add Minor Component**.
   - Click the **Add Minor Component** button.
   - Press the **Insert** key.

   The minor component appears in the Measure Manager navigation tree with a default name.



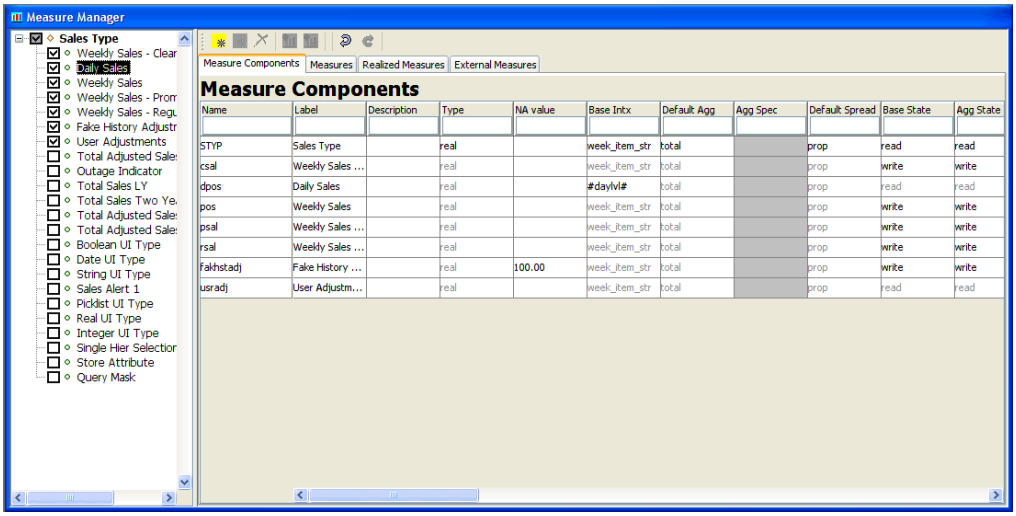
Example of New Minor Component

3. To change the name, right-click on the component from the navigation tree and select **Rename**. You can also select the component from the navigation tree and modify the **Label** field from the **Measure Components** tab.

Defining Measure Component Properties

Perform the following procedure to define the Measure Component properties:

1. Once components have been created, open the Measure Manager and select the **Measure Components** tab.
2. Select the major or minor components you want to view from the Measure Manager navigation tree. The selected components appear in the Measure Components tab.



Example of Measure Manager Window - Measure Components Tab

3. Specify the information for the component properties (for example, Name, Label, Description, etc.), which will apply to the measures that are inheriting property values from the component.

> **Note:** The values that are entered for major components are inherited by the child minor components and the auto-generated measures. Not all properties need to be entered for all components. Properties that are grayed out in the component properties table cannot have a value in the current context. Typically, this is based on the data type of the measure. For example, only components of Boolean data type can have an alert category or an alert expression.

Measure Component Properties

This section describes the fields displayed in the Measure Components tab.

Name

The name (identifier) of a component is used to identify the component within the Configuration Tools. Measure names are built by concatenating the names of the components from which the measure is built. They are concatenated in the order (from top to bottom) of the sequence that the components appear in the list of components.

Label

The label of the component is used to generate measure labels in a similar way that measure names are generated. Labels are displayed to RPAS end users. There is no maximum size limit, but keep the grid display limitations in mind when creating a measure label.

Description

A description of the component is used to generate measure descriptions in the same way that measure labels are generated. You can enter any text to provide more information beyond the measure label to the end user. The description can be viewed by the end user in the RPAS Client.

Type

The Data type. Select one of the following:

- **Real** – Floating point numeric values. Most measures are of this type.
- **Int** – Numeric integer values. There are no special "spreading" algorithms for integer measures, which should normally be used only for measures that are calculated 'bottoms up.' Formatting can be used to display real measures as integer value in the RPAS Client.
- **Boolean** – True or false values, which are typically used for flags and indicators.
- **Date** – Date and time. This can easily be converted to position names using standard RPAS functions.
- **String** – Variable length strings, which are typically used for notes and names.

NA Value

This is a value (typically zero for numeric measures) that is not physically stored, but is inferred. It is used to help with storage and calculation efficiency, and it may be changed by RPAS (in full-evaluation mode) if better efficiencies can be obtained with a different value. See "Appendix B – Calculation Engine Users Guide" and "Appendix C – Rules Function Reference Guide" of this document for more information.

Base Intx

The Base Intersection. The lowest level at which data is stored for a measure. In the domain, the measure is only stored at the base intersection. Inside a workbook (for performance reasons), values for the measure may be stored above the base intersection. Nevertheless, whether stored or not, values for aggregated levels may be viewed in a workbook and used in calculations in workbooks or domains. Double-click this field to open the Select Intersection window. The hierarchies that were defined using the Hierarchy tool are displayed. One dimension from each hierarchy can be selected, but a dimension is not required for each hierarchy. Alternatively, a measure may be marked as scalar. A scalar measure has only one value at any combination in the positions of dimensions of the domain. A Labeled Intersection may also be selected as the base intersection of a measure. The Labeled Intersection field is populated based on the Labeled Intersections defined through the Labeled Intersection dialog accessed in the Hierarchy Definition manager.

> **Note:** RPAS imposes a limit of 5 dimensions that can be defined in a measure's base intersection.

Default Agg

The default aggregation method should be selected from the valid aggregation methods for the component. The valid aggregation method depends on the data "Type" selected for the component. See Appendix B – Calculation Engine Users Guide, and Appendix C – Rules Function Reference Guide for more information on aggregation and spread methods.

Note: Only measures with an aggregation type of ambig, pst, or pet can be aggregated from below the partition levels to above the partition levels in a global domain.

Agg Spec

This hybrid aggregation mechanism is designed to allow you to specify a complex method to aggregate the values of a measure. It allows a different aggregation method to be specified for each hierarchy in the measure's intersection. When a measure with the hybrid agg type needs to be aggregated, this is accomplished by separately aggregating each hierarchy of the intersection according to the agg method for that hierarchy.

Example:

Measure XYZ is defined at day_sku_str and has a hybrid aggregation type. The specifics for the aggregation are as follows:

- Calendar should be aggregated by the "first" method.
- Location should be aggregated by the "total" method.
- Product should be aggregate by the "total" method. -stopped

Suppose that XYZ must be aggregated to the level of mnthclssrgn_. The process of generating this new value is accomplished by three successive aggregations:

1. day_sku_str_ to day_clssstr_ by total (product)
2. day_clssstr_ to day_clssrgn_ by total (location)
3. day_clssrgn_ to mnthclssrgn_ by first (calendar)

In this example, the user is allowed visibility to and control over the mechanism by which pst is performed.

A brief description of the user interface functionality/constraints is as follows:

- The hybrid aggregation method now appears in the deff agg drop-down selector.
- When a measure is specified for hybrid agg, the agg spec (aggregation specification) field becomes editable.
- An agg spec can be typed in or built through a dialog (double-click the agg spec editor or select Ctrl-Space to launch it).
- This dialog looks very similar to the standard wizard for workbooks. On the right, the ordering of hierarchies in the intersection of the measure is set by dragging the hierarchies in the list. On the left, a separate aggregation type is selected for each hierarchy. For the most part, these are the aggregation types that are available for the measure based on its type.

  Exceptions are as follows:

  Recalc or hybrid cannot be used within an agg spec.

  First and last can be used only on the Calendar hierarchy only.

  An aggregation type must be specified for each hierarchy in the intersection.

  If a value is to be typed into agg spec, the syntax and meaning is the same as the arguments used by the aggregate function of the rule engine.

  A hybrid aggregation measure must be read only in its agg state.

  A hybrid measure must have a spread type of none.

> **Note:** The hybrid aggregation type is not supported for extended measures (see "Configure Extended Measures") or for the load aggregation method for a measure.
>
> Unlike Aggregate procedure, the "recalc" aggregation type is not supported for any hierarchy for am measure using the hybrid aggregation type.
>
> Measures that use the hybrid aggregation type cannot be aggregated from a local domain into the global domain.

Default Spread

The default spread method should be selected from the valid spread methods for the component. The valid default spread method depends on the data “Type” selected for the component. See "Appendix B – Calculation Engine Users Guide" and "Appendix C – Rules Function Reference Guide" of this document for more information on aggregation and spread methods.

> **Note:** The spread method can be overridden on edit in the RPAS User Interface. For all "populated" spread methods (ending with “pop”), the spread method is the same as the underlying method (for instance, prop_pop is like prop), except that only cells with a value that is different from the naval are used in the spreading, and cells with a value equal to the naval are ignored.

Base State

The ability of the measure at the base level to be modified. The available options are **read** or **write**.

Agg State

The editability of the measure at the aggregate level, which are all intersections above the base intersection (read or write). Set the Base State to write and the Agg State to read for those measures that need to be manipulable, but where there is no business requirement to manipulate them other than at their base intersection. Usually there is no sensible way to spread such measures. The manipulability of measures will change according to ‘protection processing’ principles. Therefore, base state and agg state should only be used to override the result of protection processing (for example, to make a measure non-manipulable that protection processing would otherwise allow to be manipulated). See "Appendix B – Calculation Engine Users Guide" and "Appendix C – Rules Function Reference Guide" of this document for more information on the Agg State of measures.

Database

The physical location in the file system of the database that stores the data for this measure. Those measures that contain data that persists beyond the lifetime of a given workbook store their information within a database within the RPAS domain. This field is used to specify the path to the location of the database to use for the measure. All databases are contained within the data directory of the domain. If the specification does not begin with the data directory, "data/" will be attached to the beginning of the entry at the time of installation (for instance, the entry "Sales" will be registered as "data/Sales").

View Type

The View Type field holds properties for two types of measures:

- Those that are calculated when viewed
- Those that are synchronized with other measures.

If the view type is none, the measure is of neither type.

If the View Type is view_only, the measure is not calculated during a normal calculate cycle, and it is calculated on-the-fly when required (for instance, for viewing). Such measures must have an aggregation type of recalc and should appear on the left-hand side of only one expression in a rule group. They may not appear on the right-hand side of any expressions. The measure should not have a database assigned. See "Appendix B – Calculation Engine Users Guide" of this document for more information.

Synchronized measures are in effect, views of two or more other measures where changes and lock to those other measures are immediately reflected in the synchronized measure (and vice versa).

Example:

A “closing stock” measure may be synchronized with a “season opening stock” measure and an “opening stock” measure so that a change to “opening stock” in week 3 will immediately cause the same change to be applied to “closing stock” in week 2 (since closing stock in week 2 and opening stock in week 3 are the same). Synchronized measures require a synchronization type in the View Type property, which must be one of **sync_first_lag**, **sync_lead_last**, **sync_first** or **sync_last**, and a list of measures to synchronize with in the Sync With property.

- **none** – The measure is calculated normally.
- **view_only** – The measure is calculated when viewed.
- **sync_first_lag** – Period 1 is from the first measure (no calendar). Periods 2..N are from the second measure 1..N-1 (lag) [for example, bop synchronized with os and eop].
- **sync_lead_last** – Periods 1..N-1 are from the first measure 2..N (lead). Period N is from the second measure (no calendar) [for example, eop synchronized with bop and cs].
- **sync_first** – Gets Period 1 from the measure (similar to pst along calendar dimension) [for example, os synchronized with bop].
- **sync_last** – Gets Period N from the measure (equivalent to pet along calendar dimension) [for example, cs synchronized with eop].

Sync With

A comma-separated list of measures used for synchronization. Depends on the View Type.

Insertable

This field indicates whether the measure can be inserted as an extra measure in workbooks built from templates that are not configured to contain the measure. Insertable measures can be added to a workbook during the wizard process on the **Extra Measures** wizard page before a workbook is built, or by inserting the measure in the Show/Hide dialog window in the RPAS Client inside a built workbook. Measure security must also be defined for Insertable measures in the RPAS Security Administration workbook template. Possible values are true and false. See the *RPAS Administration Guide* for additional information about measure security.

Note: The Extra Measures wizard is not available by default for every workbook; it must be configured as a custom wizard page.

UI Type

Indicates whether the measure is a picklist or not. If a measure is defined as a picklist, the RPAS UI User must choose a value for the measure from a list of valid values defined using the range property. Possible values are “picklist” or blank.

Range

Specify an allowed range for the measure at edit time. For numeric values, the syntax is as Lower Bound : Upper Bound. If the RPAS Client user attempts to enter a value in the RPAS Client outside of this range, the modification is rejected. For string measures, any entry in this field is ignored.

For numeric or string measures with a UI Type of “picklist” (numeric and string), values are comma separated value/label pairs, where the label is given in brackets, such as a(labela), b(labelb), and c(labelc). If a label is not specified (for example, “a, b, c, d”), the value is also used as the label. The value of the cell is used in calculations; however, labels (if specified) will be displayed in the user interface, both in the grid and in the picklist. If a cell contains a value that is not valid for the picklist, the value is displayed in the grid. When the measure’s range is specified in this manner, all cells in the RPAS Client will display these same values as valid options for the picklist. The valid set of options for a picklist measure can also be defined in such a way that they are "context sensitive," which means that they vary from position to position. For example, a picklist measure with a base intersection at the SKU dimension could have valid values that vary according to which class the SKU belongs. You set this up by setting the range property of the picklist measure as “measurerange = measS” where measS is the name of a string measure that holds the valid picklist options (in the valid formats described earlier) in each of its cells. The measure that holds the valid picklist values (in this example, "measS") can have a base intersection at any of the dimensions in the hierarchies and the values shown in the picklist measure for any intersection are effectively “looked up” using normal ‘nonconforming measure’ handling.

The valid values for a picklist for a cell are referenced from a measure dynamically. If required, it is possible for the valid values of picklists to change during the life of the workbook as a result of calculations or end-user edits. The value used will always be that of the last calculate, so direct or indirect (through calculation) edits to the picklist value measure are ignored when a calculation is pending.

Purge Age

The number of days (without a load) before measure data is purged. See the *RPAS Administration Guide* for details of how this property is used in the `loadmeasure` utility.

Lower Bound and Upper Bound

If the range of valid values for a numeric (real or integer) measure applies across the whole domain, the range property can be used to specify valid values for data entry validation. If the range of valid numeric values varies according to positions in the hierarchies, the Lower Bound and Upper Bound must be used instead. If specified, the Lower Bound and Upper Bound properties must be a valid, realized measure name that provides the bounding values for this measure’s data cells. These properties must contain measure names (not numeric values).

Note: If one (but not the other) of Lower Bound and Upper Bound is specified, only one limit is checked. For example, if a Lower Bound is set, but an Upper Bound is not, valid values are greater than or equal to the value held in the Lower Bound measure, but with no upper limit. The Lower Bound and Upper Bound measures can be non-conforming with respect to the measure that has bounds, and the value to be used will be obtained by normal non-conforming processing (that is, "replicated down" from higher levels or "aggregated up" from lower levels).

Sp Value Type and Sp Value

These two properties specify the "special value" type and the "special value" value. They are used to define the manner in which "special values" are handled by RPAS. These two properties can be used together to specify how to display cell values in the User Interface (UI) that have a value equal to the "naval" of the measure. In particular, it supports solutions that want to interpret cells with the "naval" as meaning "no value" by displaying a null value to the end user.

The SP Value Type property specifies the type of value that will be shown. Valid values for this property are **Null**, **Cell Value**, and **User Entered**. The default behavior is that such cells will have their cell value shown, which is what the value of **Cell Value** in the SP Value Type property means. However, these properties can be used to override the default to either show null, which is defined below, or to display a specific value. To configure the values to display null, assign **Null** as the SP Value Type property. When **Null** is configured, the cell will be blank in the RPAS Client when the value equals the "naval" for a numeric, a date, or a string measures. For Boolean measures, it will be a grayed-out check box. When a specific value is required, you should select **User Entered** for the SP Value Type, and enter the value to be displayed in the SP Value field.

For the Special Value field; the entry in this field must be of the same data type as the measure, and validation is enforced in this field.

- For a Boolean measure; when the Special Value Type field is set to **User Entered**, the only valid entry for the Special Value field is either true or false.
- For a Date measure; when the Special Value Type field is set to **User Entered**, a date in the format of YYYYMMDD can only be entered by the user.
- By default, each measure will be registered with **Cell Value** as the default Special Value behavior. For cases where a Special Value Type setting other than 'User Entered' is used, but a Special Value entry is provided, the Special Value entry will not be used. Instead, the measure will be registered with **Cell Value** as the default behavior.
- When Special Value Type is set to **User Entered**, but a Special Value entry is not entered, the Special Value Type will not be used. Instead the measure will be registered with **Cell Value** as the default behavior.
- When a domain has been built that includes a measure with a special value setting, and that special value setting for that measure is removed. When the domain is patched the measure will get updated with **Cell Value** as the default special behavior.
- RPAS allows for the special value measure property to be updated.

Dim Attr Type

This checkbox option is used to indicate that the measure should be registered as a dimension attribute. Dimension attributes allow for additional information to be defined for the positions of a given dimension. This is commonly used to define and display an alternate label for a position (other than the loaded position label) or to display supplemental information about a position (such as the status of a given position).

The following requirements must be met for a measure to be eligible to be a dimension attribute:

- The measure must be realized.
- The measure must be 1-dimensional, which means that its base intersection must only have one dimension.
- The measure must be stored, which means that it must have a defined database.

Dim Attr Name (optional field)

This is only to be used if the measure is set to be a dimension attribute measure. When a dimension attribute is displayed within the RPAS Client, the Dim Attr Name will be used in place of the measure name. If no Dim Attr Name is supplied, the RPAS Client displays the measure name.

Dim Attr Label (optional field)

This is only to be used if the measure is set to be a dimension attribute measure. When a dimension attribute is displayed within the RPAS Client, the Dim Attr Label will be used in place of the measure label. If no Dim Attr Label is supplied, the RPAS Client displays the measure label.

Allowed Aggs

The set of the allowable aggregation methods for the measure based on the measure data type. You can add so called extended measures to RPAS Client views that are normal measures, but with aggregations based on different aggregation methods. The aggregation methods that are available for selection are based on the Allowed Aggs of the base measure. The same base measure can have multiple extended measures based on different aggregation methods.

Style

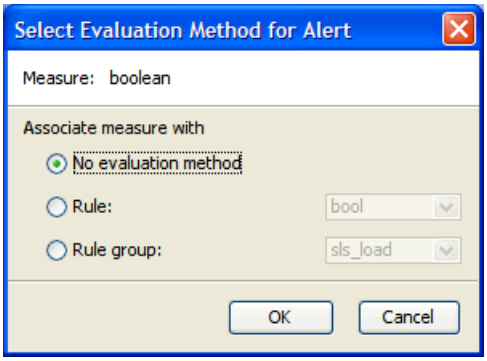
One of the styles defined within the style tool may be specified as the default style to be used to display measures based on this component inside the User Interface. See the section on the Style Manager for details on the specification of style information.

Alert Category

Identifies the measure as an alert measure and associates the category with this measure. Only measures of data type Boolean can be alert measures. All defined categories are displayed in the drop-down box. Note that alert categories are defined in the Alert Manager, which can be accessed by right-clicking a measure and selecting **Alert Manager**. See the *RPAS User Guide* for a description of alerts.

Alert Expression

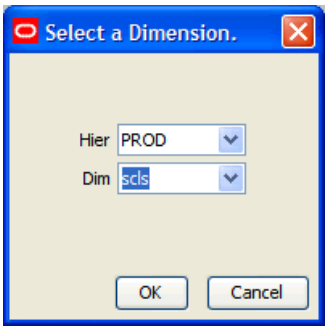
The evaluation method for this alert measure. When this cell is double-clicked, the Select Evaluation Method for Alert dialog box opens; this dialog can be used to select a rule or a rule group. Rules displayed will be those whose first expression has the given measure on its left-hand side. Rule groups displayed will be those that have rules in which its first expression contains the given measure on its left-hand side. See the *RPAS Administration Guide* for more information on Alerts.



Select Evaluation Method for Alert Dialog Box

Single Hier Select

This property is only valid for components that have a **Type** (data type) of **string**. It specifies that cell contents are to be entered by users using the "Single Select Widget." This is a widget in the RPAS Client that presents the end user with a view of the positions along the dimension set in the configuration. The user may then select any single position. You must select the hierarchy and dimension whose positions will be displayed to the user in the RPAS Client.



Select a Dimension Dialog Box

Filename (read only)

Measures included into the Data Interface Manager have a filename specified. This field displays the value, if one exists, for the filename of the measure. See the section on the Data Interface Tool for details on data interface properties. This property cannot be modified and is displayed for diagnostic purposes.

Load Intx (read only)

Measures included in the Data Interface Manager have a load intersection [Load Intx] specified. This field displays the value, if one exists, for the load intersection of the measure. See the section on the Data Interface Tool for details on data interface properties. This property cannot be modified and is displayed for diagnostic purposes.

Start (read only)

Measures included in the Data Interface Manager will have a start position specified. This field displays the value, if one exists, for the start position of the measure. See the section on the Data Interface Tool for details on data interface properties. This property cannot be modified and is displayed for diagnostic purposes.

Width (read only)

Measures included in the Data Interface Manager will have a width specified. This field displays the value, if one exists, for the width of the measure. See the section on the Data Interface Tool for details on data interface properties. This property cannot be modified and is displayed for diagnostic purposes.

Load Agg (read only)

Measures included in the Data Interface Manager will have a load aggregation method [Load Agg] specified. This field displays the value, if one exists, for the load aggregation method of the measure. See the section on the Data Interface Tool for details on data interface properties. This property cannot be modified and is displayed for diagnostic purposes.

Materialized (read only)

Certain measures may be registered as display only measures in order to improve performance within a workbook. This marking is done automatically at the time of installation. If the measure has been marked as display only, that fact will be reflected in this field. This property cannot be modified and is displayed only for diagnostic purposes.

Creator (read only)

Certain extensions make use of plug-ins to the RPAS Configuration Tools to automatically generate configuration content. This field displays the creator of the given measure. The value **user** represents content generated by a user of the Configuration Tools. A different value represents content generated by a plug-in. This property cannot be modified and is displayed for diagnostic purposes only.

Signature (read only)

The signature of a measure is used to resolve ambiguity that may result from overriding the name property of a measure. This field contains the value of the measures signature property. The contents of this field are created and maintained automatically by the Measure Manager. This property cannot be modified and is displayed only for diagnostic purposes.

Edit Components

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

Move Components

1. From the Measure Manager navigation tree, select the component to be moved.
2. Drag the component to the new location and release it.

> **Note:** A minor component cannot be moved to a different major component.
>
> You cannot move a component so that it would be a descendent of another component that is used in the specification of a realized measure.

Push Components Down

1. From the Measure Manager navigation tree, select the component to be pushed down.
2. Right-click in the Measure Definition menu, and select **Push Down**.

> **Note:** The component is pushed down one level in the component hierarchy, and a new component is created to take the place of the pushed down component.
>
> **Note:** A major component cannot be pushed down.

Pull Components Up

1. From the Measure Manager navigation tree, select the component to be pulled up.
2. Right-click and select **Pull Up**. The component is pulled up one level in the component hierarchy.

> **Note:** A minor component cannot be pulled up to become a major component, nor can a major component be pulled up.

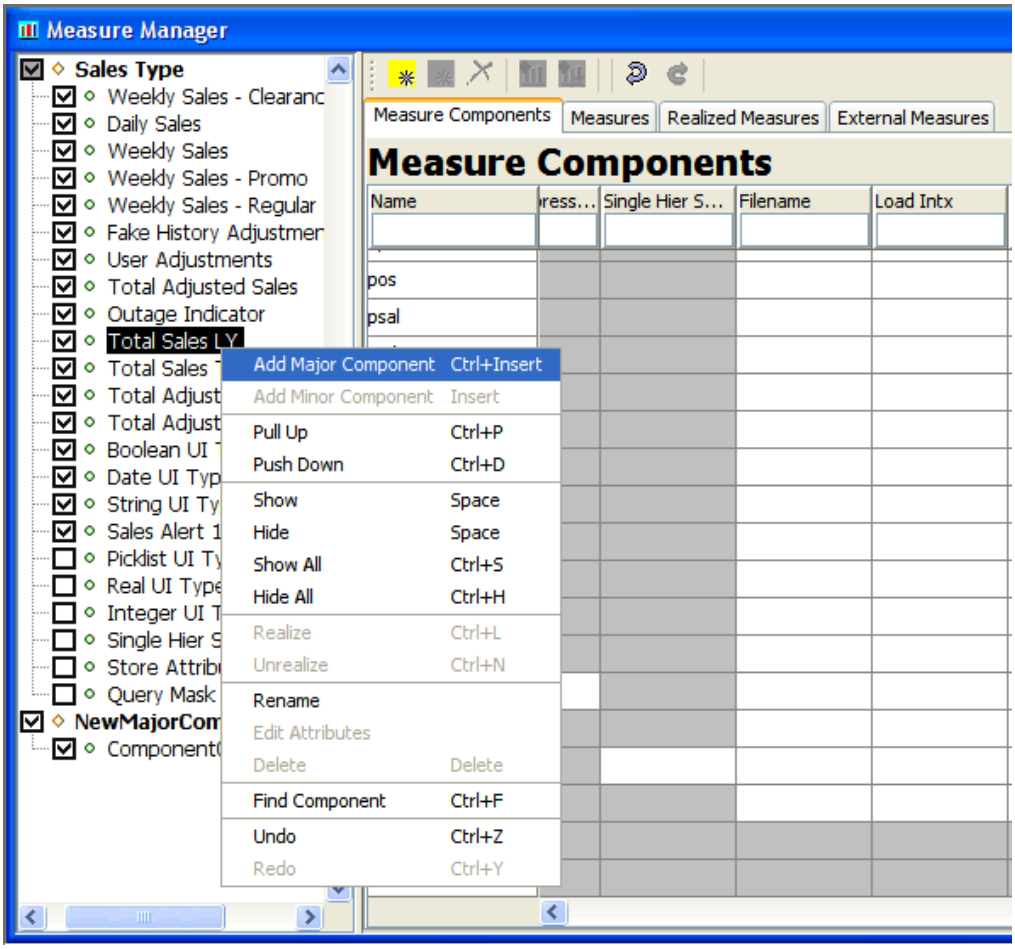
Display or Hide Components

- To display information about a component, select the check box next to the component name.
- To hide information about a component, clear the check box next to the component name.

> **Note:** Selecting or clearing a check box for a major or minor component causes the check boxes for all minor components underneath it to be selected or cleared. This check box is also used to enable a component so it becomes active when measures are generated.

Find a Component

1. Right-click in the Measure Manager navigation tree and select **Find Component**. The Input dialog box appears.



Example – Find Component Menu Option

2. Type in the name of the desired component and click **OK**. The tree will scroll to bring the specified component into view.
3. Select the desired component.

> **Note:** The full name (case sensitive) of the component is required in order to find it. If there is no component with the exact name entered, the tree will not scroll.

Rename a Component

Navigate: From the Measure Manager navigation tree, select the component to be renamed.

Choose one of the following methods:

- Right-click in the Measure Manager navigation tree and select **Rename**. Type the new name for the component.
- Double-click the component, and type the new name.
- Select and change the name of the component in the Measure Component tab.

> **Note:** Changing the name of a component will result in a change in the name of any measure that inherits from the component unless the measure has overridden the name property.

Remove Components

Navigate: From the Measure Manager navigation tree, select the component to be removed.

Choose one of the following methods:

- Select **Remove Component**  .
- Press the **Delete** key.
- Right-click in the Measure Manager navigation tree and select **Delete**.

The component is removed from the solution.

> **Note:** It is not possible to remove a component that is used (or that has a descendent component that is used) in the specification of a measure.

Alerts

Alerts are an exception management tool. An alert is a measure of type Boolean (returning a value of true or false) that is the result of the evaluation of a business rule. RPAS then notifies the user of the "true" conditions, and it allows workbooks to be built to resolve the scenario that drove the alert.

Example:

A store's inventory on a particular item is low, so an alert will be triggered (Boolean expression = true).

A summary of the process for defining and finding an alert is as follows:

1. Create an alert measure. This must be a Boolean measure (true-false, yes-no) and must be defined in the domain using the RPAS Configuration Tools.
2. Create the alert (the expression) for which the alert should be evaluated using the Configuration Tools. This flags the registered measure as an alert so that it is recognized when the "alert finder" is run.
3. Run the "alert finder" on the domain to evaluate the number of instances when one or more alert expressions are true. This operation is completed using the RPAS utility `alertmgr`.

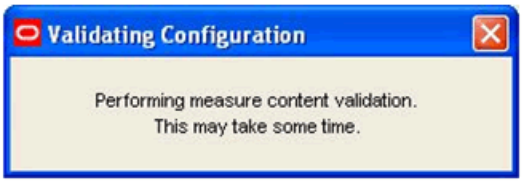
For more information on alerts, see the *RPAS Administration Guide*.

Measure Validation within the Measure Manager

The Measure Manager performs large amounts of validation on the properties of the measures that are created within it. Much of this validation involves dependencies of one property of a measure upon another property of the measure. Some validation involves dependencies of a property of a measure upon the hierarchies that are defined in the Hierarchy Tool. These forms of validation are performed automatically as edits are made in the Measure Manager.

In addition; the validity of rules, rule groups, and workbooks depends on the properties of the measures that they contain. Validation of the measure content of the rules, rule groups, and workbooks of a large solution can take a significant amount of time.

In order to facilitate the configuration process, this second form of validation does not occur as edits are made in the Measure Manager. Instead, this validation is deferred until Measure Manager is exited by selecting a different tool/option from the Configuration Manager. At this time, a dialog briefly displays to indicate the validation process is running.



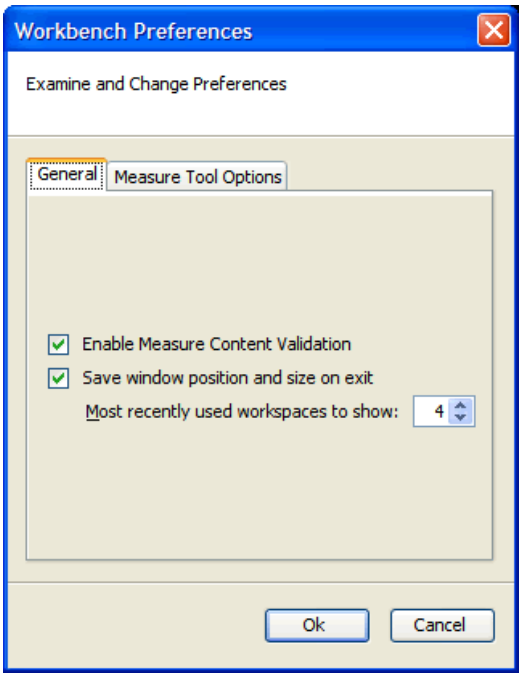
When the full suite of solution level measure content validations is complete, the dialog is no longer displayed and the selected tool is activated.

> **Note:** For fast performing validations, dialog may only be displayed for a few seconds. If the validation process is lengthy, the dialog will be displayed for a considerably longer time.

Disabling Measure Content Validation

For some cases you may disable the full validation (for instance, when performing a number of changes to measure properties that require switching back and forth between multiple tools). Validation can then be manually initiated from the Rule Definition window by selecting **Perform measure content validation**  from the Rule Definition toolbar. Perform the following procedure to turn off real-time validation.

1. Select **File – Tools Preferences**. The Workbench Preferences dialog box appears.



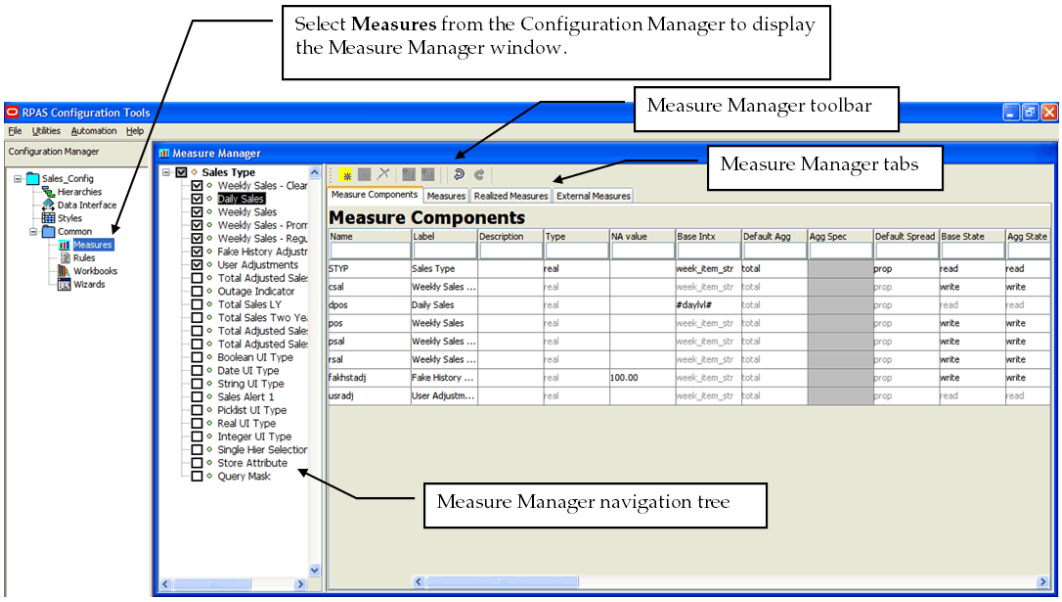
Workbench Preferences – General Tab

2. Deselect **Enable Measure Content Validation**.
3. Click **OK**.

Working with Measures

Overview

The Measure Manager allows you to create and name measures by selecting major and minor components that are already defined. By default, the measures inherit the properties that are defined for the components. To create a measure, select the components that will be used to construct measures. The Measure Manager will generate measures for all of the combinations of selected components. This saves you from the tedious task of manually creating all required measures.

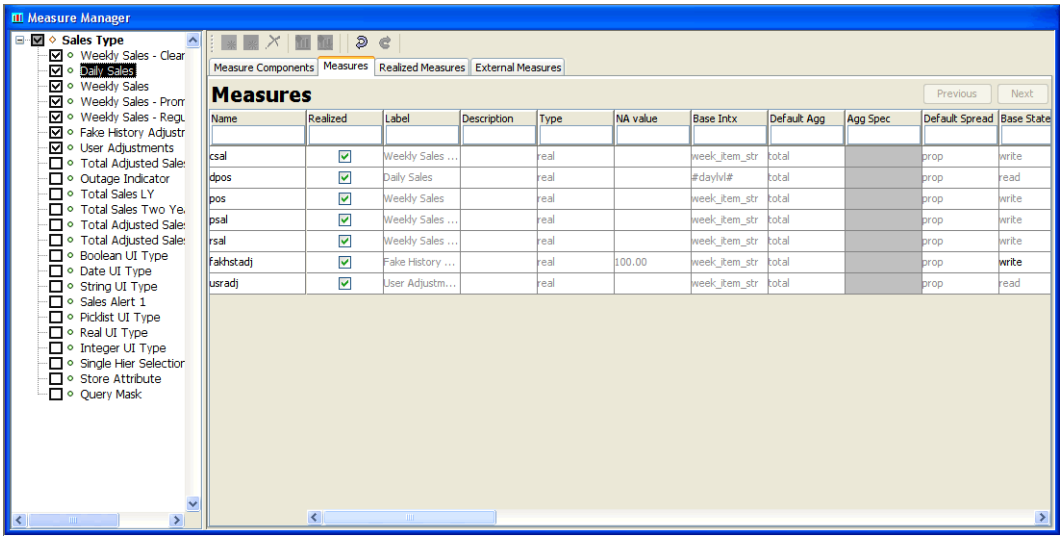


Example of Measure Manager Window

You may then override the properties for individual measures by entering them the same way as on the Measure Components tab. Once properties are overridden at the measure level, changes made at the component level will no longer spread down to that measure as it will retain the overridden value. An overridden value can also be restored to its inherited value or you may override an inherited value to be unspecified.

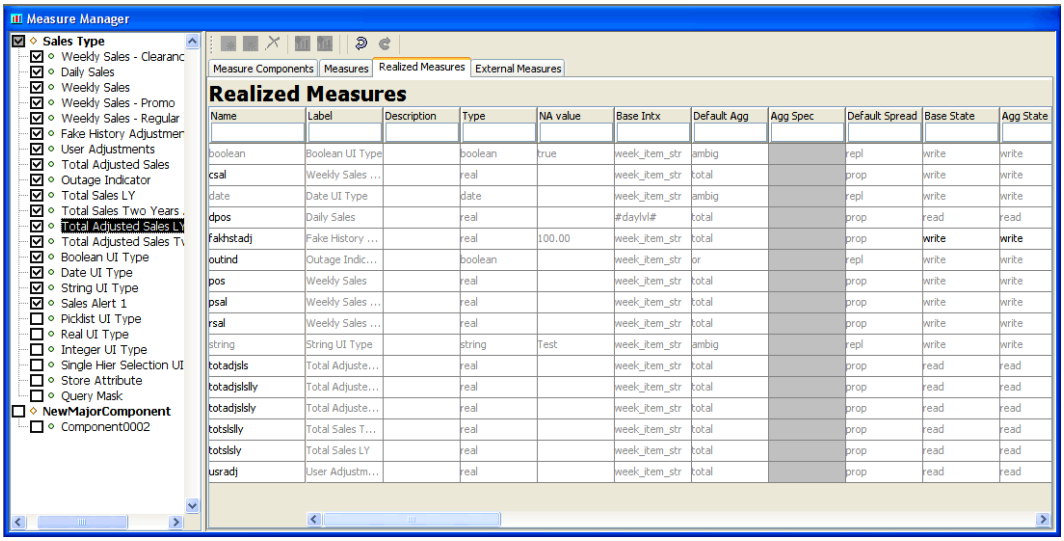
When a measure is auto-generated by the Measure Manager, it cannot be edited or used in any other configuration component such as rules and workbooks until it is realized. A measure does not need to be realized if it is not going to be used.

The **Measures** tab displays all auto-generated measures for the selected components.



Example of Measure Manager - Measures Tab

The **Realized Measures** tab only displays those measures that are realized.

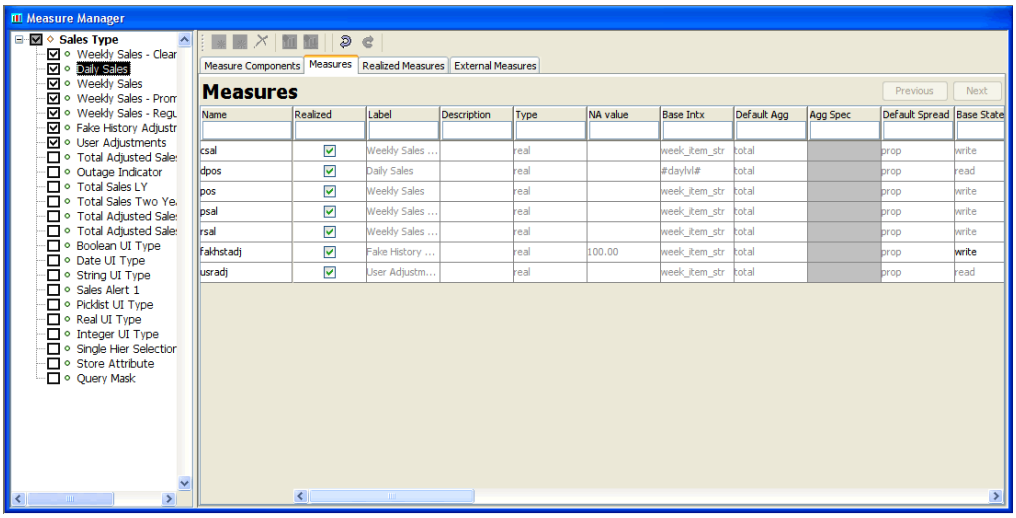


Example of Measure Manager - Realized Measures Tab

Realize and Unrealize Measures

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

1. Select the **Measures** tab.



Example of Measure Manager - Measures Tab

2. In the components tree, select the check boxes for the components that will be filtered. The Measure Manager will show measures using all of the combination of selected components. This process filters the list of prototype measures that are shown from all combinations of components to the combinations of components that have been selected. It uses those components to determine which prototype measures to show.

Realize a Measure

1. Select the components that are used for the measure(s) to be realized.
2. Select the check box in the **Realized** column for each auto-generated measure to be realized.

Unrealize a Measure

1. Select the components that are used for the measure(s) to be unrealized.
2. Deselect the check box in the **Realized** column for each auto-generated measure to be unrealized.

Rename a Measure

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

1. Select the components that are used in the measures to be renamed.
2. In the **Measures** tab, or the **Realized Measures** tab, click the name of the measure that is to be renamed.
3. Type the new name for the measure.

> **Note:** The measure must be realized before it can be renamed.

Show all Measures

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

Right-click in the **Measure Manager** window, and select **Show All**.

> **Note:** Due to memory constraints when working with very large numbers of components, all auto-generated measures may not be displayed. In this case, you will receive an error message indicating that some measure components should be deselected.

Hide Measures by Component

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

1. In the Measure Manager window, select the **Measures** tab.
2. Choose one of the following methods:
   - Deselect the check boxes next to the components to hide.
   - Select the component used in the measures to hide.
3. Right-click in the Measure Manager navigation tree and select **Hide**, or press the spacebar.

Hide All Measures

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

1. In the Measure Manager window, select the **Measures** tab.
2. Right-click the Measure Manager navigation tree, and select **Hide All**.

Sort Measures by Property Value

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

In the Realized Measures tab, measures can be sorted by property value.

1. Select the **Realized Measures** tab.
2. Hold down the control key (Ctrl) and click in the filter field at the top of the table for the property of the measures to be sorted.

   The measures are sorted in alphabetical order according to the value of the property.

Filter Measures by Property Value

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

In the Realized Measure tabs, you can filter measures by property value.

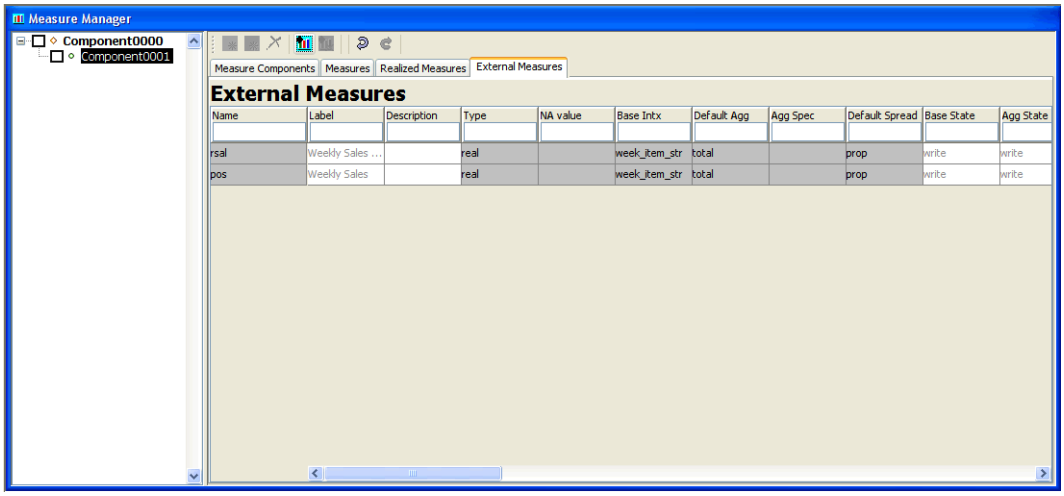
1. In the Realized Measures tab, click in the filter field at the top of the table for the property of the measures to be filtered.
2. Enter the value on which the measures are to be filtered.

> **Note:** This field is case sensitive.

External Measures

Overview

Under most circumstances, measures exist only within the solution in which they are defined. When working with a project with multiple solutions, it is sometimes desirable to make use of a measure defined in a different solution. The Measure Manager allows the "import" of a measure defined in a different solution (but not a different project) into the current solution. These measures (called external measures) then become visible in the External Measures tab of the Measure Manager. Within this tab, it is possible to modify certain measure properties so that the use of the measure in the Solution into which it has been imported will differ from its use in the Solution in which it was originally defined. For example, you may want to modify a writable measure so that it is read-only in the solution into which it is imported.



Example of Measure Manager - External Measure Tab

Within the Measure Selectors present in the Rule and Workbook tools and the Expression Builder, there is a checkbox named **Include External Measures**. When this option is selected, the Measure Selector will include those measures that were imported into the solution in addition to those that are present due to component selections in the Measure Selector.

The following properties may be overridden for an external measure:

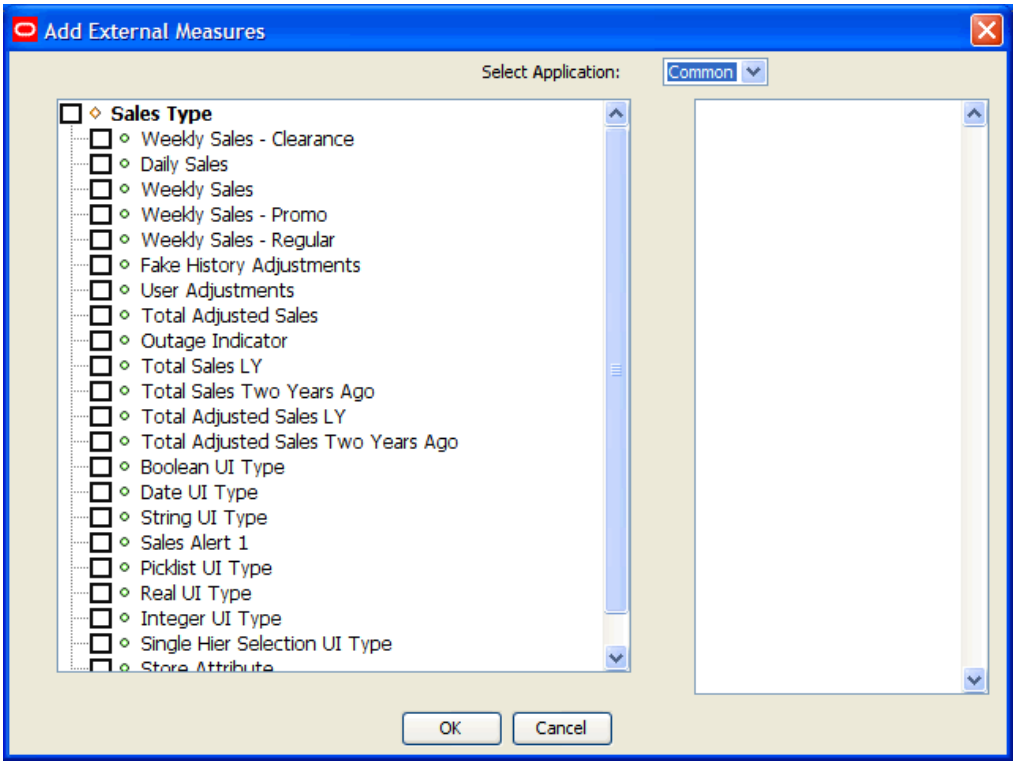
- Label
- Description
- Base State
- Agg State
- UI Type
- Range

Import a Measure

> **Note:** Y may only import a measure into a solution for a project that has at least one other solution.

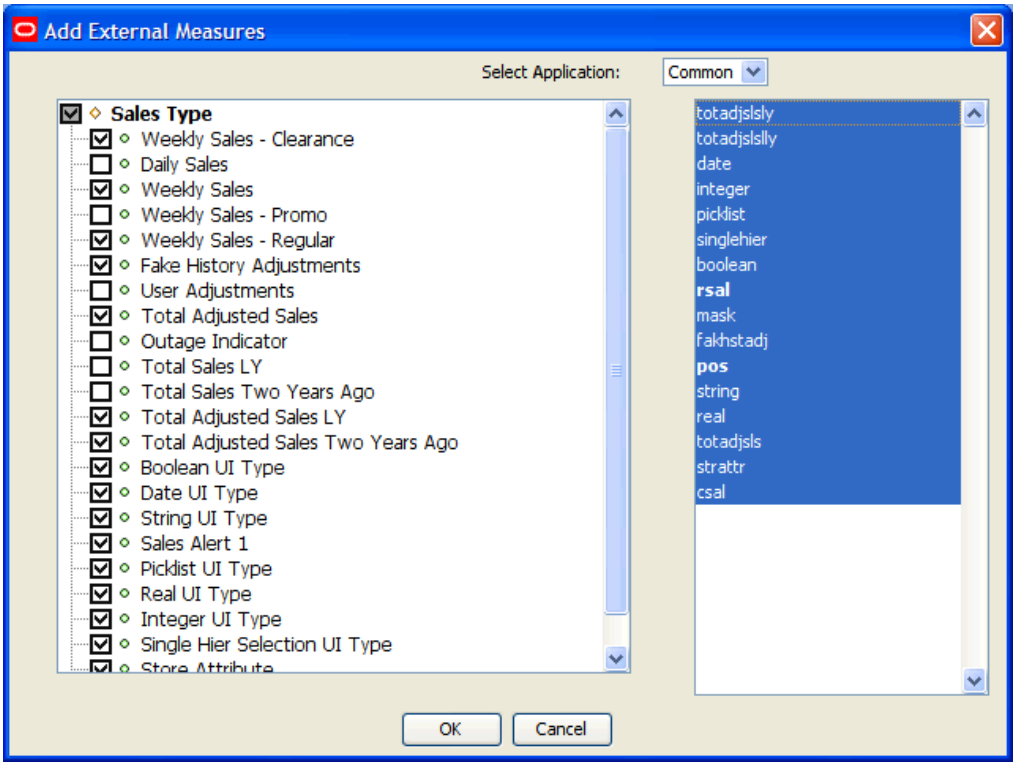
Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

1. Select the **External Measures** tab, and click the **Import Measure** button on the toolbar. The Add External Measures dialog box appears.



Add External Measures Dialog Box

2. In the Add External Measures dialog, select the solution in which the desired measure is defined.
3. Use the measure selector (left-hand side) to select the measure(s) to import.



Selected Measures to Be Imported and in Box to Right

External measures that are already imported appear in **bold**.

4. From the right-hand list, select the measure to import and click **OK**. The selected measures appear in the External Measure tab.

Remove an Imported Measure from a Solution

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Measures**. The Measure Manager window opens in the workspace.

1. Click the **External Measures** tab, and select the measure to remove.
2. Click the **Remove Imported Measure** button from the Measure Manager toolbar, or right-click and select **Remove Import**. The selected imported measure is removed from the External Measures tabs.

Rule Sets

Overview

A rule set is a collection of rule groups. It is used as a placeholder for containing rule groups, which makes the visual display of rules easier. A workbook uses the rule groups specified in one rule set.

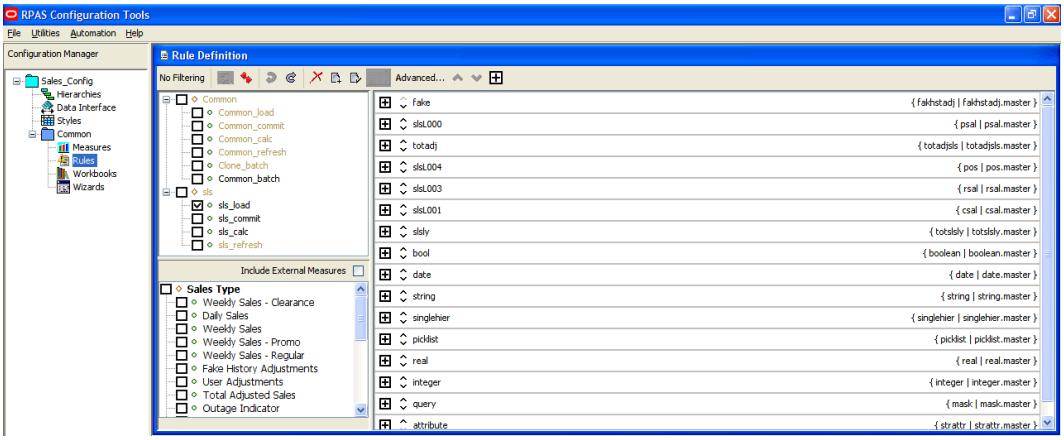
> **Note:** A rule set is a tools concept only. It does not appear in the configured solution.

A rule set is created along with the following default rule groups: load, commit, calc, and refresh.

The rule group names are prefixed with the name of the rule set followed by an underscore. After the default rule groups are created, you can create additional rule groups as necessary. You can also rename the rule groups that were automatically generated, but these rule groups cannot be deleted.

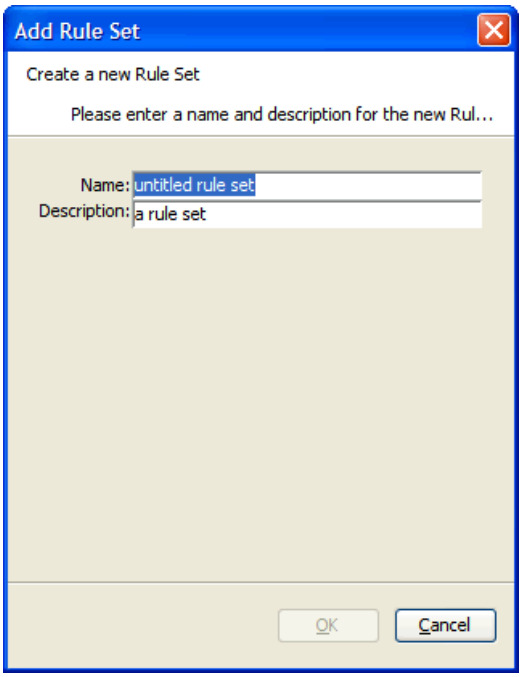
Create a Rule Set

Navigate: In the Configuration Manager, select **Project –** **Solution –** **Rules**. The Rule Definition window opens in the workspace.



Rule Definition Window

1. From the toolbar, click the **New** button and select **Rule Set**, or select **Create/Rule Set** from the right-click menu. The Add Rule Set window appears.



Add Rule Set Dialog Box

2. Perform the following:
   a. In the **Name** field, enter the name of the rule set.

      Note: A rule set name can be a maximum of ten alphanumeric or underscore characters. It must not have a name that is the same as any other rule set that exists in the project.

   b. In the **Description** field, enter a description of the rule set.
   c. Click **OK** to save any changes and close the window. The rule set appears in the Rules navigation tree.

Delete a Rule Set

Navigate: In the Configuration Manager, select **Project – Solution – Rules**. The Rule Definition window opens in the workspace.

1. In the Rule Definition window, select the rule set that to be deleted.
2. Choose one of the following methods:
   - From the toolbar, click the **Delete** button, and select **Delete Rule Set**.
   - Right-click in the Rule Definition window, select **Delete/Remove**, and select **Delete Rule Set** from the drop-down list.

     Note: When a rule set is deleted, any rules that were used in rule groups in that rule set will still be in the rule pool, but they will be unused. The rules will be permanently lost when the project is closed unless they are used in another rule group.

Rule Groups

Overview

In RPAS, a rule group is an ordered collection of rules that are treated as a unit by the calculation engine with the integrity of all the rules in the rule group being maintained together.

Rules within a rule group are given a priority. The calculation engine uses this to select a calculation path that follows business priorities. It does this by using rule priorities to determine which rule to enforce when there is a choice to be made. Although there may only be one active rule group at any time, multiple rule groups can be defined to satisfy different calculation requirements.

Types of Rule Groups

Rule groups may be one of four different types:

- **Load** – The RPAS application automatically uses the load rule group when loading data into a workbook from the domain.
- **Calculate** – The RPAS application uses a calculate rule group to apply the effects of user changes to cells. RPAS supports multiple calculation rule groups. Menu options may be configured to allow for the transition through different calculation rule groups in order to support special processes, such as authorizations. RPAS ensures a smooth transition from one rule group to another.
- **Refresh** – The RPAS application uses a refresh rule group to refresh the data from the domain (for example, to update "actuals"). Multiple refresh rule groups can be specified and selected by the user.
- **Commit** – The RPAS application automatically uses the commit rule group when committing data from the workbook to the domain.

A measure that does not have data in the domain may be loaded into a workbook by using a rule in the load rule group to calculate it based on other measures that are loaded. Similarly, a measure that exists in a domain, but not a workbook, may be committed by using a rule in the commit rule group that calculates it from other measures that are in the workbook.

Rule Group Validation

Within a solution, there may be many rules defined, and each rule is validated individually. Rules within a rule group are also validated in the context of all the other rules in that rule group. While a rule may be perfectly valid syntactically, it may not be valid within the context of a particular rule group. In Rule group validation, each rule in a rule group must represent a completely different measure relationship, which means that the following restrictions apply:

- No two rules in a rule group may use exactly the same collection of measures. If such a condition were allowed, the calculation engine would be unable to calculate either of the rules, because they would be dependent upon each other, so neither could be calculated first. This is explicitly validated in the rule tool.
- For similar reasons, a rule normally does not use a collection of measures that is a subset of the collection of measures in another rule. If the measures that are only in the larger rule were all changed, the situation would be equivalent to the above. There are circumstances where this technique is valuable. For example, in a load rule group where there may be a rule to load a measure from the domain, but other rules that include that measure. In this case, this condition is not explicitly validated.

- There must be one (and only one) expression that calculates a recalc measure used in a rule group.
- Other than in the special circumstance of a rule constructed from multiple result functions or procedures, a measure may only be on the left-hand side of one expression in a rule.

Multiple Refresh Rule Groups

The Refresh Rule Group updates (supplies new values for) data, which can generally be thought of as being "external" to the workbook. An example would be “actuals”:

- If a workbook is built in week 5, the user would have actuals for weeks 1-4.
- In week 6, the user may want to refresh the actuals to get the actuals for week 5.

The Configuration Tools and RPAS support the use of multiple refresh rule groups. Within the rule tool, there is the ability to create multiple refresh rule groups within a rule set. These multiple refresh rule groups can then be assigned to a workbook template using the Workbook Designer, and they will be available for selection within the RPAS Client.

- A workbook contains all of the rule groups in a single rule set, so if multiple refresh rule groups are required in a workbook, they must all be in the same rule set.
- You may consider naming rule groups so the usage of the refresh rule groups are reflected in their names; such as refresh_all, refresh_actuals, and refresh_manager.

Rule Group Transitions

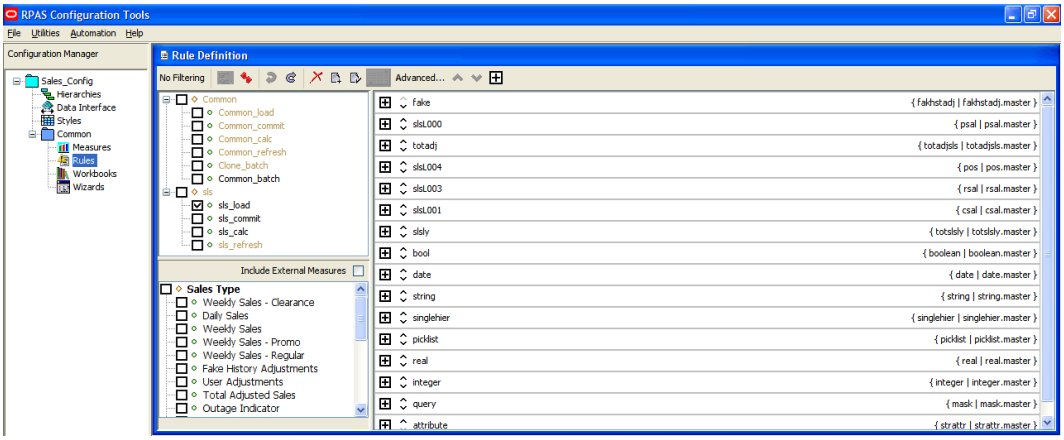
Although only a single rule group may be active at any time, RPAS supports the transition from one rule group to another, so the active rule group may be changed. The calculation engine ensures the integrity of measure relationships at all times, so this transition process is not merely a case of switching from one rule group to another, because there are no guarantees that the integrity of the rules in the rule group being transitioned into would have been maintained. There are different forms of rule group transitions. When designing rule groups, you should consider the impact of anticipated rule group transitions.

Automatic rule group transitions occur under the following circumstances:

- **On workbook building** – Data is loaded using the load rule group. This typically loads measures by calculating them from the data values held on the domain using the master modifier, but may also calculate other measures that are not explicitly loaded. When the load is complete, the system automatically executes a full transition to the calculate rule group.
- **On data refreshing** – Data refreshing causes some measures to be updated from values held in the domain. The measures that are affected by the refreshed measures are treated as affected in the calculate rule group, and a normal calculation of that rule group follows. Effectively, data refreshing causes a calculation using the calculate rule group as if the cells that were refreshed were directly changed by the user.
- **On data committing** – There is a full transition from the current calculate rule group to the commit rule group. This typically commits measures by calculating them on the domain by using the master modifier. There is then a null transition back to the calculation rule group (that is, no transition process is executed since the assumption is that nothing in the workbook has changed), so no transition is required.
- **On executing custom menus** – There is a full transition between each rule group in the custom menu, which is followed by a full transition back to the default calculate rule group.

Create a Rule Group

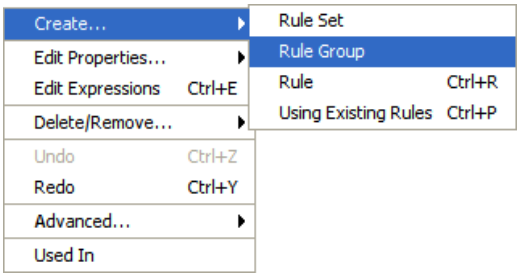
Navigate: In the Configuration Manager, select **Configuration –** **Project –** **Solution –** **Rules**. The Rule Definition window opens in the workspace.



Example of Rule Definition Window

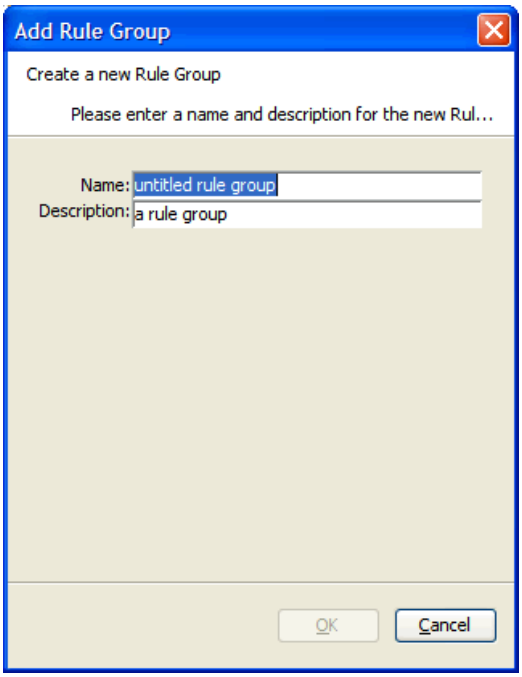
1. In the Rule Definition window, select the rule set to be used to create a new rule group.

2. From the toolbar, click the **New** button, and select **Rule Group**, or select **Create – Rule Group** from the right-click menu.



Example of Create - Rule Group Menu Option

The Add Rule Group window is displayed.



Add Rule Group Window

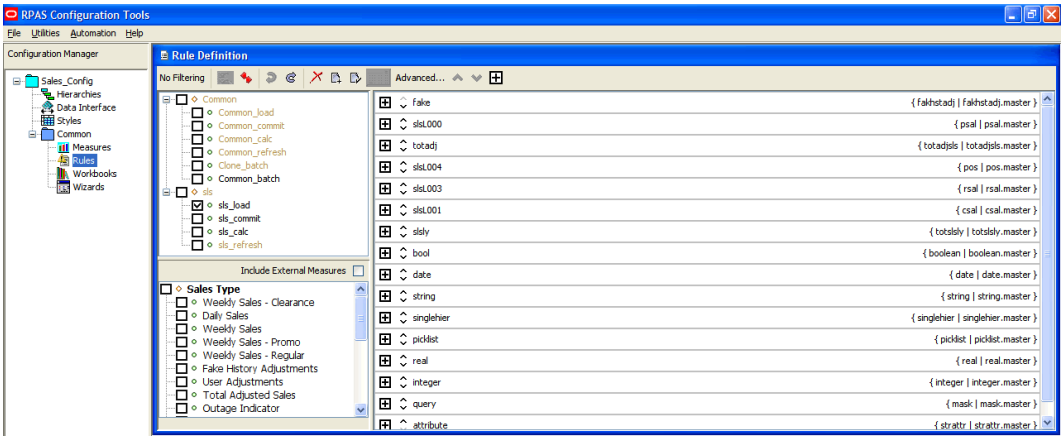
3. Perform the following:
   a. In the **Name** field, enter the name of the rule group.

      Note: A rule group name can be a maximum of 16 alphanumeric or underscore characters. It must not have a name that is the same as any other rule group that exists in the project.

   b. In the **Description** field, enter a description of the rule group.
   c. Click **OK** to save any changes and close the window. The new rule group appears in the Rule Definition tree window.

Delete a Rule Group

Navigate: In the Configuration Manager, select **Configuration** – **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.



1. In the Rule Definition window, select the rule group to be deleted.

> **Note:** Only user-created rule groups within a rule set can be deleted. You cannot delete the default load, commit, calc, and refresh rule groups. If Delete is selected for one of the default rule groups, it will not be deleted, but all of the rules will be removed from the rule group. In either case, the rules will still exist within the rule pool, but they will be lost when the project is closed if they are not used in another rule group.

2. From the toolbar, click the **Delete** button, and select **Rule Group**. The group is removed from the Rule navigation tree.

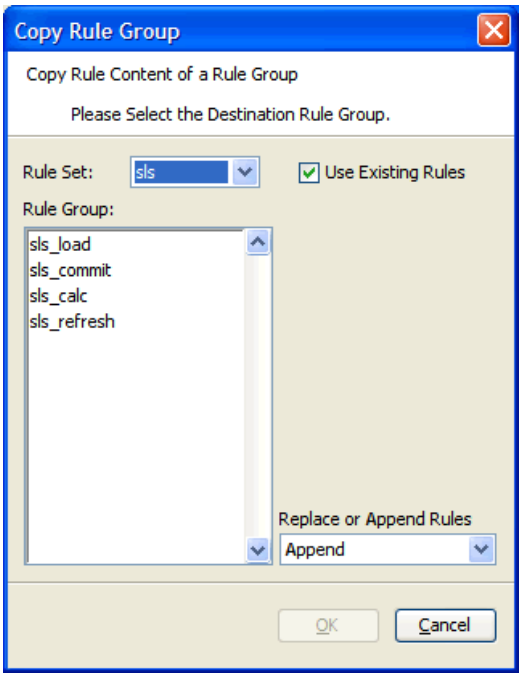
Copy a Rule Group

If two rule groups are similar, it may be beneficial to copy one rule group into the other to prevent having to create a rule group from scratch. When copying the rules of a rule group into another rule group, it is possible to specify whether existing rules will be used or copies of the rules will be created. The Use Existing Rules checkbox defaults to using any existing rules in the rule pool. If this checkbox is selected, the copy rule group operation will use the same rules that the source rule group has. If this checkbox is unchecked, the copy rule group operation will create copies of the rules and use those copies for appending to or replacing rules in the destination rule group.

> **Note:** The rule group to be copied into must already exist. A new rule group cannot be created through this process.

Navigate: In the Configuration Manager, select **Configuration** – **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

1. In the Rule Definition window, select the rule group to be copied.
2. From the toolbar, click **Advanced**, and select **Copy Rule Group**. The Copy Rule Group window appears.



Example of Copy Rule Group Window

3. Perform the following:
   a. Using the **Rule Set** list, select the destination rule set.
   b. From the **Rule Group** area, select the desired destination rule group.
   c. Using the **Replace or Append Rules** list, select:
      – **Replace** – To overwrite all rules that already exist in the destination rule group.
      – **Append** – To add to the rules already in the destination rule group.
   d. Click **OK**. The Confirm Operation dialog appears.
4. Click **OK**. The rules are copied to the selected rule group.

Measure Validation in the Rule Definition Window

If **Enable Measure Content Validation** is NOT selected in the Workbench Preferences window, measure content validation is turned off in the Measure Manager. Measure validation must be manually initiated in the rule tool. See "Measure validation within the Measure Manager."

From the Rule Definition window, click the **Perform Measure Content Validation** button on the Rule Definition toolbar.

Rules

Overview

The Rule Definition tool allows you to define, organize, and manage rule sets, rule groups, and rules. It also allows for the creation of expressions and addition of expressions to rules.

Rules are groups of expressions that describe the relationship between measures.

When a rule has multiple expressions, those expressions are given a priority sequence to help the calculation engine select a calculation path that follows business priorities. When given a choice, the calculation engine will always select the highest priority expression in the rule that is available to be selected. Considerable care should be taken in the design of rules to ensure that appropriate expression priorities are established. The business priority may vary from implementation to implementation, and it may vary from one type of plan to another in the same implementation.

Rules are also given a priority sequence within a rule group to help the calculation engine select a calculation path that follows business priorities. When given a choice, the calculation engine will always select the highest priority rule that needs to be calculated.

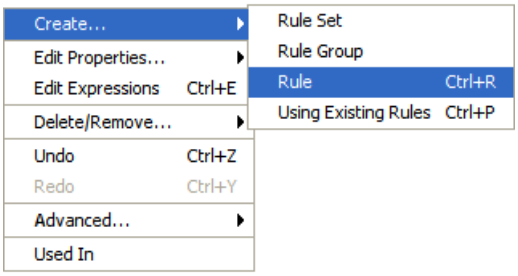
Those who are configuring the calculation requirements of a solution are expected to fully understand the operation of the RPAS calculation engine.

Create a Rule and Add It to a Rule Group

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

1. In the Rule Definition window, select the rule group in which you want to create a rule. If you want the rule to be created in a particular position in the sequence of rules in the rule group, select the rule before which you want the new rule to be placed. The new rule will be created above the selected rule.
2. Choose one of the following methods:

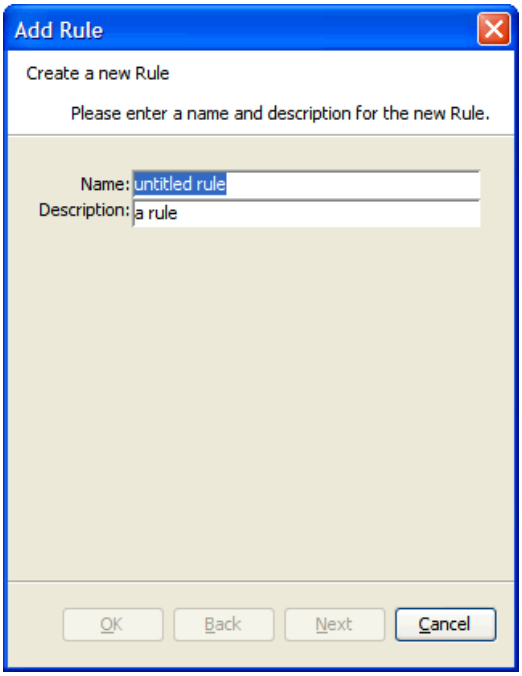
   - From the toolbar, click the **New** button and select **Rule**.
   - Select **Create – Rule** from the right-click menu.



Example of Create - Rule Menu Option

   - Press **Ctrl+R**.

The Add Rule window opens.

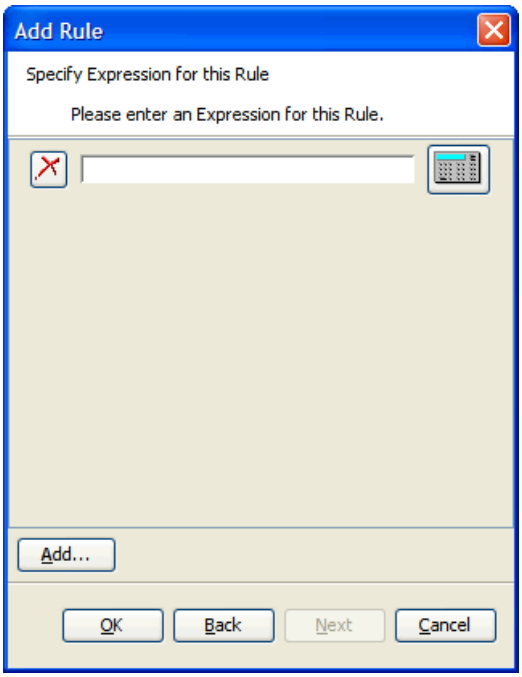


Add Rule Window

3. In the **Name** field, enter the name of the rule.

> **Note:** A rule name can be a maximum of 24 alphanumeric or underscore characters. It must not have a name that is the same as any other rule that exists in the project. Rule names may start with a letter or an underscore, but may not start with the letter "r" or "R" followed by a number.

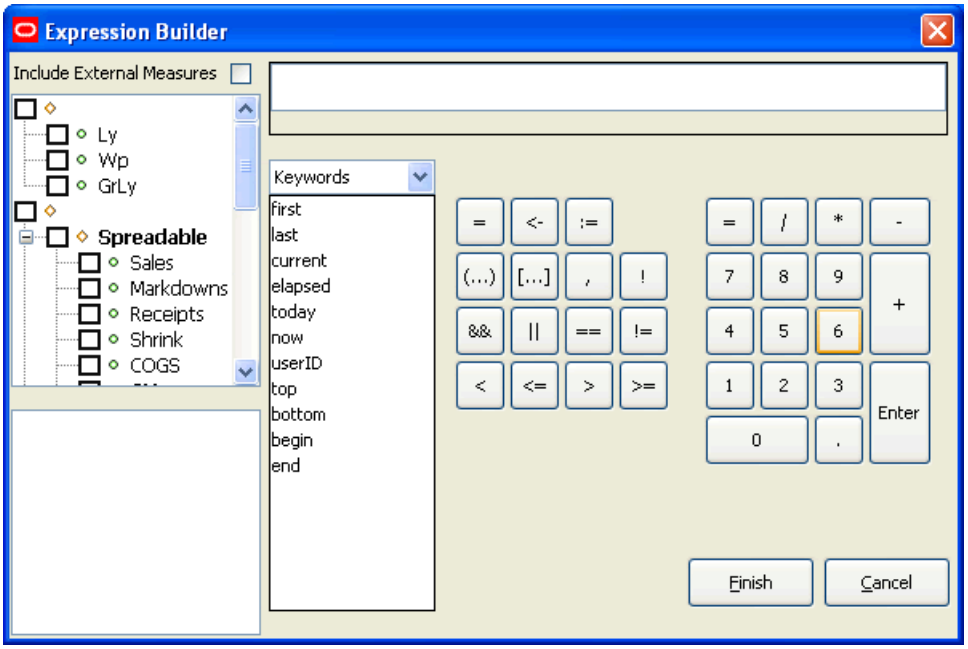
4. In the **Description** field, enter a description of the rule.
5. Click **Next**. The Expression Builder window of the Add Rule window is displayed.



Specify Expression

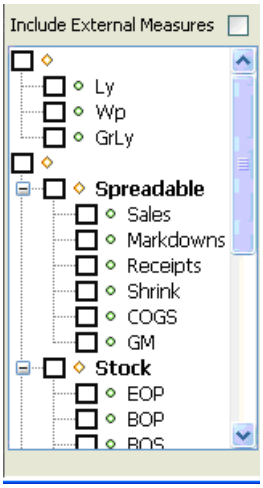
6. Type the expression in the input box or perform the following to use the Expression Builder.

   a. Click the **Expression Builder** button  to the right of the text box. The Expression Builder window opens.

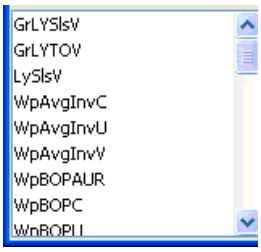


Expression Builder Window

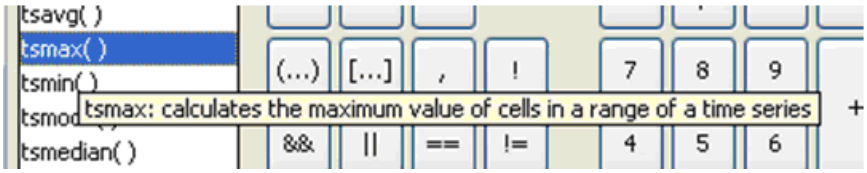
b. In the upper left-hand pane, select the measure components to filter measures to be visible for pasting into the expression. If External Measures are required in the expression, select the **Include External Measures** check box. Realized measures meeting the filtering conditions are displayed in the lower left hand pane.



c. In the lower left hand pane, double-click any measures to be used in the expression to get the measure name pasted at the insertion point in the expression.

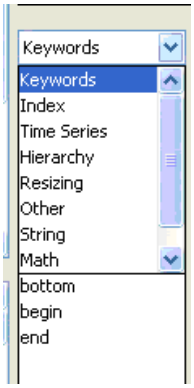


Note: Place the mouse over the name of a function, procedure, keyword, or modifier to see a tooltip that explains its function.



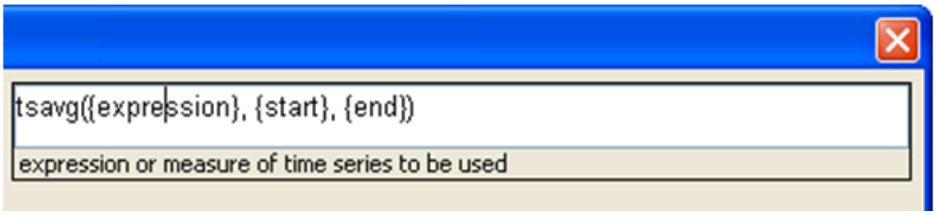
Tooltip Example

d. From the drop-down list, select a category of functions, procedures, keywords, or modifiers. Double-click on a specific function, procedure, keyword, or modifier to be used in the expression, and (if appropriate) outline syntax pasted at the insertion point in the expression.



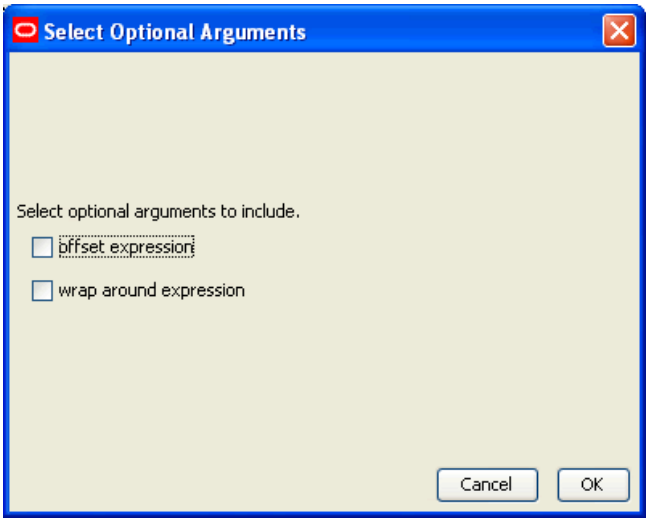
Category Options List

The outline syntax of a function, procedure, keyword, or modifier is pasted with components of the syntax separated with braces ("{}"). When the insertion point is in a component of the outline syntax in the expression, you will see a description of the component at the bottom of the expression window. When the insertion point is in a component of the outline syntax, anything that is entered or pasted replaces the whole component.



Example Expression

If the function, procedure, keyword, or modifier that is pasted has optional arguments (for example, the cover function has optional arguments for an offset expression and a wrap-around expression), you will be presented with the following dialog box to select which of the optional arguments to use in the expression. Note that all arguments are positional, so if a later argument is selected, all earlier arguments will be automatically selected. If an earlier argument is deselected, all later arguments will be automatically deselected.



Select Optional Arguments Dialog Box

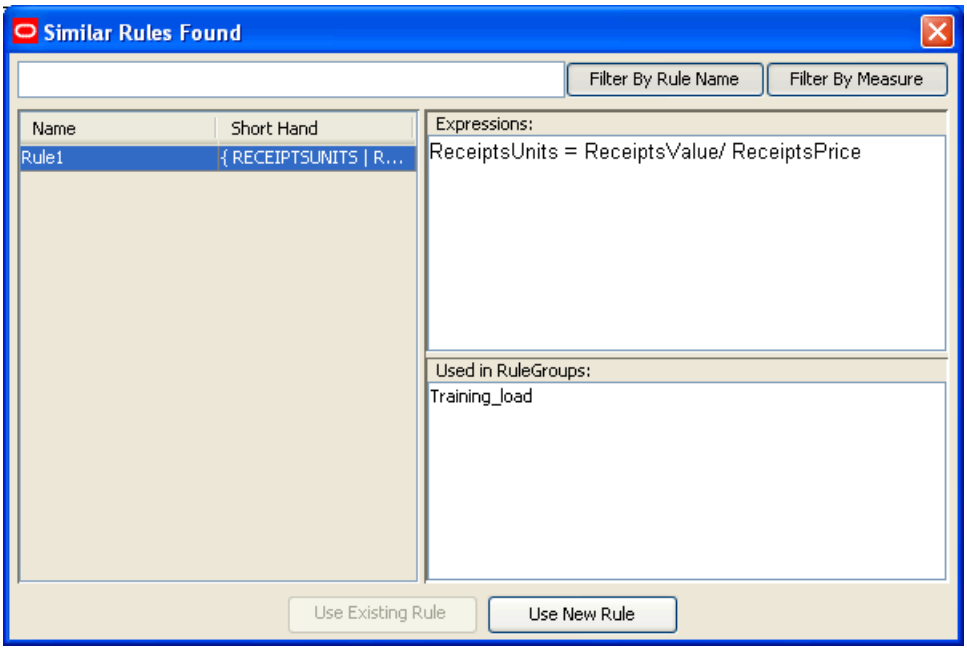
If the function, procedure, keyword, or modifier that is pasted has repeating arguments (for example the min function finds the minimum of a variable number of expressions), a dialog box appears to select how many of the repeating arguments to use in the expression.

e. Use the keyboard or dialog buttons to add the appropriate mathematical operators and constants to construct the expression.

f. When you have defined the expression as needed, click **Finish** and close the window.

> **Note:** If an invalid expression is created, a warning message is displayed.

7. To add further expressions to the rule, click **Add**, and repeat the process of entering an expression.
8. Click **OK** to save any changes and close the window.
9. If the newly defined rule's expressions use exactly the same measures as another rule that already exists in the Rule Pool, the Similar Rules Found window will be displayed. The window shows all rules that use exactly the same measures as the newly defined rule. This provides you with an opportunity to use an existing rule from the Rule Pool or to continue with the new rule. The Similar Rules Found window allows you to view rules, associated expressions, and rule groups that contain the rules. The rule table may be filtered based on the rule name or by measure. Click **Use Existing Rule** or **Use New Rule** to save changes and close the window.



Similar Rules Found Window

The new rule is placed above the rule that was selected at the start of the process in the sequence of rules in the rule group or at the end of the rule group if no rule was selected.

> **Note:** If **Use Existing Rule** or **Use New Rule** is not selected and the window is closed manually, a new rule is created.

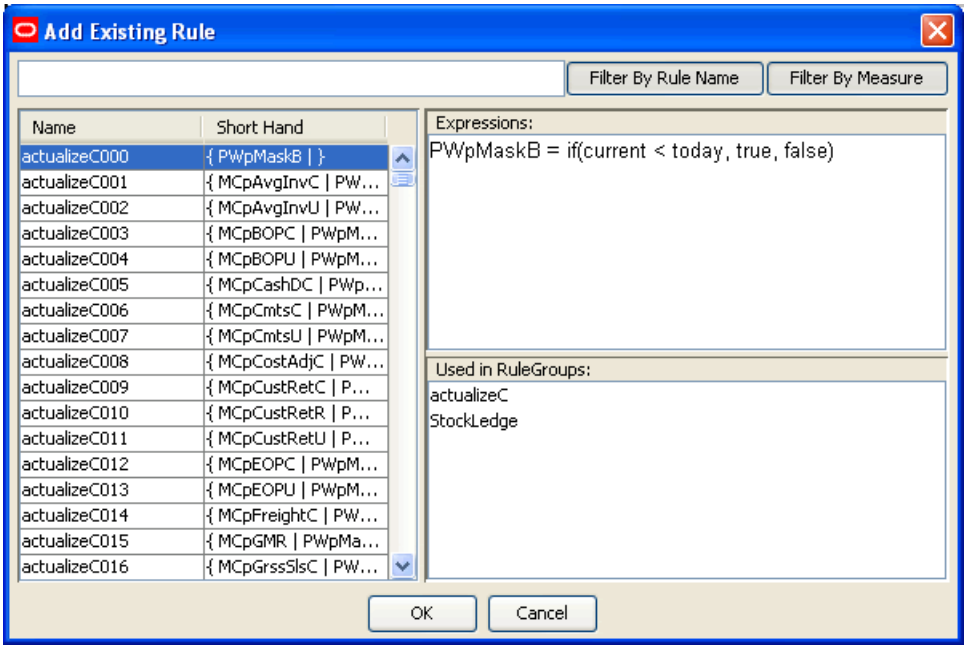
Add an Existing Rule to a Rule Group

Using the Add Existing Rules dialog, you may select multiple rules to add to a rule group. If at least one of the selected rules is already in the rule group, the **OK** button will gray out disallowing the operation until that rule is deselected. When multiple rules are selected, the expression and rule group displays will go blank. However, if there is only one selected rule, the rule's expressions and the list of rule groups that use the rule will be displayed.

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

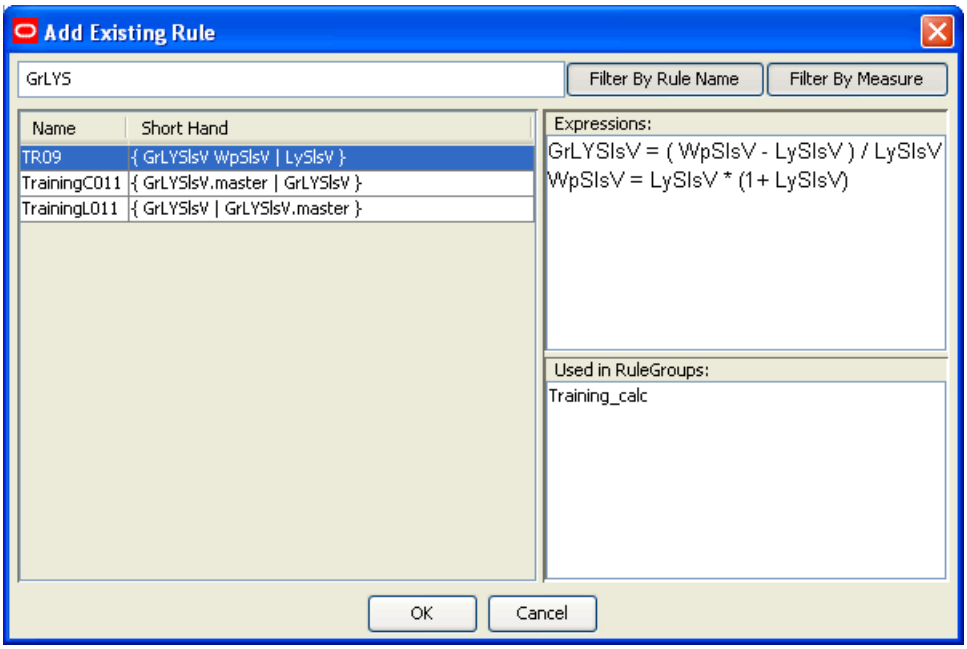
1. In the Rule Definition window, select the rule group to be used to add an existing rule. If the rule is to be placed in a particular position in the sequence of rules in the rule group, select the rule in which the new rule is to precede.
2. Choose one of the following methods:
   - From the toolbar, click the **New** button and select **Using Existing Rule**.
   - Select **Create – Using Existing Rule** from the right-click menu.
   - Press Ctrl+P.

   The Add Existing Rule dialog appears.



Add Existing Rule Dialog Box

3. Filter by Rule Name or by Measure and view the associated expressions to find the correct rule. Filtering means that all data are compared, but only matching data are allowed to "pass through." In order to filter by Rule Name or by Measure, type a filter string (for instance, "GrLYS" in the input box directly under the Title Bar. Click **Filter by Measure**, and only those measures with "GrLYS" will be displayed.



Example of Filter on GrLYS

4. Click on the rule in the table to select it.
5. Click **OK** to save changes and close the window.

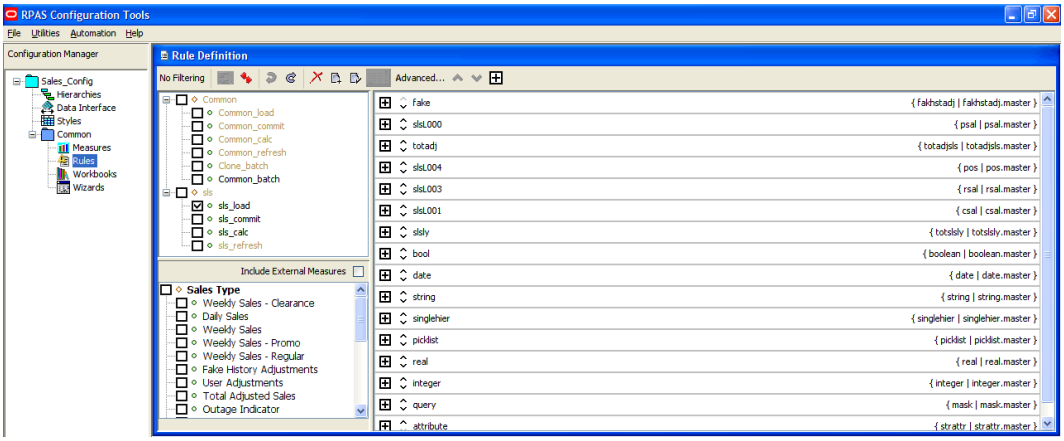
   The rule is placed above the rule that was selected at the start of the process in the sequence of rules in the rule group or at the end of the rule group if no rule was selected.

Apply a Rule Pattern to Create New Rules or to Update Existing Rules

The Apply Rule Pattern functionality allows you to create new rules or update existing rules according to a pattern established by a selected "base" or "template" rule. The rule tool recognizes inherent similarities or patterns in measure components used in some rules when compared to the base or template rule. Based on these similarities, the rule tool allows for the creation of new rules or update of exiting rules to fit the pattern set by the base or template rule.

When the Apply Pattern capability is enabled, there is a possibility that some of the "New" or "Updated" rules will have the same expressions as a rule that already exists in the rule pool. If this happens, the Similar Rules Found dialog appears and provides the option of using the existing rule or actually creating a new one.

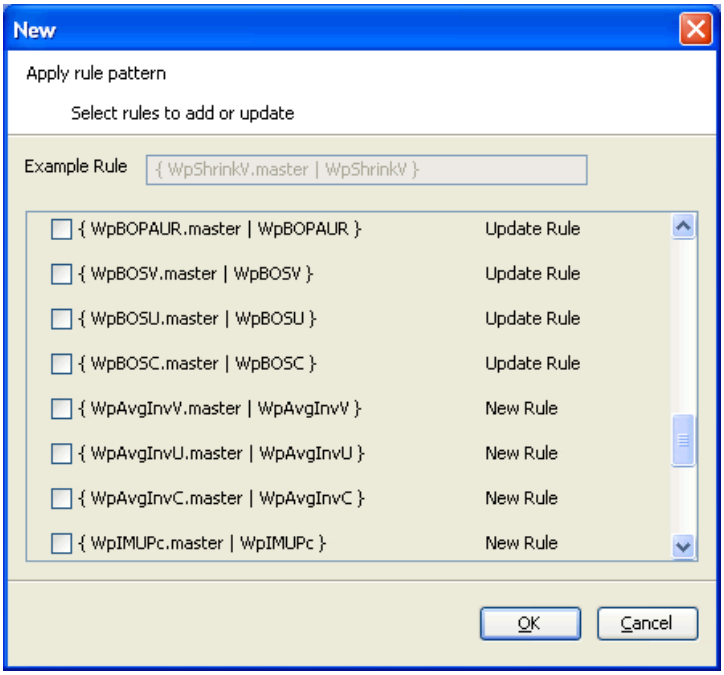
Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.



Example of Rule Definition Window

1. In the Rule Definition window, select any rule group that contains the rule to use as the pattern basis.
2. Select the rule whose pattern is to be used as a basis for creating or updating rules.
3. From the toolbar, click **Advanced** and select **Apply Pattern,** or right-click and select **Advanced - Apply Pattern**.

   A New dialog box containing a set of rules will be presented for selection. This set is composed of rules whose measures follow the selected rule's pattern in terms of the individual measure components used. The set of rules will be composed of potential new rules or potential updated rules.



New – Apply New Pattern Dialog Box

Example:

Consider a configuration with three components in the measure naming scheme:

- a “version” (such as ‘Wp’)
- a metric (such as ‘Shrink’)
- a unit of measure (such as ‘V’).

If the selected base rule is:

{ WpShrinkU WpShrinkAUR | WpShrinkV }

...then the rules:

Rule1: { WpSlsU WpSlsV WpSlsAUR | }

...and

Rule2: { WpRecU WpRecV WpRecC | }

...would fit the pattern and be included in the list.

Rule1 fits the pattern because its measures use the same measure components with the exception of the metric component. For the Metric component, the base rule uses Shrink, and Rule1 uses Sls consistently. In this case, the tool will present the rule:

{ WpSlsU WpSlsAUR | WpSlsV }

...as a possible update for Rule1.

The update results in the conversion of Rule1 to a rule that uses the same measures as the original Rule1, but it has the expression pattern of the base rule.

Rule2 fits the pattern because it uses the same Version as the base rule. For the Metric component, the base rule uses Shrink, and Rule2 uses Rec consistently. Unlike Rule1, Rule2 uses C as the Unit of Measure in one of its measures. This is not an “exact” fit like Rule1. In this case, the tool will present the rule { WpRecU WpRecAUR | WpRecV } as a possible new rule. Notice that this rule is “forced” to be an “exact” fit as Rule1 was.

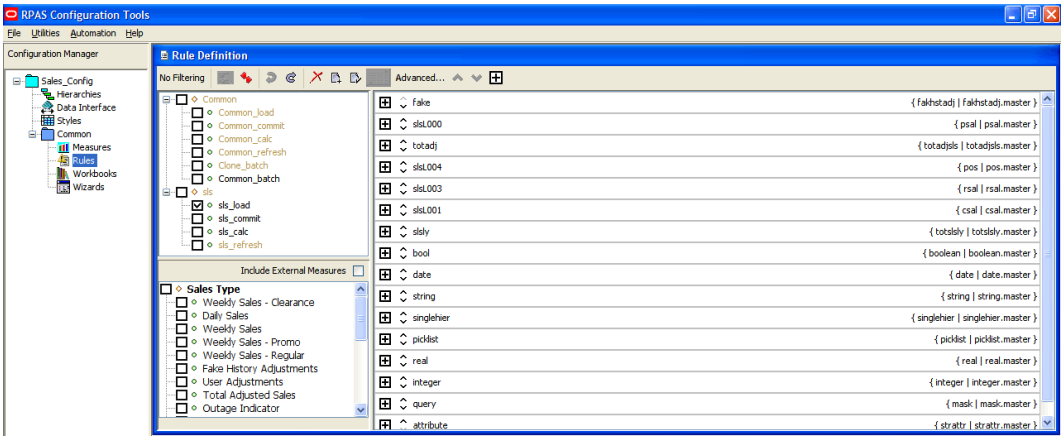
4. From the list of possible new and updated rules, select those to be updated or added to the rule group.
5. Click **OK**.

   A selected rule that is labeled “New Rule” will be added to the end of the rule group. The new rule’s name will default to the RuleSet’s name suffixed with a number to keep the name unique. A selected rule that is labeled “Update Rule” is already in the rule group and will be updated. This means that the rule’s measures will be retained, but its expression pattern will be changed to follow the base rule’s expression pattern. In both cases, the rule will follow the pattern of the base rule’s expressions.

Delete a Rule from All Rule Groups

> **Note:** This procedure will delete the rule from all rule groups that contain this rule as well as from the Rule Pool. If the desired action is to remove the rule from a rule group, but retain it in other rule groups, follow the "Remove a Rule from a Rule Group" procedure.

Navigate: In the Configuration Manager, select **Project – Solution – Rules**. The Rule Definition window opens in the workspace.

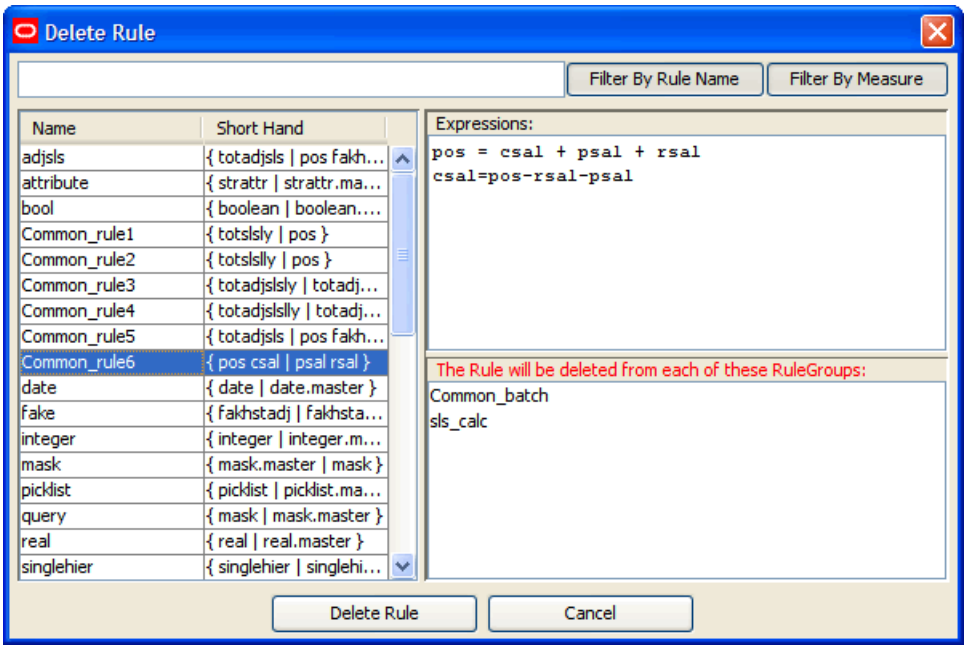


Example of Rule Definition Window

1. In the Rule Definition window, select any rule group that contains the rule to be deleted.
2. Select the rule to be deleted.

> **Note:** If multiple rules are selected, only the last selected rule will be deleted.

3. From the toolbar, click the **Delete** button and select **Delete Rule**, or select **Delete – Remove – Delete Rule** from the right-click menu. The Delete Rule Group window appears.
4. Verify that the rule selected in the table is the rule to be deleted, or select a different rule to delete by clicking on the rule in the table.



Example of Delete Rule Window

5. Click **Delete Rule** to delete the rule and close the window.

Remove a Rule from a Rule Group

> **Note:** This procedure will remove the rule(s) only from the currently selected rule group. If the desired action is to delete the rule(s) from all rule groups and the rule pool, see "Delete a Rule from All Rule Groups" in this document.

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

1. In the Rule Definition window, select the rule group that contains the rule(s) to be removed.
2. Select the rule(s) to remove.

> **Note:** Multiple rules can be selected by holding the Control (Ctrl) key as the individual rules are selected, or by clicking one rule and holding Shift key as another rule is selected, which selects all rules between the two that were clicked. A selected rule is indicated by a bold rule name.

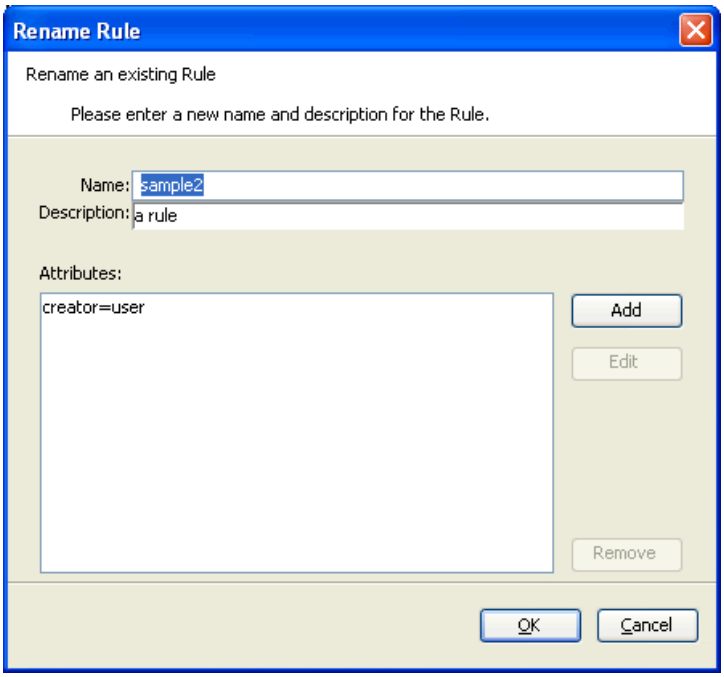
3. From the toolbar, click the **Delete** button and select **Remove Rule(s)**, or select **Delete – Remove – Remove Rule(s)** from the right-click menu.

   The rule(s) are removed from the rule group, but are still in the rule pool. The rules will be permanently lost when the project is closed, unless they are used in another rule group.

Edit Properties of a Rule

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

1. In the Rule Definition window, select any rule group that contains the rule to edit.
2. From the rule group, select the rule to edit.
3. From the toolbar, click the **Edit** button and **Select Rule**, or select **Rename – Rule** from the right-click menu. The Rename Rule dialog box opens.

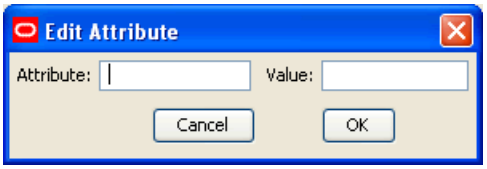


Rename Rule Dialog Box

4. To edit the name of the rule, enter a new name in the Name field.

> **Note:** A rule name can be a maximum of 24 alphanumeric or underscore characters. It must not have a name that is the same as any other rule that exists in the project. Rule names may start with a letter or an underscore, but may not start with the letter "r" or "R" followed by a number.

5. To edit the description of the rule, enter a new description in the Description field.
6. To edit attributes for a rule:
   a. Select the attribute to edit.
   b. Click **Edit**. The Edit Attribute dialog box opens.



Edit Attribute Dialog Box

   c. Update the information as necessary.

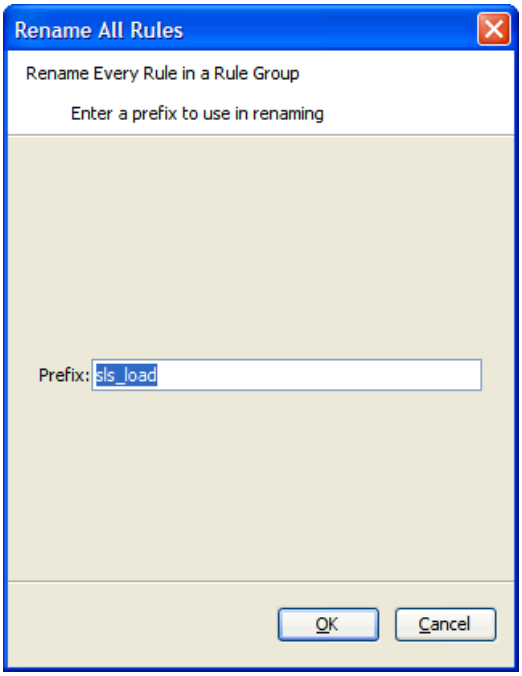
d. Click **OK** to save any changes and close the window.

7. To remove attributes from a rule:
   a. Select the attribute to delete.
   b. Click **Remove**. The attribute is removed from the display box.
8. Click **OK** to save any changes and close the window.

Rename All Rules in a Rule Group

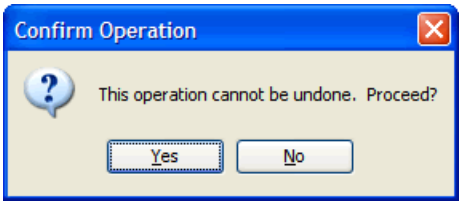
Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definitions window opens in the workspace.

1. In the Rule Definition window, select the rule group that contains the rules to rename.
2. From the toolbar, click **Advanced** and select **Rename All Rules**, or select **Advanced – Rename All Rules** from the right-click menu. The Rename All Rules dialog box appears.



Example of Rename All Rules Dialog Box

3. In the **Prefix** field, enter a prefix up to ten characters in length, which will be the start of all rule names.
4. Click **OK**. The Confirm Operation dialog box appears.



5. Click **Yes**.

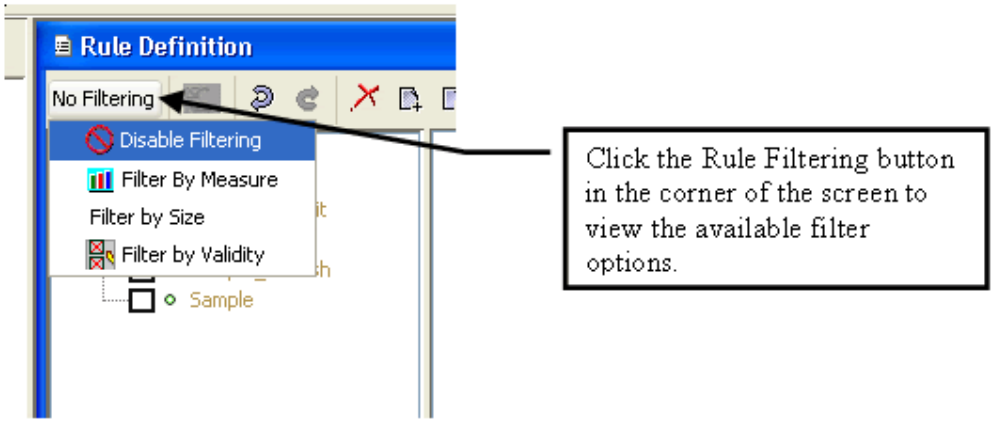
Note: All of the rules in the rule group are renamed with the prefix followed by a 4-digit numeric identifier generated by the rule tool. The rule tool will maintain the order that the rules were in before they were renamed, and it uses that order in generating the numeric identifier.

Note: Since rules may appear in more than one rule group, use of this feature may generate rule names that look out of place in other rule groups, especially if the prefix implies the rule group.

Filter Rules in a Rule Group

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definitions window opens in the workspace.

1. In the Rule Definition window, select a rule group.
2. In the Rule Definition window, click **Rule Filtering**.



Rule Filtering Button in Rule Definition Window

Note: This is a dynamic button, and the text will change depending on the current filter mode.

3. Select one of the following options:
   - **Disable Filtering –** All rules are displayed.
   - **Filter by Measure –** Works in conjunction with the measure components box in the bottom left corner of the screen. Rules are filtered to show those whose measures conform to the selected component scheme.
   - **Filter by Size –** Rules are filtered to show those with more than one expression.
   - **Filter by Validity –** Only invalid rules are displayed.

Note: When rule filtering is active, the buttons used to reorder rules in the rule group are disabled.

Reordering Rules in a Rule Group

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

1. In the Rule Definition window, select the rule group that contains the rules to reorder.
2. Select the rule to reorder.
3. Perform the following as needed:
   - Use the Up/Down arrows on the Rule Definition toolbar to move the rule up or down the list.
   - Click the Up/Down arrows to the left of the rule name to move the rule up or down the list.

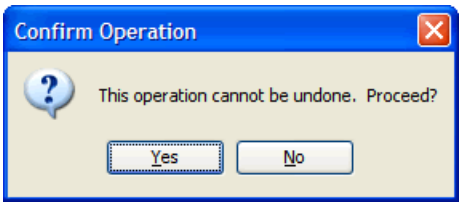
Auto Generate Load and Commit Rules

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

> **Note:** Rules for the load and commit rule groups in a rule set can be auto-generated based on the calc rule group. The measures referenced in the calc rule group are assumed to be all of the measures in a workbook (if there are others, manually add their load and/or commit rules). A load or commit rule is generated for all of those measures that have a database allocated (those that are physically stored).

1. Select the rule set for which load or commit rules are to be auto generated, or select any rule group in that rule set.
2. Perform one of the following methods:
   - From the toolbar, click **Advanced** and select **Generate Load Rules** or **Generate Calc Rules**
   - Select **Advanced – Generate Load Rules** or **Advanced – Generate Calc Rules** from the right-click menu.

   The Confirm Operation dialog box appears to inform you that this process cannot be undone.



3. Click **Yes**.

Rules are automatically generated and named for the load or commit rule group. There is one rule with a single expression that is generated for each measure used in the calc rule group for the rule set that has a database assigned.

In the load rule group, the rules are named <rulesetname>Lnnn where nnn is a 3-digit order number. The rules in a commit rule group are similarly named <rulesetname>Cnnn. The expression in a generated rule in a load rule group is of the form:

<measurename> = <measurename>.master

and in the generated commit rule group are of the form:

<measurename>.master = <measurename>

Copy Selected Rules to Another Rule Group

When copying selected rules of a rule group into another rule group, it is possible to specify whether existing rules will be used or copies of the rules will be created. The **Use Existing Rules** check box defaults to using any existing rules in the rule pool. If this checkbox is selected, the copy selected rules operation will use the same rules that the source rule group has. If this check box is not selected, the copy selected rules operation will create copies of the rules and use those copies for appending to or replacing rules in the destination rule group.

When the user uses the Find/Replace feature, it is possible that a changed rule will have the same expressions as a rule that already exists in the rule pool. If the **Use Existing Rules** check box is selected, the Similar Rules Found dialog appears. you have the option of using the existing rule or actually creating a new one.

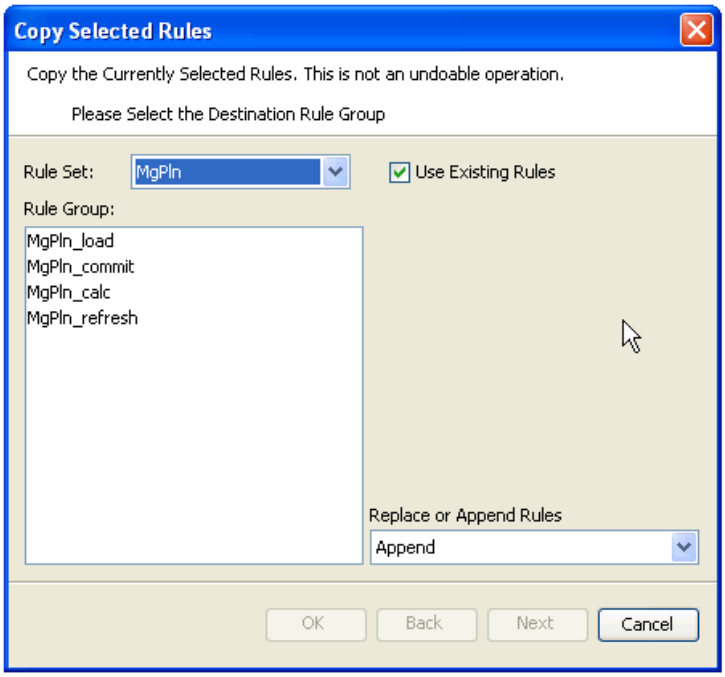
Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definitions window opens in the workspace.

1. Select the Rule Group that contains the rules to copy, and select the individual rules to be copied.

   Note: To select multiple rules, hold down the Ctrl key and click the rules to select, or click one rule and hold Shift key as selecting another rule, which selects all rules between the two that have been selected. A selected rule is indicated by a bold rule name.

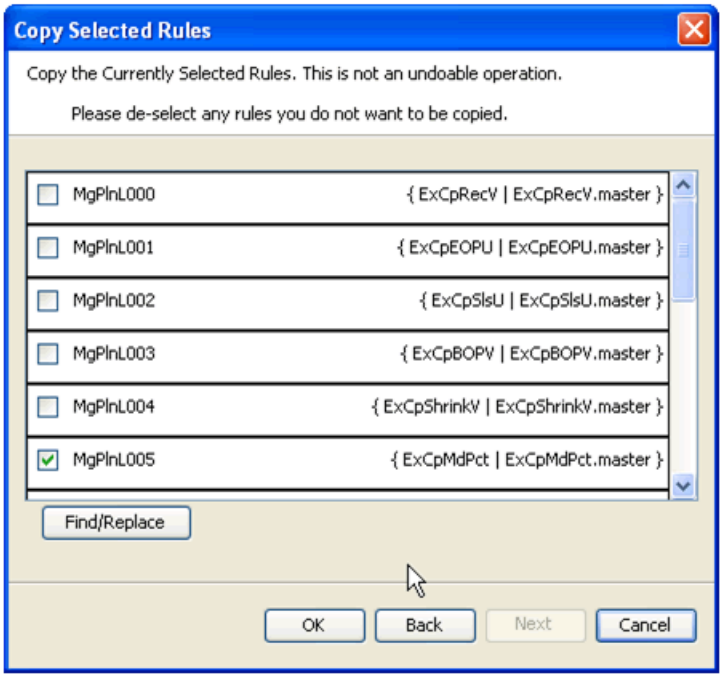
2. Perform one of the following methods:
   - From the toolbar, click **Advanced**, and select **Copy Selected Rules**.
   - Select **Advanced – Copy Selected Rules** from the right-click menu.
   - Press **Ctrl+C.**

The Copy Selected Rules dialog box opens.



Copy Selected Rules Dialog Box

3. In the **Rule Set** field, select the copy's destination rule set.
4. In the **Rule Group** area, select the desired copy's destination Rule Group.
5. In the **Replace or Append Rules** field, select:
   - **Replace –** To remove all rules that already exist in the destination rule group before the copy.
   - **Append –** To add to the rules already in the destination rule group.
6. Click **Next**. The second window of the Copy Selected Rules window opens. This window allows you to select or deselect rules from those originally selected to copy when the check box beside the rule name is selected.

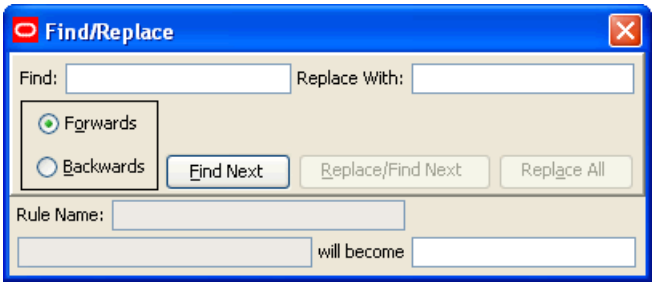


Copy Selected Rules – Rules to be copied appear with check marks

Find and Replace Measures in the Copied Rules

The ability to find/replace in the copy rules is a very powerful and useful feature. This feature can be used to build a collection of rules and "clone" them to a very similar collection of rules. For example, a collection of rules that calculate a series of variances with one version can be cloned to produce rules that calculate a series of variances with another version.

1. Click the **Find/Replace** button. The Find/Replace dialog box appears.



Find/Replace Dialog Box

2. In the **Find** field, enter the portion of the measure to replace.

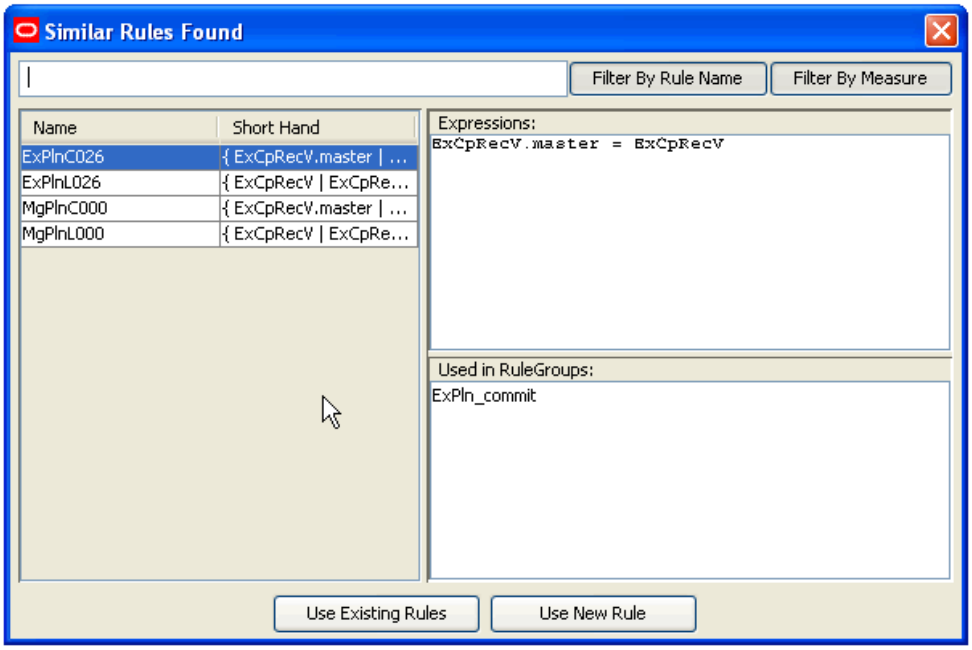
> **Note:** The Find function is case-sensitive.

3. In the **Replace With** field, enter the string to replace the portion of the measure name.
4. Perform one of the following:
   - Select **Forwards** to search the rules in order
   - Select **Backwards** to search the rules in reverse order.

Note: Searching Forwards will proceed from left to right starting with the first measure of the first expression of the first selected Rule and will go through all expressions in all selected Rules. Similarly, searching Backwards will flow in the reverse direction starting with the rightmost measure of the last expression in the last Rule selected.

5. Click **Find Next**. The first candidate measure to be replaced will be displayed in the bottom left field.
6. Perform the following as needed:
   - Click **Replace/Find Next** to replace the current candidate measure and display the next candidate measure.
   - Click **Replace All** to replace all instances in all the selected Rules of the current candidate measure. For example, if a search for Wp finds WpRecV, clicking on **Replace All** will perform a replace on all instances of WpRecV in all the selected Rules.
   - Click **Find Next** to skip over that occurrence of the portion of the measure name, and go onto the next one.

   The Similar Rules Found dialog box appears.



Similar Rules Found Dialog Box

Using this dialog box, you can replace a portion of the rules (for instance a prefix) either for all instances of the rules or only for the new instances (where the old instances are not affected).

Example:

Suppose you create a series of rules for the Executive (Ex) Calc Rule Group, and wants to use these as a model for the Manager (Mg) Calc Rule Group. Each of these original rules contains expressions with the "Ex" prefix. Each such instance needs to be replaced with "Mg."

- Click **Use Existing Rules** to replace every instance of "Ex."
- Click **Use New Rule** to replace the new instances of "Ex" without affecting the previous rules that contain "Ex."

7. Click the **Close** button to close the Find/Replace dialog box.
8. Click **OK**.
9. Click **Yes** to confirm.

   The copies of the rules will be placed in the target rule group. These copies will have names that start with as many characters as possible from the name of the original rule and end with an underscore and number.

Expressions and Rules

Overview

An expression describes and solves the relationship between measures in a way that causes a measure to be calculated through the expression. They form the basis for all calculations of the relationships between measures, and they are evaluated by the calculation engine during a calculation. In some cases, there may be business reasons for wanting more than one of the measures in a relationship to be calculable or solvable through that relationship. Expressions are written in a syntax that allows for the calculation of a single measure from other measures, constants, and parameters by using standard arithmetical functions and a rich set of mathematical, technical, and business functions. Expressions have multiple results.

Example:

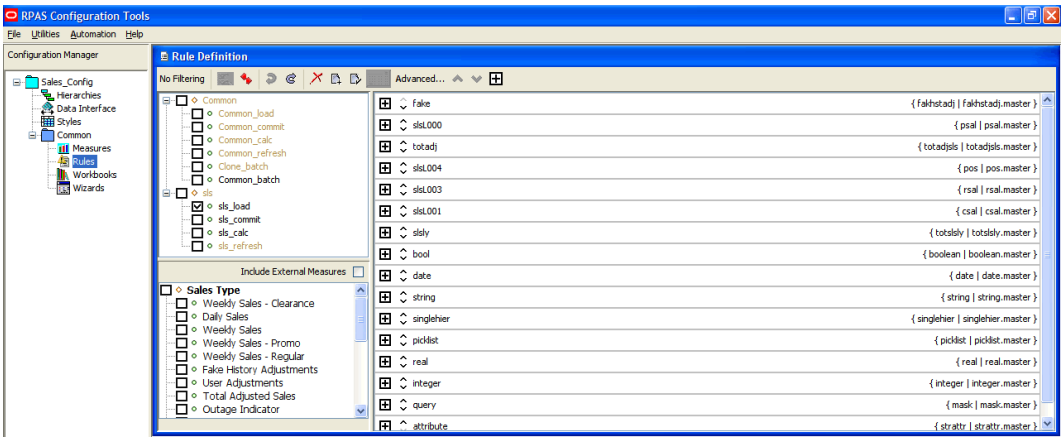
Expression 1: ReceiptUnits = ReceiptsValue / ReceiptsPrice

This expression specifies the way ReceiptUnits are calculated. ReceiptUnits are calculated by dividing ReceiptsValue by ReceiptsPrice.

> **Note:** Measures are not only calculated based on expressions. They are also calculated based on spreading and aggregating.

Reorder an Expression in a Rule

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.



Example of Rule Definition Window

1. In the Rule Definition window, select any rule group that contains the rule whose expression is to be reordered.
2. Choose one of the following methods:
   - Expand the rule to view the expressions associated with the rule. Click the **Toggle** button on the Rules toolbar and select **Expand All Expressions**.

Toggle Button

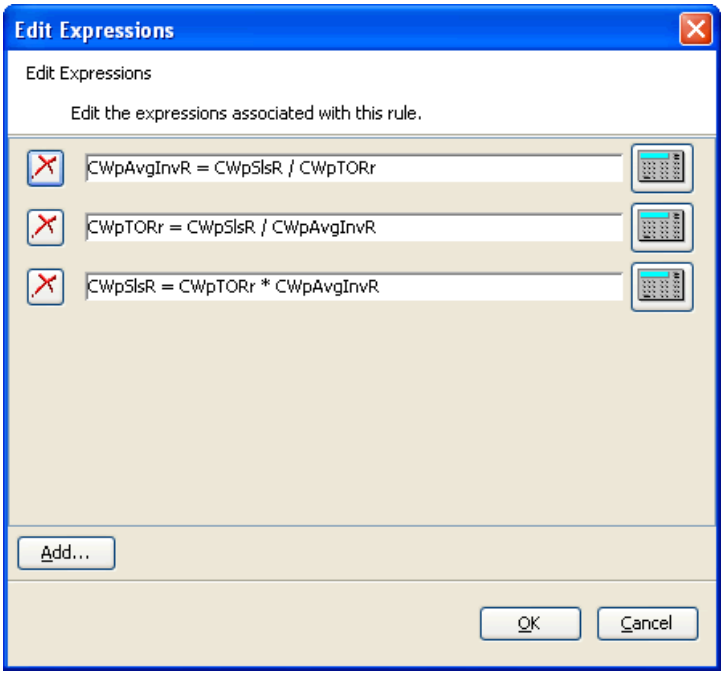
   - Click the **Toggle** button for the rule.
3. Use the up and down arrows to move the expression up or down the list.

Edit an Expression in a Rule

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

1. In the Rule Definition window, select any rule group that contains the rule whose expression is to be edited.
2. In the Rule Definition window, select the rule whose expression is to be edited.
3. Choose one of the following methods:
   - From the toolbar, click the **Expression Builder** button
   - Select **Edit Expressions** from the right-click menu.
   - Press **Ctrl+E**.

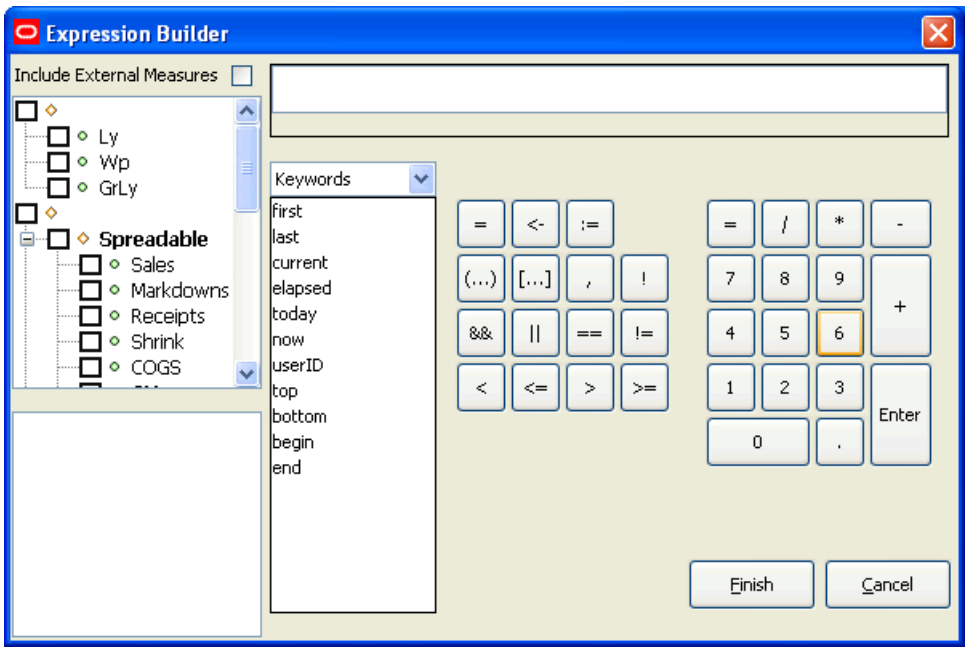
The Edit Expressions window appears.



Edit Expressions Window

To Edit an Expression

1. Choose one of the following methods:
   - Edit the expression in its text box.
   - Click the **Expression Builder**  button for the expression to edit. The Edit Expressions window appears. Use the Expression Builder to make necessary changes and click **Finish** when complete.



Expression Builder Window

2. Click **OK** to save and changes and close the window.

Delete an Expression from a Rule

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

1. In the Rule Definition window, select any rule group that contains the rule whose expression is to be deleted.
2. In the Rule Definition window, select the rule whose expression is to be deleted.
3. Choose one of the following methods:

   - From the toolbar, click the **Expression Builder** button
   - Select **Edit Expressions** from the right-click menu.
   - Press **Ctrl+E**.

   The Edit Expressions window appears.
4. Click the **Delete** button to the left of the expression in the Edit Expression box.
5. Click **OK** to delete the expression. Once **OK** is clicked, the expression will be permanently deleted from the rule.

> **Note:** If the only expression in the rule is deleted, the rule will be flagged as being invalid, because it has no expressions.

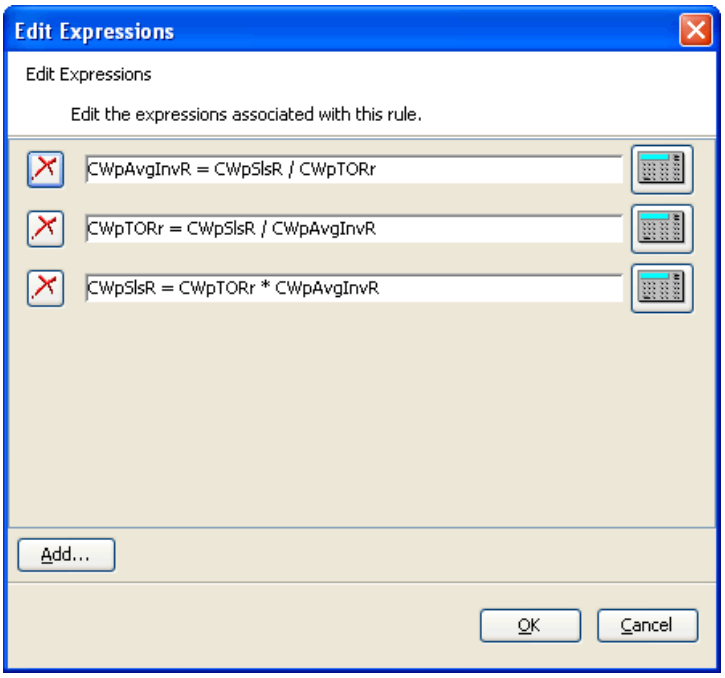
Add an Expression to a Rule

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Rules**. The Rule Definition window opens in the workspace.

1. In the Rule Definition window, select the rule group that contains the rule that will have an expression added.

2. In the Rule Definition window, select the rule that will have an expression added.
3. Choose one of the following methods:
   - From the toolbar, click the **Expression Builder**  button
   - Select **Edit Expressions** from the right-click menu.
   - Press **CTRL+E**.

   The Edit Expressions window appears.



Edit Expressions Window

4. Click **Add** to add a new expression in the Edit Expression box.
5. Choose one of the following methods:
   - Enter the expression in its text box
   - Click the **Expression Builder**  button for the expression to edit. The Edit Expressions window appears. Use the Expression Builder to define the rule and click **Finish** when complete.
6. Click **OK** to add the expression.

RPAS Functions, Procedures, Keywords, and Modifiers

Overview

RPAS functions, procedures, keywords, and modifiers are mechanisms for performing operations within an expression that are controlled and executed by the calculation engine. There is a rich collection of available functions, procedures, keywords, and modifiers that can be further extended for an implementation if required.

See Appendix C, "RPAS Rules Function Reference Guide" for details about RPAS functions, procedures, keywords, and modifiers.

Workbooks

Overview

A workbook is an easily viewed, easily manipulated multidimensional framework that is used to perform interactive business functions in the configured solution. To present data, a workbook can contain any number of multidimensional spreadsheets, called worksheets, as well as graphical charts and related reports. All of these components work together to allow you to view and analyze business functions.

The Workbook Designer allows for the creation selection, and integration of the various components of a workbook template, which is a pre-designed workbook that is formatted for RPAS users to view and manipulate data. It contains workbook tabs, worksheets, rule groups, wizards, and workflow processes.

Take the time to design a well-planned workbook. Workbooks should be laid out in a logical format and should be easy to navigate. When configuring a workbook, think about how the workbook will be used by the users in the RPAS Client. Understand the business process flow and what end users will need to access most. Most likely, this information should be contained in the first workbook tab and worksheet.

The names of all of the workbook components should be intuitive to an end user.

> **Note:** The internal RPAS names need to be unique across all workbook components in a project. This includes workbook, tab, worksheet, wizard, and custom menu names.

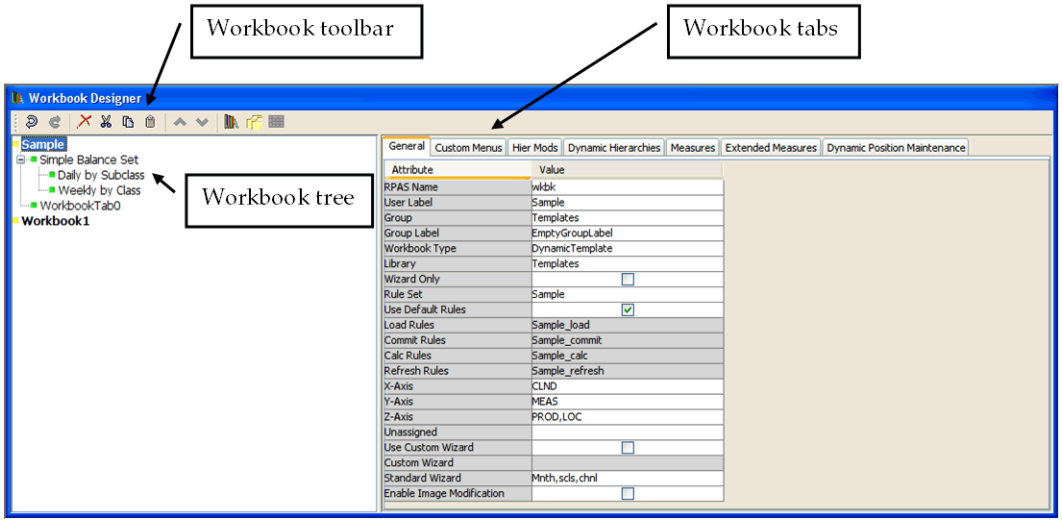
Workbook Tabs

A workbook tab is a major subdivision of a workbook. Each workbook contains at least one workbook tab by default, but additional tabs can be added for organizing workbooks to support business needs. The workbook designer allows you to define and name tabs and to specify their order in the workbook.

Worksheets

Worksheets are multidimensional spreadsheets that are used to display workbook-specific information. Workbooks can include one or many worksheets. Worksheets can present data in the form of numbers in a grid, or the numeric data values can be converted to a graphical chart.

The Workbook Designer provides a visual represent of your workbooks, workbook tabs, and worksheets.



Example of Workbook Designer Window

The Workbook Designer contains the following areas:

The Workbook tree - The Workbook tab provides a visual representation of the workbooks, workbook tabs, and worksheets. In the example provided, Sample and Workbook1 are workbooks. Simple Balance Set and WorkbookTab0 are workbook tabs. Daily by Subclass and Weekly by Class are worksheets, which are contained in the Simple Balance Set workbook tab.

The Workbook toolbar - This toolbar is used to perform common tasks. The buttons available depend on the item selected in the Workbook Designer window.

The Workbook tabs - The workbook tabs are used to define property at the workbook level. The tabs displayed depend on whether a workbook, workbook tab, or worksheet is selected from the Workbook tree. In the example above, Sample (a workbook) is selected. The 7 workbook tabs displayed are available to define specific properties for your workbook. For information on these tabs, refer to the "Workbook Tab" section.

Wizards

RPAS uses a series of wizards to obtain information in order to build a workbook. The workbook contains a subset of the entire data available in the system; so think about the most logical flow for the wizards. The main purpose of a wizard is to allow the end user to make choices regarding the scope of the workbook. The workbook designer allows you to specify which wizards will be used to build the workbooks.

Overview of Participation Measures

A "percent-to-parent measure" or "participation measure" is a measure that contains the value of the current positions as a proportion of the value at a Parent level (for example, sales as a percent of the class sales). These measures can be viewed and edited, and they may be preconfigured through the RPAS Configuration Tools or dynamically defined in the RPAS Client in a worksheet.

Typical uses of this functionality are to define measures that are percentage participations of sales measures. Typically, these are either to a fixed level (such as class) so the participation of each item to the class can be viewed and manipulated, or they are to the "next level up" in the product hierarchy.

The following examples will use the sample product hierarchy structure: SKU-style-subclass-class-company-all.

Note the following important points when using this feature:

- Changing the percentage of the percent-to-parent measure will cause the values of the underlying measure to change to reflect the newly set percentage.
- Multiple percent-to-parent measures can be defined for the same underlying measure; however, only one percent to parent measure or the underlying measure can be edited before calculation occurs. All other versions will be protected.
- The value of a percent-to-parent measure is a fraction between zero and one. You must format the measure to be displayed as a percentage if desired.

Create a Workbook

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.

1. Choose one of the following methods:
   - Click the **New Workbook** button from the Workbook Designer toolbar.
   - Right-click in the Workbook tree area, and select **New Workbook**.
   - Select an existing workbook and press **Insert**.

   A new workbook is created.
2. Enter information for the tabs displayed across the top of the Workbook Designer window as necessary. Refer to "Defining Workbook Properties" for more information.

> **Note:** Double-click in the fields in the **Value** column to enter the information.

Configure Extended Measures

To specify an extended measure for a workbook:

1. Click the **Extended Measures** tab.
2. Right-click in the table area, and select **Add**.
   a. Select the newly added row.
   b. Click **Select Measure** to get a list of the measures used in the workbook. Type the first few characters of the measure name in the box at the top of the list to go to the required measure, or scroll to find it.
   c. Double-click to select the required measure.
3. Specify the appropriate property information for the extended measure.

To change properties for an extended measure for a workbook:

1. Click the **Extended Measures** tab.
2. Specify the desired property information for the extended measure.

To remove an extended measure from a workbook:

1. Click the **Extended Measures** tab.
2. Select the row for the extended measure.
3. Right-click the row for the extended measure, and select **Remove**.

The Usage and Arguments Properties

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace. Select a workbook from the Workbook navigation tree and click the **Extended Measures** tab.

The Usage property describes the type of extended measure that is being defined. The choices offered will include all the “Allowed Aggs” for the measure, plus “Relative % To Parent” and “Absolute % to Parent.”

1. To define the extended measure to use an alternative aggregation type from the list of Allowed Aggs, click the **Usage** field and select the aggregation type.
2. To define the extended measure to be a Relative % to Parent, click the **Usage** field and select **Relative % to Parent**. Select the hierarchy that the parent should be in from the Args property. The extended measure will contain the value of the measure as a proportion of the value of the measure at the next higher dimension in the chosen hierarchy that is visible in the window.

   The "relative" percent-to-parent measure type calculates the value for a given level that is the percentage of that level and its immediate parent (meaning one level higher). This type can only be set for a single hierarchy.

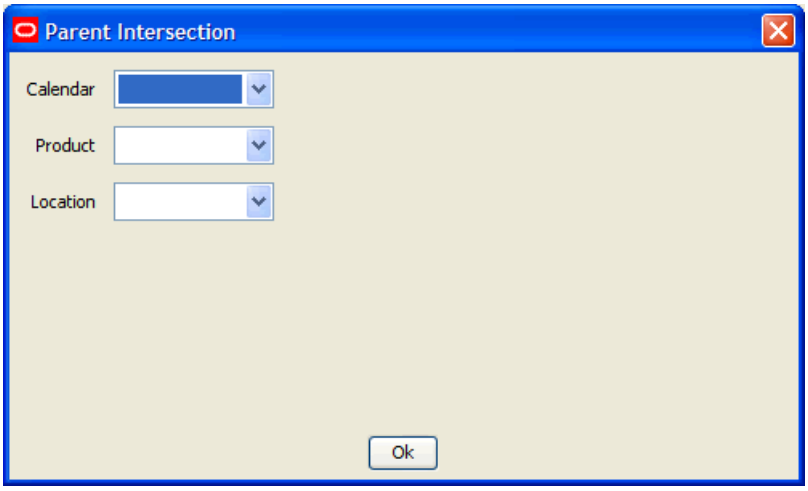
   Using the previously defined sample hierarchy structure, the percentage displayed at the "SKU" level is the "SKU" as a percent of the "style"; at the "style" level, the "style" as a percent of the "subclass"; and at the "subclass" level, the "subclass" as a percent of the "class."

   Note that only a single hierarchy is possible with the “relative” percent to parent measure type.

   In the case of multiple branching hierarchies, where certain dimensions will have multiple parents, for relative percent-to-parent measures, the percentage will always be calculated based on the active roll-up in the current window.

   Note that the calculated value is based on the actual next level up in the hierarchy (based on the hierarchy structure), not necessarily the one that is being displayed. In the previous examples, imagine that SKU-subclass-class is displayed in the client, but the underlying structure is SKU-style-subclass-class. When viewing the value at SKU, the percentage will be based on style (not subclass) even though style is not displayed.

   Cells at the top of the hierarchy will be hashed out because those values cannot be calculated.
3. To define the extended measure to be an Absolute % to Parent, click the **Usage** field and select **Absolute % to Parent**. Click the **Arguments** field. The Parent Intersection dialog box appears, which allows you to specify the intersection to be used in the % participation. A dimension should be selected from each hierarchy list options displayed. If a dimension is not selected along one of the hierarchies, the top of that hierarchy is effectively selected.



Parent Intersection Dialog Box

The “absolute” type of percent-to-parent measures allows you to explicitly define the parent level(s) that are used to calculate the percentage at all child levels.

Using the previously defined sample hierarchy structure, setting the absolute parent level to the "class" dimension in the product hierarchy, the percent-to-parent measure will show the "SKU" as a percent of the "class" at the "SKU" level, the "style" as a percent of the "class" at the "style" level, and the "subclass" as a percent of the "class" at the "subclass" level.

For the "absolute" relationships, cells at or above the explicitly set dimension/level will be hashed out.

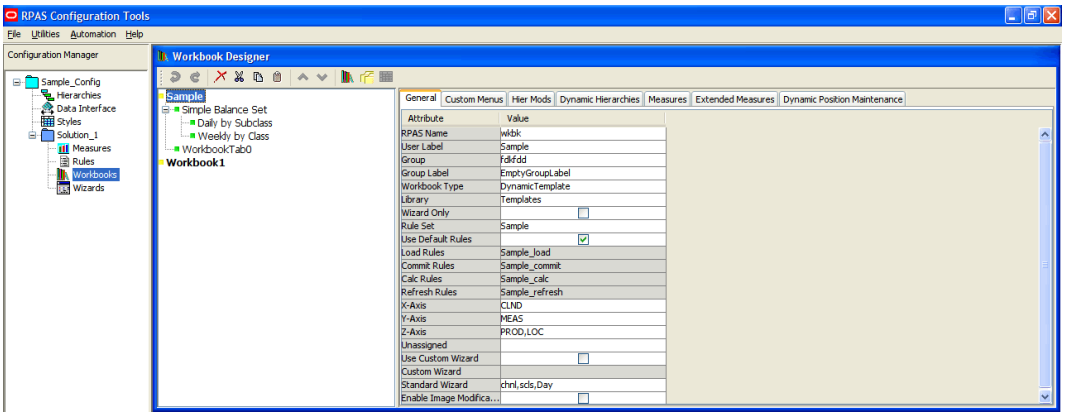
Note: Multiple different extended measures may be defined based on the same measure, but it is an error to define identical extended measures based on the same measure.

Note: The extended measure will have the same label as the base measure. A difference will only be apparent when the % attribute is displayed. Displaying this attribute takes up a lot of screen space, so it should usually be avoided.

Note: Percent-to-parent measures should be defined only on measures that have "total" as their default aggregate methods.

Edit Workbook Properties

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.



Workbook Designer Window

1. Select the workbook, and click on the tab to edit.

   When a workbook is selected from the Workbook Designer window, the following tabs appear in the workspace:

   - General
   - Custom Menus
   - Hier Mods
   - Dynamic Hierarchies
   - Measures
   - Extended Measures
   - Dynamic Position Maintenance

   For information on these tabs, refer to "Defining Workbook Properties."
2. Update the information as appropriate.
3. To remove information from any of the tables:
   a. Select the row.
   b. Right-click and select **Remove**.

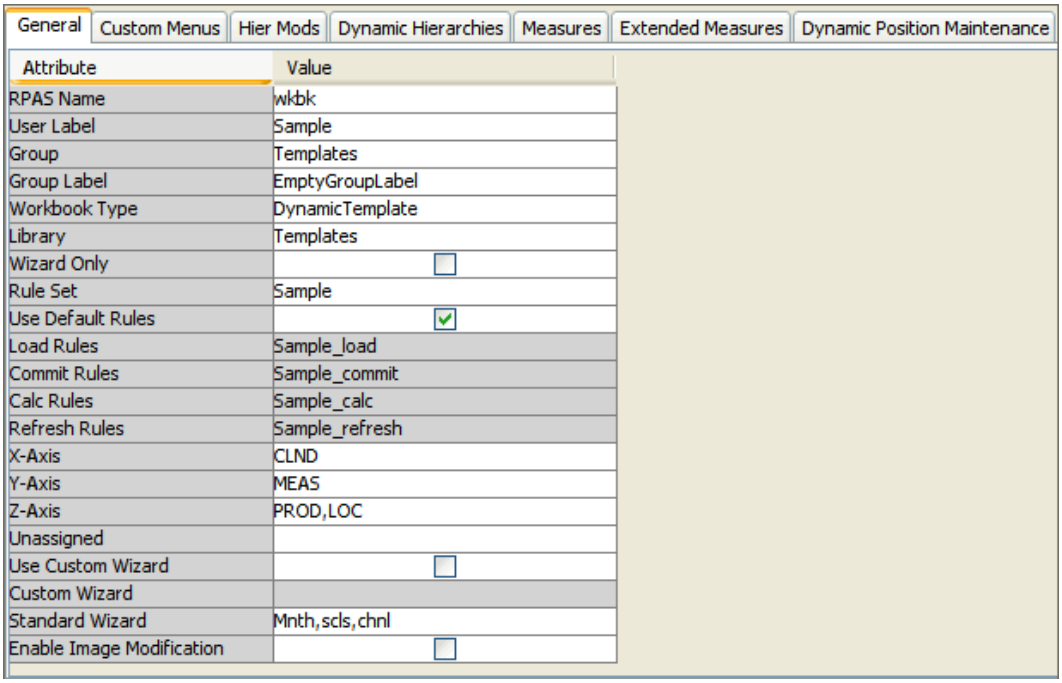
Defining Workbook Properties

When a workbook is selected from the Workbook Designer window, the following tabs appear in the workspace:

- General
- Custom Menus
- Hier Mods
- Dynamic Hierarchies
- Measures
- Extended Measures
- Dynamic Position Maintenance

Refer to the topics below of information on using these tabs to define the workbook properties.

General Tab



Example of General Tab

The following sections describe the default fields appearing on the General tab.

General Tab Default Fields

RPAS Name

The RPAS internal name of the workbook.

User Label

The label that the end user will see when selecting which workbook to build.

Group

In the RPAS Client, workbooks are grouped together under tabs (workbook template groups) to make it easier for the end user to find and select the needed workbook when solutions have multiple workbooks. This is the internal RPAS name of the group that this workbook will belong.

Group Label

In the RPAS Client, workbooks are grouped together under tabs (workbook template groups) to make it easier for the end user to find and select the needed workbook when solutions have multiple workbooks. This is the label the end user will see of the group to which this workbook will belong. If different labels are entered for the same workbook group against different workbooks, the workbook group label shown to the end user will effectively be arbitrary.

Workbook Type

This property is reserved for use when custom extensions are written. It enables the custom extension to determine the "type" of the template where the template type has a meaning defined by the custom extension writer. When there is no custom extension, this field is set to the value **DynamicTemplate** by default.

Library

When the Workbook Type is not **Dynamic Template**, it needs to be associated with a relevant custom shared library. This field holds the name of that library. When there are no custom extensions, this field is set to **Template** by default. The name entered here needs to be consistent with the custom extension. For example, if a value of ABCTemplate is entered in this field, the custom library needs to be named ABCTemplateLib and the directory where the custom extension looks for configuration files in the domain will be repos/ABCTemplates.

Wizard Only

The Wizard Only option is only used under circumstances when custom code is to be executed in a batch job at the end of the wizard process (which typically uses custom wizards) instead of building and opening a standard workbook. The selections made in the wizards are passed to the custom code. Therefore, a workbook with the Wizard Only option selected is not a workbook. However, the workbook infrastructure is used so that the process can have a name and label, and be assigned to a workbook group. This allows end users to select a Wizard Only template using the same process as workbooks. Workbooks that have the **Wizard Only** option selected do not need tabs or worksheets defined, but they do need a name, label, and workbook group.

Rule Set

Select the rule set to use with the workbook. The list of rule sets to select from includes all the rule sets in the same solution as the workbook template.

Use Default Rules

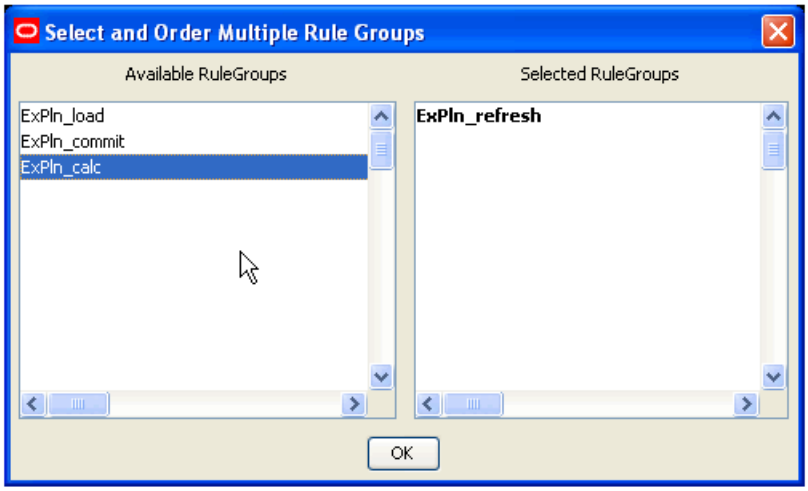
Select this option to use the default rules (Load, Commit, Calc, and Refresh) associated with the rule set. If this option is selected, the Load Rules, Commit Rules, Calc Rules, and Refresh Rules properties are disabled. If the option is not selected, the Load Rules, Commit Rules, Calc Rules, and Refresh Rules properties are enabled.

Load Rules, Commit Rules, and Calc Rules

Select the rule group to apply for each rule group type. Only rule groups from the selected rule set are offered.

Refresh Rules

This is only enabled when the **Use Default Rules** option is not selected. Select the rule group(s) to use as refresh rule groups. When enabled, click in the **Refresh Rules** field. The Select and Order Multiple Rule Groups dialog box opens.



Select and Order Multiple Rule Groups Dialog Box

Within this window, specify which groups will be available to be used to refresh the workbook. Partial data in a workbook can be refreshed by refreshing with a rule group that only updates some of the measures in the workbook. The order that the rule groups appear is the order in which they are displayed to the end user when presented with a choice of refresh rule groups within the workbook.

1. In the Available Rule Groups column, select the rule group to add, and drag it to the **Selected Rule Groups** column.
2. Click **OK** to save any changes and close the window.

X Axis, Y Axis, Z Axis and Unassigned

These properties are used to define the default axis layout of the worksheets in the workbook (that is, which hierarchies will appear in each axis). Before the hierarchies will appear in the Axis dialog, you must make sure that the database and base intersection have been assigned from the Measure Manager. The measures must also be made viewable. To do this, right-click in **Default** and select **Add Matching**,

1. Click in the **X-Axis**, **Y-Axis**, **Z-Axis**, or **Unassigned** field. The Axis dialog box opens.

Axis Dialog Box

2. Drag the hierarchies to the appropriate axis column.
3. Click **OK** to save any changes and close the window.

> **Note:** The hierarchies that appear in this process are the hierarchies used by measures placed on worksheets in the workbook. If no worksheets have yet been built, no hierarchies will appear in this process.

Use Custom Wizard

Determines the type of wizard to use for the workbook template. Select the check box to enable the Custom Wizard property and disable the Standard Wizard Property. Deselect the check box to disable the Custom Wizard property and enable the Standard Wizard Property. See "Wizards" in this document for more information on Custom Wizards.

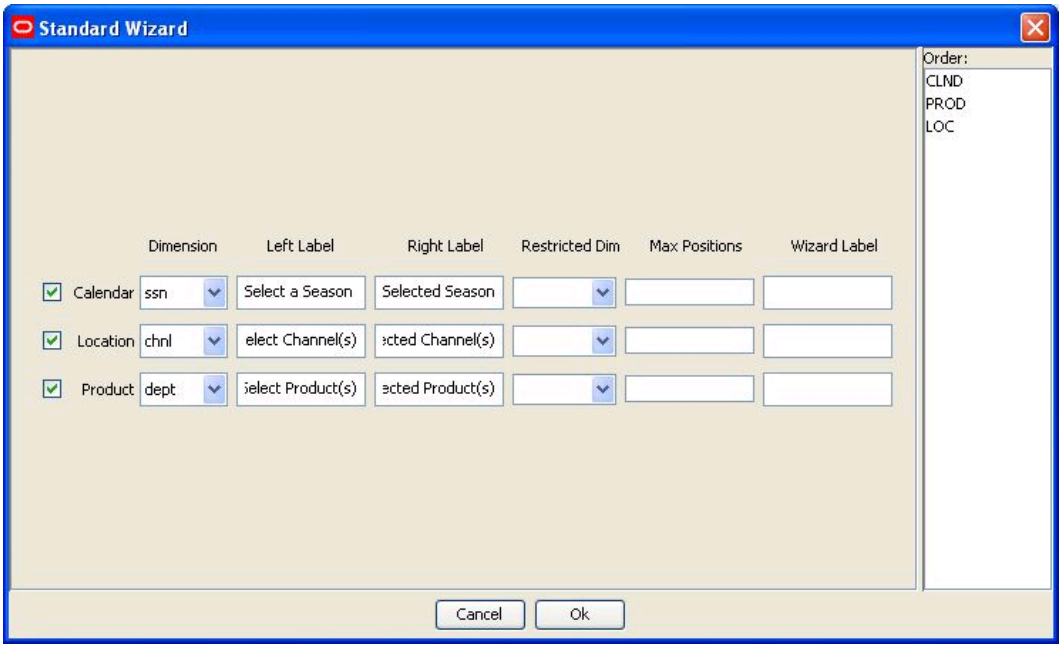
Custom Wizard

Select the custom wizard that to use to build the workbook. This field is only enabled when the **Use Custom Wizard** check box is selected. This field allows you to select a wizard from a list of wizards created in the Wizard Designer.

Standard Wizard

Select the dimensions to be selected by the end-user in the standard wizard, which presents a series of two tree selection panes to select the positions in the scope of the workbook to be built.

1. Click in the **Standard Wizard** field. The Standard Wizard dialog box opens.



Standard Wizard Dialog Box

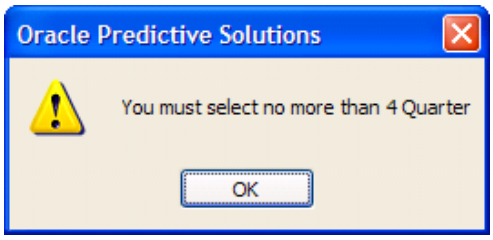
> **Note:** Hierarchies used in the lowest base intersection for the measures used in the rule set assigned to the workbook will be displayed. For each hierarchy, there will be a choice of dimensions. The dimensions offered will be the lowest dimension in that hierarchy that is used in the base intersection of a measure in the rule set assigned to the workbook, plus all higher dimensions.

2. Select the check boxes next to the hierarchy names to enable the hierarchies for which that the end user in the RPAS Client should select positions.
3. **Dimension**: Select the desired dimension from each of the enabled hierarchies.

> **Note:** The dimension selected will be the lowest dimension offered to the end-user in the scope selection wizard during the workbook build process. However, the workbook requires positions at the lowest dimension offered. Therefore, if the selected dimension is higher than the lowest dimension offered, the scope of the workbook will include all of the positions in that lowest dimension that are descended from the positions selected from that higher dimension.

4. **Left Label** and **Right Label**: (Optional) Enter the left and right labels for each hierarchy. These labels will be displayed on the left and right trees of the corresponding 2-tree wizards during the workbook build process. If these fields are left blank, no labels will be displayed over the hierarchy trees.
5. **Restricted Dim** and **Max Positions**: For applications such as pricing, a retailer might want to restrict the selection of SKUs in a planning workbook to only one category. A planner may be allowed to plan several categories within a department, but only one category per plan. Per the retailer's business process, a category would establish a coherent set of SKUs, the cross-item effects of which could be considered meaningful for a price optimization algorithm. Mixing in SKUs from two or more categories could be considered as polluting the cross-item effects, and therefore an undesirable situation. What may also be required for this application is the ability to select SKUs or Classes that comprise a subset of possible SKUs or Classes within the Category, but not the whole category.

   With this latter requirement, a single-select wizard at the category level would not allow the user to filter subsets of SKUs or Classes. What is required is the ability to make multiple selections at the SKU or Class levels in a standard RPAS Two Tree selection wizard, while still ensuring that only one Category is used. Even though this can be achieved through the disciplined selection of SKUs and Classes in a Two Tree Wizard, RPAS allows for setting up a hard constraint so that the wizard itself can keep the user from selecting subsets in more than one Category by displaying an error message and preventing the user from proceeding to the next wizard page until the constraint has been satisfied.



Example Error Message

The constraint can be easily established within the Standard Wizard definition dialog in the Workbook Definition tool of the Configuration Tools. Two new fields are available for every Two Tree selection page in the standard wizard, one where the user selects the level from the hierarchy (**Restricted Dim** field), and another where the user enters the maximum number of selectable positions from that level (**Max Positions** field). These fields are optional, and if left empty, there is no limit on the number of positions that may be selected using the wizard. These fields are also available for Two Tree pages used in custom wizards.

Another possible business application of this feature is to constrain the length of the planning period. A retailer may want the planners to never plan more than 12 weeks at a time, and it may not matter whether these weeks belong to the same quarter or not. In such a case, the retailer will want to establish the constraint of "12" at the week level, the lowest level where the selection is made. The planner may select at the quarter level, thus automatically selecting all the weeks in the Quarter; however, RPAS will ensure that whatever the definition of the Quarter is, it does not contain more than 12 weeks.

Apart from the functional ability to restrict selections to coherent set of positions provided by the Max Positions feature, this feature also allows system designers to constrain the size of workbooks by limiting the maximum number of positions that a user can add to a workbook. In the past, users have been known to add all positions

to a workbook because such a selection is easy to make. They may only require 5-10% of those positions, but they still add them all because they can easily work with the desired subset in the workbook. System designers would like to prevent such abuse of the flexibility that workbooks provide, primarily because such abuse leads to wastage of disk space and because it slows down online performance due to the extra work that RPAS has to do with unnecessary positions. System designers may therefore constrain the workbook to, for example, not include more than 500 SKUs at a time. The number 500 may not have any functional meaning, but may be chosen because it does not constrain functionality in any way while still helping to constrain the size of the workbooks.

> **Note:** This is a patchable feature, i.e., existing configurations can be enhanced to benefit from this feature.

6. **Wizard Label**: To attach a custom label to a wizard page, enter the desired label in this field. If this field is left blank, the wizard page will be given the default label.
7. **Order**: Adjust the order of the hierarchies as necessary by dragging them in the order pane. This will be the order that the position selection wizards are presented during the workbook build process.
8. Click **OK** to save any changes and close the window.

> **Note:** If any of the offered hierarchies are not enabled in the Standard Wizard dialog box, the end user will not be presented with a position selection wizard to define the scope of the workbook being built for that hierarchy. All positions in the lowest dimension offered in that hierarchy that the end user has access rights to will be automatically selected.

Enable Image Modification

Select this option to allow users the ability to add, modify, or delete image paths for all image enabled dimensions in this workbook. Refer to "Specify Dimension Properties" for information on enabling images.

Hierarchy Pre-ranging

Hierarchy pre-ranging allows you to filter available positions for selection in two-tree wizards based on relationships established at a specific intersection between the positions of two or more hierarchies. For example, you can set pre-ranging up so that when users select the time period “Fall 09” in the wizard, the subsequent SKU selection screen will only display Fall-specific products, such as sweaters and jackets.

Hierarchy pre-ranging can be enabled for both standard wizards and for two-tree wizards in custom wizards; however, in custom wizards the behavior is guaranteed only if two-tree wizards are used as is, i.e., their code is not overridden by the implementation team.

Pre-ranging is achieved by setting up a Pre-range Mask measure for the workbook. This Boolean measure establishes a mapping between the positions of the hierarchies in the intersection of the measure. This mapping is what governs the position availability in the two-tree wizard.

An important thing to note when designing pre-ranging is that the intersection of the Pre-range Mask measure could be different from the base levels of the two-tree wizards, such that the levels of each hierarchy in the base intersection of the measure correspond exactly with the wizard, or are above or below the wizard's base level. Additionally, the intersection of the mask measure may not include all hierarchies that are being filtered in the wizards or that are in the workbook. The intersection may even have more hierarchies than those used in the wizard pages. Several combinations are possible; the following such cases detail the behavior of Hierarchy pre-ranging:

- Limits on Dimensionality of the Pre-range Mask

  The Pre-range Mask measure must have at least one dimension in its base intersection; i.e., it cannot be a scalar, and it may have up to a maximum of five dimensions. The upper limit is imposed by the limit on dimensionality of a measure in RPAS.

  When the mask is one-dimensional, the two-tree page for that hierarchy simply filters the hierarchy independently of selections along any other hierarchy in other pages within the wizard. Since there is only one mask measure per workbook, only one hierarchy may be filtered independently of others; other hierarchies will not be filterable at all unless special provisions are provided in custom wizard implementation.

  When the mask is multidimensional, the filter of only the first two-tree wizard is independent of others; available selections in all subsequent wizard pages are reduced to the set of positions mapped to user selections in previous wizard pages. Note that the order of appearance of wizard pages is what is important here and not the order of hierarchies for the domain.

- Constraints on the Pre-range Mask Measure's Base Intersection

  The base intersection of the pre-range mask measure must be at the same level as or above the lowest base intersection of all measures in the workbook.

  The mask's base intersection may be below, at the same level as, or above the wizard's base intersection, but it cannot be across the wizard's intersection. That is, the mask's base intersection cannot be such that some of its dimensions are below the base dimensions of the wizard while some are above. All dimensions should be below, at the same level, or above the base dimensions of the wizard.

  If the Pre-range Mask measure has one or more dimensions in its base intersection that are higher than the dimensions in the wizard, then pre-ranging will be evaluated by spreading the mask measure value down to the dimensions in the wizard by replication. For example, if the Pre-range Mask is at the Dept/Str level and the standard wizard is at the SKU/Str level, pre-ranging is evaluated by spreading the mask measure down to SKU/Str using replication. Thus, if Dept/Str is a valid combination, all SKUs in that Department are valid for the Store.

  If the mask measure has one or more dimensions that are lower than the dimensions in the standard wizard, pre-ranging will be performed by aggregating the mask up to the wizard level using the measure's default aggregation method. That is, if the mask measure has an aggregate type of OR, and if one or more positions in the mask are enabled, the wizard will make the higher level position selectable. It is important to note that when the user selects this higher level position in the wizard, the selection will be replicated down to all positions at the levels below, regardless of whether the lower level position was selectable per the mask or not. To prevent this behavior, the implementer must either make sure that the mask is at the same level as the wizard, or that the mask has a default aggregation type of AND so that the aggregate level position is not available for selection in the wizard if any of the mask level positions that roll up to that position are not selectable.

- Pre-ranging on Hierarchies Not Selectable In the Wizards

  For hierarchies that are in the base intersection of the pre-range measure, but are not configured in the standard wizard to be displayed, pre-ranging will be performed based on selections made in the visible hierarchies. The un-displayed hierarchies will then be filtered to only have those positions that correspond to the selected positions for the displayed hierarchies. If none of the hierarchies of the pre-range mask measure are chosen to be displayed in the associated standard wizard, then pre-ranging will be performed based on the mask measure as if all valid positions had been selected.

- Non-Pre-ranged Dimensions In the Wizard

  Hierarchies in the standard two-tree wizard pages that are not a part of the base intersection of the pre-range mask measure will not be impacted by pre-ranging; i.e., all positions will be available for selection.

- Non-Populated Pre-range Mask Measure

  If at the time of building the workbook the Pre-range Mask measure has no cell with a value of TRUE, an error message will appear and the wizard will exit without building the workbook.

- Non-Boolean Pre-range Mask Measures

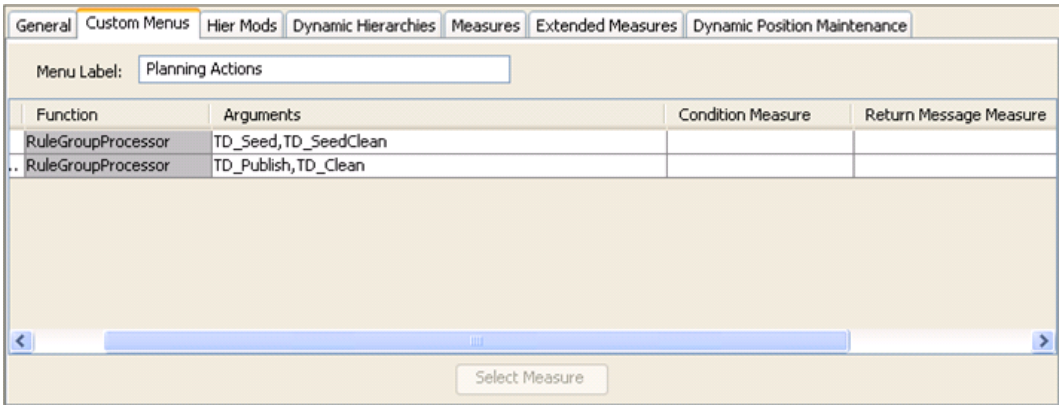
  If a non-Boolean measure is used as the mask, when building the workbook an error message will appear and the wizard will exit without building the workbook.

  Note that the state of the Pre-range Mask measure is checked when the wizard process starts and not during the wizard process. As a result, changes to the mask measure during a wizard process will not be reflected in the wizard. Furthermore, cached user selections are retained when rebuilding a pre-ranged workbook; however, if pre-ranging removes any of the positions that were in the user's previous selection, the workbook build will successfully complete with those positions eliminated (there must be at least one selectable position).

Hierarchy pre-ranging also works with batch workbook builds. Situations that lead to errors when building a pre-ranged workbook manually also cause batch builds to fail.

Custom Menus Tab

The use of this tab is optional. It is used to create a workbook specific, customized menu-driven process within the workbook where the defined menu options execute rule group transitions (which cause a series of calculations to be performed) and external scripts. Custom menus are typically used to define processes, such as an approval process.



Example of Custom Menus Tab

Create a Custom Menu

1. Select the **Custom Menus** tab.
2. In the Menu Label field, enter the name of the menu that will be displayed in the RPAS Client. This menu option will appear as a top level menu option, between the Window and Help menu options.
3. Right-click in the table area, and select **Add**.
4. Enter the following information:
   - **Label:** The label that will be displayed in the menu in the RPAS Client. These labels will appear beneath the top-level menu option named in the Menu Label property, in the order that they are displayed in this window.

     Note: Duplicate menu names are not allowed.

   - **Function:** This field defaults to RuleGroupProcessor and cannot be changed.
   - **Arguments:** The processes that are to be executed by the menu option are specified in the arguments property. There may be several processes specified in the order they are to be executed, and separated by commas. If a process starts with an "*", the string that follows the "*" is assumed to be the name of an external script. Otherwise, the string is assumed to be the name of a rule group.

     When the end user selects the menu option in the RPAS Client, RPAS executes the processes from the arguments property in the specified sequence. RPAS waits until each process has finished before executing the following process. After all of the processes have been executed, RPAS executes a final transition using the "full" transition type back to the calc rule group for the workbook. This transition does not have to be explicitly specified in the arguments property.

     Rule groups are executed with a "full transition" from the previous rule group, and the calculations apply to the whole scope of the workbook (that is, they use "full" (batch) mode rather than "incremental" mode). These terms are explained in Appendix B, "Calculation Engine User Guide." The rule group transitions ensure that the integrity of all rules is enforced in the new rule group.

Scripts referenced in the arguments property should meet the naming conventions for the operating system of the RPAS Server. They must reside in the root directory of the domain and have executable permissions. For the script to execute, the current working directory (./) has to be in the path before the DomainDeamon is started. RPAS passes the name of the current workbook (as RPAS would recognize the workbook to be) to the called script. This variable could be accessed as $1 if the executable is a shell script, or arg[1] if the executable is a binary. This argument is the internal ID that RPAS recognizes the workbook with, so any RPAS calls that are made in the script (for example `exportData`) will readily identify the workbook (if the data needs to be exported from the current workbook).

If the script to be called requires different arguments, a "wrapper" script should be called instead, which can call the target script with the appropriate arguments. RPAS waits until the called script has finished before executing the next process in the menu option. If the called script does not need to finish before the next process begins, a "wrapper" script should be implemented that can call the target script, and then return immediately.

Note: Rule groups listed in the arguments for the menu option are not limited to those in the rule set used in the workbook, but they may be any rule groups used in the project.

Note: If any of the processes in a menu option should fail unexpectedly, execution of the menu option stops along with an error message to the user. This may leave the data in the workbook in an inconsistent state.

- **Condition Measure**: This field is used to specify a scalar, Boolean condition measure in the workbook that will be checked by the custom menu to decide whether it should execute or not. If the value of the measure is TRUE, the custom menu will execute, but if the value is FALSE, the menu will not execute and will display a message relating that the custom menu could not execute because the conditions were not met. (For more information on how this message can be customized, please see the following section on the Return Message Measure field.)

  If the condition measure is not specified, i.e., the field is empty, the custom menu will always execute. The table below specifies the behavior of custom menu execution and the display of custom messages based on whether a measure name has been entered (available) in the field and whether the measure's value has been set (TRUE in case of the condition measure and a non-zero length string in case of the message measure).

Condition Measure	Message Measure	Behavior
Available & Set	Available & Set	The Custom Menu executes and displays the Custom Menu Response pop-up containing the value of the Return Message measure.
	Available but Not Set	The Custom Menu executes and displays the default message.
	Not Available	The Custom Menu executes and displays the default message.
Available but Not Set	Available & Set	The Custom menu does not execute, but does display the Custom Menu Response pop-up containing the value of the Return Message measure.
	Available but Not Set	The Custom Menu does not execute and displays a Warning pop-up message reading "Conditions for executing the Custom Menu have not been met!".
	Not Available	The Custom Menu does not execute and displays a Warning pop-up message reading "Conditions or executing the Custom Menu have not been met!".
Not Available	Available & Set	The Custom menu does not execute, but does display the Custom Menu Response pop-up containing the value of the Return Message measure.
	Available but Not Set	The Custom Menu executes and displays the default message.
	Not Available	The Custom Menu executes and displays the default message.

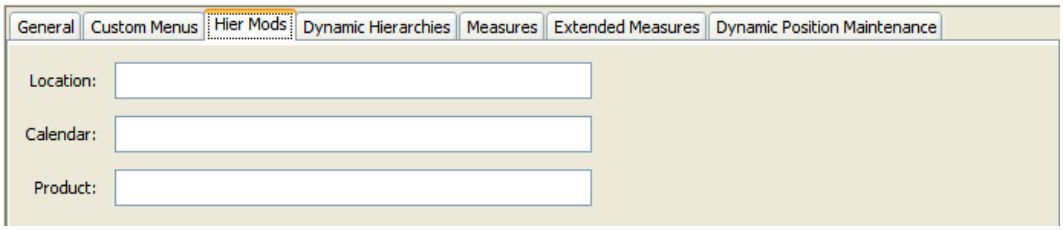
- **Return Message Measure**: This field is used to specify the scalar, String measure, the value of which is displayed by the custom menu in a pop-up dialog upon the menu's successful or failed execution. If the field is empty, RPAS will display the default message that it has historically displayed. If a measure is specified, but the value is empty, RPAS will again display the default message. If the value is a non zero-length string then the value is displayed.

To effectively use this feature it is important to understand the execution of a custom menu. When you select a custom menu from the menu, RPAS first checks if there is a condition measure available for controlling the execution. If there is none, it continues to run the rule groups or scripts in the argument of the custom menu. If a condition measure is available, RPAS checks the value of the measure for controlling the execution of the custom menu. If the value is false, it checks the availability of the return message measure. If the message measure is unavailable, RPAS displays a default message informing the user that menu could not be executed because the conditions were not met. However, if the measure is available, RPAS examines its value. If the value is empty, it defaults to the same behavior as when the message measure was not available. If the value is not empty, it displays the custom message.

If the custom menu can execute, either because the condition measure is unavailable or because it is set to true at the time the custom menu is invoked, RPAS executes the rule groups and scripts in the argument of the custom menu specification. RPAS will then look for the value of the message measure, and if the value is empty, it informs the user that the menu was successfully executed using the default message. If the value is not empty, it displays the value of the message measure. It then transitions to the Calc rule group and completes execution.

Hier Mods Tab

The use of this tab is optional. The Hier Mods (Hierarchy Modifications) function is used to define the workbook hierarchy structure if that is required to differ from the hierarchy structure defined using the Hierarchy Definition Tool. Hier Mods can effectively be used to hide individual dimensions or whole branches of a hierarchy by excluding them from the dimensions that are made available to the workbook. In some limited circumstances, it can also be used to create mappings between dimensions that are not directly related in the hierarchy structure specified in the Hierarchy Definition window, but where you know that the relationship can be accurately deduced.



Example of Hier Mods Tab

1. Click the **Hier Mods** tab.

   All hierarchies that are used in the base intersection of measures that are used in the rule set that are used in the workbook will be shown.

2. For each hierarchy to override, specify the required dimension relationships.

   Note: Any hierarchies that do not have dimension relationships specified will use the full hierarchy specification from the hierarchy tool in the workbook, using the lowest dimension in that hierarchy used in the base intersection of a measure used in the rule set for the workbook as its root.

   Dimension relationships are specified as hyphenated child-parent pairs with the child first and the pairs separated by commas. Every parent-child relationship that is wanted in the workbook must be explicitly specified. Only dimensions that have been defined in the hierarchy tool can be used, and the dimensions must be specified by name. The dimension relationships are validated to ensure that valid dimension names are used, and the use of the same dimension name in both the child and the parent is prohibited. Furthermore, validation prohibits the use of a pair where the child dimension's Aggs attribute is the same as the parent dimension. For example, mnth-week is not allowed but week-mnth is.

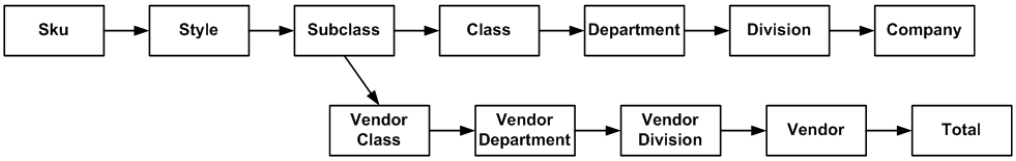
   Example 1 – Hiding Dimensions

   Consider a product hierarchy where a subclass is only supplied by a single vendor. An example of a product hierarchy that includes a branch for vendor analysis is:

   Sku-Style-Subclass-Class-Department-Division-Company

   with a branch of:

   Subclass-VendorClass-VendorDept-VendorDiv-Vendor-Total



If a workbook was wanted that included measures with a lowest base intersection in the product hierarchy of subclass that did not require the vendor branch or the division dimension, the specification of Hier Mods for the product hierarchy would be as follows:

scls-clss, clss-dept, dept-comp

The resultant workbooks would only contain the subclass, class, department, and company dimensions.

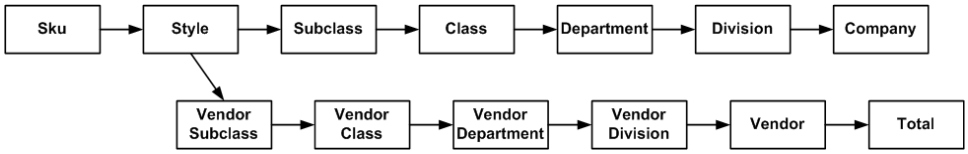
Example 2 – Defining a "Non-Structural" Dimension Relationship

Consider a product hierarchy where a subclass may be supplied by multiple vendors (with a style always supplied by a single vendor), but in some parts of the business, subclasses are only supplied by a single vendor. An example of a product hierarchy that includes a branch for vendor analysis is:

Sku-Style-Subclass-Class-Department-Division-Company

with a branch of:

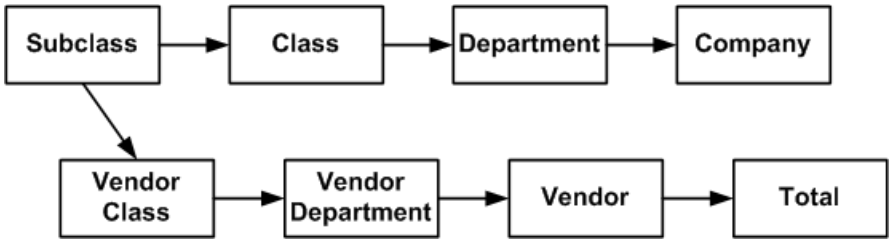
Style-VendorSubclass-VendorClass-VendorDept-VendorDiv-Vendor-Total



If a workbook was wanted that included measures with a lowest base intersection in the product hierarchy of subclass, that did require the vendor branch and did not want the division dimension, the specification of Hier Mods for the product hierarchy would be as follows:

scls-clss, clss-dept, dept-comp, scls-vcls, vcls-vdep, vdep-vend, vend-tot

The resultant workbooks would contain the subclass, class, department, and company dimensions, as well as a branch that contains the VendorClass, VendorDept, Vendor, and Total dimensions.



Note: The use of mappings that are non-structural should be carefully managed to ensure they are only used where the 'non structural' mapping happens to work. In our example, if this workbook is used by an end-user in a part of the business where a subclass happens to only include Styles from a single vendor, the hierarchy built in the workbook will work correctly. However, if it is used in a part of the business where a subclass may include styles with multiple vendors, RPAS will determine (by looking at the VendorClasses that the SKUs in the subclass belong to) that the scls-vcls relationship is ambiguous, because the subclass should belong to multiple VendorClasses. In these circumstances, RPAS will build the hierarchy using one of the valid scls-vcls relationships. As far as the end-user is concerned, the choice of VendorClass for the subclass is likely to be seen as arbitrary, and (in any case) the vendor branch will be of little or no practical value in this case.

Dynamic Hierarchies Tab

Use of this tab is optional. It is used to configure a hierarchical relationship whose parent-child relationships are not defined through the normal `loadHier` process, but are data driven. The dynamic hierarchical relationships are built using measure data during the workbook build process, and may vary each time a workbook is built; but the relationships within a workbook are constant. For example, the "Cluster" dimension may be an alternate parent of the "Store" dimension in the Location Hierarchy, and the Cluster that a Store belongs to may vary by the "Class" dimension in the Product Hierarchy. In one workbook, a clustering process may determine the Store-Cluster relationships for each Class, and store that information in a measure. A second workbook could then use that relationship to build a dynamic hierarchy. In this example, if the rollup of Store to Cluster is different for each Class, and the user brings more than one Class into the workbook, the rollup of Store to Cluster used in the workbook will be based on the data from the first class in the hierarchy. There can only be one dynamic hierarchy defined in a workbook.

The Dynamic Hierarchy process cannot "invent" a new dimension; it can only change the parent-child relationships of the existing dimensions. So in our example, the Cluster dimension must be a normal dimension defined through the hierarchy tool, and maintained through the `loadHier` or user defined dimension processes. The dimension is normal, so it may be used in the base intersection of measures.

Note: If the branch of a hierarchy that has parent-child relationships defined by the dynamic hierarchy process only has a business meaning when the dynamic hierarchy process is used, you should use the Hier Mods process to "hide" the dimensions in other workbook templates. For example, in our above Cluster example, if the Store-Cluster relationship only exists in the context of a class, use the Hier Mods tab to hide that relationship in a workbook template that does not include the product hierarchy.

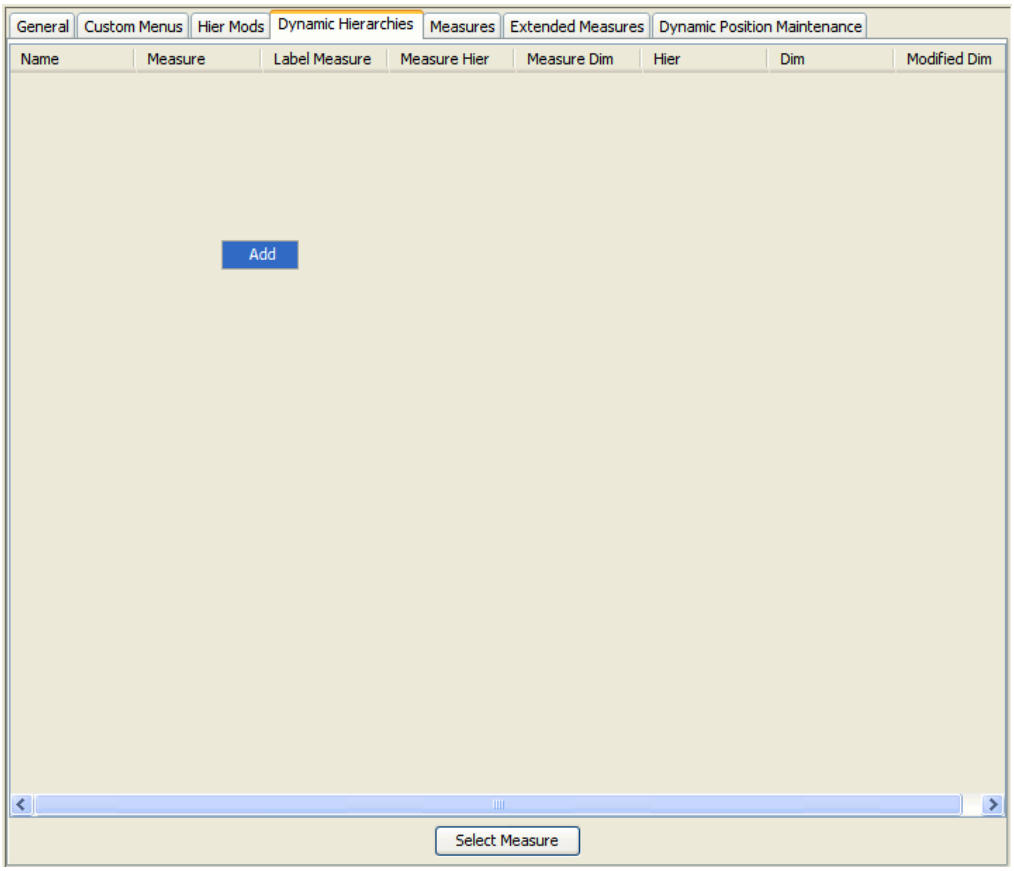
Note: It is your responsibility to ensure that the position names contained in the measure that drives the dynamic hierarchy are real positions that exist in the parent dimension. If not, positions with those names will be present in the workbook, but data for them cannot be committed to the domain, and it will be lost when the workbook is deleted.

Note: The resulting Dynamic hierarchy is created at the end of the wizard selection process and before the actual workbook build. Therefore, the end product is only visible inside the workbook and not in the wizards.

Defining a Dynamic Hierarchy

Note: There can be only one dynamic hierarchy per workbook.

1. Click the **Dynamic Hierarchies** tab.



Example of Dynamic Hierarchies Tab

2. Right-click in the table area and select **Add**. A row appears with properties to define the dynamic hierarchy.
3. Set the properties as follows:
   - **Name –** The name of the dynamic hierarchy. Duplicate names are not allowed. This is an internal name used as a "handle" to the dynamic hierarchy, and it is not visible to the end user.
   - **Measure –** This is the name of the measure that holds the name of the parent position. Click **Select Measure** to get a list of the measures that are used in the solution. Type the first few characters of the measure name in the box at the top of the list to go to the required measure, or scroll to find it. Double-click to select the desired measure. The Measure should have a base intersection of the dimension(s) that the parent-child relationship is dependant on (Class in our example), and the dimension that is the child in the parent-child relationship (Store in our example). The content of the Measure is the name of the parent position in the relationship (in our example, this is the name of the Cluster that the Store belongs to for the Class). This Measure may or may not be included in the workbook. If the Measure is included in the workbook, changes to the Measure within the workbook do not change the parent-child relationships within the workbook, which are static once the workbook is built.
   - **Label Measure –** This is the name of the measure that holds the label of the parent position. The process to select the Label Measure is the same as the process to select the Measure. The base intersection of the Label Measure should be the same as the Measure. The contents of the Label Measure will be the label of the parent position in the relationship.

Note: If a given parent position name has different labels specified for different child positions, the label for the parent position used in the built workbook will be one of the different labels, which are arbitrarily selected.

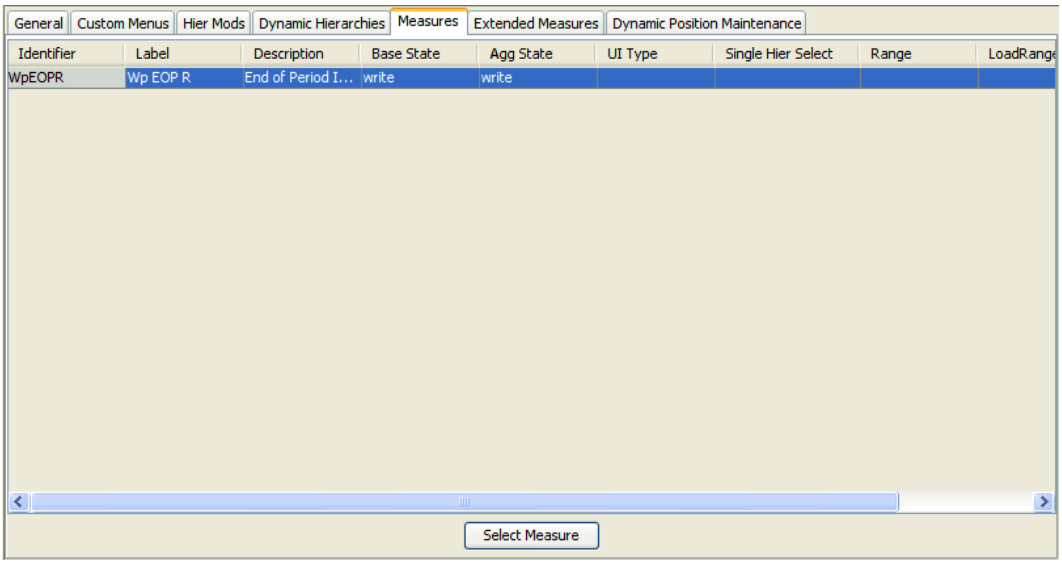
- **Measure Hier –** This is the name of the hierarchy that the parent-child relationship is dependant on. In our example this is Product.
- **Measure Dim –** This is the name of the dimension that the parent-child relationship is dependant on. In our example this is Class.
- **Hier –** This is the name of the hierarchy that the parent-child relationship belongs to. In our example this is Location.
- **Dim –** This is the name of the dimension that is the child in the parent-child relationship. In our example this is Store.
- **Modified Dim –** This is the name of the dimension that is the parent in the parent-child relationship. In our example this is Cluster.

Measures Tab

The use of this tab is optional. It allows you to override certain properties of measures at the workbook level. Use this tab in cases when it is necessary to configure multiple workbooks for a solution and the processes implied by those workbooks require different measure behavior. For example, a measure may need to be writable in one workbook in a solution, but read only in all other workbooks. By using this tab, you can override the following standard measure properties at the workbook level:

- Label, Description
- Base State
- Agg State
- UI Type
- Single Hier Select
- Range

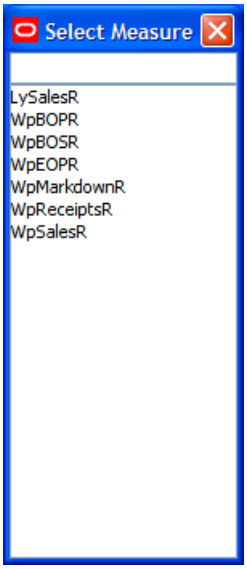
In addition, there are two properties, LoadRange and LoadRangeMeas that are not standard measure properties that may only be set though the Measures tab.



Example of Measures Tab

Defining Measure Properties Override Settings for a Workbook

1. Click the **Measures** tab.
2. Right-click in the measure table area, and select **Add**.
   a. Select the newly added row.
   b. Click **Select Measure** to get a list of the measures used in the workbook. The Select Measure window appears.



Select Measure Window

   c. Type the first few characters of the measure name in the box at the top of the list to go to the required measure, or scroll to find it. Double-click to select the desired measure. Measures that already have an entry in the Measures tab are listed but disabled, and cannot be selected.

Modifying Measure Properties Override Settings for a Workbook

1. Click the **Measures** tab.
2. Modify the appropriate property information for the measure.

Removing a Measure Override Settings from a Workbook

Perform the following procedure to remove the measure property override settings.

1. Click the **Measures** tab.
2. Right-click on the measure row you want to delete and select **Remove**.

Defining the LoadRange and LoadRangeMeas Properties

The **LoadRange** and **LoadRangeMeas** property fields can only be set in the Measure tab. They are used to specify dynamic picklists. Dynamic picklists are picklists whose valid values do not vary within a workbook, but can be set dynamically during the workbook build process.

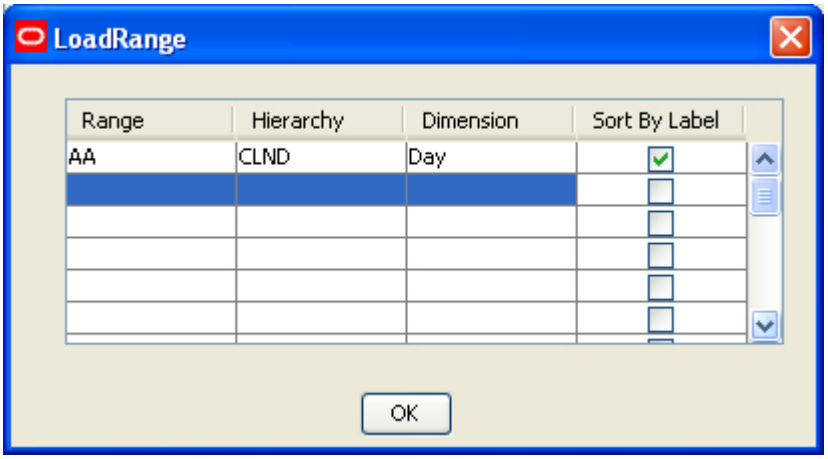
The LoadRange and LoadRangeMeas properties are retained for backwards compatibility purposes. In most cases "context-sensitive picklists" (that is, picklists using the “measurerange = measS” syntax in the range property) and "single select wizards" will be used instead.

Dynamic picklists are of two forms:

1. The first form has values that are set according to the data values in cells for another measure (using the same format as for the Range property of static picklists). As with static picklists, the value shown to the user in the UI is the label for the value. It is more usual to use "context-sensitive picklists," where picklist values can vary according to context in the workbook.
2. The second form is to have values that are positions in a branch of a hierarchy. The value shown to the user in the UI is the label of the position, but the content of the cell is the name of the position. The single select wizard provides an alternative method for selecting a position, which is more commonly used.

Defining a Measure with a Dynamic Picklist

1. Select the row for the measure.
2. Right-click in the row for the measure and select the **Set Dynamic Picklist** option.
3. If the picklist measure is to show hierarchy positions, an entry is required in the **LoadRange** property field (and not in the **LoadRangeMeas** property field). Click in the **LoadRange** field. The LoadRange dialog box appears.



Load Range Dialog Box

a. In the **Range** column, enter a name for the range. This name is used internally by RPAS and needs to be unique across the domain.

b. In the **Hierarchy** column, select the hierarchy from which the user is to select a position.

c. In the **Dimension** column, select the dimension from which the user is to select a position. The positions along this dimension, which are brought into the workbook, will be the available choices in the picklist in RPAS Client.

d. Select the **Sort by Label** check box if the positions in the picklist are to be sorted alphabetically by their label. If this is not selected, the positions will be shown in their internal order, which is the order in which they were defined.

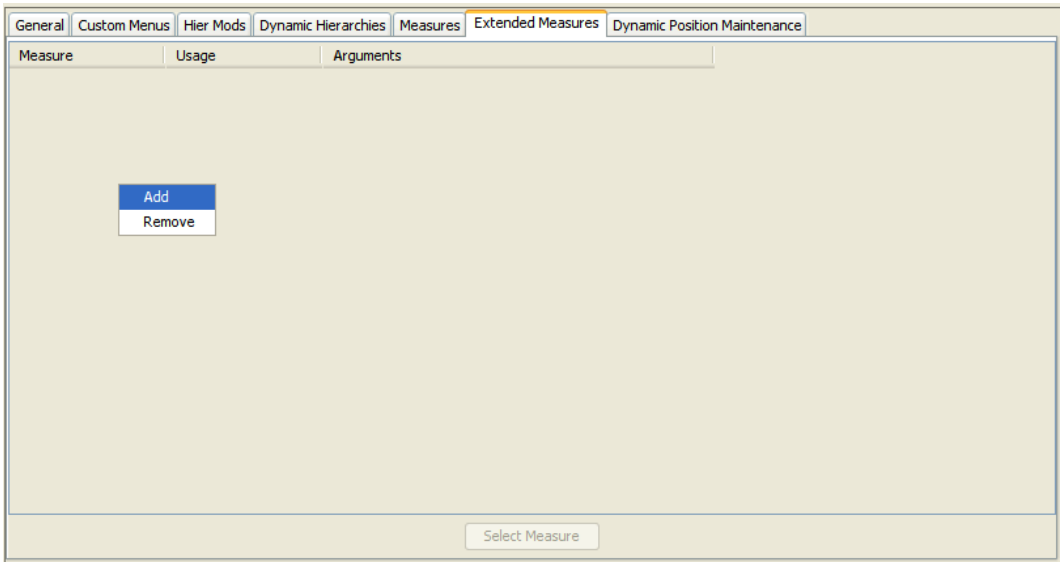
e. Click **OK** to save your changes and close the window.

4. If the picklist measure is to display values based on the data values for a cell, an entry is required in the **LoadRangeMeas** property and in the **LoadRange** property fields. Click in the **LoadRangeMeas** field, and click the **Select Measure** button. Type the first few characters of the measure name in the box at the top of the list to go to the required measure, or scroll to find it. Double-click the measure whose contents are the valid picklist values. In addition, there should be an entry in the **LoadRange** field for each hierarchy in the base intersection of the selected **LoadRangeMeasure**. Each of the entries in the **LoadRange** field needs a name, hierarchy, and dimension as described above; but the value for sort label is ignored. If the scope of the workbook is such that it covers multiple cells of the **LoadRangeMeasure**, the available picklist options in the workbook will be constructed from the content of the first cell of the **LoadRangeMeasure** when the dimensions are ranged to the positions selected during the workbook build process.

Extended Measures Tab

The use of this tab is optional. It allows for the configuration of "extended measures" that represent different usages of the underlying base measure. Extended measures support using different aggregation methods for the same base measure and participation measures, such as absolute and relative percent-to-parent measures. Once defined, these extended measures can be added onto worksheet profiles to be viewed in the RPAS Client.

Note: Hybrid is not supported for extended measures.



Extended Measures Tab

Adding an Extended Measure

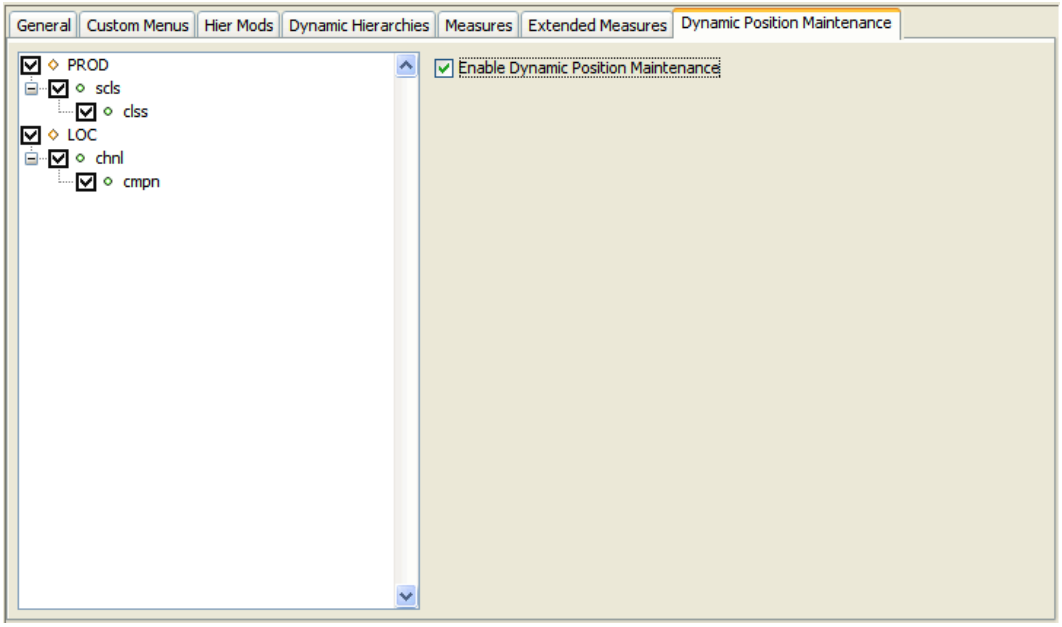
1. To add a measure, right-click in the table area and select **Add**. The row is inserted into the tab and is highlight in red until you define the Measure, Usage, and Argument fields.
2. Click **Select Measure**. The Select Measure window opens.
3. Double-click a measure to select it.
4. Click in **the Usage** field and select **Relative % To Parent** or **Absolute % To Parent** from list.
5. Click in the **Arguments** field and select the appropriate options. If the **Usage** is defined as **Absolute % To Parent** the Parent Intersection dialog appears; set the appropriate options from the dialog box and click **OK**. If the **Usage** is defined as **Relative % To Parent**, select appropriate hierarchy from the list displayed.

Removing an Extended Measure

1. Right-click on the measure you want to remove and select **Remove**.

Dynamic Position Maintenance Tab

If dimensions are enabled to support Dynamic Position Maintenance (DPM) in the Dimensions pane within the Hierarchy Definition tool, you will see those dimensions in the Dynamic Position Maintenance tab. To enable DPM functionality in the workbook, select **Enable Dynamic Position Maintenance**. You may then select the highest dimension in the hierarchy in which the end user will add positions. See the *RPAS Administration Guide* and *RPAS User Guide* for more information on Dynamic Position Maintenance.



Example of Dynamic Position Maintenance Tab

> **Note:** Users cannot import positions from alternate hierarchies that are not already in the workbook to be used as parents for new DPM positions.

Remove a Workbook

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.

1. Select the workbook to remove.
2. From the toolbar, click the **Delete** button, or select **Remove** from the right-click menu.
3. Click **Yes**. The associated worksheets and tabs are removed.

Working with the Rule Group Simulator

Overview

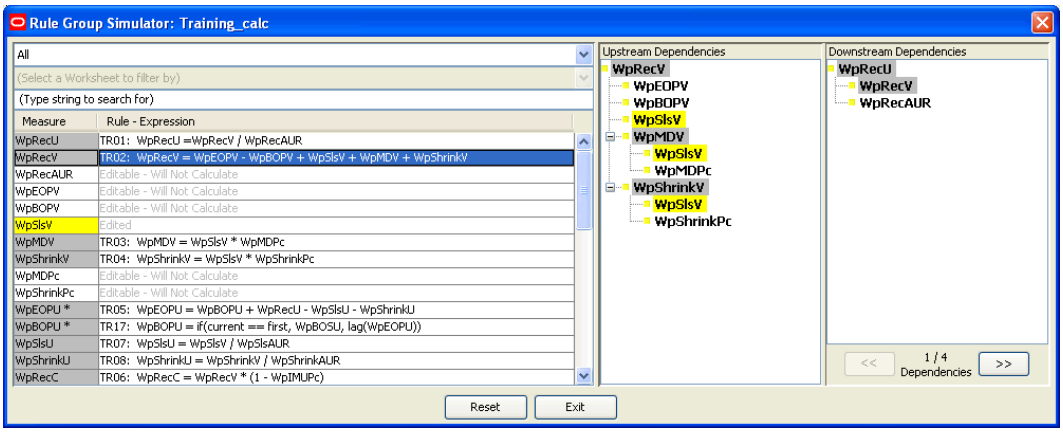
The RPAS calculation engine is powerful and complex. The rule group approach means that there are very many potential calculation paths. However, during any configuration exercise, there is a significant design verification cost to ensure that the behavior is "as would be expected" by an end user. The rule group simulator enables the verification of the interaction between measures from within the Configuration Tools. It cannot, however, enable the verification of the calculations themselves because that requires a full domain to be built.

The Rule Group Simulator is integrated into the workbook tool, and it uses all of the measures used in the rule set in the workbook, which may be more than those mentioned in the rule group being simulated. Users of the rule group simulator are expected to understand the calculation cycle, especially with respect to measure protection processing and the process that determines which expressions will be evaluated. See Appendix B, "Calculation Engine Users Guide" for more information.

> **Note:** The rule group simulator is not able to simulate the expressions that will be evaluated as the result of a rule group transition, nor simulate the calculations that will follow if a rule group is evaluated in "full" mode, such as when evaluated from the mace utility, or the evaluation of the load rule group when a workbook is built.

About the Rule Group Simulator

The Rule Group Simulator feature is provided in a separate window with two areas: a measure table, and a tree view with Upstream and Downstream Dependencies panes.



Rule Group Simulator Window

The measure table displays all of the measures in the scope of the simulation. The **Measure** column displays the measure name. The measure status is reflected by color coding. A tooltip also displays the measure status when the mouse is placed over the measure name. All measures can be shown, or the list of measures can be filtered. Editable measures can have their status toggled (to or from **Edited**), and the simulator immediately updates all statuses, calculations, and trees.

The table below explains the meaning of the color coding used in the Rule Group Simulator window.

Color	Meaning
Yellow	Edited. If it is a recalc measure, it will be calculated by indirect spreading of another measure through a mapping rule and recalculation at aggregated levels. If the measure has another aggregation type, it will be calculated by spreading and aggregation.
Pale Gray	Editable. Although the measure is not forced, and thus is still editable, it will be calculated through the calculation engine having to select an expression in an affected rule.
White	Editable. Will not be calculated, so it will not change at all.
Pale Blue	Protected by protection processing. Although the measure is protected (usually this will be because it is the measure on the left-hand side of the only expression in a rule), it is not 'forced' because none of the right-hand side measures are changed, so it does not need to be calculated, and it will not change at all.
Mid Blue	Protected by protection processing. Is "forced," so it will be calculated.
Dark Blue	Read-only. The measure is set as being read only in the measure properties, so it will not change at all. A measure that is read only, but is going to be calculated will be shown as mid-blue. That status takes priority over read-only.

Note: The status of a measure encapsulates two concepts that are not as closely linked as may appear at first sight:

Whether or not the measure can be edited (shades of blue = no, white/gray/yellow = yes)

Whether or not the measure will be calculated.

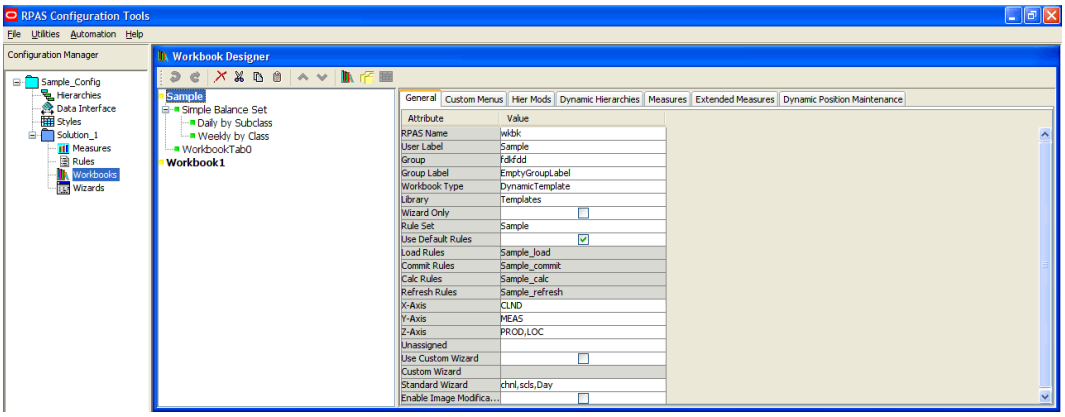
It is possible for a measure to be editable, but it would be calculated if a calculate were issued. Similarly, it is possible for a measure to be protected by protection processing that would not be calculated if a calculate were issued.

The Rule - Expression column of the table shows the calculation for each measure. For those measures that would be calculated if the end user issued a "calculate" with the current collection of edited measures, the rule and expression that would be used to calculate the measure is shown. For non-calculated measures, this column displays the measure status.

The tree view shows (in separate panes) the upstream and downstream measure relationships (that is, the expressions that will be evaluated) for the measure with focus. Measures in the panes are also color coded. If the measure with focus would be calculated, the upstream pane shows the expression to calculate it, and, all measures that it is dependent upon (calculated from) with their expressions, if appropriate. The downstream pane similarly shows measures that are dependent upon (calculated from) the measure with focus, if there are any. If the measure with focus is on the right-hand side of several expressions that will be calculated, each of the expressions can be viewed using the forward (>>) and backward (<<) arrows.

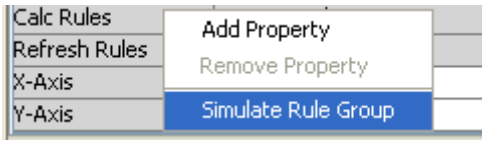
Invoking the Rule Group Simulator

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.



Workbook Designer Window

1. Select one of the workbooks in the Workbook Designer tree display.
2. Select the **General** tab of the Workbook properties table.
3. Right-click on **Calc Rules**, and select **Simulate Rule Group**.



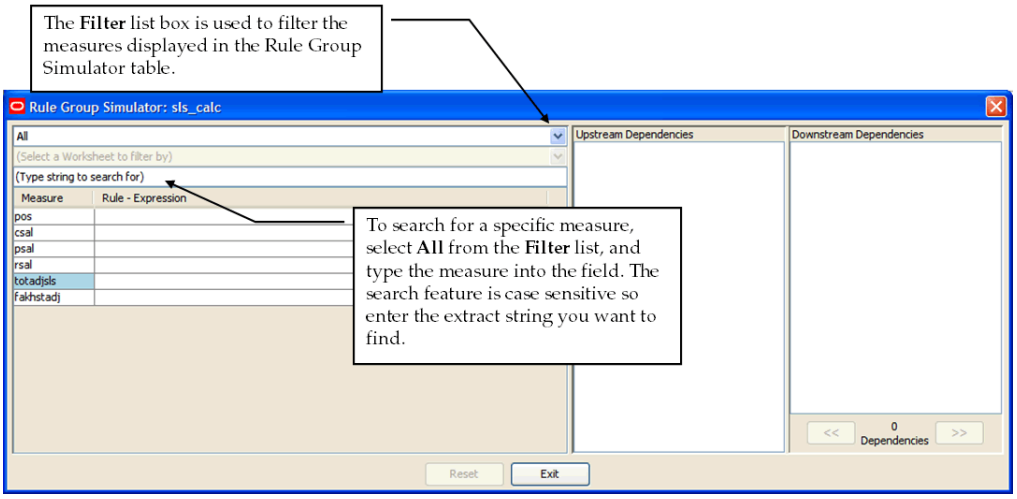
Simulate Rule Group Menu Option

The Rule Group Simulator window appears.

Filtering the Measures Table

Perform the following to filter measures displayed in the Rule Group Simulator:

1. Open the Rule Group Simulator. See "Invoking Rule Group Simulator."



Rule Group Simulator Showing Filter and Search Features

2. To filter the measures table, select the one of the following options from the **Filter** list:
   - Select **All** to display all measures in the workbook.
   - Select **Will Calculate (According to Calculation Order)** to display only those measures that will be calculated. The sequence of the measures displayed is the sequence in which they will be calculated. Measures that are edited are not shown.
   - Select **Will Not Calculate** to display only those measures that will not be calculated will be shown. Measures that are edited are not shown.
   - Select **Read Only** to display only those measures whose status is read-only (that is, have a Base State and Agg State of "read").
   - Select **Contains String** to type a case-sensitive string to filter by in the text box below the **Filter** list option. Only measures that include the string entered are displayed.
   - Select **By Worksheet** to select a worksheet from the current workbook using the list option below the filter list option. Only the default measures from that worksheet are shown. The **Worksheet** list option is disabled until **By Worksheet** is selected from the **Filter** list.
3. If searching for a specific measure, set the filter to **All**, and enter a search string (case-sensitive) in the box below the **Filter** list. The first measure that includes the string will be shown and will become the measure with focus.

Changing the Edited Status of Measures

> **Note:** Only measures that can be edited (colors gray, white, and yellow) may have their status changed.

1. Select the name of the measure in the measure table.
   a. If the status was previously **Editable** (gray or white), the status of the measure changes to **Edited** (yellow).
   b. If the status was previously **Edited** (yellow), the status of the measure changes to **Editable** (either gray or white, depending on the rule group and the other edits currently applied).

   After any change in status, the simulator updates all necessary statuses, calculations, and tree views.
2. To change the status of all **Edited** measures back to **Editable** (gray or white), click the **Reset** button.

> **Note:** Measures that are calculated in a "cycle," which typically includes BOP and EOP inventory values, are indicated with an "*" next to their names in the measure table and Upstream and Downstream Dependencies panes.

Using the Upstream and Downstream Panes

1. To change the measure with focus for the upstream and downstream panes:
   a. With the **Filter** list option set to **All**, enter a search string in the field under the **Filter** list option. The first measure that contains the search string will get focus.

   > **Note:** Remember, when searching by measures, the text entered in the search text field is case-sensitive.

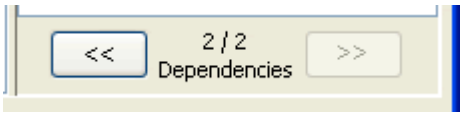
   b. Click in the **Calculation Column** of the measure table for the measure.
   c. Click on any occurrence of the measure in the Upstream or Downstream Dependencies panes.

   When the focus changes, the tree panes are refreshed as appropriate based on the measure which currently has focus, and the measure table scrolls so the measure with focus is shown.

   The measure with focus always appears at the top of the Upstream Dependencies pane. If it will be calculated, the Upstream pane shows the measures that it is dependent upon (calculated from, directly and indirectly). This is displayed using a parent-child tree structure with the measures used to calculate an individual measure showing as "children" of it. If the children are also calculated, they appear with their dependent measures, and so on. Therefore, the expanded Upstream Dependencies tree view displays all of the measure relationships that affect the measure with focus.

   The Downstream Dependencies pane shows measures that are dependent upon (calculated from) the measure with focus, if there are any. Measure relationships (expressions) appear in a parent-child tree structure. If the measure with focus is on the right-hand side of several expressions that will be calculated, the relationships cannot all be shown at the same time in a simple tree structure, so a single relationship is displayed. The number of such relationships, and the one being shown, is indicated at the bottom of the pane.

2. To collapse the detail of the dependencies for a measure in the Upstream or Downstream panes, click the (**-**) next to the measure name. The (-) changes to a (+), and the detail is collapsed. To expand the detail of the dependencies for a measure in the Upstream or Downstream Dependencies panes, click the (**+**) next to the measure name. The (+) changes to a (-) and the detail is expanded.
3. To change which measure relationship for the measure with focus is shown in the downstream pane, click back (**<<**) or forward (**>>**) buttons at the under the **Downstream Dependencies** pane.



Back and Forward Controls

> **Note:** The Rule-Expression column of the measures table will display multiple result expressions with a note beside the rule name saying that it is "multiple result." Furthermore, the entire expression will be displayed showing all of the left-hand side measures that comprise the multiple results. If a measure that has focus is one of the multiple result measures, it will be shown in the Upstream and Downstream Dependencies panes as MeasA [+MeasB][+MeasC] where MeasA is the measure with focus and MeasB and MeasC are the other multiple result measures.

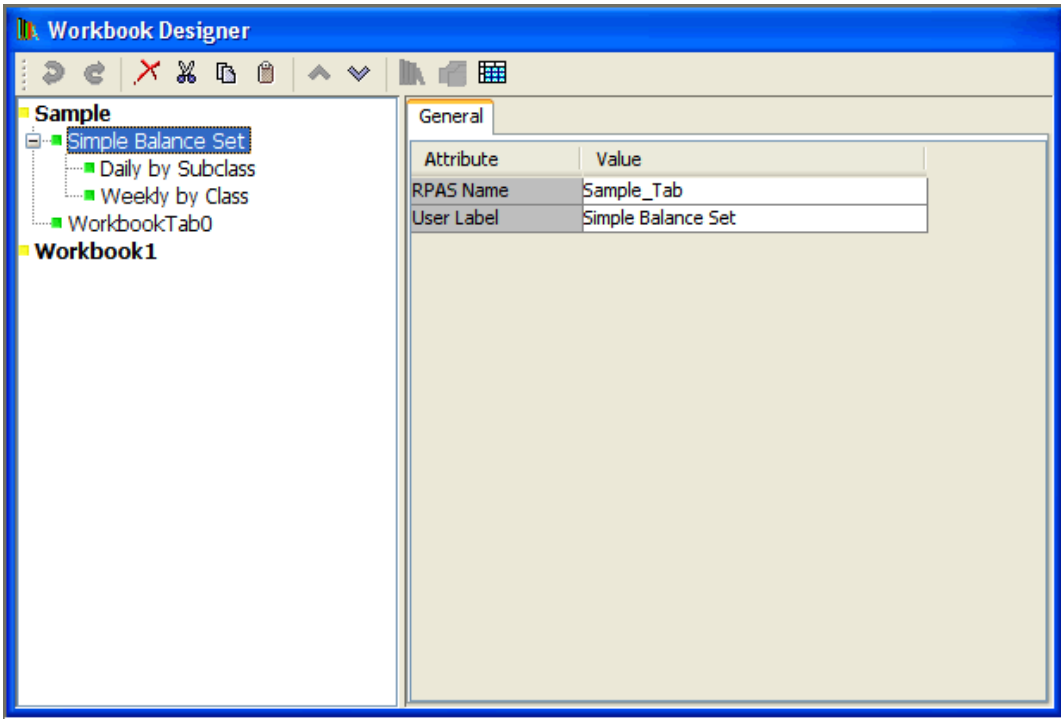
Exiting the Rule Group Simulator

To exit the rule group simulator, click the **Exit** button.

Working with Workbook Tabs

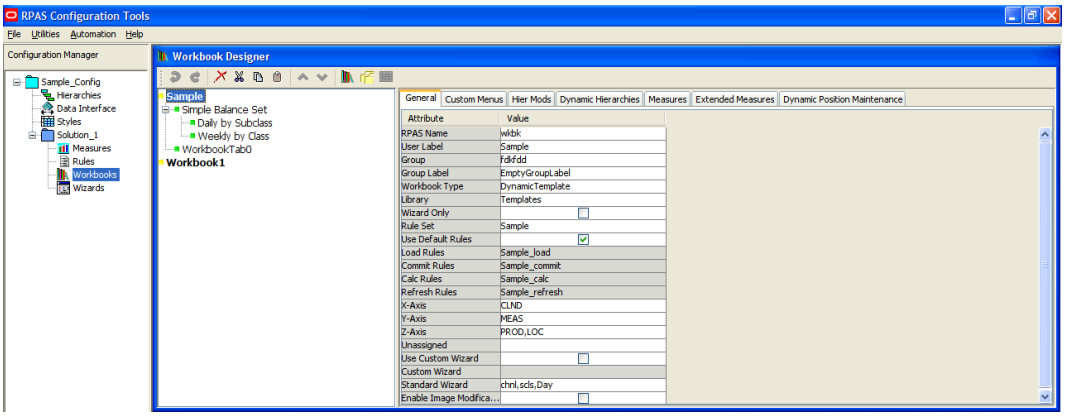
Overview

Workbook tabs are a feature in the RPAS Client that enables the workflow to be separated into steps or business processes. Each workbook must have at least one tab. Users select the appropriate tab to use depending on the stage they have reached in the business process. A tab may contain one or more worksheets that allow the users to interact with the data in the workbook. The measures available, the orientation of the hierarchies, and the base intersection that data is available for may vary by worksheet within the tab.



Create a Workbook Tab

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.



Example of Workbook Design Window

1. Select the workbook in which to create a new workbook tab.
2. Choose one of the following methods:
   - Click the **New Workbook** Tab button.
   - Right-click and select **New Workbook** tab.
   - Select an existing workbook tab in the workbook, and press **Insert**.

   A new workbook tab is created.
3. In the **RPAS Name** field, enter RPAS internal name of the workbook tab.
4. In the **User Label** field, enter a description of the workbook tab that users will see on the tab in the RPAS Client.

Edit Workbook Tab Properties

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.

1. Select the workbook tab whose properties are to be edited.
2. In the **General** tab, type the **RPAS Name** and the **User Label**.
3. Perform one of the following to alter the order in which the tab is displayed in the RPAS Client:
   - To change the order of the tabs, select the up button or down button as necessary.
   - Drag and drop the tab in the Workbook Designer tree display.

Remove a Workbook Tab

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.

1. Select the workbook tab to remove.
2. Choose one of the following methods:
   - From the toolbar, click the **Delete** button.
   - Select **Remove** from the right-click menu.
   - Press **Delete**.
3. Click **Yes**.

   The workbook tab and associated worksheets are removed.

Working with Worksheets

Overview

Measures and Worksheets

A worksheet is a specific window into the data in a workbook. Worksheets are placed on workbook tabs. Using the Configuration Tools, you define the measures on a worksheet, the base intersection the worksheet uses, and the orientation of the hierarchies on the worksheet. The workbook measures can be organized in following categories for a worksheet:

- default profile
- viewable profile
- hidden
- extended

Default Profile Measures

The default profile contains the list of measures that will initially be displayed for this worksheet in the RPAS Client. There must be at least one measure on the default profile.

Viewable Profile Measures

The viewable profile contains the full list of measures that the RPAS Client user can view in the worksheet by using the Show/Hide functionality within the RPAS Client. It must contain all of the measures in the default profile, but it often includes further measures that are not initially displayed.

Hidden Measures

Hidden measures are those that are used in the rule set assigned to a workbook, but that are not assigned to any of the profiles in any of the worksheets contained in that workbook. This might include measures that are used purely for calculation purposes and would have no usefulness to the RPAS Client user.

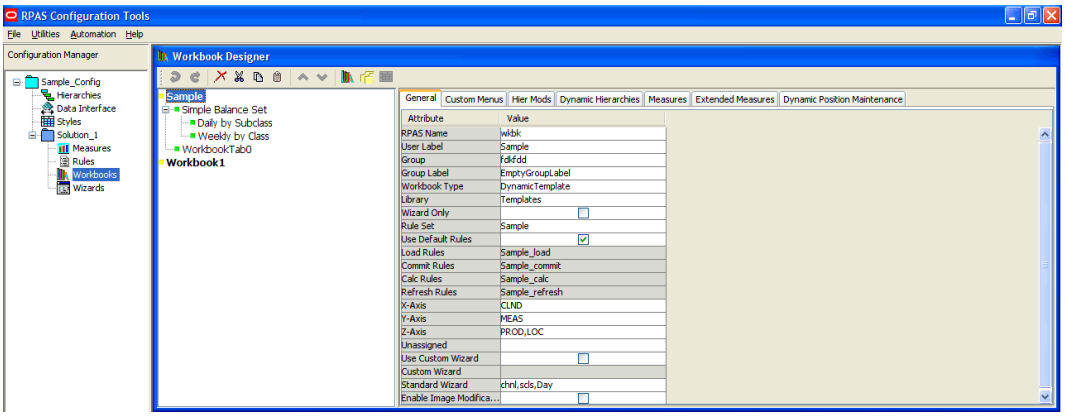
Extended Measures

Extended measures, which represent different usages of the underlying base measures, can be added to the default or viewable worksheet profile. You can add extended measures that are aggregated based on different aggregation methods. The aggregation methods available for selection are based on the Allowed Aggs of the base measure. The same base measure can have multiple extended measures based on different aggregation methods.

You can also add extended measures that represent the relative and absolute percent-to-parent contributions. The same base measure can have multiple extended measures based on different selections for relative and absolute percent-to-parent contributions.

Create a Worksheet

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.



Example of Workbook Designer Window

1. Choose one of the following methods:
   - Select the workbook tab in which to create a new worksheet by clicking the **New Worksheet** button.
   - Right-clicking and selecting **New Worksheet**.
   - Select another worksheet on the same tab.
2. Press **Insert**.

   A new worksheet is created.

   Assign the appropriate properties using the worksheet tabs (**General**, **Position Queries**, and **Style Overrides**). Refer to "Defining Worksheet Properties" for more information.

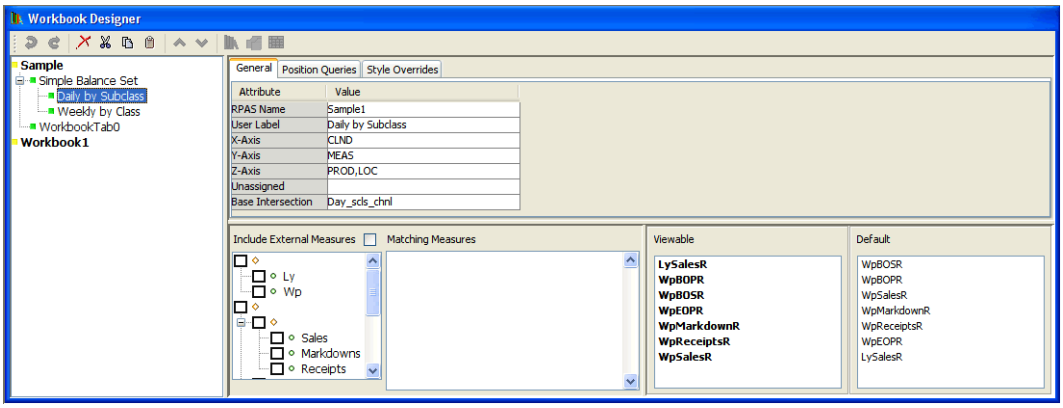
Defining Worksheet Properties

When a worksheet is selected from the Workbook Designer window, the following tabs appear in the workspace:

- General
- Position Queries
- Style Overrides

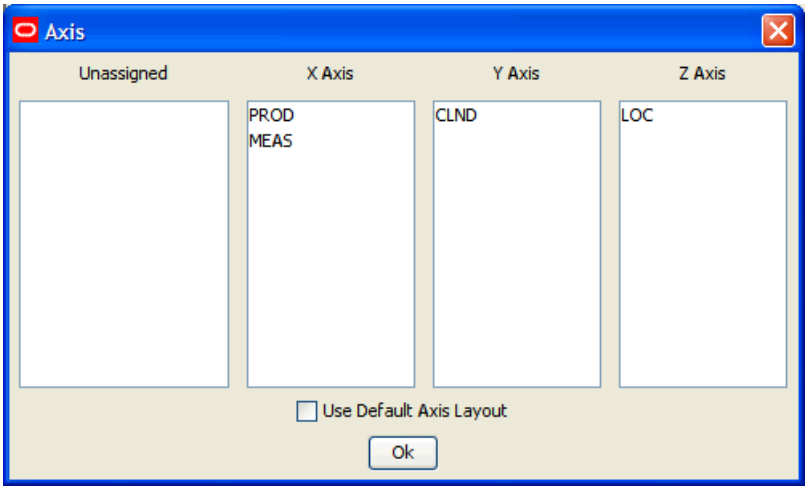
Refer to the topics below of information on using these tabs to define the worksheet properties.

General Tab



Example of General Tab for a Worksheet

1. In the **RPAS Name** field, enter the RPAS internal name of the worksheet.
2. In the **User Label** field, enter a description of the worksheet that users will see.
3. Define the axis layout of the worksheet.
   a. Click the X-axis, Y-axis, Z-axis, or Unassigned field. The Axis dialog box opens.

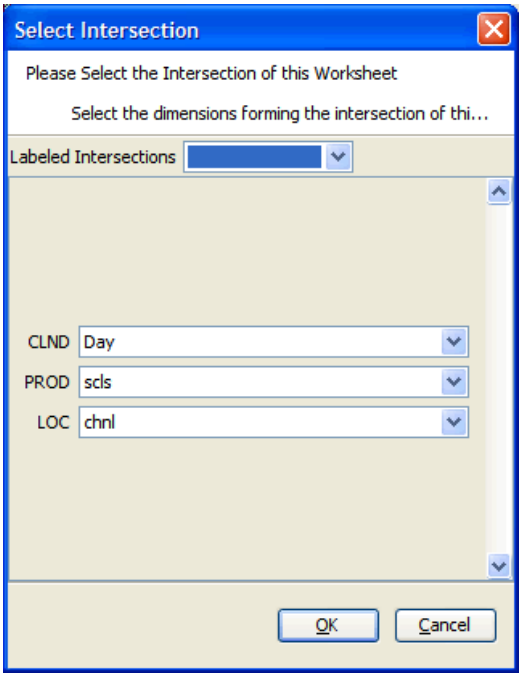


Axis Dialog Box

   b. Drag the hierarchies to the appropriate axis column.
   c. Click **OK** to save any changes and close the window.

Note: The Hierarchies that appear in this process are those used by measures placed on the default and viewable profiles for the worksheet. If no measures have yet been placed in those profiles, no hierarchies will appear in this process.

4. Click in the **Base Intersection** field. The Select Intersection dialog box opens.

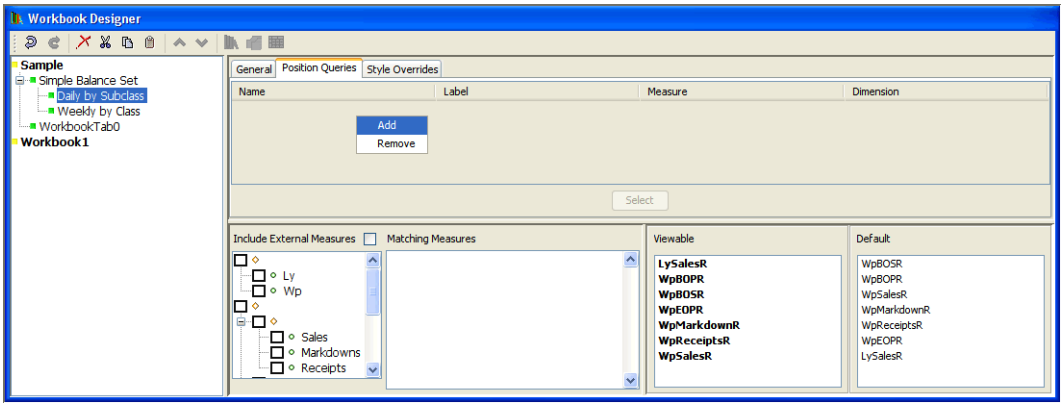


Select Intersection Dialog Box

Note: The hierarchies and dimensions that appear in this process are those used by measures placed on the default and viewable profiles for the worksheet. If no measures have yet been placed in those profiles, no hierarchies will appear in this process.

5. Select the dimension for each hierarchy. The base intersection of the sheet represents the base set of dimensions at which the window could be displayed. Data on the window can be viewed at any dimension/intersection above this. If the base intersection of a measure on the sheet is below the base intersection of the sheet, the measure's values are shown aggregated to the displayed intersection. If measure's base intersection is above the sheet intersection, the measures values are hashed out at all intersections lower than the base intersection of the measure.
6. Click **OK**.

Position Queries Tab



Example of Position Queries Tab for a Worksheet

Usage of this tab is optional. This tab allows you to specify a worksheet where the positions that are shown in a "query" dimension are based on the current position in "driving" dimension(s). The driving dimension(s) must be in the slice area, and the query dimension must be in the X or Y axes. The process uses a position query that is a Boolean measure dimensioned on the query dimension and the driving dimension(s). Only positions in the query dimension that have the value TRUE for the position query measure for the position(s) in the driving dimension(s) are shown in the worksheet. All other positions are automatically hidden. When more than one driving dimensions are present, all of the driving dimensions have to be in Z-axis for the position query to execute. If one or more driving dimensions are taken out of the Z-axis and placed in X or Y axes, associated position queries will not be executed. A given window can have more than one position query, driven by one or more dimensions in the Z-axis and driving different dimensions in the X and Y axes.

1. Click the **Position Queries** tab.
2. Right-click in the table area, and select **Add**.
3. Enter the following information:
   - **Name –** The name for the position query used by RPAS. This name has to be unique across the project.
   - **Label –** The label for the position query that is used internally by RPAS. This label has to be unique across the project.

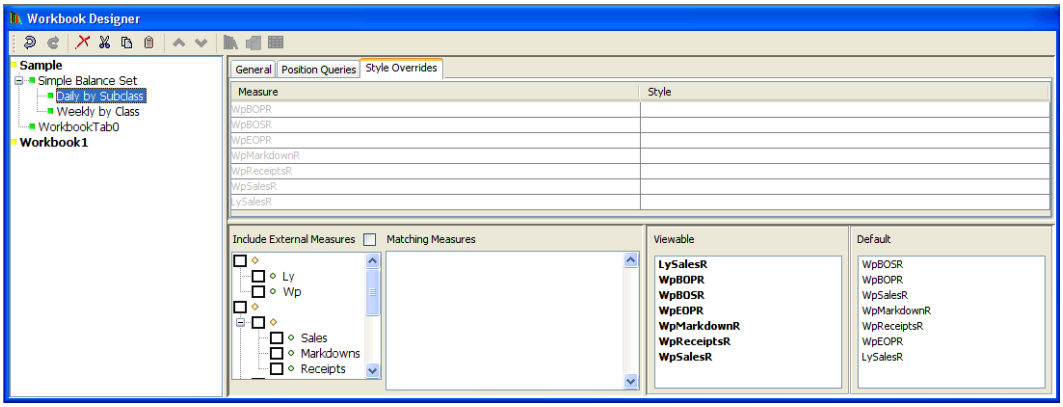
     Note: Duplicate label names are not allowed.

   - **Measure –** This defines the position query measure. This must be a Boolean type measure. Click in the field, and then click **Select Measure** to view a list of the Boolean measures used in the workbook. Type the first few characters of the measure name in the box at the top of the list to go to the required measure, or scroll to find it. Double-click to select the desired measure.
   - **Dimension –** This defines the query dimension. Select a dimension from the list of dimensions for the selected measure.

> **Note:** While configuring position queries, it is important that the Boolean mask measure that drives the position queries be reference in the workbook (by either referencing it in the load rule group or by setting it through the calc rule groups). Currently, there is no validation in Configuration Tools that checks for this, and no error is thrown at configuration time/domain build time or workbook build time.

To remove a row from the tab, select the row, right-click, and select **Remove**. The row is deleted from the Position Queries tab.

Style Overrides Tab



Example of Style Overrides tab for Worksheet

Usage of this tab is optional. This tab allows you to override the style property for a measure, so that the measure uses a different formatting style on this worksheet.

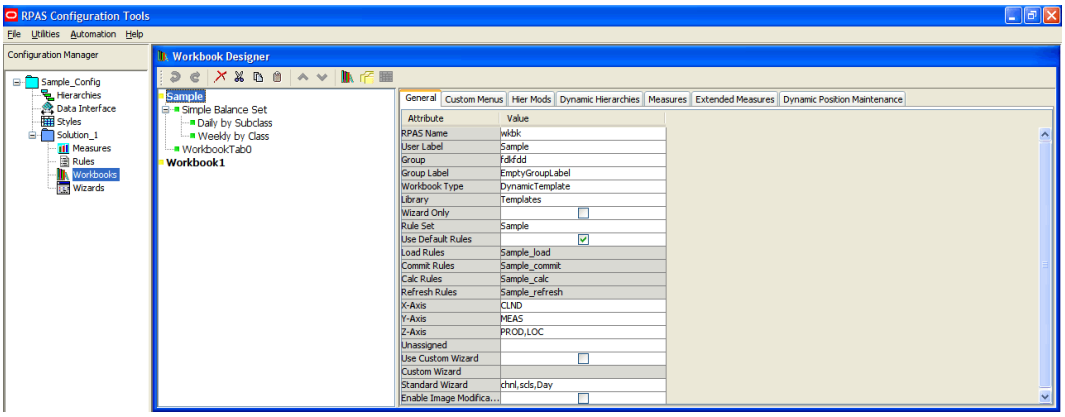
> **Note:** The measures that appear in this process are those placed on the default and viewable profiles for the worksheet. If no measures have been placed in those profiles, no measures will appear in this process.

1. Click the **Style Overrides** tab.

   The list of measures appears with their current formatting style appears.
2. Select an override formatting style for a measure. Measures whose styles have been overridden appear in black. Those whose styles are defaulting appear in gray.

Specify Which Measures Appear in a Worksheet

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.



Workbook Designer Window

1. Select the worksheet to be used to specify measures.
2. In the column that displays measure components (under Include External Measures), select the check boxes next to the Measure components. The matching measures will appear in the Matching Measures column as the components are selected. Only realized measures that are used in the rule set that is assigned to the selected workbook will be displayed.
3. If External Measures are to be available for placement on the worksheet, select the **Include External Measures** check box.
4. To add measures from the matching measures column to the **Viewable** or **Default** columns, perform one of the following options:
   - Select the measures to add from the **Matching Measures** column. Drag the measures to the **Viewable** or **Default** column.
   - Select the measures to add from the **Matching Measures** column and press **Ctrl+C**, and then click in the **Viewable** or **Default** column and press **Ctrl+V**.
   - Right-click in the **Matching Measures** column and select **Copy**, and then select **Paste** from the right-click menu in the **Viewable** or **Default** column.
   - To add ALL measures from the **Matching Measures** column, right-click in the **Viewable** or **Default** column and select **Add Matching** from the menu.
5. To add measures from the **Viewable** column to the **Default** column, perform one of the following options:
   - Select measures in the **Viewable** column, and drag the measures to the **Default** column.
   - Select measures in the **Viewable** column and press **Ctrl+C**, and then click in the **Default** column and press **Ctrl+V**.
   - Right-click in the **Viewable** column, and select **Copy**. Right-click in the **Default** column, and select **Paste**.

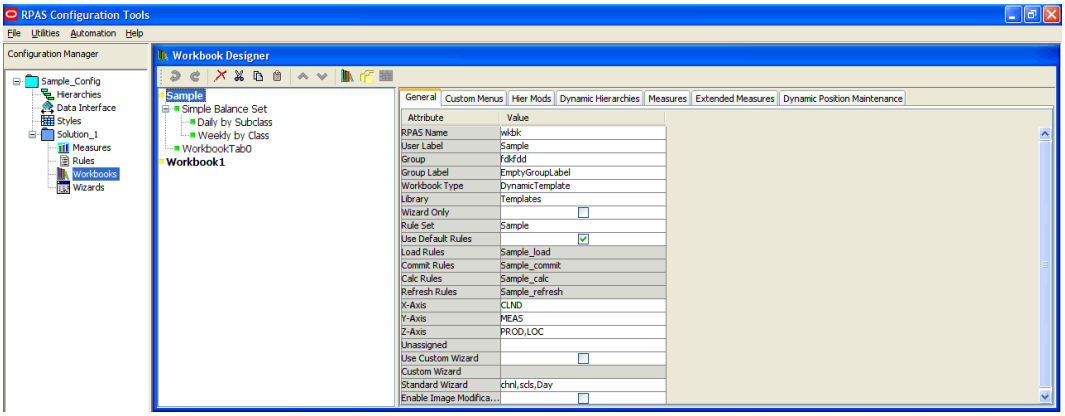
> **Note:** Adding a measure to the **Default** column also adds it to the **Viewable** column if it is not already in the **Viewable** column.

6. To remove measures from the Viewable or Default columns: perform one of the following options:
   - Select the measures to remove and press **Delete** or **Ctrl+X**, or right-click and select **Cut**.
   - Right-click and select **Remove Matching** to remove all measures that are also in the Matching Measures column, or select **Remove All** to remove all measures.

> **Note:** Removing a measure from the **Viewable** column also removes it from the **Default** column.

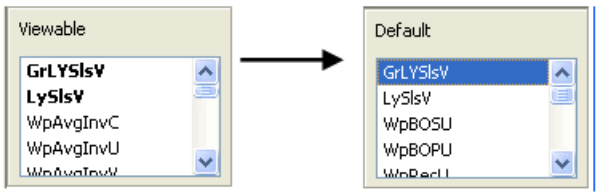
Specify the Sequence of Measures on a Worksheet

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.



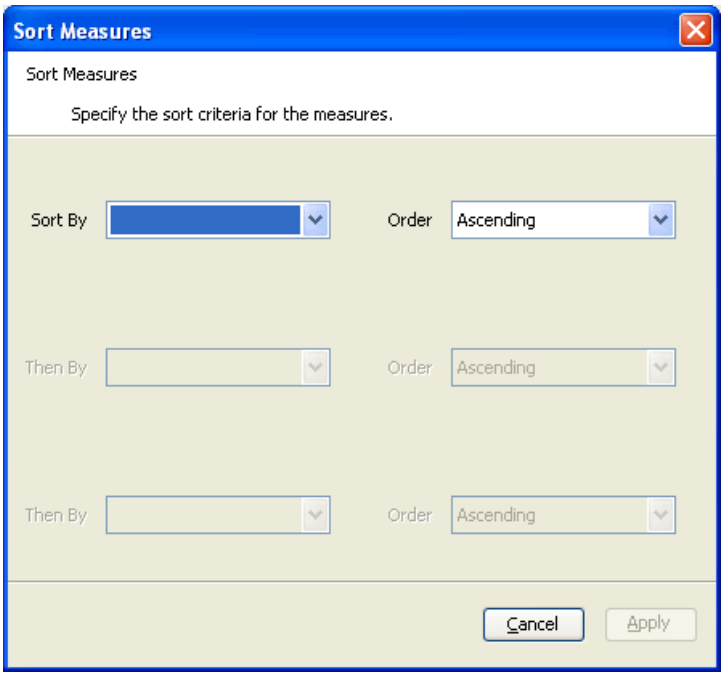
Workbook Designer Window

1. Select the worksheet that will be used to sequence measures.
2. To sequence measures manually, drag and drop the measures from the Viewable column to the Default column.



3. To sort the measures:
   a. Right-click and select **Sort** in the Default column. The Sort Measures dialog appears.

> **Note:** Sorting measures are based on the internal component name (not the label).



Sort Measures Dialog Box

b. Measures can be sorted based on their major components. Select the sort sequence in which the major components are to be applied, and whether the sort should be ascending or descending

c. Click **Apply**.

The measures are sorted into the specified sequence. This is a "one time" sort. If new measures are added to the **Default Measures** column, or measures are manually sequenced, the sort sequence previously specified will no longer apply. You would need to resort the measures again.

To be able to see the Measures in this Order in RPAS Client...

1. Right-click in the measure axes of RPAS Client and select **Sort**. The Sort dialog appears.
2. Select **User Specified Order**, and click **OK**.

   The measures in the RPAS Client for that window will be shown in the same order as that specified in the Default column of the window in the Configuration Tools.

Edit Worksheet Properties

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Workbooks**. The Workbook Designer window opens in the workspace.

1. Click the worksheet to edit.
2. Update the information as appropriate.
3. To remove information from the Position Queries table:
   a. Select the field.
   b. Right-click and select **Remove**.

Remove a Worksheet

Perform the following procedure to remove a worksheet:

1. Select the worksheet to remove.
2. From the toolbar, click the **Delete**  button, or right-click and select **Remove**.
3. Click **Yes**.

Wizards

Overview

This section describes the tasks you can perform by using the wizard designer. The wizard designer supports the graphical layout for custom wizards.

When the workbook build process only involves selecting the scope of the workbook by selecting positions from the standard hierarchies, you can use standard wizards as described in the "General Tab" section of the "Workbook." Most of the workbooks can be built using the standard wizards, and no coding is required – just configuration.

If the wizard process needs to do additional processing, you need to use custom wizards. The following two examples will help to clarify the need for custom wizards.

A simple example:

Consider the product hierarchy:

If the workbook builder needs to select just a few SKUs from a domain that contains many SKUs, that process could be tedious if the builder is presented with a wizard with huge numbers of SKUs. You may want to include a two-step process to select the SKUs:

- In the first step, the builder selects a class.
- In the second step, the builder selects SKUs from just the SKUs in that class.

A more complex example:

The workbook build process may need the builder to make choices from some predefined options. The choices that the builder makes could determine what further selections or choices the builder must make. The workbook that is eventually built could therefore be of several different 'subtypes.'

Neither of the examples above are configurable as "Standard Wizards," so custom wizards must be used. The custom wizards can be designed in the custom wizard designer, but must be accompanied with code that:

- Describes the sequence of the wizards
- Collects and processes the information from the wizards
- Generates the content of the next wizard
- Describes the content of the workbook that is generated

In the first example, the workbook designer lays out two 2-tree wizards (one for class and the other for SKU). Then to support the wizard process, the designer would write the code to read the selection from the class wizard and range down the available SKUs in the second wizard.

In the second example, the designer lays out the first wizard page as a group of check boxes (or list boxes if there are too many options). The designer would also lay out the other wizard pages that are required. The designer writes the code to collect the

selections made in the first wizard, and to display (or not) the other wizard pages that are dependent on the selections made.

In summary, when using custom wizards, the designer is responsible for:

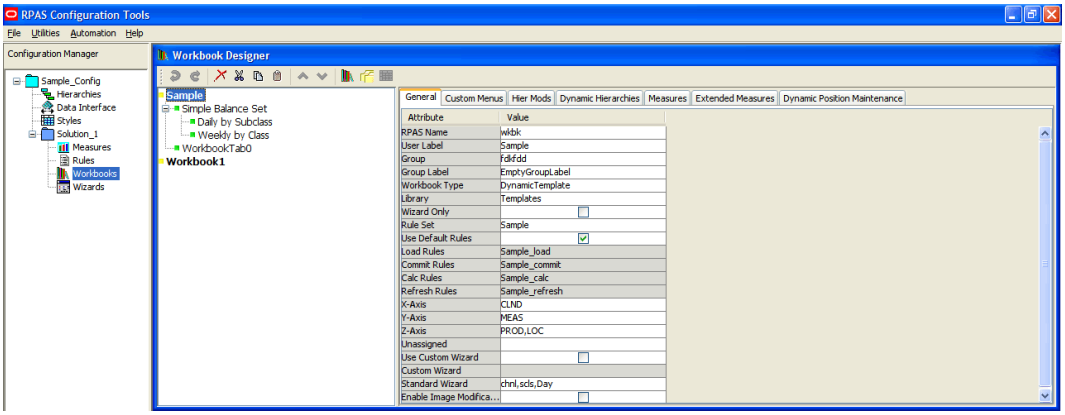
- Laying out the wizards.
- Writing code to control the transition between the wizards and out of the wizards.
- Writing code to initiate the building of the workbook.

The Wizard Tool only helps the designer in the first aspect of this work. The designer (the one who establishes the layout of these wizards) is expected to have knowledge of the process of controlling, collecting, and processing the information from these wizards.

The rest of this section describes working with layout of the custom wizards.

Create a Wizard Group

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Wizards**. The Wizard Designer window opens in the workspace.



Wizard Designer Window

1. In the Wizard Designer window, click the **New Wizard** button.
2. In the **Wizard Group** area, click in the **Value** field, and enter the name of the Wizard Group.

Create a Wizard Page

1. Click the button to add the appropriate control:

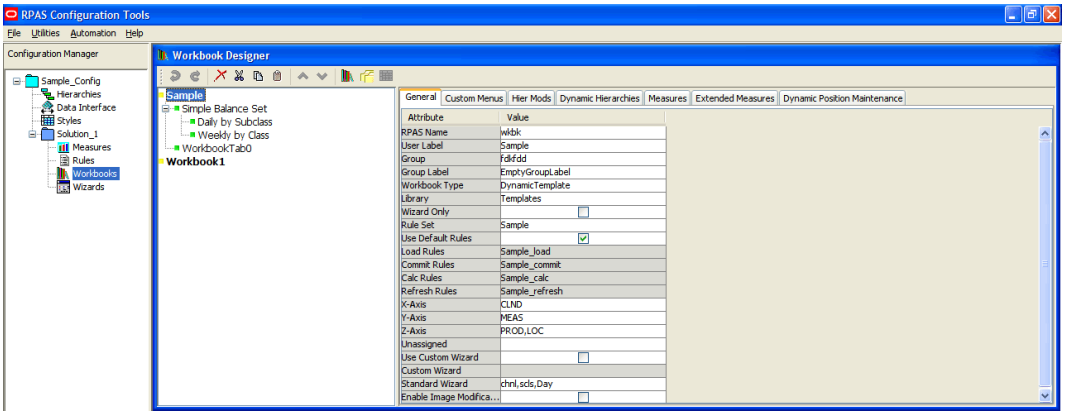
Button	Function
	Supports the creation of a new dynamic wizard.
	Supports the creation of a two tree page.
	Supports the creation of a label field that cannot be edited in the resulting wizard.
	Supports the creation of a radio button field from which the user can make one choice from several options.
	Supports the creation of a checkbox field from which the user can make multiple choices from multiple options.
	Allows the insertion of a drop-down list box from which the user can select the entered choices. The selection will be displayed in the text box.
	Allows the insertion of a field in which the user can enter free-form text.
	Allows the insertion of a list box that contains a list of items from which the user can select.
	Supports the creation of a labeled area in the wizard where other wizard elements can be grouped.
	Allows the insertion of a date picker (spinner) that contains independently scrollable date components.
	Allows the insertion of a single tree into the wizard.
	Allows the insertion of a generic object in the wizard.

2. Click on the wizard page grid to place the selected control on the page.
3. If necessary, drag the control to the appropriate place on the grid to reposition it.
4. In the Widget area, enter the following information:
   - **Name –** The RPAS internal name of the control.
   - **Type –** The control type.
   - **Text –** The text to be displayed on the control label.
   - **Align –** The same as the style attribute. Valid values are left, right, center, multiline, and flip depending on the type of widget being created.
   - **Func –** Indicates whether the widget will be dynamic or static. These are the only valid values for this attribute.
   - **Locx –** The x coordinate of the control on the wizard page. The value of this field is automatically changed when the control is moved using your mouse.

- **Locy –** The y coordinate of the control on the wizard page. The value of this field is automatically changed when the control is moved using your mouse.
- **Width –** The width of the control in pixels.
- **Height –** The height of the control in pixels.

Edit Wizard Control Properties

Navigate: In the Configuration Manager, select **Project** – **Solution** – **Wizards**. The Wizard Designer window opens in the workspace.



Wizard Designer Window

1. Select the wizard group tab that contains the wizard to edit.
2. Select the wizard tab that contains the widget to edit.
3. Select the widget.
4. In the **Widget** area, update the information as necessary.

5

System Preferences

Overview

General preferences can be set for the Configuration Tools at the workbench level, which refers to the entire tool. This includes the domain type and general preference settings.

Global Domain

Overview

A Global Domain environment provides the ability to view data from multiple physical domains in a single workbook, and to administer common activities centrally across the RPAS solution.

Domains can be built in one of two methods:

- Simple Domain – This is the traditional, stand-alone domain that has no visibility to other domains.
- Global Domain – This is a domain environment that contains two or more local domains (or sub-domains) and a master domain that has visibility to all local domains that are part of that environment.

There are two primary functional benefits in using a Global Domain environment:

- The ability to have a global view of data in workbooks.

  The end user can build workbooks with data from multiple local domains, refresh global workbook data from local domains, save global workbooks, and commit the data from global workbooks to the individual local domains.

  Local domains are typically organized (partitioned) along organizational structures that reflect user responsibilities and roles. Most users will only work within the local domain(s) that contain their area of responsibilities, and they may not need to be aware of the Global Domain environment. For performance and user contention reasons, Global Domain usage should be limited to relatively infrequent processes that require data from multiple local domains.
- Configuration and Administration.

  Most of the mechanisms that are required to build and administer a domain are centralized, so they need only be run in the "master" domain, which either propagates data to the local domains or stores it centrally so that the local domains reference it in the master.

> **Note:** For a Global Domain environment to function properly, all local domains must be structurally identical.

Measure Data

In a global domain environment, measure data can be physically stored across the local domains or in the master domain.

Measure data that is stored in local domains is split across the domains based on a pre-determined level of a given hierarchy. This level is defined during the configuration process, and it is referred as the "partition" level.

The base intersection of a measure (the dimensions that a measure contains) determines whether data is stored in the local domains or in the master domain. The data will be stored in the master domain if the base intersection of a measure is above the "partition" level or if it does not contain the hierarchy on which the Global Domain environment is partitioned. This type of measure is referred to as a "Global Domain measure," or a "Higher Base Intersection measure."

Consider a global domain environment where the partition-level is based on the Department dimension in the Product hierarchy. In this scenario, data for measures that have a sbase intersection in the Product hierarchy at or below Department (other hierarchies are irrelevant for this discussion) is stored in the local domain. This is based on the Department that the underlying position in the Product hierarchy belongs to.

Measures that have a higher base intersection in the Product hierarchy than Department (for instance, Division) or measures that do not contain the Product hierarchy (such as a measure based at Store/Week) cannot be split across the local domains. These measures will reside in the master domain, and they will be accessed from there when these measures are required in workbooks.

All measures will be registered in the master domain, and they will be automatically registered in all local domains. RPAS automatically determines where the measure needs to be stored by comparing the base intersection of the measure against the designated partition-level of the Global Domain environment.

The physical location of the measure data will be invisible to the user after the measure has been registered.

Multi-Language

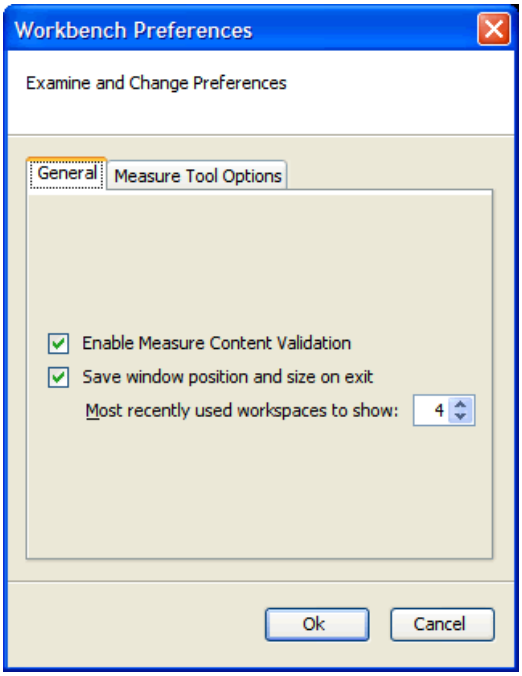
RPAS domains are built to be used in English only or in English and other languages. Multi-lingual domains allow for most data elements in an RPAS domain to be translated into another language. The translation process is managed by the Oracle Translation group and is handled as a separate agreement with Oracle.

Note: An existing domain cannot be converted to multi-lingual after it has been built.

Setting Workbench Preferences

Navigate: From the File menu, select **Tools Preferences**. The Workbench Preferences window opens.

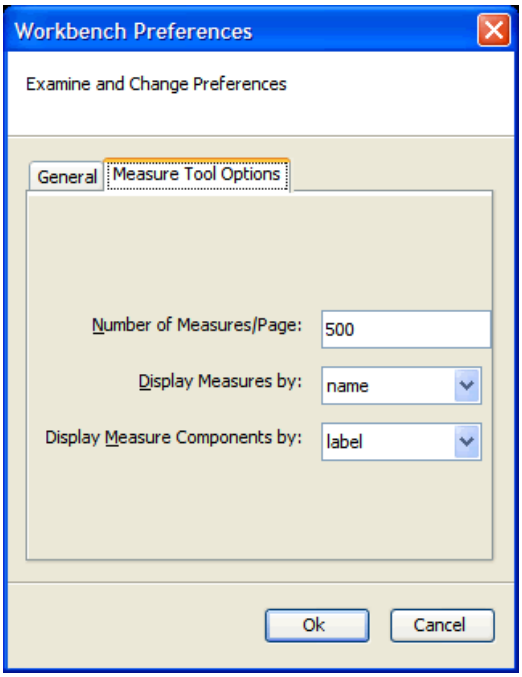
1. Select the **General** tab and select the appropriate options.



Workbench Preferences Dialog – General Tab

- The main file menu lists configurations that were recently opened. The number of configurations is displayed in this menu. To set the number of configurations, set the **Most recently used workspaces to show** field by using the up and down arrows.
- Select the **Measure Content Validation** check box to enable measure content validation. Deselect the check box to disable measure content validation. A change to the properties of a measure can affect the validity of a large number of components both within the Rule Tool and the Workbook Tool. Whenever a measure editing session is completed (for instance, upon exiting the Measure Manager and entering a different tool), the workbench will evaluate the effects of the edits made upon the measures. This process can be time consuming. When the Measure Content Validation option is unchecked, the automatic validation of measure property edits is disabled. This allows for rapid transitioning between tools when working on a large configuration, because it will not be necessary to await the completion of the automatic validity checking. When automatic validation is disabled, a manual check of measure validity can be enabled from the Rule Tool. This allows you to manually update the measure content validation of the Rule and Workbook Tools (see "Measure Validation within the Measure Manager" for more information).

2. Select the **Measure Manager Options** tab and adjust the fields as needed.



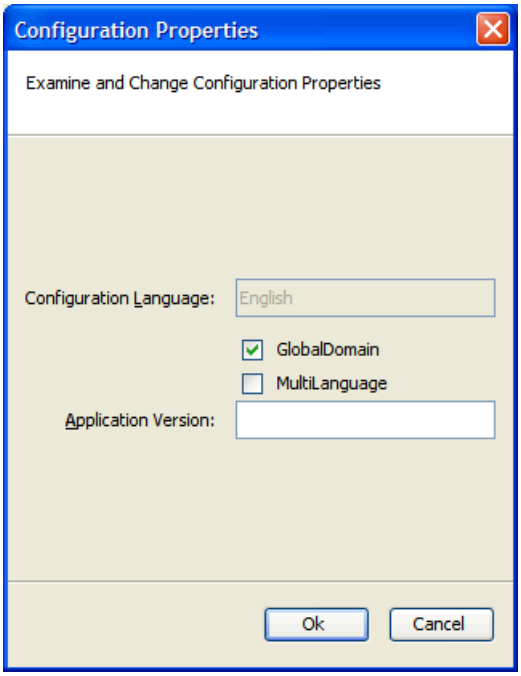
Workbench Preferences Dialog – Measure Tool Options Tab

- **Number of Measures/Page –** The Measure Manager display only a certain number of measures per page in the Measure tab. This option determines the number of measures that appear on a page.
- **Display Measures by –** This list provides two options, **name** and **label**, and determines whether measures are displayed using their name or label in the Configuration Tools. For example, in the Workbook Tool when selecting viewable measures, the name or the label will be displayed depending on the selection here.
- **Display Measure components by –** This list provides two options, **name** and **label**. Your selection determines how measure components in the Measure Manager are displayed.

3. Click **OK** to save any changes, and close the window.

Setting Configuration Properties

Navigate: From the File menu, select **Configuration Properties**. The Configuration Properties dialog box opens.



Configuration Properties Dialog Box

The **Configuration Language** field is disabled by default. English is displayed in the field because currently configurations can only be in English.

1. Select the following options as necessary:
   - **Global Domain–** Select this option if the configuration uses a global domain environment. This enables the creation of workbooks in multiple domains and to administer and update multiple domains from a single master domain.
   - **MultiLanguage –** Select this option if the configuration supports multiple languages in the domain.
2. Click **OK** to save any changes, and close the window.

6

Configuration Utilities

Overview

The utilities in this section are standalone utilities that can be run externally or they can be launched from the utilities menu of the Configuration Tools. The utilities provided include the Configuration Converter and the Function Library Manager, which are described in detail.

Configuration Converter

Overview

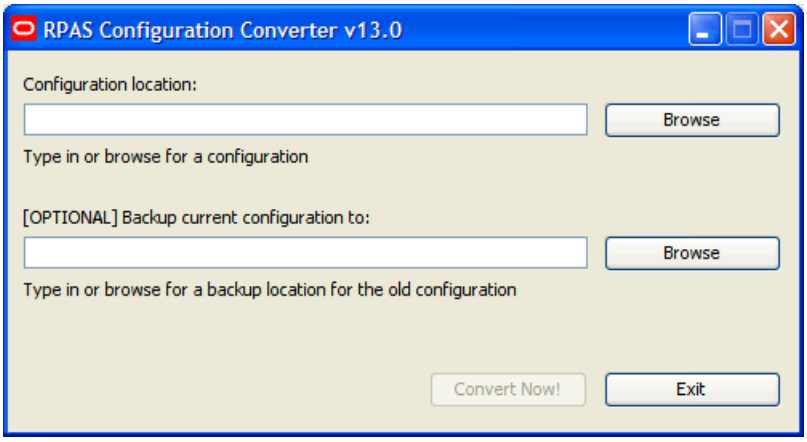
> **Note:** The functionality for converting a configuration is provided directly through the Configuration Tools. See the section, "Open an Existing Project from an Older Version of the Configuration Tools" in Chapter 3.

The Configuration Converter is a standalone utility that converts a configuration that was originally created and saved in a prior release of the Configuration Tools. Only configurations created in a prior major release need to be converted. Configurations saved in previous versions of the same major release, but in different minor releases, do not need to be converted.

Launching the Configuration Converter

The Configuration Converter can be accessed in three ways:

1. From the Utilities menu in the Configuration Tools, select **Configuration Converter**. The Configuration Converter window appears.



RPAS Configuration Converter Window

2. From the Windows Start menu, select **Oracle – RPAS – Utilities**, and select **Configuration Converter**. The Configuration Converter window appears. If this shortcut does not appear, refer to the *RPAS Installation Guide* for information about creating it.

3. Go to a command prompt. Run the RpasConverter.exe file in the \utilities directory where the Configuration Tools were installed and run the following command:

   `RpasConverter -c C:\PathToConfig\Config\Config.xml [OPTIONS]`

   The following options can be used from the command line:

   `-b BackupDir`

   Use this argument to create a backup of the original configuration in *BackupDir* location specified.

   `-g`

   Use this argument to open the RPAS Configuration Converter screen shown above.

   `-h`

   Use this argument to display usage information.

Converting a Configuration

1. In **Configuration location** field, enter path and configuration file name to be converted. This is the file in the configuration's directory that has the configuration name with an ".xml" extension. You may also click the **Browse** button to navigate and select the appropriate file. Make sure to provide the file extension in the Configuration location field.

   Example of Configuration location field entry:

   C:\Configs\MyConfig\MyConfig.xml

2. Optional: In the **Backup current configuration to** field, enter a directory where a copy of the original configuration will be stored. You may also click the **Browse** button and to navigate and select a directory.

   > **Note:** The directory entered must not already contain a directory whose name is the name of the original configuration. For example, to put a backup of a configuration named "MyConfig" in a directory "C:\Backups," "C:\Backups\MyConfig" must not exist.

3. Using the **Convert to version** list, select the version to convert to. This should always be the current version of the Configuration Tools unless there is a good reason to convert to some older version.
4. Click **Convert Now**.
5. If the conversion was successful, it may now be opened in the Configuration Tools. If there was an error while converting, an error message will be displayed, and the original configuration will remain untouched.

   > **Note:** See the *RPAS Administration Guide* and *RPAS Installation Guide* for more information on the domain installation and upgrade process.

Functional Library Manager

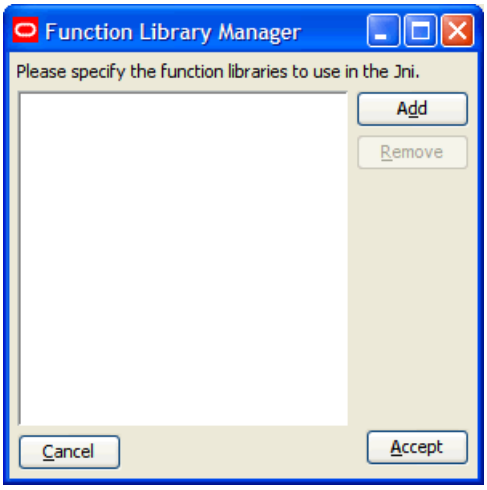
Overview

The RPAS calculation engine is designed to be extensible with support for custom functions or procedures that can be used in normal expressions. For validation purposes, the Configuration Tools are only aware of the standard RPAS functions and procedures, so they will generate an error for any expressions that use custom functions or procedures. The Function Library Manager is used to provide validation for custom functions or procedures within the Configuration Tools. The custom functions or procedures must exist in the /applib directory of the RPAS_HOME directory. If necessary, this utility can also be used to remove custom function libraries from being validated. There is no validation for the existence of the function libraries in RPAS_HOME/applib directory. When a function library is removed using the Function Library Manager, it is removed only from the list of external libraries used for validation, and the contents of RPAS_HOME/applib directory are left intact. The function libraries mentioned in this list are loaded by the Configuration Tools and will be used to perform rule validation.

Speak to an Oracle Retail Services representative for additional information about custom functions and procedures.

Launching the Functional Library Manager

Navigate: From the **Utilities** menu in Configuration Tools, select the **Function Library Manager**, or run the Functional Library Manager.bat file from the **utilities** directory where the Configuration Tools is installed. The Function Library Manager window appears.

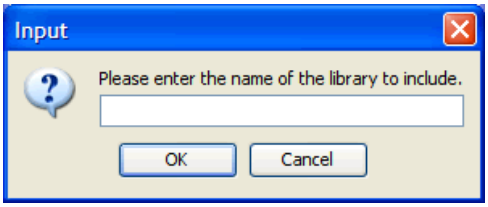


Function Library Manager Window

Adding a Function Library to Be Validated in the Configuration Tools

Perform the following procedure to add a function library to the Configuration Tools:

1. Launch the Function Library Manager.
2. Click **Add**. The Input dialog box appears.



Input Dialog Box

3. Enter the name of the library you want recognized.

> **Note:** Enter the name without the *.dll or *.so extension.

4. Click **OK**.
5. Click **Accept** to save any changes and close the window.

Removing a Function Library from Being Validated in the Configuration Tools

1. Launch the Function Library Manager.
2. Select the Function Library you want to remove from the validation process.
3. Click **Remove**. The Function Library is removed from the list.
4. Click **Accept** to save any changes and close the window.

Report Generator

Overview

The Report Generator is a utility that may be used to extract information about a configuration for external use. The information is generated in a structured text document that is much easier to manipulate than the XML format of the configuration files that are saved and loaded by the workbench. Many of the reports correspond to files generated as a part of the installation process.

Available Reports

The following reports can be created using the Report Generator:

- **Measure Extractor** – This report generates a text file that lists the measure content of a solution.
- **Data Interface Report** – This report generates a text file that lists the properties of all of the measures in the project that have been added to the Data Interface Tool.
- **Measure Description Translation** – This report generates a translation file similar to the file generated as part of the installation process. It allows the extraction of measure descriptions for a project without the need to build the domain first.
- **Measure Label Translation** – This report generates a translation file similar to the file generated as part of the installation process. It allows the extraction of measure labels for a project without the need to build the domain first.
- **Measure Patch Report** – This report examines a previous version of a configuration to determine which measure properties have changed between the two versions. It is

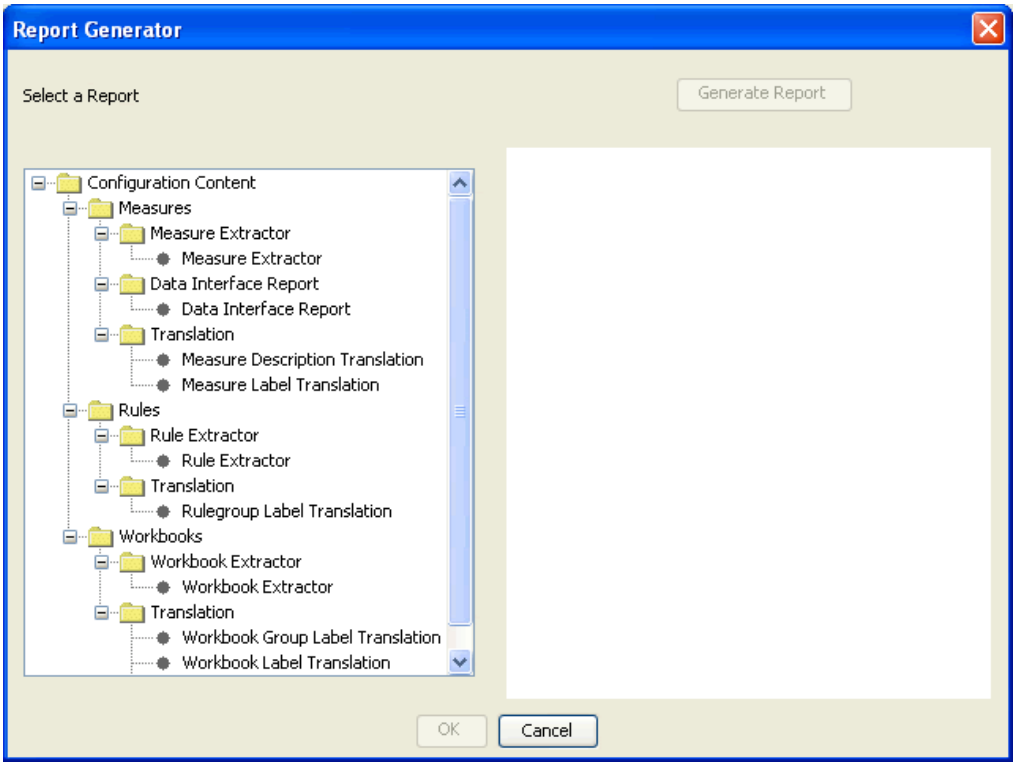
used to determine which measures will be added, removed, or updated during a patch installation.

- **Rule Extractor** – This report generates a text file that lists the rule content of a solution.
- **Rule Group Label Translation** – This report generates a translation file that is similar to the file generated as part of the installation process. It allows the extraction of rule group labels for a project without the need to build the domain first.
- **Workbook Extractor** – This report generates a text file that lists the workbook content of a solution.
- **Workbook Group Label Translation** – This report generates a translation file that is similar to the file generated as part of the installation process. It allows the extraction of workbook group labels for a project without the need to build the domain first.
- **Workbook Label Translation** – This report generates a translation file that is similar to the file generated as part of the installation process. It allows the extraction of workbook labels for a project without the need to build the domain first.
- **Messages Translation** – This report generates a translation file that is similar to the file generated as part of the installation process. It allows the extraction of messages issued by the RPAS Client for a project without the need to build the domain first.

Generate a Report

Perform the following procedure to generate a report:

1. Select the project that requires the report.
2. Select **Generate Reports** from the Utilities menu. The Select a Report dialog box opens.



Select a Report Dialog Box

3. Select the desired report from the list in the left pane of the generator dialog. The right pane displays a short description of the currently selected report.
4. Select **Generate Report** to begin the report generation process.
5. Depending upon the report in question, there may be a number of options to specify in further dialogs. These options commonly include the location where the generated file is to be stored or the selection of a single solution from the project.
6. Once all options have been specified, click **OK** to generate the report. The **OK** button will not be enabled until all options have been specified.

A

Appendix: Global Domain Technical Information

Overview

A domain can be implemented as a simple domain when:

- the data size for individual measures is small
- the number of users working on the domain at any given period of time is small

The domain can be implemented as a global domain when:

- the data size is increasing due to the hierarchy size
- there are several people using the same domain

In the global domain environment, the global domain is accompanied by two or more subdomains that contain a subset of the data that would have been in a simple domain. Each of the subdomains contains a subset of one of the hierarchies of the global domain. More specifically, the subdomains contain a subset of positions along the partition dimension. All of the measures that are defined to be at or below this dimension will be stored in the local domains. Measures above this dimension are stored in the global domain. An administrator can directly access the local domains, and a subset of users will be dealing with each local domain. This way, there is less contention between users. A domain can only be partitioned along one hierarchy of the domain.

Note the following points when configuring and setting up a global domain environment:

- When creating a new global domain configuration file, globaldomainconfig.xml, reference the RPAS example of the configuration file, globaldomainconfig_example.xml, which is located in the %RPAS_HOME%/domain/config_examples directory of the RPAS installation. Reference this to use as a guide in building this file. Once this file is created, put it in the configdir directory path as specified by using the `-configdir` option in the Installer.
- In the globaldomainconfig.xml file, specify (in the path) the entire path to the master domain and the subdomains, including the root name of the domains. The path leading up to the root of the master domain must exist, but the master domain root directory must not exist at the beginning of the domain build process. The path to the subdomains must also exist unless the subdomains are located inside the root of the master domain.
- The master global domain will contain a directory called config, which will house the globaldomainconfig.xml file. Do not delete this directory or file.
- Do not delete the tmp directory under the domain home directory while the domain build process is taking place.
- To configure the global domain functionality, provide a globaldomainconfig.xml file that specifies how each of the local domains should be partitioned based on position groupings. If a globaldomainconfig.xml file is not provided and the partitioning dimension is provided, a local domain will be built for each position within the partitioning dimension. For example, if a company has five departments, and

"department" is the partitioning dimension, there will be five local domains and one master global domain.

- Conditional parameters that are used by the Installer for configuring and setting up a global domain environment are as follows:

  –dh <domain_home> : where <domain_home> is the path to the directory in which the domain will be created

  Non-Global Domain – required

  Global Domain (with globaldomainconfig.xml) - required

  Global Domain (with globaldomainconfig.xml) – throws usage error

  –configdir <config_directory> : where <config_name> is the path to the configuration XML files, including globaldomainconfig.xml, hierarchy.xml, and calendar.xml.

  Non-Global Domain – optional, but required if using a calendar.xml file

  Global Domain (with globaldomainconfig.xml) - required

  Global Domain (without globaldomainconfig.xml) - optional, but required if using a calendar.xml file

  –p <dim_name> : where <dim_name> is the partitioning dimension. Only valid if the configuration has been marked as a global domain configuration with the Properties dialog box. If the `configdir` option is specified and a globaldomainconfig.xml file is found in the location, the `-p` option will be ignored and the partitioning dimension that is specified within the globaldomainconfig.xml file will be used instead.

  Non-Global Domain – throws usage error

  Global Domain (with globaldomainconfig.xml) - throws usage error

  Global Domain (without globaldomainconfig.xml) - required

- For patching a global domain implementation; measures, rules, and workbook templates can be changed; and the master domain and local domains will be patched accordingly. A non-global domain implementation CANNOT be updated to a global-domain implementation and vice versa. The Global Domain flag in the configuration is ignored during the patch process, so the construction of the implementation will not change even if its status has been changed.
- When patching either a global domain implementation or a regular, standalone, or single domain; in the call to the Installer (`rpasInstall`); it is imperative that none of the parameters that were used during the original domain build are changed with the exception of replacing `fullinstall` with `patchinstall`. We recommend using a script for the `rpasInstall` call so that it is easier to change the `fullinstall` parameter to `patchinstall` while leaving the other parameters in their original state.

B

Appendix: Calculation Engine Users Guide

Overview

The RPAS calculation engine is a very powerful and flexible engine that is built to support OLAP type calculations against a multi-dimensional model. At first sight, the engine is very complex. However, when the building blocks of the calculation engine are properly understood, much of this apparent complexity goes away. This overview of the calculation engine processes will therefore start by describing the three fundamental processes of aggregation, spreading, and expression evaluation before explaining how the various processes integrate into a comprehensive whole.

RPAS supports an OLAP-type model. In this model, individual pieces of data, called cells, apply to a single position in one or more hierarchies or dimensions. These will typically include a "measures" dimension, a calendar or time hierarchy, and other hierarchies such as for products and locations. The measures dimension is fundamentally different to the other hierarchies because measures (in other systems measures may be referred to as facts, performance indicators, or variables) represent the fundamental events or measurements that are being recorded, whereas the positions in the other hierarchies provide a context for the measurement (for instance; where, when, or what). Measures relate to one another through rules and expressions. Positions in all the other hierarchies relate to each other through hierarchical relationships.

RPAS supports two different forms of relationships between cells:

- Hierarchical relationships that require aggregation and spreading
- Measure relationships that require rules and expressions

Hierarchical relationships, such as weeks rolling up to months or stores rolling up to regions, require the aggregation of data values from lower levels in a hierarchy to higher levels. This is performed using a variety of methods as appropriate to the measure. To enable such data to be manipulated at higher levels, RPAS supports "spreading" the changes, which is also performed using a variety of methods. Aggregation and spreading are basic capabilities of the engine that require no coding by implementation personnel, other than the selection of aggregation and spreading types to use for a measure.

The inherent relationships between measures can be modeled through rule and expression syntax. Most of the effort in configuring an application model is in modeling these relationships.

The RPAS calculation engine is designed to be robust and extensible, while in complete control of the calculation process. It enforces data integrity by ensuring that all known relationships between cells are always enforced whenever possible. Much of the logic of the processing of rules and rule groups depends on this basic principal.

Measure Definition and Base Intersections

Certain characteristics of a measure determine how the calculation engine should handle it with regard to calculation, aggregation and spreading, and the dimensions in the hierarchies at which the measure is calculated. Since this information applies across all rules and rule groups, it is set up as part of the definition of a measure.

Data Types

RPAS supports the following data types:

- **Real**

  Floating point numeric values. Most measures are of this type.
- **Integer**

  Numeric integer values. There are no special "spreading" algorithms for integer measures, which should normally be used only for measures that are calculated "bottoms up."
- **Date**

  Date and time. Can easily be converted to position names by standard functions.
- **String**

  Variable length strings. Typically used for notes and names.
- **Boolean**

  True or false values. Typically used for flags and indicators.

Base Intersection

The base intersection for a measure is a list of dimensions (such as Class/Store/Week), one per appropriate hierarchy, which defines the lowest level at which data is held for the measure. Data is assumed to apply to the "All" position in any hierarchy, which is not explicitly referenced in the base intersection (see Non-Conforming Expressions for more information). Through aggregation, data will logically exist (though there may not be a value) for all levels higher than the base intersection up all alternative rollups.

Aggregation and Spreading Types

The aggregation type defines the aggregation method to be used for the measure (refer to Aggregation for more information) to produce values at higher levels from values at the base intersection. There is a "normal" spreading method associated with an aggregation type, which defines the method to be used to spread changes from higher levels (see Spreading) to the base intersection. Depending upon the desired characteristics of the measure, there may be several valid allowed spreading types.

Aggregation

Overview

By definition, an OLAP-type model has hierarchical relationships between positions in hierarchies. The values of measures above their base intersections for these hierarchical relationships are automatically maintained through a process referred to as aggregation.

Different types of measures need to be aggregated in different ways. Many measures, such as sales, receipts and markdowns, record the events that actually occurred or are planned to occur during a period of time. Simple totaling can produce aggregate values for these: the value for a region is the sum of the stores in the region; the value for a month is the sum of the weeks in the month; and so on. But this technique does not work for all types of measures. For example, with stock, the values record a snapshot at a point in time rather than a total of events over a period of time. The value of stock for a region is the sum of the stock in the stores in the region, but the value of stock for a month is certainly not the sum of the stocks for the weeks in the month. It is usually either the value for the first week or the last week in the month. Similarly, there are measures where the appropriate aggregation type may be to calculate an average, or a minimum,

and so on. For some calculation purposes, only cells that are "populated" (have a value other than their default value, which is typically zero) should participate in aggregations. RPAS supports a wide variety of aggregation types to support all of these requirements.

There is also another class of measures where no aggregation technique would produce the correct result. These measures are typically prices, ratios, variances, and similar performance indicators. The average price of sales for a class cannot be calculated by summing the prices of items in the class. Averaging the prices of items in the class produces a better result, but it is still not accurate because it fails to take account of the weighting of the sales of the items in the class. One item with a very large volume of sales at a low price would pull down the average price attained for the class as a whole, but this would not be reflected in an average aggregation. The way to get a correct result is to redo the price calculation at the required level. By dividing the sales value for the class by the sales units for the class (both of which will have been aggregated by summing), a correctly weighted result will be produced. The type of measure that requires this type of "aggregation" is referred to as a "recalc" measure, as "aggregation" is by recalculation of the expression used to calculate the measure. In planning applications it is not unusual for 40% or more of the measures to be of recalc type.

Aggregation Types

The table below displays the aggregation types supported by the RPAS calculation engine.

Aggregation Type	Measure Type	Description
Hybrid	For any measure type	The measure is aggregated using a specific aggregation type for each hierarchy. This is selected from the valid aggregation types for the measure type. At intersections that are aggregated in more than one hierarchy, the aggregation type used is that for the highest priority hierarchy.
recalc	For any measure type	The measure is not aggregated, but is recalculated at all aggregated levels through a recalc expression. The passthrough function is not supported with this agg type.
total	For numeric measures only	The measure is aggregated by taking the total (numeric sum) of all child values at the base intersection.
average	For numeric measures only	The measure is aggregated by taking the numeric average of all child values at the base intersection.
min	For numeric and date measures only	The measure is aggregated by taking the minimum of all child values at the base intersection. **Note:** For most purposes, the min_pop aggregation type will be more appropriate because the minimum value of all child values will typically be the naval, which is usually zero.
max	For numeric and date measures only	The measure is aggregated by taking the maximum of all child values at the base intersection.
median	For numeric measures only	The measure is aggregated as the median value (the middle value when sorted from lowest to highest) of all child values.

Aggregation Type	Measure Type	Description
pst [period start total]	For numeric measures only	For cells at the base intersection in the time hierarchy, the measure is aggregated by taking the total (numeric sum) of all child values. For cells at aggregated levels in the time hierarchy, the measure is aggregated by taking the value of the first child time period.
pet [period end total]	For numeric measures only	For cells at the base intersection in the time hierarchy, the measure is aggregated by taking the total (numeric sum) of all child values. For cells at aggregated levels in the time hierarchy, the measure is aggregated by taking the value of the last child time period.
and	For Boolean measures only	The measure is aggregated by performing a Boolean and of all child values.
or	For Boolean measures only	The measure is aggregated by performing a Boolean or of all child values.
ambig	For string type measures only	The measure is aggregated by considering the values of all child cells. If all child cells have the same value, the aggregated value is the same as the child cells. Otherwise it is ambig.
popcount	For any measure type	The measure is aggregated by counting the number of child cells that are populated (have a value different to the naval for the measure).

There are also "pop" (that is, “populated”) versions of several aggregation types. These aggregate in the same manner as the aggregation type above, but only consider cells that are populated, which means that they have a value different to the naval for the measure. This may not necessarily mean a value that an end-user thinks of as being “populated.”

These aggregation types are as follows:

- **ambig_pop** - ambig of all populated values
- **average_pop -** Average of populated values
- **min_pop -** Minimum of populated values
- **max_pop -** Maximum of populated values
- **median_pop -** Median of populated values
- **total_pop -** Total of populated values

> **Note:** Only measures with an aggregation type of ambig, pst, or pet can be aggregated from below the partition levels to above the partition levels in a global domain.

Spreading

Introduction

By definition, an OLAP-type model has hierarchical relationships between positions in hierarchies. Measures are calculated in dimensions above the base intersection by aggregation by using the parent-child relationships between the positions. RPAS allows such measures to be manipulated not only at the bottom levels, but also at aggregated levels. In order to preserve the integrity of the data with such a change, RPAS needs to change the underlying data values at the base intersection for the measure, so that when they are aggregated again, they result in the changed value at the aggregated level. The method of changing the base intersection values to achieve this is known as spreading.

Spreading always applies to cells at the base intersection of the measure. At all aggregated levels above the base intersection, the effect of any change is applied by considering all cells at the base intersection that are descended from the changed cell (for instance, children and grandchildren). These calls are described as 'child cells' in this description. Spreading does not operate from level to level to level down a hierarchical roll-up, which would not only be less efficient, but would also generate different (and generally less acceptable) results when there are changes or locks at levels between the change being spread and the base intersection.

The RPAS engine allows changes to be made to a measure for positions at multiple levels, and the effect of all such changes are performed in a single calculation step. The basic technique for managing this spreading is the same for all spreading methods, and it is described in "Multi-Level."

For calculation purposes, a lock to a cell for a spreadable measure is treated as a change to that cell that re-imposes the previous value. If none of the child cells of the locked cell have changed, the lock has no effect, and all child cell values remain unchanged.

Locks and Spreading around Locked and Changed cells

Other than in the special case where there are no cells that are free to be changed, spreading only affects cells that are free to be changed. All child cells are free to be changed except for those that are elapsed (see Chapter 8), locked by the user, explicitly changed by the user, or that have already been recalculated as the result of spreading another (lower level) change. Spreading always attempts to spread around locked or changed cells without changing their values. Where none of the child cells are free to be changed, spreading applies to all child cells that are not elapsed by using the changed or recalculated values as the base values to spread upon. For spreading purposes, when something has to give, elapsed cells are considered to be 'more important' than locked or changed cells.

Locked cells for recalc type measures are treated in an analogous manner: the mapping expression (see The Spreading of Recalc Type Measures) is reimposed (using recalculated values of other measures on the right hand side of the mapping expression if necessary) to recalculate the mapped measure. It is then spread normally.

Note: The effect of spreading where there are no child cells free to be changed is that the result for some lower level locked or changed cells will be different to the locked value or the change made. Effectively, higher level locks or changes are deemed to be 'more important' than lower level ones. Causing the circumstance where there are no free child cells can be a very useful technique when initializing data. For example, in a single calculation, a "shape" can be applied to child cells, and then a "total" to the parent cell. The result is that the parent total is spread across the children using the appropriate spreading technique, but according to the supplied shape. This is because the higher level change takes precedence.

Spreading Methods

Just as different types of measures require different aggregation techniques, different types of measures require different spreading techniques. Measures that cannot be aggregated (that is, are of "recalc" type) are not usually spread at all (see The Spreading of Recalc Type Measures), but they may employ the replicate spreading technique. The default spreading method for a measure is set up as part of the definition of the measure. This is the spreading technique that is used for all changes to the measure unless explicitly overridden on edit by the user.

The spreading methods that are supported by RPAS are listed here and described in the following sections:

- Proportional Spreading
- Replicate Spreading
- Even Spreading
- Delta Spreading
- PET and PST Spreading

Proportional Spreading

Proportional spreading is the most commonly used spreading technique once data has been initialized, and it is the default spreading method for most spreadable measures. In proportional spreading, all 'children' that are free to be changed are changed in the same proportion so that their existing ratios to each other are maintained, and the required value for the parent is achieved. If proportional spreading is used for a measure that is not initialized (that is, its children all have the "naval"), the children are assumed to all have the same weight, so the effect of the spreading is the same as the even spreading method.

Example:

- **Starting values** – ChildA 10, ChildB 20, ChildC 30, ChildD 40, Parent 100.
- **Changes** – Parent changed to 145, ChildA changed to 20, ChildB locked.
- **Resulting value**s – ChildA 20, ChildB 20, ChildC 45, ChildD 60, Parent 145.
- **Spreading Process** – ChildA and ChildB are not free to be changed by spreading because ChildA was explicitly changed and ChildB was locked. The required parent value of 145 must include 40 from ChildA and ChildB, and thus ChildC and ChildD must total 105. The previous total for ChildC and ChildD was 70, so their values must be changed by applying the multiplier of 105/70. Thus the new values for ChildC is 45, and for ChildD is 60.

  After aggregation, the result is as follows:

  The parent has the value 145, as required

  ChildA has the required 20

  ChildB did not change

  The ratio of ChildC being 75% of ChildD is maintained

This spreading method is not allowed for measures with a recalc aggregation type.

Replicate Spreading

Replicate spreading is sometimes used when initializing data, especially for recalc type measures, and for measures with aggregation type such as average, minimum, and maximum. It is unusual for it to be the default spreading method for any measure, but may be used by overriding the spread method on data entry. In replicate spreading, all child cells that are free to be changed are changed to the value of the parent cell. With replicate spreading, there is no guarantee that after aggregation the value of the parent cell will be the value that was replicated. In fact, it usually will not be. Replicate spreading should be considered to be an indirect way of entering the same value into multiple child cells.

Example:

- **Starting values** – ChildA 10, ChildB 20, ChildC 30, ChildD 40, Parent 100.
- **Changes** – Parent changed to 145, ChildA changed to 20, ChildB locked.
- **Resulting values** – ChildA 20, ChildB 20, ChildC 145, ChildD 145, Parent 330.
- **Spreading Process** – ChildA and ChildB are not free to be changed by spreading because ChildA was explicitly changed and ChildB was locked. The parent value of 145 is replicated to ChildC and ChildD. After aggregation, the result is that the parent has the value 330.

This spreading method is allowed for measures with a recalc aggregation type.

Even Spreading

Even spreading is sometimes used when initializing data. It is unusual for it to be the default spreading method for any measure, but it may be used by overriding the spread method on data entry. In even spreading, all child cells that are free to be changed are changed to the same value, which is the total for the parent cell for the free child cells divided by the number of free child cells.

Example:

- **Starting values** – ChildA 10, ChildB 20, ChildC 30, ChildD 40, Parent 100.
- **Changes** – Parent changed to 145, ChildA changed to 20, ChildB locked.
- **Resulting values** – ChildA 20, ChildB 20, ChildC 52.5, ChildD 52.5, Parent 145.
- **Spreading Process** – ChildA and ChildB are not free to be changed by spreading because ChildA was explicitly changed and ChildB was locked. The required parent value of 145 must include 40 from ChildA and ChildB, and thus ChildC and ChildD must total 105. This is spread evenly, thus the new values for ChildC and ChildD are both 52.5.

  After aggregation, the result is:

  The parent has the value 145, as required

  ChildA has the required 20

  ChildB did not change

  The remainder has been spread to ChildC and ChildD evenly

This spreading method is not allowed for measures with a recalc aggregation type.

Delta Spreading

Delta spreading is sometimes used when data is fully initialized. If it is used when the measure is not initialized, the effect will be the same as even spreading. It is unusual for it to be the default spreading method for any measure, but it may be used by overriding the spread method on data entry. In delta spreading, all child cells that are free to be changed are changed such that the delta to the parent cell is spread evenly across those child cells.

Example:

- **Starting values** – ChildA 10, ChildB 20, ChildC 30, ChildD 40, Parent 100.
- **Changes** – Parent changed to 145, ChildA changed to 20, ChildB locked.
- **Resulting values** – ChildA 20, ChildB 20, ChildC 47.5, ChildD 57.5, Parent 145.
- **Spreading Process** – ChildA and ChildB are not free to be changed by spreading because ChildA was explicitly changed and ChildB was locked. The required parent value of 145 must include 40 from ChildA and ChildB, and thus ChildC and ChildD must total 105. The previous total for ChildC and ChildD was 70, so the delta to the parent is 35. This delta is spread evenly across the children, so ChildC and ChildD are both increased by 17.5. Thus the new values for ChildC is 47.5, and for ChildD is 57.5.

  After aggregation, the result is as follows:

  The parent has the value 145, as required

  ChildA has the required 20

  ChildB did not change

  The increase to the parent has been evenly divided between ChildC and ChildD

This spreading method is not allowed for measures with a recalc aggregation type.

PET and PST Spreading

PET (period end total) and PST (period start total) are special spreading types to support measures with the PET or PST aggregation types where the values of cells represent snapshots at a period of time rather than a total of events. Opening and closing stock (inventory) are typical examples of such measures, where the value for a month will be the value for the first (opening stock) or last (closing stock) week in the month, but values up non-time hierarchies will be produced by total aggregation.

PET and PST measures require special spreading. We anticipate a future enhancement to support spreading changes to such measures at aggregated time positions by spreading the effect of the change across all children of the time period. At present, the PET and PST spread types change the first or last child only. At present, a change to closing stock for a month has exactly the same effect as a change to closing stock for the last week in the month.

Multi-Level Spreading

The RPAS engine allows changes to be made to a measure at multiple levels, all of which are dealt with in a single calculation. Because spreading requires parent-child relationships, and spreading is effected between the intersection that is changed and the base intersection for the measure, there is a requirement that all changes to be effected by a single calculation must fall on a single hierarchical roll-up. This is controlled by Hierarchical Protection Processing, which is described in the next section.

When there are changes at multiple levels, the spreading process fundamentally works "bottoms-up." That means lower level changes are implemented before higher level changes. The spreading algorithm starts with the lowest level in the hierarchical roll-up that has changes, and it spreads each change at that level in turn.

The result of this process is that every child cell of a changed cell is no longer free to be changed. If it was previously free to be changed, it has now been recalculated by spreading. When all changes at a level have been performed, the algorithm moves on to the next lowest level in the hierarchical roll-up that has changes, and it continues in this manner until all changes have been performed. If a higher level change overlaps a lower level change, the lower level changes are unaffected because all child cells of the lower level change will not be free to be changed.

Example (using proportional spreading):

- **Starting values** – jan 10, feb 15, mar 20, apr 25, may 30, jun 35, jul 40, aug 45, sep 50, oct 55, nov 60, dec 65. firsthalf 135, secondhalf 315, year 450.
- **Changes** – year changed to 500, firsthalf changed to 150, jan changed to 15, feb changed to 20, mar locked, jul and aug changed to 50, sep locked.
- **Resulting values** – jan 15, feb 20, mar 20, apr 26.39, may 31.67, jun 36.94, jul 50, aug 50, sep 50, oct 61.11, nov 66.67, dec 72.22. firsthalf 150, secondhalf 350, year 500.
- **Spreading process** – The first change to be spread is the change to the first half to be 150. jan, feb and mar now total 55, so apr, may and jun must total 95. By proportional spreading the results are 26.39, 31.67 and 36.94. The second change to be spread is the 500 for the year. Only the months oct-dec are now free to be changed. The other months total 300, so oct-dec must total 200. By proportional spreading, the results are 61.11, 66.67, 72.22.

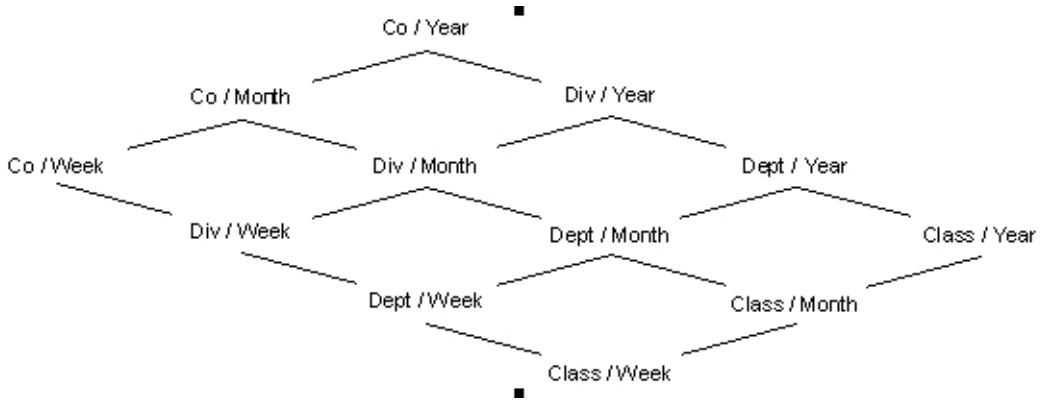
Hierarchical Protection Processing

Hierarchical protection processing is a process that ensures that all changes made at aggregated levels fall on a single hierarchical roll-up, which is a prerequisite for the spreading process to function correctly. Hierarchical protection processing operates by protecting (preventing direct manipulation) cells for intersections for combinations of dimensions that cannot reside on a single hierarchical roll-up with the changes already made.

In theory, since hierarchical protection processing is necessary to ensure the integrity of the spreading process and each measure is individually spread, hierarchical protection processing could operate independently for each measure. Having the manipulatable measures varying from intersection to intersection would probably cause considerable confusion to the users and would make implementing a consistent methodology difficult. For simplicity, hierarchical protection processing operates on all measures.

An OLAP-type model has multiple hierarchies and spreading operates from the cell that has been changed to all child cells at the base intersection, so hierarchical protection processing must operate across multiple hierarchies. A single hierarchy may have multiple roll-ups, which are also considered. Whenever a change or a lock is made to an intersection for a new combination of dimensions, the calculation engine checks all other combinations of dimensions, and it protects those that cannot be on the same hierarchical roll-up as changes already made. It does this by considering a "cross multiplication" of hierarchical roll-ups across all the hierarchies.

A simple example will clarify the process. Consider the matrix of "cross multiplied" dimension combinations that result when there is a 2-dimensional product by time model with the dimensions Co/Div/Dept/Class and Year/Month/Week. This is shown below schematically with parent-child relationships:



Other than at the top of a hierarchical roll-up, each combination of dimensions has two parent combinations: one per hierarchy with the next highest dimension, so class/week has parents of class/month and department/week.

> **Note:** For the sake of simplicity, the picture does display the roll-up of the “all” dimension (all products, all time periods).

All spreading is from the changed level to the base intersection (class/week in this example). Consider a change at an intersection of Div/Month. We know that the spreading hierarchical roll-up must be a path from the top (Co/Year) to the bottom (Class/Week) that passes through Div/Month. There are six such paths, none of which go through the combinations Co/Week, Dept/Year or Class/Year, so those combinations of dimensions are all protected. If the next change is at an intersection of Class/Month, then Div/Week and Dept/Week are similarly protected.

> **Note:** Hierarchical protection processing always reflects the current set of locks and changes.

RPAS allows cells that have been changed or locked to be unchanged or unlocked before the calculation is initiated. If an unchange or unlock removes the last change or lock for a combination of dimensions, some other combinations of dimensions that were previously protected could become unprotected. In our example above, if the first change to a Div/Month were now unchanged so that the only change outstanding is at Class/Month, then Dept/Year and Class/Year would now become manipulatable again, but Co/Week, Div/Week and Dept/Week would still be protected.

> **Note:** Non-conforming measures (see Non-Conforming Expressions) may lead to hierarchical protection processing that may appear to be over protective.

When considering hierarchical protection processing, all measures have their "scope" expanded to include the "all" level of all hierarchies that they are not dimensioned on. For example, the implications of this are that a change to a measure with a base intersection of "class," which is interpreted as meaning "class/all," would prevent the manipulation of a measure with a base intersection of "year," which is interpreted as "all/year."

The Spreading of Recalc Type Measures

Measures that are of recalc type are not usually spread by any spreading technique. Spreading techniques typically rely on the existing relationships between a parent and its children in the spreading process. In a recalc measure, those relationships cannot be relied upon because they are not "weighted." Spreading of changes to a recalc measure is therefore indirect, and applying a "mapping rule" effects the change.

A mapping rule is a rule (with two or more expressions) that calculate a spreadable measure from the changed value of a recalc measure and other measures. The selected expression for the rule is evaluated at the level of the change to the recalc measure. It results in a changed value of a spreadable measure, and if this is above the base intersection for that measure, it is spread normally using its default spreading method. Therefore, a change to a recalc measure should be considered to be an indirect change to the spreadable measure that it is mapped to.

The only constraint on the manipulability of a normally spreadable measure is through protection processing, which prevents the manipulation of measures that will be calculated. For a recalc measure, the measure must have a mapping rule. Without a mapping rule, the measure cannot be manipulated.

> **Note:** A recalc measures can only appear in a single rule in a rule group. The RPAS calculation engine therefore knows that rule contains the recalc expression for the recalc measure. If there are other expressions in the rule, they may be used as mapping expressions, which allows the recalc measure to be manipulatable. If there is just a single expression in the rule that calculates the recalc measures, the recalc measure is non-manipulatable through normal protection processing.

Non-Conforming Recalc Measures

Having a recalc measure on the right-hand side of an expression that calculates a measure whose base intersection is higher than that of the recalc measure, or using the level modifier on a recalc measure on the right-hand side of an expression can cause incorrect values to be calculated. These incorrect values can then have a knock-on effect onto other measures. Therefore, in these circumstances expressions should be written such that the right-hand side of the expression should have a "recalc expression" rather than a recalc measure. See the following section on “Non-Conforming Expressions” for more information.

Expressions, Rules, and Rule Groups

Introduction

Measures are related together through algorithmic relationships. For example, the sales value may be the sales units multiplied by the selling price. In RPAS, these relationships are specified through expressions, which are grouped for usage into rules and rule groups.

It is a fundamental principle in RPAS that the calculation engine maintains and guarantees the integrity of all the active relationships between cells at all times. Hierarchical relationships are maintained through the processes of spreading (see Spreading) and aggregation (see Aggregation). Relationships between measures are maintained by the evaluation of expressions. One of the great strengths of RPAS is that both of these types of relationships are automatically maintained in a non-procedural manner. You do not have to write code to determine what is calculated, how it is calculated, or in what sequence it is calculated. All that is required is the definition of the relationships themselves, although you do provide prioritization information to guide the calculation engine when there is a choice of calculation paths.

In an RPAS model, all cell values at aggregated level can be determined by aggregation from the cells at the base intersection. Although the description that follows is a simplification, a basic understanding of the working of the calculation process, and the importance of expressions, can be gained by understanding the interconnection between three fundamental processes: spreading, "bottom level" expression evaluation, and aggregation. A more detailed and precise description refer to The Calculation Cycle. Changes to measures at aggregated levels are spread down to their base intersections. Here, the calculation engine enforces all measure relationships that are no longer guaranteed to be true by evaluating an expression. This is because the cell values of one or more of the measures in the relationship have changed directly, through spreading, or by prior evaluation of an expression When base intersection calculation is complete, all measures at the base intersection that have been changed are aggregated to re-impose cell integrity.

Expressions

Expressions are the basis of all calculations of the relationships between measures. They are evaluated by the calculation engine during a calculation. Expressions are written in a syntax that allows for the calculation of one or more measures from other measures, constants and parameters, using standard arithmetical functions and a rich set of mathematical, technical, and business functions. Expressions are therefore an algorithmic statement of a relationship between measures. Details of the allowable syntax for expressions are provided in a separate document.

Rules

An expression describes the relationship between measures in a way that causes a measure to be calculated through the expression. An expression may be said to ‘solve’ the relationship for the measure that is calculated through the expression. In some cases, there may be business methodology reasons for wanting more than one of the measures in a relationship to be calculable or solvable through that relationship.

To support this requirement, RPAS has the concept of a rule, which consists of one or more expressions that describe the same relationship between measures, but that solve for different measures. All of the expressions in a rule should use the same measures, and

must have a different target measure. The target measure is the measure on the left-hand side (LHS) of the expression that is calculated by the expression.

Where a rule has multiple expressions, those expressions are given a priority sequence to help the calculation engine select a calculation path that follows business priorities. Consider the rule that relates together sales value, sales units, and sales price. Let us assume that there are three expressions in this rule. Each of the measures involved in the rule may be 'solved' through the rule. For instance, if there is a change to a sales value, it should be clear that the calculation engine could enforce the mutual integrity of all the cells by holding the sales price constant and recalculating a new sales units. It could also achieve the same end by keeping the sales units constant and recalculating the sales price. Both approaches are mathematically valid, and produce a consistent result with complete data integrity. However, it is likely that one approach makes more 'business sense' than the other. In this case, most businesses in most circumstances would want the price to remain constant and have the units recalculated. The prioritization of the expressions in the rule provides this information to the calculation engine. Considerable care should be taken in the design of models to ensure that appropriate expression priorities are established.

When given a choice, the calculation engine will always select the highest priority expression in the rule that is available to be selected. In this example, the expression that calculates sales units would have a higher priority than the expression that calculates sales price. Similar consideration of the desired effect of a change to sales units will probably lead to a conclusion that the expression that calculates sales value would also have a higher priority than the expression that calculates sales price.

What of the relative priority of the expressions to calculate sales value and sales units, and the "business priority" for those expressions? That may vary from implementation to implementation. It may even vary from one type of plan to another in the same implementation. For a financial merchandise plan, the preferred behavior may be that a change to the sales price only causes a recalculation of the sales units, whereas in a unit-oriented lower level plan, the preferred behavior may be that a change to the sales price causes a recalculation of sales value.

The same measure may appear in multiple rules. This will often be necessary because the same measure can be involved in many different relationships with other measures. For example, there may be a relationship between sales value, sales units, and sales price. Sales value may also be involved in another relationship with closing stock and a cover value, and yet another with opening stock, receipts, markdowns and closing stock.

Rule Groups

It is most unusual for a model to only require a single rule. In most cases, there will be a collection of relationships between measures that must be maintained. In RPAS, a Rule Group is a collection of rules that are treated as a unit by the calculation engine with the integrity of all the rules in the rule group being maintained together. The calculation engine always has one (and only one) active rule group. Even if all that is required is a single expression, that single expression will be in a rule, and that single rule will be in a rule group. The process by which the integrity of all the rules in a rule group is maintained is quite complex. It is described in detail in The Calculation Cycle topic.

Rules within a rule group are given a priority. The calculation engine uses this to select a calculation path that follows business priorities by using rule priorities to determine which rule to enforce when there is a choice to be made. This is described in more detail in The Calculation Cycle topic.

There may be many rules defined within a system as a whole. The validation of rules is performed in isolation, but rules within a rule group are also validated in the context of

all the other rules in the rule group. This can mean that a rule that is perfectly valid syntactically, but it is not valid within a particular rule group. Rule group validations include:

- Each rule in a rule group must represent a completely different measure relationship. Therefore no two rules in a rule group may use exactly the same collection of measures, and neither may one rule group use a collection of measures that is a sub-set of the collection of measures in another rule.
- There must be an expression that calculates each recalc measure.
- Any measure that is on the LHS of the only expression in a rule may not be on the LHS of any other expression.

Although there may only be one active rule group at any time, RPAS allows for the definition of multiple rule groups to satisfy different calculation requirements. Rule groups may be one of four different types:

- **load** – The RPAS application automatically uses the load rule group when loading data into the workbook.
- **calculate** – RPAS supports multiple calculation rule groups. Menu options may be configured to allow the user to select a different calculation rule group. RPAS ensures a smooth transition from one calc rule group to another.
- **refresh** – The RPAS application automatically uses the refresh rule group to refresh data.
- **commit** – The RPAS application automatically uses the commit rule group when committing data to the domain.

These rule groups are perfectly 'normal,' so although they will typically include many rules that use the master modifier to load or commit data, they may also have other rules. For example, it is perfectly possible to commit data to the domain for a measure that does not exist in the workbook merely by including the appropriate rule to calculate the measure (with the master modifier) in the commit rule group. Similarly, a measure may be loaded into a workbook that does not exist in the domain by including an appropriate rule to calculate the measure in the load rule group.

Rule Group Transitions

Although only a single rule group may be active at any time, RPAS supports the transition from one rule group to another. The calculation engine ensures the integrity of measure relationships at all times so this process is not merely a case of switching from one rule group to another. There is no guarantee that the integrity of the rules in the rule group being transitioned have been maintained.

RPAS makes a worst case assumption when transitioning rule groups. Any rule that is in both the old and new rule groups is assumed to have its integrity maintained. Any other rule is assumed to be potentially wrong, and so is flagged as "affected." A normal calculation is then initiated. Expressions to be evaluated are determined by the usual process (see The Calculation Cycle). All affected rules will therefore have their integrity imposed by the evaluation of an expression, and 'knock-on' effects may cause some rules that occur in both the old and new rule groups to also be evaluated. Since all base intersections must be calculated during rule group transition, a large or complex rule group transition is likely to take longer than a normal calculate.

There are circumstances when automatic rule group transitions occur:

- **On data loading**

  Data is loaded using the load rule group. This will typically load measures by calculating them from the data values held on the domain using the master modifier, but it may also calculate other measures that are not explicitly loaded. When the load is complete, the system will automatically transition to the calculate rule group.

- **On data refreshing**

  Data refreshing causes some measures to be updated from values held on the domain. Refreshing uses the refresh rule group, but there is no real transition. The measures that are affected by the refreshed measures are treated as affected in the calculate rule group, and a normal calculate of that rule group follows. Effectively, data refreshing causes a calculation by using the calculate rule group as if the cells that were refreshed were directly changed by the user.

- **On data committing**

  There is a normal transition from the current calculate rule group to the commit rule group. This will typically commit measures by calculating them on the domain by using the master modifier. When transitioning back from the commit rule group to the calculate rule group, there is an assumption that only measures with a "master" modifier have changed and therefore no transition is required.

The Calculation Cycle

Introduction

The calculation cycle always uses the current active rule group. It is a comprehensive process that uses non-procedural hierarchical cell relationships and expression-driven measure relationships from the rule group. These relationships are used together with details of the locks and changes to individual cells to determine and then execute the required actions to apply the effect of the changes and locks. This section describes how the calculation engine determines what to calculate, how to calculate it, and in what order to perform the calculations. Refer to the RPAS User Guide and the RPAS Administrator Guide for details of processes; such as spreading, aggregation, and the evaluation of expressions.

There are four distinct stages of the calculation cycle.

1. In the first stage, protection processing occurs while the user is making changes to cell values, and it protects those measures that the user cannot change either because they are never changeable or because changes already made force them to be calculated.
2. In the second stage, the engine decides what expressions will be evaluated.
3. In the third stage, the sequence of calculation is determined.
4. The final stage is the physical process of doing the calculation.

> **Note:** The calculation cycle can operate in one of two modes: "full" and "incremental." In "full" mode, it is assumed that all of the cells for the measures being evaluated need to be calculated. This mode is used when calculating in batch, and in all rule group transitions. "Incremental" mode is used when manipulating cells in an online session, and only those cells that are directly or indirectly affected by user edits are calculated.

Protection Processing

Other than in exceptional circumstances, the calculation engine guarantees the integrity of all relationships and ensures that the value for a cell changed by a user after calculation is the value entered by the user. In order to ensure this, the calculation engine must prevent the user from making changes to any cells where it would be unable to guarantee that integrity. The process that achieves this is called protection processing.

A measure may only be manipulated when the calculation engine is able to change other cells by spreading and/or evaluation of an expression to enforce the integrity of relationships. A measure that is not used in any rules may only be manipulated if it has a spreading technique other than recalc.

It is a basic principle of the calculation engine that a measure that is changed (or locked) cannot also be recalculated by evaluating an expression. It will be aggregated, which in the case of a recalc measure, does involve the evaluation of an expression. A measure that is to be evaluated can only be evaluated using one expression because there is no guarantee that the same result would be produced from two expressions that represent different measure relationships. It is also a basic principle that any measure relationship (rule) must be evaluated when one or more of the measures in that relationship have been changed because this is the only way to enforce the integrity of the rule relationship. Therefore, a rule where there is just a single expression means that the measure calculated by that expression cannot be changed by the user because there is no expression to evaluate to effect that change for that measure relationship. Such measures can never be manipulated in any rule group that uses the rule and are protected.

Where a rule has two expressions, the two measures that are calculated by those expressions are available to be manipulated. However, as soon as one measure is manipulated by the user, we know that the expression that calculates the other measure must be evaluated, as one of the expressions in the rule has to be evaluated, and we cannot evaluate the expression that calculates the measure that was changed. The expression that must be calculated is said to be forced, and the measure that it calculates is protected to prevent the user from changing it. That measure may be involved in more than one rule, and in the other rules in which it is used it must be treated as if the user changed it. This so-called knock-on effect may force further measures to be forced and protected. Evaluating these effects is the basic technique of protection processing.

Protection processing occurs continuously while the user is editing cells. Each time the 'changed state' of a measure changes, protection processing evaluates the measures that should now be protected. The 'changed state' of a measure means the measure goes from not having changes or locks to having them. Protection processing always reflects the current set of locks and changes. RPAS allows cells that have been changed or locked to be unchanged or unlocked before the calculation is initiated. If an unchange or unlock removes the last change or lock for the measure so that the measure is no longer affected, protection processing is quite likely to find the other measures that were previously forced, but are no longer forced. These measures are free to be manipulated, so they must be unprotected.

Protection Processing Details

The following terms are used in this description:

- An *affected measure* is a measure that has been changed by the user, is locked by the user, or is forced.
- An *affected rule* is a rule that contains one or more affected measures.
- A *free measure* is a measure that is not affected.
- A *free expression* is an expression for an affected rule that calculates a free measure.
- A *forced rule* is an affected rule that has only one free expression.
- A *forced measure* is the measure calculated by the free expression in a forced rule.

Any measure that is the measure on the LHS of the only expression in a rule is protected.

Protection processing considers each affected rule in turn. Each affected rule will be in one of three conditions:

- Affected rules that have previously been forced are ignored
- If the affected rule has two or more free expressions, it is ignored because nothing is forced.
- If the affected rule has just a single free expression, it becomes a forced rule, and the measure calculated by the free expression is forced and becomes an affected measure. The forced measure is protected. All rules that use the forced measure become affected.

When a new measure becomes forced, checking of affected rules begins again. When all affected rules have been considered without any further measures becoming forced, the first stage of protection processing is complete.

The second stage of protection processing is to perform "look ahead" protection processing. Look ahead protection processing ensures that all measures that are visible in windows (and still unprotected) can be manipulated. It does this by performing the protection processing that would occur if the measure were changed. This includes ensuring that there is a solution to the processes of determining what to calculate and ordering the calculation. If these processes fail to find a solution, the process that determines what to calculate will repeatedly back up the decision tree and select a different expression that is looking for a solution. If there is no such solution, the measure that was being checked is protected. In this manner, the calculation engine ensures that there will always be a method to calculate the effects of all changes that it allows the user to make.

> **Note:** This is a somewhat simplified description of protection processing, as it ignores the implications of "cycle groups" (see Cycle Groups) and "synchronized measures" (see Synchronized Measures).

Determining What to Calculate

The protection processing process has established which measures are forced given the current set of changes and locks. When a calculate is issued, those forced measures will be calculated (using the forced expressions). However, there may be affected rules that are not forced. For those affected rules, we know that an expression must be evaluated, and the calculation engine must select one of the expressions. Otherwise the integrity of the rule is compromised.

When there are one or more affected rules that are not forced, the highest priority affected rule is selected. From this selected rule, the highest priority free expression is selected, and it will be evaluated. These are the only uses to which the rule and

expression priorities are put. The measure that is calculated by the selected expression is then treated as forced, and knock-on effects considered, which are likely to cause other rules and measures to become forced. At the end of this process, if there are still affected rules that are not forced, the process is repeated until there are no affected rules that are not forced. At this point, any rule that is not affected does not need to be evaluated, and an expression has been forced or selected for all rules that need to be evaluated to ensure the integrity of all measures.

Determining the Calculation Sequence

The previous section has established which expressions to evaluate, but not the sequence in which they are evaluated. The sequence of evaluation of expressions is driven by the status of the right-hand side (RHS) measures. All normally spreadable (not of recalc type) measures that are changed can be spread and then aggregated at the start of the calculation cycle. Normally, spreadable measures that have been changed and those measures that will not change during the calculate are considered to be "complete." Any expression whose RHS measures are all complete may be evaluated. If the expression is a mapping rule for a recalc measure, the changed values for the mapped spreadable measure will be calculated for all changed cells. That measure may then be spread and aggregated normally. If the expression is for normal 'base intersection' evaluation, the measure will be calculated, and may then be aggregated. In either case, the calculated measure is now 'complete,' which may make further expressions available to be evaluated. The process continues until all expressions have been sequenced.

When determining the sequence of calculation, the evaluation of expressions is intermingled with spreading and aggregation. In very trivial cases, where all changed measures are spreadable, there will be:

- a phase where a number of measures are spread.
- a second phase where a number of measures are calculated at the base intersection.
- a third phase where a number of measures are aggregated.

However, if any recalc measures have been changed at aggregated levels, the 'mapping rule' cannot be applied until any affected measures on the RHS of the expression have been spread or calculated and then aggregated.

> **Note:** This is a simplified description of the calculation sequence. For efficiency purposes; groups of measures that must be spread, aggregated, or evaluated are batched together, so that an individual measure is not necessarily spread, aggregated, or evaluated as soon as it is available for that action. However, it is always spread, aggregated, or evaluated before the results of that action are required for another step. Also, expressions are not evaluated for all cells, but only for those cells where one or more of the measures on the RHS of the expression have changed. There are similar efficiencies in aggregation to avoid the redundant re-aggregation of cells that will not have changed.

Cycle Groups

This section describes the cycle group feature of the RPAS calculation engine. This feature enables relationships between measures that have cyclic dependencies from the measure perspective (there appears to be a 'deadly embrace' where each measure depends upon the other), but are actually acyclic when the time dimension of these measures is considered. Without this feature, such relationships could not be set up because the calculation engine would be unable to find a calculation sequence that enabled both measures to be calculated.

A common application of cycle groups can be found in inventory calculations that involve measures, such as beginning of period (BOP) and end of period (EOP). It is typical that EOP is calculated in some way from BOP for the same period. Other than in the very first period, the BOP of a period is equal to the EOP of the previous period. Since BOP is dependent on EOP and EOP is dependent on BOP, a cycle exists from a measure perspective. However, when the time dimension is considered, calculations can be performed in an acyclic fashion. In this example, if EOP for the first period is calculated first, then BOP for the second period can be calculated. This allows EOP for the second period to be calculated, and so on.

Cycle Breaking Functions

Some of the functions supported by the calculation engine have special cycle breaking logic associated with them. These include functions that reference previous time periods and functions that reference future time periods. When these functions are used, the calculation engine automatically determines when measure dependencies that appear to be cyclic are in fact acyclic when the calculations are performed one period at a time. The lag and lead functions are examples of cycle breaking functions.

Cycle Group Evaluation

A cycle group is a group of expressions that the calculation engine must calculate together in order to avoid cyclic dependencies. If the apparent cycle is broken by a function that looks backwards in the time dimension (such as lag), calculation proceeds with the first time period of each expression in sequence. This is followed by the second time period of each expression in sequence, and it continues until all time periods have been calculated. If the apparent cycle is broken by a function that looks forwards in the time dimension (such as lead), calculation proceeds in reverse order starting with the last time period.

> **Note:** Since the acyclic calculation of expressions in a cycle group is a 'base level calculation,' all measures being calculated in the cycle group must share the same base intersection. That is, the cycle group evaluation process cannot aggregate measures calculated in the cycle group during the cycle group evaluation.

Cycle Group Example:

Consider the following measures:

BOP: beginning of period inventory

EOP: end of period inventory

OS: opening stock (that is, the opening inventory for the first period in the plan horizon)

SLS: sales

RCP: receipts

And consider the following rules:

R1: BOP = if(current == first, OS, lag(EOP))

R2: EOP = BOP – SLS + RCP

RCP = EOP – BOP + SLS

When the measure RCP is edited, R2 is affected and the EOP expression in this rule is forced. Then rule R1 is affected and the BOP expression in this rule is forced.

Since the calculation of EOP requires BOP and the calculation of BOP requires EOP, a cycle is detected that contains both of the selected expressions. This is a valid cycle group because the calculation of BOP is dependent on the lag of EOP. Therefore, the cycle can be broken and the intra-cycle ordering results in the BOP expression being evaluated first and EOP expression second.

The evaluation of this cycle group involves the calculation of the first time period of BOP, followed by the first time period of EOP, followed by the second time period of BOP, followed by the second time period of EOP, and continues until all time periods have been calculated.

Synchronized Measures

Measure synchronization is an RPAS user interface and calculation engine feature. It enables measures that are very closely related to be represented in the user interface (UI) in a more intuitive manner. It can give the appearance of a cell edit or lock affecting two different measures. From a calculation perspective, the cell edit or lock is only applied to one of these measures. A common application of synchronized measures is to allow BOP and EOP to be synchronized. From a business logic perspective, the BOP in one period and the EOP in the previous period are the same thing, and measure synchronization means that even before calculation, an edit or lock of BOP in one period also appears on the UI as an edit or lock of EOP for the previous period, and vice versa.

To accomplish measure synchronization, a measure is defined with a synchronized view type and a list of synchronized source measures. The measure defined with these attributes is called the synchronized target measure. Synchronized target measures may be edited, but any such edits are actually treated as edits to the underlying synchronized source measures. Protection processing is performed on the synchronized source measures. The protection state of the target measure is then derived from that of the source measures. An edit to one of the source measures is also reflected in the display of the target measure.

The synchronized view types that can be used to define synchronized target measures are as follows:

1. sync_first_lag: The first period of the target measure is synchronized with the first source measure, and periods 2..N of the target measure are synchronized with periods 1..N-1 of the second source measure, where N represents the last period. The first source measure will not have a time dimension. This view type is particularly

useful for defining BOP target measures. Here the first source measure would be an opening inventory, and the second source measure would be the EOP.

2. sync_lead_last: Periods 1..N-1 of the target measure are synchronized with periods 2..N of the first source measure and period N of the target measure is synchronized with the second source measure, where N represents the last period. The second source measure will not have a time dimension. This view type is particularly useful for defining EOP target measures. Here the first source measure would be BOP, and the second source measure would be a closing inventory.
3. sync_first: The target measure is synchronized with the first period of source measure. The target measure will not have a time dimension. This view type is particularly useful when defining OS target measures.
4. sync_ last: The target measure is synchronized with last period of the source measure. The target measure will not have a time dimension. This view type is particularly useful when defining CS target measures.

> **Note:** In order for a synchronized measure to be editable, all of the measures that it is synchronized with must be viewable on the worksheet, but they do not need to be visible.

Synchronized Inventory Examples:

Consider the following measures:

BOP: beginning of period inventory

EOP: end of period inventory

OS: opening stock (that is, the opening inventory for the first period in the plan horizon)

CS: closing stock (that is, the closing inventory for the last period in the plan horizon)

SLS: sales

RCP: receipts

And consider the following rules:

R1: BOP = if(current == first, OS, lag(EOP))

R2: EOP = BOP – SLS + RCP

RCP = EOP – BOP + SLS

BOP can be defined as a synchronized measure constructed from the OS and EOP measures with the sync_first_lag type. Only one expression in the rule group may have BOP on the LHS. This expression is used to construct views of BOP, and it is merged with expressions that require BOP on the RHS.

When edits or locks are made to BOP, it is the underlying values of OS or EOP that are actually changed or locked. Thus, even though rule R1 has only one expression and this expression calculates BOP, the BOP measure is not protected by protection processing because of the measure synchronization. The BOP measure is only protected when the underlying OS or EOP measures are protected, so the first period is protected when OS is protected and the remaining periods are protected when EOP is protected.

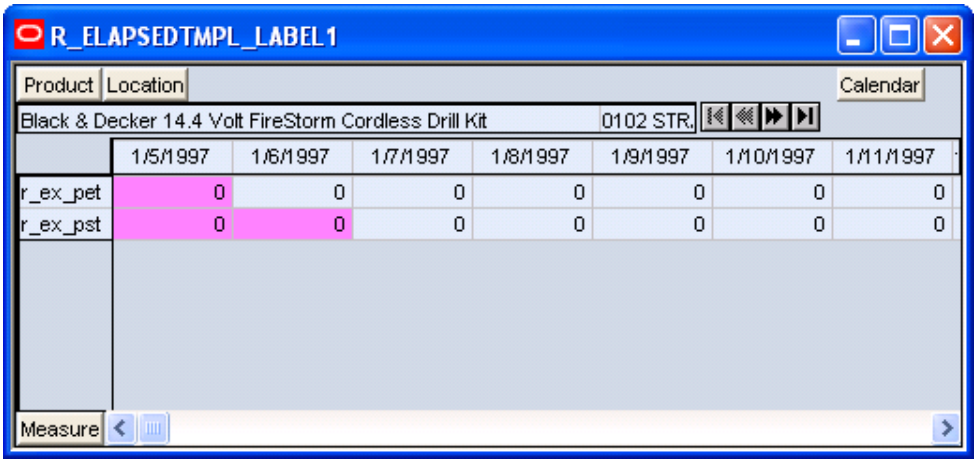
In this example, a CS measure is not required for calculation purposes, but it may be desired for viewing and editing purposes. For example, a window that contains only OS and CS but not BOP nor EOP may be wanted. In this case, the CS measure should be defined as a synchronized measure with type *sync_last* and the synchronized source measure would be EOP. As a result, an edit to CS becomes an edit to the last period of EOP.

Elapsed Period Locking

Many planning and prediction applications will cover a time horizon where some of the time periods are in the past (i.e., have elapsed), and others are in the future. RPAS assumes that time periods that have elapsed contain actuals, and that these actuals should not be editable. Therefore, all measures are rendered un-editable during elapsed periods. For positions at aggregated levels in a time hierarchy, the position is considered elapsed when the last lowest level time period descended from it has elapsed.

The RPAS Calculation Engine has special logic for handling elapsed time. Apart from being un-editable in the user interface, spreading never spreads a value to an elapsed cell (for more information, please see the previous Locks and Spreading Around Locke and Changed Cells section).

Measures that represent beginning of period (BOP) data have special handling. From a business perspective, the BOP in a period is the same as the end of period (EOP) in the previous period. Therefore, when an EOP value is elapsed, the following BOP value must also be elapsed. In RPAS, all measures with a default spread method of Period Start Total (PST) (for more information, please see the previous Spreading Methods section), or with their measure property Period Start Value set to TRUE are assumed to be "BOP type" measures, and are protected for all elapsed periods, and for the first non-elapsed period. The following example worksheet demonstrates a situation in which the elapsed threshold has been set to 1/5/1997. The pink-colored cells have been set to read-only by RPAS in order to honor elapsed period locking. In this example, the measure e_ex_pet is a regular measure, whereas, r_es_pst is a BOP type measure.



Elapsed Period Locks for BOP and Non-BOP Measures

There is also special handling of BOP type measures for aggregated time positions. These are treated as elapsed, and are therefore protected when the first bottom level time period descended from it is elapsed.

To set up elapsed period locking in a workbook, workbook designers should set the elapsed time threshold in the load rule of the workbook using the *elapsed* keyword (for more information, please see the Functional Keywords section in Appendix C: Rules and Functions Reference Guide). If the elapsed time threshold is not set, elapsed period locking will not be available in the workbook.

Example:

If the you want to setup elapsed threshold to today, you would first create a one-dimensional measure, pDay for example, with its intersection at the Day level of the Calendar hierarchy. Then, you would set up a rule like the one shown below to initialize this measure with the index of today.

pDay = prefer (today-1, if (now>end, last, -1))

You would then aggregate this measure using the PST aggregation method to set the elapsed time threshold as shown in the following rule.

elapsed = pDay.pst

Setting up the elapsed threshold in the load rule fixes the threshold for the life of the workbook; however, in-season planning applications may require the elapsed threshold to change during the lifetime of a workbook. To achieve this, you can reset the elapsed threshold in a Refresh rule-group or in the Calc rule-group using rules exemplified in the preceding discussion. RPAS inspects the value of threshold after execution of these rule-groups and immediately adjusts the elapsed period locks in the UI. Note that since elapsed threshold is evaluated and executed after the execution of these rule-groups, any spreading performed in the Calc cycle itself would use the state of elapsed threshold before the rule-group was invoked.

Non-Conforming Expressions

Introduction

One of the strengths of the RPAS calculation engine is that a workbook may contain measures with different "scopes." The size and shape of the "multidimensional cube" of data may vary by measure. Any two given measures in a workbook may have scopes that align exactly (for example, both measures have a base intersection of SKU/Store/Week), or where one is a subset of the other (for example, one has a base intersection of SKU/Store/Week and the other is at Class/Week). There can also be circumstances where each measure includes a hierarchy in its base intersection that the other dimension does not use (for example, one has a base intersection of Class/Week and the other is Store/Week). In extreme circumstances, the scopes of two measures may have no point of overlap at all (for example, one has a base intersection of Class and the other Store).

It is the scope of the measure on the LHS of an expression that determines the cells that must be calculated by the expression, even though that scope may be changed by the use of a modifier such as level. Where one or more measures on the RHS of an expression have a scope that is different (in any way) to the scope of the LHS measure, the expression is deemed to be "non-conforming." There is special logic to handle the calculation of non-conforming expressions, which depends on the type of nonconformity.

Although not explicitly declared, there is a single logical "All" position at the top of every hierarchy. When considering non-conformity, any measure that is not explicitly dimensioned on a hierarchy is implicitly assumed to be dimensioned on the "All" dimension of that hierarchy, so all data values are assumed to be for the "All" position. This concept is the key to understanding the handling of non-conforming expressions.

Handling of Non-conforming Expressions

When the concept of the "All" position is understood, all expressions can be considered to contain measures that use exactly the same hierarchies. The only potential differences between them are the "bottom levels" (dimensions in the base intersection). Thus for handling non-conformity, only three cases need to be considered, for each hierarchy:

- **RHS same**:

  In this case the RHS measure has the same bottom level as the LHS measure. The RHS measure is "conforming" for that hierarchy, and values for the RHS measure are taken from the same position as the position being calculated for the LHS measure.

- **RHS higher**:

  In this case the RHS measure has a higher bottom level than the LHS measure. The RHS measure is 'non-conforming' for that hierarchy. The values for the RHS measure for the position being calculated are assumed to be the same as the value of the RHS measure for the position in its bottom dimension that is the parent (ancestor) of the position being calculated. Effectively, it can be considered that the value of the measure has been "replicated" down the hierarchy to the required level.

- **RHS lower**:

  In this case the RHS measure has a lower bottom level than the LHS measure. The RHS measure is "non-conforming" for that hierarchy, but because the scope of the RHS measure includes the bottom level for the LHS measure, values for the RHS measure are taken from the same position as the position being calculated for the LHS measure.

  The conceptual case where the measures have scopes that do not overlap, because they have base intersections in a hierarchy that are for dimensions that are up different "branches" of the hierarchy, fails rule validation.

Examples

These examples all use the simple expression a = b + c

Example 1:

Consider the following values:

- a has a base intersection of SKU/Store/Week
- b has a base intersection of SKU/Week
- c has a base intersection of SKU/Region/Week

For each SKU/Store/Week, a is calculated from the value of b at SKU/Week (that is, it is assumed that the value of b is the same for all positions in the location hierarchy) and the value of c at SKU/Region/Week, for the Region the Store belongs in. If 'replication' of c from the Region level is not appropriate, the rule writer can simulate other 'spreading' techniques by the use of functions and modifiers such as **count** and **level**. For example, the **count** function may be used to determine the number of Stores in the Region, and so dividing the measure c by that count will simulate 'even' spreading.

Example 2:

Consider the following values:

- a has a base intersection of SKU/Store/Week
- b has a base intersection of SKU/Week
- c has a base intersection of SKU

For each SKU/Store/Week, a is calculated from the value of b at SKU/Week (that is, it is assumed that the value of b is the same for all positions in the location hierarchy) and the value of c at SKU (that is, it is assumed that the value of b is the same for all positions in the location hierarchy and time hierarchy). Note that an alternative approach, if required, would be to use a **level** modifier on the measure a, so that it is calculated at, say, SKU/Week, and then spread down to SKU/Store/Week, using the existing store participations to the measure a.

Example 3:

Consider the following values:

- a has a base intersection of SKU/Week
- b has a base intersection of SKU/Store/Week
- c has a base intersection of SKU/Region/Week

For each SKU/Week, a is calculated from the value of b and c at SKU/'All'/Week.

C

Appendix: Rules Function Reference Guide

Overview

This section provides the syntax and design of functions, procedures, modifiers, and keywords that are used in expressions in the RPAS calculation engine. There are important distinctions between each of these definitions.

Functions

Functions are separated into two type: single result functions and multiple result functions.

Functions (single result) – Mechanisms for performing operations within an expression that are controlled and executed by the calculation engine.

- Functions are most commonly used in RPAS.
- Most functions in base RPAS return only a single measure.
- Calculation engine controls and executes the evaluation of a function.
- Functions may be used in expressions with other functions and keywords.

Multiple result functions – Similar to the features and behavior of single result functions, but with semantic and syntactic differences.

- There can be more than one left-hand side (result) measure that can be specified implicitly by position in the expression or explicitly by label.
- Left-hand side measures have to be at same intersection; however, the calendar hierarchy can be dropped or added.
- The result(s) from a multiple result function cannot be used as arguments to another function, nor can the result(s) be chained with other operations to form long expression.
- Expressions can be used as arguments to multiple result functions.
- Multiple result functions cannot be part of a cycle group.

Procedures

Procedures are mechanisms for performing operations in an expression where the calculation engine controls the execution, which is performed by the procedure itself.

- Procedures can only use measures or scalars
- Procedure executes the evaluation (instead of RPAS/calculation engine), but the calculation engine still controls protection processing, sequence of calculation, when the procedure is called, and so on.
- Procedures can have multiple arguments on the left and right hand sides.
- Procedures cannot be used with functions, other procedures, keywords, and certain modifiers.
- Because of their flexibility and the control available to the developer, procedures can be used for a wide variety of special calculations and activities.
- Procedures require a different syntax. The syntax uses "<-" instead of "=" in the expression.

Modifiers

Modifiers directly modify the source or destination of measures, to override the level, aggregation type, position, and so on.

Modifier Syntax

```
<measure>.<modifier>
```

Keywords

Keywords appear in expressions or as arguments inside functions to return specific data values.

Syntax Conventions

The syntax is as quick and straightforward to implement as possible. Function names, keywords, and so on are currently in lowercase.

Keywords are allowed, but they are kept to a minimum. Function parameters are comma separated and may be optional; but they are positional, so that the absence of a parameter needs to be specified by commas if a subsequent parameter is supplied.

The table below displays the syntax conventions used in this procedure.

Indicator	Definition
[…]	All options listed in brackets are optional.
{…|…}	Options listed in "{}" with "|" separators are mutually exclusive (either/or).
{…,…}	Options listed in "{}" with "," separators way are a complete set.
Bold	Labels.
Italics	Italics indicate a temporary placeholder for a constant or a measure.
Italics/meas	This indicates that the placeholder can be either a constant or a measure.
BoldItailics	This indicates a numeric placeholder for the dynamic portion of a label. Usually a number from 1 to N.
Normal	Normal text signifies required information.
Underlined	This convention is used to identify the function or procedure name.

Specification of Hierarchy, Dimension, or Position

Many functions in RPAS require the specification of a hierarchy, dimension, or a combination thereof, to define the level at which an expression is evaluated. When defining the hierarchy and dimension names in expressions square brackets [ ] must be used.

In the document, the following syntax will be used to designate a hierarchy and dimension:

Hierarchy, Dimension, and Position Syntax

`[<hierarchy>].[<dimension>].[[<position>]]`

> **Note:** That position is noted as optional because it can only be specified in a limited number of functions.

For simplicity of parsing and clarity of rule writing, the `<hierarchy>` must be supplied in all cases, even when, as in calendar index functions, it might be implied from the context. Functions that require a hierarchy and dimension specification will have standard validation rules whereby `[<hierarchy>]` must be a valid hierarchy name and `[<dimension>]` must be a valid dimension in `[<hierarchy>]`; in some functions or procedures one of the hierarchical keywords `top`, `bottom`, or `current` (used conditionally based on context) can be used to specify the dimension. Should this validation fail, an ***error*** will be generated.

Function Inverses

Some functions (such as `cover`) have what are referred to as "inverse" functions. This is required, as all expressions in a rule group must be algorithmic inverses of each other. Each function states whether it has an inverse, and, if so, what the syntax of the inverse is.

An inverse function is only relevant when the function encompasses the whole of the expression. Functions embedded in longer expressions do not have inverses, though the expression itself may have an inverse as long as the measure being "solved" for is not an input into the function. Functions that have inverses usually have enough scope in their syntax to cover the eventualities that would typically cause them to be embedded in longer expressions (such as code to prevent an error result).

Functions with Multiple Results

The following special syntax should be used for functions with multiple results.

The left-hand side measures in a multiple result expression are comma-separated and can be identified by a labeling mechanism.

Label Syntax

`<measure>:<label>`

Valid label names are specified by the multiple result function syntax. If a multiple result function specifies valid labels, the function can be used in an expression without specifying all possible results. The multiple result function itself is aware of which results are being stored and may be able to run faster by skipping the computation of unneeded results.

Special Handling for Functions

Error Handling

There are several keywords and functions that have special control flow over the evaluation of the expression.

RPAS has no facility for holding an "error" value for a cell. Should the evaluation of any expression, or clause in an expression, result in an error, the value for the cell or clause will be the "**naval**."

> **Note:** It is good programming practice to check for any clauses that may return an error, and the **prefer** function provides a way to specify the behavior under these circumstances. Some functions have their own implicit error handling.

if

Used for handling conditional logic and masking updates within expressions.

Syntax

`if(<condition>, <use-expression>, <else-expression>)`

where `<condition>` is any valid Boolean expression. `<use-expression>` and `<else-expression>` are any valid expressions that are evaluated based on the result of `<condition>`; one (and only one) of these expressions can contain the keyword **`ignore`**. <use-expression> is evaluated when the result of `<condition>` is true; `<else-expression>` is evaluated when the result of `<condition>` is not true.

`<expression>` is any valid expression. **`ignore`** is a keyword that is used to indicate that the entire expression is not to be evaluated (that is, masking the update to the entire expression).

> **Note:** **`ignore`** can ONLY be used in either the `<use-expression>` or `<else-expression>`, but not both.

The use of **ignore** always flags the expression as a masked update – this will always prevent the expression from being evaluated or involved with aggregations when the condition is not met. To reiterate, note that the entire expression is not evaluated, not just the sub-expression that uses the `if` clause. When **`ignore`** is used in expression where the LHS measure is modified with the **`master`** keyword (typically in a commit rule group), then the `<condition>` must be a Boolean measure (in other words, not an expression). This syntactical restriction is validated when the expression is parsed.

if clauses can be nested without restrictions but must be enclosed with parentheses when used more than once within an expression.

Examples:

Conditional logic:

- BOP = **if**(**current** == **first**, SeasOP, **lag**(EOP))
- `OTB = if(ProjEOP > PlanEOP, 0, PlanRecpt – OnOrder)`

Masked update with a single expression:

- `SalesOP = if(Approved, SalesWP, ignore)` Updates Sales for the Original Plan version to the value in the Working Plan version when the Boolean measure `Approved` is set to true. **ignore** designates that no update is made to `SalesOP` if the `Approved` measure is false. This is functionally equivalent to the next example.
- `SalesOP = if(NotApproved, ignore, SalesWP)` Does not update the measure `SalesOP` with the values from the measure `SalesWP` when the Boolean measure `NotApproved` is true.

Note the distinctly different behavior between the following similar expressions:

- `a = b + (if(<condition>, c, ignore))` - This is an example of a masked update where no update is made to measure `a` if the condition is not met (that is, the entire expression is not evaluated).
- `a = b + (if(<condition>,c, 0))` - This is an example of conditional logic where an else clause is provided and the expression is always evaluated, thus `a` is always updated to either `b` or `b+c`.

prefer

Returns the first non-error value from a series of expressions.

The primary use is to enable the capture and appropriate calculation of error conditions.

Syntax

`prefer(<expression1>, <expression2> [, <expression3> … <expressionn>])`

Where `< expression1-n>` are expressions which return values of the appropriate data type. The function returns the value of the first of the expressions that does not generate an **error** when it is evaluated. It is good coding practice to use a **prefer** function around any clause of an expression, which could potentially generate an **error**.

Inverse

The **prefer** function does not have an inverse.

Examples:

- **prefer**`(A/B, 100)` - This example returns the value of `A` divided by `B`, unless that generates an **error** (as it would if `B` is zero), when it returns 100.
- **prefer**`(lag(A), B)` - This example returns the value the **lag** of `A`, unless that generates an **error** (as it would when evaluating the first period of the plan horizon), when it returns the value of `B`. The **prefer** function in this example is thus the functional equivalent of the expression:
- **if**(**current** == **first**, `B`, **lag**(`A`))

Non-Conforming Measures

Definition

One of the strengths of the RPAS engine is that a workbook may contain measures with different scopes: the size and shape of the multidimensional cube of data may vary by measure. Any two given measures in a workbook may have scopes that align exactly (for instance, both measures have a base intersection of SKU/Store/Week), or where one is a subset of the other (for instance, one has a base intersection of SKU/Store/Week, and the other is at Class/Week). There can also be circumstances where each measure includes a hierarchy in its base intersection that the other dimension does not use (for instance, one has a base intersection of Class/Week and the other is Store/Week). In extreme circumstances, the scopes of two measures may have no point of overlap at all (for instance, one has a base intersection of Class and the other Store).

It is the scope of the measure on the left hand side of an expression (referred to as the LHS measure) that determines the cells that must be calculated by the expression, though that scope may be modified by the use of a modifier such as level. Where one or more measures on the right-hand side (RHS) of an expression have a scope that is different (in any way) to the left-hand side (LHS) measure, the expression is deemed to be "non-conforming." There is special logic to handle the calculation of non-conforming expressions, which depends on the type of nonconformity.

Although not explicitly declared, there is a single logical "All" position at the top of every hierarchy. When considering non-conformity, any measure that is not dimensioned on a hierarchy, is implicitly assumed to be dimensioned on the "All" level of that hierarchy, and thus all data values are assumed to be for the "All" position. This concept is the key to understanding the handling of non-conforming expressions.

When the concept of the "All" position is understood, all expressions can be considered to contain measures that use exactly the same hierarchies. The only potential differences between them are the "bottom levels" (dimensions in the base intersection). Thus, for handling non-conformity, only three cases need to be considered, for each hierarchy:

1. **RHS same**

   In this case, the RHS measure has the same bottom level as the LHS measure. The RHS measure is "conforming" for that hierarchy, and values for the RHS measure are taken from the same position as the position being calculated for the LHS measure.

2. **RHS higher**

   In this case, the RHS measure has a higher bottom level than the LHS measure. The RHS measure is "non-conforming" for that hierarchy. The values for the RHS measure for the position being calculated are assumed to be the same as the value of the RHS measure for the position in its bottom dimension that is the parent (ancestor) of the position being calculated. Effectively, it can be considered that the value of the measure has been "replicated" down the hierarchy to the required level.

3. **RHS lower**

   In this case, the RHS measure has a lower bottom level than the LHS measure. The RHS measure is "non-conforming" for that hierarchy, but because the scope of the RHS measure includes the bottom level for the LHS measure, values for the RHS measure are taken from the same position as the position being calculated for the LHS measure. RHS measure is aggregated using the default aggregation method.

   The conceptual case where the measures have scopes that do not overlap, because they have base intersections in a hierarchy that are for dimensions that are up different "branches" of the hierarchy, fails rule validation.

Examples

> **Note:** The following examples all use the simple expression a = b + c.

Example 1

Consider the following scenario:

- "a" has a base intersection of SKU/Store/Week
- "b" has a base intersection of SKU/Week
- "c" has a base intersection of SKU/Region/Week

For each SKU/Store/Week, "a" is calculated from the value of b at SKU/Week (it is assumed that the value of "b" is the same for all positions in the location hierarchy) and the value of "c" at SKU/Region/Week, for the Region the Store belongs in. If "replication" from the Region level is not appropriate, the rule writer can simulate other spreading techniques using functions and modifiers such as count and level.

For example, the count function may be used to determine the number of Stores in the Region, and so dividing the measure c by that count will simulate 'even' spreading. Additionally level could be used to force the calculation of a at Region instead of a's base intersection, Store (a.level([loc].[reg])=b+c). In this scenario edits to "b" or "c" would calculate "a" at Region and would then spread those values down to Store for measure a using the default spread method.

Example 2

Consider the following scenario:

- "a" has a base intersection of SKU/Store/Week
- "b" has a base intersection of SKU/Week
- "c" has a base intersection of SKU

For each SKU/Store/Week, "a" is calculated from the value of b at SKU/Week (it is assumed that the value of b is the same for all positions in the location hierarchy) and the value of "c" at SKU (it is assumed that the value of "b" is the same for all positions in the location hierarchy and time hierarchy).

> **Note:** An alternative approach, if required, would be to use a level modifier on the measure a, so that it is calculated at SKU/Week, and then spread down to SKU/Store/Week, using the existing store participations to the measure a.

Example 3

Consider the following scenario:

- "a" has a base intersection of SKU/Week
- "b" has a base intersection of SKU/Store/Week
- "c" has a base intersection of SKU/Region/Week

For each SKU/Week combination, "a" is calculated from the value of "b" and "c" at SKU/'All'/Week. Otherwise stated b and c are aggregated up the location hierarchy, and then added to "a" for each position in SKU/Week.

Functional Keywords

Overview

Functional keywords are keywords that may be used in expressions that return specific data values. There are a group of keywords that provide information (in the form of index numbers) about the calendar hierarchy, and a further group of keywords that provide information of the current session.

Calendar Index Functional Keywords

Certain calendar index functional keywords are supported in the syntax, as described below. In this context, a calendar index number is an ordinal position counter of the position in a dimension within the scope of the calendar horizon, where the dimension is as for the cell being evaluated. For example, in a plan whose scope is a year, the first week will have an index of 0, week 26 will have an index of 25, and week 52 will have an index of 51. Similarly, if an expression is being evaluated at the quarter level, the first quarter will have an index of 0, and the last one an index of 3. Calendar index functional keywords may be included in any numeric expression.

first

Returns the index number of the first calendar position.

This keyword is provided for completeness and clarity of rule function writing, since the value will always be zero!

last

Returns the index number of the last calendar position.

last + 1 will therefore always be the number of positions in the calendar horizon in the current dimension.

current

Returns the index number of the period being evaluated.

current can be used as a standalone keyword only under the context of time.

> **Note:** It can also be used in the syntax of a function as a hierarchical keyword (for specifying the current level in a hierarchy) and is allowed for any hierarchy (but must follow the syntax <hierarchy>.**current**).

today

Returns the index number of the period that contains the current time as given by the system clock.

The index number that **today** returns is determined by the base intersection of the measure that is being evaluated (on the left hand side of the expression). For example, if the base intersection of the measure being evaluated is week, **today** will return the index number of the current week.

> **Note:** The effect of this keyword may be overridden by providing the environment variable RPAS_TODAY. If this is present, the time in the RPAS_TODAY environment variable is used instead of the system clock time.
>
> **Note:** The difference between the keywords today and now is that today returns an index number; now returns the value of the current date and time. An **error** is generated when the current period is not included in the workbook.

elapsed

Returns the index number of the period that is the last elapsed period.

elapsed is interpreted as the last period for which actuals have been posted. If there is no elapsed period, this keyword returns –1.

elapsed must be assigned (to a measure on the left-hand side of an expression evaluated in a load, refresh, and calc rule groups) before it can be used in calculations (on the right-hand side of other rule groups). Use the following syntax for assigning the index number in the base calendar dimension as the elapsed value.

Syntax

elapsed = <expression>

Where <expression> is any valid expression that returns a numeric value, of which only the integer portion is used. elapsed can only be used on the left-hand side of an expression in the load, refresh, and calc rule groups. The elapsed keyword can be used on the right hand side of other rule groups only after the elapsed value has been assigned.

Session Keywords

now

Returns the current date and time from the system clock.

now is stored with date and time information.

> **Note:** The difference between the keywords **today** and **now** is that **today** returns an index number; **now** returns the value of the current date and time.

The displayed format of **now** is based on the measure type.

This keyword can be used to hold information about when data was changed (for instance, the beginning date and time of a batch run). The value returned by now can be overridden by RPAS_TODAY environment variable.

userid

Returns a string that contains the id of the current user.

This keyword can be used to hold information about the user who made a specific change.

Calendar Hierarchical Date Keywords

begin

Returns a date type value for the first index in the root calendar dimension.

Because it returns a date type value, this keyword is not context sensitive (meaning it does not depend on where it is being used) and can be compared with the **now** keyword.

> **Note:** The root calendar dimension is defined as the unique dimension that is at the root of the calendar hierarchy.

end

Returns a date type value for the last index in the root calendar dimension.

Because it returns a date type value, this keyword is not context sensitive (meaning it does not depend on where it is being used) and can be compared with the **now** keyword.

Modifiers

Overview

Modifiers are used to directly modify the source or destination of measures. Modifiers must be used in conjunction with a measure in the manner displayed under Syntax:

Syntax

```
<measure>[.<modifier>[.<modifier>]…]
```

The following modifiers can be used with measures in a variety of ways. Note the acceptable uses for each modifier as there are restrictions regarding use on the left hand side and if they can be used in conjunction with other modifiers.

master

References the domain-version of a measure.

master is used as a modifier to a measure to reference the version of the measure that resides in the domain. It can only be used in load and commit rule groups. It cannot be used in calculation rule groups.

Syntax

```
<measure>.master
```

Where <measure> is any valid measure. **master** can be used on both the left hand side and right hand side of expressions and can be used with functions. When used with other modifiers, **master** must be the first modifier.

On the right-hand side of an expression, **master** can be used with both **level** and **aggtype**. On the left-hand side, **master** must be used by itself.

Examples:

- `Sales=Sales.master`

  Used in load rule group to retrieve Sales from the domain into a workbook.
- `Sales.master=Sales`

  Used in commit rule group to commit the updated Sales measure to the domain from the version in the workbook.

aggtype

References to alternative aggregation types.

When a measure is referenced just by name in an expression, or as a parameter in a rule function, the value used is for the default aggregation type for the measure. Values from alternative aggregation types are also available by using the syntax:

Syntax

```
<measure>.<aggtype>
```

Where **<aggtype>** is a supported aggregation type as listed in an appendix of this document. Every function parameter that requires a measure will also accept this extended form.

> **Note:** If alternate aggregation types are required for a measure in rules, this approach is more efficient that defining another measure with the alternate aggregation type, as data values at the base intersection are not duplicated.

The **aggtype** modifier can only be used on the right-hand side of an expression, but it can be used with functions and other modifiers. When used with **level** and/or **master** modifiers, **aggtype** must be the specified last.

level

Returns the value of an expression for a specific intersection of parent positions, or forces the calculation at a specific intersection.

The parents specified may be in one or more hierarchies.

Syntax

<measure>.**level**(<dimspec1>[+<dimspec2>… +<dimspecn>])

Where <dimspec1-n> is [<hierarchy>].{[<dimension>] | **top** | **current**} and each dimension specification is separated by a plus (+) sign.

<measure> is the measure to be specified. <hierarchy> is the name of a valid hierarchy. **top** and **current** are keywords referring to the highest, and current (that is, being evaluated if on the RHS, or base intersection in the hierarchy if on the LHS) dimensions in the hierarchy. If a hierarchy is not specified, the <dimension> for that hierarchy is assumed to be **current**. If the <dimension> for a hierarchy is lower than the base intersection for the measure (when used on the LHS), or the <dimension> is not a valid dimension in the specified hierarchy, an **error** is generated.

This modifier can be used on both the LHS and RHS of a rule expression. It can only be used by itself on the LHS, but it can be combined with other functions and modifiers on the RHS.

When this modifier is on the LHS of a rule expression, the rule is evaluated at the specified intersection. The newly calculated value at an aggregated intersection is then spread down the hierarchies to the base intersection for the measure, using the default spread-type for the measure. A typical usage of this modifier on the LHS of a rule expression is to calculate a "non-conforming" measure where the scope of the measure includes hierarchies not present in the measures on the RHS of the expression. The calculation would usually be at the base intersection of the common hierarchies, but at the "top" of the additional hierarchies, and spread to their base intersections.

When this modifier is on the RHS of a rule expression, the measure being modified is evaluated at the specified intersection.

> **Note:** Just the measure, not the rule, is evaluated at the designated level.

Under normal circumstances a measure is always calculated at the base intersection, or the intersection at which the LHS is being evaluated if it is higher. Use of the modifier will evaluate the measure at the designated (higher) level using the measure's default aggregation type, which can be overridden by the aggtype modifier. An example of its use on the RHS could be calculating a ratio of sales for each SKU with respect to its parent department.

Examples:

- `sales.level([loc].top)`

  Returns the value for the measure sales for the position at the top of the location hierarchy and for the current position in all other hierarchies.
- `sales.level([loc].[area])`

  Returns the value for the measure sales for the position in the area dimension that is the parent of the position being evaluated and the current position in all other hierarchies (that is, the total sales in my area).
- `sales.level([loc].[area]+[prod].[div])`

  Returns the value for the measure sales for the position in the area and division dimensions that is the parent of the position being evaluated and current position in all other hierarchies (that is, the total sales in my area for my division).
- `recpts.level([rec].top) = <expression>`

  The measure `recpts` is calculated at the base intersection of all hierarchies except the `rec` hierarchy, where it is calculated at the top. This value is spread down to the base intersection for the measure.

old

References the value of a measure as of the previous calculate.

Syntax

`<measure>.old`

Any measure modified with **`old`** will use the value that was available at the start of the calculation process, which means that these modified measures can be ignored for such things as protection processing. Most importantly, this means that a measure can effectively be calculated from itself, as the **`.old`** modifier breaks the cycle.

Assumptions/Restrictions

The following assumptions/restrictions apply to `old`:

- Can only be used in a rule group of type "calculation".
- Can only be used on the right-hand side of an expression.
- Cannot be used in combination with **`.master`**, **`.level`**, or **`.aggtype`** modifiers.
- Cannot be used with (cannot modify) non-materialized measures.

Use of the **`old`** modifier has no effect on calculation sequence or protection processing, as the values of measures modified with **`old`** are known before the calculation starts.

Note: The `old` modifier is not designed to operate with measures whose aggregation type is *recalc*. In particular, expressions that attempt to use the `old` modifier on a measure with an aggregation type of recalc, such as

```
a=b + c.old
```

where `c` is a measure with an aggregation type of recalc, are not allowed. Similarly, expressions that attempt to calculate a measure with an aggregation type of recalc, but which use the `old` modifier, such as

```
c=a + b.old
```

where `c` is a measure with an aggregation type of recalc, are also not allowed.

Example:

The **`old`** modifier can be used in conjunction with the **`propspread`** function to implement a hierarchical relationship among measures. In the following example, Total sales (`TotalSls`) is the "parent" measure and regular sales (`RegSls`), promotional sales (`PromSls`), and markdown sales (`MkdSales`) are the "child" measures. Using **`old`** and **`propspread`** to configure this relationship allows the manipulation of any combination of these measures before calculating, except for all of them.

In the following example and in other such hierarchical measure relationships, the order of the expressions within a rule is critical for the measures to be correctly calculated.

```
TotalSls = RegSls + PromoSls + MkdSls
RegSls, PromoSls, MkdSls = propspread(TotalSls, RegSls.old, PromoSls.old,
MkdSls.old)
PromoSls, MkdSls = propspread(TotalSls - RegSls, PromoSls.old, MkdSls.old)
RegSls, MkdSls = propspread(TotalSls - PromoSls, RegSls.old, MkdSls.old)
RegSls, PromoSls = propspread(TotalSls - MkdSls, RegSls.old, PromoSls.old)
RegSls = TotalSls - PromoSls - MkdSls
PromoSls = TotalSls - RegSls - MkdSls
MkdSls = TotalSls - RegSls - PromoSls
```

Description of Functions

Calendar Index Functions

These are functions that return the calendar index numbers of positions that are specified relative to the current position through hierarchical relationships, or by date. Support is in place for functions to find the first and last children of a parent at a given dimension (for instance, the first week of the current quarter, the last week of the current month). These are to support relative time series functions, such as month to date totals. These may be constrained by setting a condition under which the expression is evaluated.

indexfirst

Returns the calendar index number of the first position in the current dimension that is descended from the parent of the current position at the specified dimension.

See the `tssum` function for an example of typical usage. The function may be constrained by setting a condition for the evaluation.

Syntax

```
indexfirst([<clndhierarchy>].{[<dimension>] | top}[, <boolexpr>])
```

Where `<clndhierarchy>` is the name of the calendar (time) hierarchy, and `<dimension>` is the name of a dimension in the calendar hierarchy. `top` is a keyword that implies the top dimension in the calendar hierarchy. If `<dimension>` is not a valid dimension in the calendar hierarchy, or it is not a dimension that is equal to or higher than the current (being evaluated) dimension in any alternate hierarchy, an ***error*** is generated.

`<boolexpr>` is optional and is any valid Boolean expression used to set a condition for the evaluation of the function. If `<boolexpr>` is not specified, the function returns the index number of the first position of the dimension descended from the parent of the current position of the specified dimension. When `<boolexpr>` is specified, the function returns the index number of the first position of the dimension descended from the parent of the current position at the specified dimension where the `<boolexpr>` evaluates to true.

Inverse

The `indexfirst` function does not have an inverse.

Examples:

- `indexfirst([clnd].[qtr])`

  If the cell being evaluated is a week, this returns the calendar index number of the first week in the quarter that the week of the cell being evaluated belongs to (that is, the first week in the current quarter).

- `indexfirst([clnd].[week], Receipts != 0)`

  If the cell being evaluated is a day, this returns the calendar index number of the first day of the current week when that has a value for `Receipts` that is not equal zero (that is, the first day in the current week with recorded Receipts).

- `indexfirst([clnd].top)`

  If the cell being evaluated is a week, this returns the calendar index number of the first week in the calendar horizon. This keyword is included for consistency with other functions, as it will always return the value first (that is, zero).

indexlast

Returns the calendar index number of the last position in the current dimension that is descended from the parent of the current position at the specified dimension.

The function may be constrained by setting a condition for the evaluation.

Syntax

```
indexlast([<clndhierarchy>].{[<dimension>] | top}[, <boolexpr>])
```

Where <clndhierarchy> is the name of the calendar (time) hierarchy. <dimension> is the name of a dimension in the calendar hierarchy. top is a keyword that implies the top dimension in the calendar hierarchy. If <dimension> is not a valid dimension in the calendar hierarchy, or is not a dimension that is equal to or higher than the current (being evaluated) dimension (in any alternate hierarchy), an ***error*** is generated.

<boolexpr> is optional and is any valid Boolean expression used to set a condition for the evaluation of the function. If <boolexpr> is not specified, the function returns the index number of the last position of the dimension descended from the parent of the current position at the specified dimension. When <boolexpr> is specified, the function returns the index number of the last position of the dimension descended from the parent of the current position at the specified dimension where the <boolexpr> evaluates to true.

Inverse

The indexlast function does not have an inverse.

Examples:

- `indexlast([clnd].[qtr])`

  If the cell being evaluated is a week, this returns the calendar index number of the last week in the quarter that the week for the cell being evaluated belongs to (that is, the last week in the current quarter).

- `indexlast([clnd].[week], Receipts != 0)`

  If the cell being evaluated is a day, this returns the calendar index number of the last day of the current week that has a value for Receipts that is not equal to zero (that is, the last day of the current week with recorded Receipts).

- `indexlast([clnd].top)`

  If the cell being evaluated is a week, this returns the calendar index number of the last week in the calendar horizon. This keyword is included for consistency with other functions, as it will always return the value last.

indextostartdate

Returns the start date of the period whose index number is supplied.

Syntax

```
indextostartdate(<index>[ ,[<clndhierarchy>].{[<dimension>] | current}])
```

Where <clndhierarchy> is the name of the calendar (time) hierarchy, and <dimension> is the name of a dimension in the calendar hierarchy. current is a keyword that implies the current dimension in the calendar hierarchy. If <dimension> is not a valid dimension in the calendar hierarchy, an ***error*** is generated. If the calendar hierarchy and dimension are not supplied, the default is the current calendar dimension.

> **Note:** This function requires that the day dimension of the calendar hierarchy be included in the workbook. If the lowest dimension of the calendar hierarchy is above the day dimension, the function will not be able to return a valid date.

<index> is an expression that returns an index number in the indicated calendar dimension. If <index> is non-integer, only the integer portion is used. If <index> is not a valid index number for the specified dimension, an ***error*** is generated. If the measure being evaluated does not have a base intersection in the calendar hierarchy, and the current option is used, an ***error*** is generated.

The function returns a date that is the start date of the period indicated by the dimension and index number. If the period being evaluated is at or below the day level, the start date is the date of the whole of the period. If the period being evaluated is above the day level, the start date is the date of the first child position at the day level of the period being evaluated.

Inverse

The indextostartdate function does not have an inverse.

Examples:

- `indextostartdate(current)`

  Returns the start date of the current time period.

- `indextostartdate (indexfirst([clnd].[qtr]))`

  Returns the start date of the first period in the current time dimension in the current quarter.

- `indextostartdate (index([clnd].[week], openweek), [clnd].[week])`

  Returns the start date of the period at the week level whose name is held in the openweek measure.

indextoenddate

Returns the end date of the period whose index number is supplied.

Syntax

```
indextoenddate(<index>[ ,[<clndhierarchy>].{[<dimension>] | current}])
```

Where <clndhierarchy> is the name of the calendar (time) hierarchy, and <dimension> is the name of a dimension in the calendar hierarchy. current is a keyword that implies the current dimension in the calendar hierarchy. If <dimension> is not a valid dimension in the calendar hierarchy, an ***error*** is generated. If the calendar hierarchy and dimension are not supplied, the default is the current calendar dimension.

> **Note:** This function requires that the day dimension of the calendar hierarchy be included in the workbook. If the lowest dimension of the calendar hierarchy is above the day dimension, the function will not be able to return a valid date.

<index> is an expression that returns an index number in the indicated calendar dimension. If <index> is non-integer, only the integer portion is used. If <index> is not a valid index number for the specified dimension, an error is generated. If the measure being evaluated does not have a base intersection in the calendar hierarchy, and the current option is used, an ***error*** is generated.

The function returns a date that is the end date of the period indicated by the dimension and index number. If the period being evaluated is at or below the day level, the end date is the date of the whole of the period. If the period being evaluated is above the day level, the end date is the date of the last child position at the day level of the period being evaluated.

Inverse

The indextoenddate function does not have an inverse.

Examples:

- `indextoenddate(current)`

  Returns the end date of the current time period.
- `indextoenddate (indexfirst([clnd].[qtr]))`

  Returns the end date of the last period in the current time dimension in the current quarter.
- `indextoenddate (index([clnd].[week], openweek), [clnd].[week])`

  Returns the end date of the period at the week level whose name is held in the openweek measure.

Index and Position Functions

This is a class of general functions that may be used for any hierarchy that enables reference to positions in a generic manner. In most cases, the functions do not generate results that are useful in themselves, but they are typically used as parameters that are passed into other functions.

An "index" is an internal reference to a position in a dimension. For dimensions in the calendar hierarchy, the index reflects an ordering of positions because there is a well-defined sequence (oldest to newest, based on the start and end dates) of periods. There are special calendar index functions that exploit this property. For other dimensions, there is no such ordering, and the index number can be considered to be "random."

> **Note:** Index numbers (including calendar index numbers) should not be saved and reused between planning sessions, as there is no guarantee that the same index numbers will apply in subsequent sessions since the positions or relationships in a hierarchy may change.

These general index functions may be used for any hierarchy, including the calendar hierarchy.

index

Returns the index number of the specified position in the specified dimension of the specified hierarchy.

Syntax

`index([<hierarchy>].{[<dimension>] | current}[,{ <stringexpr> | <dateexpr>}])`

Where <hierarchy> is the name of a valid hierarchy, and <dimension> is the name of a valid dimension in that hierarchy. current is a keyword that returns the current dimension in <hierarchy>. If <hierarchy> is not a valid hierarchy or <dimension> is not a valid dimension in that hierarchy, an ***error*** is generated.

<stringexpr> and <dateexpr> are optional expressions that can be used to specify a position. If neither <stringexpr> nor <dateexpr> are specified the function returns the index number of the current position of the dimension being evaluated. <stringexpr> is a string expression that results in a position name. If the result of <stringexpr> is not a valid position name in the dimension being evaluated, an ***error*** is generated. <dateexpr> is a numeric expression that results in a date type value and can only be used if <hierarchy> is the calendar hierarchy. If the result of <dateexpr> is not a date type value, or the result is returned when evaluating a dimension that is not in the calendar hierarchy, an ***error*** is generated.

The function returns the index number of the indicated position in the specified dimension of the specified hierarchy. When used with dates, the indicated position is the position that contains the date specified.

Inverse

The index function does not have an inverse.

Examples:

- `index([prod].[item], likeitem)`

  This returns the index number of the string position in the item dimension referenced in the likeitem measure.

- `index([prod].[cls], "cls123")`

  This returns the index number of the class cls123.

- `index([clnd].[mnth], opendate)`

  This returns the index number of the month that contains the date that results from the opendate measure.

position

Returns the position name of the position in the specified dimension of the specified hierarchy with the supplied index number. The returned string is in upper case.

Syntax

`position([<hierarchy>].{[<dimension>] | current}[, <indexexpression>])`

<hierarchy> must be the name of a valid hierarchy. If specified, <dimension> must be the name of a valid dimension in that hierarchy. current is a keyword that returns the current dimension in <hierarchy>. If <hierarchy> is not a valid hierarchy or <dimension> is not a valid dimension in that hierarchy, an ***error*** is generated.

<indexexpression> is an optional parameter to specify the index of the position to be evaluated. If <indexexpression> is not specified, the current position is assumed. The expression must be a valid expression that results in a numeric measure. The integers of the resulting values of the expression are used as the index numbers to determine the position to be evaluated. If <indexexpression> does not return a valid index number for the specified dimension an ***error*** is generated.

The function returns an uppercase string that is the position name of the position with the specified index number for the specified dimension of the specified hierarchy.

Inverse

The `position` function does not have an inverse.

Examples:

- `position([prod].[item], 3)`

  This returns the position name of the item with index number =3.
- `position([prod].[item], likeindex)`

  This returns the position name of the item with the index number in the measure `likeindex`.
- `position([prod].current)`

  This returns the position name of the current position of the current dimension in the product hierarchy.

attribute

Returns the value of the specified attribute for the current position, or the position with the supplied index number.

Syntax

```
attribute(<attribute>, [<hierarchy>].{[<dimension>] | current}[,
<indexexpression>])
```

Where `<attribute>` is a valid attribute for the dimension to be used, otherwise an ***error*** is generated. `<hierarchy>` must be the name of a valid hierarchy. If specified, `<dimension>` must be the name of a valid dimension in that hierarchy. **current** is a keyword that returns the current dimension in `<hierarchy>`. If `<hierarchy>` is not a valid hierarchy or `<dimension>` is not a valid dimension in that hierarchy, an ***error*** is generated.

`<indexexpression>` is an optional parameter to specify the index of the position to be evaluated. If `<indexexpression>` is not specified, the current position is assumed. The expression must be a valid expression that results in a numeric measure. The integers of the resulting values of the expression are used as the index numbers to determine the position to be evaluated. If `<expression>` does not return a valid index number for the specified dimension an ***error*** is generated.

Valid values for `<attribute>` for all non-measure dimensions include the following, which must be specified using quotes:

- `"label"` – The label (description) for the position. This value must be specified using quotes. The attribute function requires left-hand side measure to be a string measure. All keywords which need to be passed to a function must be wrapped in double quotes. Any other syntax will throw an error.
- `"dpmstatus"` – The DPM status of the position. This attribute function required left-hand side measure to be a Boolean measure. TRUE value corresponds to an "informal" status. A FALSE value corresponds to a "formal" status.

The function returns the value of the specified attribute for the specified position.

Inverse

The `attribute` function does not have an inverse.

Examples:

- `attribute("label", [prod].current)`

  This returns the value of the label attribute for the current position of the current dimension in the product hierarchy.

- `attribute("dpmstatus", [prod].[item], likeindex)`

  This returns the value of the `dpmstatus` attribute for the item with the index number in the measure `likeindex` (that is, the label for my like item).

Forecast Procedure

Using the RPAS Configuration Tools, a time-series demand forecast may be configured as part of a planning workflow or business process. The Forecast procedure provides only a small subset of the functionality that is available through RDF. The differences between these solution extensions are as follows:

- The forecast produced by the Forecast procedure is a single-level forecast.
- RDF allows for forecasts to be generated at aggregate levels in the data (to remove sparsity), and then this forecast is spread down to the execution level by using a profile.
- The Forecast procedure allows for a single forecasting method to be specified in the calculation of the forecast.
- RDF allows for forecasting methods and forecasting parameters to be modified as needed at all levels in your data.
- No standard approval process of the resulting forecasts are included as part of the Forecast procedure.
- RDF allows for forecast adjustments and approvals to be made at the lowest level necessary in your data.

The "Forecast Procedure Syntax" section contains the specifications and syntax for configuring the Forecast procedure.

Forecast Requirements

The following libraries must be registered in any domain(s) that will use the Forecast solution extension:

- AppFunctions
- RdfFunctions

Using the Forecast Procedure

The following notes are intended to serve as a guide for configuring the Forecast procedure within the RPAS Configuration Tools.

- Refer to the appropriate input parameters and output measures when using the Forecast procedure.
- The resultant measure (that is, the forecast output) should be at the same intersection as your history measure (that is, pos). This will be the base intersection of the final level.
- The Forecast procedure is a multiple result procedure, meaning that it can return multiple results with one procedure call within a rule. In order to get multiple results, the resultant measures must be configured in the Measure Tool and the specific measure label must be used on the left-hand side (LHS) of the procedure call. The resultant measure parameters must be comma-separated in the procedural call.

Syntax Conventions

The table below displays the syntax conventions used in this procedure.

Indicator	Definition
[…]	All options listed in brackets are optional.
{…|…}	Options listed in "{}" with "|" separators are mutually exclusive (either/or).
{…,…}	Options listed in "{}" with "," separators way are a complete set.
Bold	Labels.
Italics	Italics indicate a temporary placeholder for a constant or a measure.
Italics/meas	This indicates that the placeholder can be either a constant or a measure.
BoldItailics	This indicates a numeric placeholder for the dynamic portion of a label. Usually a number from 1 to N.
Normal	Normal text signifies required information.
Underlined	This convention is used to identify the function or procedure name.

Forecast Procedure Syntax

The syntax for using the Forecast procedure appears below. The example below is a simplified syntax version of the Forecast procedure. For the complete syntax version, refer to the *RDF Configuration Guide*. The input and output parameter tables explain the specific usage of the parameters names use in the procedure.

Generic Example:

FORECAST: FORMEAS , **PEAKS:**PEAKSMEAS, **CHMETHOD:**METHMEAS<-***FORECAST***(**MASK:**MEASKMEAS, {**STARTDATE:**STARTDATE | **STARTDATEMEAS:**STARTDATEMEAS}, **HISTORY:** HISTORYMEAS, **FORECASTLENGTH:**FORECASTLENGTH, **PERIOD:**PERIOD ,{**FRCSTSTARTMEAS:**FRCSTSTARTMEAS | **FRCSTSTART:**FRCSTSTART}, **PLAN:**PLAN, **PROFILE:**PROFILE, **BAYESIAN_HORIZ:**BAYESIAN_HORIZ, {**VALID_DD:**VALID_DD, **DDPROFILE:**DDPROFILE })

Sample:

```
forecast:frcstout,cumint:cumintout,int:intout<-
Forecast(forecastlength:12,history:pos,mask:frcstmask,period:26,startdatemeas:toda
ymeas)
```

Configuration Parameters and Rules

Input Parameters

The table below provides the input parameters for the Forecast procedure.

Parameter Name	Description
FORECASTLENGTH	The length of the forecast. Data Type: Integer Multiple Allowed: No Required: Yes

Parameter Name	Description
HISTORY	The input measure the forecast is based on. Data Type: Real Multiple Allowed: No Required: Yes
MASK	Array that identifies what forecast method is used for each time series. Refer to Forecast Model/Model List table. Data Type: Integer Multiple Allowed: No Required: Yes
MAXALPHA	The maximum alpha value. Data Type: Real Multiple Allowed: No Required: No
PERIOD	The forecasting period for calculating seasonal coefficients. Data Type: Integer Multiple Allowed: No Required: Yes
FRCSTSTARTMEAS	The measure of the forecast start dates. Data Type: Datetime Multiple Allowed: No Required: No
FRCSTSTART	The forecast start date. Data Type: Datetime Multiple Allowed: No Required: No
PLAN	The Plan measure. Data Type: Real Multiple Allowed: No Required: No
PROFILE	The Seasonal Profile measure. Data Type: Real Multiple Allowed: No Required: No
STARTDATE/ STARTDATEMEAS	The forecast start date. Either STARTDATE or STARTDATEMEAS is required. STARTDATEMEAS, if used, must be a scalar for AutoES method. Data Type: STARTDATE - Date as a string. Data Type: STARTDATEMEAS – scalar measure. Multiple Allowed: No Required: Yes

Parameter Name	Description
BAYESIAN_HORIZ	The horizon to which the Bayesian adjust is applied. Data Type: Integer Multiple Allowed: No Required: No BAYESIAN_HORIZ should have the same base intx as METHOD.
VALID_DD	The maximum non-zero history to use de-seasonalized demand value for seasonal profile based forecasting. Data Type: Integer Multiple Allowed: No Required: No
DDPROFILE	De-seasonalized demand measure. Used only for profile-based forecasting. Data Type: Double Multiple Allowed: No Required: No

Output Parameters

The table below provides the output parameters for the Forecast procedure.

Parameter Name	Description
CHMETHOD	Selected method. Refer to Forecast Model/Model List table. Data Type: Integer Multiple Allowed: No Required: No
FORECAST	Forecast output. Data Type: Real Multiple Allowed: No Required: Yes
PEAKS	Peaks, which are used for calculating baseline of the forecast. Data Type: Real Multiple Allowed: No Required: No

Forecast Method/Model List

The table below provides the numeric value assigned to the forecast model/model list.

Model	Numeric Value
AUTO ES	1
SIMPLE	2

Model	Numeric Value
HOLT	3
WINTERS	4
CASUAL	5
AVERAGE	6
NO FORECAST	7
COPY	8
CROSTON	9
M. WINTERS	10
A. WINTERS	11
SIMPLE CROSTON	12
BAYESIAN	13
LOADPLAN	14
PROFILE	15

Time Series Functions

Overview

This is a collection of very similar functions to perform typical calculation tasks over a range of cells in one or more time series. The <start> and <end> positions, defined using calendar index numbers, specifies the range of cells to be used. Typically, there may be some arithmetic performed to calculate the start and/or end positions.

Note: By using the **indexdate** or **index** functions to provide calendar index numbers, the <start> and <end> positions to be used in the time series can effectively be specified by position name or by date.

Note: If the level modifier is used, the **current** keyword only has a value when the level used is higher than the level being evaluated (since, for example, the concept of "the current week" is ambiguous when evaluating a month, so an **error** is generated).

Single Time Series Functions

tssum

Produces a sum of the cells in the time series for the measure defined by the start and end positions.

tssum is used for the following types of calculations:

- Season to date
- Balance to achieve
- 4 week moving sum

The function produces a sum of the cells in the time series for the positions implied by the <start> and <end> for the specified dimension.

Syntax

tssum(<*expression*>[, <*start*>[, <*end*>]])

Where <expression> is an expression or measure whose time series is to be used, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<expression> is mandatory, the other parameters are optional. If <start> is not specified, the default value is **first** (that is, 0). If <end> is not specified, the default value is **current**.

Use the **level** modifier to specify a dimension in the calendar hierarchy when calculating above or below the current calendar dimension.

Inverse

The **tssum** function does not have an inverse.

Examples:

- **tssum**(PlanSales)

  This is a plan-to-date or running total value for sales.
- **tssum**(PlanSales, **current**, **last**)

  This provides a "balance to achieve" (that is, a sum from the current period to the end of the horizon).
- **tssum**(PlanSales.level([clnd].[week]), **current** – 3, **current**)

  This provides a 4 week moving total for sales.
- **tssum**(PlanSales, **indexfirst**([clnd].[qtr]))

  This provides a "quarter to date" running total (see the **indexfirst** function).

tsavg

The average (mean) value of the cells in the range.

The function produces an average of the cells in the time series for the positions implied by the <start> and <end> for the specified dimension.

Syntax

tsavg(<*expression*>[, <*start*>[, <*end*>]])

Where <expression> is an expression or measure whose time series is to be used, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<expression> is mandatory; the other parameters are optional. If <start> is not specified, the default value is **first** (for instance, 0). If <end> is not specified, the default value is **current**.

Use the **level** modifier to specify a dimension in the calendar hierarchy when calculating above or below the current calendar dimension.

Inverse

The **tsavg** function does not have an inverse.

tsmax

The maximum value of any cell in the range.

The function returns the maximum value of the cells in the time series for the positions implied by the <start> and <end> for the specified dimension.

Syntax

tsmax(<*expression*>[, <*start*>[, <*end*>]])

Where <expression> is an expression or measure whose time series is to be used, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<expression> is mandatory; the other parameters are optional. If <start> is not specified, the default value is **first** (for instance, 0). If <end> is not specified, the default value is **current**.

Use the **level** modifier to specify a dimension in the calendar hierarchy when calculating above or below the current calendar dimension.

Inverse

The **tsmax** function does not have an inverse.

tsmin

The minimum value of any cell in the range.

The function returns the minimum value of the cells in the time series for the positions implied by the <start> and <end> for the specified dimension.

Syntax

tsmin(<*expression*>[, <*start*>[, <*end*>]])

Where <expression> is an expression or measure whose time series is to be used, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<expression> is mandatory; the other parameters are optional. If <start> is not specified, the default value is **first** (for instance, 0). If <end> is not specified, the default value is **current**.

Use the **level** modifier to specify a dimension in the calendar hierarchy when calculating above or below the current calendar dimension.

Inverse

The **tsmin** function does not have an inverse.

tsmode

The modal value of the cells in the range.

The function returns the modal value of the cells in the time series for the positions implied by the <*start*> and <*end*> for the specified dimension.

Syntax

tsmode(<*expression*>[, <*start*>[, <*end*>]])

Where <expression> is an expression or measure whose time series is to be used, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<expression> is mandatory; the other parameters are optional. If <start> is not specified, the default value is **first** (for instance, 0). If <end> is not specified, the default value is current.

If there is more than one value for the mode, then the function returns the first value that is calculated.

Use the **level** modifier to specify a dimension in the calendar hierarchy when calculating above or below the current calendar dimension.

Inverse

The **tsmode** function does not have an inverse.

tsmedian

The median value of the cells in the range.

The function returns the median value of the cells in the time series for the positions implied by the <*start*> and <*end*> for the specified dimension.

Syntax

tsmedian(<*expression*>[, <*start*>[, <*end*>]])

Where <expression> is an expression or measure whose time series is to be used, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<expression> is mandatory; the other parameters are optional. If <start> is not specified, the default value is **first** (for instance, 0). If <end> is not specified, the default value is current.

If there is no middle number, the function returns the average of the middle two numbers.

Use the **level** modifier to specify a dimension in the calendar hierarchy when calculating above or below the current calendar dimension.

Inverse

The **tsmedian** function does not have an inverse.

tsstd

The standard deviation of the cells in the range.

The function returns the standard deviation of the cells in the time series for the positions implied by the <start> and <end> for the specified dimension.

Syntax

tsstd(<*expression*>[, <*start*>[, <*end*>]])

Where <expression> is an expression or measure whose time series is to be used, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<expression> is mandatory; the other parameters are optional. If <start> is not specified, the default value is **first** (for instance, 0). If <end> is not specified, the default value is current.

Use the **level** modifier to specify a dimension in the calendar hierarchy when calculating above or below the current calendar dimension.

Inverse

The **tsstd** function does not have an inverse.

tsvar

The variance of the cells in the range.

The function returns the variance of the cells in the time series for the positions implied by the <start> and <end> for the specified dimension.

Syntax

tsvar(<*expression*>[, <*start*>[, <*end*>]])

Where <expression> is an expression or measure whose time series is to be used, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<expression> is mandatory; the other parameters are optional. If <start> is not specified, the default value is **first** (for instance, 0). If <end> is not specified, the default value is current.

Use the **level** modifier to specify a dimension in the calendar hierarchy when calculating above or below the current calendar dimension.

Inverse

The **tsvar** function does not have an inverse

Double Time Series (Statistical Error) Functions

tsme

Produces the Mean Error of an 'estimate' time series compared to an 'actuals' time series.

Syntax

tsme(<*x*>, <*y*>[, <*start*>[, <*end*>]])

Where <x> is an expression or measure that represents the *estimate* and <y> is an expression or measure that represents the *actuals*, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated

<x> and <y> are mandatory, and the other parameters are optional. If <start> is not specified, the default value is **first** (that is, 0). If <end> is not specified, the default value is **current**. The Mean error is calculated using the following formula:

$$\frac{\sum_{i=0}^{n-1}(x_i - y_i)}{n}$$

Inverse

The **tsme** function does not have an inverse.

Examples:

- `tsme(FcstSales, ActSales)`

  This calculates the Mean Error of the `FcstSales` measure from the start of the calendar horizon until the current time period.

- `tsme(FcstSales, ActSales, first, elapsed)`

  This calculates the Mean Error of the `FcstSales` measure from the start of the calendar horizon until the last time period with actuals loaded.

- `tsme(FcstSales, ActSales, first, min(elapsed, current))`

  This calculates the Mean Error of the `FcstSales` measure from the start of the calendar horizon until the first of the period being evaluated or the last time period with actuals loaded.

tsmae

Mean Absolute Error.

Syntax

tsmae(<*x*>, <*y*>[, <*start*>[, <*end*>]])

Where <x> is an expression or measure that represents the *estimate* and <y> is an expression or measure that represents the *actuals*, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<x> and <y> are mandatory, the other parameters are optional. If <start> is not specified, the default value is **first** (that is, 0). If <end> is not specified, the default value is **current**.

The Mean Absolute error is calculated using the following formula:

$$\frac{\sum_{i=0}^{n-1} \left| x_i - y_i \right|}{n}$$

Inverse

The **tsmae** function does not have an inverse.

tsmape

Mean Absolute Percentage Error.

Syntax

tsmape(<*x*>, <*y*>[, <*start*>[, <*end*>]])

Where <x> is an expression or measure that represents the *estimate* and <y> is an expression or measure that represents the *actuals*, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated..

<x> and <y> are mandatory, and the other parameters are optional. If <start> is not specified, the default value is **first** (for instance, 0). If <end> is not specified, the default value is **current**. The Mean Absolute Percentage error is calculated using the following formula:

$$\frac{\sum_{i \in (0 \le i < n \cap y_i \neq 0)} \left| \frac{x_i - y_i}{y_i} \right|}{\sum_{i \in (0 \le i < n \cap y_i \neq 0)} 1}$$

Inverse

The **tsmape** function does not have an inverse.

tsrmse

Root Mean Square Error.

Syntax

tsrmse(<*x*>, <*y*>[, <*start*>[, <*end*>]])

Where <x> is an expression or measure that represents the *estimate* and <y> is an expression or measure that represents the *actuals*, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<x> and <y> are mandatory, and the other parameters are optional. If <start> is not specified, the default value is **first** (that is, 0). If <end> is not specified, the default value is **current**. The Root Mean Square error is calculated using the following formula:

$$\sqrt{\frac{\sum_{i=0}^{n-1}(x_i - y_i)^2}{n}}$$

Inverse

The **tsrmse** function does not have an inverse.

tspae

Percentage Absolute Error.

Syntax

tspae(<x>, <y>[, <start>[, <end>]])

Where <x> is an expression or measure that represents the *estimate* and <y> is an expression or measure that represents the *actuals*, and <start> and <end> are expressions that calculate numbers. The current calendar dimension is assumed, and if the cell being evaluated does not have a calendar dimension, the bottom calendar dimension is assumed. If the values of <start> or <end> are numeric, but non-integer, only the integer portion will be used. If <end> is less than <start>, or either parameter is non-numeric or outside the scope of the calendar index numbers for the specified dimension, an **error** is generated.

<x> and <y> are mandatory, and the other parameters are optional. If <start> is not specified, the default value is **first** (that is, 0). If <end> is not specified, the default value is current. The Percentage Absolute error is calculated using the following formula:

$$\frac{\sum_{i=0}^{n-1}|x_i - y_i|}{\sum_{i=0}^{n-1}|y_i|}$$

Inverse

The **tspae** function does not have an inverse.

Hierarchical Functions and Procedures

Overview

This is a collection of functions and procedures that provide some knowledge of hierarchical structures, and the how the current position fits in, or uses knowledge of hierarchical structures.

count

Returns the count of children at a specified level that belong to a parent at a higher level.

Syntax

count*([<hierarchy>]*[*.<childdimspec>*[*,<parentdimspec>*]]*)*

Where *<childdimspec>* is {[*<childdimension>*] | **bottom** | **current**}

and *<parentdimspec>* is [*<hierarchy>*].{[*<parentdimension>*] | **top** | **current**}

<hierarchy> is the name of a valid hierarchy (same hierarchy must be referenced throughout the function). *<childdimension>* and *<parentdimension>* must be valid dimensions in the specified hierarchy. If both are specified, then *<childdimension>* must be lower than *<parentdimension>* in a roll-up, or an ***error*** is generated. **bottom**, **top,** and **current** are keywords referring to the lowest, highest, and current (being evaluated) dimensions in the hierarchy. If *<childdimspec>* is not specified, the default is **bottom**. If *<parentdimension>* is not specified, the default is **current**.

The function returns the number of children in the dimension *<childdimension>* that are descended from the implied position (the current position or the ancestor of the current position at the specified level) in the dimension *<parentdimension>*. If the *<childdimension>* and the *<parentdimension>* are the same, the function returns the value of 1.

Inverse

The **count** function does not have an inverse.

Examples:

- **count([loc].bottom)**

  Returns the number of children in the bottom dimension in the location hierarchy for the current position in the location hierarchy

- **count([loc].[str])**

  Returns the number of children in the store dimension (str) in the location hierarchy for the current position in the location hierarchy (that is, 'how many stores do I own')

- **count([loc].[str], [loc].[area])**

  Returns the number of children in the store dimension in the location hierarchy for the position in the dimension "area" that is the ancestor of the current position in the location hierarchy (that is, 'how many stores in my area')

lookup

Procedure that returns the value of an expression for a specific intersection.

The positions to be "looked up" may be in one or more hierarchies. This procedure has the following special uses and restrictions:

- lookup is a procedure and thus cannot be combined with functions and other procedures in any manner.
- Used for history mapping and like SKU/sister store functionality.
- The base intersection of the output measure must be the same as the input measure and/or one or more of the mapping measures.

Syntax

```
<output> <- lookup(<input>, <dimspec1> [, <dimspec2> ... , <dimspecn>])
```

Where <*dimspec1-n*> is [<*hierarchy*>].{[<*dimension*>] | **bottom** | **current** | **top**}, <*map*>

<*output*> is the measure being updated. <*input*> is the measure to be evaluated. Each <*dimspec*> is used to specify the hierarchy and dimension to be used in the mapping process and the measure that contains the mapping values.

For each <*dimspec*> that is specified, the <*hierarchy*> must be the name of a valid hierarchy and the <*dimension*> must be the name of a valid dimension in that hierarchy. **top** is a keyword that refers to the highest dimension in the hierarchy, **bottom** is a keyword that refers to the lowest dimension in the hierarchy, and **current** is a keyword that refers to the current dimension (that is, the dimension of the cell being evaluated).

<*map*> is either a measure or an explicitly stated position used to designate how positions in <*input*> are mapped to determine the resulting values in <*output*>. The output, input, and mapping measures used in the **lookup** procedure must conform in a certain manner. Specifically, the resulting measure <*output*> must have the same base intersection as <*input*>, <*map*>, or both measures so that all conform.

When <*map*> is a measure, it must result in either index numbers or position names, either of which must be valid index numbers or position names from the related dimension specification. When <*map*> contains index numbers that do not map to valid positions, an **error** is generated and the **na value** for <*output*> is returned. There is no special "cycle breaking" logic for the **lookup** procedure. This means that a measure may never be calculated from the **lookup** of the same measure.

> **Note:** **lookup** is a procedure so it cannot be combined with functions, modifiers, or other procedures in any manner. As a procedure, it requires a different syntax: "<-" instead of "=" when being assigned.

Inverse

The **lookup** procedure does not have an inverse.

Examples:

- **`output <- lookup(input, [presentationstyle].[ presentationstyle], map)`**

  Where output is at sku-week, input is at sku-presentationstyle, and map is at sku-week with position names or index numbers from the presentation style dimension. The output and mapping measures have the same base intersection. This expression calculates the output measure from the mapping of presentation styles that vary for each sku-week combination.

- **`output <- lookup(input, [prod].[sku], map)`**

  Where output and input are at sku-week and map is at sku with position names or index numbers from the sku dimension. This expression calculates the output measure from the like sku of the input measure.

tablelookup

Procedure that returns the value (interpolated if necessary) from the entry in a "table" of information held in measures that matches with supplied "keys."

Syntax

`tablelookup``(<expression>, <matching technique>, <keymeasure> [,<resultmeasure>])`

Where *`<matching technique>`* is `{exactmatch, <nomatchvalue> | average | nearest | high | low | interpolate}`

The `tablelookup` procedure requires that a "table" be available that may be the target of the lookup. This table will be formed from normal measures with a base intersection of "normal" dimensions. Nevertheless, the most usual usage will be where the table measures are dimensioned on a dimension built for the purpose, plus other dimensions as required.

Example:

Imagine a requirement to look up valid price points that may be applied as prices for an item. The collection of valid price points will be different for each *class*. To satisfy this requirement, a table is built. A 'table' hierarchy is defined with a "tableentry" dimension with a number of positions, which are named e01, e02, e03, … e99 to allow for 99 entries in the table, with the order of the positions being the same as their natural sort sequence, and the order of the hierarchy being the highest (innermost) non-time hierarchy. A measure named "pp" is defined with a base intersection of tableentry/class. The "pp" measure is populated with valid pricepoints for each class, with the lowest valid pricepoint in position e01, the next lowest in e02, and so on. This "table" can now be used to look up valid pricepoints. The procedure call (indirectly) provides a class and (directly) provides a target price as arguments, and a valid price point is returned based on the selected matching technique. See the following examples for an example that uses this "table."

`<expression>` is any valid expression that results in a value of the same data type as the `<keymeasure>`. In the description that follows, this value is referred to as the key value. `<keymeasure>` is the name of the measure to be used as a key when matching the key value against the "table." `<resultmeasure>` is an optional measure that holds the return value. If `<resultmeasure>` is not specified, `<keymeasure>` is used for the values of the result as in the price point example, below.

The procedure attempts to match the key value against an entry in the "table." The innermost non-time dimension in the base intersection of the `<keymeasure>` is assumed to be the dimension along which entries in the table are indexed. For all other dimensions in the base intersection of the `<keymeasure>`, the procedure will match against the parent at that dimension of the cell being evaluated.

> **Note:** The values in <keymeasure> must be in ascending order and must not contain any repeated values. A value that is either out of sequence or repeated designates that the previous value is the last entry in the "table." In other words, only the sorted elements in the key measure will be considered in the lookup process.

The <matching technique> specifies the matching technique to be used when an exact match of the <keymeasure> against the key value is not found. If the matching technique is exactmatch, <nomatchvalue> is a numeric value that must be specified to indicate the value to use in cells when there is no exact match. Otherwise, if the key value is higher than the highest value in the "table," or lower than the lowest value in the table, it is assumed to match against the highest or lowest value accordingly. If the matching technique is high and no match against the key value is found, the procedure returns the value of the <resultmeasure> for the entry immediately higher than the key value. If the matching technique is low and no match against the key value is found, the procedure returns the value of the <resultmeasure> for the entry immediately lower than the key value. If the matching technique is nearest and no match against the key value is found, the procedure returns the value of the <resultmeasure> for the entry immediately lower than the key value or immediately higher than the key value, depending upon which entry is nearest (this is like rounding to the nearest value). If the matching technique is average and no match against the key value is found, the procedure returns the numeric average of the value of the <resultmeasure> for the entry immediately lower and immediately higher than the key value, or it generates an error if the <resultmeasure> is not of numeric data type.

If the matching technique is interpolate and no match against the key value is found, the procedure returns an interpolated value between the value of the <resultmeasure> for the entry immediately lower and immediately higher than the key value, or it generates an error if the <resultmeasure> is not of numeric data type. The interpolation is calculated as follows:

$$lowresult + \frac{(highresult - lowresult) * (keyvalue - lowvalue)}{(highvalue - lowvalue)}$$

Inverse

The **tablelookup** procedure does not have an inverse.

Examples:

- `tablelookup(tgtpr, nearest, pp)`

  Returns the nearest valid value of the pp measure to the supplied target price (tgtpr).

- `tablelookup(perc, interpolate, epct, elast)`

  Looks up the percentage markdown (perc) of the current position against a percentage change elasticity table (epct). Returns the matching elasticity value (elast). If the percentage markdown is not found in the table, the procedure will interpolate the elasticity value from the nearest values above and below the percentage markdown.

flookup

The fixed look up function that returns the value of a measure for an explicitly named fixed intersection.

Syntax

flookup(<measure>, <posspec1> [, <posspec2> … , <posspecn>])

Where <*posspec1-n*> is: [<*hierarchy*>].[<*dimension*>].[<*positionname*>]

<measure> is the measure to be looked up. This <measure> must conform with the measure being calculated as follows. Some hierarchies may be present in the base intersection of both measures, and these are handled by normal "non-conforming" logic. For any hierarchies that are only in the base intersection of the measure being calculated (output measure), all positions will lookup the same value. For any hierarchies that are only in the base intersection of the <*measure*> (input measure), the position to be used **must** be **explicitly** named through a position specification (<posspec>).

> **Note:** If the position to be used can only be specified indirectly (for example, if it is held in a measure), the **flookup** function cannot be used, and the more powerful **lookup** procedure should be used instead.

flookup can be used to return a constant or a slice. In case of a constant, the NA value of the flookup function will be the value of the constant. In case of a slice, the NA value of the flookup function will be the NA value of <measure>.

For each <posspec> that is specified, the <hierarchy> must be the name of a valid hierarchy, the <dimension> must be the name of a valid dimension in that hierarchy, and the <positionname> must be the name of a valid position in that dimension, If the position name includes special characters, it can be enclosed in quotes (" ") in addition to the standard requirement for square brackets ([ ]). If <hierarchy> is not a valid hierarchy or <dimension> is not a valid dimension in that hierarchy, or <positionname> is not a valid position in that dimension, an **error** is generated.

Additionally, <dimension> must be a dimension in the base intersection of <measure>. To use dimensions not in the base intersection, the <measure> must have a level modifier to explicitly raise it to the desired dimension.

There is no special "cycle breaking" logic for the flookup function. This means that a measure may never be calculated from the flookup of the same measure. The flookup function returns the value of the expression from the specified fixed intersection.

Inverse

The **flookup** function does not have an inverse.

Examples:

- **flookup**(perc, [flvl].[flvl].[flvla])

  Returns the value for the measure perc for the position flvla in the flvl dimension of the flvl hierarchy.

- **flookup**(leadtime, [prod].[cls].[class1], [loc].[whse].[whseA])

  Returns the value for the measure leadtime for the class class1 for the warehouse whseA.

aggregate

The aggregate procedure provides similar functionality to the hybrid aggregation type. Measures that use the hybrid aggregation type cannot be manipulated above their base intersection (as there is no mechanism to spread changes), but since the aggregate procedure is used on recalc measures, they can be changed with the change being applied through normal mapping rules. In addition, the aggregate procedure has a **recalc** aggregation type that is not available in the hybrid aggregation method.

This procedure returns the value of a measure aggregated from the base intersection to the current level using the supplied aggregation type.

Syntax

aggregate (<cachemeasure>, <hierspec1> [, <hierspec2> … , <hierspecn>])

where <hierspec1-n> is [<hierarchy>].<aggtype>

The rule writer specifies a <cachemeasure> that holds the base intersection values to be aggregated, and it is also the source of values for recalc aggregation.

The rule writer also specifies the aggregation type for each hierarchy and the priority sequence to be used. The priority sequence is required because at levels that are aggregated in more than one hierarchy (for instance, Department/Region/Month for a measure with a base intersection of Class/Store/Week), different results would usually be obtained by aggregating up each of the hierarchies. For example, if the requirement is to aggregate up the product hierarchy by using the total aggregation type, up the location hierarchy by using the average aggregation type, and up the calendar hierarchy by using the first aggregation type; there are three potential ways to calculate a value at Department/Region/Month. We could total from Class/Region/Month, average from Department/Store/Month, or first from Department/Region/Week. These would almost certainly generate three completely different values. By providing a priority sequence, the rule writer explicitly determines which of these values are required. See the worked example, below.

> **Note:** The effect of a series of aggregations of the same type up a single hierarchy may return different results from those of a measure with the same aggregation type.
>
> 'Normal' aggregation for a measure driven by its aggregation type is performed from all base intersection cells descended from the cell being evaluated. For example, for a measure with a base intersection of Class/Week and an 'average' aggregation type, the value calculated for a cell at Department/Month is the average of all values for all Class/Week cells for the Department/Month. If the measure is a recalc measure, calculated at aggregated levels from a rule with an aggregate function, such as aggregate(x, [prod].average, [clnd].average), the value for the Department/Month will be the average of all the Class/Months (not Class/Weeks) that belong to the Department/Month. Other than coincidentally, this would generate a different value.

<cachemeasure> is the measure to be aggregated, and the value of <cachemeasure> is also the value used for cells that are at the base intersection (bottom levels), and at aggregated levels when the required aggregation type is recalc. <hierarchy> is the name of a valid hierarchy. Each hierarchy may only be specified once in the procedure, but hierarchies may appear in any order. The sequence that the hierarchies are specified in is used to

determine which hierarchy to aggregate up if the cell being evaluated is at an aggregated level in more than one hierarchy. In this circumstance, aggregation is performed up the first specified hierarchy that the cell is at an aggregated level in, and the other hierarchies are ignored. <aggtype> specifies the aggregation type to be used. The <aggtype> must be one of the standard aggregation types. If any hierarchy that is in the scope of the measure being calculated is not explicitly specified, the aggregation type of that hierarchy is assumed to be total. Such hierarchies are assumed to be sequenced after all hierarchies that are explicitly referenced, and they are ordered from innermost to outermost.

> **Note:** The value of the <cachemeasure> is used at the base intersection of the measure being calculated. If, for a given cell, the aggregation type to be used is recalc, the value is also obtained directly from the <cachemeasure> at that level, which will normally have an aggregation type of **recalc**.
>
> **Note:** aggregate is a procedure so it cannot be combined with functions, modifiers, or other procedures in any manner. As a procedure it requires a different syntax: "<-" instead of "=" when being assigned.

Inverse

The **aggregate** procedure does not have an inverse.

Examples:

- `result <- aggregate(x, [clnd].recalc)`

  For cells at the base intersection, the value is calculated from the measure x. For cells at an aggregated level in the calendar hierarchy, the value is also obtained from the measure x, which we can assume has an aggregation type of recalc, and thus the result of the procedure is as if the aggregation type were recalc, using the usual expression to calculate measure x. If the cell is not at an aggregated level in the time hierarchy, and assuming in this example that the other hierarchies are product and location; in that priority, the value for a cell at an aggregated product level is calculated as the total of all cells for products descended from that product for the same location and time. Otherwise, the value for the cell is calculated as the total of all cells for locations descended from the cell's location for the same product and time.

- `result <- aggregate(x, [loc].average)`

  In a similar manner to the previous example, cells at aggregated levels in the location hierarchy will be calculated by averaging the values of cells for all descendent locations. Otherwise, the value will be totaled up the product or time hierarchy as appropriate.

- `result <- aggregate(x, [clnd].average)`

  Totals up all hierarchies except time, which uses an average aggregation type.

- `result <- aggregate(x, [prod].average, [clnd].first)`

  Averages up the product hierarchy if possible. Otherwise, takes the first child value up the calendar hierarchy. Otherwise, totals up the other hierarchies.

- `result <- aggregate(x, [prod].average, [clnd].last)`

  Averages up the product hierarchy if possible. Otherwise, takes the last child value up the calendar hierarchy. Otherwise, totals up the other hierarchies.

Multi-Level Calculation Example

Consider a measure calculated from the expression `aggregate(x, [prod].total, [loc].avg, [clnd].first)`. The measure is assumed to have a base intersection of Class/Store/Week.

Examples:

Examples of the calculations that would be applied at various levels are as follows:

- Class/Store/Month: first from Class/Store/Week
- Class/Region/Month: avg from Class/Store/Month
- Department/Region/Month: total from Class/Region/Month

Transform Procedures

RPAS offers the following transformation procedures:

- transformSum
- transformMax
- transformOr
- transformProp
- transformEven
- transformRepl

Transform Procedure Requirements

The following libraries must be registered in any domain(s) that will use the transform procedures:

- Transform

Example:

```
regfunction -d <pathToDomain> -l Transform -add
```

transformSum

`transformSum` converts data across hierarchies using sum aggregation. The procedure converts data between measures of different dimensionality using a set of map measures to convert positions from the source measure to positions in the target measure. Source measures are aggregated into the target using the sum aggregation method.

Syntax

```
<target> <- transformSum(<source>, <transformspec1> [, <transformspec2> … , <transformspecn>])
```

Input Parameters

The table below provides the input parameters for the `transformSum` procedure.

Parameter Name	Description
`source`	Measure that is being aggregated into `<target>` measure using the aggregation type of **sum**.

Parameter Name	Description
transformspec1-n	This parameters is [<source hierarchy>].[<source dimension>], [<target hierarchy>].[<target dimension>] , [LABEL|POSNAME], <map> The <transformspec> defines which dimension in the source is mapped to which dimension in the target and how the positions are mapped between the dimensions. The <map> measure may either be text or Boolean. If it is text then the value of the cell contains the position id or label name of a position in the target dimension. The compulsory [LABEL|POSNAME] parameter specifies which method is used. If the <map> measure is Boolean then its base intersection must include the <source dimension>; any true cells in the map measure will define the positions that are transformed to the target. If a label is not unique within a dimension and the LABEL option is used, then only the first position in the dimension that includes the label will be part of the transformation.

Output Parameters

The table below provides the output parameter for the transformSum procedure.

Parameter Name	Description
target	Measure into which the <source> measure is aggregated into using the aggregation type of **sum**.

Notes

If a hierarchy is in both the source and target measures, then the dimension for that hierarchy in the source and target must be the same, unless the transformation is defined through a mapping *transformspec*, meaning the source measure cannot have a base intersection of item if the target measure has a base intersection of class and there is no explicit transformation specified from item to class in *transformspec*.

If a dimension in the target is not in the source and is also not defined by a mapping, then transformation is applied to every position in that dimension.

transformSum only works for numeric measures. Text or Boolean measures will not get transformed.

If a cell in the source cannot be mapped to a position in the target then it is ignored. The Transform procedure always writes a status message to rpas.log indicating how many cells were successfully transformed, how many cells failed and how many seconds the transformation took to execute.

The source measure and any map measure may be non-conforming. For instance, the source may be defined at month and the map defined at season.

Example:

```
WpVRSlsR <-transformSum(WpSlsR, [LOC].[STR], [DVR].[VR], LABEL, WpRankTx)
```

Takes WpSlsR (store/class/month) and transforms it to WpVRSlsR (volume rank/class/month) using label mappings defined in WpRankTx (store/class/season).

transformMax

The transformMax procedure converts data across hierarchies using **max** aggregation. The procedure operates in the same way as transformSum, except that the aggregation method used is **max**.

Syntax

```
<target> <- transformMax(<source>, <transformspec1> [, <transformspec2> … ,
<transformspecn>])
```

Input Parameters

The table below provides the input parameters for the transformMax procedure.

Parameter Name	Description
source	Measure that is being aggregated into <target> measure using the aggregation type of **max**.
transformspec1-n	This parameter is [<hierarchy>].[<dimension>], [<hierarchy>].[<dimension>] , [LABEL|POSNAME], <map>

Output Parameters

The table below provides the output parameter for the transformMax procedure.

Parameter Name	Description
target	Measure into which the <source> measure is aggregated into using the aggregation type of **max**.

Example:

```
r_ut_out<-transformMax(r_ut_in, [prod].[sku], [clnd].[week], 0, r_ut_map)
```

Takes r_ut_in (sku/str/day) and transforms it to r_ut_out (sku/str/week) using label mappings defined in r_ut_map (sku/str). Here the maximum across all the days of a week is taken from r_ut_in and stored in the r_ut_out measure using label mappings defined in r_ut_map (sku/str).

transformOr

The transformOr procedure converts data across hierarchies using **or** aggregation. The procedure operates in the same way as transformSum, except that the aggregation method used is **or**. Both source and target measures must be Boolean measure types.

Syntax

```
<target> <- transformOr(<source>, <transformspec1> [, <transformspec2> … ,
<transformspecn>])
```

Input Parameters

The table below provides the input parameters for the transformOr procedure.

Parameter Name	Description
source	Measure that is being aggregated into <target> measure using the aggregation type of **or**. Must be a Boolean measure type.
transformspec1-n	This parameter is [<hierarchy>].[<dimension>], [<hierarchy>].[<dimension>] , [LABEL|POSNAME], <map>

Output Parameters

The table below provides the output parameter for the transformOr procedure.

Parameter Name	Description
target	Measure into which the <source> measure is aggregated into using the aggregation type of **or**. Must be a Boolean measure type.

Example:

```
r_ut_out<-transformOr(r_ut_in, [prod].[sku], [clnd].[week], 0, r_ut_map)
```

Takes r_ut_in (sku/str/day) and transforms it to r_ut_out (sku/str/week) using label mappings defined in r_ut_map (sku/str). Here the Boolean OR across all the days of a week is taken from r_ut_in and stored in the r_ut_out measure using label mappings defined in r_ut_map (sku/str).

transformProp

The transformProp procedure converts data across hierarchies using Proportional spreading. The procedure converts data between measures of different dimensionality using a set of map measures to convert positions from the source measure to positions in the target measure. While the transformSum procedure (and related aggregation procedures) assumes a many->one relationship as it performs the transformation (aggregation), the transformProp assumes a one->many relationship between source and target cells (spreading).

Each source value is spread to a set of target values, leaving the ratio between the target values in tact.

If the sum of all target cells is zero, then the source is spread evenly to the targets.

Syntax

```
<target> <- transformProp(<source>, <transformspec1> [, <transformspec2> … ,
<transformspecn>])
```

Input Parameters

The table below provides the input parameters for the transformProp procedure.

Parameter Name	Description
source	Measure that is being spread into <target> measure.
transformspec1-n	This parameter is [<hierarchy>].[<dimension>], [<hierarchy>].[<dimension>] , [LABEL|POSNAME], <map>

Output Parameters

The table below provides the output parameter for the transformProp procedure.

Parameter Name	Description
target	Measure into which the <source> measure is spread.

Note

If the <source> measure has a calendar dimension, then the r_elapsed measure has to have a value. (This is true for all TransformSpread flavors: transformProp, transformRepl, transformEven)

Example:

```
mace -d . -run -expression "r_ut_out <- transformProp(r_ut_in, [clnd].[day], [loc]
.[str], 0, r_ut_map)
```

transformEven

The transformEven procedure converts data across hierarchies using Even spreading.

Syntax

```
<target> <- transformEven(<source>, <transformspec1> [, <transformspec2> … ,
<transformspecn>])
```

Input Parameters

The table below provides the input parameters for the transformEven procedure.

Parameter Name	Description
source	Measure that is being spread into <target> measure.
transformspec1-n	This parameter is [<hierarchy>].[<dimension>], [<hierarchy>].[<dimension>] , [LABEL|POSNAME], <map>

Output Parameters

The table below provides the output parameter for the transformEven procedure.

Parameter Name	Description
target	Measure into which the <source> measure is spread.

Note

If the <source> measure has a calendar dimension, then the r_elapsed measure has to have a value. (This is true for all TransformSpread flavors: transformProp, transformRepl, transformEven)

Example:

```
mace -d . -run -expression "r_ut_out <- transformEven(r_ut_in, [clnd].[day], [loc]
.[str], 0, r_ut_map)"
```

transformRepl

The transformRepl procedure converts data across hierarchies using Replicate spreading.

Syntax

```
<target> <- transformRepl(<source>, <transformspec1> [, <transformspec2> … ,
<transformspecn>])
```

Input Parameters

The table below provides the input parameters for the transformRepl procedure.

Parameter Name	Description
source	Measure that is being spread into <target> measure.
transformspec1-n	This parameter is [<hierarchy>].[<dimension>], [<hierarchy>].[<dimension>] , [LABEL|POSNAME], <map>

Output Parameters

The table below provides the output parameter for the transformRepl procedure.

Parameter Name	Description
target	Measure into which the <source> measure is spread.

Note

If the <source> measure has a calendar dimension, then the r_elapsed measure has to have a value. (This is true for all TransformSpread flavors: transformProp, transformRepl, transformEven)

Example:

```
mace -d . -run -expression "r_ut_out <- transformRepl(r_ut_in, [clnd].[day], [loc]
.[str], 0, r_ut_map)"
```

Normalization and Resizing Functions

resize

Uses the "shape" of a time series to produce another time series of a different length, but with the same shape.

Syntax

resize(<*expression*>, <*start*>, <*fromlength*>, <*tolength*>)

Where <expression> is a measure or expression whose time series is to be used, and <start>, <fromlength> and <tolength> are expressions that calculate numbers. <start> is assumed to be a calendar index number: if its value is numeric but non-integer, only the integer portion will be used. If <fromlength> or <tolength> are less than 0, or either parameter is non-numeric or when added to <start>-1 is outside the scope of the calendar index numbers for the dimension being calculated, an **error** is generated. If <fromlength> or <tolength> are non-integer, only the integer portion will be used.

The function returns a time series that is resized such that the overall shape of the values is retained, but the number of time periods is stretched or shrunk from <fromlength> or <tolength>. For time periods outside the horizon covered by <start> and <start> -1 + <tolength> (if there are any) the function will return zero – if values other than this are required, or if no update to those periods is required, the function should be wrapped in an if function that can set the appropriate value or use the ignore clause, as appropriate.

The function stretches or shrinks the section of the time series by interpolation or decimation. The algorithm uses upsampling, convolution, and then downsizing. The filter used in convolution is a finite impulse response (FIR) lowpass filter, using a hamming window with cut-off frequency and length determined from greatest common denominator of the source and destination time series lengths.

The values generated for individual cells through this process are not normalized (for a similar function that normalizes the result, see the resizenorm function), and will be of similar magnitude to the cell values for the source cells.

Inverse

The **resize** function does not have an inverse.

Examples:

- **resize**(profile, first, 10, 17)

  The first 17 periods of the result time series will have values with a shape the same as the first 10 periods of the measure profile. All other periods will be zero.

- **resize**(tssum(profile,startweek, startweek), profilelength, numweeks)

  This example should be compared with the similar example of the normalize function. It uses a profile to generate a sales plan for an item for a specified length of time from a specified period of time. The profile is not necessarily the same length as the period for which sales are to be generated. The measure profile is assumed to have a profile (shape) for the sales of an item, starting in the first period with values for a number of periods given by the measure profilelength. startweek is an index number of the period from which sales should be generated for the item. numweeks has the length of the sales profile to be generated. Periods before the startweek or after the startweek-1+numweeks will have a result of zero. The periods from startweek to startweek-1+numweeks will have the result of the first profilelength weeks of the profile measure, stretched or shrunk to fit the appropriate number of periods.

resizenorm

Uses the "shape" of a time series to produce another time series of a different length, but with the same shape, normalized to a specific total.

Syntax

resizenorm(<expression>, <start>, <fromlength>, <tolength>[, <total>])

<*total*> is an expression that returns a numeric value. If <*total*> is not specified, it is assumed to be the sum of the cells of <*expression*> from *startweek* to *startweek-1+fromlength*. See the **resize** function for an explanation of the other parameters.

This function is identical to the **resize** function, except that the calculation engine automatically normalizes the resized values to the specified <*total*>.

Inverse

The **resizenorm** function does not have an inverse.

Examples:

- **resizenorm**(profile, first, 10, 17)

  The first 17 periods of the result time series will have values with a shape the same as the first 10 periods of the measure *profile*. All other periods will be zero. The values of the cells will be such that sum of the 17 generated periods of the result time series will be the same as the first 10 periods of the measure *profile*.

- **resizenorm**(tssum(profile,startweek, startweek), profilelength, numweeks, targetsales)

  This example should be compared with the similar example of the resize function. The generated sales will be normalized so that their sum is the value of the *targetsales* measure.

Other Functions and Procedures

cover

The cover function returns the number of future periods for which "stock" covers "sales."

Alternately phrased, that is a "forwards weeks of supply," or the number of future periods of "sales" that could be satisfied from the "stock" with no further receipts.

The **cover** function allows for two "sales" expressions, where the second is a "wrap around" expression to provide a well-defined cover for periods at or near the end of the calendar horizon that would otherwise "run out" of forward sales. An offset is also specified to allow the **cover** function to behave appropriately for both opening and closing stock.

Syntax

cover(<stockexpression>, <salesexpression>[, <offsetexpression>, [<wraparoundsalesexpression>]])

Where <*stockexpression*> is an expression or measure that represents the 'stock.' <*salesexpression*> is an expression or measure that represents the "sales." <*offsetexpression*> is an expression that calculates a number that represents the offset to apply. If the value is non-integer, only the integer portion is used. If the value is non-numeric, an **error** is generated. If <*offsetexpression*> is not provided, the default value will be 1. <*wraparoundsalesexpression*> is an expression or measure that represents the "wrap around sales." If <*wraparoundsalesexpression*> is not provided, there will be no wraparound, and the function will generate an **error** if there is insufficient "forward sales" to calculate the cover.

The <*salesexpression*> can be considered to define a time series of sales data values, starting at the current period offset by the <*offsetexpression*>, and stretching until the

end of the calendar horizon. If this time series is too short to evaluate the cover value, it can be considered to be extended by one or more copies of the time series implied by the *<wraparoundsalesexpression>*, if specified, from the start until the end of the calendar horizon. The cover value is calculated by summing down the time series until a sum is reached that is equal to or greater than the value of the *<stockexpression>*. If the sum is equal to the *<stockexpression>*, the number of periods used is returned. If the sum is greater than the *<stockexpression>*, the value returned is the number of periods used minus 1, plus the proportion of the last period reached that is required to exactly reach the value of the *<stockexpression>*. If the *<offsetexpression>* causes the start of the time series to be before the start of the calendar horizon, or no *<wraparoundsalesexpression>* is specified, and there is insufficient 'forward sales' to determine the cover, an **error** is generated.

Inverse

The **cover** function has an inverse function, **uncover**. uncover returns the amount of "stock" that is required to give a specified number of "forward periods cover." There is no inverse function that solves this relationship for "sales" (which is used as a time series, rather than a single value).

> **Note:** The inverse can only apply if the *<stockexpression>* is a single measure, rather than an expression.

Examples:

- **cover**(EOP, Sales)

  This provides an EOP based forward cover. There is no "wraparound" sales expression, so this function will generate ***errors*** towards the end of the plan horizon.

- **cover**(BOP, Sales + MD, 0)

  This provides a BOP based forward cover, using Sales plus markdowns as the expression to be covered. There is no 'wraparound' sales expression, so this function will probably generate ***errors*** towards the end of the plan horizon.

- **cover**(EOP, Sales, 1, Sales)

  This provides an EOP based forward cover. Sales itself is used as the "wraparound sales expression" (this is typical where the plan horizon is a year, since the Sales measure has the appropriate seasonality; where this is not the case, another measure, such as "next season sales" would be used) so this function will return "reasonable" values towards the end of the plan horizon when the cover is greater than the number of weeks remaining.

Note: The cover function is always calculated at the current time dimension. For example, in a plan where the bottom time dimension is week, a measure with an aggregation type of **recalc** that is calculated from a **cover** function at the month level will calculate "forward months of supply." If forward weeks of supply are required to be calculated for the month dimension, it would be more appropriate to specify the measure with an aggregation type of **first** or **last**, so that aggregation, rather than calculation through the rule, is used to generate the values at the month dimension.

Make sure that the wrap around expression, if used, is seeded with appropriate values.

Both the "stock" and the "sales" used in the cover function are expressions. This supports various business needs, such as using covers based on "sales plus markdowns." If the "stock" is provided as an expression, rather than just a single measure, the function will not have an inverse.

The offset expression is used to define the offset: from which period to start using the sales expression. It is assumed to be an offset from the current period, so that a value of zero means that the sales for the current period should be used in evaluating the cover (which is appropriate for an "opening stock" based cover), and an offset of 1 means start in the period following the current period (which is appropriate for a "closing stock" based cover). Values other than 0 and 1 may be used.

uncover

The uncover function returns the amount of "stock" required to cover "sales" for the specified number of forward periods.

The **uncover** function allows for two "sales" expressions where the second is a "wrap around" expression that provides a well defined cover for periods at or near the end of the calendar horizon that would otherwise "run out" of forward sales. An offset is also specified to allow the **uncover** function to behave appropriately for both opening and closing stock.

Syntax

uncover(*<coverexpression>*, *<salesexpression>*[, *<offsetexpression>*, [*<wraparoundsalesexpression>*]])

Where *<coverexpression>* is an expression or measure that represents the "cover value." *<salesexpression>* is an expression or measure that represents the "sales." *<offsetexpression>* is an expression that calculates a number that represents the offset to apply. If the value is non-integer, only the integer portion is used. If the value is non-numeric, an **error** is generated. If *<offsetexpression>* is not provided, the default value will be 1. *<wraparoundsalesexpression>* is an expression or measure that represents the "wrap around sales." If *<wraparoundsalesexpression>* is not provided, there will be no wraparound, and the function will generate **errors** if there is insufficient "forward sales" to calculate the stock.

The *<salesexpression>* can be considered to define a time series of sales data values, starting at the current period offset by the *<offsetexpression>*, and stretching until the end of the calendar horizon. If this time series is too short to evaluate the stock value, it can be considered to be extended by one or more copies of the time series implied by the *<wraparoundsalesexpression>*, if specified, from the start until the end of the calendar horizon. The stock value is calculated by summing down the time series for a number of periods equal to the integer portion of the *<coverexpression>* and adding the value of the next period, multiplied by the fractional portion of the *<coverexpression>*. If the *<offsetexpression>* causes the start of the time series to be before the start of the calendar horizon, or no *<wraparoundsalesexpression>*, is specified, and there is insufficient "forward sales" to determine the stock, an **error** is generated.

Inverse

The **uncover** function has an inverse function, the **cover** function. This function returns the number of forward periods of cover implicit in the specified stock. There is no inverse function that "solves" this relationship for "sales" (which is used as a time series, rather than a single value).

> **Note:** The inverse can only apply if the *<coverexpression>* is a single measure, rather than an expression.

Examples:

- **uncover**(WOS, Sales)

  This provides an EOP stock value that gives the specified weeks of supply. There is no "wraparound" sales expression, so this function will generate **errors** towards the end of the plan horizon.

- **uncover**(WOS, Sales + MD, 0)

  This provides a BOP stock value that gives the specified weeks of supply, using Sales plus markdowns as the expression to be covered. There is no "wraparound" sales expression, so unless the value of WOS is less than 1, this function will generate **errors** towards the end of the plan horizon.

- **uncover**(WOS, Sales, 1, Sales)

  This provides an EOP stock value that gives the specified weeks of supply. Sales itself is used as the "wraparound sales expression" (this is typical where the plan horizon is a year, since the Sales measure has the appropriate seasonality; where this is not the case, another measure, such as "next season sales" would be used) so this function will return "reasonable" values towards the end of the plan horizon when the cover is greater than the number of weeks remaining.

Note: The uncover function is always calculated at the current time dimension. For example, in a plan where the bottom time dimension is week, a rule or mapping rule that uses an uncover function at the month level will calculate the "stock" on the assumption that the *<coverexpression>* provides a "forward months of supply."

Make sure that the wrap around expression, if used, is seeded with appropriate values.

Both the "cover" and the "sales" used in the uncover function are expressions. This supports various business needs, such as using covers based on "sales plus markdowns." If the "cover" is provided as an expression, rather than just a measure, the function will not have an inverse.

The offset expression is used to define the offset: from which period to start using the sales expression. It is assumed to be an offset from the current period, so that a value of zero means that the sales for the current period should be used in evaluating the cover (which is appropriate for an "opening stock" based cover), and an offset of 1 means start in the period following the current period (which is appropriate for a "closing stock" based cover). Values other than 0 and 1 may be used.

min

The min function returns the minimum value from a series of expressions or set of measures.

Syntax

min(<expression1>, <expression2> [, <expression3> … <expressionn>])

Where *<expression1-n>* are expressions or a set of measures (denoted by {*<measureset>*}), which return numeric values. The function returns the minimum value of the expressions.

Inverse

The **min** function does not have an inverse.

Example:

- min (A, B, C)

  Returns the minimum of the measures A, B, and C.

max

The max function returns the maximum value from a series of expressions or set of measures.

Syntax

max(<expression1>, <expression2> [, <expression3> … <expressionn>])

Where <*expression1-n*> are expressions or a set of measures (denoted by {<*measureset*>}), which return numeric values. The function returns the maximum value of the expressions.

Inverse

The **max** function does not have an inverse.

Example:

- **max** (A, B, C)

  Returns the maximum of the measures A, B, and C.

sum

The sum function returns the sum of a series of expressions or measure set.

Syntax

sum(<expression1>, <expression2> [, <expression3> … <expressionn>])

Where <*expression1-n*> are expressions or a set of measures (denoted by {<*measureset*>}), which return numeric values. The function returns the summed value of the expressions or measure set.

Inverse

The **sum** function does not have an inverse.

Example:

- **sum** (A, B, C)

  Returns the sum of the measures A, B, and C.

lag

The lag function returns the value of an expression from the previous time period in the dimension being evaluated.

Syntax

lag(<expression>)

Where <*expression*> is any valid expression. The function returns the value of the expression in the previous period. If the current period being evaluated is the **first** period in the calendar horizon (so that there is no previous period), an ***error*** is generated. For that reason, **lag** functions are usually embedded in **if** functions or **prefer** functions to check for that case.

Inverse

The **lag** function does not have an inverse.

Example:

- **lag**(EOP)

  Returns the value of the measure EOP from the next period.

Note: The **tssum** procedure can be used if you need to lag or lead by more than one period.

The **lag** function has special "cycle breaking" logic that enables a series of expressions to be calculated in a manner that allows them to be evaluated "period wise." This allows an apparent "deadly embrace" to be broken. Thus the following two expressions are allowed, and can be calculated in the same rule group, even though EOP appears to depend on BOP, which appears to depend on EOP:

```
EOP = BOP + Rec – SLs – MD
BOP = lag(EOP)
```

Note, however, that the cycle breaking logic does not support the measure being calculated being lagged on the RHS of the expression. Thus the following expression is not allowed:

```
AccumSls = Sls + lag(AccumSls)
```

lead

The lead function returns the value of an expression from the next (following) time period in the dimension being evaluated.

Syntax

lead(<expression>)

Where <*expression*> is any valid expression. The function returns the value of the expression in the following period. If the current period being evaluated is the last period in the calendar horizon (so that there is no following period), an ***error*** is generated. For that reason, **lead** functions are usually embedded in **if** functions or **prefer** functions to check for that case.

Inverse

The **lead** function does not have an inverse.

Examples:

- **lead**(BOP)

  Returns the value of the measure BOP from the next period.

Note: The **lead** function is deliberately intended as a "simple" version of the **timeshift** procedure for one of the most frequently used cases, which is that the offset is one period in the future. Use the **timeshift** procedure for leading with a variable offset.

In a similar manner to the **lag** function, the **lead** function has special "cycle breaking" logic that enables a series of expressions to be calculated in a manner that allows them to be evaluated "period wise." This allows an apparent 'deadly embrace' to be broken.

Even when an error is generated because the current period is the last period in the calendar horizon, the **lead** function itself, if not guarded by **if** or **prefer** functions, returns the re-evaluated NA value of the measure. For example, for the following expression group:

```
A = lead(B)
B = A + 1
```

...assume that the NA value for both A and B is 0. The system first re-evaluates B's NA value to be A's NA value + 1 = 1 based on the second expression. The system will attempt to retrieve the time period after B's last time period when `A = lag(B)` is evaluated. Because that time period does not exist, the **lead** function will return B's re-evaluated NA value instead, which is 1.

timeshift

The `timeshift` procedure that returns the value of a measure from a time period in the dimension being evaluated that is lagged by a designated number of periods.

This procedure has the following special uses and restrictions:

- Measures used in this procedure can be modified with the **master** modifier.
- Currently **timeshift** cannot be used in calculation rule groups.
- Used for lagging the values of a measure by more than one period.
- Used for retrieving values from time periods outside the scope of the workbook.
- Used for addressing 52-53 week year differences.

Syntax

```
<output> <- timeshift(<input>, {<lagvalue> | <lagmeas> | <lagmap>})
```

<input> is the measure that is being lagged and must have the same base intersection as *<output>* or must be forced to evaluate at the base intersection of *<output>* by using the **level** modifier. *<input>* must include a dimension in the calendar hierarchy and must be the same data type as *<output>*.

<lagvalue> is a scalar value that designates the number of periods each position in *<input>* is shifted. A negative value refers to shift forward in calendar dimension (lead), and a positive value refers to shift backward in calendar dimension (lag).

<lagmeas> is a numeric measure that contains values that determine how each position is shifted. *<lagmeas>* cannot have a calendar dimension and all non-calendar dimensions must be identical to *<input>*.

> **Note:** This implies that if either <*input*> or <*lagmeas*> measure is modified with the **master** modifier, the other measure must also be modified with the **master** modifier.

<*lagmap*> is a string measure used for sophisticated mappings. The measure contains position names that indicate how each time period is mapped, and it must only contain positions from the dimension from the calendar hierarchy. Multiple positions can be specified by separating them using a space. In other words, <*lagmap*> defines a mapping of positions from the input measure to the destination measure along time. Entries in <*lagmap*> that are not the names of valid positions in the dimension from the calendar hierarchy are ignored.

> **Note:** This implies that if either <*input*> or <*lagmap*> measure is modified with the **master** modifier, the other measure must also be modified with the **master** modifier.

This mapping technique is primarily used when lagging measures between 52 and 53-week years. When mapping multiple positions to a single position (such as mapping the last 2 weeks in a 53-week year to the last week in a 52-week year), the resulting value is the sum of the source values (that is, the sum of the last 2 weeks of the 53-week year). When mapping a single position to multiple positions (such as mapping the last week in a 52-week year to the last 2 weeks in a 53-week year), the source value is replicated to the resulting values (that is, weeks 52 and 53 in the 53-week year are updated to week 52 in the 52-week year).

> **Note:** **timeshift** is a procedure so it cannot be combined with functions, modifiers, or other procedures in any manner. As a procedure, it requires a different syntax: "<-" instead of "=" when being assigned.

Inverse

The **timeshift** procedure does not have an inverse.

Examples:

- `salesly <- timeshift(sales.master, -52)`

  Updates the positions in the workbook measure for last year's sales with the values from the domain measure sales where each position is lagged by 52 periods.

- `salesly <- timeshift(sales.master, saleslag)`

  Where `sales` and `salesly` have a base intersection of SKU-week, the numeric measure `saleslag` contains a value for each SKU that indicates the number of periods to lag by SKU.

- `salesly <- timeshift(sales.master, salesmap)`

  Where `salesmap` is a string measure that contains position names indicating which position in sales to use for each position in `salesly`; the current year in the workbook contains 52 weeks, the previous year that is not in the workbook contains 53 weeks; the 52nd position in `salesly` contains the position names "week52" and "week53" and results in the sum of the 2 positions.

round

Returns the value of an expression rounded up or down to the nearest multiple.

Syntax

round*(<expression>[, <multipleexpression>])*

Where *<expression>* is any valid expression, which specifies the value to be rounded, *<multipleexpression>* is an expression that calculates a number that represents the multiplier to use. If the value is not specified, it is assumed to be 1. The value may be non-integer. If the value of either expression is non-numeric, an **error** is generated. The rounding is up or down to the nearest multiple of the multiplier. If there are 2 multiples equally near to the value (for instance, rounding 1.5 to the nearest integer), then rounding is up (away from zero).

Inverse

The **round** function does not have an inverse.

Examples:

- **round**(qty)

  Returns the value of the measure qty, rounded up or down to the nearest integer. If the qty is 14.324, this returns the result of 14, if the qty is 14.824, this returns the result of 15.

- **round**(qty, packsize)

  Returns the value of the measure qty, rounded up or down to the nearest multiple of the pack size. If the qty is 14.324 and the packsize is 6, this returns the result of 12. If the qty is 16.824 and the packsize is 6, this returns the result of 18.

roundup

The roundup function returns the value of an expression rounded up to the nearest multiple.

Syntax

roundup*(<expression>[, <multipleexpression>])*

Where *<expression>* is any valid expression, which specifies the value to be rounded. *<multipleexpression>* is an expression that calculates a number that represents the multiplier to use. If the value is not specified, it is assumed to be 1. The value may be non-integer. If the value of either expression is non-numeric, an **error** is generated. Rounding is always up (to the nearest multiple of the multiplier further away from zero).

Inverse

The **roundup** function does not have an inverse

Examples:

- **roundup**(qty)

  Returns the value of the measure qty, rounded up to the nearest integer. If the qty is 14.324 or 14.824, this returns the result of 15.

- **roundup**(qty, packsize)

  Returns the value of the measure qty, rounded up to the nearest multiple of the pack size. If the packsize is 6 and the qty is 14.324 or 16.824, this returns the result of 18.

rounddown

The **rounddown** function returns the value of an expression rounded down to the nearest multiple.

Syntax

rounddown*(<expression>[, <multipleexpression>])*

Where *<expression>* is any valid expression, which specifies the value to be rounded, *<multipleexpression>* is an expression that calculates a number that represents the multiplier to use. If the value is not specified, it is assumed to be 1. The value may be non-integer. If the value of either expression is non-numeric, an **error** is generated. Rounding is always down (to the nearest multiple of the multiplier closer to zero).

Inverse

The **rounddown** function does not have an inverse.

Examples:

- **rounddown**(qty)

  Returns the value of the measure qty, rounded down to the nearest integer. If the qty is 14.324 or 14.824, this returns the result of 14.

- **rounddown**(qty, packsize)

  Returns the value of the measure qty, rounded down to the nearest multiple of the pack size. If the packsize is 6 and the qty is 14.324 or 16.824, this returns the result of 12.

> **Note:** The round functions have no inverses. Great care should be used in designing rule groups that use these functions, and the preferred technique for rounding is often to not round during calculation, but to round values on display only.
>
> The round functions cause problems because they can compromise the integrity of rule and expression relationships. Consider a typical relationship between value, units and price. If the units are calculated through a round function (on the apparently reasonable assumption that units should be integers) after a change to, say, the value, then the integrity of the rule relationships is immediately compromised because the price is no longer the value divided by the units.

navalue

The **navalue** function returns the NA value of the specified expression.

Syntax

navalue(<*expression*>)

<*expression*> can be a constant, a measure, or an expression.

The **navalue** function does not directly generate ***errors***, but it can propagate errors generated by <*expression*>.

Inverse

The **navalue** function does not have an inverse.

Examples:

- **navalue**(<meas>)

  This returns the NA value of <meas>.

- **navalue**(<meas1> + <meas2>)

  This returns the NA value of the expression <meas1> + <meas2>. In this example, if the NA value of <meas1> is 2 and the NA value of <meas2> is 5, the result of the navalue function will be 7.

propspread

propspread is a multiple result function that spreads a value across a collection of measures while retaining their relative proportions. The multiple results are not named, and are therefore positional only. The typical usage of this function is to allow spreading of "hierarchical measures."

Syntax

propspread(<*totalexpression*>, <*childexp1*>, … <*childexpn*>)

Where <*totalexpression*> is an expression that returns a numeric value to which to balance the results of the function, <*childexp1*> - <*childexpn*> are expressions that provide the "shape" of the results. They will typically be the same measures as those assigned to the result of the function, but using the **old** modifier. A measure defined as a result cannot be used on the right-hand side without **old**.

The function generates *n* positional results, where n is the number of "child expressions." The results will sum to the <*totalexpression*>, using the "shapes" of the child expressions in the order of the child expressions.

The number of results should be equal to the number of child expressions, which means that there should be one more argument on the right-hand side than output measures on the left-hand side. Additional child expressions are ignored. If too few child expressions are defined, the function will fail. Currently, there is no validation to warn when this condition occurs.

If the sum of the child expressions is zero, the spread will be even.

Inverse

The **propspread** function does not have an inverse.

Example:

The **old** modifier can be used in conjunction with the **propspread** function to implement a hierarchical relationship among measures. In the following example, Total sales (TotalSls) is the "parent" measure and regular sales (RegSls), promotional sales (PromSls), and markdown sales (MkdSales) are the "child" measures. Using **old** and **propspread** to configure this relationship allows the manipulation of any combination of these measures before calculating, except for all of them.

In the following example and in other such hierarchical measure relationships, the order of the expressions within a rule is critical for the measures to be correctly calculated.

```
TotalSls = RegSls + PromoSls + MkdSls
RegSls, PromoSls, MkdSls = propspread(TotalSls, RegSls.old, PromoSls.old,
MkdSls.old)
PromoSls, MkdSls = propspread(TotalSls - RegSls, PromoSls.old, MkdSls.old)
RegSls, MkdSls = propspread(TotalSls - PromoSls, RegSls.old, MkdSls.old)
RegSls, PromoSls = propspread(TotalSls - MkdSls, RegSls.old, PromoSls.old)
RegSls = TotalSls - PromoSls - MkdSls
PromoSls = TotalSls - RegSls - MkdSls
MkdSls = TotalSls - RegSls - PromoSls
```

passthrough

passthrough is a multiple result function that is used to encapsulate any number of normal computations into a single expression.

> **Note:** The passthrough function is not allowed for measures with a **recalc** agg type.

Syntax

passthrough(<*exp1*>, <*exp2*>, …, <*exp-n*>)

Where <*exp1*> - <*exp-n*> are normal expressions used to calculate the resulting measures.

All measures on the left hand side must be computed at the same base intersection. The number of results should be less than or equal to the number of calculation expressions (additional calculation expressions are ignored). If too few calculation expressions are defined then function will fail. Currently, there is no validation to warn an individual when this condition is met.

There are two main reasons for using this function:

1. Use **passthrough** in an expression for a rule when computing values for multiple measures without having to write (develop) a multiple-result function or procedure.
2. To improve performance. If many measures are computed using the same or similar set of RHS measures, combining those calculations using passthrough may be faster because there is less physical input/output with the data.

Inverse

The passthrough function does not have an inverse.

Examples:

- `A, B = passthrough(C + D, C - D)`

  Computes the sum and difference of two measures simultaneously.

- `SalesA, SalesB = passthrough(SalesA.old * TotalSales / TotalSales.old, SalesB.old * TotalSales / TotalSales.old)`

  Proportionately spread TotalSales down to its components, SalesA and SalesB.

ranksort

The **ranksort** procedure returns the rank of intersections given the rank order (ascending or descending), the measure to rank upon and the dimensions to rank over.

Syntax

<output> <- ranksort(<input>,<rank order> [,<dimspec1>, …, <dimspecn>])

<output> is the measure that will contain the ranking results. The result of ranking will always be an integer value, so the data type of <output> must be integer or numeric.

<input> is the measure to be ranked.

<rank order> is {ascending | descending}. ascending is a keyword meaning that the intersection will be ranked in ascending value of the <input> measure, and descending is a keyword meaning that the intersection will be ranked in descending value of the <input> measure. All keywords which need to be passed to a function must be wrapped in double quotes (" "). Any other syntax will throw an error.

<dimspec1-n> is [<hierarchy>].{[<dimension>] | top} <dimspec1-n> specifies the dimensions to rank over. For each <dimspec> that is specified, the <hierarchy> must be the name of a valid hierarchy and the <dimension> must be the name of a valid dimension in that hierarchy. top is a keyword that refers to the highest dimension ("all") in the hierarchy. <dimspec1-n> is optional, and if omitted the value for each hierarchy in the base intersection of <output> will be [hierarchy].top. A <dimspec> for a hierarchy that is not in the base intersection of <output>, or that references a dimension that is not higher than (a parent/grandparent etc. of) the dimension in that hierarchy in the base intersection of <output>, or which references a hierarchy that already has a <dimspec>, is an error.

The base intersection of <output> determines the intersections that will be ranked. If the base intersection of <input> is different to that of <output>, as will usually be the case, then the values of <input> used for ranking will be the values at the intersections implied by the base intersection of <output> obtained by normal non-conforming measure handling, with replication from higher dimensions and/or aggregation from lower dimensions.

The scope of the ranking is dictated by <dimspec1-n>. These will usually be implied rather than explicitly specified, and be at the top of the hierarchy. However, when a dimension is specified, there will be a separate ranking for each position (or combination of positions where a dimension is specified in two or more hierarchies) in that dimension. Thus, for example, when evaluating a measure calculated from the ranksort procedure that has a base intersection of sku/week, where the <dimspecs> reference the dimensions class and season, in a workbook with 4 classes and 2 seasons, there will be eight sets of ranks, one per class/season, and the value for each sku/week intersection will be the order of that sku/week within its class/season.

The ranking process sorts the intersections in ascending or descending value of <input>, as required, and the ranking number is the order that each position is after sorting. The intersection with the highest value of <input> (lowest when ranking ascending) will have a rank of 1, with subsequent intersections having a rank higher by one. Where two or more intersections have the same value of <input>, they will be given the same rank, but the next rank value will account for the number of intersections with identical rankings. Thus for example, the first few rankings might be 1, 2, 3, 3, 5, 6, …

Note: ranksort is a procedure and thus cannot be combined with functions, modifiers, or other procedures in any manner. As a procedure, it requires a different syntax: "<-" instead of "=" when being assigned.

The level modifier cannot be used on the LHS of an expression that uses the ranksort procedure. That is, the level at which the ranking is executed will always be determined by the base intersection of <output>.

The ranksort procedure must, by its nature, calculate a rank value for every intersection within a scope, not just those that have changed values for measures on the right-hand side of the expression. In incremental calculation mode (for example, when planning online) this may cause longer than expected calculation times, especially when the measure calculated through the ranksort procedure is used on the right-hand side of other expressions, as those expressions, plus any "knock-on" effects will also have to be calculated for every intersection within the scope.

Examples:

- **Rank <- ranksort(WpSlsR, "descending")**

  If Rank has a base intersection of sku, the result of this procedure is the integer value representing where each SKU's Sales value ranks amongst all SKUs. The SKU with the highest WpSlsR value will have a rank of 1.

- **Rank <- ranksort(WpSlsU, "descending", [prod].[clss])**

  If Rank has a base intersection of sku, the result of this procedure is the integer value representing where each SKU's Sales units ranks amongst all SKUs within its class. The SKU with the highest WpSlsU value in each class will have a rank of 1, and there will be several SKUs with a rank of 1, one per class.

- **Rank <- ranksort(WpSlsR, "descending", [prod].[clss])**

  If Rank has a base intersection of sku/week, the result of this procedure is the integer value representing where each SKU/Week's Sales value ranks amongst all SKU/weeks within its class for the whole time horizon. The SKU/week with the highest WpSlsR value in each class will have a rank of 1, and there will be several SKU/weeks with a rank of 1, one per class.

- **Rank <- ranksort(WpSlsR, "descending", [prod].[clss], [clnd].[seas])**

  If Rank has a base intersection of sku/week, the result of this procedure is the integer value representing where each SKU/Week's Sales value ranks amongst all SKU/weeks within its class/season. The SKU/week with the highest WpSlsR value in each class/season will have a rank of 1, and there will be several SKU/weeks with a rank of 1, one per class/season.

positionLocked

Position locking allows a user to lock one or more positions at any level of a hierarchy in a workbook. Once locked, the values of cells corresponding to locked positions cannot change as a result of incremental evaluation, i.e., calculations resulting from user edits in the workbook. However, those values can change as a result of full evaluation resulting from either a full transition to the Calc rule after a refresh, a custom menu execution, or from the execution of an expression that cannot be evaluated incrementally; for example, *lhsmeasure* = 25. None of the RPAS procedures, such as lookup or flookup, honor position locking.

The positionLocked function has been provided to help solution designers honor position locking during full evaluation. However, since usage of functions cannot be combined with the evaluation of special expressions (procedures), this provision does not help designers in honoring position locking when special expressions (procedures) are used. Position locking is not supported for special expressions.

The positionLocked function is evaluated at the level at which calculation is being performed. It returns a FALSE if none of the positions for the current cell's dimensions are locked and returns TRUE otherwise. Since position locking is only available in a workbook and can only be used after a workbook has been built, the function always returns a FALSE when evaluated in a domain, used in the load rule group, or used in a workbook. When used in a domain, the function will log a warning in the RPAS logs, but will not fail evaluation. The function will work as expected when used in refresh, calc and commit rule groups. It will also work as expected in custom menu rule groups that operate on the workbook.

The positionLocked function does not provide for hierarchical protection processing. Refer to the following examples for a better understanding of this behavior.

Syntax

```
positionLocked()
```

The function does not take any arguments and returns a Boolean value. The function can be used by itself on the RHS.

Inverse

The function does not have an inverse.

Examples:

- `Output = positionLocked()`

  Populates the Output measure with values that tell whether a cell is locked as a result of position locking along any of the dimensions in the base intersection of the measure.

- `Output = !positionLocked()`

  Populates the Output measure with values that tell whether a cell is not locked as a result of position locking along any of the dimensions in the base intersection of the measure.

- `Output.level([PROD].[clss]) = positionLocked()`

  Populates the Output measure (default spread type: *repl*) with values that tell whether a cell is locked as a result of position locking along any of the dimensions, except those belonging to the PROD hierarchy, in the base intersection of the measure. For the PROD hierarchy, the check is done at the *clss* dimension and the results would be spread down to the base intersection of the Output measure. Therefore, at the base intersection level, the cell value will be TRUE if all child positions of the cell's *clss* are position locked, and FALSE if any of them are unlocked irrespective of whether the position itself is locked or not; i.e., the positionLocked function does not provide for hierarchical protection processing.
- `Price = if (positionLocked(), ignore, Price.master)`

  When used in a load rule group, this expression behaves the same as "Price = Price.master" because positionLocked() always returns FALSE. When used in a refresh rule group, the LHS is not updated for positions that are locked.
- `Price.level([PROD].[clss]) = if (positionLocked(), ignore, Price.master)`

  When used in a load rule group, this expression behaves the same as "Price.level([PROD].[clss]) = Price.master" because positionLocked() always returns FALSE. When used in a refresh rule group, the LHS is not updated for *clss* level positions that are locked, i.e., all their children are locked. However, if any of the children is unlocked, and hence the *clss* level position is unlocked, the result of the spread after the expression evaluation will alter the child position's value, even if the child position was locked, i.e., positionLocked function does not provide for hierarchical protection processing.

String Functions

uppercase

Converts a string to upper case.

Syntax

`uppercase``(<expression>)`

Where the value of `<expression>` is returned as a string with upper case characters. Useful in making string comparisons.

lowercase

Converts a string to lower case.

Syntax

`lowercase``(<expression>)`

Where the value of `<expression>` is returned as a string with lower case characters. Useful in making string comparisons.

Math Functions

pow

Returns the value of a number raised to the power of another number (x to the power of y).

Syntax

`pow(<x>, <y>)`

<x> and <y> are expressions that return real numbers. <y> designates the exponent to which <x> is raised.

exp

Returns the value of the transcendental number "e" raised to the power of a number (e to the power of x).

e is the base of natural logarithms.

Syntax

`exp(<x>)`

<x> is an expression that returns a real number to which the number "e" (value 2.71828183) is raised.

sqrt

Returns the square root of a number.

Syntax

`sqrt(<x>)`

<x> is an expression that returns a real number. This function returns the equivalent of "`pow(x, 0.5)`".

log

Returns the logarithm of a number.

This function returns the exponent that indicates the power to which a number is raised to produce a given number.

Syntax

`log(<x>, [<base>])`

Where <x> and <base> are expressions that return real numbers. If <base> is not specified the default value is 10.

Examples:

- **`log`**`(100)`

  The logarithm of 100 to the base 10 is 2.
- **`log`**`(125, 5)`

  The logarithm of 125 to the base 5 is 3.

ln

Returns the natural logarithm of a number.

This function returns the logarithm of <x> to base "e" (2.71828183).

Syntax

`ln(<x>)`

<x> is an expression that returns a real number.

mod

Returns the remainder as the result of the division of 2 numbers.

The result of this function is the remainder of <x> divided by <y>.

Syntax

```
mod(<x>, <y>)
```

<x> and <y> are expressions that return real numbers.

Example:

- **mod**(5, 2)

  The remainder of 5 divided by 2 is 1.

abs

Returns the absolute value of a number.

Syntax

```
abs(<x>)
```

<x> is an expression that returns a real number.

D

Appendix: Aggregation and Spread Types

Aggregation Types

The following table describes the supported aggregation types.

Aggregation Type	Description	Valid Data Types	Recommended Spread Types
recalc	Recalculate measure at each level, via recalc expression. The passthrough function is not valid for use with this agg type.	numeric, string, date, Boolean	none
ambig	ambig of all values (all values equal, otherwise ambig)	string	none
ambig_pop	ambig of all populated values	string	none
popcount	Count of populated values in base	numeric, string, date, Boolean	none
hybrid			
total	Sum of all values	numeric	prop
total_pop	Sum of all populated values	numeric	prop_pop
average	Average of all values	numeric	prop
average_pop	Average of all populated values	numeric	prop_pop
max	Maximum of all values	numeric, date	repl
max_pop	Maximum of populated values	numeric, date	repl_pop
min	Minimum of all values	numeric, date	repl
min_pop	Minimum of populated values	numeric, date	repl_pop

Aggregation Type	Description	Valid Data Types	Recommended Spread Types
pst	First value in innermost hierarchy, total in others hierarchies **Note:** "First" only has a meaning in the calendar hierarchy. Therefore, this agg type should only be used for measures whose innermost hierarchy is the calendar hierarchy.	numeric	ps
pet	Last value in innermost hierarchy, total in other hierarchies **Note:** "First" only has a meaning in the calendar hierarchy. Therefore, this agg type should only be used for measures whose innermost hierarchy is the calendar hierarchy.	numeric	pe
median	Median of all values	numeric	repl
median_pop	Median of populated values	numeric	repl_pop
and	and of all values	Boolean	repl
or	or of all values	Boolean	repl

Note: Only measures with an aggregation type of ambig, pst, or pet can be aggregated from below the partition levels to above the partition levels in a global domain.

Spread Types

The following table describes the supported spread types.

Spread Type	Description	Valid Data Types
none	Values are not spread	numeric, string, date, Boolean
repl	Replicate the value to each cell	numeric, string, date, Boolean
prop	Spread value proportionally (previous total non-zero) or evenly (previous total zero)	numeric
prop_pop	Spread value proportionally (previous total non-zero) or evenly (previous total zero) to all populated cells	numeric
even	Spread value evenly	numeric
delta	Increment/decrement each cell evenly. Effectively the "even" spreading of the change ("delta").	numeric
ps	Apply delta to starting period	numeric
pe	Apply delta to ending period	numeric

Arithmetic Operators

This section provides information about the arithmetic operators supported in Configuration Tools.

Unary Operators

The following unary arithmetic operators are supported:

Symbol	Type	Function
-	real	Negation
!	Boolean	Compliment

Binary Operators

The following binary arithmetic operators are supported:

Symbol	Type	Function
=	real, Boolean, string, date	Assignment
+	real	Addition
-	real	Subtraction
*	real	Multiplication
/	real	Division
&&	Boolean	Boolean and
||	Boolean	Boolean or
==	real, Boolean, string, date	Equality
!=	real, Boolean, string, date	Inequality
<	real, Boolean, string, date	Less than
<=	real, Boolean, string, date	Less than or equal to
>	real, Boolean, string, date	Greater than
>=	real, Boolean, string, date	Greater than or equal to