IBM Cognos Analytics
Version 11.0

Data Modeling Guide

IBM
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Chapter 1. Data modeling in Cognos Analytics

You can use data modeling in IBM® Cognos® Analytics to access and shape data from data servers or uploaded files. You can create a data module by fusing together many sources of data that includes relational databases, Hadoop-based technologies, Microsoft Excel spreadsheets, and text files. Star schemas are the ideal database structure for data modules but transactional schemas are equally supported.

You can refine a data module in many ways.
• Creating calculations.
• Defining data filters.
• Referencing additional tables.
• Reviewing and updating metadata properties that include aggregation settings and labels.

You can save data modules so that you and other users can access them. When you want other users to access a data module, save the data module in a folder that users, groups, and roles have appropriate permissions to access. This procedure is the same idea as saving a report or dashboard into a folder that controls who can access it.

Data modules can be used in both dashboards and reports. A dashboard can be assembled from multiple data modules.

Data modeling in Cognos Analytics does not replace IBM Cognos Framework Manager, IBM Cognos Cube Designer, or IBM Cognos Transformer, which remain available for more complex modeling.

Intent-driven modeling

You can use intent-driven modeling to add tables into your data module. Intent-driven modeling proposes tables to include in the module, based on matches between the terms you supply and metadata in the underlying sources.

While you are typing in keywords for intent-driven modeling, text from column and table names in the underlying data sources are retrieved by the Cognos Analytics software. The intent field has a type-ahead list that suggests terms that are found in the source metadata.

Intent-driven modeling recognizes the difference between fact tables and dimension tables by the number of rows, data types, and distribution of values within columns. When possible, the intent-driven modeling proposal is a star or snowflake of tables. If an appropriate star or snowflake cannot be determined, then intent-driven modeling proposes a single table or collection of tables.
Chapter 2. Creating a data module

You can create data modules by combining inputs from up to four types of input sources: other data modules, data servers, uploaded files, and data sets.

When you create a new data module from the home screen of IBM Cognos Analytics, you are presented with five possible input sources in Sources. These sources are described here.

Data modules
Data modules are source objects that contain data from data servers, uploaded files, or other data modules, and are saved in My content or Team content.

Data servers
Data servers are databases for which connections exist. For more information, see Managing IBM Cognos Analytics.

Uploaded files
Uploaded files are data that are stored with the Upload files facility.

Data sets
Data sets contain extracted data from a package or a data module, and are saved in My content or Team content.

Packages
Packages are created in IBM Cognos Framework Manager and contain dimensions, query subjects, and other data contained in Cognos Framework Manager projects. You can use packages as sources for a data module.

You can combine multiple sources into one data module. After you add a source,

click Add sources ( ) in Selected sources to add another source. You can use a combination of data source types in a data module.

Each type of data source is described in the following topics.

Using a data module source

Saved data modules can be used as data sources for other data modules. When a data module is used as a source for another data module, parts of that module are copied into the new data module.

Procedure
1. When you select Data modules in the Sources slide-out panel, you are presented with a list of data modules to use as input. Check one or more data modules to use as sources.
2. Click Start or Done in Selected sources to expand the data module into its component tables.
3. Drag tables into the new data module.
4. Continue to work with your new data module, and then save it.
5. If the source data module or any of its tables are deleted, then the next time that you open the new data module, tables that are no longer available have a red outline in the diagram and **missing** is listed in the **Source** fields of the **Properties** pane of the table.

6. A table in your new data module that is linked is read-only. You cannot modify it in the new data module in any way. You can break the link to the source data module, and modify the table, by clicking **Break link** in the actions for the table.

---

**Using a data server source**

Data servers are databases for which connections exist and can be used as source for data modules.

**Before you begin**

Data server connections are created in **Manage > Data servers**. For more information, see *Managing IBM Cognos Analytics*.

**Procedure**

1. When you select **Data modules** in the **Sources** slide-out panel, you are presented with a list of data servers to use as input. Check one or more data servers to use as sources.

2. The available schemas in the data server are listed. Choose the schema that you want to use. Only schemas for which metadata is preloaded are displayed. If you want to use other schemas, click **Manage schemas...** to load metadata for other schemas.

3. Click **Start** or **Done** in **Selected sources** to expand the data module into its component tables.

4. To start populating your data module, type some terms into the **Intent** slide-out panel and then click **Go**.

5. You are presented with a proposed model. Click **Add this proposal** to create a data module.

6. You can also drag tables from the data server schema into the data module.

**Example**

For an example data module created from a data server, see [Chapter 3, “Creating a simple data module,” on page 7](#).

**What to do next**

If the metadata of your data server schemas changes after you create the data module, you can refresh the schema metadata. For more information, see the topic on preloading metadata from a data source connection in the *IBM Cognos Analytics Managing User Guide*.

---

**Using an uploaded file source**

Uploaded files are data that is stored with the **Upload files** facility. You can use these files as sources for a data module.
Before you begin

Supported formats for uploaded files are Microsoft Excel (.xlsx and .xls) spreadsheets, and text files that contain either comma-separated, tab-separated, semi colon-separated, or pipe-separated values. Only the first sheet in Microsoft Excel spreadsheets is uploaded. If you want to upload the data from multiple sheets in a spreadsheet, save the sheets as separate spreadsheets. Uploaded files are stored in a columnar format.

To upload a file, click **Upload files** on the navigation bar in the IBM Cognos Analytics home screen.

Procedure

1. When you select **Uploaded files** in the **Sources** slide-out panel, you are presented with a list of uploaded files to use as input. Check one or more uploaded files to use as sources.
2. Click **Start** or **Done** in **Selected sources** to expand the data module into its component tables.
3. Drag the source uploaded file into your data module to start modeling.

Using a data set source

Data sets contain data that is extracted from a package or a data module, and are saved in **My content** or **Team content**.

About this task

Procedure

1. When you select **Data sets** in the **Sources** slide-out panel, you are presented with a list of data sets to use as input. Check one or more data sets to use as sources.
2. Click **Start** or **Done** in **Selected sources** to expand the data set into its component tables and queries.
3. Drag tables or queries into the new data module.
4. If the data in the data sets changes, this change is reflected in your data module.

Using a package source

Packages are created in IBM Cognos Framework Manager and contain query subject and other data contained in Cognos Framework Manager projects. You can use relational packages as sources for a data module.

Before you begin

The package must be relational and use Dynamic Query Mode.
Procedure
1. When you select Packages in the Sources slide-out panel, you are presented with a list of packages to use as input. Check one or more packages to use as sources.
2. Click Start or Done in Selected sources to select the packages.
3. Drag the source packages into your data module to start modeling.

What to do next
When you use a package as your data source, you cannot select individual tables. You must drag the entire package into your data module. The only actions you can take are to create relationships between query subjects in the package and query subjects in the data module.
Chapter 3. Creating a simple data module

You can create a simple data module based on the Great Outdoors Warehouse sales data database that is included in IBM Cognos Analytics samples.

Before you begin

Install the Great Outdoors sales data warehouse database and create a connection to the database. For more information, see Samples for IBM Cognos Analytics.

Procedure

1. In the IBM Cognos Analytics welcome screen, click New → Data module.
2. In Sources, select Data servers.
3. In Data servers, select great_outdoors_warehouse.
4. In great_outdoors_warehouse, check GOSALES DW/gosalesdw.
5. In Selected sources, click Start.
6. In Intent, type sales revenue and then click Go. A proposed model is displayed in Intent.
7. In Intent, click Add this proposal A base module is created and displayed.

8. You can now explore the model. For example, click an item in Data module, and then click to view and modify the properties of the item.

9. To save the model, click Save ( ).
10. To create a report from your data module, click **Try it**. A new tab opens in your browser with IBM Cognos Analytics - Reporting open within it. Your data module is shown in **Source Data items**.

11. Drag **Product Line Code** from **Sls Product Dim** and **Quantity** from **Sls Sales Fact** into the report.

12. Click **Run options** ( ) to select an output format, and then click **Run HTML** to run the report and view the output as a web page.
Chapter 4. Refining a data module

The initial data module that you create manually or using intent modeling might contain data that is not required for your reporting purposes. Your goal is to create a data module that contains only the data that meets your reporting requirements and that is properly formatted and presented.

For example, you can delete some tables from your initial data module, or add different tables. You can also apply different data formatting, filter and group the data, and change the metadata properties.

You can refine your data module by applying the following modifications:

- Add or delete tables.
- Edit or create new relationships between tables.
- Change column properties.
- Create basic and custom calculations.
- Define filters.
- Group data.
- Clean the text data.
- Hide tables and columns.

You can initiate these actions from the **Data module** panel or from the diagram.

When working in a data module, you can use the undo and redo actions in the application bar to revert or restore changes to the data module in the current editing session. You can undo or redo up to 20 times.

The following graphic shows the user interface for viewing and editing data modules.
Source panel

The source panel shows the sources of data that were selected when the data module was created. The types of sources include data servers, uploaded files, and other data modules.

Expand the specific source to view its tables and columns.

Drag tables onto the data module panel or onto the diagram to add them to the data module.

Data module panel

The data module tree shows the tables and columns of data that is included in the data module. This is the primary space for editing the data module.

Click the context menu icon for the module, table, or column to view its modeling and editing context menu options. Here you can start joining tables, creating filters and calculations, or renaming and deleting items.

Diagram

The diagram is a graphical representation of table relationships in a data module. You can use the diagram to examine the relationships, edit the data module, and view the cardinality information for the relationships.

Figure 1. User interface for viewing and editing data modules
Right-click a table in the diagram to view the table context menu that can be your starting point for creating joins or filters, renaming the table, viewing the table properties, or removing it from the module.

Click any table join to see the join summary information that includes the matching keys. When you right-click the join line, the context menu appears with options for editing or deleting the join.

Click the change view icon in the application toolbar. In the box that appears, select the **Cardinality** check box. The diagram now shows the cardinality of relationships between different tables in your data module. Move the **Degrees of separation** slider. Depending on the slider position, the diagram shows different distances of relationships between tables.

**Data tray**

You can use the data tray to view the actual data in table columns and rows.

Select a table in the data module tree or in the diagram, and click the data tray icon to open the data tray.

To navigate between rows of data, drag the data tray icon up and down. To navigate between the columns of data, use the column navigation bar at the bottom of the data tray. To close the data tray, click its icon again.

**Validation tray**

You can use the validation tray to view errors that are identified by the validation process.

The messages are displayed after you start the **Validate** operation anywhere in the modeling user interface, and the failed validation icon is displayed for tables, columns, expressions, or joins where errors are discovered.

To open or close the validation tray, click its icon. To expand the message viewing area, drag the tray icon up.

**Relationships**

A relationship joins logically related objects that the users want to combine in a single query. Relationships exist between two tables.

You can modify or delete relationships, or create new ones so that the data module properly represents the logical structure of your business. Verify that the relationships that you require exist in the data module, the cardinality is set correctly, and referential integrity is enforced.

The diagram provides a graphical view of table relationships in a data module. You can use the diagram to examine the relationships, create and edit the joins, or view the join cardinality.
Creating a relationship from scratch

You need to create relationships whenever the required relationships are not detected by the IBM Cognos software.

About this task

Relationships can be created between tables from the same source and from different sources.

The diagram is the most convenient place to view all data module relationships, and quickly discover the disconnected tables.

Tip: The list of possible keys in the relationship editor excludes measures. This means that if a row in a column was misidentified as a measure, but you want to use it as an identifier, you will not see the row in the key drop-down list. You need to examine the data module to confirm that the usage property is correct on each column in the table.

Procedure

1. In the data module tree or in the diagram, click the table for which you want to create a relationship, and from the context menu, click Join.

   Tip: You can also start creating a relationship using the following methods:
   • In the data module tree or in the diagram, control-click the two tables that you want to join in a relationship, and click Join.
   • On the Relationships tab in the table properties, click Create new.

   If the data module does not include the table that you need, you can drag this table from Selected sources directly onto the diagram.

2. In the relationship editor, specify the second table to include in the relationship, and then select the matching columns in both tables.

   Depending on the method that you used to start the relationship, the second table might already be added, and you only need to match the columns. You can include more than one set of matching rows in both tables.

3. Specify the Join type for the relationship by selecting one of the available options.

4. Specify the Cardinality of the relationship by selecting one of the available options.

5. Specify the Filter join. If you apply this filter, the performance of a join can be improved by filtering one side of the join with the values that are retrieved by the other side.

6. Click OK.

Results

The new relationship appears on the Relationships tab in the properties page of the tables that you joined, and in the diagram view.

To view or edit all relationships defined for a table, go to the Relationships tab in the table properties. To edit a relationship, click its expression, and make the modifications. To view a relationship from the diagram, click the join line to open a small graphical view of the relationship. To edit a relationship from the diagram, right-click the join line, and click Edit.
To delete a relationship for a table, go to the Relationships tab in the table properties, and click Edit. Then, click the remove icon for the required relationship, and click Done. To delete the relationship from the diagram, right-click the line joining the two tables, and click Remove.

Calculations

Calculations allow you to answer questions that cannot be answered by the source columns.

The following product functionality that you can use to refine your data modules is based on underlying calculations:
- Basic arithmetic calculations and field concatenations.
- Custom groups.
- Cleaning text data.
- Custom calculations.

Creating basic calculations

You can create basic arithmetic calculations for columns with numeric data types, and concatenate text values for columns with the text data type.

About this task

The expression for these calculations is predefined and you only need to select it. For example, you can create a column Revenue by multiplying values for Quantity and Unit price. You can create a column Name by combining two columns: First name and Last name.

Procedure

1. To create a simple arithmetic calculation for columns with numeric data types, use the following steps:
   a. In the data module tree, right-click the column for which you want to create a calculation. For calculations that are based on two columns, use control-click to select the columns.
   b. In the Create a calculation box, type a name for the calculation.
   c. If the calculation is based on one column, type the number to use in the calculation.
   d. Click Create.
2. To create a calculation that concatenates values for columns with the text data type, use the following steps:
   a. In the data module tree, control-click the two columns that you want to combine into a single column. Depending on which column you select first, its value appears at the beginning of the combined string.
   b. Click Create a calculation, and select the suggested option.
   c. Type a name for the calculation.
   d. Click Create.

Results

In the table that you added the calculation to, you can now see a new column with the new calculation at the end of the list of columns. An expression for the
calculation is automatically created in the expression editor. To view the expression, go to the column properties page and click on the expression that is shown for the Expression property.

**Grouping data**

You can organize the column data into custom groups so that the data is easier to read and analyze.

**About this task**

You can create two types of custom groups depending on the data type of the column: one group type for columns with numeric data and the second group type for columns with text data. For example, in the Employee code column you can group employees into ranges, such as 0-100, 101-200, 200+. In the Manager column, you can group managers according to their rank, such as First line manager, Senior manager, and so on.

**Procedure**

1. In the data module tree, right-click the column that you want to group on, and click Custom groups.
2. If you selected a numeric column, specify the grouping in the following way:
   a. Specify how many groups you want to create.
   b. Specify the distribution of the values to be either Equal distribution or Custom.
   c. If you chose Equal distribution, specify the values to be contained in each group by typing the numbers or clicking the scroll bars.
   d. If you chose Custom, you can enter your own range values for the group.
   e. Optional: Change the group name.
   f. Click Create.
3. If you selected a text column, specify the grouping in the following way:
   a. Control-select the values to include in the first group.
   b. In the Groups column, click the plus sign.
   c. Specify the name for the group, and click OK. The values are added in the Group members column, and the name of the group appears in the Groups column. You can add additional values to a group after it is created, and you can remove values from a group. You can also remove a group.
   d. Optional: To add another group, repeat the steps for the first group.
   e. Optional: To create a group that contains all of the values that aren’t already included in a group, select the Group remaining and future values in check box, and specify a name for the group.
   f. Click Create.

**Results**

The custom group column that is based on your selections appears at the end of the list of columns in the table. A group expression is automatically created in the expression editor. To view the expression, go to the column properties page and click on the expression that is shown for the Expression property.

**Tip:** To complete the action of creating the custom group, you can click Replace instead of Create. This option will replace the column name in the table with the group name.
Cleaning data

Data is often messy and inconsistent. You might want to impose some formatting order on your data so that it’s clearer and easier to read.

About this task

The Clean options that are available for a column depend on the column data type. Some options can be specified for multiple columns with the same data type, and some for singular columns only.

The following options are available to clean your data:

Whitespace
    Trim leading and trailing whitespace
Select this check box to remove leading and trailing whitespace from strings.

Convert case to
    UPPERCASE, lowercase, Do not change
Use this option to change the case of all characters in the string to either uppercase or lowercase, or to ensure that the case of each individual character is unchanged.

Return a substring of characters
Return a string that includes only part of the original string in each value. For example, an employee code can be stored as CA096670, but you need only the number 096670 so you use this option to remove the CA part. You can specify this option for singular columns only.

For the Start value, type a number that represents the position of a character in the string that will start the substring. Number 1 represents the first character in the string. For the Length value, specify the number of characters that will be included in the substring.

NULL values

Specify NULL-handling options for columns with text, numeric, date, and time data types that allow NULL values. When Cognos Analytics detects that a column does not allow NULL values, these options are not available for that column.

The default value for each option depends on the column data type. For text data, the default is an empty string. For numbers, the default is 0. For dates, the default is 2000-01-01. For time, the default is 12:00:00. For date and time (timestamp), the default is 2000-01-01T12:00:00.

The entry field for each option also depends on the column data type. For text, the entry field accepts alphanumeric characters, for numbers, the entry field accepts only numeric input. For dates, a date picker is provided to select the date, and for time, a time picker is provided to select the time.

The following NULL-handling options are available:

Replace this value with NULL
Replaces the text, numbers, date, and time values, as you specify in the entry field, with NULL.
For example, if you want to use an empty string instead of NULL in a given column, but your uploaded file sometimes uses the string n/a to indicate that the value is unknown, you can replace n/a with NULL, and then choose to replace NULL with the empty string.
Replace NULL values with
Replaces NULL values with text, numbers, date, and time values, as you specify in the entry field.
For example, for the Middle Name column, you can specify the following values to be used for cells where middle name does not exist: n/a, none, or the default empty string. For the Discount Amount column, you can specify 0.00 for cells where the amount is unknown.

Procedure

1. In the data module tree, click the context menu icon ☰️ for a column, and click **Clean**.

   **Tip:** To clean data in multiple columns at once, control-select the columns that you want to clean. The **Clean** option is available only if the data type of each selected column is the same.

2. Specify the options that are applicable for the selected column or columns.
3. Click **Clean**.

Results

After you complete the **Clean** operation, the expression editor automatically creates an expression for the modified column or columns. To view the expression, open the column properties panel, and click the expression that is shown for the **Expression** property.

Creating custom calculations

To create a custom calculation, you must define your own expression using the expression editor.

About this task

Custom calculations can be created at the data module level or at the table level. The module-level calculations can reference columns from multiple tables.

For information about the functions that you can use to define your expressions, see Appendix A, “Using the expression editor,” on page 23.

Procedure

1. In the data module tree, right-click the data module name or a specific table name, and click **Create custom calculation**.
2. In the **Expression editor** panel, define the expression for your calculation, and specify a name for it.
   - To enter a function for your expression, type the first character of the function name, and select the function from the drop-down list of suggested functions.
   - To add table columns to your expression, drag-and-drop one or more columns from the data module tree to the expression editor panel. The column name is added where you place the cursor in the expression editor.

   **Tip:** You can also double-click the column in the data module tree, and the column name appears in the expression editor.
3. Click **Validate** to check if the expression is valid.
4. After successful validation, click **OK**.

**Results**

If you created your calculation at the data module level, the calculation is added after the last table in the data module tree. If you created your calculation at the table level, the calculation is added at the end of the list of columns in the table. To view the expression for the calculation, open the calculation properties panel, and click on the expression that is shown for the **Expression** property.

---

**Creating navigation groups**

Creating navigation groups is a collection of non-measure columns that business users might associate for data exploration.

When a data module contains navigation groups, the dashboard users can drill down and back to change the focus of their analysis by moving between levels of information. The users can drill down from column to column in the navigation group by either following the order of columns in the navigation group, or by choosing the column to which they want to proceed.

**About this task**

You can create a navigation group with columns that are logically related, such as year, month, quarter, week. You can also create a navigation group with columns that are not logically related, such as product, customer, state, city.

Columns from different tables can be added to a navigation group. The same column can be added to multiple navigation groups.

**Procedure**

1. In the data module panel, start creating a navigation group by using one of the following methods:
   - From the data module context menu, click **Properties**, and then click the **Navigation groups** tab. Click **Add a navigation group**, and drag columns from the data module panel to the **Create navigation group** panel.
   - In the data module tree, select one or more columns, and from the context menu of any of the selected columns, click **Create navigation group**.

   The selected columns are listed in the **Create navigation group** panel. If there are multiple columns, the name of the navigation group includes names of the first and last column in the group.

2. If needed, modify the navigation group in the following way:
   - To add different columns, drag the columns from the data module panel to the navigation group panel. You can multi-select columns and drag them all at once.
   - To remove columns, click the remove icon for the column.
   - To change the order of columns, drag them up or down.
   - To change the navigation group name, overwrite the default name.
The default name reacts to the changed order of columns. If you override the default name, it does no longer change when you modify the group definition. The name cannot be blank.

3. Click Apply, and save the data module.

   If you select the option Identify navigation group members in the data module toolbar, the columns that are members of navigation groups are underlined.

Results

The navigation group is added to the data module and will be available to users in dashboards and stories.

What to do next

The modeler can modify navigation groups at any time, and re-save the data module.

To view the navigation group or groups that a column belongs to, from the column context menu, click Properties > Navigation groups. Click the navigation group name to view or modify its definition.

To view all navigation groups in a data module, from the data module context menu, click Properties > Navigation groups. Click the navigation group names to view or modify their definitions. To delete a navigation group, click Remove, click the remove icon for the group, and click Done.

Filtering data

A filter specifies the conditions that rows must meet to be retrieved from a table.

About this task

The filter is based on a specific column in a table, but it affects the whole table. Also, only rows that meet the filter criteria are retrieved from other tables.

You can create filters at the table level, which allows you to add multiple filters at once, or at the column level.

Procedure

1. In the data module tree or in the diagram, locate the table for which you want to create filters.

   • To create a filter at the table level, click the table context menu icon, and then click Filter.

   Tip: You can also right-click the table in the diagram, and click Filter from there.

   On the Filters tab in the table properties pane, click Add a filter, select a column, and click Enter a value.

   • To create a filter at the column level, expand the table in the data module panel, and from the column context menu, click Filter.
2. Select the filter values in the following way:
   a. If the column data type is integer, you have two options to specify the values: Range and Individual values. When you choose Range, use the slider to specify the value ranges. When you choose Individual values, select the check boxes associated with the values.
   b. For columns with numeric data types other than integer, use the slider to specify the range values.
   c. For columns with date and time (timestamp) data types, specify a range of values before, after, or between the selected date and time, or select individual values.
   d. For columns with text data types, select the check boxes associated with the values.
3. Optional: To select values that are outside the range that you specified, click Invert.
4. Specify a meaningful label for the filter.
5. Click Apply.

**Results**

After you create a filter, the filter icon is added for the table and column in the data module panel and in the diagram.

**What to do next**

To view, edit, or remove the filters defined for a table, go to the Filters tab in the table properties. To edit the filter, click its expression, make the modifications, and click Done.

Tip: To edit a filter on a single column, from the column context menu in the data module panel, click Filter to open the filter definition.

To remove any filter from a table, go to the Filters tab in the table properties, and click Edit. Then, click the remove icon that appears before the filter name, and click Done.

**Hiding tables and columns**

You can hide a table or column in a data module. The hidden tables or columns remain visible in the modeling interface, but they are not visible in the reporting and dashboarding interfaces. The hidden items are fully functional in the product.

**About this task**

Use this feature to provide an uncluttered view of metadata for the report and dashboard users. For example, when you hide columns that are referenced in a calculation, the metadata tree in the reporting and dashboarding interfaces shows only the calculation column, but not the referenced columns. When you hide the identifier columns used as keys for joins, the keys are not exposed in the dashboarding and reporting interfaces, but the joins are functional in all interfaces.
Procedure

1. In the data module tree, click the context menu icon for a table or column, and click **Hide**.
   You can also select multiple tables or columns to hide them at once.
   
   **Tip:** To un-hide the items, click the context menu icon for the hidden table or column, and click **Show**.

2. Save the data module.

Results

The labels on the hidden tables and columns are grayed out in the data module tree and in the diagram. Also, on the **General** tab of the table or column properties, the check box **This item is hidden from users** is selected.

The hidden tables and columns are not visible in the reporting and dashboarding interfaces.

---

**Validating data modules**

11.0.4

Use the validation feature to check for invalid object references within a data module.

**About this task**

Validation identifies the following errors:

- A table or column that a data module is based on no longer exists in the source.
- A calculation expression is invalid.
- A filter references a column that no longer exists in the data module.
- A table or column that is referenced in a join no longer exists in the data module.

Errors in the data module are identified by the failed validation icon 🔄. The descriptions of errors are shown in the validation tray when it is open ✅.

**Procedure**

1. In the data module tree, click the data module context menu icon ⬇️, and click **Validate**

If errors are identified, the failed validation icon 🔄 is displayed in the data module tree, in the diagram, and in the properties panel, next to the column or expression where the error exists. The descriptions of errors are displayed in the validation tray.

**Tip:** To open or close the validation tray, click its icon ✅.
2. Click the failed validation icon for a module, column, expression, or join to view a pop-up box that informs you of the number of errors for the selected item. Double-click the failed validation icon in the pop-up box to view the error details.

Results

Using the validation messages, try to resolve the errors. You can save a data module with validation errors in it.
Appendix A. Using the expression editor

An expression is any combination of operators, constants, functions, and other components that evaluates to a single value. You build expressions to create calculation and filter definitions. A calculation is an expression that you use to create a new value from existing values that are contained within a data item. A filter is an expression that you use to retrieve a specific subset of records.

Operators

Operators specify what happens to the values on either side of the operator. Operators are similar to functions, in that they manipulate data items and return a result.

(  
Identifies the beginning of an expression.

**Syntax**

( expression )

)

Identifies the end of an expression.

**Syntax**

( expression )

*  
Multiplies two numeric values.

**Syntax**

value1 * value2

/  
Divides two numeric values.

**Syntax**

value1 / value2

||  
Concatenates, or joins, strings.

**Syntax**

string1 || string2

+  
Adds two numeric values.

**Syntax**

value1 + value2
Subtracts two numeric values or negates a numeric value.

**Syntax**

```plaintext
value1 - value2
or
- value
```

**<**

Compares the values that are represented by "value1" against "value2" and retrieves the values that are less than "value2".

**Syntax**

```plaintext
value1 < value2
```

**<=**

Compares the values that are represented by "value1" against "value2" and retrieves the values that are less than or equal to "value2".

**Syntax**

```plaintext
value1 <= value2
```

**<>**

Compares the values that are represented by "value1" against "value2" and retrieves the values that are not equal to "value2".

**Syntax**

```plaintext
value1 <> value2
```

**=**

Compares the values that are represented by "value1" against "value2" and retrieves the values that are equal to "value2".

**Syntax**

```plaintext
value1 = value2
```

**>**

Compares the values that are represented by "value1" against "value2" and retrieves the values that are greater than "value2".

**Syntax**

```plaintext
value1 > value2
```

**>=**

Compares the values that are represented by "value1" against "value2" and retrieves the values that are greater than or equal to "value2".

**Syntax**

```plaintext
value1 >= value2
```
and

Returns "true" if the conditions on both sides of the expression are true.

Syntax
argument1 and argument2

between

Determines if a value falls in a given range.

Syntax
expression between value1 and value2

Example
[Revenue] between 200 and 300

Result

Returns the number of results with revenues between 200 and 300.

Result data

<table>
<thead>
<tr>
<th>Revenue</th>
<th>Between</th>
</tr>
</thead>
<tbody>
<tr>
<td>$332.06</td>
<td>false</td>
</tr>
<tr>
<td>$230.55</td>
<td>true</td>
</tr>
<tr>
<td>$107.94</td>
<td>false</td>
</tr>
</tbody>
</table>

case

Works with when, then, else, and end. Case identifies the beginning of a specific situation, in which when, then, and else actions are defined.

Syntax
case expression { when expression then expression } [ else expression ] end

contains

Determines if "string1" contains "string2".

Syntax
string1 contains string2

distinct

A keyword used in an aggregate expression to include only distinct occurrences of values. See also the function unique.

Syntax
distinct dataItem

Example
count ( distinct [OrderDetailQuantity] )

Result
else

Works with the if or case constructs. If the if condition or the case expression are not true, then the else expression is used.

Syntax
if ( condition ) then .... else ( expression ) , or case .... else ( expression ) end

end

Indicates the end of a case or when construct.

Syntax
case .... end

ends with

Determines if "string1" ends with "string2".

Syntax
string1 ends with string2

if

Works with the then and else constructs. If defines a condition; when the if condition is true, the then expression is used. When the if condition is not true, the else expression is used.

Syntax
if ( condition ) then ( expression ) else ( expression )

in

Determines if "expression1" exists in a given list of expressions.

Syntax
expression1 in ( expression_list )

is missing

Determines if "value" is undefined in the data.

Syntax
value is missing

like

Determines if "string1" matches the pattern of "string2", with the character "char" optionally used to escape characters in the pattern string.

Syntax
string1 LIKE string2 [ ESCAPE char ]
**Example 1**

[PRODUCT_LINE] like 'G%'

**Result**

All product lines that start with 'G'.

**Example 2**

[PRODUCT_LINE] like '%Ga%' escape 'a'

**Result**

All the product lines that end with 'G%'.

**lookup**

Finds and replaces data with a value you specify. It is preferable to use the case construct.

**Syntax**

lookup ( name ) in ( value1 --> value2 ) default ( expression )

**Example**

lookup ([Country]) in ( 'Canada'--> ([List Price] * 0.60), 'Australia'--> ([List Price] * 0.80 ) ) default ([List Price] )

**not**

Returns TRUE if "argument" is false or returns FALSE if "argument" is true.

**Syntax**

NOT argument

**or**

Returns TRUE if either of "argument1" or "argument2" are true.

**Syntax**

argument1 or argument2

**starts with**

Determines if "string1" starts with "string2".

**Syntax**

string1 starts with string2

**then**

Works with the if or case constructs. When the if condition or the when expression are true, the then expression is used.

**Syntax**

if ( condition ) then ..., or case expression when expression then .... end
when
Works with the case construct. You can define conditions to occur when the WHEN expression is true.

Syntax
case [expression] when ... end

Summaries
This list contains predefined functions that return either a single summary value for a group of related values or a different summary value for each instance of a group of related values.

Statistical functions
This list contains predefined summary functions of statistical nature.

standard-deviation
Returns the standard deviation of selected data items.

Syntax
standard-deviation ( expression [ auto ] )
standard-deviation ( expression for [ all|any ] expression { , expression } )
standard-deviation ( expression for report )

Example
standard-deviation ( ProductCost )

Result
Returns a value indicating the deviation between product costs and the average product cost.

variance
Returns the variance of selected data items.

Syntax
variance ( expression [ auto ] )
variance ( expression for [ all|any ] expression { , expression } )
variance ( expression for report )

Example
variance ( Product Cost )

Result
Returns a value indicating how widely product costs vary from the average product cost.

average
Returns the average value of selected data items. Distinct is an alternative expression that is compatible with earlier versions of the product.
Syntax

average ( [ distinct ] expression [ auto ] )
average ( [ distinct ] expression for [ all | any ] expression { ,
expression } )
average ( [ distinct ] expression for report )

Example

average ( Sales )

Result

Returns the average of all Sales values.

count

Returns the number of selected data items excluding null values. Distinct is an alternative expression that is compatible with earlier versions of the product. All is supported in DQM mode only and it avoids the presumption of double counting a data item of a dimension table.

Syntax

count ( [ all | distinct ] expression [ auto ] )
count ( [ all | distinct ] expression for [ all | any ] expression { ,
expression } )
count ( [ all | distinct ] expression for report )

Example

count ( Sales )

Result

Returns the total number of entries under Sales.

maximum

Returns the maximum value of selected data items. Distinct is an alternative expression that is compatible with earlier versions of the product.

Syntax

maximum ( [ distinct ] expression [ auto ] )
maximum ( [ distinct ] expression for [ all | any ] expression { ,
expression } )
maximum ( [ distinct ] expression for report )

Example

maximum ( Sales )

Result

Returns the maximum value out of all Sales values.

median

Returns the median value of selected data items.
Syntax
median ( expression [ auto ] )
median ( expression for [ all|any ] expression { , expression } )
median ( expression for report )

**minimum**
Returns the minimum value of selected data items. Distinct is an alternative expression that is compatible with earlier versions of the product.

**Syntax**
minimum ( [ distinct ] expression [ auto ] )
minimum ( [ distinct ] expression for [ all|any ] expression { , expression } )
minimum ( [ distinct ] expression for report )

**Example**
minimum ( Sales )

**Result**
Returns the minimum value out of all Sales values.

**percentage**
Returns the percent of the total value for selected data items. The "<for-option>" defines the scope of the function. The "at" option defines the level of aggregation and can be used only in the context of relational datasources.

**Syntax**
percentage ( numeric_expression [ at expression { , expression } ] [ <for-option> ] [ prefILTER ] )
percentage ( numeric_expression [ <for-option> ] [ prefILTER ] )
<for-option> ::= for expression { , expression }|for report|auto

**Example**
percentage ( Sales 98 )

**Result**
Returns the percentage of the total sales for 1998 that is attributed to each sales representative.

**Result data**

<table>
<thead>
<tr>
<th>Employee</th>
<th>Sales 98</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gibbons</td>
<td>60646</td>
<td>7.11%</td>
</tr>
<tr>
<td>Flertjan</td>
<td>62523</td>
<td>7.35%</td>
</tr>
<tr>
<td>Cornel</td>
<td>22396</td>
<td>2.63%</td>
</tr>
</tbody>
</table>

**percentile**
Returns a value, on a scale of one hundred, that indicates the percent of a distribution that is equal to or below the selected data items. The "<for-option>" defines the scope of the function. The "at" option defines the level of aggregation and can be used only in the context of relational datasources.
Syntax

percentile ( numeric_expression [ at expression { , expression } ] [ <for-option> ] [ prefilter ] )
percentile ( numeric_expression [ <for-option> ] [ prefilter ] )
<for-option> ::= for expression { , expression } | for report | auto

Example

percentile ( Sales 98 )

Result

For each row, returns the percentage of rows that are equal to or less than the quantity value of that row.

Result data

<table>
<thead>
<tr>
<th>Qty</th>
<th>Percentile (Qty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>1</td>
</tr>
<tr>
<td>700</td>
<td>0.875</td>
</tr>
<tr>
<td>600</td>
<td>0.75</td>
</tr>
<tr>
<td>500</td>
<td>0.625</td>
</tr>
<tr>
<td>400</td>
<td>0.5</td>
</tr>
<tr>
<td>400</td>
<td>0.5</td>
</tr>
<tr>
<td>200</td>
<td>0.25</td>
</tr>
<tr>
<td>200</td>
<td>0.25</td>
</tr>
</tbody>
</table>

quantile

Returns the rank of a value within a range that you specify. It returns integers to represent any range of ranks, such as 1 (highest) to 100 (lowest). The "<for-option>" defines the scope of the function. The "at" option defines the level of aggregation and can be used only in the context of relational datasources.

Syntax

quantile ( numeric_expression , numeric_expression [ at expression { , expression } ] [ <for-option> ] [ prefilter ] )
quantile ( numeric_expression , numeric_expression [ <for-option> ] [ prefilter ] )
<for-option> ::= for expression { , expression } | for report | auto

Example

quantile ( Qty , 4 )

Result

Returns the quantity, the rank of the quantity value, and the quantity values broken down into 4 quantile groups (quartiles).

Result data

<table>
<thead>
<tr>
<th>Qty</th>
<th>Rank</th>
<th>Quantile (Qty, 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>700</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>600</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>500</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>400</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
The quartile function returns the rank of a value, represented as integers from 1 (highest) to 4 (lowest), relative to a group of values. The "<for-option>" defines the scope of the function. The "at" option defines the level of aggregation and can be used only in the context of relational data sources.

**Syntax**

```
quartile ( numeric_expression [ at expression { , expression } ] [ <for-option> ] [ prefilter ] )
quartile ( numeric_expression [ <for-option> ] [ prefilter ] )
<for-option> ::= for expression { , expression }|for report|auto
```

**Example**

```
 quartile ( Qty )
```

**Result**

Returns the quantity and the quartile of the quantity value represented as integers from 1 (highest) to 4 (lowest).

**Result data**

<table>
<thead>
<tr>
<th>Qty</th>
<th>Quatire (Qty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>1</td>
</tr>
<tr>
<td>400</td>
<td>1</td>
</tr>
<tr>
<td>350</td>
<td>2</td>
</tr>
<tr>
<td>300</td>
<td>2</td>
</tr>
<tr>
<td>250</td>
<td>3</td>
</tr>
<tr>
<td>200</td>
<td>3</td>
</tr>
<tr>
<td>150</td>
<td>4</td>
</tr>
<tr>
<td>100</td>
<td>4</td>
</tr>
</tbody>
</table>

The rank function returns the rank value of selected data items. The sort order is optional; descending order (DESC) is assumed by default. If two or more rows tie, then there is a gap in the sequence of ranked values (also known as Olympic ranking). The "<for-option>" defines the scope of the function. The "at" option defines the level of aggregation and can be used only in the context of relational data sources. Distinct is an alternative expression that is compatible with earlier versions of the product. Null values are ranked last.

**Syntax**

```
rank ( expression [ ASC|DESC ] { , expression [ ASC|DESC ] } [ at expression { , expression } ] [ <for-option> ] [ prefilter ] )
rack ( [ distinct ] expression [ ASC|DESC ] { , expression [ ASC|DESC ] } [ <for-option> ] [ prefilter ] )
<for-option> ::= for expression { , expression }|for report|auto
```
Example

rank ( Sales 98 )

Result

For each row, returns the rank value of sales for 1998 that is attributed to each sales representative. Some numbers are skipped when a tie between rows occurs.

Result data

<table>
<thead>
<tr>
<th>Employee</th>
<th>Sales 98</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gibbons</td>
<td>60000</td>
<td>1</td>
</tr>
<tr>
<td>Flertjan</td>
<td>50000</td>
<td>2</td>
</tr>
<tr>
<td>Cornel</td>
<td>50000</td>
<td>2</td>
</tr>
<tr>
<td>Smith</td>
<td>48000</td>
<td>4</td>
</tr>
</tbody>
</table>

tertile

Returns the rank of a value as High, Middle, or Low relative to a group of values.

Syntax

tertile ( expression [ auto ] )
tertile ( expression for [ all|any ] expression { , expression } )
tertile ( expression for report )

Example
tertile ( Qty )

Result

Returns the quantity, the quantile rank value of the quantity as broken down into tertiles, and the quantile rank label as broken down into tertiles.

Result data

<table>
<thead>
<tr>
<th>Qty</th>
<th>Quantile (Qty, 3)</th>
<th>Tertile (Qty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>1</td>
<td>H</td>
</tr>
<tr>
<td>700</td>
<td>1</td>
<td>H</td>
</tr>
<tr>
<td>500</td>
<td>2</td>
<td>M</td>
</tr>
<tr>
<td>400</td>
<td>2</td>
<td>M</td>
</tr>
<tr>
<td>200</td>
<td>3</td>
<td>L</td>
</tr>
<tr>
<td>200</td>
<td>3</td>
<td>L</td>
</tr>
</tbody>
</table>

total

Returns the total value of selected data items. Distinct is an alternative expression that is compatible with earlier versions of the product.

Syntax

total ( [ distinct ] expression [ auto ] )
total ( [ distinct ] expression for [ all|any ] expression { , expression } )
total ( [ distinct ] expression for report )
Example

total (Sales)

Result

Returns the total value of all Sales values.

---

**Business Date/Time Functions**

This list contains business functions for performing date and time calculations.

**_add_seconds**

Returns the time or datetime, depending on the format of "time_expression", that results from adding "integer_expression" seconds to "time_expression".

**Syntax**

_add_seconds ( time_expression, integer_expression )

**Example 1**

_add_seconds ( 13:04:59, 1 )

Result

13:05:00

**Example 2**

_add_seconds ( 2002-04-30 12:10:10.000, 1 )

Result

2002-04-30 12:10:11.000

**Example 3**

_add_seconds ( 2002-04-30 00:00:00.000, 1/100 )

Note that the second argument is not a whole number. This is supported by some database technologies and increments the time portion.

Result

2002-04-30 00:00:00.010

**_add_minutes**

Returns the time or datetime, depending on the format of "time_expression", that results from adding "integer_expression" minutes to "time_expression".

**Syntax**

_add_minutes ( time_expression, integer_expression )

**Example 1**

_add_minutes ( 13:59:00, 1 )

Result
Example 2
_add_minutes ( 2002-04-30 12:59:10.000, 1 )
Result
2002-04-30 13:00:10.000

Example 3
_add_minutes ( 2002-04-30 00:00:00.000, 1/60 )
Note that the second argument is not a whole number. This is supported by some database technologies and increments the time portion.
Result
2002-04-30 00:00:01.000

_add_hours
Returns the time or datetime, depending on the format of "time_expression", that results from adding "integer_expression" hours to "time_expression".

Syntax
_add_hours ( time_expression, integer_expression )

Example 1
_add_hours ( 13:59:00, 1 )
Result
14:59:00

Example 2
_add_hours ( 2002-04-30 12:10:10.000, 1 )
Result
2002-04-30 13:10:10.000,

Example 3
_add_hours ( 2002-04-30 00:00:00.000, 1/60 )
Note that the second argument is not a whole number. This is supported by some database technologies and increments the time portion.
Result
2002-04-30 00:01:00.000

_add_days
Returns the date or datetime, depending on the format of "date_expression", that results from adding "integer_expression" days to "date_expression".
Syntax
_add_days ( date_expression, integer_expression )

Example 1
_add_days ( 2002-04-30 , 1 )

Result
2002-05-01

Example 2
_add_days ( 2002-04-30 12:10:10.000, 1 )

Result
2002-05-01 12:10:10.000

Example 3
_add_days ( 2002-04-30 00:00:00.000, 1/24 )
Note that the second argument is not a whole number. This is supported by some database technologies and increments the time portion.

Result
2002-04-30 01:00:00.000

_add_months
Add "integer_expression" months to "date_expression". If the resulting month has fewer days than the day of month component, then the last day of the resulting month is returned. In all other cases the returned value has the same day of month component as "date_expression".

Syntax
_add_months ( date_expression, integer_expression )

Example 1
_add_months ( 2012-04-15 , 3 )

Result
2012-07-15

Example 2
_add_months ( 2012-02-29 , 1 )

Result
2012-03-29

Example 3
_last_of_month ( _add_months ( 2012-02-29 , 1 ) )

Result
Example 4
_add_months ( 2012-01-31 , 1 )

Result
2012-02-29

Example 5
_add_months ( 2002-04-30 12:10:10.000 , 1 )

Result
2002-05-30 12:10:10.000

_add_years
Adds "integer_expression" years to "date_expression". If the "date_expression" is February 29 and resulting year is non leap year, then the resulting day is set to February 28. In all other cases the returned value has the same day and month as "date_expression".

Syntax
_add_years ( date_expression, integer_expression )

Example 1
_add_years ( 2012-04-15 , 1 )

Result
2013-04-15

Example 2
_add_years ( 2012-02-29 , 1 )

Result
2013-02-28

Example 3
_add_years ( 2002-04-30 12:10:10.000 , 1 )

Result
2003-04-30 12:10:10.000

_age
Returns a number that is obtained from subtracting "date_expression" from today's date. The returned value has the form YYYYMMDD, where YYYY represents the number of years, MM represents the number of months, and DD represents the number of days.

Syntax
_age ( date_expression )
Example

_age ( 1990-04-30 ) (if today's date is 2003-02-05)

Result

120906, meaning 12 years, 9 months, and 6 days.

current_date

Returns a date value representing the current date of the computer that the database software runs on.

Syntax

current_date

Example
current_date

Result

2003-03-04

current_time

Returns a time with time zone value, representing the current time of the computer that runs the database software if the database supports this function. Otherwise, it represents the current time of the IBM Cognos Analytics server.

Syntax

current_time

Example
current_time

Result

16:33:11.354+05:00

current_timestamp

Returns a datetime with time zone value, representing the current time of the computer that runs the database software if the database supports this function. Otherwise, it represents the current time of the server.

Syntax

current_timestamp

Example
current_timestamp

Result

2003-03-03 16:40:15.535+05:00
**_day_of_week_**

Returns the day of week (1 to 7), where 1 is the first day of the week as indicated by the second parameter (1 to 7, 1 being Monday and 7 being Sunday). Note that in ISO 8601 standard, a week begins with Monday being day 1.

**Syntax**

`_day_of_week ( date_expression, integer )`

**Example**

`_day_of_week ( 2003-01-01, 1 )`

Result

3

**_day_of_year_**

Returns the day of year (1 to 366) in "date_expression". Also known as Julian day.

**Syntax**

`_day_of_year ( date_expression )`

**Example**

`_day_of_year ( 2003-03-01 )`

Result

61

**_days_between_**

Returns a positive or negative number representing the number of days between "date_expression1" and "date_expression2". If "date_expression1" < "date_expression2", then the result will be a negative number.

**Syntax**

`_days_between ( date_expression1, date_expression2 )`

**Example**

`_days_between ( 2002-04-30, 2002-06-21 )`

Result

-52

**_days_to_end_of_month_**

Returns a number representing the number of days remaining in the month represented by "date_expression".

**Syntax**

`_days_to_end_of_month ( date_expression )`
Example
_days_to_end_of_month ( 2002-04-20 14:30:22.123 )

Result
10

_end_of_day
Returns the end of today as a timestamp.

Syntax
_end_of_day

Example
_end_of_day

Result
2014-11-23 23:59:59

_first_of_month
Returns a date or datetime, depending on the argument, by converting "date_expression" to a date with the same year and month but with the day set to 1.

Syntax
_first_of_month ( date_expression )

Example 1
_first_of_month ( 2002-04-20 )

Result
2002-04-01

Example 2
_first_of_month ( 2002-04-20 12:10:10.000 )

Result
2002-04-01 12:10:10.000

_from_unixtime
Returns the unix time specified by an integer expression as a timestamp with time zone.

Syntax
_from_unixtime ( integer_expression )

Example
_from_unixtime ( 1417807335 )

Result
2014-12-05 19:22:15+00:00
_hour

Returns the value of the hour field in a date expression.

Syntax

_hour( date_expression )

Example

_hour( 2002-01-31 12:10:10.254 )

Result

12

_last_of_month

Returns a date or datetime, depending on the argument, that is the last day of the month represented by "date_expression".

Syntax

_last_of_month( date_expression )

Example 1

_last_of_month( 2002-01-14 )

Result

2002-01-31

Example 2

_last_of_month( 2002-01-14 12:10:10.000 )

Result

2002-01-31 12:10:10.000

_make_timestamp

Returns a timestamp constructed from "integer_expression1" (the year), "integer_expression2" (the month), and "integer_expression3" (the day). The time portion defaults to 00:00:00.000.

Syntax

_make_timestamp( integer_expression1, integer_expression2, integer_expression3 )

Example

_make_timestamp( 2002, 01, 14 )

Result

2002-01-14 00:00:00.000

_minute

Returns the value of the minute field in a date expression.
Syntax
_minute( date_expression )

Example
_minute ( '2002-01-31 12:10:10.254' )

Result
10

_MONTH
Returns the value of the month field in a date expression.

Syntax
_month( date_expression )

Example
_month ( '2003-03-01' )

Result
3

_MONTHS_BETWEEN
Returns a positive or negative integer number representing the number of months between "date_expression1" and "date_expression2". If "date_expression1" is earlier than "date_expression2", then a negative number is returned.

Syntax
_months_between ( date_expression1, date_expression2 )

Example
_months_between ( '2002-04-03', '2002-01-30' )

Result
2

SECOND
Returns the value of the second field in a date expression.

Syntax
_second( date_expression )

Example
_second ( '2002-01-31 12:10:10.254' )

Result
10.254

SHIFT_TIMEZONE
Shifts a timestamp value from one time zone to another time zone. This function honors the Daylight Savings Time when applicable. If the first argument is of type "timestamp", then the second and third arguments represent the "from" and
"target" time zones, respectively. If the first argument is of type "timestamp with time zone", then the "from" time zone is already implied in the first argument therefore the second argument represents the "target" time zone. The data type of the first argument will also determine the data type of the return value. The second and third arguments are of type "string" and represent time zone identifiers. A list of these identifiers can be found below. Note: using this function will cause local processing.

Syntax

_shift_timezone ( timestamp_value , from_time_zone ,
    target_time_zone )
_shift_timezone ( timestamp_with_time_zone_value , target_time_zone )

Example 1

_shift_timezone ( 2013-06-30 12:00:00 , 'EST' , 'GMT' )

Result

2013-06-30 16:00:00

Example 2

_shift_timezone ( 2013-11-30 12:00:00-05:00 , 'PST' )

Result

2013-11-30 09:00:00-08:00

Example 3

Time zone abbreviations:

Result data

GMT (GMT+00:00) Greenwich Mean Time
UTC (GMT+00:00) Coordinated Universal Time
WET (GMT+00:00) Western Europe Time: Lisbon, Faeroe Islands, Canary Islands
ECT (GMT+01:00) European Central Time: Amsterdam, Brussels, Paris, Rome, Vienna
MET (GMT+01:00) Middle European Time
ART (GMT+02:00) Egypt Time: Cairo, Damascus, Beirut, Amman, Nicosia
CAT (GMT+02:00) Central African Time: Johannesburg, Blantyre, Harare, Tripoli
EET (GMT+02:00) Eastern Europe Time: Athens, Kiev, Sofia, Minsk, Bucharest, Vilnius, Tallinn
EAT (GMT+03:00) East Africa Time: Addis Ababa, Asmera, Kampala, Nairobi, Mogadishu, Khartoum
NET (GMT+04:00) Near East Time
PLT (GMT+05:00) Pakistan Lahore Time
IST (GMT+05:30) Indian Time
BST (GMT+06:00) Bangladesh Time
VST (GMT+07:00) Vietnam Time
CTT (GMT+08:00) Asia, Hong Kong S.A.R. of China
JST (GMT+09:00) Japan Time: Tokyo
ACT (GMT+09:30) Australian Central Time: Darwin
AET (GMT+10:00) Australian Eastern Time: Sydney, Melbourne, Canberra
SST (GMT+11:00) Solomon Time
AGT (GMT+03:00) Argentina Time
BET (GMT+03:00) Brazil Eastern Time: Sao Paulo, Buenos Aires
CNT (GMT+03:30) Newfoundland Time: St. Johns
PRT (GMT+04:00) Puerto Rico and U.S. Virgin Islands Time
EST (GMT-05:00) Eastern Time: Ottawa, New York, Toronto, Montreal,
Jamaica, Porto Acre
CST (GMT-06:00) Central Time: Chicago, Cambridge Bay, Mexico City
MST (GMT-07:00) Mountain Time: Edmonton, Yellowknife, Chihuahua
PST (GMT-08:00) Pacific Time: Los Angeles, Tijuana, Vancouver
AST (GMT-09:00) Alaska Time: Anchorage, Juneau, Nome, Yakutat
HST (GMT-10:00) Hawaii Time: Honolulu, Tahiti
MIT (GMT-11:00) Midway Islands Time: Midway, Apia, Niue, Pago Pago

Example 4
A customized time zone identifier may also be used, using the format GMT(+|-)HH:MM. For example, GMT-06:30 or GMT+02:00.
A more complete list of time zone identifiers (including longer form identifiers such as "Europe/Amsterdam") may be found in the "i18n_res.xml" file from the product's configuration folder.

_start_of_day
Returns the start of today as a timestamp.

Syntax
_start_of_day

Example
_start_of_day

Result
2014-11-23 00:00:00

_week_of_year
Returns the number of the week of the year of "date_expression" according to the ISO 8601 standard. Week 1 of the year is the first week of the year to contain a Thursday, which is equivalent to the first week containing January 4th. A week starts on Monday (day 1) and ends on Sunday (day 7).

Syntax
_week_of_year ( date_expression )

Example
_week_of_year ( 2003-01-01 )

Result
1

_timezone_hour
Returns the value of the timezone hour field in a date expression.

Syntax
_timezone_hour ( date_expression )

Example
_timezone_hour ( 2002-01-31 12:10:10.254-05:30 )

Result
_timezone_minute

Returns the value of the timezone minute field in a date expression.

**Syntax**

```
_timezone_minute( date_expression )
```

**Example**

```
_timezone_minute( 2002-01-31 12:10:10.254-05:30 )
```

Result

30

_unix_timestamp

Returns the unix time specified by an integer expression as a timestamp with timezone.

**Syntax**

```
_unix_timestamp
```

**Example**

```
_unix_timestamp
```

Result

1416718800

_year

Returns the value of the year field in a date expression.

**Syntax**

```
_year( date_expression )
```

**Example**

```
_year( 2003-03-01 )
```

Result

2003

_years_between

Returns a positive or negative integer number representing the number of years between "date_expression1" and "date_expression2". If "date_expression1" < "date_expression2" then a negative value is returned.

**Syntax**

```
_years_between( date_expression1, date_expression2 )
```

**Example**

```
_years_between( 2003-01-30, 2001-04-03 )
```

Result
_ymdint_between

Returns a number representing the difference between "date_expression1" and "date_expression2". The returned value has the form YYYYMMDD, where YYYY represents the number of years, MM represents the number of months, and DD represents the number of days.

Syntax

_ymdint_between ( date_expression1, date_expression2 )

Example

_ymdint_between ( 1990-04-30, 2003-02-05 )

Result

120906, meaning 12 years, 9 months and 6 days.

Common Functions

abs

Returns the absolute value of "numeric_expression". Negative values are returned as positive values.

Syntax

abs ( numeric_expression )

Example 1

abs ( 15 )

Result

15

Example 2

abs ( -15 )

Result

15

cast

Converts "expression" to a specified data type. Some data types allow for a length and precision to be specified. Make sure that the target is of the appropriate type and size. The following can be used for "datatype_specification": character, varchar, char, numeric, decimal, integer, bigint, smallint, real, float, date, time, timestamp, time with time zone, timestamp with time zone, and interval. When type casting to an interval type, one of the following interval qualifiers must be specified: year, month, or year to month for the year-to-month interval datatype; day, hour, minute, second, day to hour, day to minute, day to second, hour to minute, hour to second, or minute to second for the day-to-second interval datatype. Notes: When you convert a value of type timestamp to type date, the time portion of the timestamp value is ignored. When you convert a value of type timestamp to type
time, the date portion of the timestamp is ignored. When you convert a value of type date to type timestamp, the time components of the timestamp are set to zero. When you convert a value of type time to type timestamp, the date component is set to the current system date. It is invalid to convert one interval datatype to the other (for instance because the number of days in a month is variable). Note that you can specify the number of digits for the leading qualifier only, i.e. YEAR(4) TO MONTH, DAY(5). Errors will be reported if the target type and size are not compatible with the source type and size.

**Syntax**
cast ( expression , datatype_specification )

**Example 1**
cast ( '123' , integer )

Result
123

**Example 2**
cast ( 12345 , varchar ( 10 ) )

Result
a string containing 12345

**ceiling**
Returns the smallest integer that is greater than or equal to "numeric_expression".

**Syntax**
ceiling ( numeric_expression )

**Example 1**
ceiling ( 4.22 )

Result
5

**Example 2**
ceiling ( -1.23 )

Result
-1

**char_length**
Returns the number of logical characters in "string_expression". The number of logical characters can be distinct from the number of bytes in some East Asian locales.

**Syntax**
char_length ( string_expression )
**Example**

cchar_length ( 'Canada' )

Result

6

**coalesce**

Returns the first non-null argument (or null if all arguments are null). Requires two or more arguments in "expression_list".

**Syntax**

c coalesce ( expression_list )

**Example**

c coalesce ( [Unit price], [Unit sale price] )

Result

Returns the unit price, or the unit sale price if the unit price is null.

**exp**

Returns 'e' raised to the power of "numeric_expression". The constant 'e' is the base of the natural logarithm.

**Syntax**

c exp ( numeric_expression )

**Example**

c exp ( 2 )

Result

7.389056

**floor**

Returns the largest integer that is less than or equal to "numeric_expression".

**Syntax**

c floor ( numeric_expression )

**Example 1**

c floor ( 3.22 )

Result

3

**Example 2**

c floor ( -1.23 )

Result
\texttt{ln}\hspace{1em} \textit{Returns the natural logarithm of "numeric\_expression".}

\textbf{Syntax}
\begin{verbatim}
ln ( numeric\_expression )
\end{verbatim}

\textbf{Example}
\begin{verbatim}
ln ( 4 )
\end{verbatim}
\textit{Result}
\begin{verbatim}
1.38629
\end{verbatim}

\texttt{lower}\hspace{1em} \textit{Returns "string\_expression" with all uppercase characters shifted to lowercase.}

\textbf{Syntax}
\begin{verbatim}
lower ( string\_expression )
\end{verbatim}

\textbf{Example}
\begin{verbatim}
lower ( 'ABCDEF' )
\end{verbatim}
\textit{Result}
\begin{verbatim}
abcdef
\end{verbatim}

\texttt{mod}\hspace{1em} \textit{Returns the remainder (modulus) of "integer\_expression1" divided by "integer\_expression2". "Integer\_expression2" must not be zero or an exception condition is raised.}

\textbf{Syntax}
\begin{verbatim}
mod ( integer\_expression1, integer\_expression2 )
\end{verbatim}

\textbf{Example}
\begin{verbatim}
mod ( 20, 3 )
\end{verbatim}
\textit{Result}
\begin{verbatim}
2
\end{verbatim}

\texttt{nullif}\hspace{1em} \textit{Returns null if "expression1" equals "expression2", otherwise returns "expression1".}

\textbf{Syntax}
\begin{verbatim}
nullif ( expression1, expression2 )
\end{verbatim}

\texttt{position}\hspace{1em} \textit{Returns the integer value representing the starting position of "string\_expression1" in "string\_expression2" or 0 when the "string\_expression1" is not found.}
Syntax

position ( string_expression1 , string_expression2 )

Example 1

position ( 'C' , 'ABCDEF' )

Result

3

Example 2

position ( 'H' , 'ABCDEF' )

Result

0

position_regex

Returns the integer value representing the beginning or ending position of the substring in "string_expression" that matches the regular expression "regex_expression". The search starts at position "integer_expression1", which has a default value of 1. The occurrence of the pattern to search for is specified by "integer_expression2", which has a default value of 1. The return option, specified by the first argument, specifies what is returned in relation to the occurrence. If you specify "start", the position of the first character of the occurrence is returned. If you specify "after", the position of the character following the occurrence is returned. If you don't specify a return option, "start" is implicit. Flags to set options for the interpretation of the regular expression are specified by "flags_expression". Individual letters are used to define the flags, with valid values being 's', 'm', 'i', and 'x'.

Syntax

position_regex ([ start|after ] regex_expression , string_expression [ , integer_expression1 [ , integer_expression2 [ , flags_expression ]]] )

Example 1

position_regex ( '.er' , 'Flicker Lantern' )

Result

5

Example 2

position_regex ( after '.er' , 'Flicker Lantern' )

Result

8

Example 3

position_regex ( '.er' , 'Flicker Lantern' , 1 , 2 )

Result
power
Returns "numeric_expression1" raised to the power "numeric_expression2". If "numeric_expression1" is negative, then "numeric_expression2" must result in an integer value.

Syntax
power( numeric_expression1, numeric_expression2 )

Example
power( 3, 2 )

Result
9

_round
Returns "numeric_expression" rounded to "integer_expression" decimal places. Notes: "integer_expression" must be a non-negative integer. Rounding takes place before data formatting is applied.

Syntax
_round( numeric_expression, integer_expression )

Example
_round( 1220.42369, 2 )

Result
1220.42

sqrt
Returns the square root of "numeric_expression". "Numeric_expression" must be non-negative.

Syntax
sqrt( numeric_expression )

Example
sqrt( 9 )

Result
3

substring
Returns the substring of "string_expression" that starts at position "integer_expression1" for "integer_expression2" characters or to the end of "string_expression" if "integer_expression2" is omitted. The first character in "string_expression" is at position 1.
Syntax
substring ( string_expression, integer_expression1 [ , integer_expression2 ] )

Example
substring ( 'abcdefg', 3, 2 )
Result
cd

substring_regex
Returns a substring of "string_expression" that matches the regular expression "regex_expression". The search starts at position "integer_expression1", which has a default value of 1. The occurrence of the pattern to search for is specified by "integer_expression2", which has a default value of 1. Flags to set options for the interpretation of the regular expression are specified by "flags_expression". Individual letters are used to define the flags, with valid values being 's', 'm', 'i', and 'x'.

Syntax
substring_regex ( regex_expression, string_expression [ , integer_expression1 [ , integer_expression2 [ , flags_expression ] ] ] )

Example 1
substring_regex ( '.er', 'Flicker Lantern' )
Result
ker

Example 2
substring_regex ( '.er', 'Flicker Lantern', 1, 2 )
Result
ter

trim
Returns "string_expression" trimmed of leading and trailing blanks or trimmed of a certain character specified in "match_character_expression". "Both" is implicit when the first argument is not stated and blank is implicit when the second argument is not stated.

Syntax
trim ( [ [ trailing | leading | both ] [ match_character_expression ] , ] string_expression )

Example 1
trim ( trailing 'A', 'ABCDEFA' )
Result
ABCDEF
Example 2
trim ( both , ' ABCDEF ' )

Result
ABCDEF

upper
Returns "string_expression" with all lowercase characters converted to uppercase.

Syntax
upper ( string_expression )

Example
upper ( 'abcdef' )

Result
ABCDEF

Trigonometric functions

arccos
Returns the arc cosine of the argument, where the argument is in the range of -1 to 1 and the result is a value expressed in radians.

Syntax
arccos ( numeric_expression )

Example
arccos ( -1 )

Result
3.1415

arcsin
Returns the arc sine of the argument, where the argument is in the range of -1 to 1 and the result is a value expressed in radians.

Syntax
arcsin ( numeric_expression )

Example
arcsin ( 0 )

Result
3.1415

arctan
Returns the arc tangent of the argument, where the argument is in the range of -1 to 1 and the result is a value expressed in radians.
Syntax
arctan ( numeric_expression )

Example
arctan ( 0 )

Result
3.1415

cos
Returns the cosine of the argument, where the argument is expressed in radians.

Syntax
cos ( numeric_expression )

Example
cos ( 0.3333 * 3.1415 )

Result
0.5

coshyp
Returns the hyperbolic cosine of the argument, where the argument is expressed in radians.

Syntax
coshyp ( numeric_expression )

Example
coshyp ( 0 )

Result
1

sin
Returns the sine of the argument, where the argument is expressed in radians.

Syntax
sin ( numeric_expression )

Example
sin ( 0.1667 * 3.1415 )

Result
0.5

sinhyp
Returns the hyperbolic sine of the argument, where the argument is expressed in radians.
**Syntax**
sinhyp ( numeric_expression )

**Example**
sinhyp ( 0 )

Result
0

**tan**
Returns the tangent of the argument, where the argument is expressed in radians.

**Syntax**
tan ( numeric_expression )

**Example**
tan ( 0.25 * 3.1415 )

Result
1

**tanhyp**
Returns the hyperbolic tangent of the argument, where the argument is expressed in radians.

**Syntax**
tanhyp ( numeric_expression )

**Example**
tanhyp ( 0 )

Result
0
Appendix B. About this guide

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