

3 THE MULTIDIMENSIONAL SOLUTION



MODULE OBJECTIVE

In the multidimensional model, data is modeled as a series of cubes and dimensions. In this module we will explore how to create and configure a cube. Dimensions will be discussed in a later module.

MODULE TOPICS



UNDERSTANDING THE MULTIDIMENSIONAL MODEL



If you are familiar with previous versions of Analysis Services, you are familiar with the multidimensional mode of BISM. This approach to multidimensional BI revolves around an entity known as a data warehouse. A data warehouse is a system of records (a BI gathering system) that takes data from a company's operational databases and other data sources and transforms it into a structure conducive to

business analysis. Business calculations are often performed on the organized data to further its usefulness for making business decisions. Finally, the data is made available to the end user for querying, reporting, and analysis. A data warehouse system that is cleansed and organized has optimized storage of historical records that gives the organization an intelligence gathering system to understand the dynamics of the business. Business analytics is a function in which information workers, business analysts, and other business users investigate business data to identify patterns and trends, and make business decisions to improve their business processes. The general approach to storing business data in a dimensional model and providing quick answers by slicing and dicing the business data is known as online analytical processing (OLAP). OLAP systems are architected in different ways. The most common types are multidimensional OLAP (MOLAP), relational OLAP (ROLAP), and hybrid OLAP (HOLAP). SQL Server 2012 multidimensional mode is a business intelligence platform that provides a scalable infrastructure with servers (Analysis Services and Reporting Services) and tools (Data Quality Services, Integration Services, Master Data Services, and Reporting Services) to extract, transform, cleanse, load, build, audit, query, and report on the data in your data warehouse.

UTILIZING DATA SOURCES AND DATA SOURCE VIEWS



DATA SOURCES

- ▶ Supported Data Sources
- ▶ Connection
- ▶ Impersonation

Cube data comes from relational databases. To access these databases you need to identify their location and supply security credentials. In SSAS this information is stored in a data source. Before you create cubes in Visual Studio, you need to have at least one data source.

Supported Data Sources

Source	Versions	File type	Providers 1
Access databases	Microsoft Access 2003, 2007, 2010.	.accdb or .mdb	Microsoft Jet 4.0 OLE DB provider OLE DB Provider for SQL Server SQL Server Native Client
SQL Server relational databases	Microsoft SQL Server 2005, 2008, 2008 R2, 2012, Windows Azure SQL Database 2	(not applicable)	OLE DB Provider SQL Server Native 11.0 Client OLE DB Provider .NET Framework Data Provider for SQL Client
SQL Server Parallel Data Warehouse (PDW)	2008 R2, 2012	(not applicable)	OLE DB provider for SQL Server PDW
			Oracle OLE DB Provider .NET Framework Data

Oracle relational databases	Oracle 9i, 10g, 11g.	(not applicable)	Provider for Oracle Client .NET Framework Data Provider for SQL Server MSOAORA OLE DB provider 4 OraOLEDB MSDASQL
Teradata relational databases	Teradata V2R6, V12	(not applicable)	TDOLEDB OLE DB provider .Net Data Provider for Teradata
Informix relational databases	V11.10	(not applicable)	Informix OLE DB provider
IBM DB2 relational databases	8.1	(not applicable)	DB2OLEDB
Sybase relational databases	V15.0.2	(not applicable)	Sybase OLE DB provider
Other relational databases	(not applicable)	(not applicable)	OLE DB provider or ODBC driver

Connection

In an Analysis Services multidimensional model, a data source object represents a connection to the data source from which you are processing (or importing) data. A multidimensional model must contain at least one data source object, but you can add more to combine data from several data warehouses. If you have previously created a connection within a solution, Visual Studio already has the data connection listed on the second screen of the Data Source Wizard. If one is not listed, click the New button to create a new connection.

Impersonation

The Impersonation Information window identifies the Windows account used for SSAS processing. This Windows account must have access to both the SQL Server relational Database Engine and the Analysis Services cube engine, because it interacts with both servers during SSAS processing.

Service Account Option

The “Use the service account” option uses a Windows Security ID associated with the account that starts up the SSAS service.

Current User Account Option

The “Use the credentials of the current user” option allows the connection to access the SQL Server and SSAS with the SID of the person using Visual Studio. Later, when a cube deploys from Visual Studio to the actual SSAS server, whatever account used to automate cube processing will become the current user. This is confusing and prone to configuration errors (Author’s opinion).

Inherit Option

One option that looks attractively simple is the Inherit option. One might consider this to be the “automatically choose for me” option since that is what it does. It automatically selects the service account for some operations and the current user’s credentials for others. This option may work in Visual Studio, but seldom will not work once the cube deploys to the SSAS server.

Specific Windows Account Option

The first option, “Use a specific Windows user name and password,” is the best choice. This option allows you to use a specific Windows account by entering the name and password in the provided textboxes.

DATA SOURCE VIEWS

- ▶ Select a Data Source
- ▶ Select Tables and Views
- ▶ Exploring Data
- ▶ Change Names to “Friendly”
- ▶ Named Queries
- ▶ Named Calculations

Microsoft does not allow cubes to be built directly on the data warehouse tables. Instead, Microsoft decided to use an abstraction layer, which is the essence of a data source view. Therefore, before you can make your cubes, you need a data source view. A data source view consists of a set of one or more logical tables with each table representing a saved SQL SELECT statement. This feature has a number of advantages. It allows you to add or modify the underlying database design to fit your current needs without breaking the cubes. If the underlying database changes, modify the data source view to present the database as it was before the change. Additionally, if the data warehouse is not designed the way you would like it to be, you can modify the data source view to mimic your ideal data warehouse design.

A data source view contains the following items:

- ▶ A name and a description
- ▶ A definition of any subset of the schema retrieved from one or more data sources, up to and including the whole schema, including the following:
 - Table names
 - Column names
 - Data types
 - Nullability
 - Column lengths
 - Primary keys
 - Primary key - foreign key relationships

Select a Data Source

The Data Source Wizard asks you to select an SSAS data source. When defining a data source view that contains tables, views, or columns from multiple data sources, the first data source from which you add objects to the data source view is designated as the primary data source (you cannot change the primary data source after it is defined). After defining a data source view based on objects from a single data source, you can then add objects from other data sources.

Select Tables and Views

Using the Add/Remove Tables dialog box, you can move tables or views between the Available objects and Included objects lists. The Available objects list initially includes any tables or views in the primary data source that are not already in the data source view.

Exploring Data

Once the view is defined you can explore the underlying table by right-clicking the table and selecting Explore Data.

Change Names to “Friendly”

Another interesting aspect of the data source view is your ability to change the names of both columns and tables.

Named Queries

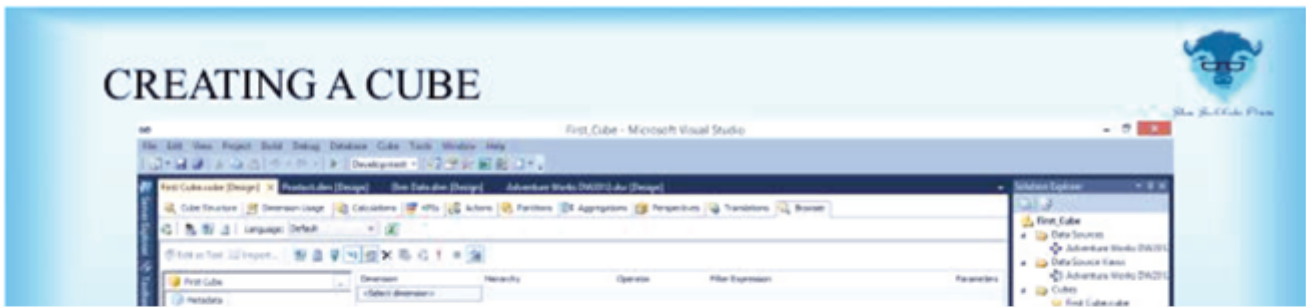
A named query is a SQL expression represented as a table. In a named query, you can specify a SQL expression to select rows and columns returned from one or more tables in one or more data sources. A named query is like any other table in a data source view with rows and relationships, except that the named query is based on an expression.

A named query lets you extend the relational schema of existing tables in a data source view without modifying the underlying data source.

Named Calculations

A named calculation is a SQL expression represented as a calculated column. This expression appears and behaves as a column in the table. A named calculation lets you extend the relational schema of existing tables or views in a data source view without modifying the tables or views in the underlying data source.

CREATING A CUBE



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A simple Cube object is composed of basic information, dimensions, and measure groups. Basic information includes the name of the cube, the default measure of the cube, the data source, the storage mode, and others.

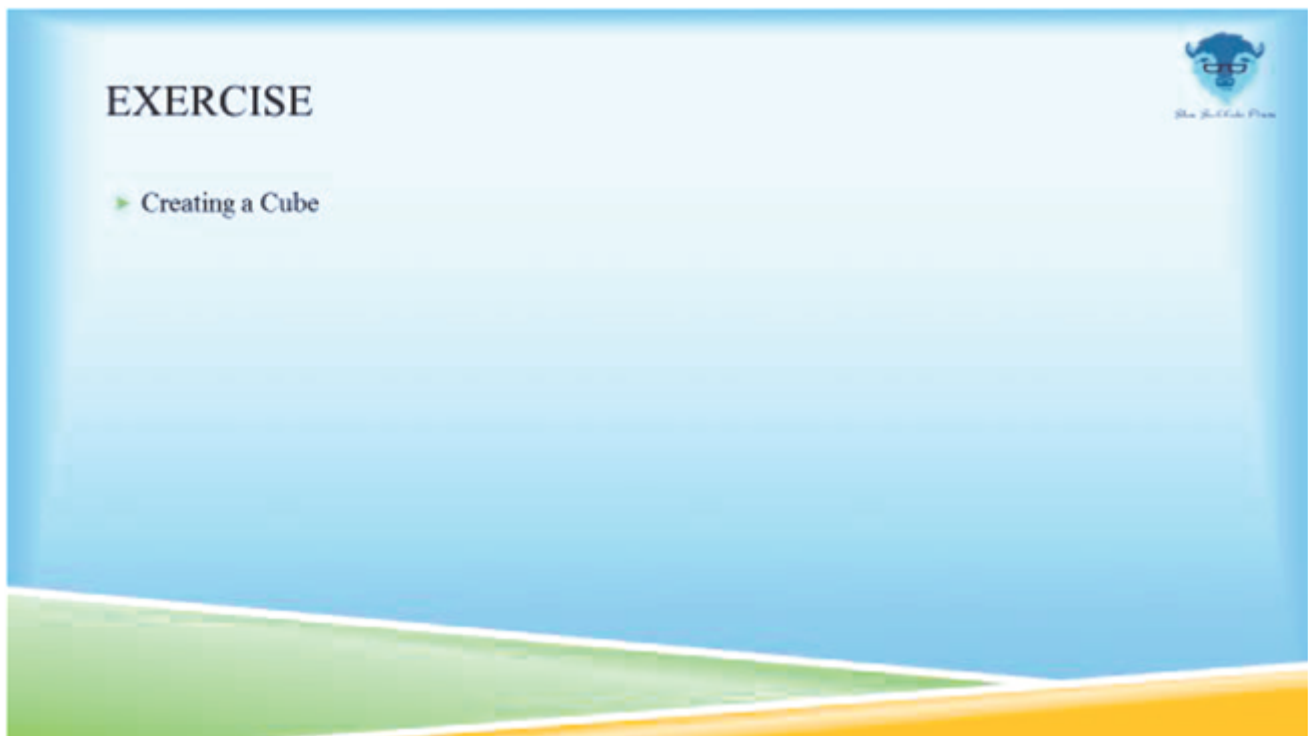
Cubes contain two major aspects: Facts and Dimensions. Facts are often numeric and additive, although that is not a requirement. Facts are sometimes called measures. For the purpose of this course the two terms are interchangeable. An example of a fact is gross sales amount. Dimensions give meanings to facts. Combining the aspect of facts and dimensions we get cubes.

DEMONSTRATION

VIDEO: CREATING A CUBE

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EXERCISE A.1: CREATING A CUBE

Objective: in this exercise we will create a cube.

- A.1.1 Navigate down to the taskbar, right-click **SQL Server Data Tools** icon, right-click the new **SQL Server Data Tools** icon showing, and then click **Run as administrator**.
- A.1.2 In the **User Account Control** dialog box, click **Yes**.

- A.1.3 When **Microsoft Visual Studio** opens, click **New Project....**
- A.1.4 When the **New Project** dialog box opens, navigate to the left side of the dialog box, in the **Installed Templates** section, verify **Business Intelligence** is selected, then move to the middle of the dialog box, and click to select **Analysis Services Multidimensional and Data Mining Project**.
- A.1.5 Click **Browse....**
- A.1.6 In the **Project Location** dialog box, navigate to **C: | Lab Files | Student**.



If you don't see the Student folder listed, create a new folder and name it Student.

- A.1.7 Inside the **Student** folder, create a new folder, and name it **03 The Multidimensional Solution**.
- A.1.8 Open the **03 The Multidimensional Solution** folder.
- A.1.9 Click **Select Folder**.
- A.1.10 Back in the **New Project** dialog box, navigate to the **Name** text box and change the name to **First_Cube**.
- A.1.11 Click **OK**.
- A.1.12 Navigate to **Solution Explorer** pane on the right, right-click **Data Sources** folder and click **New Data Source....**
- A.1.13 In the **Welcome to the Data Source Wizard** dialog box, review the welcome message, then click **Next**.
- A.1.14 When the **Select how to define the connection** dialog box opens, review the options and settings available.
- A.1.15 Click **New....**
- A.1.16 When the **Connection Manager** dialog box opens, review the settings and options available.

A.1.17 Navigate to the **Server name** text box and enter . .



A.1.18 In the **Connect to a database** section, move to the **Select or enter a database name** setting, use the drop-down arrow provided and click to select **AdventureWorksDW2012**.

A.1.19 Click **Test Connection**.

A.1.20 In the **Connection Manager** dialog box advising **Test connection succeeded**, click **OK**.

A.1.21 Back at the **Connection Manager** dialog box, click **OK**.

A.1.22 At the **Select how to define the connection** dialog box, review the settings and then click **Next**.

A.1.23 In the **Impersonation Information** dialog box, review the settings and options available.

A.1.24 Navigate to the **User name** text box and enter Quick\Student.

A.1.25 Move to the **Password** text box and enter Passw0rd. (*The 0 is numeric.*)

A.1.26 Click **Next**.

A.1.27 In the **Completing the Wizard** dialog box, review the settings.

A.1.28 Click **Finish**.

A.1.29 Navigate back to **Solution Explorer** pane on the right and review the results in the **Data Sources** folder.

A.1.30 Right-click **Data Source Views** folder, and click **New Data Source View....**

A.1.31 In the **Welcome to the Data Source View Wizard** dialog box, review the welcome message, then click **Next**.


A.1.32 In the **Select a Data Source** dialog box, review the settings.

A.1.33 Click **Next**.

A.1.34 When the **Select Tables and Views** dialog box opens, review the settings and options available.

A.1.35  Maximize the window.

A.1.36 Navigate to the **Available objects** section and click to select **DimDate (dbo)**.

A.1.37 Click  and notice **DimDate (dbo)** is now listed in the **Included objects** section.

A.1.38 Navigate back to the **Available objects** section and click to select **DimProduct (dbo)**.

A.1.39 Press and hold **CTRL**.

A.1.40 Navigate back to the **Available objects** section and click to select **DimProductCategory (dbo)**, **DimProductSubcategory (dbo)**, **FactInternetSales (dbo)**, and **FactResellerSales (dbo)**.

A.1.41 Click and notice **DimProduct (dbo)**, **DimProductCategory (dbo)**, **DimProductSubcategory (dbo)**, **FactInternetSales (dbo)**, and **FactResellerSales (dbo)** are now listed in the **Included objects** section.

A.1.42 Click **Next**.

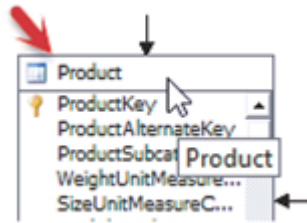
A.1.43 In the **Completing the Wizard** dialog box, review the settings.

A.1.44 Click **Finish**. Review the results.

A.1.45 Navigate to the design area and click to select **DimProduct** table.

A.1.46 Move to the lower-right, locate the **Properties** pane, move to the **FriendlyName** setting, click into the corresponding row, and delete **Dim** from the name, leaving only **Product** listed.

A.1.47 Click back into the design area and review the results, noticing the name was changed.



- A.1.48 Navigate to **Solution Explorer** pane on the right, right-click **Dimensions** folder, and click **New Dimension....**
- A.1.49 In the **Welcome to the Dimension Wizard** dialog box, review the welcome message, and then click **Next**.
- A.1.50 When the **Select Creation Method** dialog box opens, review the options and settings available.
- A.1.51 Leave **Use an existing table** selected, and click **Next**.
- A.1.52 In the **Specify Source Information** dialog box, review the settings.
- A.1.53 Click **Next**.
- A.1.54 When the **Select Dimension Attributes** dialog box opens, review the options.
- A.1.55 Navigate to the **Available attributes** section, and place checks in the **Calendar Quarter**, **Calendar Year**, **Fiscal Quarter**, and **Fiscal Year** check boxes.
- A.1.56 Click **Next**.
- A.1.57 In the **Completing the Wizard** dialog box, review the settings.
- A.1.58 Click **Finish**. Review the results.
- A.1.59 Navigate to **Solution Explorer** pane on the right, right-click **Dimensions** folder, and click **New Dimension....**
- A.1.60 In the **Welcome to the Dimension Wizard** dialog box, review the welcome message, and then click **Next**.
- A.1.61 When the **Select Creation Method** dialog box opens, review the options and settings available.

- A.1.62 Leave **Use an existing table** selected, and click **Next**.
- A.1.63 In the **Specify Source Information** dialog box, review the settings.
- A.1.64 Move to the **Main table** setting, use the corresponding drop-down arrow, and click to select **Product**.
- A.1.65 Click **Next**.
- A.1.66 When the **Select Related Tables** dialog box opens, review the options.
- A.1.67 Clear the check from the **DimProductSubcategory** check box.
- A.1.68 Click **Next**.
- A.1.69 In the **Select Dimension Attributes** dialog box, review the options available.
- A.1.70 Scroll down and clear the check from the **Product Subcategory Key** check box.
- A.1.71 Navigate to the **Available attributes** section and place a check in the **English Product Name** check box.
- A.1.72 Place checks in the **Standard Cost**, and **Color** check boxes.
- A.1.73 Click **Next**.
- A.1.74 In the **Completing the Wizard** dialog box, review the settings.
- A.1.75 Click **Finish**. Review the results.
- A.1.76 Move to **Solution Explorer** pane on the right, locate the **Dimensions** folder, and review the results noticing both new dimensions are listed.
- A.1.77 Right-click **Cubes** folder and click **New Cube....**
- A.1.78 In the **Welcome to the Cube Wizard** dialog box, review the welcome message.
- A.1.79 Click **Next**.
- A.1.80 In the **Select Creation Method** dialog box, review the options available.
- A.1.81 Leave **Use existing tables** selected, and click **Next**.

- A.1.82 When the **Select Measure Group Tables** dialog box opens, review the options available.
- A.1.83 Move to the **Measure group tables** section, and place checks in both the **FactInternetSales** and **FactResellerSales** check boxes.
- A.1.84 Click **Next**.
- A.1.85 In the **Select Measures** dialog box, review the options available, and then click **Next**.
- A.1.86 In the **Select Existing Dimensions** dialog box, review the current dimensions, and then click **Next**.
- A.1.87 When the **Select New Dimensions** dialog box opens, review the current settings.
- A.1.88 Clear the check from the **Fact Internet Sales** dimension check box.
- A.1.89 Clear the check from the **Fact Reseller Sales** Dimension check box.



All check boxes should now be cleared.

- A.1.90 Click **Next**.
- A.1.91 In the **Completing the Wizard** dialog box, review the settings.
- A.1.92 Navigate to the **Cube name** text box and change the name to First Cube.
- A.1.93 Click **Finish**. Review the results.
- A.1.94 Move to the **Dimensions** pane in the lower-left, click to select **Order Date** dimension, right-click the same dimension, and click **Delete**.
- A.1.95 In the dialog box advising **The following objects will be deleted**, click **OK**. Review the results noticing the dimension is no longer listed.
- A.1.96 Move back to the **Dimensions** pane in the lower-left, click to select **Ship Date** dimension, right-click the same dimension, and click **Delete**.

- A.1.97 In the dialog box advising **The following objects will be deleted**, click **OK**. Review the results noticing the dimension is no longer listed.
- A.1.98 Navigate to the **Solution Explorer** pane on the right, right-click the **First_Cube** project, then click **Build**.
- A.1.99 Notice in the lower-left you see **Build succeeded**.
- A.1.100 Move back to the **Solution Explorer** pane on the right, right-click the **First_Cube** project, then click **Deploy**.
- A.1.101 Notice in the lower-left you see **Deploy succeeded**.
- A.1.102 Click **Browser** tab.
- A.1.103 When the browser opens, move to the **Metadata** pane on the left, and expand **Measures**. Review the results.
- A.1.104 Expand **Fact Internet Sales** folder. Review the results.
- A.1.105 Locate **Sales Amount**, right-click the measure, and click **Add to Query**. Review the results.
- A.1.106 Expand **Fact Reseller Sales** folder. Review the results.
- A.1.107 Locate **Sales Amount - Fact Reseller Sales**, right-click the measure, and click **Add to Query**. Review the results.
- A.1.108 Expand **Product** dimension.
- A.1.109 Locate **English Product Name**, right-click the dimension, and then click **Add to Query**. Review the results.
- A.1.110 Click the header cell for the **English Product Name** column, then right-click that same cell, and click **Delete English Product Name**. Review the results noticing the column is no longer listed.
- A.1.111 Move back to the **Metadata** pane on the left, and expand **Due Date** dimension.
- A.1.112 Locate **Fiscal Quarter**, right-click the dimension, and then click **Add to Query**. Review the results.

A.1.113 Move back to the **Metadata** pane on the left, locate **Fiscal Year**, right-click the dimension, and then click **Add to Query**. Review the results.

A.1.114 Navigate up to the toolbar and click  (**Save All**).

A.1.115 Switch to **SQL Server Management Studio**.

A.1.116 Back in **SQL Server Management Studio**, navigate to the **Object Explorer** pane on the left, right-click the **Databases** folder within the **Analysis Server** connection, and click **Refresh**.

A.1.117 Expand **Databases** folder and review the results noticing **First_Cube** is now listed.

A.1.118 Leave all windows open.

MODULE REVIEW



MODULE OBJECTIVE

In the multidimensional model, data is modeled as a series of cubes and dimensions. In this module we will explore how to create and configure a cube. Dimensions will be

discussed in a later module.

REVIEW QUESTIONS



1. A _____ is a system of records (a BI gathering system) that takes data from a _____ company's operational databases and other data sources and transforms it into a structure conducive to business analysis.
2. OLAP systems are architected in different ways. Name the three most common types.
3. The _____ window identifies the Windows account used for SSAS processing.
4. A _____ is a SQL expression represented as a calculated column.
5. Cubes contain two major aspects: _____ and _____.

REVIEW QUESTIONS ANSWERED



1. A _____ is a system of records (a BI gathering system) that takes data from a company's operational databases and other data sources and transforms it into a structure conducive to business analysis.
 - a. Data warehouse
2. OLAP systems are architected in different ways. Name the three most common types.
 - a. Multidimensional OLAP (MOLAP), relational OLAP (ROLAP), and hybrid OLAP (HOLAP)
3. The _____ window identifies the Windows account used for SSAS processing.
 - a. Impersonation Information
4. A _____ is a SQL expression represented as a calculated

column.

a. Named calculation

5. Cubes contain two major aspects: _____ and _____.

a. Facts and Dimensions

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