Working with Cubes in TIBCO Spotfire®

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Documentation for TIBCO Spotfire Analyst and related products is available on the Spotfire Analyst Product Documentation page.

- TIBCO Spotfire® Analyst User's Guide
- TIBCO Spotfire® Administration Manager User's Guide
- Working with Cubes in TIBCO Spotfire®
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For quick access to TIBCO Spotfire content, see https://community.tibco.com/products/spotfire.

Introduction

This guide contains information that can be useful if you are working with cube data in TIBCO Spotfire®.

What is a Cube?

An OLAP (Online Analytical Processing) cube is a multi-dimensional representation of data.

The OLAP cube consists of a set of measures (or facts) and a number of dimensions.

Dimensions organize the data for a user in relation to an area of interest, such as customers, stores, or geographies. Dimensions are usually hierarchical in nature. Measures (facts) reside in the intersections between the dimensions. As such, the measures or facts are aggregated by the cube itself (either beforehand, or, they are dynamically calculated).

This differs from relational databases where the measures or facts are stored in the database table and you apply aggregation methods when the database table is queried.

Cube Example

In the schematic image above, the sides of the cube could be said to represent different dimensions and the cell contains the associated measure.

As a simplification, if side 1 represents product type, side 2 is a time unit, and side 3 is region, then the cube could be queried in several different ways: the yellow plane could mean "Show sales per product for different years.", the pink plane could mean "Show sales per product in different regions." and the blue plane "Show sales per region for different years.".

In Spotfire, an OLAP cube is represented as a table. If you are new to Spotfire, a good starting visualization to use is the cross table visualization (also known as a spreadsheet).

What are Measures?

Measures is a general name for measurements, metrics or facts which are of interest in the data analysis. Measures are mostly numerical in nature. Examples of measures are sales, quantity, accounts, and so on.

A measure value is computed for a given point or cell by aggregating the data corresponding to the respective dimension intersection for the cell.

In Spotfire, each measure is represented as a column. Such a column is generally what you would put on the value axis of a visualization. Since measures are calculated by the OLAP cube you cannot change the aggregation method for measures in Spotfire.

In SAP BW, measures are referred to as 'Key Figures'.

What is a Dimension?

Dimensions organize the data in relation to an area of interest. Dimensions can be things like customers, stores, or geographies, and they are usually hierarchical in nature.

Different OLAP cube systems see dimensions differently. Some systems see dimensions as a container for related area of interests (for example, where the Customer dimension contains Occupation and Gender hierarchies), whereas other systems see dimensions as hierarchies. For systems that see dimensions as hierarchical, each dimension implicitly becomes a hierarchy.

In Spotfire, dimensions cannot be put in a visualization. They are a way to organize related data and can be seen in the Data in analysis flyout and in the Views in Connection dialog, as a means of finding relevant data. Instead, it is the hierarchies that are used on axes in Spotfire visualizations.

SAP BW distinguishes between 'Key Figures' and 'Characteristics'. Key figures become measures in Spotfire, and all characteristics will be found in the 'Characteristics' dimension.

In Oracle Essbase, all dimensions are hierarchical in nature. In Spotfire, the Essbase dimensions are all shown as hierarchies.

What is a Hierarchy?

A hierarchy defines a set of parent-child relationships. Typically, a parent member belongs to a more general concept than its children and the parent member "summarizes" its children. Parent members can further be aggregated as the children of other parents.

A hierarchy can also be viewed as a set of mappings from a set of low-level concepts to higher-level, more general, concepts. Each concept is given a name – its level name. The levels are ordered so that a "more general" level precedes a "less general" level.

Each concept or level consists of a set of values. The level values are called members. Each member has a name and a key where the key is guaranteed to be unique.

As an example, consider a 'Geography' hierarchy that has the concepts of 'Country' and 'City', where 'Country' is more general than City'. That is, the 'Geography' hierarchy has two levels 'Country' and 'City', where the 'Country' level precedes the 'City' level. There are two members; 'US' and 'Germany', who belong to the 'Country' level and four members 'Boston' (whose parent is 'US'), 'Hamburg' (whose parent is 'Germany'), 'Berlin' (whose parent is Germany), and 'Berlin' (whose parent is US), who belong to the 'City' level.

Geographical hierarchy example.

Hierarchies are commonly referred to as categories in Spotfire. That is, hierarchies are generally what you would put on the categorical axis of a visualization. A hierarchy with only one (1) level is represented as a column in Spotfire. A hierarchy with more than one level is represented as a hierarchy in Spotfire.

Cube Queries

When working with in-database cube data, Spotfire creates MDX (MultiDimensional eXpression) queries that are sent to the cube query engine to get results back.

In an MDX query, all hierarchies in the cube matter, even if they are not specified in the query. If a hierarchy is not specified in a query, then the default member of that hierarchy is used. You can view this as an implicit slicing of the cube on the default member. The default member is usually a member that denotes "all possible items", but this is not always the case.

For example, if you have a cube that contains one measure ('Sales') and two hierarchies ('Time' and 'Countries') and you use Sales on one axis and Time on another axis in a visualization. The result you will get back is Sales over Time for all countries. If you are using a currency dimension or hierarchy, it is not uncommon that the default member is a specific currency and not "all currencies". That means that you will get the value (e.g., Sales) for the currency that is the default currency. If this is not what you want, then you should ask your cube administrator to change the default member in the cube (only possible in Microsoft SQL Server Analysis Services), or, provide a Spotfire filter for the currency hierarchy, where you can select which currency to display.

If you do not see any data in your visualizations, it could be that no data has been aggregated for the combination of default member or members and the specified hierarchies in the cube. A potential remedy to this situation is to explicitly slice or dice the cube by applying the appropriate Spotfire filter for the hierarchy or hierarchies where default members are used.

Theoretically, you could split a query enough to return the actual values from the underlying data warehouse, but the cube would still consider the query as aggregated.

Large OLAP Hierarchies in Spotfire

When you are analyzing external cube data in Spotfire, you may encounter situations when a hierarchy filter takes a really long time to load, or even fails to load. This happens because the filter is populated in advance by reading the hierarchy outline from the cube. If the hierarchy is large (with many different levels and categories), the loading of all values at once may even cause problems for the cube data source itself.

If you notice that the creation of a filter takes an unreasonably long time, or, if you know that your cube contains a very large hierarchy, you can configure the hierarchy to be loaded on request in the filter, instead of loading the entire hierarchy at once.

Configuring a Cube Hierarchy to be Loaded on Request

These steps describe how a cube hierarchy can be configured to be loaded on request, so that large OLAP hierarchies can be handled in Spotfire.

This configuration must be done separately for each large hierarchy in the cube data connection.

In this example, an embedded data connection to a Microsoft SQL Server Analysis Services cube is used as an example, but you can use the same steps to configure hierarchies from any cube data source.

Procedure

1. Click **Files and data** .
2. In the Files and data flyout, click **Connect to**.
3. In the list of connectors, click **Microsoft SQL Server Analysis Services**.
4. In the Microsoft SQL Server Analysis Services flyout, click **New connection**.
5. In the Microsoft SQL Server Analysis Services Connection dialog, specify the **Server** you want to connect to.
6. Click **Connect**.
7. Select the **Cube** of interest.
8. Click **OK.**
9. In the Data Selection in Connection dialog, click on the object of interest in the left pane, then click **Add >**.
10. In the **Data selection in connection** list, locate the large hierarchy that you want to load on request and right-click on it.
11. From the pop-up menu, select **Load Values on Request**.
12. Repeat steps 8 and 9 for all hierarchies that you want to load on request.
13. When you are done with the data connection configuration, click **OK**.
    The connection is added to the **Data tables** list in the Add Data Tables dialog.
14. The final step, the Add data to analysis flyout, is a summary view of the data tables that will be added to your Spotfire analysis. Make sure that the data table that is added from your connection is configured as **External**, for in-database analysis.

    To change the load method of a data table to **External**, click the data table in the summary view, and then use the drop-down menus to select **External**.
15. Click **OK**.

Result

When creating a filter for the hierarchy, the values in the filter will be loaded on request.

You can edit a previously created embedded data connection by selecting **Data** > **Data connection properties**, clicking **Settings** and then clicking **Edit**. A data connection saved in the library is edited by selecting **Data** > **Manage data connections**, browsing to the connection in the library and clicking **Edit.**

Hierarchy Filters Loaded on Request

When the connection has been configured to load values on request, the hierarchy filter will query the cube for the currently shown values only, and a new query is sent to the cube each time a new category is expanded.

When hierarchies are loaded on request, the filter cannot display the search field that is otherwise available. You may also see progress indications for each category you expand, as new values are fetched from the external source.

Hierarchy filters from external cube sources will include an (All) check box and the setting that indicates that a category is only partially selected will be turned on by default. These settings can be switched off in the Filtering Scheme Properties dialog.

Common Operations on Cubes and their Spotfire Equivalent

Some common operations on cubes have a corresponding action in the Spotfire environment.

Operation	Explanation	Corresponding Spotfire Equivalent
Slicing	Slicing is the act of picking a subset of a cube by choosing a single value for one of its dimensions.	In Spotfire, slicing is done by bringing up a filter for the hierarchy and selecting one value. The fastest way of doing this for a multi-level hierarchy is to bring up the hierarchy filter, select the single value, right-click and choose **Deselect Other Values**.
Dicing	Dicing is the act of picking specific values from dimensions.	Dicing is done by bringing up filters for the hierarchies in question and selecting the specific values in those hierarchies.
Drill-down and Drill-up	Drill-down and drill-up are used to navigate among levels of data ranging from the most summarized (up) to the most detailed (down).	This is done by selecting the hierarchy that the levels belong to on a categorical axis and moving the hierarchy slider to the left (drill-up) or to the right (drill-down).
Rotating/Pivoting	Rotating (or Pivoting) is the act of changing the dimensional orientation of a report or page display. For example, a rotating operation may consist of swapping the rows and columns, or by moving one of the row dimensions to the column dimension.	In Spotfire, rotating is done by moving the hierarchies to a different categorical axis.
Nesting (of multi-dimensional columns and rows)	Nesting is a display technique used to show the results of multiple hierarchies on a column or row. The column or row labels will display the extra dimensionality of the output by nesting the labels describing the members of each hierarchy.	Nesting in Spotfire is done by selecting the hierarchies "in nesting order" on a given categorical axis. The leftmost hierarchy is the top of the nesting and the rightmost hierarchy is at the bottom of the nesting.

Combining OLAP Data and Other Data in the Same Analysis

Hierarchy values in a cube have both a caption and key. The key will always be unique, but the caption can be the same as for another hierarchy value. The key can be used for identifying a value. When you visualize data from an in-database cube in Spotfire, you may encounter cases where you cannot separate multiple instances of a value from each other (for example, when there are more than one city in the world with the same name (i.e., caption), like the case with Paris, France and Paris, Texas) in a visualization. In that case, you probably want to match values based on the keys, rather than on the values themselves. This is done by selecting the KeyOf method on the matching column of the cube directly.

When you want to combine cube data and other data (for example, data from a relational database) you must have a column that matches the cube's KeyOf values in the relational data. The keys can often be exported from the cube to provide good matching.

If a KeyOf-value is missing in a cube, an error message will be displayed in the visualization that shows the cube data. In the details for the error it will be indicated that an error occurred in the external data source. For example, this could occur if you configure a relation between a cube and a data table coming from another external system, and the data in the other system contains the key Hannover whereas the cube key is called Hanover. When Hannover is used in cube database queries, no key is found and an error is shown.

Defining a New Relation Between a Relational Data Table and a Cube Data Source Using Keys

If you have data in a cube data source and want to be able to use this data to retrieve details about a certain value from a relational data source on demand, or if you simply want to be able to propagate markings from the cube data source to visualizations based on the relational source, you may want to define a relation between the two data tables.

Prerequisites

You must have a data table based on a cube data source and one data table from a relational source available in the analysis.

Procedure

1. On the menu bar, select **Data** > **Data table properties**.
2. In the Data Table Properties dialog, go to the **Relations** tab.
3. Click **Manage Relations**.
4. In the Manage Relations dialog, select the data table to **Show relations for**.
5. Click **New**.
6. Select the cube data table you want to connect to from the **Left data table** drop-down list and the relational data table from the **Right data table** drop-down list.
7. Select the column containing the identifiers in the **Left column** and **Right column** drop-down lists.
8. Provided that the cube data source is on the left, under **Left method**, select the `KeyOf` method.

   Comment: This specifies that the match should be done using the cube key of that identifier and not the actual value.
9. Click **OK** to close all dialogs.

Result

The relational data table and the cube data table are now related.

When you are using a cube hierarchy on an axis in a visualization you will automatically see the caption and not the key. To explicitly show the keys in your visualizations, you need to set up a custom expression.

Creating Column Matches Based on Keys to View Cube Data in the Same Visualization as Other Data

If you have two columns with the same dimension values in a cube data source as well as in a relational data source and you want to display the data in the same visualization you may need to apply the `KeyOf` method to match the values.

Prerequisites

You must have a data table based on a cube data source and one data table from a relational source available in the analysis.

Procedure

1. On the menu bar, select **Data** > **Data table properties**.
2. Go to the **Column Matches** tab.
3. In the **Data tables** list, select the cube data source.
4. Click **New**.
5. In the New Match dialog, select the other data table of interest under **Right data table**.
6. Make sure the columns with the matching information are selected in the **Left matching column** and **Right matching column selectors**.
7. Open the column selector for the cube column under **Left Matching column** and select **Methods** to open the menu.
8. Select `KeyOf`.

   Comment: It is not possible to use `KeyOf` as a transformation, it must be applied directly as a method on the matching column.
9. Click **OK** to close all dialogs.

Result

You can now show data from both the cube data and the relational data in the same visualization.

When you are using a cube hierarchy on an axis in a visualization you will automatically see the caption and not the key. To explicitly show the keys in your visualizations, you might need to set up a custom expression.

Limiting Data

When specifying what data to work with in the Data Selection in Connection dialog, you also have the possibility to limit further on dimensions. Single sublevels in hierarchies can be selected or deselected. Limiting the dimension to view only the required data is of particular interest when you intend to import your cube data, since too large amounts of data cannot be imported from the cube. Some data sources may also have limits on the number of cells which you may import.

If you are using SAP BW BEx queries, data has already been limited due to the selections in the BEx query, so further limiting is often unnecessary. Make sure that you do not filter out all data by selecting values that have already become invalid by the selection of BEx variables.

Procedure

1. In the Files and data flyout, click **Connect to**.
2. Select a cube data source (Microsoft SQL Server Analysis Services, SAP BW, or Oracle Essbase) and then click **New connection**. Provide the required information for the connection to the data source.

   For more information about specific system settings, see the section about the system of interest in this user's guide.
3. In the Data Selection in Connection dialog, click on the column or hierarchy to limit in the **Data selection in connection** list.
4. In the Settings pane, click **Limit...**.
5. In the Limit Data dialog, clear the check boxes for those categories that you do not want to include in your selection.

   You can also right-click in the dialog to display a pop-up menu where you can **Select All Values** or **Deselect Other Values** (clears the check boxes for all values except for the value you right-clicked on).
6. Click **OK**.

Data Selection in Connection

When you define a new data connection you get the option to select which cube data should be included in the connection. If the data is going to be imported, it is important to limit the data as much as possible, because too large selections cannot be imported.

Option	Description
The cube structure is shown below. Make selections or search to limit what is shown.	The left pane shows the structure of the cube you have selected in the previous connection dialog. If you have connected to Microsoft SQL Server Analysis Services, then you will have the option to select a single measure group using a drop-down list. For all cubes it is possible to locate items containing specific words in the cube or query by typing some text in the search field. When you have located the data of interest, click to select it in the left pane, then click **Add >**. Note that you can only select full hierarchies and not parts of a hierarchy when adding items to the **Data Selection in Connection** list. See Icon Descriptions for more information about what the icons in the list mean. Double-clicking on an item will expand/collapse the item in the list if possible, or, if it is a leaf node, add the item to the **Data selection in connection** list.
Add >	Adds the data selected in the left list to the **Data selection in connection** list.
< Remove	Removes the selected data from the **Data selection in connection** list.

Option	Description
Data selection in connection	Lists the data that you have added from the cube. If you are using SAP BW and have selected a BEx query, then any BEx variables will automatically be added to this list. You must define a value for all variables that are listed as required. Type some text in the search field to locate specific words in the field. Columns or hierarchies that have been used to limit the data may be indicated by the addition of the text (Limited), depending on the settings in the limitations menu, ☰▾. If specified, dimensions (columns or hierarchies) that can be used to limit the data in the selection may be shown in blue text. Click on an item in the list to show settings for that item in the Settings pane (if applicable). See Icon Descriptions for more information about what the icons in the list mean. Double-clicking on an item will expand/collapse the item in the list if possible, or, if it is a leaf node, remove the item from the right **Data selection in connection** list. You can specify that the data in the connection should be available as external data only, or as imported data only, using the pop-up menu. Right-click on the cube in this list and select **Load Method** > **External Data Only (In-database)**or **Load Method** > **Imported Data Only (In-memory)**. You can also specify that a large hierarchy should load values on request only by right-clicking on the hierarchy. See Large OLAP Hierarchies in Spotfire for more information.
☰▾	Displays the limitations menu where you can handle indications related to data limiting in the **Data selection in connection** field. Indications may help you see which columns can be limited and/or which columns have been limited, but they can also be removed completely to get a cleaner user interface.
No Indications	Removes all indications.
Indicate All Columns Possible to Limit	Shows all columns or hierarchies that are possible to limit in a blue color.
Indicate All Limited Columns	Appends the word (Limited) to all columns or hierarchies that have been limited.
Clear All Limitations	Removes all previously specified limitations from the selected data.

Option	Description
Settings	Displays settings for the selected item in the **Data selection in connection** list. **Value presentation** For characteristics and hierarchies from SAP BW, you can select how to display the characteristic in Spotfire. A characteristic in SAP BW can have many types of metadata, such as attributes and technical names. Use the **Value presentation** settings to determine what to display: • **Technical names** Use technical names as the value presentation. You can select to use the text, the technical key, or a combination of both. • **Attributes** If the characteristic has attributes defined in SAP BW, you can select an attribute to use as the value presentation. • **Custom** Define a custom value presentation manually. With this option, you can combine technical names, attributes, and other information. To add or edit the expression for the custom value presentation, click **Edit…**. If you selected an SAP BW BEx variable, only Technical names are available for changing the value presentation. Your selection specifies how the variable values is presented in the Define Value dialog and prompts for the variable. **Limit data** You also have the option to limit data for the selected dimension. It is always recommended to limit the data as much as possible if you intend to import data from the connection into Spotfire. Clicking **Limit...** opens the **Limit Data** dialog where you can further limit the data for the currently selected column. Note that it is only possible to limit dimensions, because measures are calculated based on the selected dimensions. Click **Clear** to remove a previously added limit. **Define SAP BW BEx variables** If you are using SAP BW and have selected a BEx variable, you will have the option to define the variable value. To define a static value for the variable in the connection, click **Define Value**. If a variable is 'Mandatory' or 'Mandatory not initial', you must define a value or configure prompting for that variable if no default value has been defined already. **Prompt for SAP BW BEx variables**

Option	Description
	For BEx variables, you can define prompting to let the end user define the variable value. Prompting can be used in place of defining the BEx variable in the connection, for greater flexibility. To create a prompt for the selected BEx variable, select the check box Prompt for values. For more information on prompting for BEx variables, see Details on Prompting for SAP BW BEx Queries.
Estimate Import Size	Opens a dialog where you can get an estimate of the size of the current selection. The size of the selected data is important when you are going to import the data into Spotfire for in-memory analysis. See Data Import for more information. The values you get when doing an estimate depends on the system you use and on the data in the cube. You can use the information to learn whether or not this type of selection is possible to import from your system. If you try an import and it fails, make sure the estimated import size is lower the next time you try to import data. If the estimation takes a long time it often, but not always, means that the selection is too big to import.

Icon Descriptions

Different types of data are shown with a different icon in order to help you to quickly understand what you see.

The icons are used in many different places in Spotfire. For example, when you create a new connection, the icons are visible in the Data Selection in Connection dialog where you can specify which data to include in the connection. The icons are also visible in the Data in analysis flyout when the connection has been created and the data made available in Spotfire.

Icon	Description
	Cube
	Measure
	Dimension
	Sets
	Hierarchy
	Hierarchy level 1
	Hierarchy level 2
	Hierarchy level 3
	Hierarchy level 4
	Hierarchy level 5

Icon	Description
	Hierarchy level 5+, used for all levels above level 5

Sap BW specific icons

Icon	Description
BEx	BEx variables
	A mandatory BEx variable that must be defined

In-database Cubes in Spotfire

Because cube data is already aggregated from the start, aggregations are not performed by Spotfire when working with in-db cube data. All aggregations that need to be done (if any) are pushed down to the cube query engine. Instead, Spotfire can be used as a way to display the related combinations of measures and hierarchies configured by the cube administrator.

By taking advantage of the natural structure of the cube you can make sure that you are viewing relevant data. The free-dimensionality of Spotfire does otherwise allow you to make combinations of measures and dimensions from the cube that do not always make sense, or lead to "The expression is not valid"- messages in the visualizations.

Each time you change what is shown on the axes in a visualization based on in-db cube data, or make a selection in a hierarchy filter or a check box filter, a request is sent to the cube to provide the selected data. This means that if you make many changes in Spotfire, many requests may be sent to the database instead of just the request for the final selection.

Spotfire uses a delay of about one second in order to see if there are any additional selections made in a filter before sending the request to the database. This means that you should try to make coherent changes in filtering in a steady pace and not pause for too long while selecting various check boxes. If you pause for more than about a second, the current filter selection will be sent to the cube which will start to provide the requested data. Making additional changes to the filter will send an additional request to the database, causing a higher workload on the database, as the first request might still be running.

Microsoft SQL Server Analysis Services

If you have access to data in a Microsoft SQL Server Analysis Services system, you can use the Microsoft SQL Server Analysis Services Connector in Spotfire to connect to your OLAP cube.

When you configure a connection to a Microsoft SQL Server Analysis Services cube, you can choose whether to analyze data in-database or to import it into your analysis. Note that you need to install a driver on your computer to get access to the Microsoft SQL Server Analysis Services connector. See the System Requirements for Spotfire Connectors to find the correct driver.

Dimensions and Attributes

Dimensions organize data with relation to an area of interest, for example, time, product, customer, region, etc. An attribute is a kind of categorization.

For each dimension, you can be interested in a number of different dimension attributes. For example, the 'Product' dimension may be investigated with regard to the attributes 'Product.Color' or 'Product.Model'. These attributes can also be organized into multi-level hierarchies.

Measure Groups

Measure groups are used to associate dimensions with measures.

A cube includes measures in measure groups, business logic, plus a collection of dimensions that give context for evaluating the numerical data that a measure provides.

Both measures and measure groups are an essential component of a cube. A cube cannot exist without at least one of each.

Spotfire allows you to select a single measure group in the Data Selection in Connection dialog, which can help you limiting the data from the cube:

Note that if you select a dimension belonging to another measure group you will automatically also include that measure group in the selection and the measure group will also be visible in the Data in analysis flyout. (However, you will not get the measures from that measure group, only selected measures.)

Most of the times, you will probably only be interested in analyzing data from a single measure group, but there may be exceptions. It is important to know what you are doing if you are working with cube data in Spotfire. For example, if data is selected from two different, unrelated measure groups you might end up with empty visualizations.

Hierarchies

Hierarchies are used to organize measures that are contained in a cube. In Spotfire, attribute hierarchies and single-level user hierarchies are represented as columns, whereas multi-level hierarchies are represented as hierarchies.

In Microsoft SQL Server Analysis Services, attributes are, by default, organized into two-level hierarchies consisting of a leaf level and an optional 'All' level. The All level contains a single member – the All member – which represents the aggregated value of the attribute's members across the related measures. Note that if the hierarchy is non-aggregatable, the All level is not created.

Henceforth, this structure is called an attribute hierarchy, to distinguish it from a user hierarchy. A user hierarchy is a user-defined hierarchy of attributes that is used in Microsoft SQL Server Analysis Services to organize the members of a dimension into a hierarchical structure that provide navigation (drill-down, drill-up) paths, by which users can browse the data. The positions of members within the hierarchy are controlled by the order of the attributes in the hierarchy's definition. Each attribute in the hierarchy definition constitutes a level in the hierarchy.

Attribute hierarchies are represented as a single column in Spotfire, containing the leaf level members and an implicit All member (if defined). The All member is not visible as a column value in Spotfire.

User hierarchies are represented as hierarchies in Spotfire unless the user hierarchy is a single level (1 level) hierarchy. Then the hierarchy is represented as a column in Spotfire.

Named Sets

Named sets return a data set based on a defined logic. They are primarily used to create data sets that are often requested from the cube.

There are two types of named sets – static named sets and dynamic named sets.

Spotfire currently only supports named sets that return a certain single level in a user hierarchy or an attribute hierarchy (i.e., a 1-level hierarchy). That is, Spotfire can only handle results that can be seen as a single column.

Static named sets are evaluated once during creation – they are never re-evaluated. Dynamic named sets, on the other hand, are evaluated each time a query references it and is evaluated in a current context. For example, a dynamic set may show the Top 50 customers. This dynamic set could either be displayed over different countries in the world, or within a single country, when using standard cube reporting tools.

When you are working with dynamic named sets in Spotfire, the content of a dynamic named set column depends on the current context, that is, it depends on the current limitations and filtering. Therefore, the axis expression must be evaluated after the current filtering is applied, when dynamic sets are used in visualizations.

This is different from how axes traditionally are evaluated in Spotfire, but the 'evaluate after'-setting is applied automatically when you are placing a dynamic named set column on an axis. See Details on Advanced Settings help section in TIBCO Spotfire User's Guide (available under **Help** > **Help Topics**) for more information about axis evaluation settings.

If you limit the selected data to male customers only, and use a set showing Top 50 customers, you will get the top 50 male customers. If limitations make the number of available male customers lower than 50, then this is the number you will end up with. All of these calculations are handled by the cube.

If you are going to import data from a Microsoft SQL Server Analysis Services cube, and named sets are included in the selection, the sets will be used to limit the data retrieved on import and to calculate the measures. For example, if the selection of data to import contains data from Germany and France, and a Top 50 customers set is used in the import, the Top 50 customers from Germany and France are imported. Filtering out Germany from the imported data may result in less than 50 values, because the set will now show only those customers that were imported from France. The same selection of data when working in-database will add the set as a dimension and the filtering will let you see the Top 50 values from France.

Microsoft SQL Server Analysis Services Cubes in Spotfire

Normally, you would use measures on axes where actual values are to be displayed, such as, on the value axis of a bar chart, or as cell values in a cross table. Dimension columns, that is, attribute hierarchies and user hierarchies, can be used to split the viewed data into smaller subsets on categorical axes.

When you look at cube data in the Data in analysis flyout, you have the possibility to select one measure group and one related dimension at a time, which may help you selecting suitable options on the axes. The whole cube is treated as a single data table in Spotfire when you analyze it in-database.

There are also other implications of working with cube data. Since the measures are defined by the context of a dimension, it is not possible to create filters for measures.

When importing cube data, all cube aggregations are lost. Hierarchies are imported down to the leaf level and measure values for that level are retrieved. See Data Import more information.

Adding In-db Data from Microsoft SQL Server Analysis Services

Follow the steps below to add a connection with in-database data to Microsoft SQL Server Analysis Services.

Procedure

1. Click **Files and data** .
2. In the Files and data flyout, click **Connect to**.
3. In the list of connectors, click **Microsoft SQL Server Analysis Services**.
4. In the Microsoft SQL Server Analysis Services flyout, click **New connection**.
5. In the Microsoft SQL Server Analysis Services Connection dialog, specify the **Server** you want to connect to.
6. Select the **Authentication method** you want to use, and if you selected **Username and password**, enter your credentials.
7. Click **Connect**.
8. Select the **Database** and **Cube** of interest.
9. Click **OK**.
   The Data Selection in Connection dialog is opened.
10. Click to select data of interest in the panel to the left.

    Click on the top level to select the entire cube.

    Limit what is shown in the panel by selecting a single measure group, or by typing a search term in the search field.

    Double-click on a collapsed item to expand it, or double-click on a leaf node to send it to the **Data selection in connection** list.
11. Click **Add >** to move the selected data to the **Data selection in connection** field.
12. Dimension columns and hierarchies can be further limited by clicking the selected column or hierarchy in the **Data selection in connection list** and then, in the Settings pane, clicking **Limit...**.

    This way, you can filter out certain values of the dimension to only include values of interest. For example, you can select data from a single country only. Note that it is not possible to limit measures, only dimensions, because the cube calculates the measures in the context of the selected dimensions.
13. If desired, you can specify that the data in this connection should be available as external data only. Right-click on the cube name and select **Load Method** and the desired option.
14. The final step, the Add data to analysis flyout, is a summary view of the data tables that will be added to your Spotfire analysis. Make sure that the data table that is added from your connection is configured as **External**, for in-database analysis.

    To change the load method of a data table to **External**, click the data table in the summary view, and then use the drop-down menus to select **External**.

15. Click **OK**.

Importing Data from Microsoft SQL Server Analysis Services

Follow the steps below to import data from a Microsoft SQL Server Analysis Services cube.

Procedure

1. Click **Files and data** .
2. In the Files and data flyout, click **Connect to**.
3. In the list of connectors, click **Microsoft SQL Server Analysis Services**.
4. In the Microsoft SQL Server Analysis Services flyout, click **New connection**.
5. In the Microsoft SQL Server Analysis Services Connection dialog, specify the **Server** you want to connect to.
6. Select the **Authentication method** you want to use, and if you selected **Username and password**, enter your credentials.
7. Click **Connect**.
   Spotfire connects to the specified server, and the cubes that are available on that server are listed in the **Cube** drop-down list.
8. Select the **Database** of interest.
9. Select the **Cube** of interest.
10. Click **OK**.
    The Data Selection in Connection dialog opens.
11. If you want to limit your import to data from a single measure group, select the measure group of interest in the drop-down list.

    You can also type any text in the search field to find objects containing that text only.
12. Click on the object of interest in the left pane, then click **Add >**.

    See Icon Descriptions for information about what the different objects represent. If you select the cube icon, you will get all data in the cube. When it comes to hierarchies, you always have to add the entire hierarchy to the list, but you can use the **Limit Data** button to filter out higher levels of detail in the hierarchy from the actual selection at a later stage. You can repeat this step as many times as you want to add more data to the selection.

    The selected data is added to the **Data selection in connection** list.
13. Dimension columns and hierarchies can be further limited by clicking on the selected column or hierarchy in the **Data selection in connection** list and then, in the Settings pane, clicking **Limit...**. The Limit Data dialog opens.
14. Clear the check boxes for categories that you want to remove from the selection.
15. Click **OK** to close the Limit Data dialog.
16. When you are done with your data selection it is recommended to click the **Estimate Import Size** button to get a hint on whether this selection will be possible to import or not.

    The calculation may take a while. No measures are taken into account in the calculation, so if you have added many measures, you may be unable to import the selection even if the estimated number of rows and columns is small. The estimated import size may be of help if an import should fail. Then, the next time you try to import data from that cube, you should try to make sure that the estimated size is smaller than the previous time.
17. When you are done with the data selection, click **OK**.

18. The final step, the Add data to analysis flyout, is a summary view of the data tables that will be added to your Spotfire analysis. Make sure that the data table that is added from your connection is configured as **Imported**, for in-memory analysis.

    To change the load method of a data table to **Imported**, click the data table in the summary view, and then use the drop-down menus to select **Imported**.

19. Click **OK**.

Result

If the data selection was small enough, the data is imported.

Do all of the data selection work in a shared data connection and save it to the library instead of adding it to the analysis directly. This way you can reuse the work you have done later, or share your selections with others.

- During import, sets are applied once. This means that selection of multiple sets with no intersecting data will result in a data table without any data.
- PKIs are not supported.

Settings for Microsoft SQL Server Analysis Services Connection

Use this dialog to connect to Microsoft SQL Server Analysis Services.

Option	Description
Server	The name of the server where your data is located. To include a port number, add it directly after the name preceded by colon. To include an instance name, add it directly after the server name preceded by backslash. Example with port number: myDatabaseServer:1234 Example with instance name: MyDatabaseServer\InstanceName
Authentication method	The authentication method to use when logging in to the external data source. Choose from: • Windows authentication • Username and password You can use Username and password authentication only if you connect to Microsoft SQL Server Analysis Services over HTTP, for example when you connect to an Azure Analysis Services instance. If you are not connecting over HTTP, the server ignores username and password information and uses Windows authentication instead.

Option	Description
Username	[Only available if you selected the authentication method Username and password.] The name of the user account you wish to use when logging into Microsoft SQL Server Analysis Services.
Password	[Only available if you selected the authentication method Username and password.] The password for the specified username.
Connect	Connects you to the specified server and populates the lists of available databases and cubes. Microsoft SQL Server Analysis Services only supports Windows authentication.
Database	Select the database of interest from the drop-down list.
Cube	Select the cube of interest from the drop-down list.

Option	Description
Preferred language	If localized data exist in the cube, you can select your preferred language to use when analyzing the data in Spotfire.

Option	Description
Command timeout (seconds)	[You can only configure the settings for this option after you have clicked **Connect** on the **General** tab, to connect to the Microsoft SQL Server Analysis Services server.] Specifies the maximum time, in seconds, allowed for a command to be executed. By default, this field is left blank, and the default timeout settings in the data source driver will be used.
Allow sets in MDX where clauses	[You can only configure the settings for this option after you have clicked **Connect** on the General tab, to connect to the Microsoft SQL Server Analysis Services server.] Because of limitations in Microsoft SQL Server Analysis Services, errors can sometimes occur in the external data source when queries that include MDX sets are generated from Spotfire. If you encounter such errors in your connection, you can clear this check box. When the check box is cleared, queries from Spotfire to the external data source are formatted differently, in a way that can resolve such errors related to MDX sets. By default, this check box is selected.

Oracle Essbase

If you have access to data in an Oracle Essbase system, you can use the Oracle Essbase connector in Spotfire to connect to your OLAP cube.

When you configure a connection to an Oracle Essbase cube, you can choose whether to analyze data in-database or to import it into your analysis. Note that you need to install a driver on your computer to get access to the Oracle Essbase connector. See the System requirements for connectors in Spotfire to find the correct driver.

Measures in Oracle Essbase

In an Oracle Essbase cube, you organize measures in one dimension, which you tag as the accounts dimension. If no dimension in the cube is tagged as accounts, you must specify the dimension where the measures in the cube are located, when you create a connection in Spotfire.

You define the dimension to use for measures in the Select Measure Dimension dialog, which is displayed automatically when you connect to an Oracle Essbase cube that does not have an accounts dimension.

Formula-based measures

Some measures in Oracle Essbase cubes are calculated based on non-dynamic Essbase formulas. By default, the possibility to aggregate such calculated measures with MDX is disabled, because aggregating them can yield unpredictable results.

For formula-based measures that you know have a definition that makes them able to be aggregated, you can enable MDX aggregation. When you select data to include in your connection, in the Data Selection in Connection dialog, click to select the formula-based measure you want to configure, and, in the Settings pane, select **Allow aggregation with MDX**.

Hierarchical Measures

In Oracle Essbase, measures can be organized in hierarchies, in contrast to other cube data sources.

When the data source structure is shown in Spotfire, a measure that is also a parent is shown both as a folder and as a separate measure, which is slightly different compared to what the structure looks like in the Oracle Essbase Administration Services user interface.

Example of Structure

In the Data Selection in Connection dialog in Spotfire, only metadata is shown. This means that even if the **Show both member and alias** check box has been selected in the Oracle Essbase connection dialog, the member names will still be shown in the Data Selection in Connection dialog. The aliases will be shown in the data when the selection has been added to Spotfire.

Adding In-database Data from Oracle Essbase

You can add a data connection to Oracle Essbase to an analysis and select to analyze the data in-database.

Procedure

1. On the authoring bar, click **Files and data** .
2. In the Files and data flyout, click **Connect to**.
3. In the list of connectors, click **Oracle Essbase**.
4. In the Oracle Essbase flyout, click **New connection**.
5. In the Oracle Essbase Connection dialog, specify the **Server** you want to connect to.
6. Enter your credentials in the **Username** and **Password** text fields.
7. Click **Connect**.
8. From the **Application** drop-down list, select the application of interest.
9. Specify which database in the selected application you want to work with.
10. In the **Alias table** drop-down list, select from which table the member names should be retrieved.

    An alias table maps the original member name to a more user friendly name, or they could contain long or short versions of a name.
11. Optionally, select the check box **Show both the member name and the alias**.

    The member name and alias name will be shown in the user interface, separated by comma.

12. Click **OK**.
    The Data Selection in Connection dialog opens.
13. In the left pane, click on the object of interest, and then click **Add >**.

    See Icon Descriptions for information about what the different objects represent. If you select the cube icon, you will get all data in the cube. When it comes to hierarchies, you always have to add the entire hierarchy to the list, but you can limit the data further, see step 12.

    The selected data is added to the **Data selection in connection** list.
14. Dimension columns and hierarchies can be further limited by clicking on the selected column or hierarchy in the **Data selection in connection** list and then, in the Settings pane, clicking **Limit...**. The Limit Data dialog opens.
15. Clear the check boxes for categories that you want to remove from the selection.
16. Click **OK** to close the Limit Data dialog.
17. When you are done with the data selection, click **OK**.
18. The final step is a summary view of the data tables that will be added to your Spotfire analysis. Make sure that the data table that is added from your connection is configured as **External**, for in-database analysis.

    To change the load method of a data table to External, click the data table in the summary view, and then use the drop-down menus to select **External**.
19. Click **OK**.

Result

The external data table is added to your analysis.

Do all of the data selection work in a shared data connection and save it to the library instead of adding it to the analysis directly. This way you can reuse the work you have done later, or share your selections with others.

Importing Data from Oracle Essbase

When you want to import data from an Oracle Essbase cube, it important to limit the selected data as much as possible.

Procedure

1. On the authoring bar, click **Files and data**.
2. In the Files and data flyout, click **Connect to**.
3. In the list of connectors, click **Oracle Essbase**.
4. In the Oracle Essbase flyout, click **New connection**.
5. In the Oracle Essbase Connection dialog, specify the **Server** you want to connect to.
6. Enter your credentials in the **Username** and **Password** text fields.
7. Click **Connect**.
   Spotfire will connect to the specified server, and retrieve the names of the available applications.
8. From the **Application** drop-down list, select the application of interest.
9. Specify which database in the selected application you want to work with.
10. In the **Alias table** drop-down list, select from which table the member names should be retrieved.

    An alias table maps the original member name to a more user friendly name, or they could contain long or short versions of a name.

11. Optionally select the check box **Show both the member name and the alias**.

    The member name and alias name will be shown in the UI separated by comma.

12. Click **OK**.
    The Data Selection in Connection dialog opens.

13. In the left pane, click on the object of interest, and then click **Add >**.

    See Icon Descriptions for information about what the different objects represent. If you select the cube icon, you will get all data in the cube. When it comes to hierarchies, you always have to add the entire hierarchy to the list, but you can limit data further, see step 12.

    The selected data is added to the **Data selection in connection** list.

14. Dimension columns and hierarchies can be further limited by clicking on the selected column or hierarchy in the **Data selection in connection** list and then, in the Settings pane, clicking **Limit...**. The Limit Data dialog opens.

15. Clear the check boxes for categories that you want to remove from the selection.

16. Click **OK** to close the Limit Data dialog.

17. When you are done with your data selection it is recommended to click the **Estimate Import Size** button to get a hint on whether this selection will be possible to import or not.

    The calculation may take a while. No measures are taken into account in the calculation, so if you have added many measures, you may be unable to import the selection even if the estimated number of rows and columns is small. The estimated import size may be of help if an import should fail. Then, the next time you try to import data from that cube, you should try to make sure that the estimated size is smaller than the previous time.

18. When you are done with the data selection, click **OK**.

19. The final step, the Add data to analysis flyout, is a summary view of the data tables that will be added to your Spotfire analysis. Make sure that the data table that is added from your connection is configured as **Imported**, for in-memory analysis.

    To change the load method of a data table to **Imported**, click the data table in the summary view, and then use the drop-down menus to select **Imported**.

20. Click **OK**.

Result

If the data selection was small enough, the data is imported.

Do all of the data selection work in a shared data connection and save it to the library instead of adding it to the analysis directly. This way you can reuse the work you have done later, or share your selections with others.

Spotfire for Oracle Smart View Users

If you are an Oracle Smart View user who is accustomed to do ad-hoc analysis, that is, if you are using Microsoft Excel spreadsheets with Smart View functionality for selecting members from a cube, there are a number of things you should think about when doing analysis in TIBCO Spotfire.

When doing ad-hoc analysis in Excel, you often start off with all dimensions as columns, and a single measure on the row. No data is shown until you explicitly refresh the spreadsheet. If you are familiar with your working cube, you might also be used to the free-form mode, where you type member names directly into the cells and thereby slice your cube. In Spotfire, there is no free-form mode editing. Because Spotfire is interactive, you do not have to refresh your spreadsheet explicitly – the spreadsheet is automatically updated as you go.

The equivalent to the Excel spreadsheet in Spotfire is the cross table visualization. When you create a cross table visualization, Spotfire will suggest a measure as well as a dimension/hierarchy in the initial

cross table. You can also view the data in the Data in analysis flyout, which shows you the available dimensions/hierarchies and measures.

Cross table visualization in Spotfire.

Sales per Product and Year

Year

Category	Type	2015	2016	2017
Fruit	Apples	150.00	153.00	162.00
	Bananas	332.00	336.00	344.00
	Pears	267.00	266.00	279.00
Vegetables	Cucumber	140.00	141.00	152.00
	Lettuce	246.00	245.00	258.00
	Tomatoes	156.00	161.00	168.00

Product (Type)

Sum(Sales)

Because there is no free-form mode editing in Spotfire, you should *not* start off by dragging all hierarchies to the visualization and go from there. Instead, you select what measures or accounts to show in the cells by selecting the appropriate measure in the lower horizontal axis selector in the cross table (or by dragging the appropriate measure from the Data in analysis flyout to the axis selector). Also, in Spotfire, there is no explicit pivot operation. Instead, you select what dimension members to show on the vertical axis by selecting or dragging the dimension to the vertical axis selector. Similarly, you select which dimension members should be shown on the horizontal axis by selecting or dragging the dimension to the upper horizontal axis selector.

Note that you can have multiple dimensions on each axis. Those dimensions then become nested. Also note that multiple measures can be selected on the lower horizontal axis (value axis), but in that case "pivoting" is not possible.

In Spotfire, you slice your cube through filtering. That is, in the Data in analysis flyout, you click on the filter icon next to the dimension you want to slice. This brings up an appropriate filter in which you select the member for that dimension. Repeat this for each dimension that should be sliced.

The best way to slice a hierarchy (to select a single member in a hierarchy filter) is to do the following:

1. Locate the member to slice by in the hierarchy filter by expanding the appropriate part of the hierarchy (click on the plus-signs before the parents to expand).
2. Right-click on the member to slice by and select **Deselect Other Values** from the pop-up menu.

If you want to continuously see how the filters are defined, you can click on the **Filter** button on the menu bar. This brings up the Filters panel, in which all filters are displayed. You can modify the filter from within this panel, as well as from the Data in analysis flyout. In the Data in analysis flyout, you click on the filter icon next to the dimension you want to see or modify the filtering for to display the filter.

Often, the visualization will not show any data until all members to slice by have been specified (filtered) correctly. It is also common that query performance is bad until the cube has been sliced. Therefore, it might be better to define all the slicers before configuring the visualization correctly (by selecting the correct measures and dimensions on the axes).

Minimizing the Strain on the Oracle Essbase Database

This topic provides some tips on how to put minimum strain on your Essbase database. You can mimic the workflow from Smart View use in Excel by first removing all visualizations, then filtering (slicing) the data, and finally, configuring your visualization.

Mimic the workflow where you configure your visualization or spreadsheet and then refresh to see results, using these steps:

Procedure

1. Remove all visualizations in the Spotfire analysis.
2. Define the slicers that are needed by filtering the appropriate dimensions in the Data in analysis flyout.

   When you define your slicer member in a hierarchy filter you:

   a) Locate and select the slicer member in the filter for the hierarchy.

   b) Right-click on the slicer member and select **Deselect Other Values** from the pop-up menu.
3. To create the visualization (spreadsheet), click **Visualization types** and select **Cross Table**.
4. Specify your measures and dimensions on the various axes in the cross table (spreadsheet).

Result

The cube data is ready to be analyzed.

If you always want to view a cross table when you create a new Spotfire analysis, you can make the cross table your default visualization (the visualization that is shown when you bring in new data). To do that, select **Tools** > **Options** on the menu bar, go to the **Document** page, and set **Initial visualization when loading data** to **Cross Table**. If you want the filter panel to be automatically displayed, you can select the **Filters panel open by default** check box in the same dialog.

Settings for Oracle Essbase Connection

Use this dialog to connect to Oracle Essbase.

Option	Description
Server	The name of the server where your data is located. Add the port number directly after the name preceded by colon. Example: myDatabaseServer:1234
Username	The username you wish to use when logging into the Oracle Essbase database.
Password	The password for the specified username.
Connect	Connects you to the specified server and populates the lists of available applications and databases.
Application	Select the application of interest from the drop-down list.
Database	Select the database of interest from the drop-down list.
Alias table	Allows you to select which alias table to get the names from. An alias table maps the original member name to a more user friendly name, or they could contain long or short versions of a name. Select 'Do not use aliases' to get the original member names.

Option	Description
Show both member name and alias	Select this check box to show both the member name and an alias name in the UI, separated by comma. For example, you could show both a product ID and the product name like this: PNO2345, Fruit drink

Option	Description
Operation timeout (minutes)	[You can only configure the settings for this option after you have clicked **Connect** on the **General** tab, to connect to the Oracle Essbase server.] Specifies the maximum time, in minutes, allowed for a command to be executed.
Options for formula-based accounts/ measures	Use the following option to configure how measures that are based on Essbase formulas should be handled in the connection.

Option	Description
Allow aggregation with MDX	[You can only configure the settings for this option after you have clicked **Connect** on the **General** tab, to connect to the Oracle Essbase server.] Some measures in Oracle Essbase cubes are calculated based on non-dynamic Essbase formulas. By default, the possibility to aggregate such calculated measures with MDX is disabled, because aggregating them can yield unpredictable results. Select this check box to allow MDX aggregation for all measures in the connection that are based on non-dynamic Essbase formulas. Enabling this option affects all formula-based measures in the connection. If you want to enable MDX aggregation only for some formula-based measures, leave this check box cleared. Instead, when you select the data that you want to include in the connection in the Data Selection in Connection dialog, configure each selected formula-based measure individually.

Select Measure Dimension

If you are connecting to an Oracle Essbase cube that does not have a dimension tagged as the accounts dimension, you must specify which dimension contains the measures. When you create a connection to such a cube, this dialog will be displayed, and you can manually specify which dimension to use as the designated measure (accounts) dimension in your connection.

Working with measures in a Spotfire-designated accounts dimension

When you work with data from an Oracle Essbase cube which has no accounts dimension, Spotfire can only use the aggregation function SUM to make any further calculations of the measures in the Spotfire-designated accounts dimension. When you work with a regular Oracle Essbase cube, which already has a default accounts dimension, Spotfire uses the function AGGREGATE when it needs to calculate measures, which means that the underlying operations in the measures are used for aggregation.

In Spotfire, calculations of measures are performed, for example, in certain cases of filtering.

When you work with an Oracle Essbase cube which has no accounts dimension, keep the following in mind:

- Avoid using measures that are aggregated with functions other than SUM, or you might get unpredictable results in your Spotfire analysis.
- If the measures use other aggregations than SUM, contact your database administrator. You will have more options when creating your Spotfire analysis, if your database administrator tags the dimension with the measures as the accounts dimension in the cube. Otherwise, be aware that calculations of measures from a Spotfire-designated accounts dimension will use the function SUM.

Settings for Select Measure Dimension

Option	Description
Available dimensions	Lists all the dimensions in the cube. To select which dimension to use as the measure (accounts) dimension, click the dimension that contains measures. Then click **OK**.
[Type to search]	Type a search string to limit the number of dimensions listed in the Available dimensions list.

SAP BW

If you have access to data in an SAP BW system, you can use the SAP BW connector in Spotfire to connect to your OLAP cube.

Note that you need to install a driver on your computer to get access to the SAP BW connector. For more information and instructions for installing the required drivers, see Installing Drivers for the SAP BW Connector.

Installing Drivers for the SAP BW Connector

The Spotfire connector for SAP BW can employ either the BAPI interface, or the ODBO interface, for connecting to SAP BW systems. This depends on which data source driver you have installed on your computer.

Procedure

- For information on how to install the drivers required for using the Spotfire connector for SAP BW, see Drivers and data sources in TIBCO® Spotfire.

InfoProviders

InfoProviders are the reportable entities in SAP BW, for example, InfoCubes and MultiProviders.

InfoCubes
InfoCubes are multidimensional models in SAP BW. In Spotfire, the InfoCubes become cubes (that is, data tables). Standard InfoCubes are self-contained data sets for particular business subjects or processes, such as sales, lost deals, and plans. They consist of dimensions, characteristics, key figures and navigational attributes.

MultiProviders
Because each InfoCube normally only supports an individual business subject or process, there is a need to create reports where data from different processes are joined. MultiProviders are used for this purpose. They exist as a logical definition only, so they do not physically store any data. MultiProviders are also frequently used in cases where a single InfoCube would become very large due to high data volume. MultiProviders also become cubes (that is, data tables) in Spotfire.

Key Figures

Key figures are numeric values, quantities, dates or times.

For example, typical key figures are sales revenue, or, quantity sold. That is, key figures are the measures of the cube and the are found under 'Key Figures' in the Spotfire Data in analysis flyout.

Characteristics

A characteristic usually denotes a business entity that is being evaluated or measured by a key figure. Characteristics can be either attributes or hierarchies. Attributes are further broken down into display attributes and navigation attributes.

SAP BW hierarchies are represented as hierarchies in Spotfire. Navigation attributes are represented as columns in Spotfire. Display attributes are currently not available in Spotfire.

Navigation attributes can be used in BEx queries for drilling and filtering and are thus visible to Spotfire (in the context of the BEx query).

Navigation attributes appear as display attributes in the context of an InfoCube and are therefore *not* visible in Spotfire in that context. If you need to access these attributes in Spotfire, the workaround is to create a BEx query based on the InfoCube, and expose the navigation attributes in the BEx query.

Value presentation - Choosing how a characteristic or hierarchy is displayed

For characteristics and hierarchies from SAP BW, you can decide how to display the characteristic in Spotfire. A characteristic in SAP BW can have many types of metadata, such as attributes and technical names. With the **Value presentation** settings in the Data Selection in Connection dialog, you can choose to use a combination of technical names, a certain attribute, or you can define a custom value presentation.

If you want to use all the metadata for a characteristic or hierarchy in Spotfire, you can do this with a custom value presentation. Then, if you want the metadata in separate columns, you can split the resulting column. Note that you can only split columns when you import data.

Dimensions

In SAP BW, dimensions are groupings of logically related characteristics.

However, not all characteristics belong to a dimension, so Spotfire does not show these dimensions. Instead, all characteristics are found under the 'Characteristics' dimension in Spotfire.

Variables

Variables act as parameters to a Business Explorer (BEx) query. They are filled with values and processed at query runtime.

For example, you might have a BEx query that reports sales for the year 2014. When new data for 2015 becomes available, you do not want to change the year to 2015, but rather want the end user of the query to select which year the query should be executed for.

In that case, you modify (parameterize) the query so that it uses a variable for the year. Then, the end user can specify the year of interest by selecting a value for that variable when the Spotfire analysis is opened.

When working with BEx queries with variables, avoid limiting characteristics using the Limit Data dialog. Data has already been limited by the selections in the BEx variables, so, generally, further limiting is not necessary. Because of restrictions in SAP BW, if you both limit a characteristic and define a BEx variable that filters out values for that characteristic, you might get unpredictable results when loading and analyzing data.

Variables are globally available, so that once they are defined, they are available for use in any BEx query. However, not all variables are available to Spotfire. The underlying SAP BW driver does not return any Text variables. In addition, only variables that have the processing types Manual Entry or Default Value are returned by the driver.

Hierarchy variables are not supported by Spotfire. Hiearchy node variables, however, are supported.

Business Explorer (BEx) Queries

SAP BW users can create Business Explorer (BEx) queries in the BEx Query Designer. BEx queries are intended to provide the end users with queries for reporting and analysis in SAP BW. In Spotfire each BEx query becomes a cube.

For a BEx query to be visible in Spotfire, the query has to be configured to allow external access by OLE DB for OLAP. This is done by selecting the **Allow External Access to this Query by OLE BD for OLAP** check box in the **Extended** tab in the Query Properties for the query in the BEx Query Designer application.

When you select an SAP BW BEx query in Spotfire, you may have to specify desired values for predefined variables. The specified values will be used to limit the selected data. Once the BEx variables have been specified, you cannot change them.

SAP Message Server

An SAP message server can be used for load distribution and communication between individual application servers in an SAP BW system. When you create an SAP BW connection in Spotfire, you must specify whether you will connect directly to an application server, or if you want to connect via a message server.

To connect to an SAP BW data source via a message server, select **Connection type > Group/Server selection** in the SAP BW connection dialog. Different information is required to create a connection to an SAP BW data source via a message server, compared to when you connect directly to the application server.

Adding In-database Data from SAP BW

Follow the steps below to add a connection with in-database data to SAP BW.

Procedure

1. On the authoring bar, click **Files and data**.
2. In the Files and data flyout, click **Connect to**.
3. In the list of connectors, click **SAP BW**.
4. In the Oracle Essbase flyout, click **New connection**.
5. In the SAP BW Connection dialog, enter the information and credentials for the data source you want to connect to.
6. Click **Connect**.
   Spotfire will connect to the specified server, and retrieve the names of the available catalogs, cubes, and BEx queries.
7. In the **Catalog** drop-down list, you can narrow down the amount of listed cubes. Cubes containing BEx queries are listed, but you can also select (All cubes) if you do not want to narrow down the selection.
8. In the **Cube or query** drop-down list, select the cube or query of interest.

   If a name is preceded by a dollar sign ($) in the drop-down list, it is a cube, otherwise it is a BEx query.
9. Click **OK**.

   The Data Selection in Connection dialog opens.

   If you selected a BEx query with variables, the BEx variables will automatically be added to the **Data selection in connection** list. Variables listed as **Mandatory** must be defined if no default has been specified already. Variables listed as **Mandatory not initial** must always be defined. Click on each variable to display its settings and click **Define Value** to specify values for each variable.

10. Click on the object of interest in the left pane, then click **Add >**.

    See Icon Descriptions for information about what the different objects represent. If you select the cube icon, you will get all data in the cube. When it comes to hierarchies, you always have to add the entire hierarchy to the list, but you can limit data further, see step 12.

    The selected data is added to the **Data selection in connection** list.

11. Dimension columns and hierarchies can be further limited by clicking on the selected column or hierarchy in the **Data selection in connection** list and then, in the Settings pane, clicking **Limit...**. The Limit Data dialog opens.
12. Clear the check boxes for categories that you want to remove from the selection.
13. Click **OK** to close the Limit Data dialog.
14. When you are done with the data selection, click **OK**.
15. The final step is a summary view of the data tables that will be added to your Spotfire analysis. Make sure that the data table that is added from your connection is configured as **External**, for in-database analysis.

    To change the load method of a data table to External, click the data table in the summary view, and then use the drop-down menus to select **External**.

16. Click **OK**.

Result

The external data table is added to your analysis.

Do all of the data selection work in a shared data connection and save it to the library instead of adding it to the analysis directly. This way you can reuse the work you have done later, or share your selections with others.

Importing Data from SAP BW

Follow the steps below to import data from a SAP BW cube.

Procedure

1. On the authoring bar, click **Files and data** .
2. In the Files and data flyout, click **Connect to**.
3. In the list of connectors, click **SAP BW**.
4. In the Oracle Essbase flyout, click **New connection**.
5. In the SAP BW Connection dialog, enter the information and credentials for the data source you want to connect to.
6. Click **Connect**.
   Spotfire will connect to the specified server, and retrieve the names of the available catalogs, cubes, and BEx queries.
7. In the **Catalog** drop-down list, you can narrow down the amount of listed cubes. Cubes containing BEx queries are listed, but you can also select (All cubes) if you do not want to narrow down the selection.
8. In the **Cube or query** drop-down list, select the cube or query of interest.

   If a name is preceded by a dollar sign ($) in the drop-down list, it is a cube, otherwise it is a BEx query.

9. Click **OK**.

   The Data Selection in Connection dialog opens.

   If you selected a BEx query with variables, the BEx variables will automatically be added to the **Data selection in connection** list. Variables listed as **Mandatory** must be defined if no default has been specified already. Variables listed as **Mandatory not initial** must always be defined. Click on each variable to display its settings and click **Define Value** to specify values for each variable.

10. Click on the object of interest in the left pane, then click **Add >**.

    See Icon Descriptions for information about what the different objects represent. If you select the cube icon, you will get all data in the cube. When it comes to hierarchies, you always have to add the entire hierarchy to the list, but you can limit data further, see step 12.

    The selected data is added to the **Data selection in connection** list.

11. Dimension columns and hierarchies can be further limited by clicking on the selected column or hierarchy in the **Data selection in connection** list and then, in the Settings pane, clicking **Limit...**. The Limit Data dialog opens.

12. Clear the check boxes for categories that you want to remove from the selection.

13. Click **OK** to close the Limit Data dialog.

14. When you are done with your data selection it is recommended to click the **Estimate Import Size** button to get a hint on whether this selection will be possible to import or not.

    The calculation may take a while. No measures are taken into account in the calculation, so if you have added many measures, you may be unable to import the selection even if the estimated number of rows and columns is small. The estimated import size may be of help if an import should fail. Then, the next time you try to import data from that cube, you should try to make sure that the estimated size is smaller than the previous time.

15. When you are done with the data selection, click **OK**.

16. The final step, the Add data to analysis flyout, is a summary view of the data tables that will be added to your Spotfire analysis. Make sure that the data table that is added from your connection is configured as **Imported**, for in-memory analysis.

    To change the load method of a data table to **Imported**, click the data table in the summary view, and then use the drop-down menus to select **Imported**.

17. Click **OK**.

Result

If the data selection was small enough, the data is imported.

Do all of the data selection work in a shared data connection and save it to the library instead of adding it to the analysis directly. This way you can reuse the work you have done later, or share your selections with others.

- It is not possible to import multiple characteristics that belong to the same dimension.

Prompting for SAP BW BEx Variables

You can define prompting for a data connection to an SAP BW BEx query. Using prompting, you can let the end user define values for BEx variables, upon opening the connection.

In BEx queries, variables are used to limit the data to be loaded. Prompting can bring greater flexibility to a BEx query connection, as you can use it in place of static values for BEx variables. By defining BEx variables via prompts, one connection can be used to load different data from the source depending on the user input.

Some variables are 'Mandatory' and values must be defined before the query can be opened. By setting up prompting, you can let the end user define the variable value, instead of defining it in the connection configuration.

You can define both a value and prompting for the same BEx variable. The variable value you define in the connection will be the default selection in the prompt dialog for the variable when opening the connection, which can be useful if you save the connection in the library for reuse. However, if you create an analysis where prompts will be shown to the end user, then your selection in the prompts when opening the connection will be stored in the analysis. Your selection in the prompts, rather than the variable values you defined in the connection, will then be the default selection in the prompts to the end user.

Compared to working with relational data sources, BEx queries are more restrictive regarding how you can set up prompting. When a variable is defined in the query, it is designed to only accept certain input; for example single value, multiple value or range. In Spotfire, the accepted input determines what prompt types you can use for a BEx variable.

By default, unless **Load values automatically** is selected, prompts for BEx variables will give users the option to manually enter values. When typing variable values manually, Spotfire supports entering values as text (captions). Entering values as keys is not supported.

Adding Prompts to an SAP BW BEx Query Connection

You can define prompting for a data connection to an SAP BW BEx query. Using prompting, you can let the end user define values for BEx variables, upon opening the connection.

Prompting can bring greater flexibility to a BEx query connection, as you can use it in place of static values for BEx variables. By defining BEx variables via prompts, one connection can be used to load different data from the source depending on the user input.

Prerequisites

The following example describes the process for adding prompting for a BEx variable in a saved connection in the library. However, you can add prompts to connections embedded in an analysis file too.

Procedure

1. On the menu bar, select **Data > Manage Data Connections**.
2. Locate the SAP BW BEx query connection of interest and click **Edit**.
   You might need to enter the data source credentials to proceed.
3. In the Data Connection Settings dialog, click **Edit...**.
   The Data Selection in Connection dialog is displayed.
4. In the Data selection in connection list, select the BEx variable that you want to define prompting for.
5. In the Settings pane, select **Prompt for values**.
6. In the **Prompt type** menu, select the desired prompt type.

   Comment: What prompt type you can use depends on what input the selected BEx variable is configured to accept. For example, if the variable accepts only a single value, you will only be able to select the prompt type 'Single selection'.
7. Select whether or not to **Load values automatically** in the prompt.

   Comment: By default, this option is not selected and the user can choose either to load a list of all available values to select from, or to type values in the prompt manually. Typing values can be preferable, especially when the user needs to select a large number of values. The user can then use

a saved list of values, by loading a file with text values or pasting it in the input field. If you select not to load values automatically, the end user will not have the option to type values manually.

8. Optionally, type a **Description** to be shown in the prompt dialog, explaining what type of value that the end user should provide.
9. Click **OK**, and then, in the Data Connection Settings dialog, click **Save**.

To show prompts when opening an analysis with an embedded connection with prompting

If you have saved an analysis with an embedded connection with prompting, by default, the end user will not be prompted for input upon opening the analysis. The data selection will be based on the selection that you made in the prompts, when authoring the analysis. Follow these steps to show the prompts and let the end user define variable values, upon opening the analysis.

Your selection in the prompts, when authoring the analysis, will be the default selection in the prompts to the end user.

Procedure

1. On the menu bar, select **Data > Data Table Properties**.
2. In the Data Table Properties dialog, on the General tab, click **Linked (individual settings per source)**.
3. Select **Prompt for new settings before loading**.
4. Click **OK**.

Details on Prompting for SAP BW BEx Queries

Prompting for BEx queries is defined in the Data Selection in Connection dialog. Click a BEx variable and, in the Settings pane, the following options will be available to define prompting.

Option	Description
Settings	
Value presentation	Used to specify how the values of a characteristic (dimension) will be presented in Spotfire. You can choose to display text only, the technical key or a combination of both. If you have selected a BEx variable, your selection in this menu specifies how the variable values will be presented in the Define Value dialog and prompts for the variable.
Variable value	Click to open the Define Value dialog, where you can define a value for the selected BEx variable.
Prompt for values	Select this option to prompt the end user for input to define the selected BEx variable.
Prompt type	Specify the input type to use when prompting the end user. Depending on the BEx variable, different prompt types will be available. This is the full list of prompt types: Range Multiple selection Single selection Hierarchy selection

Option	Description
Load values automatically	[Only available for 'member' BEx variables.] Select to load available values when prompting the end user to define a variable value. The end user will be able to select from a list of all available values. By default, this option is not selected and the user can either type values in the prompt manually or load the list of values to select from. Typing values manually can be a preferable input method, especially when the user needs to select a large number of values. Using manual input, the user can paste a list or load a saved file with variable values, instead of selecting them one by one.
Min / Max selections	[Only available for the prompt type 'Multiple selection'.] Used to specify the minimum and maximum number of selections that can be made in the prompt.
Description	Type a description that will be shown in the prompt. This is a good opportunity to explain to the end user what input is expected for the BEx variable. This is especially important when available values are not loaded and shown to the user.
Order of prompts	Opens the Order of Prompts dialog, where you can specify in what order the prompts will appear to the end user of the connection. The prompt order is important, because the selection in one prompt will reduce the available values before the next prompt is shown. Properly ordered, the prompts are more intuitive to understand for the end user. You also reduce the risk of allowing user input that will reduce the data so much that other prompts become empty.

Best Practices for the SAP BW Connector

When you work with SAP BW data in Spotfire, there are certain restrictions in SAP BW that you should keep in mind. The following sections contain information describing common SAP BW limitations and suggestions for how you can work around them.

Default Cell Limit: Maximum 1 000 000 Cells

By default, there is a limit to how many cells of data can be returned in a single query from Spotfire to SAP BW. The MDX interface of SAP BW can generate a result set containing a maximum of 1M cells.

There is a preference setting, that a Spotfire administrator can enable, to make Spotfire use a special set of functions to query SAP BW data sources. Enabling the preference UseNativeSapFunctionsAllowingMoreThanOneMillionCells will allow you to work with larger amounts of data from SAP BW. For more information, see *SAP Note 1232751*.

For this preference setting to have any effect, you must have installed the BAPI driver (SAP NetWeaver RFC SDK) on your computer.

Working within the default SAP BW cell limit

If you are running the SAP BW connector with the ODBO driver (SAP BW OLE DB for OLAP provider), or if you have not enabled the preference setting for working with SAP BW data that exceeds 1M cells, consider the following recommendations for working within the restrictions of the SAP BW 1M cell limit.

Tips to avoid exceeding the SAP BW cell limit for in-database data

- Use filters to limit the data in your analysis.
- Include a key figure (measure) when you set up a visualization.

> If a query to an SAP BW data source includes no key figure (measure), more data than intended might be returned from the data source.

Tips avoid exceeding the cell limit when you import SAP BW data

- In the Data Selection in Connection dialog, reduce your data selection as much as possible. Only include columns and hierarchies that are relevant to your analysis. Define BEx variables and limit characteristics to only include data for values of interest.
- Click **Estimate Import Size** to evaluate whether the selected data can be imported.
- Include a key figure (measure) in the data selection.

> If a query to an SAP BW data source includes no key figure (measure), more data than intended might be returned from the data source.

Importing SAP BW Data in Pieces

If you want to analyze a very large amount of SAP BW data, which exceeds the limit of 1M cells, you can import it piece by piece into Spotfire.

To import data in pieces, limit the data selection to only include data for a portion of the values in a characteristic or variable. Then use **Add rows** to add the remaining data to the data table containing the imported data.

Procedure

1. In the Data Selection in Connection dialog, select the data you want to import from the data source.
2. Identify a characteristic or variable that contains a suitable number of categorical values to limit the data to.

   Example: If you have a data source with sales data for the year 2016, the characteristic 'Calendar day' contains too many values for it to be practical to piece the data by. The characteristic 'Quarter' is more suitable, because it contains only 4 values. By limiting the data by 'Quarter', you can import the data in 4 pieces, each containing only the data for the specified quarter of the year.
3. Click the characteristic or BEx variable and limit the data to only one value.

   Tip: You can limit the data to more than one value. For example, you could make an import of the data for 'Q1-Q2' first, and then add the rows for 'Q3-Q4' in a second import.
4. Click **OK** to close the Data Selection in Connection dialog.
5. In the Add data to analysis flyout, make sure that the data table that is added from your connection is configured for **Import**, for in-memory analysis. Then click **OK**.
6. On the authoring bar, click **Data canvas** .

7. On the data canvas, select the data table with your SAP BW data, and in the source view, click the plus icon between the nodes where you want to add rows, and select **Add rows**.

8. In the Files and data flyout, on the **Recommended** tab, click to open your SAP BW connection again. It is listed under **Data connections in current analysis**.
9. In the Data Selection in Connection dialog, select the same data you selected in step 1.
10. Click the characteristic or BEx variable that you used to limit the data import in step 3, and make a new selection to limit the data.
11. Click **OK** and, in the Add data to analysis flyout, make sure the data you are adding is configured for Import. Click **OK**.
12. Repeat steps 6-11 until you have imported all the data you want to analyze.

Limitation: Multiple Hierarchies or Columns from the Same Characteristic

SAP BW does not support mixing hierarchies or columns that are based on the same characteristic. If more than one hierarchy or column is based on the same characteristic in your data source, make sure you only include one of those columns or hierarchies.

Procedure

1. In the Data Selection in Connection dialog, select the data you want to analyze.
2. In the **Data selection in connection** list, expand each characteristic to inspect associated hierarchies and columns.
3. If any characteristic contains more than one hierarchy or column, make sure you only include one, by selecting the redundant hierarchies or columns and then clicking **<Remove**.

Other Tips for Using the SAP BW Connector

The following tips are useful suggestions to keep in mind when you use the Spotfire connector for SAP BW.

Navigational attributes
To use navigational attributes in Spotfire, the attributes must be exposed in a BEx query.

Do not limit BEx variable characteristics
If you are connecting to an SAP BW BEx query with variables, avoid limiting characteristics in the Limit Data dialog. If you both limit a characteristic and define a BEx variable that filters out values for that characteristic, you might get unpredictable results when loading and analyzing data.

Settings for SAP BW Connection

Use this dialog to connect to SAP BW.

The SAP BW connector supports both a BAPI and and an ODBO driver. In the title of this dialog, appended inside parentheses, you can see information about which type of driver (either BAPI or ODBO) that the SAP BW connector is using.

Option	Description
Connection type	Select the type of SAP BW connection you want to create. **Application server** Connect directly to an SAP BW application server. **Group/server selection** Connect to the data source using a logon group, via a message server.

Option	Description
Application server	[Only available for connection type 'Application server'.] The name of the server where your data is located. The server can be identified in the following ways: • By IP address. For example: 192.0.2.1 • By IP address, but including a SAProuter string. For example: /H/198.51.100.1/S/3299/H/203.0.113.1/H/CPCB701 • By name in the domain. For example: my-sap-bw.mycompany.com
Message server	[Only available for connection type 'Group/Server selection'.] The name of the message server in the SAP BW system you want to connect to.
Group/Server	[Only available for connection type 'Group/Server selection'.] The name of the SAP logon group.
Client	The SAP BW client number.
System number	[Only available for connection type 'Application server'.] The SAP BW system number.
System ID	[Only available for connection type 'Group/Server selection'.] The SAP BW system ID.
SNC partner name	The Secure Network Communication (SNC) partner name which is required when using single sign-on.
Language	Use this field to specify the language used in your data. Refer to official SAP documentation for a complete list of supported language codes.
Authentication method	The authentication method to use when logging into the database. Choose from Windows authentication and SAP BW authentication. **Windows authentication** When using Windows authentication the access token of the logged in user will be used. Users that have been given the appropriate access rights to SAP BW will be able to connect and read data. For more information about using single sign-on with the SAP BW connector, see this page on the TIBCO Community. Domain credentials are not stored in the analysis file. **SAP BW authentication** Authenticate using a database user. Users who open the connection, or an analysis using the connection, will be prompted to enter database credentials to connect to the data source. You can save database credentials, unencrypted, as part of an analysis file, using a setting in the Data Source Settings dialog. If credentials are embedded in your analysis, it means that users will not be prompted to enter credentials to connect to the data source. Note that it can be a security risk to embed database credentials in an analysis file.
Username	The username you wish to use when logging into the SAP BW cube or query.
Password	The password for the specified username.
Connect	Connects you to the specified server and populates the lists of available catalogs and cubes below.

Option	Description
Catalog	Select the catalog of interest from the drop-down list. You can choose among (All cubes) and cubes containing BEx queries.

Option	Description
Cube or query	Select the cube or BEx query of interest from the drop-down list. If the catalog selected is (All cubes) , only cube names are shown here; if the catalog selected is a cube, only its BEx queries and the cube itself will be included here. If a name is preceded by a dollar sign ($) in the drop-down list, it is a cube, otherwise it is a BEx query.

Option	Description
Operation timeout (minutes)	Specifies the maximum time, in minutes, allowed for a command to be executed.

Define Value

This dialog is used to specify a value for a BEx query variable. The appearance of the dialog depends on the type of variable you have selected, but a few examples are shown below:

Option	Description
Select a value for variable [variable name]	
From list of values	Select this option to choose variable values from a list of available values in the data source. Depending on the variable type, it can be a regular or a hierarchical list. This will filter the retrieved data so that only data relevant to your selection will be seen in Spotfire.
Load variable values from data source	This link is shown to prevent automatic loading of a large number of values from the data source, which may take a long time. Click on the link to show all available values from the source.
Value presentation	Select how you want to present the different values in the resulting column in Spotfire.

Option	Description
Manually (separate using comma, semicolon, or new line)	Select this option to manually type or paste values of interest. Also, select this option if you want to load values from a previously saved list.
Load from File...	[Only available when variable allows multiple value selection.] Click to select a file with text values to filter on. California Florida Arizona Supported file formats are CSV or TXT. Supported delimiters are line break, comma, tab and semicolon.

Option	Description
Select a value for variable [variable name]	Type a numeric value of interest for the specified variable. This will filter the retrieved data so that only data relevant to your selection will be seen in Spotfire.

Option	Description
Select a range for variable [Variable name]	

Option	Description
From list of values	Select this option to choose variable values from a list of available values in the data source. Select the 'From' and 'To' values of interest in the drop-down lists. This will filter the retrieved data so that only data relevant to your selection will be seen in Spotfire.
Load variable values	This link is shown to prevent automatic loading of a large number of values from the data source, which may take a long time. Click on the link to show all available values from the source in the drop-down lists.
Value presentation	Select how you want to present the different values in the resulting column in Spotfire.
Manually	Select this option to manually type or paste values of interest.

Custom value presentation

For characteristics and hierarchies from SAP BW, you can select how to display the characteristic in Spotfire. A characteristic in SAP BW can have many types of metadata, such as attributes and technical names.

In this dialog, you can define a custom value presentation for a SAP BW characteristic or hierarchy. You can combine available technical names and attributes to your liking, and customize the presentation with other characters.

Option	Description
Available technical names and attributes	Lists all the available attributes and technical names for the characteristic or hierarchy.
Name	The name of the attribute or technical name.
Identifier	The identifier used to reference the attribute or technical name in the **Value presentation expression**.

Option	Description
Insert	Click to insert the selected attribute or technical name in the **Value presentation expression**. Note that you can also quickly insert attributes or technical names in the expression by double-clicking items in the list.

Value presentation expression	The expression describing the custom value presentation.
	You reference attributes and technical names with their respective **Identifier** string.
	You can enter other characters in the expression, for example as separators to make the values display the way you want.
	Example
	In the example in the image, we are creating a custom value presentation for a characteristic with currency information. We want to display the characteristic with the technical name `Key` and the attribute `Medium Name` , separated by an en dash.
	The technical name `Key` contains a three-letter abbreviation for the currency, for example 'USD'. The attribute `Medium Name` contains the full name of the currency, for example 'United States Dollar'.
	The expression looks like this:
	`{Key} - {[0CURRENCY]}.{[50CURRENCY]}`
	The expression results in a custom value presentation where values in the currency characteristic are displayed like this:
	`USD - United States Dollar`
	`GBP - Pound Sterling`

Data Import

When you add data tables from a data connection, you have the option to either keep the data table external or to import it into the Spotfire data engine and use it in-memory.

When you are importing cube data into Spotfire you will actually flatten the cube into a single data table, which means that some features that you have access to when working with an in-database cube are lost and you may see different results when aggregating your imported data in Spotfire compared to what you get when the external system does all the aggregation. Spotfire does not import aggregated data, only leaf nodes that then can be aggregated using the Spotfire aggregation methods.

If you are interested in all of the data from an OLAP (Online Analytical Processing) cube, it is probably a better idea to use an in-database connection, while import is mainly intended for small subsections of the cube data.

Limit the Number of Dimensions

If you intend to import data from a cube into Spotfire there are a number of things that you must remember.

First of all, the full cube may be enormous, so it is recommended to always limit the dimensions to import to those that are absolutely necessary only, to reduce data explosion as much as possible. If a cube like the one shown to the left below is imported into Spotfire, you will get the table shown to the right. The visualizations you set up will then decide how to aggregate the measures from the resulting table.

Country	City	State-Province	Sales
Germany	Berlin	Hessen	8681.11
France	Bobigny	Seine Saint Denis	10813.63
France	Bobigny	Seine Saint Denis	9390.53
France	Cergy	Val d'Oise	13173.19
France	Chatou	Yveline	9695.73
France	Colombes	Hauts de Seine	10899.62
France	Colombes	Hauts de Seine	9421.91
France	Colomiers	Garonne (Haute)	13242.70
France	Dunkerque	Nord	13265.99
Germany	Hamburg	Hessen	10580.35
Germany	Hamburg	Hamburg	9904.97

When an imported cube data table is aggregated (for example, with the default Sum aggregation), the available leaf values are simply summarized when you show a categorical value of a higher level (e.g. the Sum(Sales) for France from the table above). However, in the in-db cube, it is the external system that decides what an aggregation means, which may include other aggregation methods, data that was not included in the import, and so on, which may produce a completely different result.

As an example of the importance of limiting the data as much as possible prior to import, imagine a cube with the following number of values for different dimensions.

Department: 10

Product: 5000

Currency: 20

Business Unit: 1000

Scenario: 10

Account: 100

Bringing in the entire cube would result in a cross-joined table with the following number of columns: 10x5000x20x1000x10x100=1x10 12

As you can see, the amount of data very quickly explodes with the number of dimensions used, especially if each dimension contains many different values. Take care not to overload the data source by combining too many dimensions.

Data Import Best Practices

To get the most out of your data, follow these recommendations for import of data from cubes.

- Limit the data to import as much as possible by selecting only the necessary dimensions and measures in the Data Selection in Connection dialog.
- Limit data further by clearing check boxes for undesired categories in the selected data in the Limit Data dialog.
- Click **Estimate Import Size** to try to evaluate whether import is possible before you try to import a data selection.

Known Limitations

- On-demand is not supported for cube data sources (neither for imported cubes nor for in-database cubes).
- In contrast to data connections from relational data sources, selections for cube data connections always result in a single data table.
- You cannot switch from an imported configuration to an in-database configuration in a cube data connection, the way you can with relational data sources, or vice versa. However, you can always replace a data table based on a cube data connection with another data table.
- When cube hierarchies have been added to a connection, the hierarchies in Spotfire will not be updated when the data connection is edited. However, you can always recreate new hierarchies manually.
- Import of large amounts of data may not work. If you try to import and it fails, edit the connection and limit the selected dimensions and/or categories some more.
- The estimation of the expected import size is only an approximation and cannot give any definitive information regarding whether or not an import will work. If the estimation takes a long time it often, but not always, means that the result of the selection is too big to import.
- If multiple instances of one leaf value exist you may get different behavior between imported data and in-db data, since the imported data may have lost hierarchical information required in order to distinguish the leaf values from each other. For example, there is more than one city called Berlin in the world and after an import, all of those cities will be clumped together into one group in the flattened data table, unless you make sure to always include full hierarchies on all axes.
- You will always get the leaf nodes for those branches in the hierarchies you select. This means that you can only select full hierarchies, not single columns from a hierarchy.

Creating a Shared Data Connection in the Library

If you want to be able to use a data connection in multiple analyses or share it with other users, you can create a data connection item in the library.

Procedure

1. In the Spotfire Windows client, on the menu bar, select **Data** > **Manage Data Connections**.
2. In the Manage Data Connections dialog, select **Add New** > **Data Connection** and choose the selected data connection type from the list.
   The connection configuration dialog for the selected data source opens.
3. Provide all the necessary input for the connection to the data source and specify which data to include.

   For more information about specific system settings, see the section about the system of interest in this user's guide.
4. **Save** the connection to the library.