

# Connecting to SAP HANA with Microsoft Excel 2007 PivotTables and ODBO



## Applies to:

ODBO, MDX Query Language, Microsoft Excel, Microsoft Excel 2007, PivotTables for connecting to SAP HANA.

## Summary

This paper provides an overview of SAP HANA MDX. It also includes step-by-step instructions for you to access and analyze SAP HANA data with Microsoft Excel PivotTables.

**Authors:** Aryn Rajan, Darryl Eckstein, George Chow, King Long Tse and Roman Moehl

**Company:** SAP; Simba Technologies Inc.

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## Author Bio

### About Simba Technologies

Simba Technologies Incorporated (<http://www.simba.com>) builds development tools that make it easier to connect disparate data analysis products to each other via standards such as, ODBC, JDBC, OLE DB, OLE DB for OLAP (ODBO), and XML for Analysis (XMLA). Independent software vendors that want to extend their proprietary architectures to include advanced analysis capabilities look to Simba for strategic data connectivity solutions. Customers use Simba to leverage and extend their proprietary data through high performance, robust, fully customized, standards-based data access solutions that bring out the strengths of their optimized data stores. Through standards-based tools, Simba solves complex connectivity challenges, enabling customers to focus on their core businesses.

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### About the Authors

Aryn Rajan is President and CEO of Simba Technologies. Aryn has over two decade's experience in custom software development, and is responsible for driving Simba's success as a leader in data connectivity solutions.

Darryl Eckstein is a Senior Computer Scientist with Simba Technologies. Darryl has over 12 years experience in software development, and is a specialist in SAP NetWeaver BI and OLAP data access.

George Chow is CTO of Simba Technologies. George has over two decade's experience in software development and multi-tier architecture with an emphasis on database and data connectivity.

King Long Tse is a Computer Scientist with Simba Technologies. King Long has over 2 years experience in software development, and is a specialist in SAP NetWeaver BI and OLAP data access.

Roman Moehl is a Senior Computer Scientist with SAP AG. Roman has over 11 years experience in software development, and is a specialist in SAP BW and HANA MDX.

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938 West 8th Avenue

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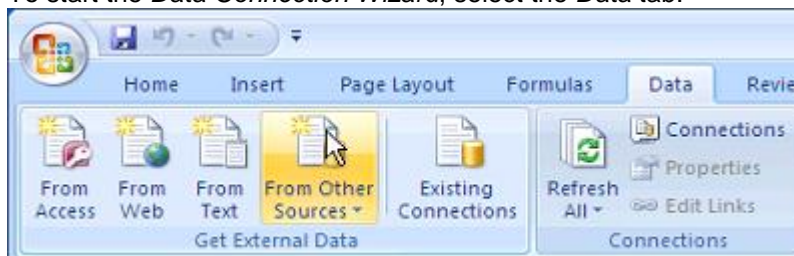
## Connecting to SAP HANA with Microsoft Excel PivotTables and ODBO

Microsoft Excel is considered by many to be the most commonly used BI tool in the world. Excel PivotTables are a practical way to access and analyze SAP HANA data. Excel is ubiquitous and well understood, and PivotTables are an excellent way to explore the world of SAP HANA data. However, the first hurdle you face as a new user is connecting to your SAP HANA data source. Connecting PivotTables to a SAP HANA data source is straightforward, if you know a few important items that we will outline here. What follows is a step-by-step description of the process that will connect you to your data. Note that all steps presented here are for Excel 2007/2010 connecting to SAP HANA 1.0.

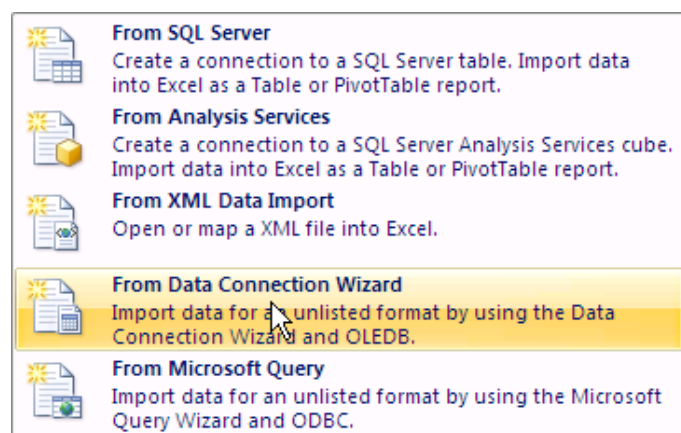
### Creating a Connection

Connecting to HANA and populating an Excel PivotTable is a three-step process. First, you must specify or create a data source connection. Second, you decide what you want to create with the connection. And third, you use this data source to populate a PivotTable or PivotChart report. It all begins with the *Data Connection Wizard*.

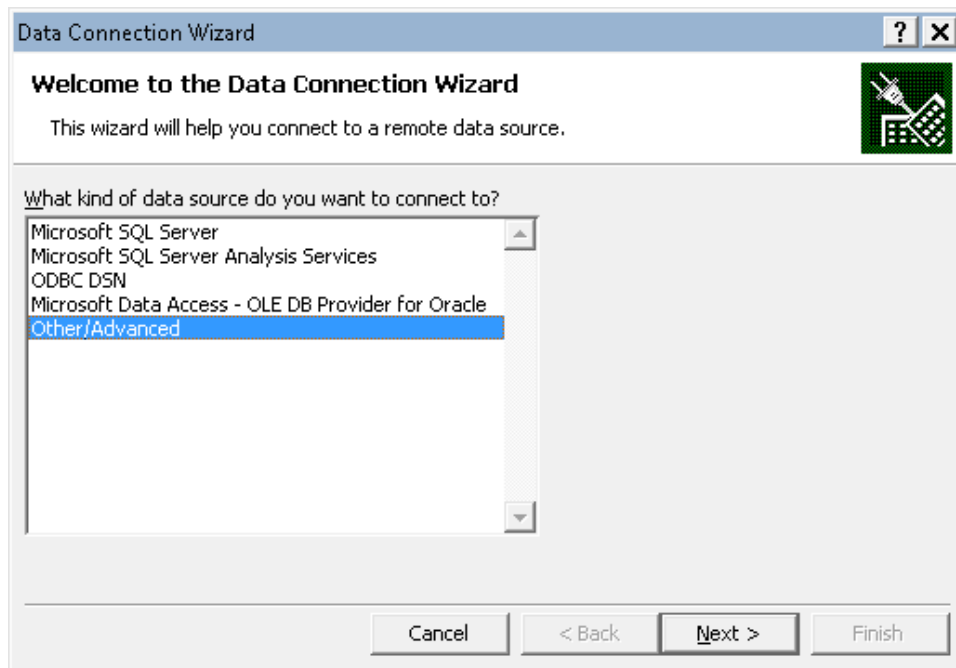
To start the *Data Connection Wizard*, select the *Data* tab.



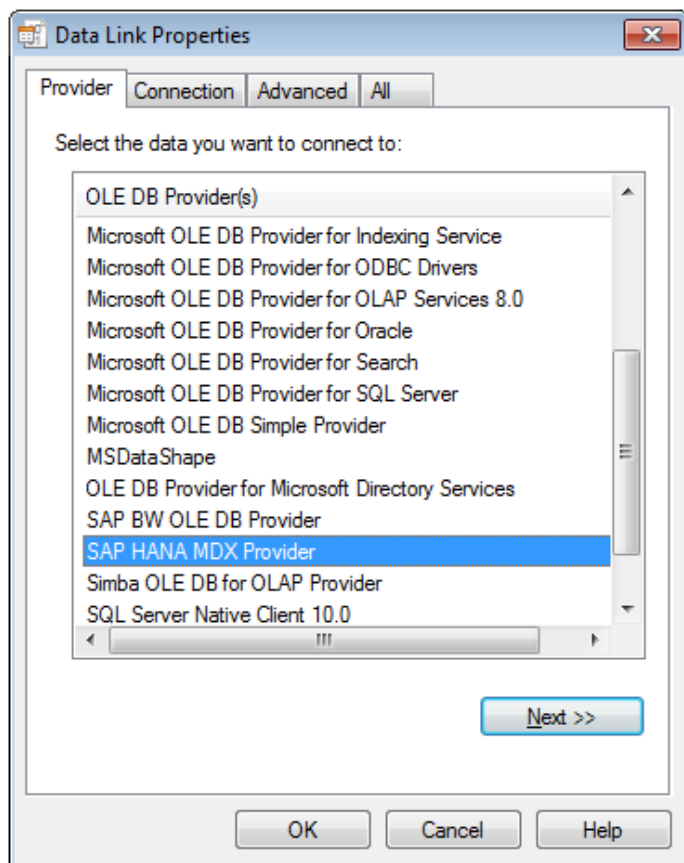
Click on *From Other Sources* on the ribbon and a drop down list will appear.



Select *From Data Connection Wizard* and the *Data Connection Wizard* dialog with the *Welcome to the Data Connection Wizard* banner will appear.

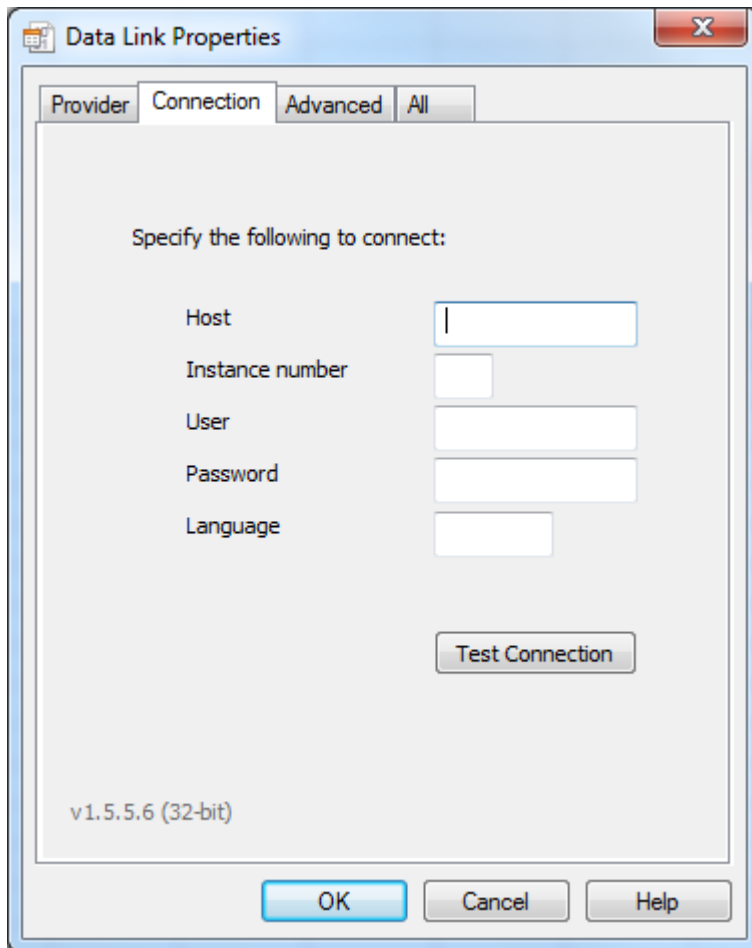


Select *Other/Advanced* and then click on *Next*. The *Data Link Properties* dialog will appear.



The *Provider* tab is the default tab. Scroll down the *OLE DB Provider(s)* list and select *SAP HANA MDX Provider*. Click on *Next*, or move on to the *Connection* tab. You will now specify your connection parameters.

Observe in the above screenshot that the HANA MDX provider is a distinct interface from the BW MDX provider. SAP HANA is an independent product apart from SAP BW and each product has its own independent interfaces.



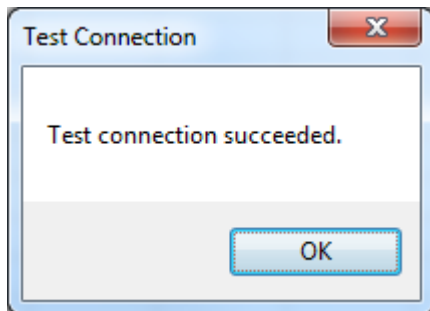
Fill in the following connection information:

- In the *Host* box enter the host name of the SAP In-Memory Database.
- In the *Instance number* box enter the instance number of the host. Leave blank to use the default value 00.
  - The value of Host and Instance number of your SAP In-Memory Database can be found by looking at the Path value within the HANA modeller. Open the HANA modeller and right-click on your HANA system -> Properties -> Resource. The Path format is /host:instance\_number:SYSTEM. If you have no access to the HANA modeller contact your system administrator.
- In the *User / Password* box enter the user name and password. If your system supports Single Sign On, then the Password field can be left blank.
- In the *Language* box enter a POSIX compliant language key. Leave blank to use the default language. The POSIX format for language is [language[\_territory][.codeset][@modifier]]. For example: en for English, de for German, jp for Japanese, or pt\_BR for Brazilian Portuguese.

### Connecting via Single Sign On

If your SAP HANA system & user have been configured to use Single Sign On, you can enter your *User* and leave the *Password* field blank.

After you have entered the client information click on the *Connection* tab, click the *Test Connection* button to test the connection. A dialog will appear to tell you if your connection is successful.

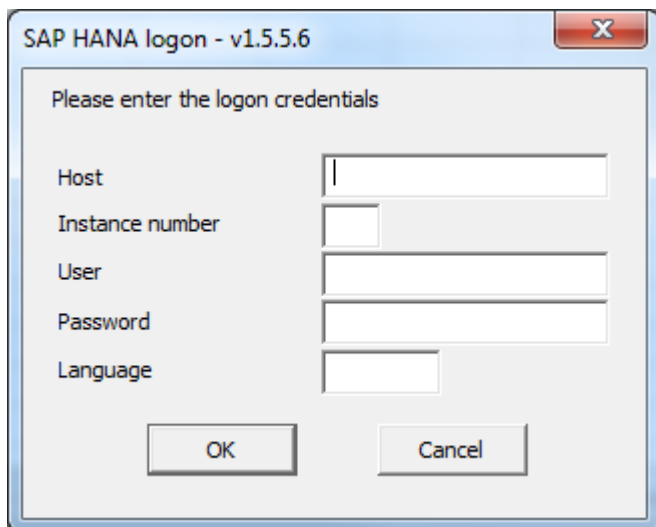


If an error message appears then the credentials or server information that was entered may be incorrect. Make sure the credentials are correct and click on *OK* to continue.

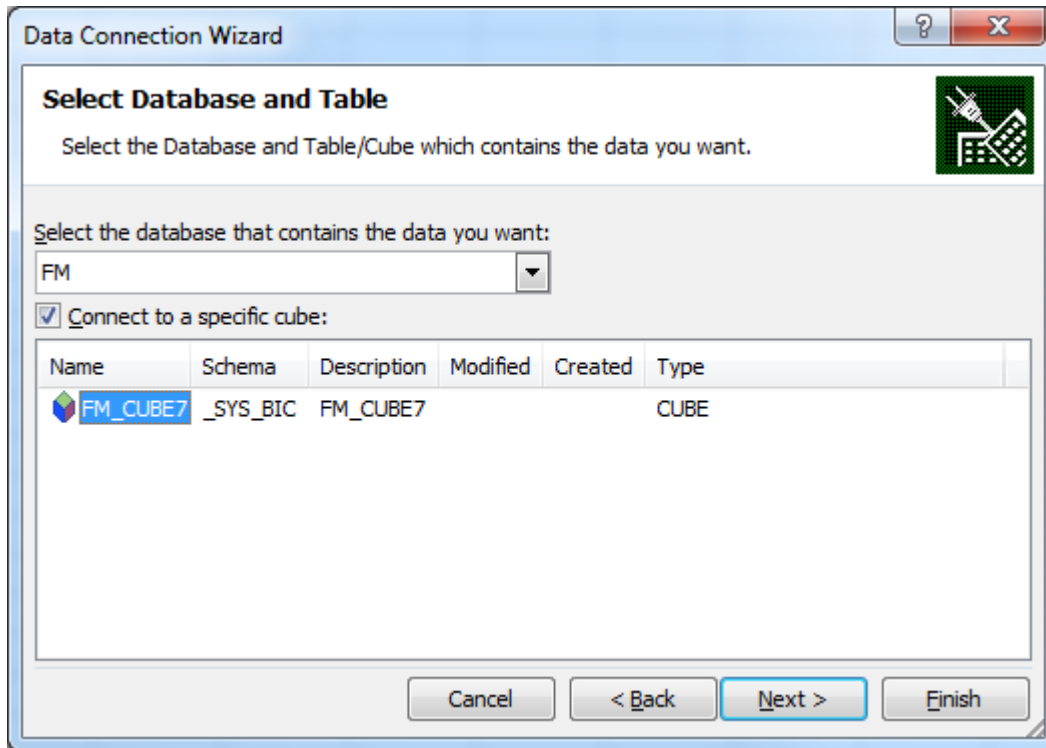
Click on *OK* to continue. You will be returned to the *Data Link Properties* dialog.

### Cube Selection

After you finish setting up the connection and click *OK* in the *Data Link Properties* dialog, the *SAP Logon* dialog may appear asking for more information so that you can log on to the system. This can occur, for example, if you do not enter your password or user name in the *Data Link Properties* dialog.

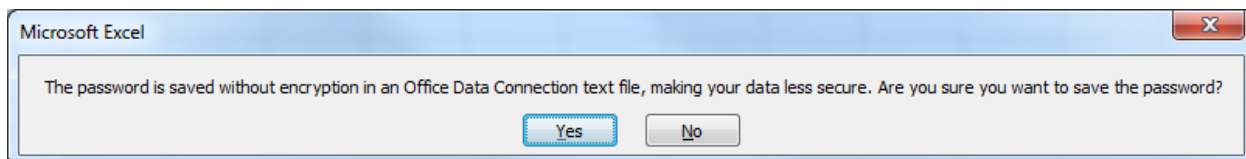


Enter the logon credentials and server information and click *OK*. The *Data Connection Wizard* dialog appears again – this time with the *Select Database and Table* banner.



Select the database by clicking on the drop-down list, then select the Analytic View you wish to use and then click on *Next >*. Analytic Views from the SAP In-Memory Database will appear as cubes within Excel PivotTables. The *Data Connection Wizard* will appear with the *Save Data Connection File and Finish* banner.

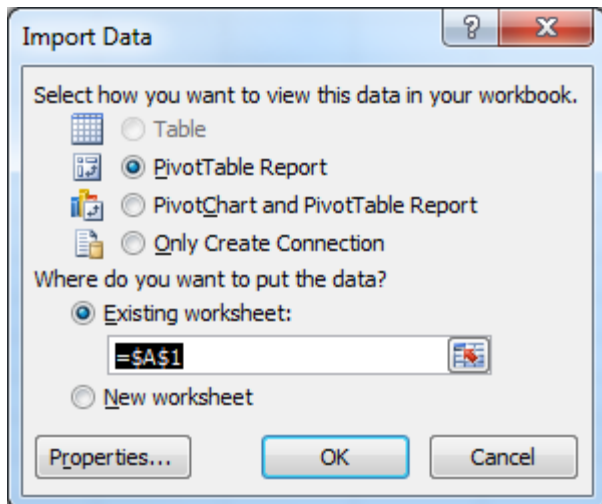
Enter a file name and a friendly name. The friendly name will show up in the Connections lists. If you are not using single sign on, then you may also want to save the password to the connection file. Otherwise, the logon dialog will appear as you exercise many of the functions of the Excel PivotTables. To save the password, click on the *Save password to file* checkbox. Since the password will be saved in a non-encrypted form on the local machine, a warning dialog will appear. It is recommended to use single sign on because it is a more secure authentication method.



Click on *Yes* to save the password. Then, click on *Finish*. The *Import Data* dialog will appear.



## Selecting A View of The Data

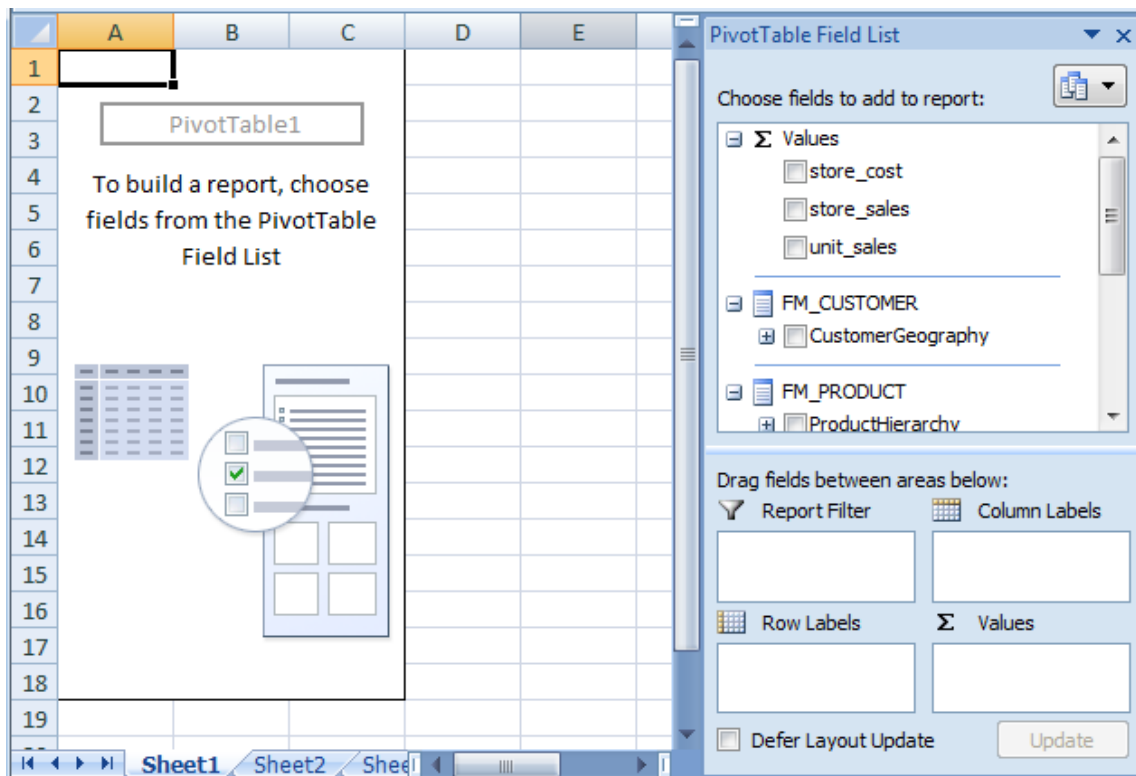


Now you can decide how to view the data. There are three options enabled. We will select *PivotTable Report*. You can select the layout and location options for your new PivotTable, or you can just click *OK* to accept the PivotTable layout defaults and to locate the PivotTable on the current worksheet.

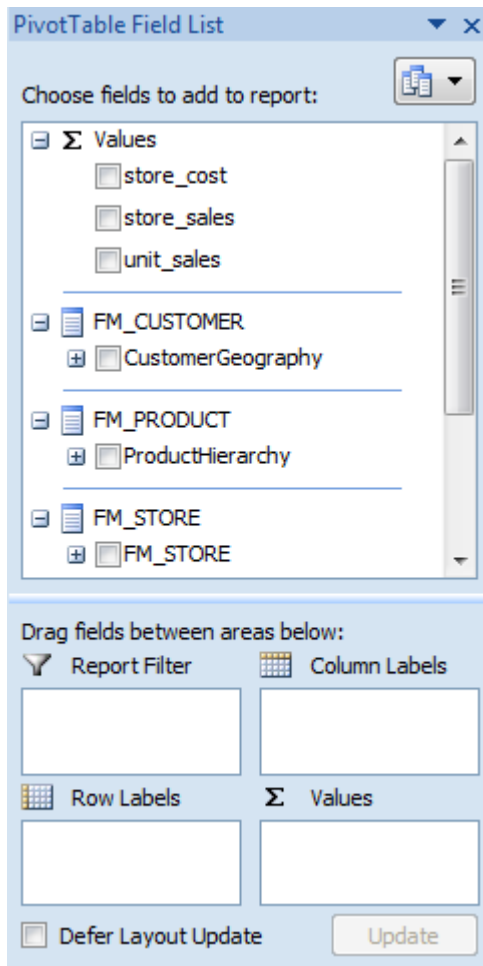
The data source has now been created and saved in an .ODC file. The next time you want to create a PivotTable from this data source, simply select the *Existing Connection* from the *Data* menu tab and select the data source from *Existing Connections* dialog. You will not have to repeat the steps above to reuse an existing data source.

## Populating The PivotTable

If you did not save the password, the *SAP HANA Logon* dialog will prompt you for your SAP credentials one last time. When you enter them and click *OK*, the PivotTable appears.



The new PivotTable looks similar to any other PivotTable and shows the dimensions and measures from the chosen HANA cube in the *PivotTable Field List*. The measures come first, grouped under  $\Sigma$  *Values*. If you scroll down, you will see the dimensions. The hierarchies are grouped under the respective dimension. The levels are listed under the hierarchy node.



You can drag and drop dimensions and measures from the *PivotTable Field List* onto the boxes below to have them show up as Column, or Row labels, filters or values. If you just click on the checkboxes, values will go to *Values*, non-time dimensions to *Row Labels*, and time dimensions to *Column Labels* by default. Your data will be inserted into the PivotTable directly from your SAP HANA server over a live connection.

The screenshot shows Microsoft Excel 2007 with a PivotTable and the PivotTable Field List task pane. The PivotTable is located in the range A1:E6 and displays sales data for 'unit\_sales' categorized by country (Canada, Mexico, USA) and product type (Drink, Food, Non-Consumable). The PivotTable Field List task pane is open on the right, showing the 'unit\_sales' field selected in the Values area, and 'CustomerGeography' selected in the Row Labels area. The 'ProductHierarchy' field is also visible in the Field List.

unit_sales	Column Labels				
Row Labels	Drink	Food	Non-Consumable	Grand Total *	
Canada	199	1,513		350	2,062
Mexico	123	936		252	1,311
USA	12,719	100,349		26,053	139,121
<b>Grand Total *</b>	<b>13,041</b>	<b>102,798</b>		<b>26,655</b>	<b>142,494</b>

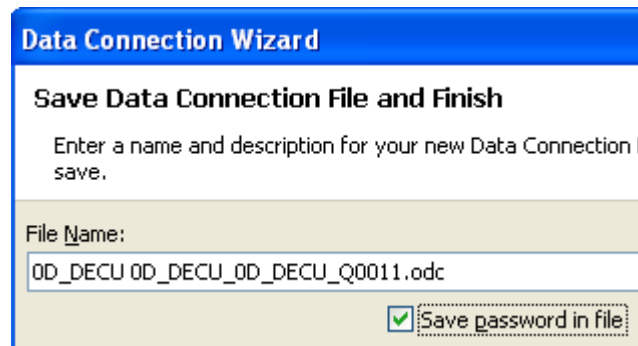
From here you can begin to explore your SAP HANA data. This is a huge topic and we won't cover it here, but now you have the tools to get started.

## Setting up Connections to Perform a Silent Logon

There are a number of ways to specify the connection parameters in Excel so that user credentials are not required when creating Pivot Tables from a connection file or opening a saved work book. The list below details the required parameters.

1. Data Source, User, Password
2. Data Source, User (if your system is configured to use single sign on)

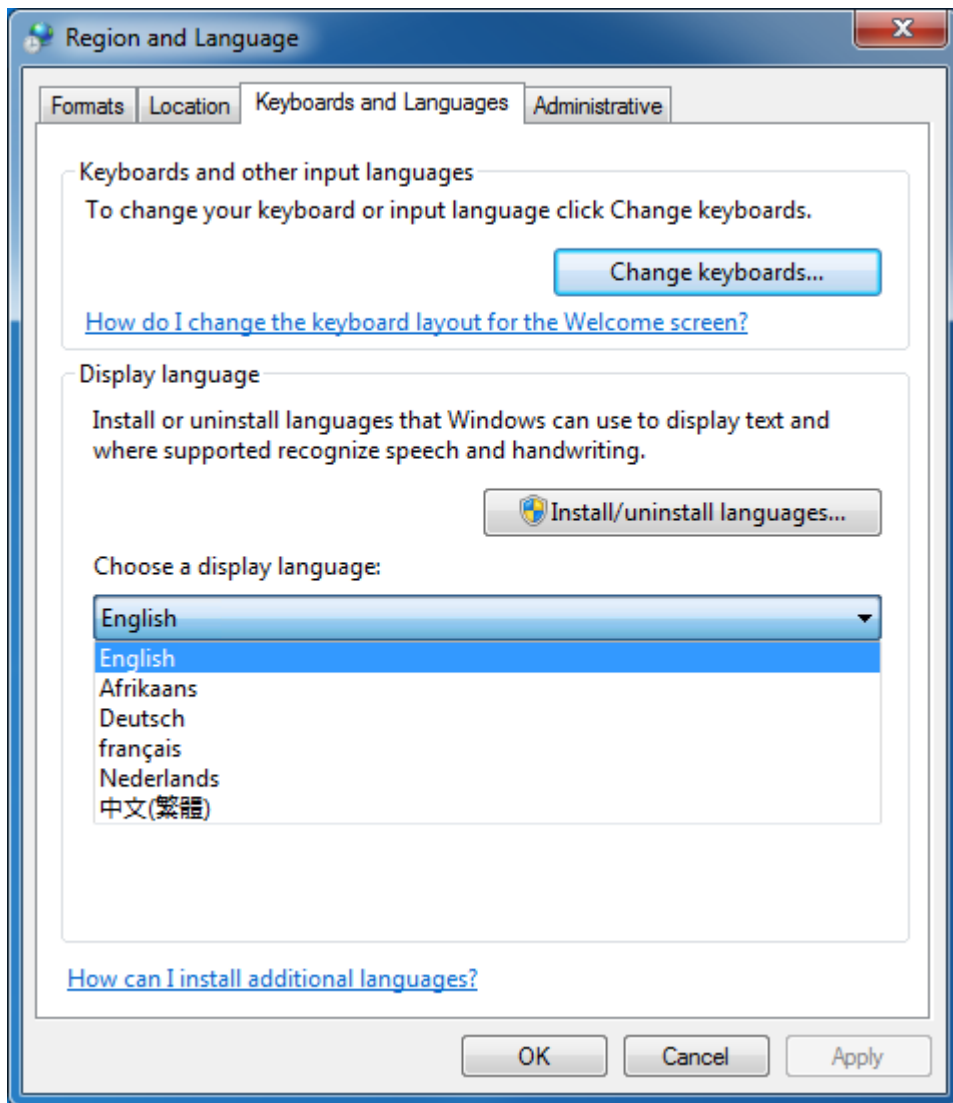
If the User and Password are specified then you must save the password in the connection file that Excel creates.



## Changing the Display Language of the User Interface

The SAP HANA client used to create a connection in the *Data Connection Wizard* currently supports English, French, German, and Japanese. The interface will switch itself automatically if the operating system is in one of these supported languages or if a language pack for the supported language is installed and is used as the Display Language. If the operating system is set to an unsupported language, the interface reverts to English. To change the Display Language, go to *Control Panel* and enter "Region and Language" into the search box at the top-right corner. Click on the *Region and Language* icon to open it and go to the *Keyboards and Languages* tab. Under the *Display language* group, click on the dropdown list to select a language.

Note that the language of Microsoft Office's user interface can be overridden by Microsoft Office Language Settings (under Microsoft Office Tools). However, the language of the SAP HANA client is controlled solely by the Window's Display Language settings.



## Excel features supported by SAP HANA 1.0

The table below lists the Excel PivotTable features supported by SAP HANA 1.0. As a comparison, the features supported by SAP NetWeaver BW 7.x are also shown. Future releases of HANA may support additional Excel features.

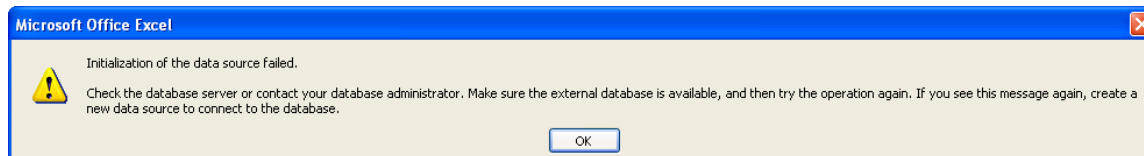
Feature	SAP HANA 1.0	SAP NetWeaver BW 7.x
Drilling Down	X	X
Selection Filtering	X	X
Top/Bottom 10 Filters	X	X
Report Filters	X	X
Member Properties	X	X
CUBE* functions		X
Convert PivotTable to Formulas		X
Server Formatting		X
Pre-modelled calculated members/measures	X	X
Show/Hide fields	X	X
Enhanced Value & Label Filters (Subqueries)		X

### Troubleshooting

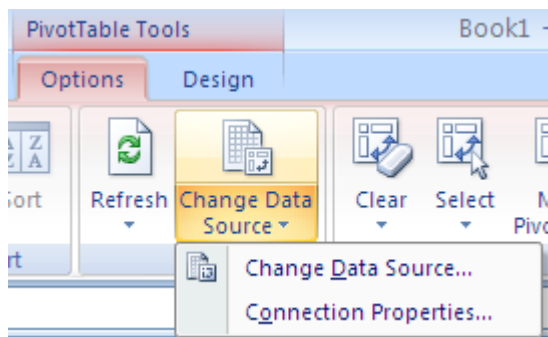
This section describes common issues that may occur when using Microsoft Excel PivotTables with SAP HANA.

#### Initialization Error When Opening Saved Workbooks

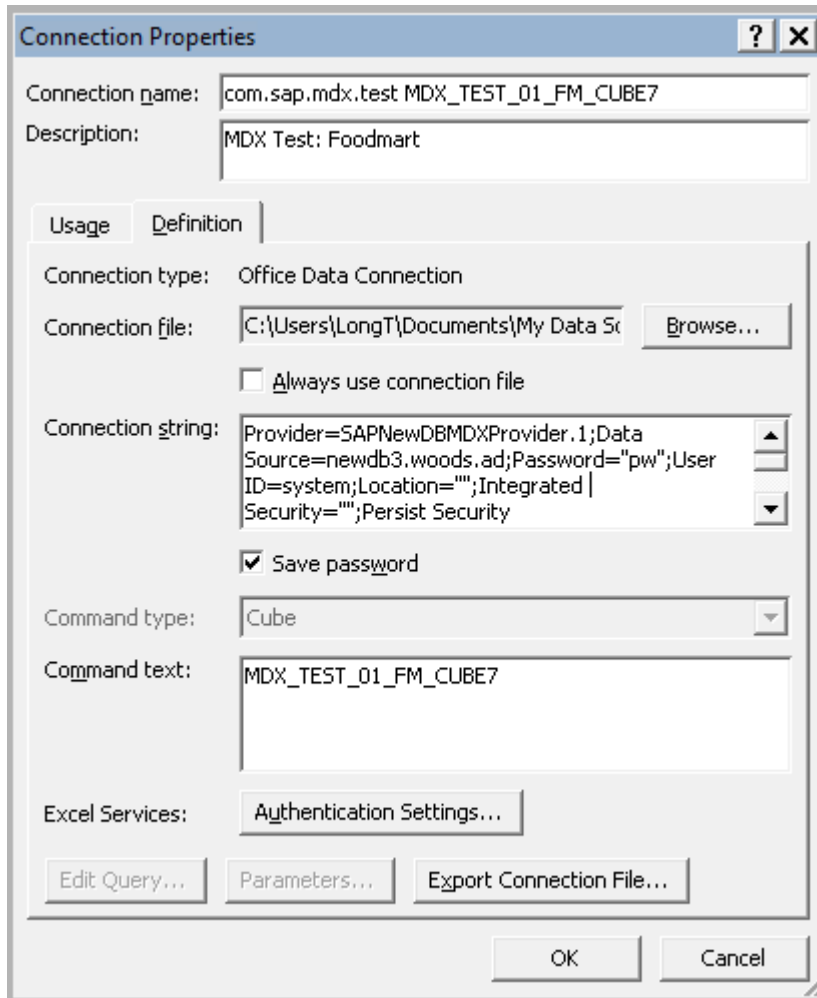
When you open a saved workbook and enable the data connection an error appears that the data source initialization failed.



This error will occur if you use User and Password authentication even if you have specified the connection parameters to perform a silent logon and saved the password in the connection file. To workaround this error you first need to have created a connection as described above to perform a silent logon. Next you need to save the password with the workbook. Under the PivotTable tab select *Change Data Source* and then *Connection Properties...*

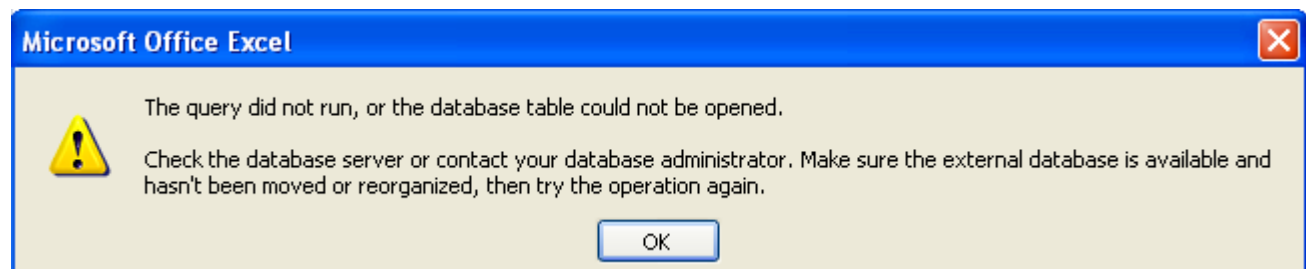


In the dialog that appears switch to the *Definition* tab and click the *Save password* checkbox. Now when you save and reopen a workbook the error will not appear.



### Query Failures

When a query error occurs Excel may display a generic error message as shown below.



This error can occur for a number of reasons as detailed in the sections below.

### Query is Too Large

Microsoft Excel 2007 removes limits on spreadsheet size that were in previous versions. In Microsoft Excel 2007 the maximum spreadsheet size is 1,048,576 rows by 16,384 columns (further information is available [here](#)). You will receive an error if you construct a PivotTable report that goes beyond those limits. You may be able to work around these limits by setting filters, selecting fewer dimensions or deferring the layout of the PivotTable until the report is completely specified.

## Excel Cannot Find SAP HANA MDX Provider

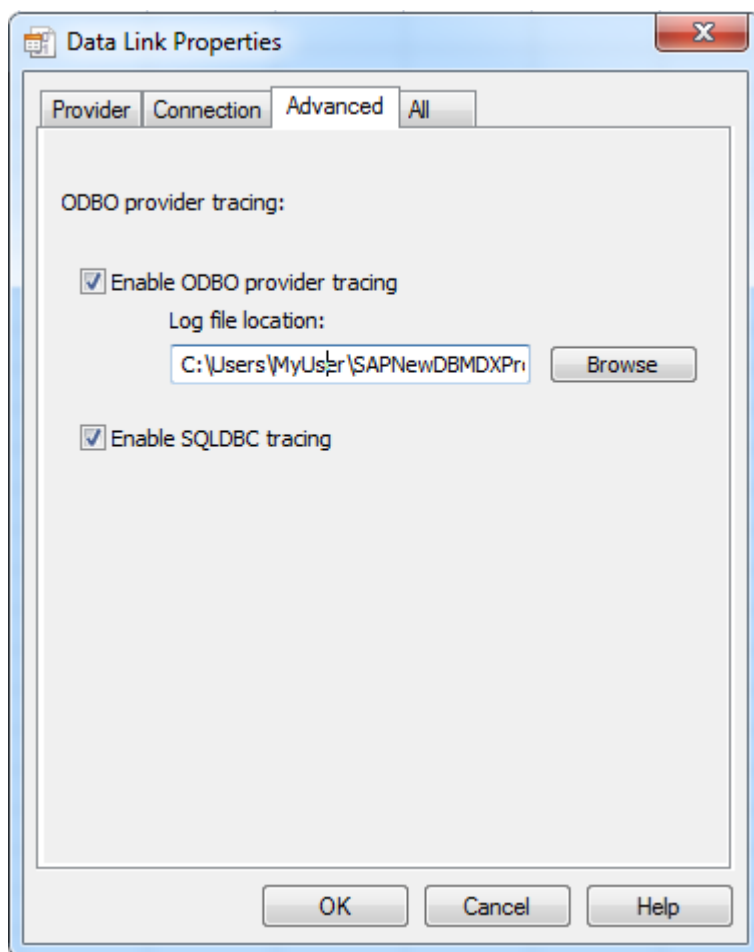
In the *Data Link Properties* window the SAP HANA MDX Provider is not present or is missing. If Excel 2010 is used, make sure the bit-width of Excel 2010 matches the provider. That is, if Excel 2010 64-bit is installed, then the 64-bit SAP HANA client must be installed. To check the bit-width of Excel 2010, go to the *File* ribbon and click on *Help*. The bit-width is indicated on the right hand side along-side the product version number. Reinstall your SAP HANA client if the problem persists after confirming that the provider's bit-width matches Excel.

### Turning on SAP HANA MDX Provider tracing

In case you need assistance from SAP support personnel you may need to provide them with trace logs. The trace settings are specified as part of the connection. When creating a connection in the *Data Link Properties* window, click on the *Advanced* tab to inspect and/or set the trace setting. There are two trace settings available: *ODBO provider* and *SQLDBC*. *ODBO provider* provides details for the OLE DB and MDX API and the operation of the client layer. You need to specify the pathname of the trace file to generate. If you wish to send multiple trace files to report different scenarios, you will want to change the pathnames after you run through each scenario.

*SQLDBC* provides further details at the level of the calls to HANA. These trace files are stored in the "current directory" which is the application's current working directory (e.g., C:\Program Files\Microsoft Office\Office12 for Excel). Each trace file is named *SQLDBC-xxxx.txt* where "xxxx" are digits.

If you are unsure of which to use, we recommend that you turn both on. Please turn on the tracing if requested by SAP support. Be sure to turn them off again after you're done.





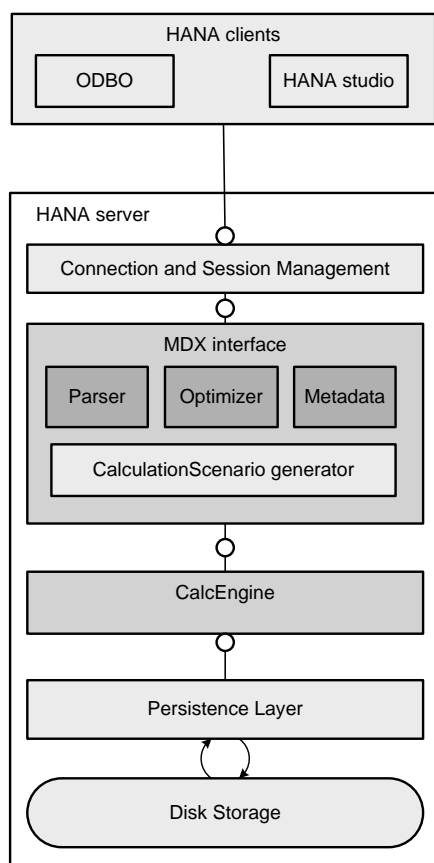
## MDX interface of SAP HANA

SAP HANA supports the query languages SQL and MDX. Both languages can be consumed via standard based interfaces. JDBC and ODBC are used for SQL-based access. ODBO is used for MDX-based access. Excel PivotTables are using MDX as a query language to read the data from SAP HANA.

### Introduction to MDX

MDX (**M**ulti**D**imensionale**X**pressions) is a query language for OLAP databases. It has been defined as part of the ODBO (OLE DB for OLAP) specification from Microsoft. It is a powerful language to define data selections, calculations and the layout of the resultset. While the query language has similarities to SQL, the underlying model is quite different. MDX is based on a multidimensional model. The metamodel consists of Cubes, Dimensions, Hierarchies, Levels and Members. These base artefacts are combined to Tuples and Sets in MDX. In addition, MDX provides a rich set of functions and methods that support common reporting and analytics requirements. These functions and methods are de-facto standard and supported by various OLAP vendors.

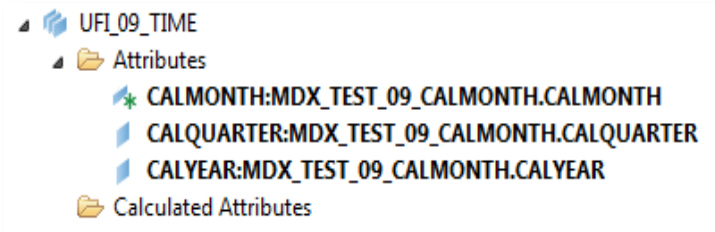
### Overall architecture



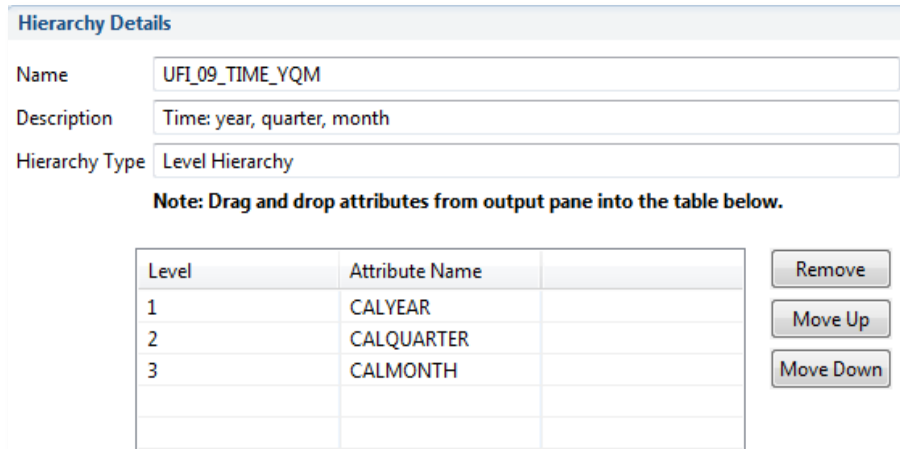
## Consumption of SAP HANA models

MDX in SAP HANA is able to consume models defined in HANA studio. This design-time environment allows you to define logical models on top of physical tables. The existing physical tables represent the data foundation for the logical model. There are the following types of model artefacts that are defined in a logical model:

- AttributeViews are typically modeled for master data tables. For example tables that represent data for customers or products. They are linked to fact tables of an AnalyticalView and add more context to the main analytical model. It is possible to define hierarchies for an AttributeView.

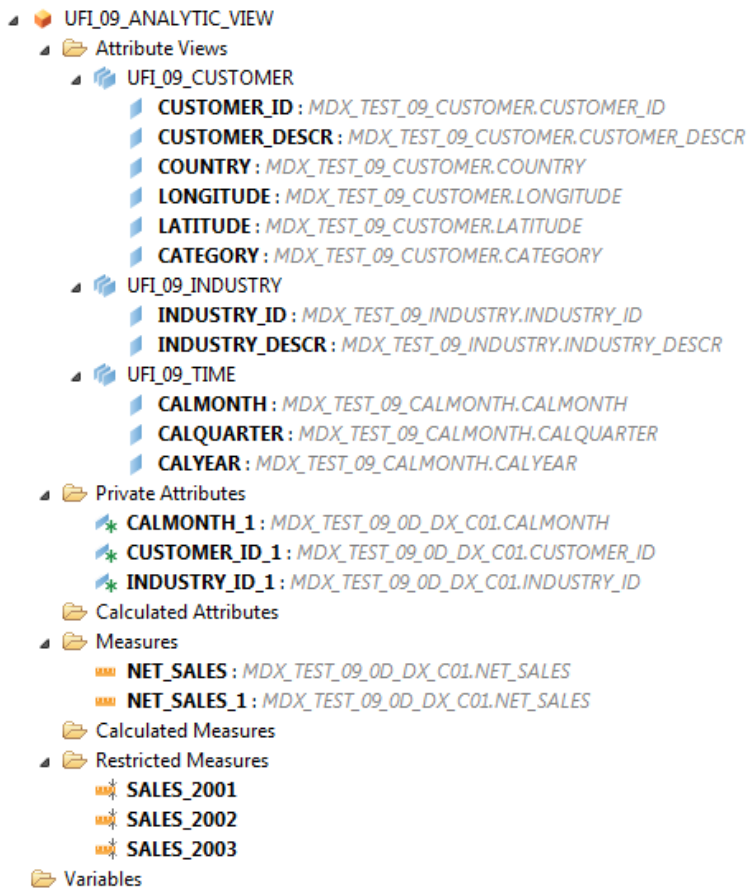


Projected table fields in an Attribute View

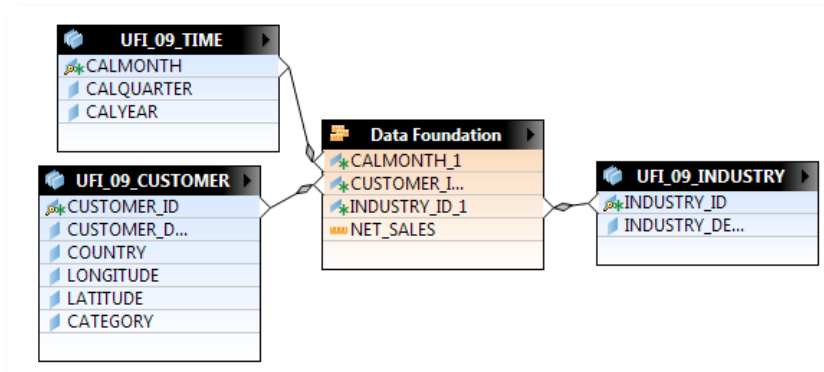


Leveled hierarchy in an Attribute View

- **AnalyticalViews** are typically modeled for fact tables, for example tables that represent sales data. Attributes and Measures are defined for AnalyticalViews. Attributes are linked to modeled AttributeViews. Measures can either be defined as base Measures, restricted- or calculated Measures.



Elements of an Analytic View



Binding of Attribute Views in an AnalyticView

- **CalculationViews** are either script-based or defined by a graphical data flow. Similar to AnalyticalViews, CalculationViews represent Cube-like datastructures. CalculationViews are much more flexible for defining data flows.

AnalyticalViews and CalculationViews are exposed as Cubes in MDX. AttributeViews are visible as Dimensions. One unique benefit of SAP HANA MDX is the native support of hierarchies defined for AttributeViews. There are two types of hierarchies in SAP HANA: level-based- and parent-child-hierarchies. Both types of hierarchies are accessible via MDX.

## Runtime integration

As a first class citizen of SAP HANA, MDX is tightly integrated into the HANA database. Statements that are executed by HANA clients, like Excel 2007, are handled by the common connection and session management of SAP HANA database. At runtime the statement is parsed by the MDX interface. Metadata references are resolved and the statement is optimized to ensure optimal runtime performance. After the optimization step, a Calculation Model is generated on the fly for a given MDX statement. The Calculation Model is translated into a native execution plan that leverages the parallelization and compression capabilities of SAP HANA's column store. Algorithms for hierarchy navigation and dimension properties are supported by the core database engine along with relational operations that ensure excellent response times. The execution plan creates the standard-based resultsets for MDX. The resultsets can be directly consumed by OLAP clients.

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