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SQL Server Analysis Services 2008

Lab Book

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Creating Dimensions and Cube based on Data Source and Data Source View

Lab 1	Creating Dimensions and Cube based on Data Source and Data Source View
Description	We will be creating a SSAS Project. We will be creating Data source and Data Source Views to build OLAP solution
Objective	To learn 1. How to start off with New Analysis Services Project and Define the Data Source Views which includes required relational tables.

To create a new Analysis Services project

1. Click **Start**, point to **All Programs**, point to **Microsoft SQL Server**, and then click **SQL Server Business Intelligence Development Studio**.

The Microsoft Visual Studio development environment opens.

2. On the **File** menu of Visual Studio, point to **New**, and then click **Project**.

3. In the **New Project** dialog box, select **Business Intelligence Projects** in the **Project types** pane, and then select **Analysis Services Project** in the **Templates** pane.

Notice the default project name, the default solution name, and the default project location in the bottom of the dialog box. By default, a new directory will be created for the solution.

4. Change the project name to **Analysis Services Tutorial**, which also changes the solution name, and then click **OK**.

After you create an Analysis Services project, you generally start working with the project by defining one or more data sources that the project will use. When you define a data source, you are defining the connection string information that will be used to connect to the data source.

To define a new data source

1. In Solution Explorer, right-click **Data Sources**, and then click **New Data Source**.

2. On the **Welcome to the Data Source Wizard** page, click **Next** to open the **Select how to define the connection** page.

3. On the **Select how to define the connection** page, you can define a data source based on a new connection, based on an existing connection, or based on a previously defined data source object. In this tutorial, you define a data source based on a new connection. Verify that **Create a data source based on an existing or new connection is selected** and then click **New**.

4. In the **Connection Manager** dialog box, you define connection properties for the data source. In the **Provider** list, verify that **Native OLE DB\SQL Server Native Client 10.0** is selected.

Analysis Services also supports other providers, which are displayed in the **Provider** list.

5. In the **Server name** text box, type **localhost**.

To connect to a named instance on your local computer, type **localhost\<instance name>**. To connect to the specific computer instead of the local computer, type the computer name or IP address.

6. Verify that **Use Windows Authentication** is selected. In the **Select or enter a database name** list, select **AdventureWorksDW**.

7. Click **Test Connection** to test the connection to the database.

8. Click **OK**, and then click **Next**.

9. On the **Impersonation Information** page of the wizard, you define the security credentials for Analysis Services to use to connect to the data source. Impersonation affects the Windows account used to connect to the data source when Windows Authentication is selected. Analysis Services does not support impersonation for processing OLAP objects. Select **Use the service account**, and then click **Next**.

10. On the **Completing the Wizard** page, click **Finish** to create the new data source with the name **Adventure Works DW**.

To define a new data source view

1. In Solution Explorer, right-click **Data Source Views**, and then click **New Data Source View**.

2. On the **Welcome to the Data Source View Wizard** page, click **Next**.

3. The **Select a Data Source** page appears. Under **Relational data sources**, the **Adventure Works DW** data source is selected. Click **Next**.

> **Note:**
> To create a data source view that is based on multiple data sources, you first define a data source view that is based on a single data source. This data source is then called the primary data source. You can then add tables and views from a secondary data source. When designing dimensions that contain attributes based on related tables in multiple data sources, you might have to define a Microsoft SQL Server data source as the primary data source to use its distributed query engine capabilities.

4. On the **Select Tables and Views** page, you select tables and views from the list of objects that are available from the selected data source. You can filter this list to help you in selecting tables and views.

> **Note:**
> Click the maximize button in the upper-right corner so that the window covers the full screen. This will make it easier to see the complete list of available objects.

5. In the **Available objects** list, select the following objects. You can select multiple tables by clicking each while holding down the CTRL key:

   - **DimCustomer (dbo)**
   - **DimGeography (dbo)**
   - **DimProduct (dbo)**
   - **DimTime (dbo)**
   - **FactInternetSales (dbo)**

6. Click **>** to add the selected tables to the **Included objects** list.

7. Click **Next**, and then click **Finish** to define the Adventure Works DW data source view.

The **Adventure Works DW** data source view appears in the **Data Source Views** folder in Solution Explorer. The content of the data source view is also displayed in Data Source View Designer in Business Intelligence Development Studio. This designer contains the following elements:

- A **Diagram** pane in which the tables and their relationships are represented graphically.
- A **Tables** pane in which the tables and their schema elements are displayed in a tree view.
- A **Diagram Organizer** pane in which you can create subdiagrams so that you can view subsets of the data source view.
- A toolbar that is specific to Data Source View Designer.

8. To maximize the Microsoft Visual Studio development environment, click the **Maximize** button.

9. To view the tables in the **Diagram** pane at 50 percent, click the **Zoom** icon on the Data Source View Designer toolbar. This will hide the column details of each table.

10. To hide Solution Explorer, click the **Auto Hide** button, which is the pushpin icon on the title bar. To view Solution Explorer again, position your pointer over the Solution Explorer tab along the right side of the development environment. To unhide Solution Explorer, click the **Auto Hide** button again.

11. If the window is not hidden by default, click **Auto Hide** on the title bar of the Properties window.

You can now view all the tables and their relationships in the **Diagram** pane. Notice that there are three relationships between the FactInternetSales table and the DimTime table. Each sale has three dates associated with the sale: an order date, a due date, and a ship date. To view the details of any relationship, double-click the relationship arrow in the **Diagram** pane You can change the value of the **Friendly Name** property for objects in the data source view to increase the user-friendliness of their names.

To modify the default name of a table

1. In the **Tables** pane of **Data Source View Designer**, right-click the **FactInternetSales** table, and then click **Properties** to display the properties for the **FactInternetSales** object in the Adventure Works Tutorial data source view.

2. Click the **Auto Hide** button on the title bar of the Properties window so that this window will remain visible.

It is easier to change the properties for each table in the data source view when the Properties window remains open. If you do not pin the window open by using the **Auto Hide** button, the window will close when you click a different object in the **Diagram** pane.

3. Change the **FriendlyName** property for the **FactInternetSales** object to **InternetSales**.

When you click away from the cell for the **FriendlyName** property, the change is applied. In the next lesson, you will define a measure group that is based on this fact table. The name of the fact table will be InternetSales instead of FactInternetSales because of the change you made in this lesson.

4. Click **DimProduct** in the **Tables** pane. In the Properties window, change the **FriendlyName** property to **Product**.

5. Change the **FriendlyName** property of each remaining table in the data source view in the same way, to remove the "**Dim**" prefix.

6. When you have finished, click the **Auto Hide** button to hide the Properties window again.

7. On the **File** menu, or on the toolbar of BI Development Studio, click **Save All** to save the changes you have made to this point in the Analysis Services Tutorial project. You can stop the tutorial here if you want and resume it later.

Creating Dimensions and building a Cube.

Lab 2	Creating Dimensions and building a Cube.
Description	After we define a Data Source View in Microsoft Analysis Services project, we are going to Define an Initial Analysis Services Cube by defining dimensions and building a Cube
Objective	To learn How to Create a Time Dimension How to Create a Initial Cube with Dimension using wizard How to Customize the Dimensions Defining Named Calculations in DSVs Defining Attribute Hierarchies Defining Attribute Relationships Deploying the Cube and Browsing the Cube Result

To define a dimension

1. In Solution Explorer, right-click **Dimensions**, and then click **New Dimension**.
2. On the **Welcome to the Dimension Wizard** page, click **Next**.
3. On the **Select Creation Method** page, verify that the **Use an existing table** option is selected, and then click **Next**.
4. On the **Specify Source Information** page, verify that the Adventure Works DW data source view is selected.
5. In the **Main table** list, select **Time**.
6. Click **Next**.
7. On the **Select Dimension Attributes** page, select the check boxes next to the following attributes:
   - **Time Key**
   - **Full Date Alternate Key**
   - **English Month Name**
   - **Calendar Quarter**
   - **Calendar Year**
   - **Calendar Semester**
8. Change the setting of the **Full Date Alternate Key** attribute's **Attribute Type** column from **Regular** to **Date**. To do this, click **Regular** in the **Attribute Type** column. Then click the arrow to expand the options. Next, click **Date** > **Calendar** > **Date**. Click **OK**. Repeat these steps to change the attribute type of the following attributes as follows:

- **English Month Name** to **Month**
- **Calendar Quarter** to **Quarter**
- **Calendar Year** to **Year**
- **Calendar Semester** to **Half Year**

9. Click **Next**.
10. On the **Completing the Wizard** page, in the Preview pane, you can see the **Time** dimension and its attributes.
11. Click **Finish** to complete the wizard.

    In Solution Explorer, in the Analysis Services Tutorial project, the Time dimension appears in the **Dimensions** folder. In the center of the development environment, Dimension Designer displays the Time dimension.

12. On the **File** menu, click **Save All**.

The Cube Wizard helps you define the measure groups and dimensions for a cube. In the following task, you will use the Cube Wizard to build a cube.

To define a cube and its properties

1. In Solution Explorer, right-click **Cubes**, and then click **New Cube**.
2. On the **Welcome to the Cube Wizard** page, click **Next**.
3. On the **Select Creation Method** page, verify that the **Use existing tables** option is selected, and then click **Next**.
4. On the **Select Measure Group Tables** page, verify that the Adventure Works DW data source view is selected.
5. Click **Suggest** to have the cube wizard suggest tables to use to create measure groups.

   The wizard examines the tables and suggests **InternetSales** as a measure group table. Measure group tables, also named fact tables, contain the measures you are interested in such as the number of units sold.

6. Click **Next**.
7. On the **Select Measures** page, review the selected measures in the **Internet Sales** measure group, and then clear the check boxes for the following measures:

   - **Promotion Key**
   - **Currency Key**
   - **Sales Territory Key**
   - **Revision Number**

By default, the wizard selects as measures all numeric columns in the fact table that are not linked to dimensions. However, these four columns are not actual measures. The first three are key values that link the fact table with dimension tables that are not used in the initial version of this cube.

8. Click **Next**.

9. On the **Select Existing Dimensions** page, select the **Time** dimension that you created earlier and then click **Next**.

10. On the **Select New Dimensions** page, select the new dimensions to be created. To do this, verify that the **Customer**, **Geography** and **Product** check boxes are selected and clear the **InternetSales** check box.

11. Click **Next**.

12. On the **Completing the Wizard** page, change the name of the cube to **Analysis Services Tutorial**. In the Preview pane, you can see the **InternetSales** measure group and its measures. You can also see the **Time**, **Customer,** and **Product** dimensions.

13. Click **Finish** to complete the wizard.

In Solution Explorer, in the Analysis Services Tutorial project, the Analysis Services Tutorial cube appears in the **Cubes** folder, and database dimensions appear in the **Dimensions** folder. Additionally, in the center of the development environment, Cube Designer displays the Analysis Services Tutorial cube.

14. On the toolbar of Cube Designer, change the **Zoom** level to 50 percent, so that you can more easily see the dimensions and fact tables in the cube. Notice that the fact table is yellow and the dimension tables are blue.

15. On the **File** menu, click **Save All**.

Adding Attributes to the Customer Dimension

1. Open Dimension Designer for the Customer dimension. To do this, double-click the Customer dimension in the Dimensions node of Solution Explorer.

2. In the **Attributes** pane, notice the Customer Key and Geography Key attributes that were created by the Cube Wizard.

3. On the toolbar of the **Dimension Structure** tab, use the Zoom icon to view the tables in the **Data Source View** pane at 100 percent.

4. Drag the following columns from the Customer table in the **Data Source View** pane to the **Attributes** pane:

- **BirthDate**
- **MaritalStatus**
- **Gender**
- **EmailAddress**
- **YearlyIncome**
- **TotalChildren**
- **NumberChildrenAtHome**

- **EnglishEducation**
- **EnglishOccupation**
- **HouseOwnerFlag**
- **NumberCarsOwned**
- **Phone**
- **DateFirstPurchase**
- **CommuteDistance**

5. Drag the following columns from the Geography table in the **Data Source View** pane to the **Attributes** pane:

- **City**
- **StateProvinceName**
- **EnglishCountryRegionName**
- **PostalCode**

6. On the File menu, click **Save All**.

Adding Attributes to the Product Dimension

1. Open Dimension Designer for the Product dimension.

2. In the **Attributes** pane, notice the Product Key attribute that was created by the Cube Wizard.

3. On the toolbar of the **Dimension Structure** tab, use the Zoom icon to view the tables in the **Data Source View** pane at 100 percent.

4. Drag the following columns from the Products table in the **Data Source View** pane to the **Attributes** pane:

- **StandardCost**
- **Color**
- **SafetyStockLevel**
- **ReorderPoint**
- **ListPrice**
- **Size**
- **SizeRange**

- **Weight**
- **DaysToManufacture**
- **ProductLine**
- **DealerPrice**
- **Class**
- **Style**
- **ModelName**
- **StartDate**
- **EndDate**
- **Status**

5. On the File menu, click **Save All**.

To deploy the Analysis Services project

1. In Solution Explorer, right-click the **Analysis Services Tutorial** project, and then click **Properties**.

The **Analysis Services Tutorial Property Pages** dialog box appears and displays the properties of the Active(Development) configuration. You can define multiple configurations, each with different properties. For example, a developer might want to configure the same project to deploy to different development computers and with different deployment properties, such as database names or processing properties. Notice the value for the **Output Path** property. This property specifies the location in which the XMLA deployment scripts for the project are saved when a project is built. These are the scripts that are used to deploy the objects in the project to an instance of Analysis Services.

2. In the **Configuration Properties** node in the left pane, click **Deployment**.

Review the deployment properties for the project. By default, the Analysis Services Project template configures an Analysis Services project to incrementally deploy all projects to the default instance of Analysis Services on the local computer, to create an Analysis Services database with the same name as the project, and to process the objects after deployment by using the default processing option. **Related topic:** Configuring Analysis Services Project Properties

Note:
If you want to deploy the project to a named instance of Analysis Services on the local computer, or to an instance on a remote server, change the **Server** property to the appropriate instance name, such as <*ServerName*>\<*InstanceName*>.

3. Click **OK**.

4. In Solution Explorer, right-click the **Analysis Services Tutorial** project, and then click **Deploy**.

Business Intelligence Development Studio builds and then deploys the Analysis Services Tutorial project to the specified instance of Analysis Services by using a deployment script. The progress of the deployment is displayed in two windows: the **Output** window and the **Deployment Progress – Analysis Services Tutorial** window. Open the Output window, if

necessary, by clicking **Output** on the **View** menu. The **Output** window displays the overall progress of the deployment. The **Deployment Progress – Analysis Services Tutorial** window displays the detail about each step taken during deployment.
Related topics: Building Analysis Services Projects, Deploying Analysis Services Projects

5. Review the contents of the **Output** window and the **Deployment Progress – Analysis Services Tutorial** window to verify that the cube was built, deployed, and processed without errors.

6. Hide the **Deployment Progress - Analysis Services Tutorial** window by clicking the **Auto Hide** icon on the toolbar of the window.

7. Hide the **Output** window by clicking the **Auto Hide** icon on the toolbar of the window.

You have successfully deployed the Analysis Services Tutorial cube to your local instance of Analysis Services, and then processed the deployed cube.

To browse the deployed cube

1. Switch to **Dimension Designer** for the Product dimension in Business Intelligence Development Studio. To do this, double-click the **Product** dimension in the **Dimensions** node of Solution Explorer.

2. Click the **Browser** tab to display the **All** member of the **Product Key** attribute hierarchy. In lesson three, you will define a user hierarchy for the Product dimension that will let you browse the dimension.

3. Switch to **Cube Designer**

Modifying Measures, Attributes and Hierarchies

1. Switch to the **Cube Structure** tab of Cube Designer for the Analysis Services Tutorial cube, expand the **Internet Sales** measure group in the **Measures** pane, right-click **Order Quantity**, and then click **Properties**.

2. In the Properties window, click **Auto Hide** to pin the Properties window open.

   It is easier to change properties for several items in the cube when the Properties window remains open.

3. In the Properties window, in the **Format String** list, type **#,#**.

4. On the toolbar of the **Cube Structure** tab, click **Show Measures Grid**.

   The grid view lets you select multiple measures at the same time.

5. Select the following measures. You can select multiple measures by clicking each while holding down the CTRL key:

   - **Unit Price**
   - **Extended Amount**
   - **Discount Amount**
   - **Product Standard Cost**
   - **Total Product Cost**

- **Sales Amount**
- **Tax Amt**
- **Freight**

6. In the Properties window, in the **FormatString** list, select **Currency**.

7. In the drop-down list at the top of the Properties window, select the measure **Unit Price Discount Pct**, and then select **Percent** in the **FormatString** list.

8. In the Properties window, change the **Name** property for the **Unit Price Discount Pct** measure to **Unit Price Discount Percentage**.

9. In the **Measures** pane, click **Tax Amt** and change the name of this measure to **Tax Amount**.

10. In the Properties window, click **Auto Hide** to hide the Properties window, and then click **Show Measures Tree** on the toolbar of the **Cube Structure** tab.

11. On the **File** menu, click **Save All**.

Modifying the Customer Dimension

To rename an attribute

1. Switch to **Dimension Designer** for the Customer dimension in Business Intelligence Development Studio. To do this, double-click the Customer dimension in the **Dimensions** node of Solution Explorer.

2. In the **Attributes** pane, right-click **English Country Region Name** and select **Rename**. Change the name of the attribute to **Country-Region**.

3. Change the names of the following attributes in the same manner:

- **English Education** attribute — change to **Education**
- **English Occupation** attribute — change to **Occupation**
- **State Province Name** attribute — change to **State-Province**

4. On the File menu, click **Save All**.

Creating a Attribute Hierarchy

You can create a new hierarchy by dragging an attribute from the **Attributes** pane to the **Hierarchies** pane.

1. Drag the **Country-Region** attribute from the **Attributes** pane into the **Hierarchies** pane.

2. Drag the **State-Province** attribute from the **Attributes** pane into the **<new level>** cell in the **Hierarchies** pane, underneath the **Country-Region** level.

3. Drag the **City** attribute from the **Attributes** pane into the **<new level>** cell in the **Hierarchies** pane, underneath the **State-Province** level.

4. In the **Hierarchies** pane of the **Dimension Structure** tab, right-click the title bar of the **Hierarchy** hierarchy, select **Rename** and type **Customer Geography**.

   The name of the hierarchy is now **Customer Geography**.

5. On the File menu, click **Save All**.

Adding a Named Calculation

You can add a named calculation, which is a SQL expression that is represented as a calculated column, to a table in a data source view. The expression appears and behaves as a column in the table. Named calculations let you extend the relational schema of existing tables in a data source view without modifying the table in the underlying data source. For more information, see Defining Named Calculations in a Data Source View (Analysis Services)

1. Open the Adventure Works DW data source view by double-clicking it in the **Data Source Views** folder in Solution Explorer.

2. In the **Tables** pane, right-click **Customer**, and then click **New Named Calculation**.

3. In the **Create Named Calculation** dialog box, type **FullName** in the **Column name** box, and then type the following **CASE** statement in the **Expression** box:

```
CASE
  WHEN MiddleName IS NULL THEN
  FirstName + ' ' + LastName
  ELSE
  FirstName + ' ' + MiddleName + ' ' + LastName
END
```

4. The **CASE** statement concatenates the **FirstName**, **MiddleName**, and **LastName** columns into a single column that you will use in the Customer dimension as the displayed name for the **Customer** attribute.

5. Click **OK**, and then expand **Customer** in the **Tables** pane.

   The **FullName** named calculation appears in the list of columns in the Customer table, with an icon that indicates that it is a named calculation.

6. On the File menu, click **Save All**.

7. In the **Tables** pane, right-click **Customer**, and select **Explore Data**.

8. Review the last column in the **Explore Customer Table** view.

   Notice that the **FullName** column appears in the data source view, correctly concatenating data from several columns from the underlying data source and without modifying the original data source.

9. Close the **Explore Customer Table** view.

Using the Named Calculation for Member Names

After you have created a named calculation in the data source view, you can use the named calculation as a property of an attribute.

1. Switch to Dimension Designer for the Customer dimension.
2. In the **Attributes** pane of the **Dimension Structure** tab, click the **Customer Key** attribute.
3. Open the Properties window and click the **Auto Hide** button on the title bar so that it stays open.
4. In the **Name** property field, type **Full Name**.
5. Click in the **NameColumn** property field and then click the browse (**…**) button to open the **Name Column** dialog box.
6. Select **FullName** in the **Source column** list and then click **OK**.
7. Drag the **Full Name** attribute from the **Attributes** pane into the **<new level>** cell in the **Hierarchies** pane, underneath the **City** level.
8. On the File menu, click **Save All**.

Defining Display Folders

You can use display folders to group user and attribute hierarchies into folder structures to increase user-friendliness.

1. Open the **Dimension Structure** tab for the Customer dimension.
2. In the **Attributes** pane, select the following attributes by holding down the CTRL key while clicking each of them:
   - **City**
   - **Country-Region**
   - **Postal Code**
   - **State-Province**
3. In the Properties window, click the **AttributeHierarchyDisplayFolder** property field and type **Location**.
4. In the **Hierarchies** pane, click **Customer Geography**, and then select **Location** as the value of the **DisplayFolder** property in the Properties window.
5. In the **Attributes** pane, select the following attributes by holding down the CTRL key while clicking each of them:
   - **Commute Distance**
   - **Education**
   - **Gender**
   - **House Owner Flag**

- **Marital Status**
- **Number Cars Owned**
- **Number Children At Home**
- **Occupation**
- **Total Children**
- **Yearly Income**

6. In the Properties window, click the **AttributeHierarchyDisplayFolder** property field and type **Demographic**.
7. In the **Attributes** pane, select the following attributes by holding down the CTRL key while clicking each of them:
   - **Email Address**
   - **Phone**
8. In the Properties window, click the **AttributeHierarchyDisplayFolder** property field and type **Contacts**.
9. On the File menu, click **Save All**.

Defining Composite KeyColumns

The **KeyColumns** property contains the column or columns that represent the key for the attribute. In this lesson, you create a composite key for the **City** and **State-Province** attributes. Composite keys can be helpful when you need to uniquely identify an attribute. For example, when you define attribute relationships later in this tutorial, a **City** attribute must uniquely identify a **State-Province** attribute. However, there could be several cities with the same name in different states. For this reason, you will create a composite key that is composed of the **StateProvinceName** and **City** columns for the **City** attribute. For more information, see How to: Modify the KeyColumn Property of an Attribute.

To define composite KeyColumns for the City attribute

1. Open the **Dimension Structure** tab for the Customer dimension.
2. In the **Attributes** pane, click the **City** attribute.
3. In the **Properties** window, click in the **KeyColumns** field and then click the browse (**...**) button.
4. In the **Key Columns** dialog box, in the **Available Columns** list, select the column **StateProvinceName**, and then click the **>** button.

   The **City** and **StateProvinceName** columns are now displayed in the **Key Columns** list.
5. Click **OK**.
6. To set the **NameColumn** property of the **City** attribute, click in the **NameColumn** field in the property window and then click the browse (**...**) button.
7. In the **Name Column** dialog box, in the **Source Column** list, select **City** and then, click **OK**.

8. On the File menu, click **Save All**.

To define composite KeyColumns for the State-Province attribute

1. Open the **Dimension Structure** tab for the Customer dimension.
2. In the **Attributes** pane, click the **State-Province** attribute.
3. In the **Properties** window, click in the **KeyColumns** field and then click the browse (**...**) button.
4. In the **Key Columns** dialog box, in the **Available Columns** list, select the column **EnglishCountryRegionName**, and then click the **>** button.

   The **EnglishCountryRegionName** and **StateProvinceName** columns are now displayed in the **Key Columns** list.
5. Click **OK**.
6. To set the **NameColumn** property of the **State-Province** attribute, click in the **NameColumn** field in the property window and then click the browse (**...**) button.
7. In the **Name Column** dialog box, in the **Source Column** list, select **StateProvinceName** and then, click **OK**.
8. On the File menu, click **Save All**.

Defining Attribute Relationships

If the underlying data supports it, you should define attribute relationships between attributes. Defining attribute relationships speeds up dimension, partition, and query processing. For more information, see Defining Attribute Relationships and Attribute Relationships.

1. In the **Dimension Designer** for the Customer dimension, click the **Attribute Relationships** tab.
2. In the diagram, right-click the **City** attribute and then select **New Attribute Relationship**.
3. In the **Create Attribute Relationship** dialog box, the **Source Attribute** is **City**. Set the **Related Attribute** to **State-Province**.
4. In the **Relationship type** list, set the relationship type to **Rigid**.

   The relationship type is **Rigid** because relationships between the members will not change over time. For example, it would be unusual for a city to become part of a different state or province.
5. Click **OK**.
6. In the diagram, right-click the **State-Province** attribute and then select **New Attribute Relationship**.
7. In the **Create Attribute Relationship** dialog box, the **Source Attribute** is **State-Province**. Set the **Related Attribute** to **Country-Region**.
8. In the **Relationship type** list, set the relationship type to **Rigid**.
9. Click **OK**.
10. On the File menu, click **Save All**.

Deploying Changes, Processing the Objects, and Viewing the Changes

After you have changed attributes and hierarchies, you must deploy the changes and reprocess the related objects before you can view the changes.

1. On the **Build** menu of BI Development Studio, click **Deploy Analysis Services Tutorial**.

2. After you have received the **Deployment Completed Successfully** message, click the **Browser** tab of Dimension Designer for the Customer dimension and then click the reconnect icon on the toolbar of the designer.

3. Verify that **Customer Geography** is selected in the **Hierarchy** list, and then in the browser pane expand **All**, expand **Australia**, expand **New South Wales**, and then expand **Coffs Harbour**.

   The browser displays the customers in the city.

4. Switch to **Cube Designer** for the Analysis Services Tutorial cube. To do this, double-click the **Analysis Services Tutorial** cube in the **Cubes** node of **Solution Explorer**.

5. Click the **Browser** tab, and then click the reconnect icon on the toolbar of the designer.

6. In the **Measure Group** pane, expand **Customer**.

   Notice that instead of a long list of attributes, only the display folders and the attributes that do not have display folder values appear underneath Customer.

7. On the **File** menu, click **Save All**.

Modifying the Time Dimension

Adding a Named Calculation

You can add a named calculation, which is a SQL expression that is represented as a calculated column, to a table in a data source view. The expression appears and behaves as a column in the table. Named calculations enable you to extend the relational schema of existing tables in a data source view without modifying the table in the underlying data source. For more information, see Defining Named Calculations in a Data Source View (Analysis Services)

1. Open the Adventure Works DW data source view by double-clicking it in the **Data Source Views** folder in Solution Explorer.

2. In the **Tables** pane, right-click **Time**, and then click **New Named Calculation**.

3. In the **Create Named Calculation** dialog box, type **SimpleDate** in the **Column name** box, and then type the following in the **Expression** box:

```
DATENAME(mm, FullDateAlternateKey) + ' ' +
DATENAME(dd, FullDateAlternateKey) + ', ' +
DATENAME(yy, FullDateAlternateKey)
```

4. The statement extracts the year, month, and day values from the FullDateAlternateKey column. You will use this new column as the displayed name for the FullDateAlternateKey attribute.

5. Click **OK**, and then expand **Time** in the **Tables** pane.

   The **SimpleDate** named calculation appears in the list of columns in the Customer table, with an icon that indicates that it is a named calculation.

6. On the File menu, click **Save All**.

7. In the **Tables** pane, right-click **Time**, and select **Explore Data**.

8. Review the last column in the **Explore Customer Table** view.

   Notice that the **SimpleDate** column appears in the data source view, correctly concatenating data from several columns from the underlying data source and without modifying the original data source.

9. Close the **Explore Customer Table** view.

Using the Named Calculation for Member Names

After you have created a named calculation in the data source view, you can use the named calculation as a property of an attribute.

1. Open **Dimension Designer** for the Time dimension in Business Intelligence Development Studio. To do this, double-click the **Time** dimension in the **Dimensions** node of **Solution Explorer**.

2. In the **Attributes** pane of the **Dimension Structure** tab, click the **Time Key** attribute.

3. Open the Properties window and click the **Auto Hide** button on the title bar so that it stays open.

4. Click in the **NameColumn** property field and then click the ellipsis (**…**) button to open the **Name Column** dialog box.

5. Select **SimpleDate** in the **Source column** list and then click **OK**.

6. On the File menu, click **Save All**.

Creating a Hierarchy

You can create a new hierarchy by dragging an attribute from the **Attributes** pane to the **Hierarchies** pane.

1. In **Dimension Designer** for the **Time** dimension, drag the **Calendar Year** attribute from the **Attributes** pane into the **Hierarchies** pane.

2. Drag the **Calendar Semester** attribute from the **Attributes** pane into the **<new level>** cell in the **Hierarchies** pane, underneath the **Calendar Year** level.

3. Drag the **Calendar Quarter** attribute from the **Attributes** pane into the **<new level>** cell in the **Hierarchies** pane, underneath the **Calendar Semester** level.

4. Drag the **English Month Name** attribute from the **Attributes** pane into the **<new level>** cell in the **Hierarchies** pane, underneath the **Calendar Quarter** level.

5. Drag the **Time Key** attribute from the **Attributes** pane into the **<new level>** cell in the **Hierarchies** pane, underneath the **English Month Name** level.

6. In the **Hierarchies** pane, right-click the title bar of the **Hierarchy** hierarchy, select **Rename**, and type **Calendar Time**.

7. In the **Calendar Time** hierarchy, rename the **English Month Name** level to **Calendar Month** and rename the **Time Key** level to **Date**.

8. Delete the **FullDateAlternateKey** attribute from the **Attributes** pane because you will not be using it.

9. On the File menu, click **Save All**.

Defining Attribute Relationships

If the underlying data supports it, you should define attribute relationships between attributes. Defining attribute relationships speeds up dimension, partition, and query processing.

1. In the **Dimension Designer** for the **Time** dimension, click the **Attribute Relationships** tab.

2. In the diagram, right-click the **English Month Name** attribute and then select **New Attribute Relationship**.

3. In the **Create Attribute Relationship** dialog box, the **Source Attribute** is **English Month Name**. Set the **Related Attribute** to **Calendar Quarter**.

4. In the **Relationship type** list, set the relationship type to **Rigid**.

   The relationship type is **Rigid** because relationships between the members will not change over time.

5. Click **OK**.

6. In the diagram, right-click the **Calendar Quarter** attribute and then select **New Attribute Relationship**.

7. In the **Create Attribute Relationship** dialog box, the **Source Attribute** is **Calendar Quarter**. Set the **Related Attribute** to **Calendar Semester**.

8. In the **Relationship type** list, set the relationship type to **Rigid**.

9. Click **OK**.

10. In the diagram, right-click the **Calendar Semester** attribute and then select **New Attribute Relationship**.

11. In the **Create Attribute Relationship** dialog box, the **Source Attribute** is **Calendar Semester**. Set the **Related Attribute** to **Calendar Year**.

12. In the **Relationship type** list, set the relationship type to **Rigid**.

13. Click **OK**.

14. On the File menu, click **Save All**.

Providing Unique Dimension Member Names

In this task, you will create user-friendly name columns that will be used by the **EnglishMonthName**, **CalendarQuarter**, and **CalendarSemester** attributes.

1. Switch to the Adventure Works DW data source view by double-clicking it in the **Data Source Views** folder in Solution Explorer.

2. In the **Tables** pane, right-click **Time**, and then click **New Named Calculation**.

3. In the **Create Named Calculation** dialog box, type **MonthName** in the **Column name** box, and then type the following statement in the **Expression** box:

```
EnglishMonthName+' '+ CONVERT(CHAR (4), CalendarYear)
```

4. The statement concatenates the month and year for each month in the DimTime table into a new column.

5. Click **OK**.

6. In the **Tables** pane, right-click **Time**, and then click **New Named Calculation**.

7. In the **Create Named Calculation** dialog box, type **CalendarQuarterDesc** in the **Column name** box, and then type the following SQL script in the **Expression** box:

Copy Code

```
'Q' + CONVERT(CHAR (1), CalendarQuarter) +' '+ 'CY ' +
CONVERT(CHAR (4), CalendarYear)
```

8. This SQL script concatenates the calendar quarter and year for each quarter in the DimTime table into a new column.

9. Click **OK**.

10. In the **Tables** pane, right-click **Time**, and then click **New Named Calculation**.

11. In the **Create Named Calculation** dialog box, type **CalendarSemesterDesc** in the **Column name** box, and then type the following SQL script in the **Expression** box:

Copy Code

```
CASE
WHEN CalendarSemester = 1 THEN 'H1' + ' ' + 'CY' + ' '
     + CONVERT(CHAR(4), CalendarYear)
ELSE
'H2' + ' ' + 'CY' + ' ' + CONVERT(CHAR(4), CalendarYear)
END
```

12. This SQL script concatenates the calendar semester and year for each semester in the DimTime table into a new column.

13. Click **OK.**

14. On the **File** menu, click **Save All**.

Defining Composite KeyColumns and Setting the Name Column

The **KeyColumns** property contains the column or columns that represent the key for the attribute. In this task, you will define composite **KeyColumns**.

To define composite KeyColumns for the English Month Name attribute

1. Open the **Dimension Structure** tab for the Time dimension.

2. In the **Attributes** pane, click the **English Month Name** attribute.

3. In the **Properties** window, click in the **KeyColumns** field and then click the browse (**...**) button.

4. In the **Key Columns** dialog box, in the **Available Columns** list, select the column **CalendarYear**, and then click the **>** button.

5. The **EnglishMonthName** and **CalendarYear** columns are now displayed in the **Key Columns** list.

6. Click **OK**.

7. To set the **NameColumn** property of the **EnglishMonthName** attribute, click in the **NameColumn** field in the property window and then click the browse (**...**) button.

8. In the **Name Column** dialog box, in the **Source Column** list, select **MonthName** and then, click **OK**.

9. On the File menu, click **Save All**.

To define composite KeyColumns for the Calendar Quarter attribute

1. In the **Attributes** pane, click the **Calendar Quarter** attribute.

2. In the **Properties** window, click in the **KeyColumns** field and then click the browse (**...**) button.

3. In the **Key Columns** dialog box, in the **Available Columns** list, select the column **CalendarYear**, and then click the **>** button.

The **CalendarQuarter** and **CalendarYear** columns are now displayed in the **Key Columns** list.

4. Click **OK**.

5. To set the **NameColumn** property of the **Calendar Quarter** attribute, click in the **NameColumn** field in the properties window and then click the browse (**...**) button.

6. In the **Name Column** dialog box, in the **Source Column** list, select **CalendarQuarterDesc** and then, click **OK**.

7. On the File menu, click **Save All**.

To define composite KeyColumns for the Calendar Semester attribute

1. In the **Attributes** pane, click the **Calendar Semester** attribute.

2. In the **Properties** window, click in the **KeyColumns** field and then click the browse (**...**) button.

3. In the **Key Columns** dialog box, in the **Available Columns** list, select the column **CalendarYear**, and then click the **>** button.

The **CalendarSemester** and **CalendarYear** columns are now displayed in the **Key Columns** list.

4. Click **OK**.

5. To set the **NameColumn** property of the **Calendar Semester** attribute, click in the **NameColumn** field in the property window and then click the browse (**...**) button.

6. In the **Name Column** dialog box, in the **Source Column** list, select **CalendarSemesterDesc** and then, click **OK**.

7. On the File menu, click **Save All**.

Deploying and Viewing the Changes

After you have changed attributes and hierarchies, you must deploy the changes and reprocess the related objects before you can view the changes.

To deploy and view the changes

1. On the **Build** menu of BI Development Studio, click **Deploy Analysis Services Tutorial**.

2. After you have received the **Deployment Completed Successfully** message, click the **Browser** tab of **Dimension Designer** for the **Time** dimension and then click the reconnect icon on the toolbar of the designer.

3. Select **Calendar Quarter** from the **Hierarchy** list. Review the members in the **Calendar Quarter** attribute hierarchy.

   Notice that the names of the members of the **Calendar Quarter** attribute hierarchy are more user-friendly because you created a named calculation to use as the name. Members now exist in the **Calendar Quarter** attribute hierarchy for each quarter in each year The members are not sorted in chronological order. Instead they are sorted by quarter and then by year. In the next task in this topic, you will modify this behavior to sort the members of this attribute hierarchy by year and then by quarter.

4. Review the members of the **English Month Name** and **Calendar Semester** attribute hierarchies.

   Notice that the members of these hierarchies are also not sorted in chronological order. Instead, they are sorted by month or semester, respectively, and then by year. In the next task in this topic, you will modify this behavior to change this sort order.

Changing the Sort Order by Modifying Composite Key Member Order

In this task, you will change the sort order by changing the order of the keys that make up the composite key.

To modify the composite key member order

1. Select the **Dimension Structure** tab of Dimension Designer for the **Time** dimension, and then select **Calendar Semester** in the **Attributes** pane.

2. In the Properties window, review the value for the **OrderBy** property. It is set to **Key**.

   The members of the **Calendar Semester** attribute hierarchy are sorted by their key value. With a composite key, the ordering of the member keys is based first on the value of the first member key, and then on the value of the second member key. In order words, the members of the **Calendar Semester** attribute hierarchy are sorted first by semester and then by year.

3. In the Properties window, click the ellipsis button (**...**) to change the **KeyColumns** property value.

4. In the **Key Columns** list of the **Key Columns** dialog box, verify that **CalendarSemester** is selected, and then click the down arrow to reverse the order of the members of this composite key. Click **OK**.

   The members of the attribute hierarchy are now sorted first by year and then by semester.

5. Select **Calendar Quarter** in the **Attributes** pane, and then click the ellipsis button (**...**) for the **KeyColumns** property in the Properties window.

6. In the **Key Columns** list of the **Key Columns** dialog box, verify that **CalendarQuarter** is selected, and then click the down arrow to reverse the order of the members of this composite key. Click **OK**.

   The members of the attribute hierarchy are now sorted first by year and then by quarter.

7. Select **English Month Name** in the **Attributes** pane, and then click the ellipsis button (**...**) for the **KeyColumns** property in the Properties window.

8. In the **Key Columns** list of the **Key Columns** dialog box, verify that **EnglishMonthName** is selected, and then click the down arrow to reverse the order of the members of this composite key. Click **OK**.

   The members of the attribute hierarchy are now sorted first by year and then by month.

9. On the **Build** menu of BI Development Studio, click **Deploy Analysis Services Tutorial**. When deployment has successfully completed, click the **Browser** tab in Dimension Designer for the Time dimension.

10. On the toolbar of the **Browser** tab, click the reconnect icon**.**

11. Review the members of the **Calendar Quarter** and **Calendar Semester** attribute hierarchies.

    Notice that the members of these hierarchies are now sorted in chronological order, by year and then by quarter or semester, respectively.

12. Review the members of the **English Month Name** attribute hierarchy.

Modifying the Product Dimension

Adding a Named Calculation

You can add a named calculation to a table in a data source view. In the following task, you create a named calculation that will display the full product line name.

1. Open the Adventure Works DW data source view by double-clicking it in the Data Source Views folder in Solution Explorer.

2. In the diagram pane, right-click the **Product** table, and then click **New Named Calculation**.

3. In the **Create Named Calculation** dialog box, type **ProductLineName** in the **Column name** box.

4. In the **Expression** box, type the following **CASE** statement:

```
CASE ProductLine
  WHEN 'M' THEN 'Mountain'
  WHEN 'R' THEN 'Road'
  WHEN 'S' THEN 'Accessory'
  WHEN 'T' THEN 'Touring'
  ELSE 'Components'
END
```

5. This **CASE** statement creates user-friendly names for each product line in the cube.

6. Click **OK** to create the **ProductLineName** named calculation.

7. On the File menu, click **Save All**.

Modifying the NameColumn Property of an Attribute

1. Switch to Dimension Designer for the Product dimension. To do this, double-click the Product dimension in the Dimensions node of Solution Explorer.

2. In the **Attributes** pane of the **Dimension Structure** tab, select **Product Line**.

3. In the Properties window, click in the **NameColumn** property field and then click the browse (**…**) button to open the **Name Column** dialog box.

4. Select **ProductLineName** in the **Source column** list and then click **OK**.

The NameColumn field now contains the text **Product.ProductLineName (WChar)**. The members of the **Product Line** attribute hierarchy will now display the full name of the product line instead of an abbreviated product line name.

5. In the **Attributes** pane of the **Dimension Structure** tab, select **Product Key**.

6. In the Properties window, click in the **NameColumn** property field and then click the ellipsis (**…**) button to open the **Name Column** dialog box.

7. Select **EnglishProductName** in the **Source column** list and then click **OK**.

The NameColumn field now contains the text **Product.EnglishProductName (WChar)**.

8. In the Properties window, change the value of the **Name** property for the **Product Key** attribute to **Product Name**.

Creating a Hierarchy

1. Drag the **Product Line** attribute from the **Attributes** pane into the **Hierarchies** pane.

2. Drag the **Model Name** attribute from the **Attributes** pane into the **<new level>** cell in the **Hierarchies** pane, underneath the **Product Line** level.

3. Drag the **Product Name** attribute from the **Attributes** pane into the **<new level>** cell in the **Hierarchies** pane, underneath the **Model Name** level.

4. In the **Hierarchies** pane of the **Dimension Structure** tab, right-click the title bar of the **Hierarchy** hierarchy, select **Rename** and type **Product Model Lines**.

The name of the hierarchy is now **Product Model Lines**.

5. On the File menu, click **Save All**.

Specifying Folder Names and All Member Names

1. In the **Attributes** pane, select the following attributes by holding down the CTRL key while clicking each of them:
   - **Class**
   - **Color**
   - **Days To Manufacture**
   - **Reorder Point**
   - **Safety Stock Level**
   - **Size**
   - **Size Range**
   - **Style**
   - **Weight**
2. In the **AttributeHierarchyDisplayFolder** property field in the Properties window, type **Stocking**.

   You have now grouped these attributes into a single display folder.
3. In the **Attributes** pane, select the following attributes:
   - **Dealer Price**
   - **List Price**
   - **Standard Cost**
4. In the **AttributeHierarchyDisplayFolder** property cell in the Properties window, type **Financial**.

   You have now grouped these attributes into a second display folder.
5. In the **Attributes** pane, select the following attributes:
   - **End Date**
   - **Start Date**
   - **Status**
6. In the **AttributeHierarchyDisplayFolder** property cell in the Properties window, type **History**.

   You have now grouped these attributes into a third display folder.
7. Select the **Product Model Lines** hierarchy in the **Hierarchies** pane, and then change the **AllMemberName** property in

the Properties window to **All Products**.

8. Click an open area of the **Hierarchies** pane, and then change the **AttributeAllMemberName** property to **All Products**.

Clicking an open area lets you modify properties of the Product dimension itself. You could also click the Product dimension icon at the top of the attributes list in the Attributes pane.

9. On the File menu, click **Save All**.

Defining Attribute Relationships

If the underlying data supports it, you should define attribute relationships between attributes. Defining attribute relationships speeds up dimension, partition, and query processing. For more information, see Defining Attribute Relationships and Attribute Relationships.

1. In the **Dimension Designer** for the Product dimension, click the **Attribute Relationships** tab.

2. In the diagram, right-click the **Model Name** attribute and then select **New Attribute Relationship**.

3. In the **Create Attribute Relationship** dialog box, the **Source Attribute** is **Model Name**. Set the **Related Attribute** to **Product Line**.

In the **Relationship type** list, leave the relationship type set to **Flexible** because relationships between the members might change over time. For example, a product model might eventually be moved to a different product line.

4. Click **OK**.

5. On the File menu, click **Save All**.

To review the Product dimension changes

1. On the **Build** menu of Business Intelligence Development Studio, click **Deploy Analysis Services Tutorial**.

2. After you have received the **Deployment Completed Successfully** message, click the **Browser** tab of **Dimension Designer** for the **Product** dimension and then click the reconnect icon on the toolbar of the designer.

3. Verify that **Product Model Lines** is selected in the **Hierarchy** list, and then expand **All Products**.

Notice that the name of the **All** member appears as All Products. This is because you changed the **AllMemberName** property for the hierarchy to **All Products** earlier in the lesson. Also, the members of the **Product Line** level now have user-friendly names, instead of single letter abbreviations.

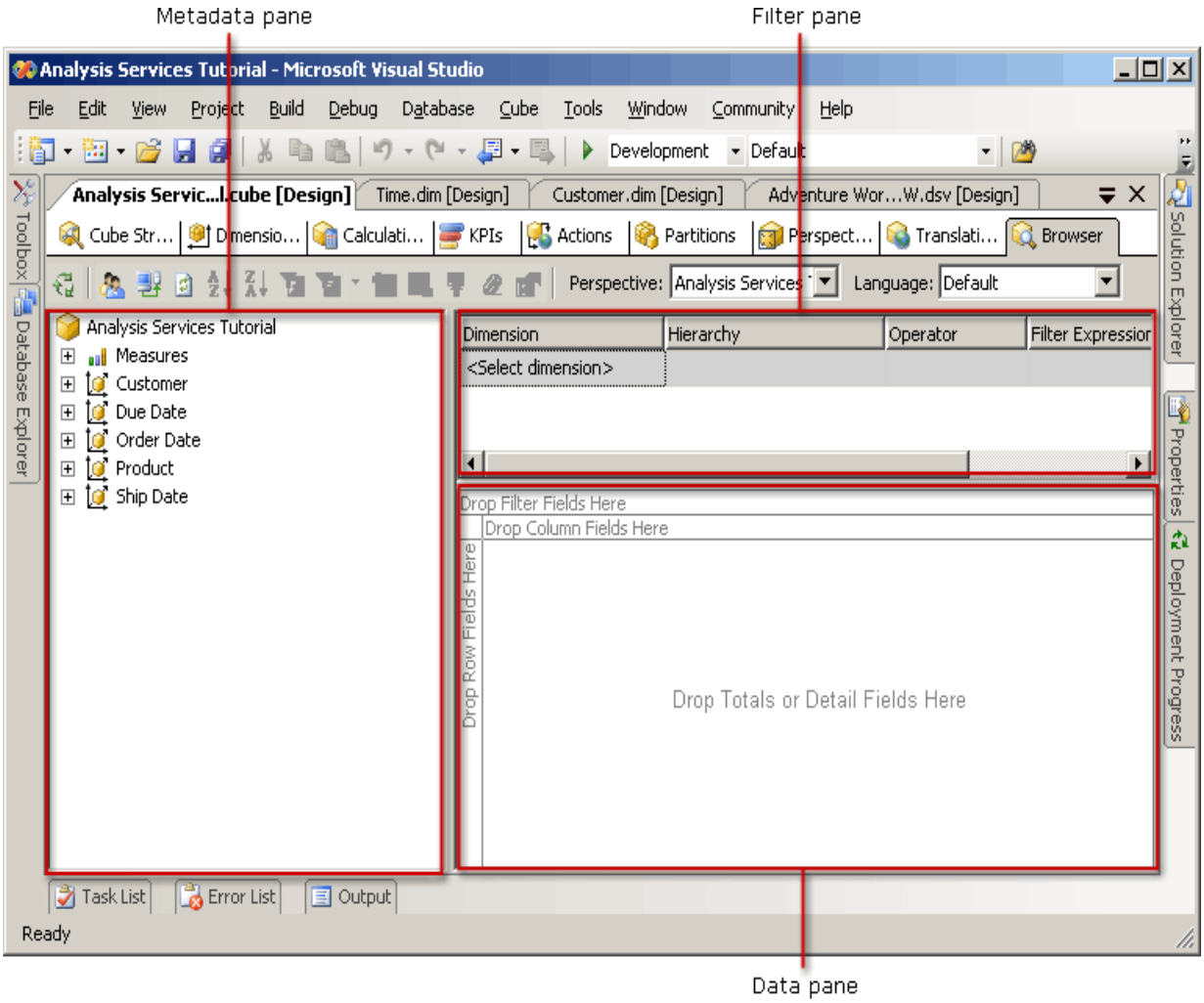
Browsing the Deployed Cube

1. Switch to Cube Designer in BI Development Studio by clicking the Analysis Services Tutorial cube.

2. Select the **Browser** tab, and then click **Reconnect** on the toolbar of the designer.

The left pane of the designer shows the metadata for the Analysis Services Tutorial cube. Notice that **Perspective** and **Language** options are available on the toolbar of the **Browser** tab. Notice also that the **Browser** tab includes two panes to the right of the metadata pane: the upper pane is the filter pane, and the lower pane is the data pane.

The following image highlights the individual panes in Cube Designer.



3. In the metadata pane, expand **Measures**, expand **Internet Sales**, and then drag the **Sales Amount** measure to the **Drop Totals or Detail Fields Here** area of the **Data** pane.

4. In the metadata pane, expand **Product**.

Notice that the attribute and user hierarchies are organized into display folders in the **Product** metadata list.

5. Drag the **Product Model Lines** user hierarchy to the **Drop Column Fields Here** area of the data pane, and then expand the **Road** member of the **Product Line** level of this user hierarchy.

Notice that the user hierarchy provides a path to the product name level.

6. In the metadata pane, expand **Customer**, expand **Location**, and then drag the **Customer Geography** hierarchy from the Location display folder in the Customer dimension to the **Drop Row Fields Here** area of the data pane.

7. On the row axis, expand **United States** to view the sales details by region within the United States.

8. Expand **Oregon** to view the sales details by city within the state of Oregon.

9. In the metadata pane, expand **Order Date** and then drag the **Order Date.Calendar Time** hierarchy to the **Drop Filter Fields Here** area of the **Data** pane.

10. Click the arrow to the right of the **Order Date.Calendar Time** filter in the data pane, clear the check box for the **(All)** level, expand **2002**, expand **H1 CY 2002**, expand **Q1 CY 2002**, select the check box for **February 2002**, and then click **OK**.

Internet sales by region and product line for the month of February, 2002 appear as shown in the following image.

Dimension	Hierarchy	Operator	Filter Expression
<Select dimension>			

Order Date.Calendar Time
February 2002

			Product Line / Model Name / Product Name				
			Mountain	Road			Grand Total
				Road-150	Road-650	Total	
Country-Region / State-Province / City			Sales Amount	Sales Amount	Sales Amount	Sales Amount	Sales Amount
Australia			$6,799.98	$153,865.61	$3,495.49	$157,361.10	$164,161.08
Canada			$10,149.97	$150,287.34	$699.10	$150,986.44	$161,136.41
France			$6,749.98	$21,469.62	$2,097.29	$23,566.91	$30,316.89
Germany			$3,374.99	$42,939.24	$1,398.20	$44,337.44	$47,712.43
United Kingdom			$13,574.96	$32,204.43	$1,398.20	$33,602.63	$47,177.59
United States	California		$6,749.98	$42,939.24	$2,097.29	$45,036.53	$51,786.51
	Oregon	Corvallis			$699.10	$699.10	$699.10
		Oregon City			$699.10	$699.10	$699.10
		Portland	$3,399.99	$7,156.54		$7,156.54	$10,556.53
		W. Linn	$3,374.99				$3,374.99
		Total	$6,774.98	$7,156.54	$1,398.20	$8,554.74	$15,329.72
	Washington		$6,749.98	$25,047.89	$1,398.20	$26,446.09	$33,196.07
	Total		$20,274.94	$75,143.67	$4,893.69	$80,037.36	$100,312.30
Grand Total			$60,924.82	$475,909.91	$13,981.96	$489,891.87	$550,816.69

11. In the metadata pane, expand **Customer**, expand **Demographic**, expand the **Commute Distance** attribute hierarchy, expand **Members**, and then expand **All**.

12. Right-click the **10+ Miles** member, and then click **Add to Subcube Area**.

Commute Distance appears in the filter pane, above the data pane. The values that are displayed in the data pane are now filtered to show data for customers who commute more than 10 miles. This is effectively equal to the WHERE clause in a Multidimensional Expressions (MDX) query statement. For more information, see MDX Query Fundamentals (MDX).

13. On the **File** menu, click **Save All**.

Implement advanced concepts in SSAS Cube

Lab 3	Implement advanced concepts in SSAS Cube
Description	We will be working on SSAS Project of Lab 2. We will be enhancing the Cube by adding more features
Objective	To learn 1. Creating a Parent-Child Dimension Hierarchy 2. Create Calculated Members 3. Define KPI and view the results 4. Define a drilldown action

Defining Advanced Attribute and Dimension Properties

To load and process the enhanced tutorial project

1. On the **File** menu, click **Close Solution**.

2. On the **File** menu, point to **Open**, and then click **Project/Solution**.

3. Browse to _____ Folder, and then double-click Analysis Services Tutorial.sln.

4. Deploy the enhanced version of the Analysis Services Tutorial project to the local instance of Analysis Services, or to another instance, and verify that processing completes successfully.

Defining Parent Attribute Properties in a Parent-Child Hierarchy

1. In Solution Explorer, double-click **Employee.dim** in the **Dimensions** folder to open Dimension Designer for the Employee dimension.

2. Click the **Browser** tab, verify that **Employees** is selected in the **Hierarchy** list, and then expand the **All Employees** member.

   Notice that **Ken J. Sánchez** is the top-level manager in this parent-child hierarchy.

3. Select the **Ken J. Sánchez** member.

   Notice that the level name for this member is **Level 02**. (The level name appears after **Current level:** immediately above the **All Employees** member.) In the next task, you will define more descriptive names for each level.

4. Expand **Ken J. Sánchez** to view the names of the employees who report to this manager, and then select **Brian S. Welcker** to view the name of this level.

   Notice that the level name for this member is **Level 03**.

5. In Solution Explorer, double-click **Analysis Services Tutorial.cube** in the **Cubes** folder to open Cube Designer for the Analysis Services Tutorial cube.

6. Click the **Browser** tab.

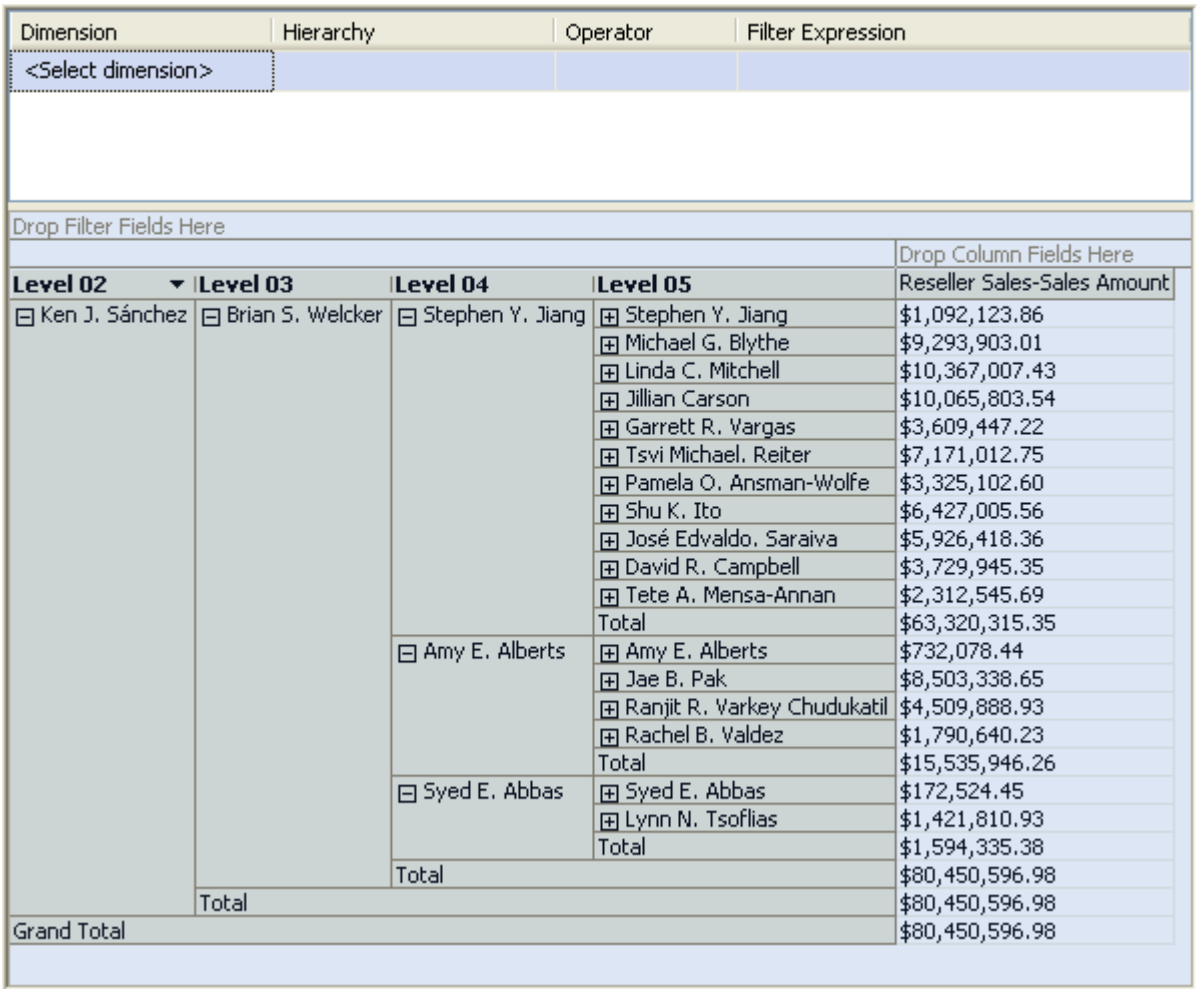
7. In the **Metadata** pane, expand **Measures**, expand **Reseller Sales**, right-click **Reseller Sales-Sales Amount**, and then select **Add to Data Area**.

8. In the metadata pane, expand **Employee**, and then drag the **Employees** hierarchy to the **Drop Row Fields Here** area of the **Data** pane.

   All the members of the Employees hierarchy are added to the **Data** pane in a collapsed view.

9. In the **Data** pane, expand the **Level 02** column of the **Employees** hierarchy, and then continue expanding levels to view the members of levels 02 through 05.

   The following image shows the **Data** pane with levels 02 through 05 of the Employees hierarchy expanded.



Dimension	Hierarchy	Operator	Filter Expression
<Select dimension>			

Drop Filter Fields Here

Drop Column Fields Here

Level 02	Level 03	Level 04	Level 05	Reseller Sales-Sales Amount
⊟ Ken J. Sánchez	⊟ Brian S. Welcker	⊟ Stephen Y. Jiang	⊞ Stephen Y. Jiang	$1,092,123.86
			⊞ Michael G. Blythe	$9,293,903.01
			⊞ Linda C. Mitchell	$10,367,007.43
			⊞ Jillian Carson	$10,065,803.54
			⊞ Garrett R. Vargas	$3,609,447.22
			⊞ Tsvi Michael. Reiter	$7,171,012.75
			⊞ Pamela O. Ansman-Wolfe	$3,325,102.60
			⊞ Shu K. Ito	$6,427,005.56
			⊞ José Edvaldo. Saraiva	$5,926,418.36
			⊞ David R. Campbell	$3,729,945.35
			⊞ Tete A. Mensa-Annan	$2,312,545.69
			Total	$63,320,315.35
		⊟ Amy E. Alberts	⊞ Amy E. Alberts	$732,078.44
			⊞ Jae B. Pak	$8,503,338.65
			⊞ Ranjit R. Varkey Chudukatil	$4,509,888.93
			⊞ Rachel B. Valdez	$1,790,640.23
			Total	$15,535,946.26
		⊟ Syed E. Abbas	⊞ Syed E. Abbas	$172,524.45
			⊞ Lynn N. Tsoflias	$1,421,810.93
			Total	$1,594,335.38
		Total		$80,450,596.98
	Total			$80,450,596.98
Grand Total				$80,450,596.98

Notice that the sales made by each manager in Level 04 are also displayed in Level 05. This is because each manager is also an employee of another manager. In the next task, you will hide these sale amounts.

Modifying Parent Attribute Properties in the Employee Dimension

1. Switch to Dimension Designer for the **Employee** dimension.

2. Click the **Dimension Structure** tab, and then select the **Employees** attribute hierarchy in the **Attributes** pane.

Notice the unique icon for this attribute. This icon signifies that the attribute is the parent key in a parent-child hierarchy. Notice also, in the Properties window, that the **Usage** property for the attribute is defined as **Parent**. This property was set by the Dimension Wizard when the dimension was designed. The wizard automatically detected the parent-child relationship.

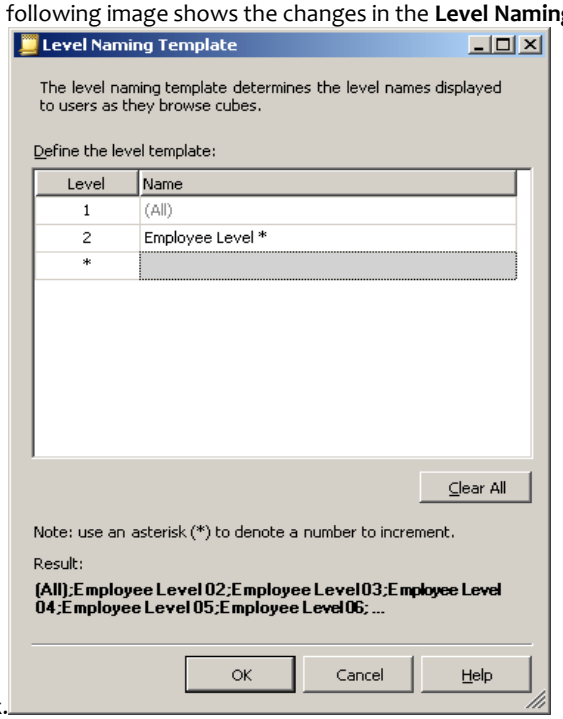
3. In the Properties window, click the ellipsis button (**...**) in the **NamingTemplate** property cell.

In the **Level Naming Template** dialog box, you define the level naming template that determines the level names in the parent-child hierarchy that are displayed to users as they browse cubes.

4. In the second row, the ***** row, type **Employee Level *** in the **Name** column, and then click the third row.

Notice under **Result** that each level will now be named "Employee Level" followed by a sequentially increasing number.

The following image shows the changes in the **Level Naming Template** dialog box.



5. Click **OK**.

6. In the Properties window for the **Employees** attribute, in the **MembersWithData** property cell, select **NonLeafDataHidden** to change this value for the **Employees** attribute.

This will cause data that is related to non-leaf level members in the parent-child hierarchy to be hidden.

Browsing the Employee Dimension with the Modified Attributes

1. On the **Build** menu of Business Intelligence Development Studio, click **Deploy Analysis Services Tutorial**.

2. When deployment has successfully completed, switch to Cube Designer for the Analysis Services Tutorial cube, and then click **Reconnect** on the toolbar of the **Browser** tab.

3. In the left pane of the designer, select **Employees** in the Employee dimension, and then drag this hierarchy to the **Drop Row Fields Here** area. Expand the hierarchy several times to display the first five levels.

Notice that the level names are now more descriptive and that the sales values for each manager are no longer displayed. However, notice also that the total for each level displays the total for each employee, including the hidden amount for the manager. In Lesson 10 you will learn how to enable visual totals so that the total for **Employee Level 05** reflects only those values that are actually visible to the user.

The following image shows the changes that you made to the Employees hierarchy.

Dimension	Hierarchy	Operator	Filter Expression
<Select dimension>			

Drop Filter Fields Here

				Drop Column Fields Here
Employee Level 02	**Employee Level 03**	**Employee Level 04**	**Employee Level 05**	Reseller Sales-Sales Amount
⊟ Ken J. Sánchez	⊟ Brian S. Welcker	⊟ Stephen Y. Jiang	⊞ Michael G. Blythe	$9,293,903.01
			⊞ Linda C. Mitchell	$10,367,007.43
			⊞ Jillian Carson	$10,065,803.54
			⊞ Garrett R. Vargas	$3,609,447.22
			⊞ Tsvi Michael. Reiter	$7,171,012.75
			⊞ Pamela O. Ansman-Wolfe	$3,325,102.60
			⊞ Shu K. Ito	$6,427,005.56
			⊞ José Edvaldo. Saraiva	$5,926,418.36
			⊞ David R. Campbell	$3,729,945.35
			⊞ Tete A. Mensa-Annan	$2,312,545.69
			Total	$63,320,315.35
		⊟ Amy E. Alberts	⊞ Jae B. Pak	$8,503,338.65
			⊞ Ranjit R. Varkey Chudukatil	$4,509,888.93
			⊞ Rachel B. Valdez	$1,790,640.23
			Total	$15,535,946.26
		⊟ Syed E. Abbas	⊞ Lynn N. Tsoflias	$1,421,810.93
			Total	$1,594,335.38
		Total		$80,450,596.98
	Total			$80,450,596.98
Grand Total				$80,450,596.98

Grouping Attribute Hierarchy Members in the Employee Dimension

1. Switch to Dimension Designer for the Employee dimension.

2. In the **Data Source View** pane, right-click the **Employee** table, and then click **Explore Data**.

Notice the values for the **SickLeaveHours** column and the **VacationHours** column.

3. Close the **Explore Employee Table** tab.

4. In the **Attributes** pane, select **Sick Leave Hours**.

5. In the Properties window, change the value for the **DiscretizationMethod** property to **Clusters** and change the value for the **DiscretizationBucketCount** property to **5**.

6. In the **Attributes** pane, select **Vacation Hours**.

7. In the Properties window, change the value for the **DiscretizationMethod** property to **Equal Areas** and change the value for the **DiscretizationBucketCount** property to **5**.

To browse the modified attribute hierarchies

1. On the **Build** menu of Business Intelligence Development Studio, click **Deploy Analysis Services Tutorial**.

2. When deployment has successfully completed, switch to Cube Designer for the Analysis Services Tutorial cube, and then click **Reconnect** on the **Browser** tab.

3. Remove all the levels of the **Employees** hierarchy from the row field area of the data pane and remove all measures from the data pane. To do this, right-click in the data pane and click **Clear Results**.

4. Add the **Internet Sales-Sales Amount** measure to the data area of the data pane. To do this, right-click **Internet Sales-Sales Amount** and select **Add to Data Area**.

5. In the metadata pane, expand the **Product** dimension, and then drag the **Product Model Lines** user hierarchy to the **Drop Row Fields Here** area of the data pane.

6. Expand the **Customer** dimension in the **Metadata** pane, expand the **Demographic** display folder, and then drag the **Yearly Income** attribute hierarchy to the **Drop Column Fields Here** area.

   The members of the **Yearly Income** attribute hierarchy are now grouped into six buckets, including a bucket for sales to customers whose yearly income is unknown. Not all buckets are displayed.

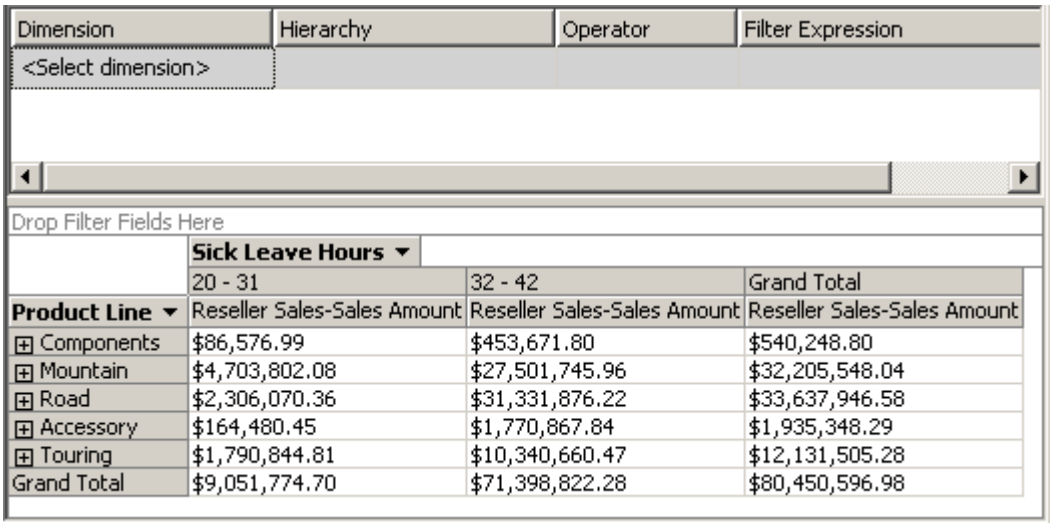
7. Remove the **Yearly Income** attribute hierarchy from the column area and remove the **Internet Sales-Sales Amount** measure of the **Data** pane.

8. Add the **Reseller Sales-Sales Amount** measure to the data area.

9. In the metadata pane, expand the **Employee** dimension, expand **Organization**, right-click **Sick Leave Hours**, and then click **Add to Column Area**.

   Notice that all sales are made by employees within one of two groups. (If you want to see the three groups that have no sales, right-click the data area and then click **Show Empty Cells**). Notice also that the employees with 32 - 42 sick leave hours made significantly more sales than employees with 20 - 31 sick leave hours.

   The following image shows sales dimensioned by employee sick leave hours.



Dimension	Hierarchy	Operator	Filter Expression
<Select dimension>			

Drop Filter Fields Here

	Sick Leave Hours		
	20 - 31	32 - 42	Grand Total
Product Line	Reseller Sales-Sales Amount	Reseller Sales-Sales Amount	Reseller Sales-Sales Amount
⊞ Components	$86,576.99	$453,671.80	$540,248.80
⊞ Mountain	$4,703,802.08	$27,501,745.96	$32,205,548.04
⊞ Road	$2,306,070.36	$31,331,876.22	$33,637,946.58
⊞ Accessory	$164,480.45	$1,770,867.84	$1,935,348.29
⊞ Touring	$1,790,844.81	$10,340,660.47	$12,131,505.28
Grand Total	$9,051,774.70	$71,398,822.28	$80,450,596.98

10. Remove the **Sick Leave Hours** attribute hierarchy from the column area of the **Data** pane.

11. Add **Vacation Hours** to the column area of the **Data** pane.

Notice that two groups appear, based on the equal areas grouping method. Three other groups are hidden because they contain no data values.

To modify the grouping properties and review the effect of the changes

1. Switch to Dimension Designer for the **Employee** dimension, and then select **Vacation Hours** in the **Attributes** pane.

2. In the Properties window, change the value of the **DiscretizationBucketCount** property to **10.**

3. On the **Build** menu of BI Development Studio, click **Deploy Analysis Services Tutorial**.

4. When deployment has successfully completed, switch back to Cube Designer for the Analysis Services Tutorial cube.

5. Click **Reconnect** on the **Browser** tab, and then view the effect of the change to the grouping method.

Setting Attribute Hierarchy Properties in the Employee Dimension

To set the attribute hierarchy properties in the Employee dimension

1. Switch to Dimension Designer for the Employee dimension, and then click the **Browser** tab.

2. Verify that the following attribute hierarchies appear in the **Hierarchy** list:

- **Base Rate**
- **Birth Date**
- **Login ID**
- **Manager SSN**
- **SSN**

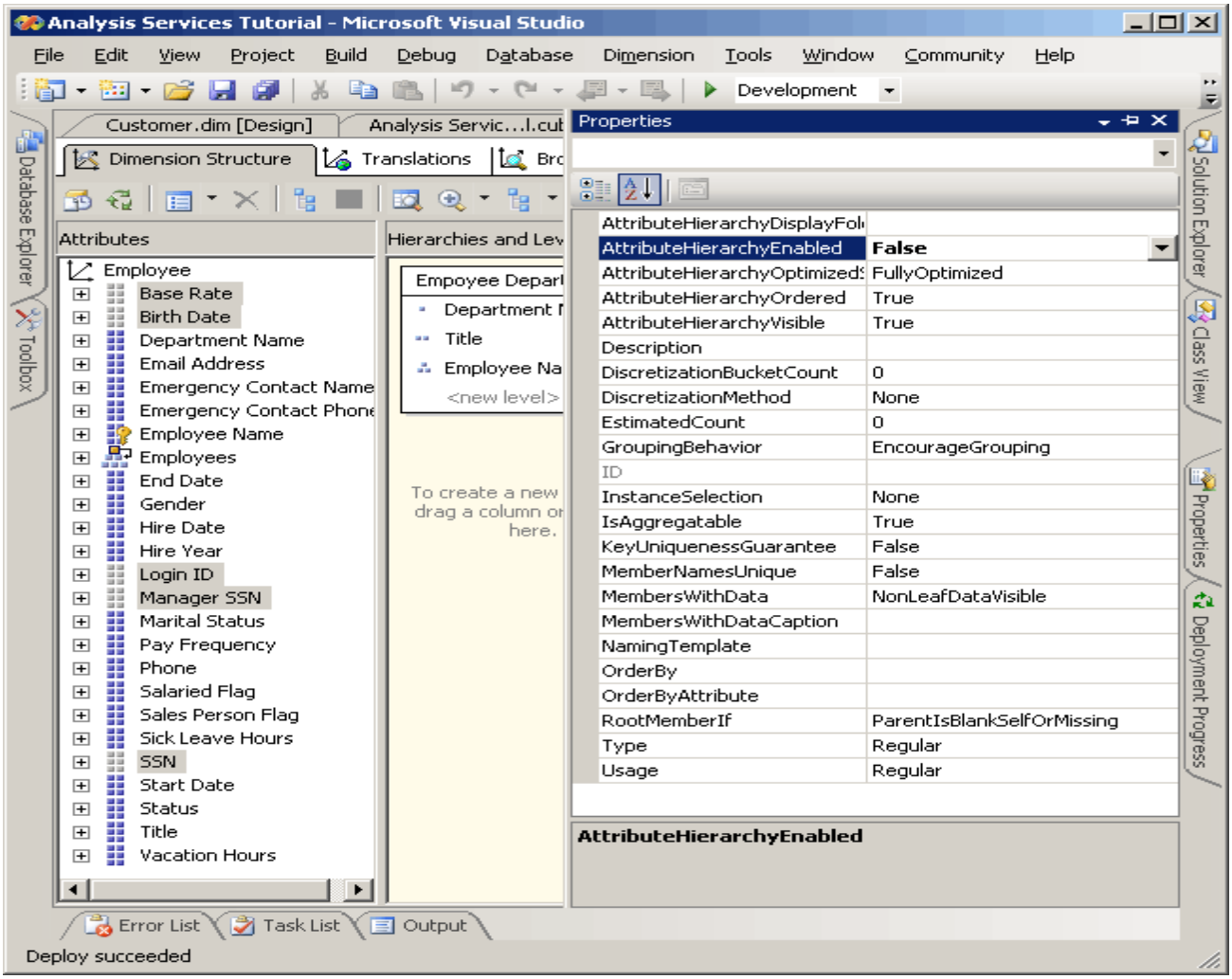
3. Switch to the **Dimension Structure** tab, and then select the following attributes in the **Attributes** pane. You can select multiple measures by clicking each while holding down the CTRL key:

- **Base Rate**
- **Birth Date**
- **Login ID**
- **Manager SSN**
- **SSN**

4. In the Properties window, set the value of the **AttributeHierarchyEnabled** property to **False** for the selected attributes.

Notice in the **Attributes** pane that the icon for each attribute has changed to indicate that the attribute is not enabled.

The following image shows the **AttributeHierarchyEnabled** property set to False for the selected attributes.



5. On the **Build** menu, click **Deploy Analysis Services Tutorial**.

6. When processing has successfully completed, switch to the **Browser** tab, click **Reconnect**, and then try to browse the modified attribute hierarchies.

Notice that the members of the modified attributes are not available for browsing as attribute hierarchies in the **Hierarchy** list. If you try to add one of the disabled attribute hierarchies as a level in a user hierarchy, you will receive an error notifying you that the attribute hierarchy must be enabled to participate in a user-defined hierarchy.

Setting Attribute Hierarchy Properties in the Customer Dimension

1. Switch to Dimension Designer for the Customer dimension, and then click the **Browser** tab.

2. Verify that the following attribute hierarchies appear in the **Hierarchy** list:

- **Full Name**
- **Postal Code**

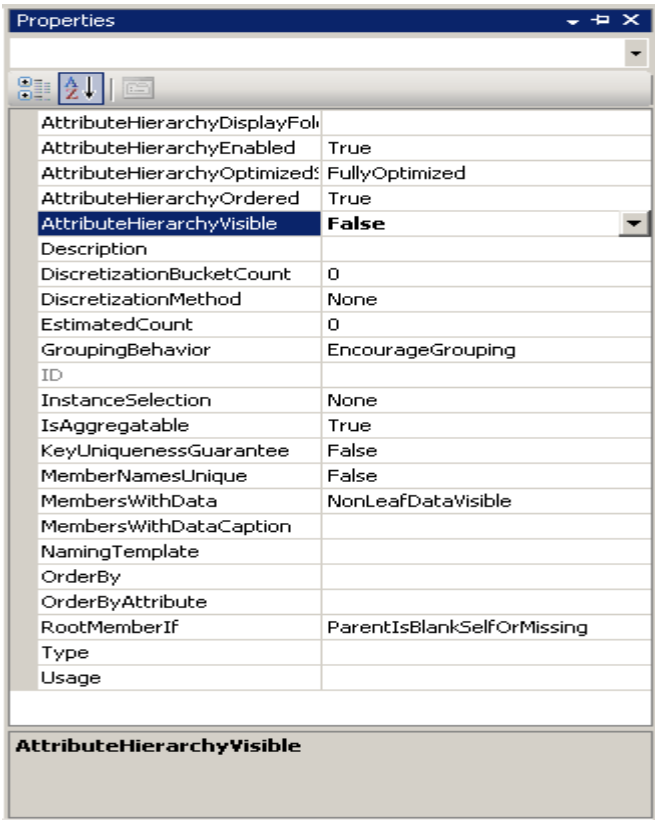
3. Switch to the **Dimension Structure** tab, and then select the following attributes in the **Attributes** pane by using the CTRL key to select multiple attributes at the same time:

- **Full Name**
- **Postal Code**

4. In the Properties window, set the value of the **AttributeHierarchyVisible** property to **False** for the selected attributes.

Because the members of these attribute hierarchies will be used for dimensioning fact data, ordering and optimizing the members of these attribute hierarchies will improve performance. Therefore, the properties of these attributes should not be changed.

The following image shows the **AttributeHierarchyVisible** property set to False.



5. Drag the **Postal Code** attribute from the **Attributes** pane into the **Customer Geography** user hierarchy in the **Hierarchies and Levels** pane, immediately under the **City** level.

Notice that a hidden attribute can still become a level in a user hierarchy.

6. On the **Build** menu, click **Deploy Analysis Services Tutorial**.

7. When deployment has successfully completed, switch to the **Browser** tab for the Customer dimension, and then click **Reconnect**.

8. Try to select either of the modified attribute hierarchies from the **Hierarchy** list.

Notice that neither of the modified attribute hierarchies appears in the **Hierarchy** list.

9. In the **Hierarchy** list, select **Customer Geography**, and then browse each level in the browser pane.

Notice that the hidden levels, **Postal Code** and **Full Name**, are visible in the user-defined hierarchy.

Defining an Attribute Relationship and Sort Order in the Time Dimension

1. Open Dimension Designer for the **Time** dimension, and then review the **OrderBy** property for the **Month Name** attribute in the Properties window.

Notice that the **Month Name** attribute members are ordered by their key values.

2. Switch to the **Browser** tab, verify that **Calendar Time** is selected in the **Hierarchy** list, and then expand the levels in the user-defined hierarchy to review the sort order for the calendar months.

   Notice that the members of the attribute hierarchy are sorted based on the ASCII values of their member keys, which are month and year. In this case, sorting by the attribute name or key does not sort calendar months chronologically. To solve this, you will sort the members of the attribute hierarchy based on a new attribute, the **MonthNumberOfYear** attribute. You will create this attribute based on a column that conveniently exists in the **Time** dimension table.

3. Switch to the **Dimension Structure** tab for the Time dimension, right-click **MonthNumberOfYear** in the **Data Source View** pane, and then click **New Attribute from Column**.

4. In the **Attributes** pane, select **Month Number Of Year**, and then set the **AttributeHierarchyEnabled** property to **False** in the Properties window, set the **AttributeHierarchyOptimizedState** property to **NotOptimized**, and set the **AttributeHierarchyOrdered** property to **False**.

   These settings will hide the attribute from users and will improve processing time. This attribute will not be used for browsing. It will only be used for ordering the members of another attribute.

Note:
Sorting properties in the Properties window alphabetically will simplify this task as these three properties will be sorted adjacent to each other.

1. Click the **Attribute Relationships** tab.

   Notice that all the attributes in the **Time** dimension are related directly to the **Date** attribute, which is the member key that relates the dimension members to the facts in the related measure groups. There is no relationship defined between the **Month Name** attribute and the **Month Number Of Year** attribute.

2. In the diagram, right-click the **Month Name** attribute and then select **New Attribute Relationship**.

3. In the **Create Attribute Relationship** dialog box, the **Source Attribute** is **Month Name**. Set the **Related Attribute** to **Month Number Of Year**.

4. In the **Relationship type** list, set the relationship type to **Rigid**.

   The relationships between the members of the **Month Name** attribute and the **Month Number Of Year** attribute will not change over time. As a result, Analysis Services will not drop aggregations for this relationship during incremental processing. If a change does occur, a processing error will occur during incremental processing and you will need to perform a full process of the dimension. You are now ready to set the sort order for the members of **Month Name**.

5. Click **OK**.

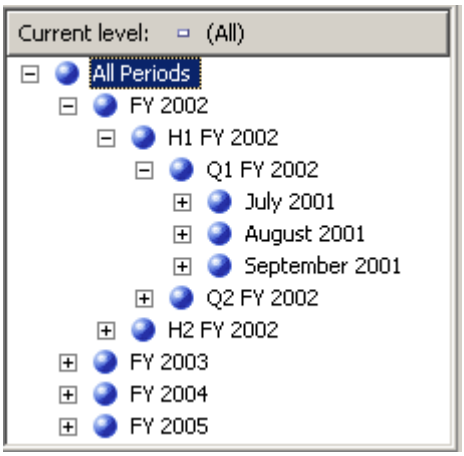
6. Click the **Dimension Structure** tab.

7. Select **Month Name** in the **Attributes** pane, and then change the value of the **OrderBy** property in the Properties window to **AttributeKey** and change the value of the **OrderByAttribute** property to **Month Number Of Year**.

8. On the **Build** menu, click **Deploy Analysis Services Tutorial**.

9. When deployment has successfully completed, switch to the **Browser** tab for the Time dimension, click **Reconnect**, and then browse the **Calendar Time** and **Fiscal Time** user hierarchies to verify that months now sort in chronological order.

   Notice that the months are now sorted in chronological order, as shown in the following image.



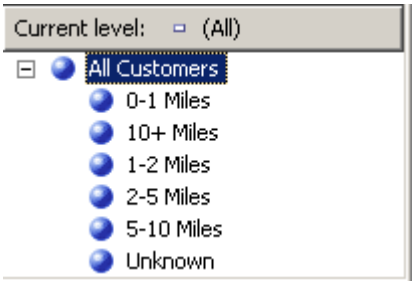
Defining Attribute Relationships and Sort Order in the Customer Dimension

To define the attribute relationships and sort order in the Customer dimension

1. Switch to the **Browser** tab in Dimension Designer for the Customer dimension, and then browse the members of the **Commute Distance** attribute hierarchy.

Notice that the members of this attribute hierarchy are sorted based on the ASCII values of the member key. In this case, sorting by the attribute name or key does not sort the commute distances from least to most. In this task, you sort the members of the attribute hierarchy based on the **CommuteDistanceSort** named calculation that ascribes the appropriate sort number to each distinct value in the column. To save time, this named calculation has already been added to the **Customer** table in the Adventure Works DW data source view. You can switch to this data source view to view the SQL script that is used in this named calculation. For more information, see Defining Named Calculations in a Data Source View (Analysis Services).

The following image shows the members of the **Commute Distance** attribute hierarchy, sorted by the ASCII values of the member key.



2. Switch to the **Dimension Structure** tab in Dimension Designer for the Customer dimension, right-click **CommuteDistanceSort** in the **Customer** table in the **Data Source View** pane, and then click **New Attribute from Column**.

3. In the **Attributes** pane, select **Commute Distance Sort**, and then set the **AttributeHierarchyEnabled** property for this attribute to **False** in the Properties window, set the **AttributeHierarchyOptimizedState** property to **NotOptimized**, and set the **AttributeHierarchyOrdered** property to **False**.

   These settings will hide the attribute from users and will improve processing time. This attribute will not be used for browsing. It will only be used for ordering the members of another attribute.

4. Select **Geography**, and then set its **AttributeHierarchyVisible** property to **False** in the Properties window, set its **AttributeHierarchyOptimizedState** property to **NotOptimized**, and set its **AttributeHierarchyOrdered** property to **False**.

   These settings will hide the attribute from users and will improve processing time. This attribute will not be used for browsing. It will be only be used for ordering the members of another attribute. Because **Geography** has member properties, its **AttributeHierarchyEnabled** property must be set to **True**. Therefore, to hide the attribute, you set the **AttributeHierarchyVisible** property to **False**.

5. Click the **Attribute Relationships** tab.

6. In the attributes list, right-click the **Commute Distance** attribute and then select **New Attribute Relationship**.

7. In the **Create Attribute Relationship** dialog box, the **Source Attribute** is **Commute Distance**. Set the **Related Attribute** to **Commute Distance Sort**.

8. In the **Relationship type** list, set the relationship type to **Rigid**.

   The relationship between the members of the **Commute Distance** attribute and the **Commute Distance Sort** attribute will not change over time.

9. Click **OK**.

   You are now ready to set the sort order for the **Commute Distance** attribute.

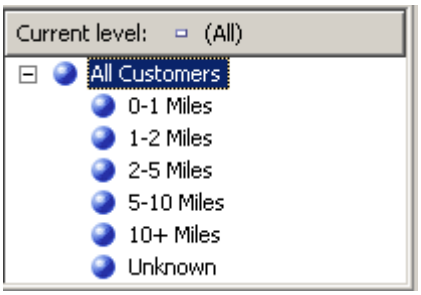
10. Click the **Dimension Structure** tab.

11. In the **Attributes** pane, select **Commute Distance**, and then change the value of the **OrderBy** property in the Properties window to **AttributeKey**, and change the value of the **OrderByAttribute** property to **Commute Distance Sort**.

12. On the **Build** menu, click **Deploy Analysis Services Tutorial**.

13. When deployment has successfully completed, switch to the **Browser** tab of Dimension Designer for the Customer dimension, click **Reconnect**, and then browse the **Commute Distance** attribute hierarchy.

    Notice that the attribute hierarchy members are now sorted in a logical order based on increasing distance, as shown in the following image.

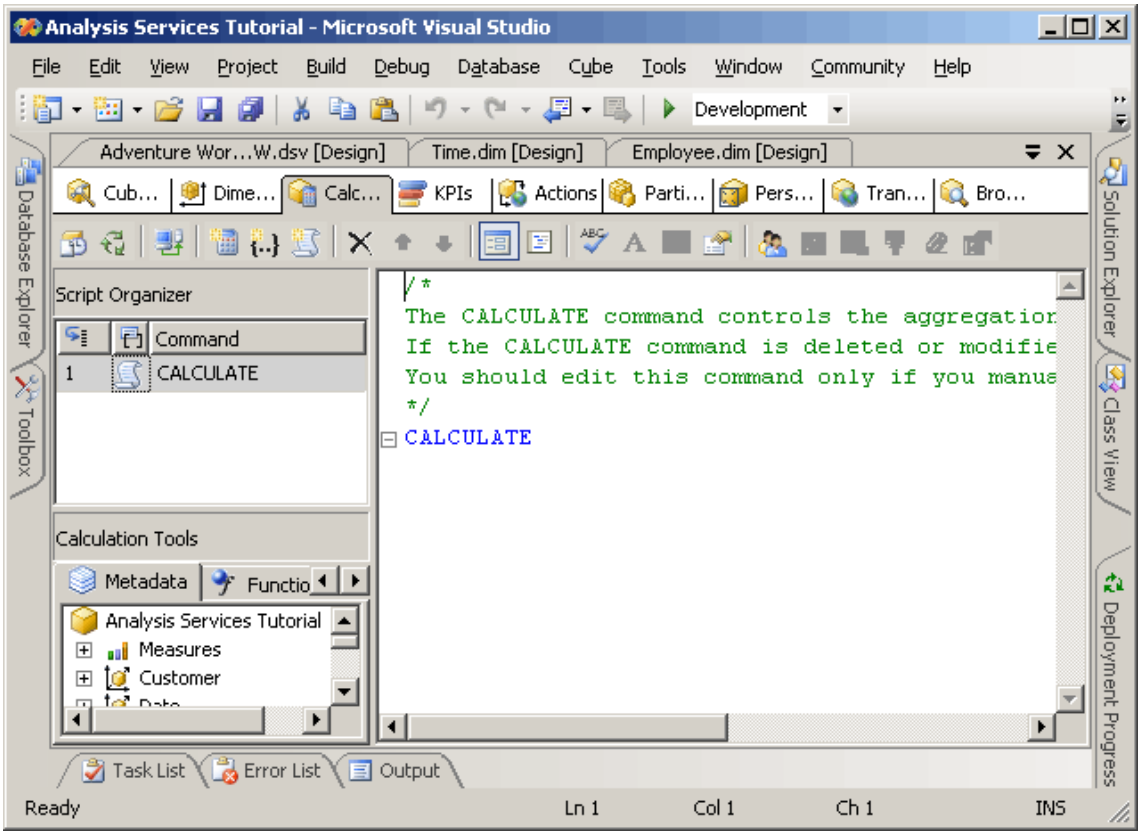


Defining Calculations to Aggregate Physical Measures

1. Open Cube Designer for the Analysis Services Tutorial cube, and then click the **Calculations** tab.

Notice the default CALCULATE command in the **Calculation Expressions** pane and in the **Script Organizer** pane. This command specifies that the measures in the cube should be aggregated according to the value that is specified by their AggregateFunction properties. Measure values are generally summed, but may also be counted or aggregated in some other manner.

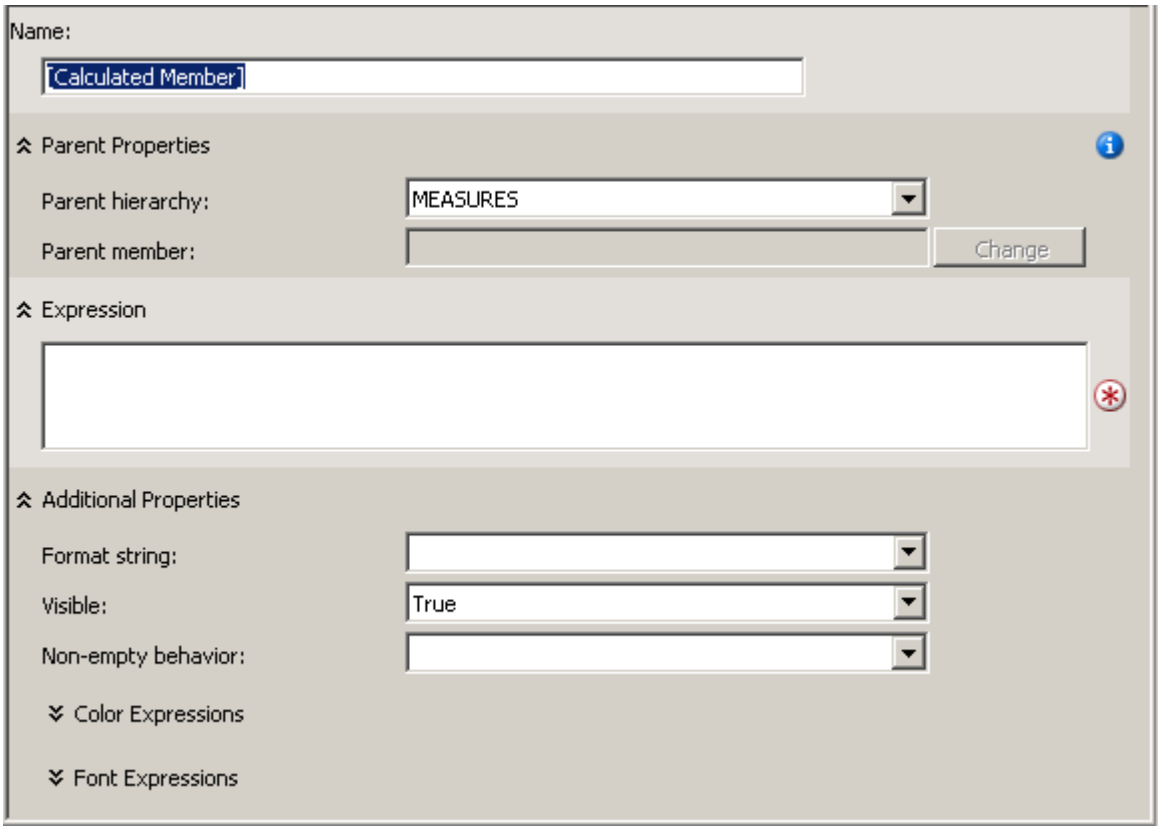
The following image shows the **Calculations** tab of Cube Designer.



2. On the toolbar of the **Calculations** tab, click **New Calculated Member**.

A new form appears in the **Calculation Expressions** pane within which you define the properties of this new calculated member. The new member also appears in the **Script Organizer** pane.

The following image shows the form that appears in the **Calculation Expressions** pane when you click **New Calculated Member**.



3. In the **Name** box, change the name of the calculated measure to **[Total Sales Amount]**.

If the name of a calculated member contains a space, the calculated member name must be enclosed in square brackets.

Notice in the **Parent hierarchy** list that, by default, a new calculated member is created in the **Measures** dimension. A calculated member in the Measures dimension is also frequently called a calculated measure.

4. On the **Metadata** tab in the **Calculation Tools** pane of the **Calculations** tab, expand **Measures** and then expand **Internet Sales** to view the metadata for the **Internet Sales** measure group.

You can drag metadata elements from the **Calculation Tools** pane into the **Expression** box and then add operators and other elements to create Multidimensional Expressions (MDX) expressions. Alternatively, you can type the MDX expression directly into the **Expression** box.

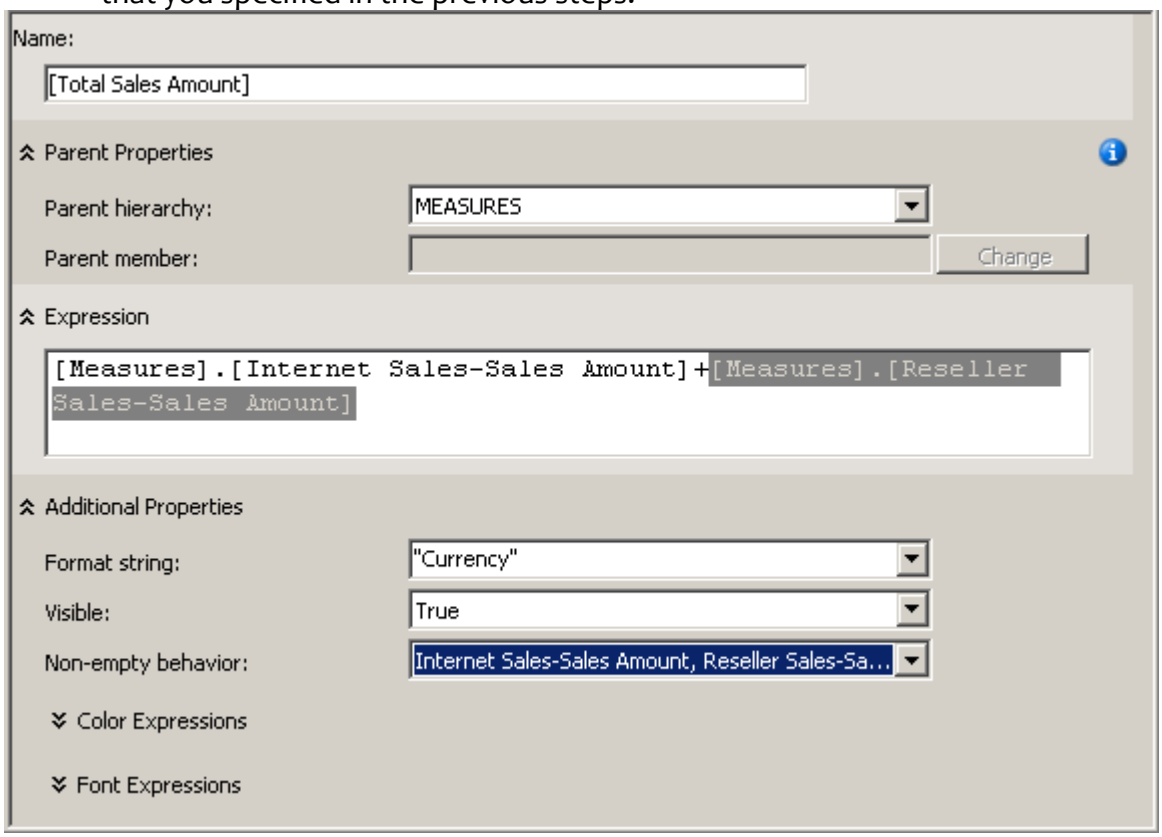
Note:
If you cannot view any metadata in the **Calculation Tools** pane, click **Reconnect** on the toolbar. If this does not work, you may have to process the cube or start the instance of Analysis Services.

1. Drag **Internet Sales-Sales Amount** from the **Metadata** tab in the **Calculation Tools** pane into the **Expression** box in the **Calculation Expressions** pane.
2. In the **Expression** box, type a plus sign (**+**) after **[Measures].[Internet Sales-Sales Amount]**.

3. On the **Metadata** tab in the **Calculation Tools** pane, expand **Reseller Sales**, and then drag **Reseller Sales-Sales Amount** into the **Expression** box in the **Calculation Expressions** pane after the plus sign (+).
4. In the **Format string** list, select **"Currency".**
5. In the **Non-empty behavior** list, select the check boxes for **Internet Sales-Sales Amount** and **Reseller Sales-Sales Amount**, and then click **OK**.

   The measures you specify in the **Non-empty behavior** list are used to resolve NON EMPTY queries in MDX. When you specify one or more measures in the **Non-empty behavior** list, Analysis Services treats the calculated member as empty if all the specified measures are empty. If the **Non-empty behavior** property is blank, Analysis Services must evaluate the calculated member itself to determine whether the member is empty.

   The following image shows the **Calculation Expressions** pane populated with the settings that you specified in the previous steps.



6. On the toolbar of the **Calculations** tab, click **Script View**, and then review the calculation script in the **Calculation Expressions** pane.
   Notice that the new calculation is added to the initial CALCULATE expression; each individual calculation is separated by a semicolon. Notice also that a comment appears at the beginning of the calculation script. Adding comments within the calculation script for groups of calculations is a good practice, to help you and other developers understand complex calculation scripts.

7. Add a new line in the calculation script after the **Calculate;** command and before the newly added calculation script, and then add the following text to the script on its own line:

8. The following image shows the calculation scripts as they should appear in the **Calculation Expressions** pane at this point in the tutorial.

```
/*
The CALCULATE command controls the aggregation of leaf cells in the cube.
If the CALCULATE command is deleted or modified, the data within the cube is affected.
You should edit this command only if you manually specify how the cube is aggregated.
*/
CALCULATE;
/* Calculations to aggregate Internet Sales and Reseller Sales measures */
CREATE MEMBER CURRENTCUBE.[MEASURES].[Total Sales Amount]
 AS [Measures].[Internet Sales-Sales Amount]+[Measures].[Reseller Sales-Sales Amount],
FORMAT_STRING = "Currency",
NON_EMPTY_BEHAVIOR = { [Internet Sales-Sales Amount], [Reseller Sales-Sales Amount] },
VISIBLE = 1  ;
```

9.

10. On the toolbar of the **Calculations** tab, click **Form View**, verify that **[Total Sales Amount]** is selected in the **Script Organizer** pane, and then click **New Calculated Member**.
11. Change the name of this new calculated member to **[Total Product Cost]**, and then create the following expression in the **Expression** box:

```
[Measures].[Internet Sales-Total Product Cost] + [Measures].[Reseller Sales-Total Product Cost]
```

12. In the **Format string** list, select **"Currency"**.
13. In the **Non-empty behavior** list, select the check boxes for **Internet Sales-Total Product Cost** and **Reseller Sales-Total Product Cost**, and then click **OK**.
    On the toolbar of the **Calculations** tab, click **New Calculated Member**.

Create a Calculation for calculating Total Gross Profit Margin

1. In the **Name** box, change the name of this calculated measure to **[Total GPM]**.
2. In the **Expression** box, create the following MDX expression:

Copy Code

```
([Measures].[Total Sales Amount] -
[Measures].[Total Product Cost]) /
[Measures].[Total Sales Amount]
```

3. Notice that this calculated member is referencing other calculated members. Because this calculated member will be calculated after the calculated members that it references, this is a valid calculated member.
4. In the **Format string** list, select **"Percent"**.
5. In the **Non-empty behavior** list, select the check boxes for **Internet Sales-Sales Amount** and **Reseller Sales-Sales Amount**, and then click **OK**.
6. On the toolbar of the **Calculations** tab, click **Script View** and review the three calculations you just added to the calculation script.

Browsing the New Calculated Members

1. On the **Build** menu of Business Intelligence Development Studio, click **Deploy Analysis Services Tutorial**.
2. When deployment has successfully completed, switch to the **Browser** tab, click **Reconnect**, and then remove all hierarchies and measures from the **Data** pane.
3. In the **Metadata** pane, expand **Measures** to view the new calculated members in the Measures dimension.
4. Add the **Total Sales Amount**, **Internet Sales-Sales Amount**, and **Reseller Sales-Sales Amount** measures to the data area, and then review the results.

Notice that the **Total Sales Amount** measure is the sum of the **Internet Sales-Sales Amount** measure and the **Reseller Sales-Sales Amount** measure.

5. Add the **Product Categories** user-defined hierarchy to the filter area of the **Data** pane, and then filter the data by **Mountain Bikes**.

Notice that the **Total Sales Amount** measure is calculated for the **Mountain Bikes** category of product sales based on the **Internet Sales-Sales Amount** and the **Reseller Sales-Sales Amount** measures for **Mountain Bikes**.

6. Add the **Date.Calendar Time** user-defined hierarchy to the row area, and then review the results.

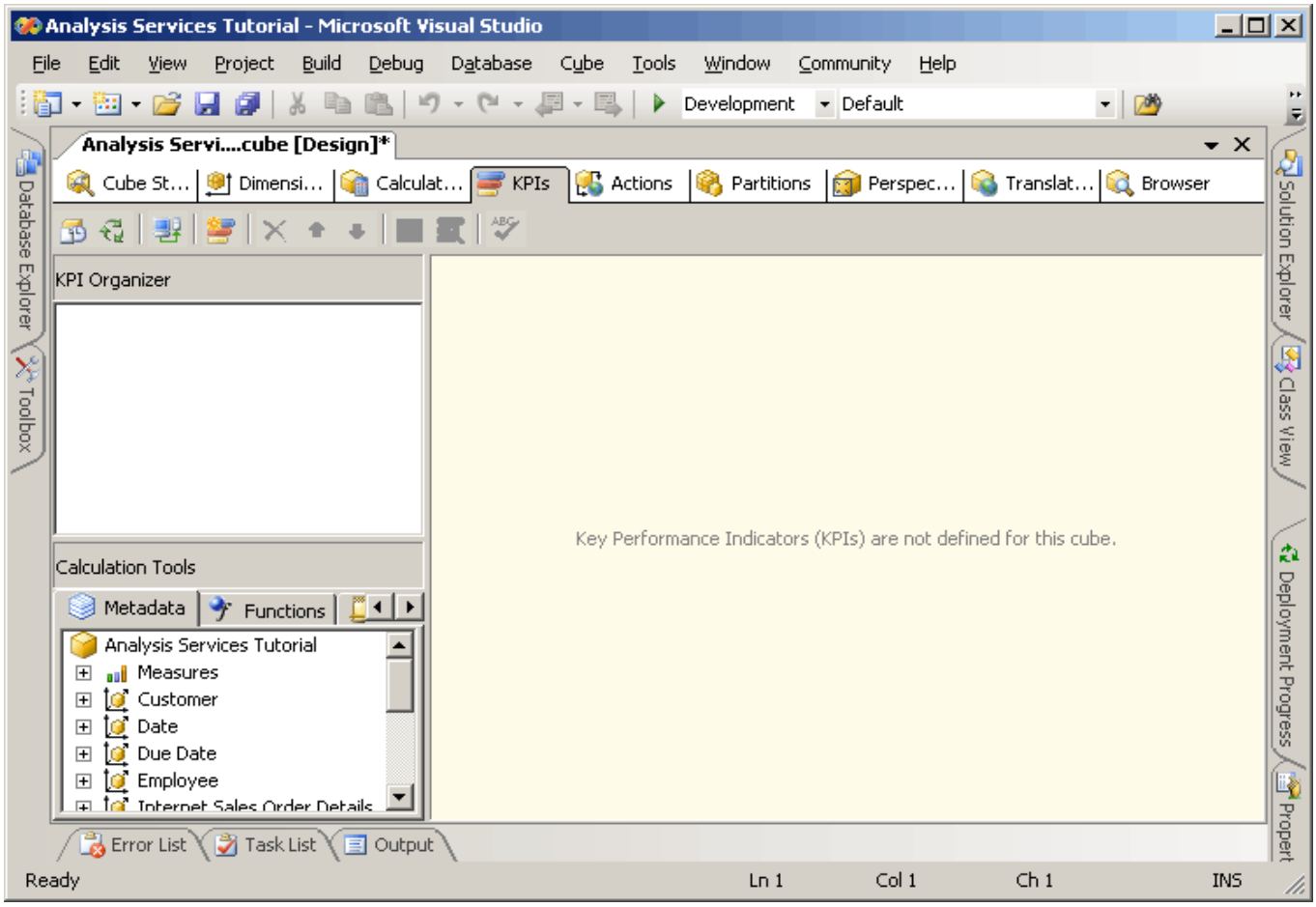
Notice that the **Total Sales Amount** measure for each calendar year is calculated for the **Mountain Bikes** category of product sales based on the **Internet Sales-Sales Amount** and the **Reseller Sales-Sales Amount** measures for **Mountain Bikes**.

Defining the Reseller Revenue KPI

1. Open Cube Designer for the Analysis Services Tutorial cube, and then click the **KPIs** tab.

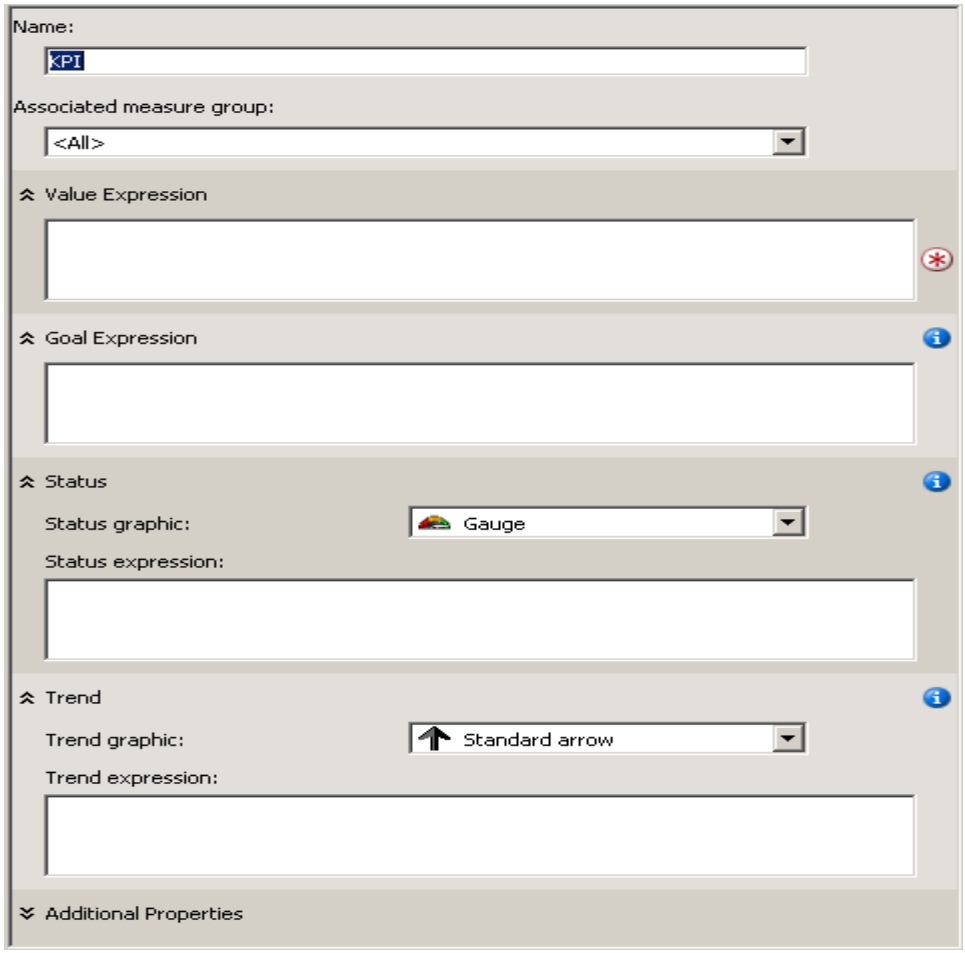
The **KPIs** tab includes several panes. On the left side of the tab are the **KPI Organizer** pane and the **Calculation Tools** pane. The display pane in the middle of the tab contains the details of the KPI that is selected in the **KPI Organizer** pane.

The following image shows the **KPIs** tab of Cube Designer.



2. On the toolbar of the **KPIs** tab, click the **New KPI** button.

A blank KPI template appears in the display pane, as shown in the following image.



3. In the **Name** box, type **Reseller Revenue**, and then select **Reseller Sales** in the **Associated measure group** list.
4. On the **Metadata** tab in the **Calculation Tools** pane, expand **Measures**, expand **Reseller Sales**, and then drag the **Reseller Sales-Sales Amount** measure to the **Value Expression** box.
5. On the **Metadata** tab in the **Calculation Tools** pane, expand **Measures**, expand **Sales Quotas**, and then drag the **Sales Amount Quota** measure to the **Goal Expression** box.
6. Verify that **Gauge** is selected in the **Status indicator** list, and then type the following MDX expression in the **Status expression** box:

```
Case
 When
  KpiValue("Reseller Revenue")/KpiGoal("Reseller Revenue")>=.95
   Then 1
 When
  KpiValue("Reseller Revenue")/KpiGoal("Reseller Revenue")<.95
   And
  KpiValue("Reseller Revenue")/KpiGoal("Reseller Revenue")>=.85
   Then 0
```

```
 Else-1
End
```

7. This MDX expression provides the basis for evaluating the progress toward the goal. In this MDX expression, if actual reseller sales are more than 85 percent of the goal, a value of 0 is used to populate the chosen graphic. Because a gauge is the chosen graphic, the pointer in the gauge will be half-way between empty and full. If actual reseller sales are more the 90 percent, the pointer on the gauge will be three-fourths of the way between empty and full.
8. Verify that **Standard arrow** is selected in the **Trend indicator** list, and then type the following expression in the **Trend expression** box:

```
Case
 When IsEmpty
 (ParallelPeriod
  ([Date].[Calendar Time].[Calendar Year],1,
     [Date].[Calendar Time].CurrentMember))
 Then 0
When  (
 KpiValue("Reseller Revenue") -
  (KpiValue("Reseller Revenue"),
   ParallelPeriod
    ([Date].[Calendar Time].[Calendar Year],1,
     [Date].[Calendar Time].CurrentMember))
    /
    (KpiValue ("Reseller Revenue"),
     ParallelPeriod
      ([Date].[Calendar Time].[Calendar Year],1,
       [Date].[Calendar Time].CurrentMember)))
     >=.02
 Then 1
  When(
   KpiValue("Reseller Revenue") -
    (KpiValue ( "Reseller Revenue" ),
     ParallelPeriod
      ([Date].[Calendar Time].[Calendar Year],1,
       [Date].[Calendar Time].CurrentMember))
      /
       (KpiValue("Reseller Revenue"),
        ParallelPeriod
         ([Date].[Calendar Time].[Calendar Year],1,
           [Date].[Calendar Time].CurrentMember)))
       <=.02
 Then -1
```

```
  Else 0
End
```

9. This MDX expression provides the basis for evaluating the trend toward achieving the defined goal.

Browsing the Cube by Using the Reseller Revenue KPI

1. On the **Build** menu of Business Intelligence Development Studio, click **Deploy Analysis Service Tutorial**.
2. When deployment has successfully completed, on the toolbar of the **KPIs** tab, click the **Browser View** button , and then click **Reconnect**.

The status and trend gauges are displayed in the **KPI Browser** pane for reseller sales based on the values for the default member of each dimension, together with the value for the value and the goal. The default member of each dimension is the All member of the All level, because you have not defined any other member of any dimension as the default member.

3. In the filter pane, select **Sales Territory** in the **Dimension** list, select **Sales Territories** in the **Hierarchy** list, select **Equal** in the **Operator** list, select the **North America** check box in the **Filter Expression** list, and then click **OK**.
4. In the next row in the **Filter** pane, select **Date** in the **Dimension** list, select **Calendar Time** in the **Hierarchy** list, select **Equal** in the **Operator** list, select the **Q3 CY 2003** check box in the **Filter Expression** list, and then click **OK**.
5. Click anywhere in the **KPI Browser** pane to update the values for the **Reseller Revenue KPI**.

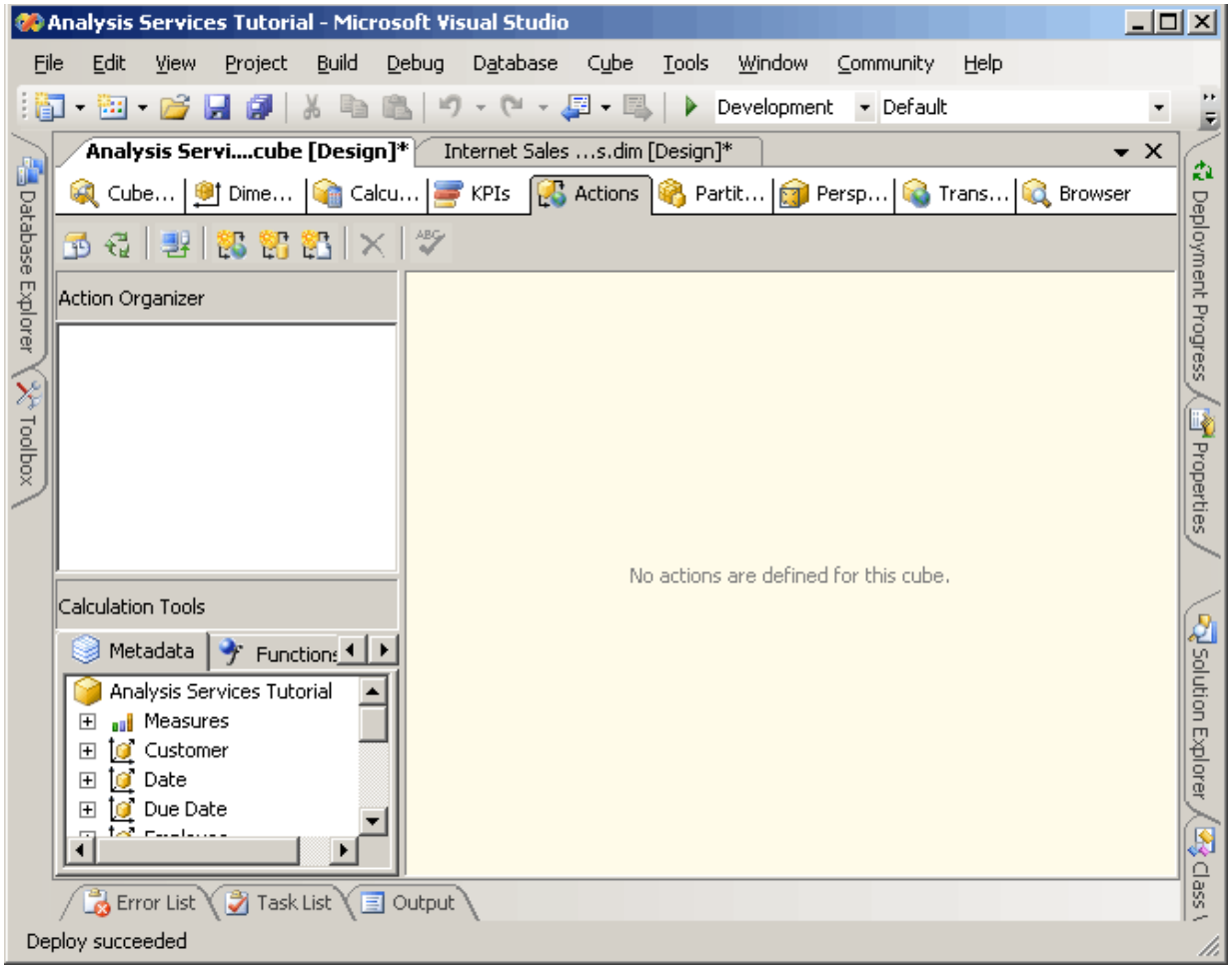
Notice that the **Value**, **Goal**, and **Status** sections of the KPI reflect the values for the new time period

Display Structure	Value	Goal	Status	Trend
Reseller Revenue	$10,926,196.09	$13,733,000.00		

Defining the Drillthrough Action Properties

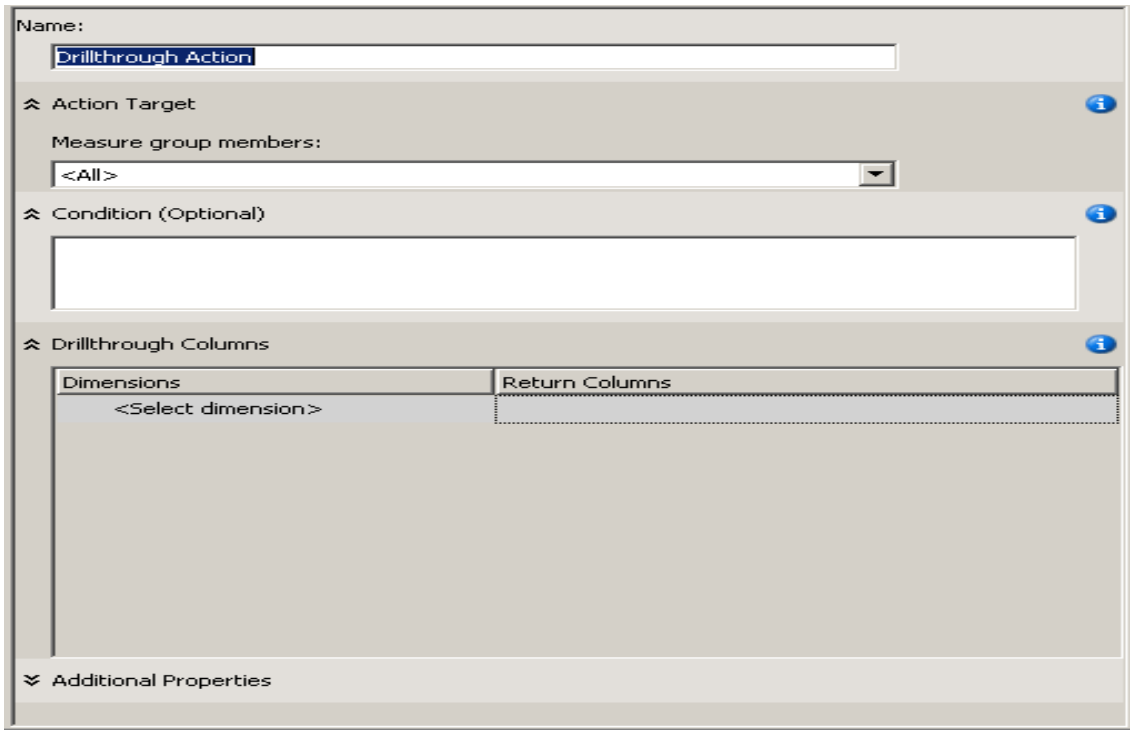
1. In Cube Designer for the Analysis Services Tutorial cube, click the **Actions** tab.

The **Actions** tab includes several panes. On the left side of the tab are the **Action Organizer** pane and the **Calculation Tools** pane. The pane to the right of these two panes is the **Display** pane, which contains the details of the action that is selected in the **Action Organizer** pane.
The following image shows the **Actions** tab of Cube Designer.

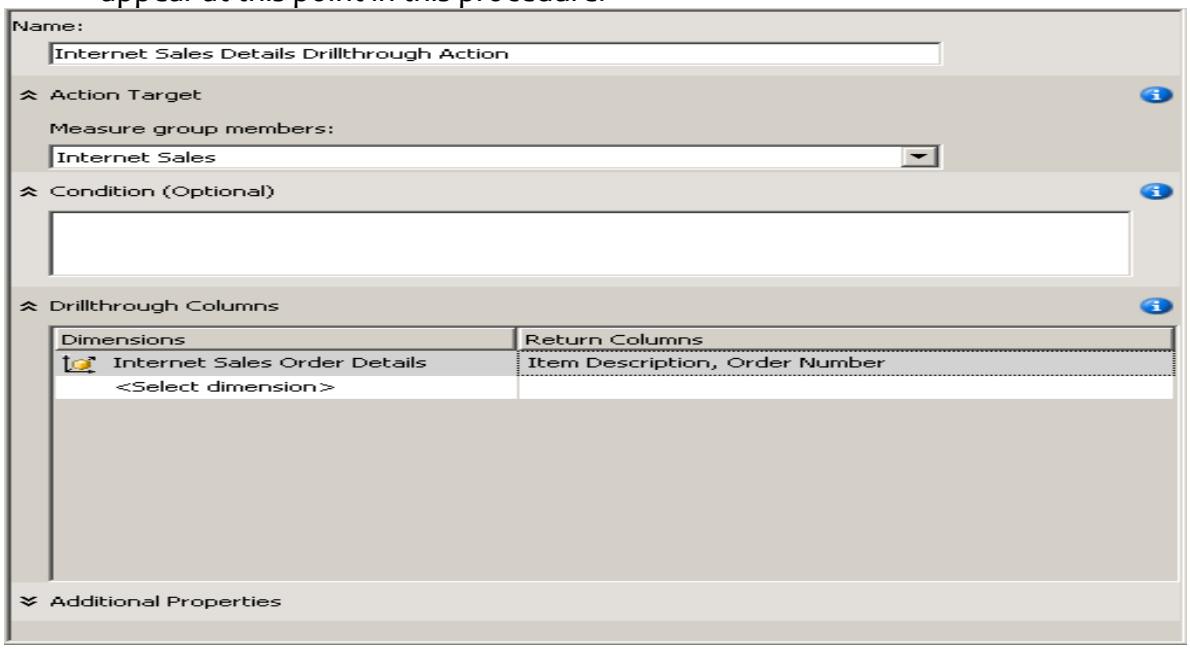


2. On the toolbar of the **Actions** tab, click the **New Drillthrough Action** button.

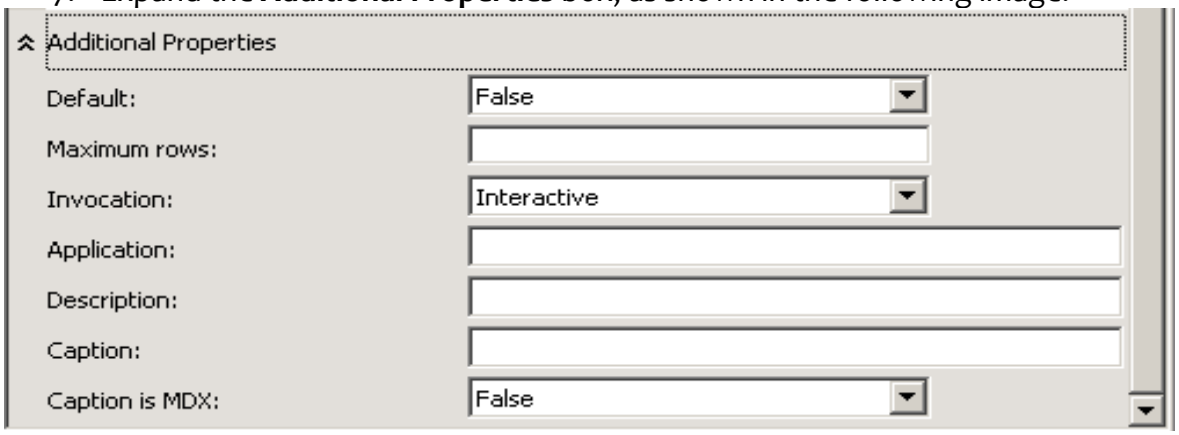
A blank action template appears in the display pane.



3. In the **Name** box, change the name of this action to **Internet Sales Details Drillthrough Action**.
4. In the **Measure group members** list, select **Internet Sales**.
5. In the **Drillthrough Columns** box, select **Internet Sales Order Details** in the **Dimensions** list.
6. In the **Return Columns** list, select the **Item Description** and the **Order Number** check boxes, and then click **OK**. The following image shows the Action template as it should appear at this point in this procedure.

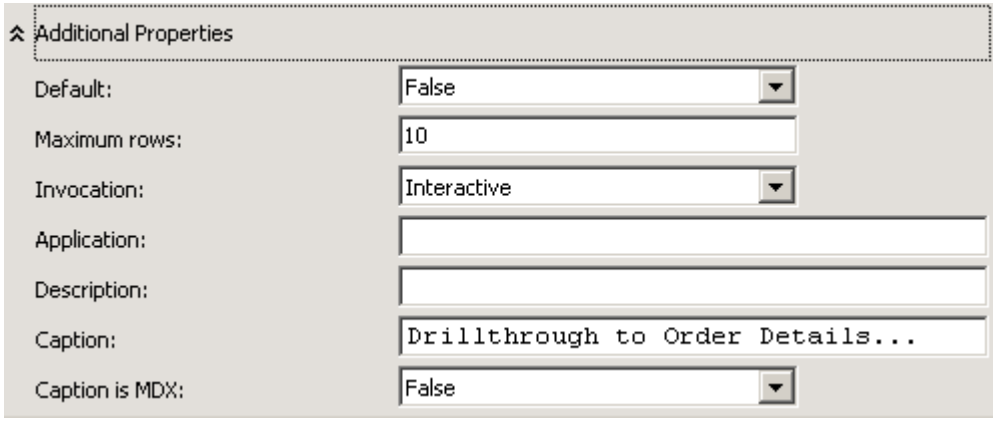


7. Expand the **Additional Properties** box, as shown in the following image.



8. In the **Maximum Rows** box, type **10**.
9. In the **Caption** box, type **Drillthrough to Order Details...**.

These settings limit the number of rows returned and specify the caption that appears in the client application menu. The following image shows these settings in the **Additional Properties** box.



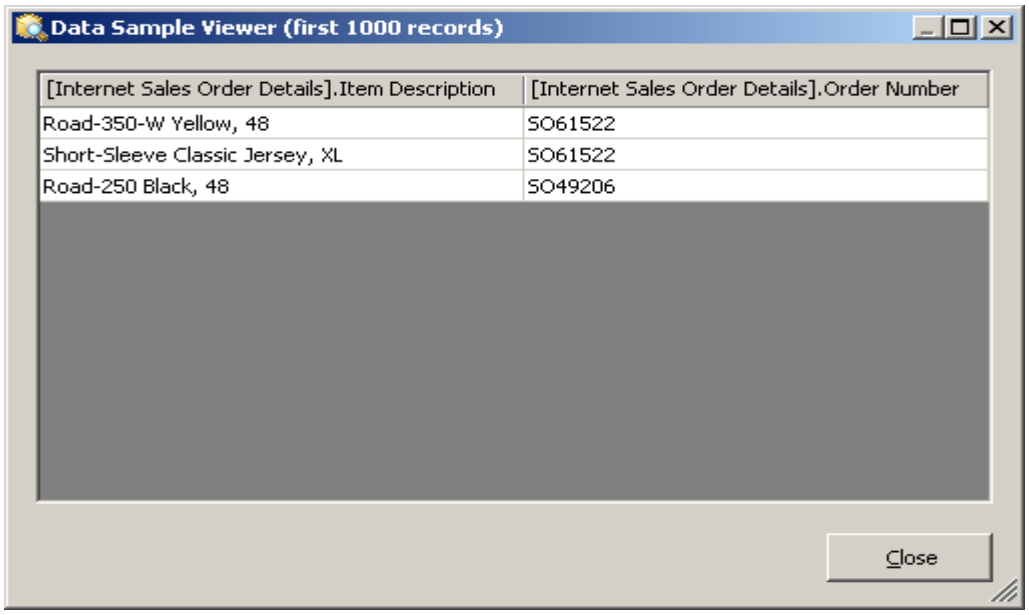
Using the Drillthrough Action

1. On the **Build** menu, click **Deploy Analysis Services Tutorial**.
2. When deployment has successfully completed, click the **Browser** tab in Cube Designer for the Analysis Services Tutorial cube, and then click the **Reconnect** button.
3. Remove all hierarchies and measures from the **Data** pane and all dimension members from the **Filter** pane.
4. Add the **Internet Sales-Sales Amount** measure to the data area.
5. Add the **Customer Geography** user-defined hierarchy from the **Location** folder in the **Customer** dimension to the **Filter** pane.
6. In the **Filter Expression** list, expand **All Customers**, expand **Australia**, expand **Queensland**, expand **Brisbane**, expand **4000**, select the check box for **Adam Powell**, and then click **OK**.

The total sales of products by Adventure Works Cycles to Adam Powell are displayed in the data area.

7. Click the data cell in the Data pane, and then right-click that data cell and click **Drillthrough to Order Details**.

The details of the orders that were shipped to Adam Powell are displayed in the **Data Sample Viewer**, as shown in the following image. However, some additional details would also be useful, such as the order date, due date, and ship date. In the next procedure, you will add these additional details.



8. Click **Close** to close the **Data Sample Viewer** window.

Modifying the Drillthrough Action

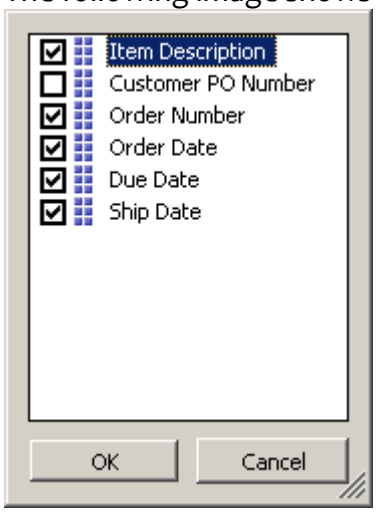
1. Open Dimension Designer for the **Internet Sales Order Details** dimension.

Notice that only three attributes have been defined for this dimension.

2. In the **Data Source View** pane, right-click an open area, and then click **Show All Tables**.
3. On the **Format** menu, point to **Autolayout** and then click **Diagram**.
4. Locate the **InternetSales (dbo.FactInternetSales)** table by right-clicking in an open area of the **Data Source View** pane. Then click **Find Table,** click **InternetSales,** and click **OK**.
5. Create new attributes based on the following columns:
   - OrderDateKey
   - DueDateKey
   - ShipDateKey
6. Change the **Name** property for the **Order Date Key** attribute to **Order Date** Then, click the browse button for the **Name Column** property, and in the **Name Column** dialog box, select **Time** as the source table and select SimpleDate as the source column. Click **OK**.
7. Change the **Name** property for the **Due Date Key** attribute to **Due Date**, and then, by using the same method as the **Order Date Key** attribute, change the **Name Column** property for this attribute to **Time.SimpleDate (WChar)**.
8. Change the **Name** property for the **Ship Date Key** attribute to **Ship Date**, and then change the **Name Column** property for this attribute to **Time.SimpleDate (WChar)**.
9. Switch to the **Actions** tab of Cube Designer for the Analysis Services Tutorial cube.

10. In the **Drillthrough Columns** box, select the check boxes to add the following columns to the **Return Columns** list, and then click **OK:**
    - Order Date
    - Due Date
    - Ship Date

The following image shows these columns selected.



Reviewing the Modified Drillthrough Action

To review the modified drillthrough action

1. On the **Build** menu, click **Deploy Analysis Services Tutorial**.
2. When deployment has successfully completed, switch to the **Browser** tab in Cube Designer for the Analysis Services Tutorial cube, and then click the **Reconnect** button.
3. Click the single data cell, and then right-click that cell and click **Drillthrough to Order Details**.

The details of these orders shipped to Adam Powell are displayed in the **Data Sample Viewer**. This includes the order date, due date, and ship date information, as shown in the following image.

4. Click **Close** to close the **Data Sample Viewer**.

Use Cube Partition Concept to load incremental changes

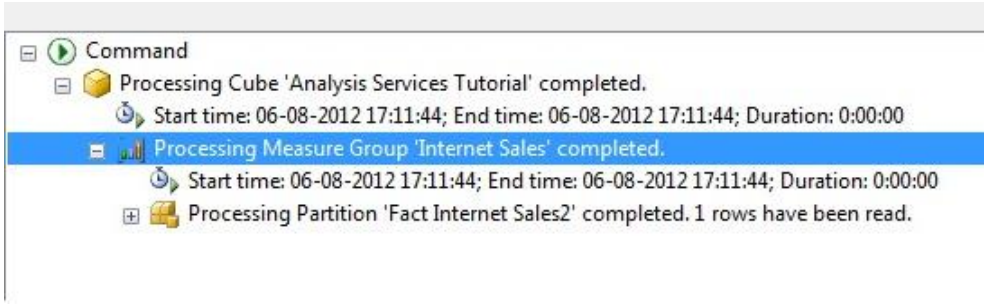
Lab 4	Use Cube Partition Concept to load incremental changes
Description	We will be working on SSAS Project of Lab 2 & 3. We will be creating a new partition to load the new data of Internet Sales.
Objective	To learn 1. Creating a New Storage Partition for a Cube based on new relational table 2. Processing the partition load the changes 3. Cross check the changes in the report.

1. Launch SSMS and connect to your AdventureWorks2008DW SQL Server Database.
   a. Create one more table with name "FactInternetSales2" which has same structure as FactInternetSales table.
   b. Add one record to the FactInternetSales2 table.

   Hint: You can use "select * into … " to create table and "insert into ….select top 1 from …… " to add one record.
2. Open the Analysis Services Project of Lab 3 if not already open.
3. Open the cube designer from solution explorer
4. Go to the Browser tab, drag the Category Attribute from product dimension and Internet Sales-Sales Amount measure. Note the result: It could be as below

Drop Filter Fields Here	
	Drop Column Fields Here
Category	Internet Sales-Sales Amount
Accessories	$700,759.96
Bikes	$28,318,144.65
Clothing	$339,772.61
Grand Total	$29,358,677.22

5. Go to Partitions TAB
   a. There will be one partition already existing for Internet Sales Measure Group, which is referring to FactInternetSales Table.
   b. Now, click the "New Partition" link.
   c. From the available tables in the wizard, select FactInternetSales2.
   d. Click Next and Finish the wizard.
6. Right click this new Partition and select Process, Click Run on the resulting dialog box



7. Once succeeded, In the Cube Browser TAB, Re-Connect and generate the same report again.

Drop Filter Fields Here	
	Drop Column Fields Here
Category ▼	Internet Sales-Sales Amount
Accessories	$700,759.96
Bikes	$28,321,722.92
Clothing	$339,772.61
Grand Total	$29,362,255.49

Check the difference in the report.
For instance in this case the additional sales have happened under Bikes Product Category.

Using Data Mining Algorithm

Lab 5	Using Data Mining Algorithm
Description	We will be working on New SSAS Project where we will mine data of Bike Buyers, apply mining algorithm to analyze data and do prediction.
Objective	To learn 1. How to create Mining Structure 2. Create Mining Model based on Mining Structure using Decision Tree and Clustering Mining Algorithm 3. View the Mining Model Result 4. Do prediction

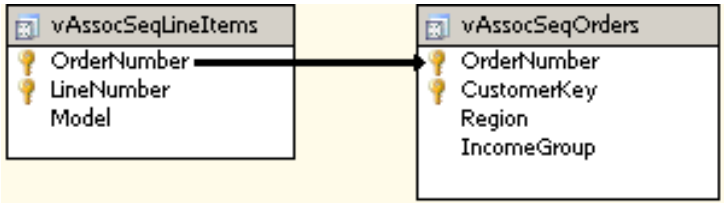
Creating a Data Source and Data Source View

1. Create a New Analysis Services Project.
2. From Solution Explorer add a New Data Source, Name it Adventure Works DW.ds. Connect to AdventureWorksDW database
3. Create a Data Source View. Name it Adventure Works DW DSV.dsv
4. Select following Tables and Views in the new data source view:
    a. dbo.ProspectiveBuyer
    b. dbo.vAssocSeqLineItems
    c. dbo.vAssocSeqOrders
    d. dbo.vTargetMail
    e. dbo.vTimeSeries
5. In the data source view pane of Data Source View Designer, select the OrderNumber column in the vAssocSeqLineItems table.
6. Drag the column to the vAssocSeqOrders table, and put it on the OrderNumber column.

Important:

Make sure to drag the OrderNumber column from the vAssocSeqLineItems nested table, which represents the many side of the join, to the vAssocSeqOrders case table, which represents the one side of the join.

7. A new many-to-one relationship now exists between the vAssocSeqLineItems and vAssocSeqOrders tables. If you have joined the tables correctly, the data source view should appear as follows:



Creating a Mining Structure

8. In Solution Explorer, right-click Mining Structures and select New Mining Structure to start the Data Mining Wizard.
9. On the Welcome to the Data Mining Wizard page, click Next.
10. On the Select the Definition Method page, verify that From existing relational database or data warehouse is selected, and then click Next.
11. On the Create the Data Mining Structure page, under Which data mining technique do you want to use?, select Microsoft Decision Trees.

12. Click Next.
13. On the Select Data Source View page, notice that Adventure Works DW is selected by default. Click Browse to view the tables in the data source view, and then click Close to return to the wizard.
14. Click Next.
15. On the Specify Table Types page, select the check box in the Case column next to the vTargetMail table, and then click Next.
16. On the Specify the Training Data page, verify that the check box in the Key column is selected next to the CustomerKey column.
17. If the source table from the data source view indicates a key, the Data Mining Wizard automatically chooses that column as a key for the model.
18. Select Input and Predictable next to the BikeBuyer column.
19. Click Suggest to open the Suggest Related Columns dialog box.
20. The Suggest button is enabled whenever at least one predictable attribute has been selected. The Suggest Related Columns dialog box lists the columns that are most closely related to the predictable column, and orders the attributes by their correlation with the predictable attribute. Columns with a value greater than 0.05 are automatically selected to be included in the model.
21. Review the suggestions, and then click Cancel to ignore the suggestions and keep the original values set by the wizard.

Note:
If you click OK, all listed suggestions are used, and the selected columns are marked as input columns in the wizard. If you agree with only some of the suggestions, you must change the values manually.

22. Select the Input check boxes next to the following columns:

a. Age
b. CommuteDistance
c. EnglishEducation
d. EnglishOccupation
e. FirstName
f. Gender
g. GeographyKey
h. HouseOwnerFlag
i. LastName
j. MaritalStatus
k. NumberCarsOwned
l. NumberChildrenAtHome
m. Region
n. TotalChildren
o. YearlyIncome

23. Click Next.
24. On the Specify Columns' Content and Data Type page, click Detect to run an algorithm that samples numeric data and determines whether the numeric columns contain continuous or discrete values. For example, a column can contain salary information as actual salary values, which are continuous, or it can contain integers that represent encoded salary ranges, such as 1 = < $25,000; 2 = from $25,000 to $50,000, which are discrete.
25. After you click Detect, review the entries in the Content Type and Data Type columns and change them if necessary, to make sure that the settings are the same as those listed in the following table.
26. Typically, the wizard will detect numbers and assign an appropriate numeric data type, but there are many scenarios where you might want to handle a number as text instead. For example, the GeographyKey should be handled as text, because it would be inappropriate to perform mathematical operations on this identifier.

Column	Content Type	Data Type
Age	Continuous	Long
BikeBuyer	Discrete	Long
CommuteDistance	Discrete	Text
CustomerKey	Key	Long
EnglishEducation	Discrete	Text
EnglishOccupation	Discrete	Text
FirstName	Discrete	Text
Gender	Discrete	Text

GeographyKey	Discrete	Text
HouseOwnerFlag	Discrete	Text
LastName	Discrete	Text
MaritalStatus	Discrete	Text
NumberCarsOwned	Discrete	Long
NumberChildrenAtHome	Discrete	Long
Region	Discrete	Text
TotalChildren	Discrete	Long
YearlyIncome	Continuous	Double

27. Click Next.
28. On the Split data into training and testing sets page, for Percentage of testing data, leave the default value of 30.
29. For Maximum number of cases in testing data set, type 1000. Click Next.
30. On the Completing the Wizard page, in Mining structure name, type Targeted Mailing.
31. In Mining model name, type TM_Decision_Tree.
32. Select the Allow drill through check box.
33. Click Finish.

Creating a Microsoft Clustering Model

34. Switch to the Mining Models tab in Data Mining Designer in Business Intelligence Development Studio.
35. Notice that the designer displays two columns, one for the mining structure and one for the initial mining model, which you created in the previous task in this lesson.
36. Right-click the Structure column and select New Mining Model.
37. The New Mining Model dialog box opens.
38. In Model name, type TM_Clustering.
39. In Algorithm name, select Microsoft Clustering.
40. Click OK.

Processing the Mining Models

41. On the Mining Model menu of BI Development Studio, click Process Mining Structure and All Models.
42. The Process Mining Structure - <Targeted Mailing> dialog box opens.
43. Click Run.
44. The Process Progress dialog box opens to display information about model processing. Model processing might take some time, depending on your computer.

45. After processing is complete, click Close in the Process Progress and Process Mining Structure - <Targeted Mailing> dialog boxes.

Exploring the Targeted Mailing Models

46. Switch to Mining Model Viewer TAB.
    a. Select v Target Mail as Mining Model and Viewer as Microsoft Tree Viewer
    b. Tree as : Bike Buyer
    c. Background : 1
    d. Set Show Level to: 3

You will be able to see the Tree which shows density of the Bike Buyers across major parameters.

47. Go to Dependency Network sub tab:
    a. Move the slide to identify the parameters which most affect bike buying capacity
48. Now, select TM_Clustering as Mining Model
    a. Shading Variabe: Bike Buyer
    b. State: 1

The Viewer will show groups (clusters) with background shade showing the density of the potential Bike Buyers.

Creating Predictions

49. On the Mining Model Prediction tab of Data Mining Designer, in the Mining Model box, click Select Model.
50. The Select Mining Model dialog box opens.
51. Navigate through the tree to the Targeted Mailing structure, expand the structure, select TM_Decision_Tree, and then click OK.
52. In the Select Input Table(s) box, click Select Case Table.
53. The Select Table dialog box opens.
54. In the Data Source list, select Adventure Works DW.
55. In Table/View Name, select the ProspectiveBuyer table, and then click OK.
56. After you select the input table, Prediction Query Builder creates a default mapping between the mining model and the input table, based on the names of the columns.

To build the prediction query

57. In the Source column in the grid on the Mining Model Prediction tab, click the cell in the first empty row, and then select ProspectiveBuyer.
58. In the ProspectiveBuyer row, in the Field column, select ProspectAlternateKey.
59. This adds the unique identifier to the prediction query so that you can identify who is and who is not likely to buy a bicycle.
60. Click the next empty row in the Source column, and then select TM_Decision_Tree.
61. In the TM_Decision_Tree row, in the Field column, select Bike Buyer.

62. This outputs the column in the Microsoft Decision Tree model that is the target of the predictions.
63. Click the next empty row under the Source column, and then select Prediction Function.
64. In the Prediction Function row, in the Field column, select PredictProbability.
65. Prediction functions provide information about how the model predicts. The PredictProbability function provides information about the probability of the prediction being correct. You can specify parameters for the prediction function in the Criteria/Argument column.
66. In the PredictProbability row, in the Criteria/Argument column, type [TM_Decision_Tree].[Bike Buyer].
67. This specifies the target column for the PredictProbability function. For more information about functions, see Data Mining Extensions (DMX) Function Reference.
68. The first tool on the toolbar of the Mining Model Prediction tab is the Switch to query design view / Switch to query result view button. By clicking the down arrow on this button, you can switch between views of the query you just created. The Query view enables you to review the DMX code that Prediction Query Builder created. The Result view enables you to run the query and see the results. The Design view enables you to add new prediction functions to the query. Note that if you manually alter the text of the query in Query view, the modified query is not persisted when you switch back to the Design view.

Viewing the Prediction Results

69. You can run the query by clicking the arrow next to the Switch to query design view / Switch to query result view button, the first button on the toolbar, and then selecting Result.
70. The ProspectAlternateKey, BikeBuyer, and Expression columns identify potential customers, indicate whether the potential customers are bike buyers, and indicate the probability of the prediction being correct. You can use these results to determine which potential customers you should target for the mailing.