

*Hong Kong Baptist University*  
*Department of Computer Science*

*COMP 7810/4096 Business Intelligence (2019-20)*

## SQL Server Analysis Services (SSAS)

---

### Introduction

By using SQL Server Data Tools (SSDT) Analysis Services, you can build a **multidimensional model** to perform **OLAP (online analytical processing) analysis**. OLAP performs multidimensional analysis of business data and provides the capability for complex calculations, trend analysis, and sophisticated data modeling. The basic concepts of OLAP include:

<b>Cube:</b>	Cube is the basic unit of storage and analysis in Analysis Services. A cube is a collection of data that's been aggregated to allow queries to return data quickly. Cubes are ordered into <i>dimensions</i> and <i>measures</i> .
<b>Dimension table:</b>	A <i>dimension table</i> contains hierarchical data by which you'd like to summarize. It contains a primary key and other attributes that describe the entities stored in the table.
<b>Dimension:</b>	Each cube has one or more <i>dimensions</i> , each based on one or more dimension tables.
<b>Fact table:</b>	A <i>fact table</i> contains the basic information that you wish to summarize. This might be order detail information, payroll records etc.
<b>Measure:</b>	Every cube will contain one or more <i>measures</i> , each based on a column in a fact table that you'd like to analyze.
<b>Schema:</b>	There are two basic OLAP schemas: star and snowflake. In a <i>star schema</i> , every dimension table is related directly to the fact table. In a <i>snowflake schema</i> , some dimension tables are related indirectly to the fact table.

This tutorial describes how to use SSDT to develop and deploy an Analysis Services project, using the fictitious company Adventure Works Cycles for all examples.

### Learning Outcomes

By finishing this lab session, you should be able to

- Develop a database for data warehousing
- Create an Analysis Service project using SSDT for OLAP analysis.

### **Tools**

- Microsoft SQL Server Management Studio 2012
- Visual Studio 2010 with SQL Server Data Tools (SSDT)

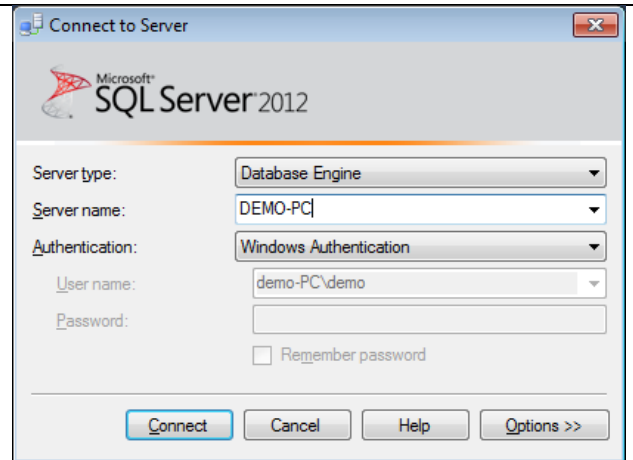
### **Source files required**

- AdventureWorksDW2012.bak (save it in C:\)

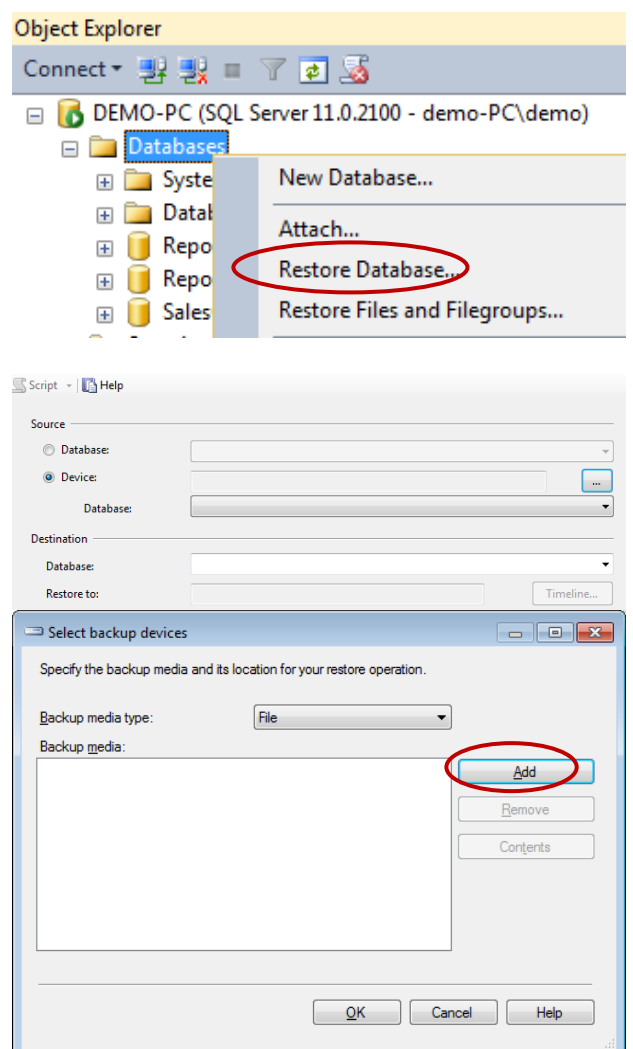
## Part A: Use SQL Server Analysis Services to create OLAP cube

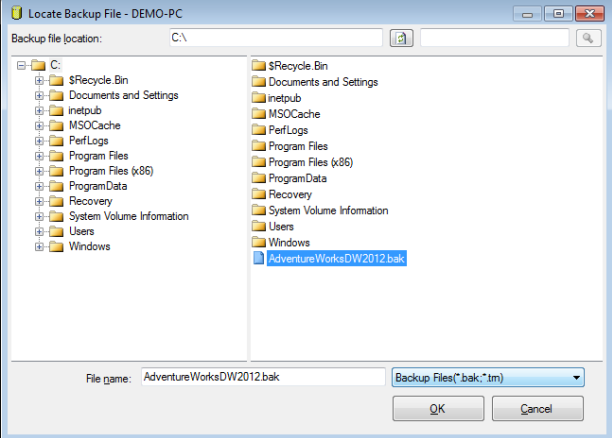
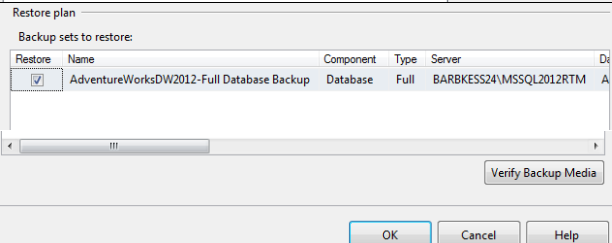
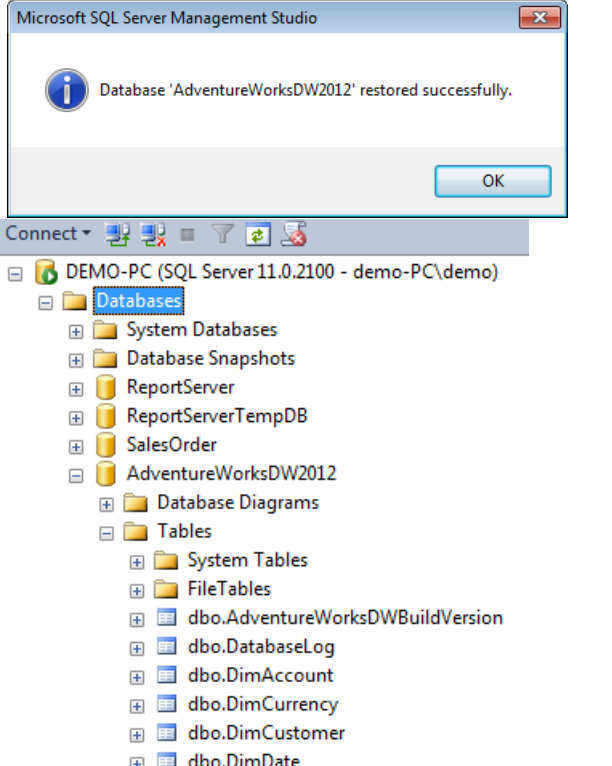
### I. Recover a database into SQL Server

1. Open **SQL Server Management Studio** and connect to **localhost / default server**



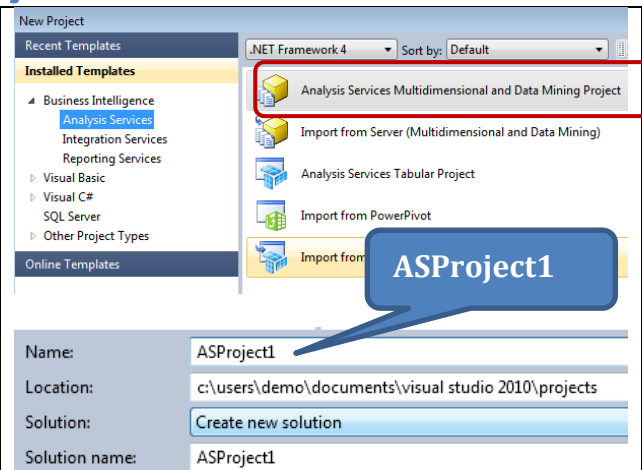
2. **Right click "Databases"** under localhost, select **Restore Database**
3. Select **Device**. In the dialog Select backup devices, click **Add**
4. Select the AdventureWorks DW backup file (**AdventureWorksDW2012.bak**) in the location you just save.
5. Press **OK**. And **OK**.



<div data-bbox="268 577 746 654" data-label="Text"> <p><b>AdventureWorksDW2012.bak</b></p> </div>	 <p>Specify the backup media and its location for your restore operation.</p> <p>Backup media type: <span>File</span></p> <p>Backup media: <span>C:\AdventureWorksDW2012.bak</span> <span>Add</span></p>
<p>6. Make sure the restore plan is correct. Then press <b>OK</b>.</p>	
<p>7. The database: <b>AdventureWorksDW2012</b> is restored successfully.</p> <p>Note: It contains tables like DimCustomer, DimDate etc</p>	

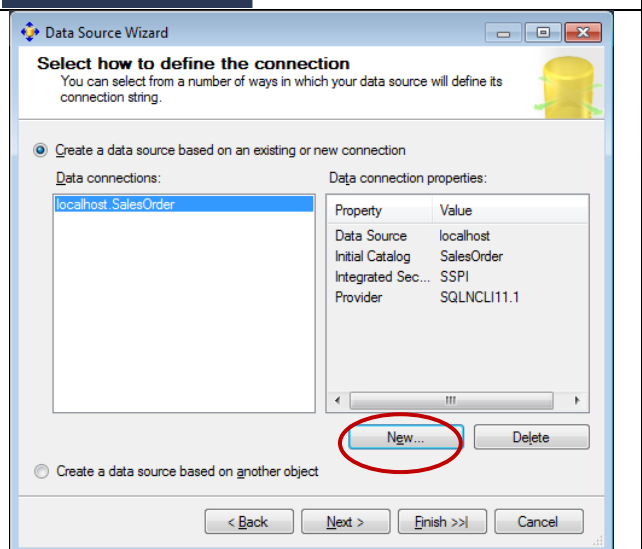
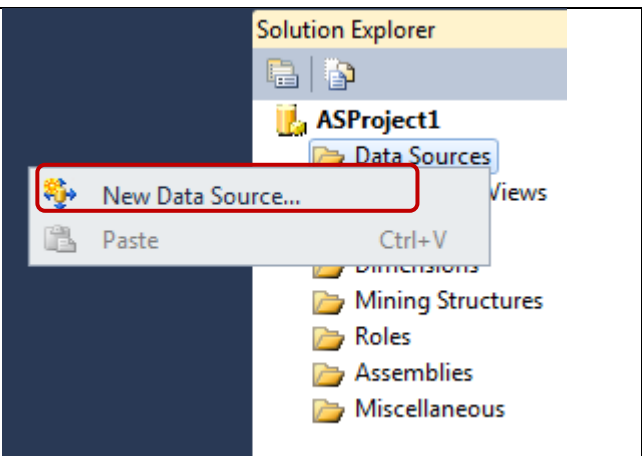
## II. Create a new Analysis Services project

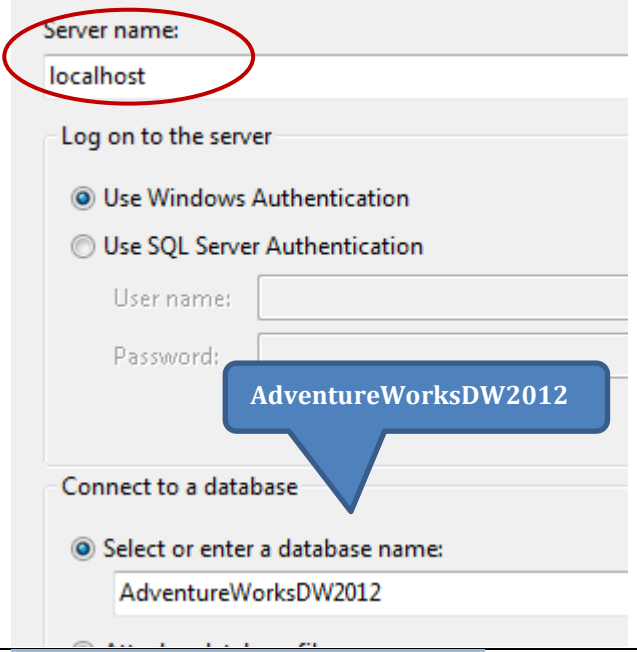
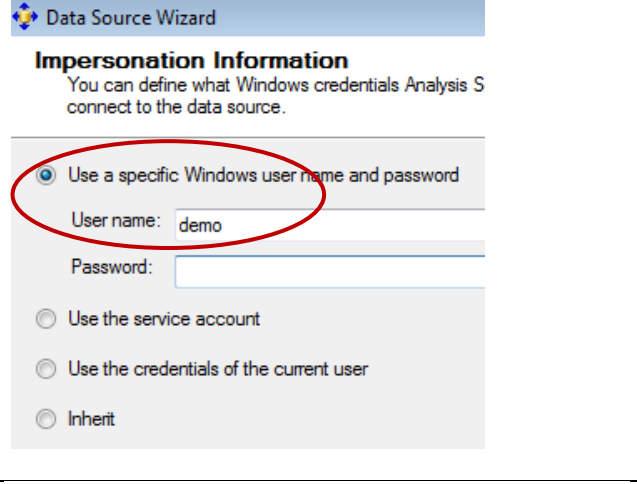
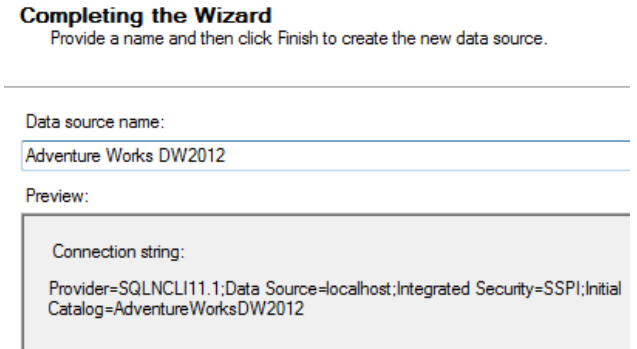
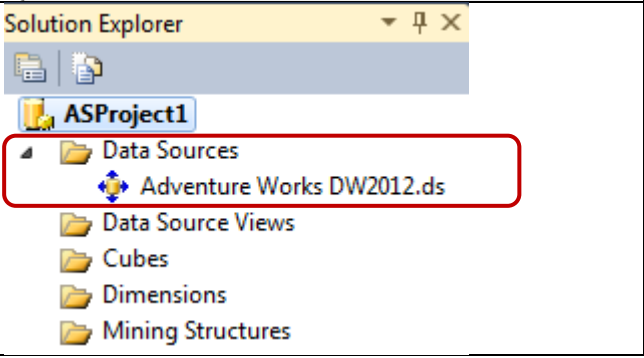
1. Open the program **Visual Studio with SSDT**.
2. Select **File → New → Project**.
3. Expand **Business Intelligence → Analysis Services**, and then click **Analysis Services Multidimensional and Data Mining Project**.
4. Change the project name to **ASProject1**, which also changes the solution name, a new directory will be created for the solution. Press **OK**.



## III. To define a new data source

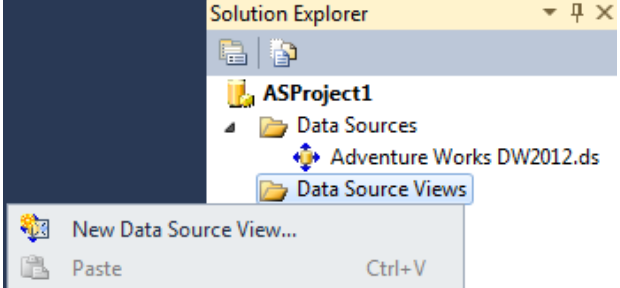
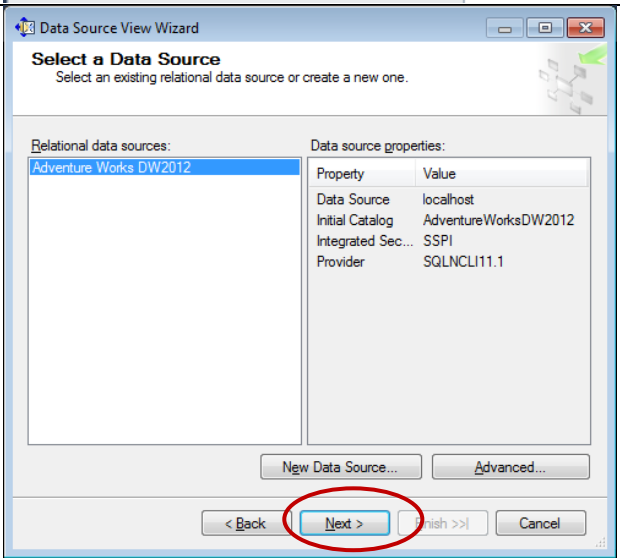
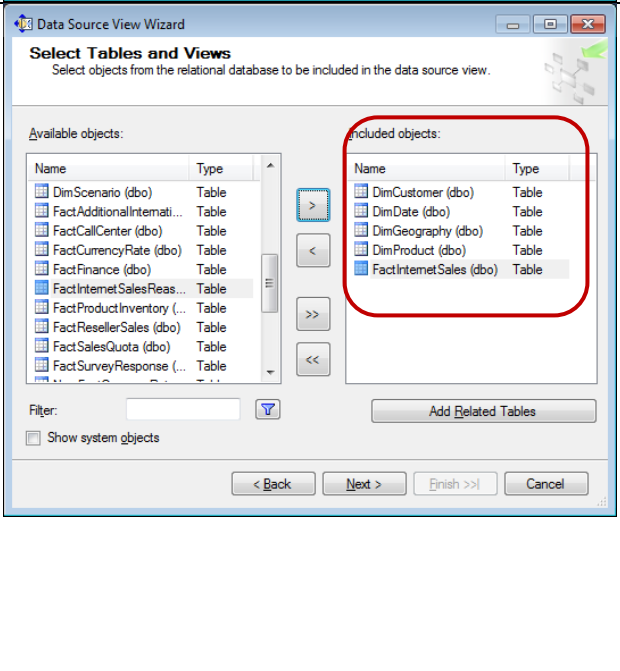
1. **Right click Data Sources**, select **New Data Source**, then click **Next**.
2. Define a new data source based on a new connection by clicking **New** button.

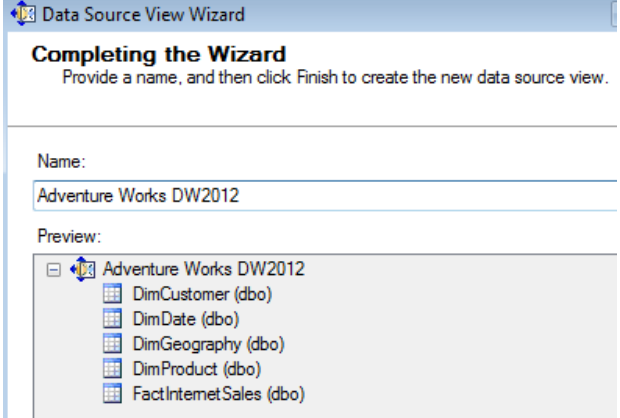
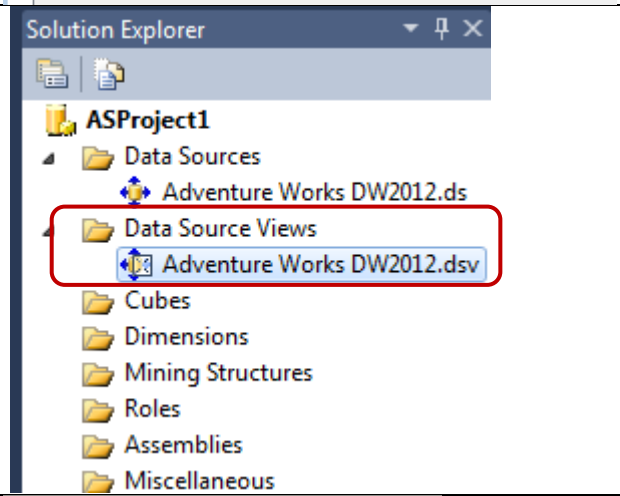
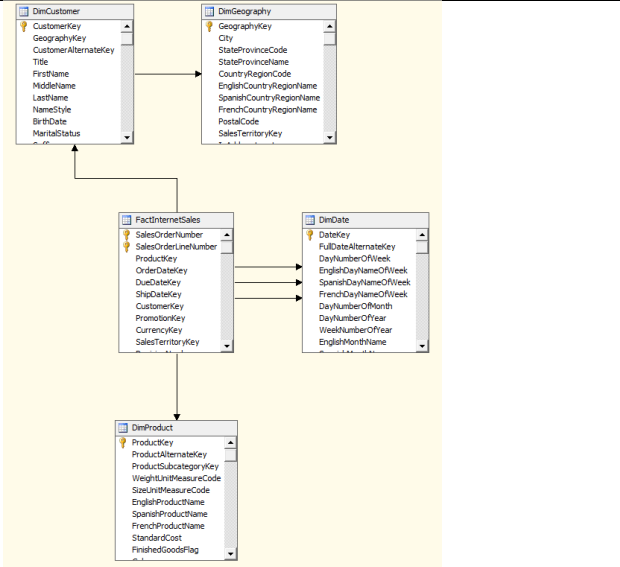
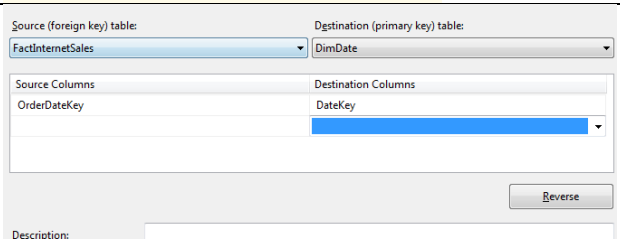


<p>3. In the <b>Connection Manager</b> dialog box appears. Define connection properties for the data source.</p> <ul style="list-style-type: none"> <li>• <b>Provider:</b> Native OLE DB\SQL server Native Client 11.0</li> <li>• <b>Server Name:</b> type localhost</li> <li>• <b>Database:</b> AdventureWorksDW2012</li> </ul> <p>4. Click <b>OK</b>, and then click <b>Next</b>.</p>	
<p>5. In <b>Impersonation Information</b> page, you need to define the security credentials for Analysis Services to connect to the data source. Select <b>the first option (use a specific Windows user name and password)</b>, and input the password for the user demo (if the password is not assigned, you need to change it in Control Panel). Then click <b>Next</b>.</p> <p>Note: This account has the necessary permissions to access the Adventure Works DW.</p>	
<p>6. Accept the default data source name <b>Adventure Works DW2012</b> by clicking <b>Finish</b>.</p>	
<p>7. In <b>Solution Explorer</b>, it shows the new data source (<b>Adventure Works DW2012.ds</b>) in the <b>Data Sources</b> folder.</p>	

#### IV. Defining a Data Source View

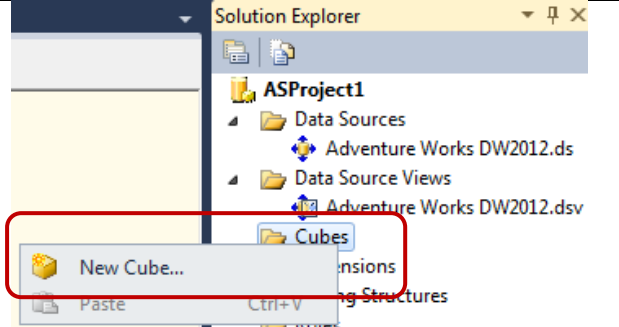
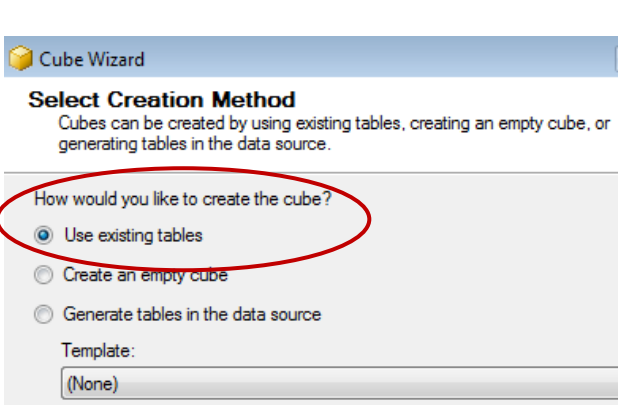

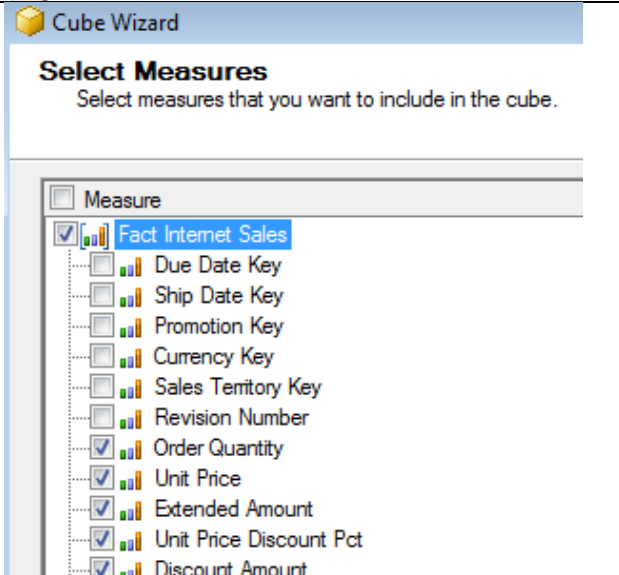
A data source view is a persistent set of tables from a data source that supply the data *for a particular cube*. SSDT also includes a wizard for creating data source views, which you can invoke by right-clicking on the **Data Source Views** folder in **Solution Explorer**.

<ol style="list-style-type: none"> <li>1. <b>Right click</b> on the <b>Data Source Views</b> folder in <b>Solution Explorer</b>, select <b>New Data Source View</b>.</li> <li>2. Click <b>Next</b> on the Welcome page.</li> </ol>	
<ol style="list-style-type: none"> <li>3. Select the <b>Adventure Works DW2012</b> data source and click <b>Next</b>.</li> </ol>	
<ol style="list-style-type: none"> <li>4. The <b>Select Tables and Views</b> page appears. In the <b>Available objects</b> list, <b>Click &gt;</b> to add the following objects to the <b>Included objects</b> list: <ul style="list-style-type: none"> <li>• <b>DimCustomer</b></li> <li>• <b>DimDate</b></li> <li>• <b>DimGeography</b></li> <li>• <b>DimProduct</b></li> <li>• <b>FactInternetSales</b></li> </ul> </li> <li>5. Click <b>Next</b></li> </ol>	

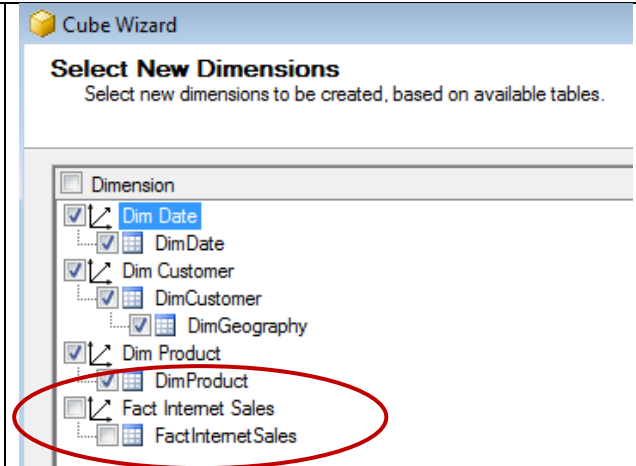
<p>6. Click <b>Finish</b>. The new <b>Data Source View</b> “Adventure Works DW2012” is created.</p>	
<p>7. In <b>Solution Explorer</b>, the data source view <b>Adventure Works DW2012</b> is created.</p>	
<p>8. The contents of the data source view are displayed in Data Source View Designer. This designer contains the following elements:</p> <ul style="list-style-type: none"> <li>• <b>Diagram pane:</b> the tables and their relationships are represented graphically.</li> <li>• <b>Tables pane:</b> the tables and their schema elements are displayed in a tree view.</li> <li>• <b>Diagram Organizer pane:</b> you can create subdiagrams so that you can view subsets of the data source view.</li> </ul>	
<p>9. <b>Delete the 3 relationships</b> between FactInternetSales and Dim Date.</p> <p>10. <b>Recreate one relationship</b> by linking OrderDateKey in the fact table with DateKey in dimension table.</p>	



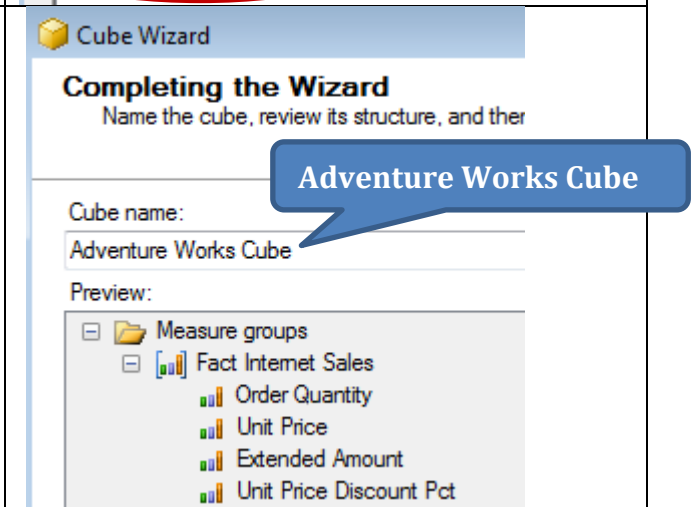
## V. Create a cube and its properties

<p>11. In <b>Solution Explorer</b>, right click <b>Cubes</b>, then select <b>New Cube</b>.</p> <p>12. On the <b>Welcome</b> page, click <b>Next</b>.</p>	
<p>13. On the <b>Select Creation Method</b> page, choose <b>Use existing tables</b>. And click <b>Next</b>.</p>	
<p>14. Place a <b>checkmark</b> next to the <b>FactInternetSales</b> table to designate it as a measure group table</p> <p>15. Then click <b>Next</b>.</p>	
<p>16. The <b>Select Measures</b> page displays some measures. <b>Uncheck</b> the first 6 boxes and click <b>Next</b>:</p> <p>Note: These columns are NOT actual measures. Some of them are the key values that link fact table with other dimension tables that we did not use.</p>	

17. **Uncheck** **Fact Internet Sales** and keep others as dimensions. And click **Next** to continue.

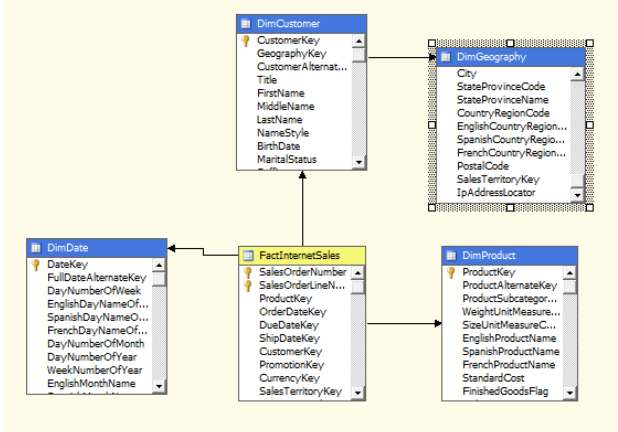


18. On the **Completing the Wizard** page, you can preview the measure groups, measures and dimensions. **Rename** the cube to **Adventure Works Cube** and click **Finish** to complete the wizard.



19. In **Solution Explorer**, the cube **Adventure Works Cube.cube** is built in the Cubes folder. There are 4 dimension tables and one fact table. Each dimension table is linked to a fact table directly or indirectly.

- A direct primary key to foreign key relationship with a fact table. This is referred to as a **star schema**.
- An indirect primary key to foreign key relationship with a fact table through some other table. This is referred to as a **snowflake schema**.

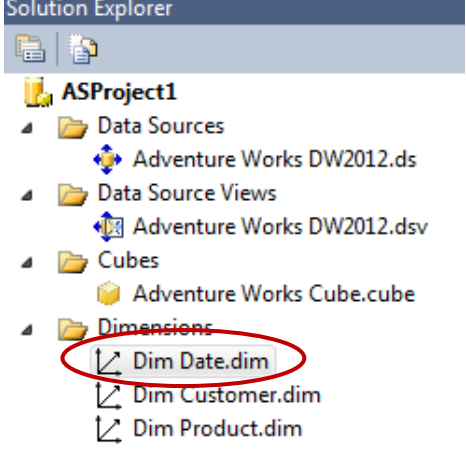
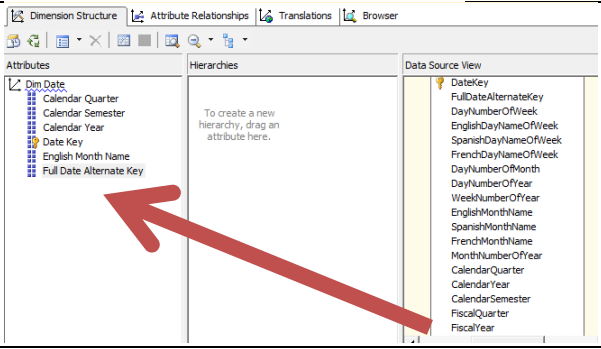

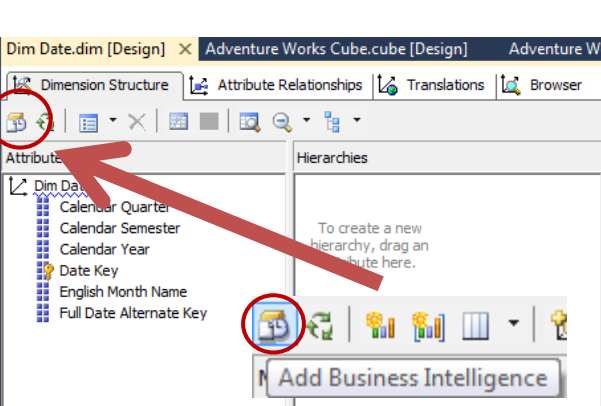
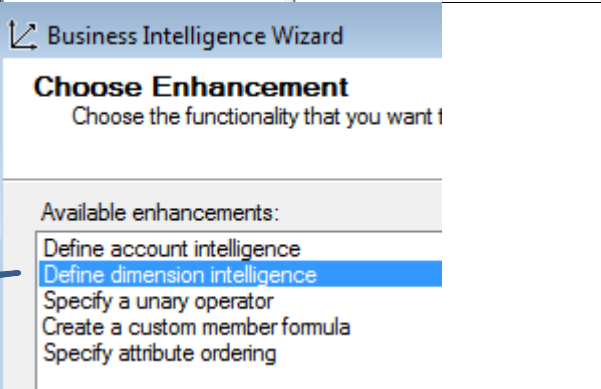


For this case, the schema is:

20. Change the **Zoom** level to **50%** so that you can see the dimensions and fact tables in the cube easily. Select **File → Save All** to save the changes.

## VI. Defining Dimension Intelligence

The cube wizard defines dimensions based upon your choices, but it doesn't populate the dimensions with attributes. You will need to edit each dimension, adding any attributes that your users will wish to use when querying your cube.

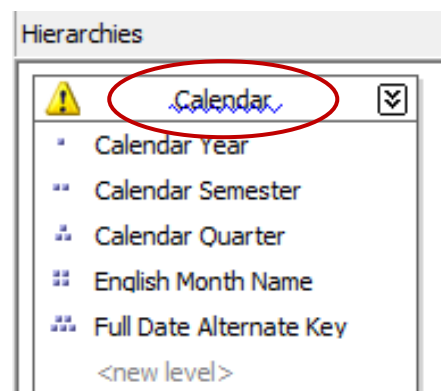
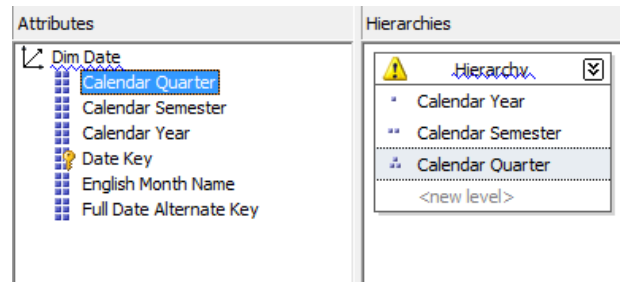
<p>1. In the <b>Solution Explorer</b>, double click on <b>Dim Date.dim</b></p>	
<p>2. Drag the following dimensions from the <b>Data Source View</b> (on the right) and drop them to <b>Attributes</b> (on the left).</p> <ul style="list-style-type: none"> <li>➤ CalendarYear</li> <li>➤ CalendarSemester</li> <li>➤ CalendarQuarter</li> <li>➤ EnglishMonthName</li> <li>➤ FullDateAlternateKey</li> </ul> <p>3. Select <b>File</b> → <b>Save All</b> to save the changes.</p>	
<p>4. To get summarized data in a cube is by time, you need to add Dimension Intelligence. Click <b>Add Business Intelligence</b> button  on the left. Then click <b>Next</b>.</p>	
<p>5. Choose to <b>Define dimension intelligence</b> and click <b>Next</b>.</p> <div data-bbox="296 1899 759 1973" style="border: 1px solid black; background-color: #4f81bd; color: white; padding: 5px; text-align: center; margin-top: 20px;"> Define dimension intelligence </div>	

<p>6. <b>Define Dimension Intelligence</b> page appears. Choose <b>Time</b> as the dimension type.</p>	<p><b>Define Dimension Intelligence</b> Specify a dimension type and map dimension attributes to built-in attribute types.</p> <p>Dimension type: Time</p>																																				
<p>7. <b>Place a checkmark</b> next to the following units of time and then select which field in DimDate contains that type of data. Press <b>Next</b> to continue.</p> <table border="1" data-bbox="272 506 754 748"> <thead> <tr> <th>Attribute Type</th> <th>Dimension Attribute</th> </tr> </thead> <tbody> <tr> <td>Year</td> <td>Calendar Year</td> </tr> <tr> <td>Half Year</td> <td>Calendar Semester</td> </tr> <tr> <td>Quarter</td> <td>Calendar Quarter</td> </tr> <tr> <td>Month</td> <td>English Month Name</td> </tr> <tr> <td>Date</td> <td>Full Date Alternate Key</td> </tr> </tbody> </table>	Attribute Type	Dimension Attribute	Year	Calendar Year	Half Year	Calendar Semester	Quarter	Calendar Quarter	Month	English Month Name	Date	Full Date Alternate Key	<p>Dimension type: Time</p> <p>Dimension attributes:</p> <table border="1" data-bbox="815 488 1401 734"> <thead> <tr> <th>Include</th> <th>Attribute Type</th> <th>Dimension Attribute</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/></td> <td>Year</td> <td>Calendar Year</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Half Year</td> <td>Calendar Semester</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Quarter</td> <td>Calendar Quarter</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Trimester</td> <td></td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Month</td> <td>English Month Name</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Date</td> <td>Full Date Alternate Key</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Ten Days</td> <td></td> </tr> </tbody> </table>	Include	Attribute Type	Dimension Attribute	<input checked="" type="checkbox"/>	Year	Calendar Year	<input checked="" type="checkbox"/>	Half Year	Calendar Semester	<input checked="" type="checkbox"/>	Quarter	Calendar Quarter	<input type="checkbox"/>	Trimester		<input checked="" type="checkbox"/>	Month	English Month Name	<input checked="" type="checkbox"/>	Date	Full Date Alternate Key	<input type="checkbox"/>	Ten Days	
Attribute Type	Dimension Attribute																																				
Year	Calendar Year																																				
Half Year	Calendar Semester																																				
Quarter	Calendar Quarter																																				
Month	English Month Name																																				
Date	Full Date Alternate Key																																				
Include	Attribute Type	Dimension Attribute																																			
<input checked="" type="checkbox"/>	Year	Calendar Year																																			
<input checked="" type="checkbox"/>	Half Year	Calendar Semester																																			
<input checked="" type="checkbox"/>	Quarter	Calendar Quarter																																			
<input type="checkbox"/>	Trimester																																				
<input checked="" type="checkbox"/>	Month	English Month Name																																			
<input checked="" type="checkbox"/>	Date	Full Date Alternate Key																																			
<input type="checkbox"/>	Ten Days																																				
<p>8. Complete the wizard by clicking <b>Finish</b> button.</p>	<p><b>Business Intelligence Wizard</b></p> <p><b>Completing the Wizard</b> Review the changes made by the wizard and then click Finish.</p> <p>Changes:</p> <ul style="list-style-type: none"> <li>Dim Date             <ul style="list-style-type: none"> <li>Type = Time</li> <li>Attributes                     <ul style="list-style-type: none"> <li>Calendar Year                             <ul style="list-style-type: none"> <li>Type = Years</li> </ul> </li> <li>Calendar Semester                             <ul style="list-style-type: none"> <li>Type = Half Years</li> </ul> </li> <li>Calendar Quarter                             <ul style="list-style-type: none"> <li>Type = Quarters</li> </ul> </li> <li>English Month Name                             <ul style="list-style-type: none"> <li>Type = Months</li> </ul> </li> <li>Full Date Alternate Key                             <ul style="list-style-type: none"> <li>Type = Days</li> </ul> </li> </ul> </li> </ul> </li> </ul>																																				

## VII. Define Hierarchies

If you consider a dimension as a table, all the fields in this table can be perceived as attributes. **Hierarchy** in a dimension is a group of attributes/fields logically related to each other with a defined cardinality.

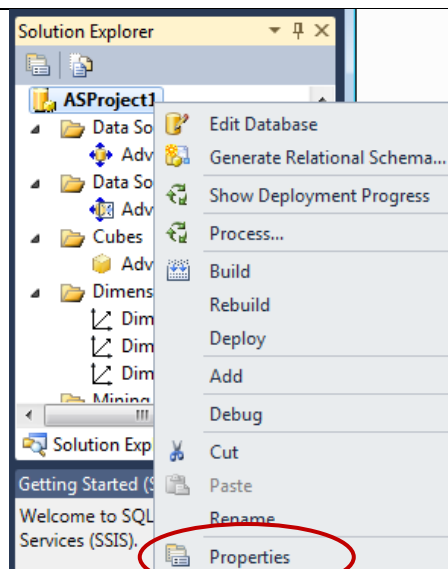
1. Open **Dim Date.dim** (if it is not opened). Create a new hierarchy by dragging the **Calendar Year** field from the **Attributes** panel and drop it in the middle pane (called **Hierarchies**)
2. Add a second level by dragging the **Calendar Semester** field from the Attributes panel and drop it on the <new level> spot in the Hierarchies panel.
3. Repeat the previous step to create a third level - **Calendar Quarter**.
4. Add two more levels as shown here. **Right click** on the hierarchy name and rename it to **Calendar**.
5. The user-defined hierarchy "**Calendar**" is created. There are \_\_\_\_\_ levels.
6. Select **File → Save All** to save the changes in ASProject1.

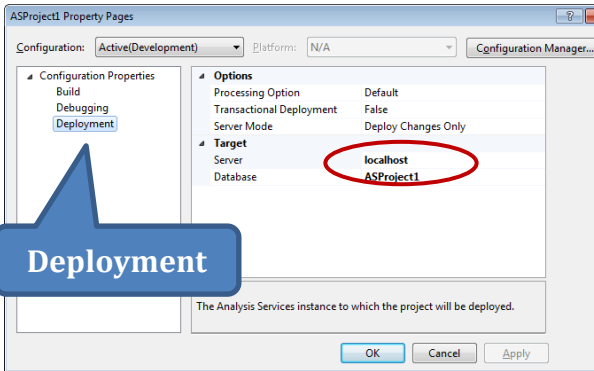
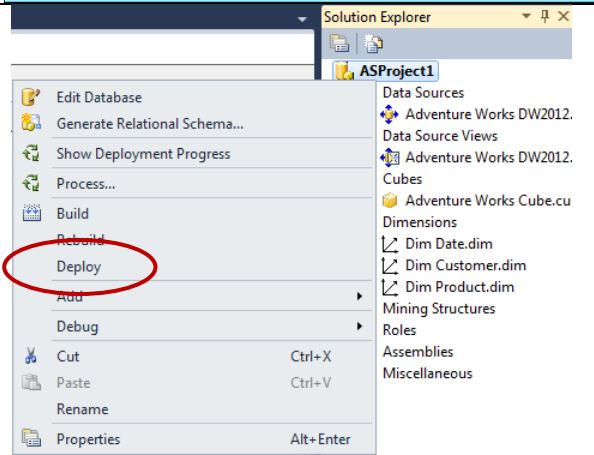
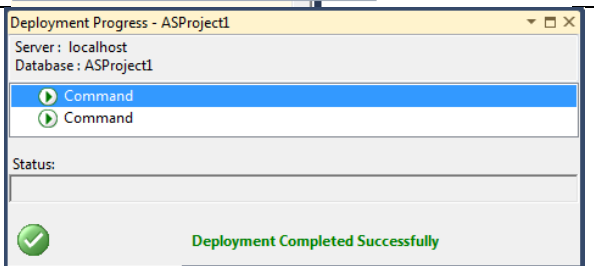
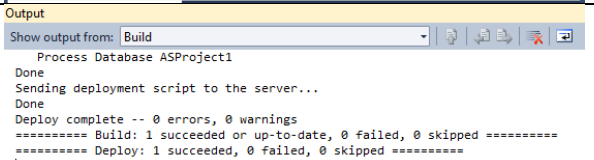


## VIII. Deploying and Processing a Cube

At this point, you've defined the structure of the new cube - but there's still more work to be done. You still need to deploy this structure to an Analysis Services server and then process the cube to create the aggregates that make querying fast and easy.

1. In **Solution Explorer**, right click the **ASProject1**, and then click **Properties**.

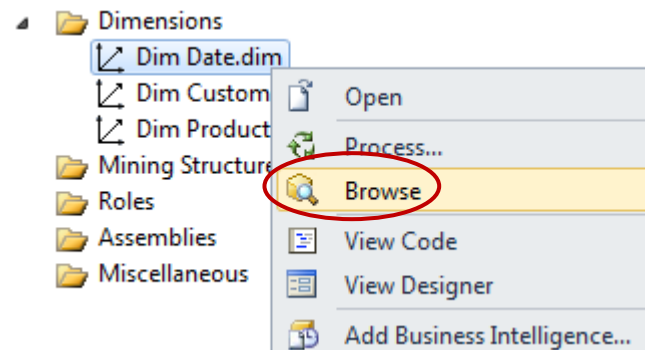


<p>2. In the <b>Configuration Properties</b> node in the left pane, click <b>Deployment</b> category. The cube will be deployed in local Analysis Server (localhost). Press <b>OK</b> to accept the default Server property.</p>	
<p>3. <b>Right click</b> the <b>ASProject1</b>, and choose <b>Deploy</b></p>	
<p>4. The deployment should be successful. (You may ignore the warnings as long as there is no error)</p>	
<p>5. Select <b>View</b> → <b>Output</b></p>	

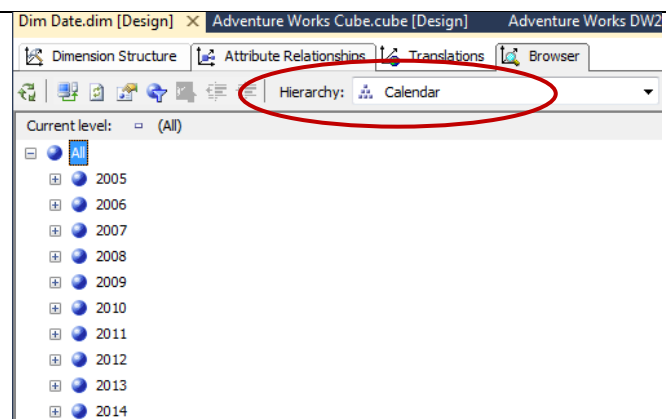
## IX. Exploring Date Dimension and add another hierarchy

**Visual Studio** includes a built-in **Cube Browser** which lets you interactively explore the data in the cube that has been deployed and processed. The Cube Browser is a drag-and-drop environment.

1. In **Solution Explorer**, right click on the dimension **Dim Date.dim** and select **Browse** option. The user-defined hierarchy **Calendar** appears in the Hierarchy list.



2. Expand **All** member to display the members of the **Calendar Year** level.
3. Expand the **2007** member to display the members of the **Calendar Semester** level.
4. Expand the **1** member to display the members of the **Calendar Quarter** level.
5. Expand the **2** member to display the members of the **English Month Name** level.
6. Expand the **June** member to display the members of the **Full Date Alternate Key** level.




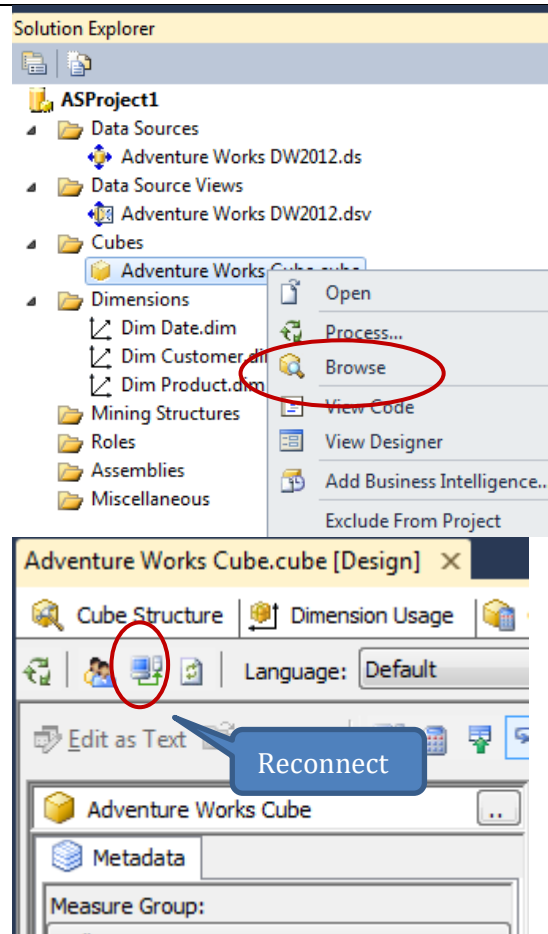
Note: **Level** is a type of summary that can be retrieved from a single dimension.

7. Double click the **Dim Customer.dim**, add the **MaritalStatus** field as an attribute.
8. Add 3 more fields in Dim Customer.dim to create another user defined hierarchy
  - **EnglishCountryRegionName**
  - **StateProvinceName**
  - **City**
 Rename the hierarchy to **Country-State-City**.
9. Also edit **Dim Product.dim** to add the fields:
  - **EnglishProductName**
  - **Color**
  - **ProductLine**
10. Select **File → Save All** to save the changes. **Deploy** the cube again.

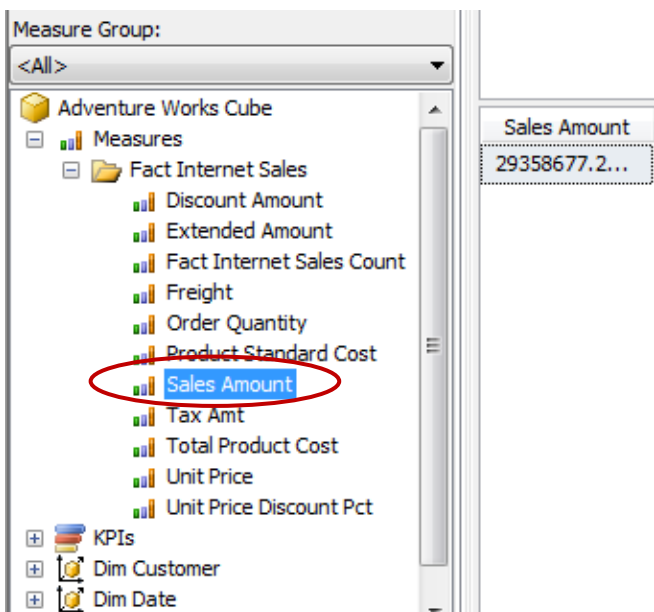


### X. Exploring the cube using cube browser

1. In **Solution Explorer**, right click on the cube **Adventure Works Cube.cube** and select **Browse**.
2. Click **Reconnect**  to try loading the browser again.



3. In the **Metadata** pane, expand **Measures**, expand **Fact Internet Sales**, and drag the measure **Sales Amount** to the data browsing pane on the right. It shows the sum of sales amount.





4. To show the sales amount in each country, drag the **English Country Region Name** attribute (under Dim Customer) to the data browsing pane.

5. To show the sales amount by country and by product line, expand **Dim Product**, right click **Product Line**, and click **Add to Query**

English Country Region Name	Product Line	Sales Amount
Australia	M	2906994.44...
Australia	R	5029120.40...
Australia	S	127128.610...
Australia	T	997757.119...
Canada	M	672429.314...
Canada	R	948943.347...
Canada	S	82736.0700...
Canada	T	273736.129...
France	M	917158.250...
France	R	1323295.80...
France	S	55001.2099...

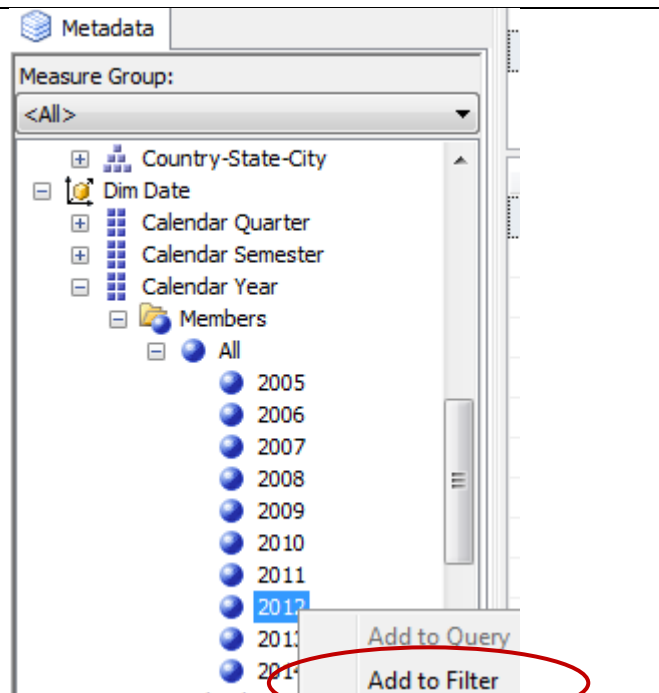
6. To show the sales amount by country and by product line in the first quarter, expand **Dim Date**, right click **Calendar Quarter**. Choose **Add to Filter**

7. Filter the result by choosing **first quarter**.

Note: you are actually showing the sales amounts for the first calendar quarter of every calendar year, NOT for any particular calendar year.

English Country Region Name	Product Line	Sales Am
Australia	M	2906994.44...
Australia	R	5029120.40...
Australia	S	127128.610...
Australia	T	997757.119...
Canada	M	672429.314...
Canada	R	948943.347...
Canada	S	82736.0700...

8. To show the sales amount by country and by product line for first quarter in the year 2012 only, expand **Dim Date** → **Calendar Year** → **Members** → **All**. Right click the **2012** member and click **Add to Filter**.



9. The result will be similar to this one.

10. Select **File** → **Save All** to save the project.

English Country Region Name	Product Line	Sales Amount
Australia	M	123503.927
Australia	R	272817.89
Canada	M	14455.2944
Canada	R	120967.395
France	M	34968.5978
France	R	97388.0325
Germany	M	18508.848
Germany	R	86045.325
United Kingdom	M	41205.178
United Kingdom	R	119381.265
United States	M	103035.2664
United States	R	343564.3

**XI. Exercise 1**

1. Use the *Cube Browser* to browse the following results, save the results for each question using screen capture (e.g. in **jpg** or **png** format) and put all the screenshots in a MS Word file named **lab2B-ans.docx**
  - A. Total order quantity for each country
  - B. Total order quantity by country and product line
  - C. Total order quantity for each product color
  - D. Total sales amount by country and product line for married customers only
  - E. Total sales amount by country by product line in 2014 only
  - F. Total sales amount by country in 2012 Quarter 2 only
  - G. Compare sales amount quarter-by-quarter in each year
  - H. Compare sales amount for Q1 and Q2 in 2012

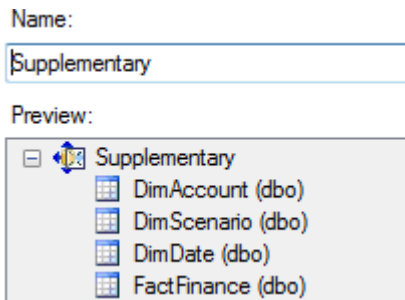
**XII. Answer Submission**

1. **Zip** your Analysis Services projects (**ASProject1 folder with ASProject1.sln**) that you created in C:\Users\demo\Documents\Visual Studio 2010\Projects. The default file name is **ASProject1.zip**
2. Submit the following files to the site <http://buelearning.hkbu.edu.hk/>
  - **lab2B-ans.docx**
  - **ASProject1.zip**

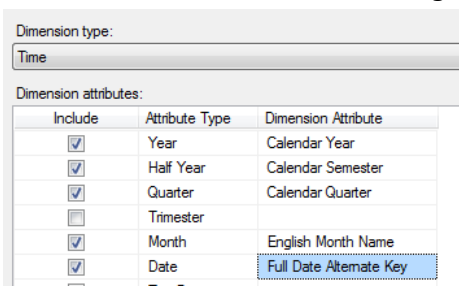
### XIII. Supplementary (no need to submit)

Follow the steps below to create another cube which displays year-to-year budgets by account.

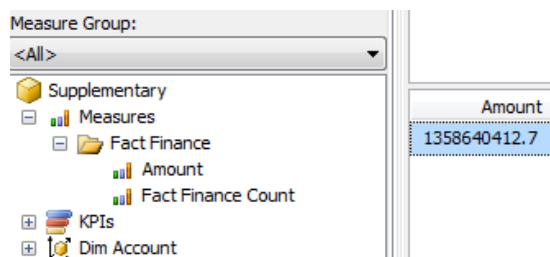
1. Create a *new Data Source View* named **Supplementary** which contains **FactFinance, DimAccount, DimDate, DimScenario**.



2. Create a *new cube* and select a suitable *measure group table*. (you may need to uncheck certain keys)
3. Add **AccountType** attribute to **Dim Account.dim**
4. Add **ScenarioName** attribute to **Dim Scenerio.dim**
5. Create a user defined hierarchy named **Calendar2** containing 5 levels for **Dim Date 1.dim**. Add *time dimension intelligence* as shown below.



6. Use *Cube browser* to **calculate total amount**.



7. **Deploy** the project.
8. Expand the **Dim Account** node and add the **Account Type** to data browsing pane.
9. Expand the **Dim Scenario** node and add the **Scenario Name** to the Field area.
10. Select **Budget** scenario name only.

Account Type	Amount
Expenditures	17057050
Revenue	25354800

## Part B: How to deploy a tabular model to Azure (Demonstration)

### I. What is Azure Analysis Service and Tabular model?

**Azure** is an open, flexible, enterprise-grade cloud computing platform. It provides many cloud computing services such as analysis service, data storage and management, virtual computing, machine learning and much more.

**Azure Analysis Services** is one of the services provided by Azure. It is an online analytical engine use in decision support and business analytics. It is a fully managed platform as a service (PaaS) that provides enterprise-grade data models in the cloud. The overall cost will be lower as the resources are allocated on demand and servers are automatically updated.

**Tabular model** was introduced in SQL Server 2012. It uses a different engine (xVelocity) and it is designed to be faster for queries based in columns. This engine **compresses** and **stores the data in memory** at runtime. It uses DAX for scripting which is similar to using excel formulas. Therefore, it is **faster to design, test, and deploy**. If you want to deploy/migrate a model to the cloud using Azure Analysis Services, you need to use **tabular model**. **\*\*Multidimensional model is NOT supported** by Azure Analysis Service.

<https://docs.microsoft.com/en-us/azure/analysis-services/analysis-services-overview>

### II. Create Azure free account and create Analysis Service using Azure portal.

Create Azure free account (<https://azure.microsoft.com/en-us/free/students/>)

Create a resource (**Analysis Service**) in Azure portal and **start** the service. Azure Analysis Service allows you to create a semantic model of your data that users can access directly with visualization tools like Power BI or Excel. It is built on the SQL Server Analysis Services tools that run on-premises with SQL Server.

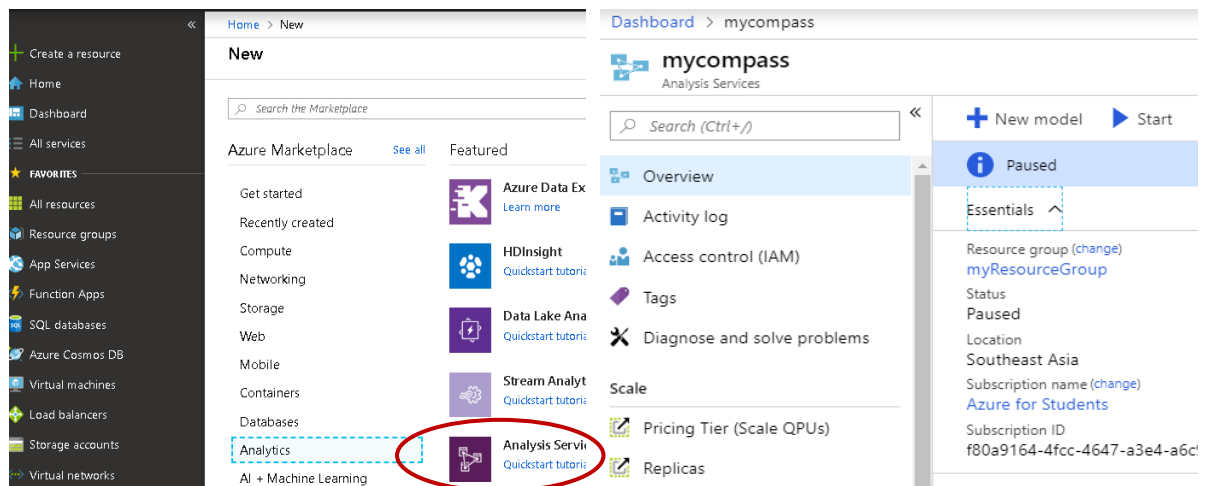
- Click + **Create a resource > Analytics > Analysis Services**
- Create new **resource group** for managing a collection of Azure resources
- Specify the **location**, which is the datacenter location that hosts the server (Better choose one that is nearest to you). Later, you need to connect to **the same** location via On-premise data gateway

Setting up the Azure analysis service:

<https://docs.microsoft.com/en-us/azure/analysis-services/analysis-services-create-server>

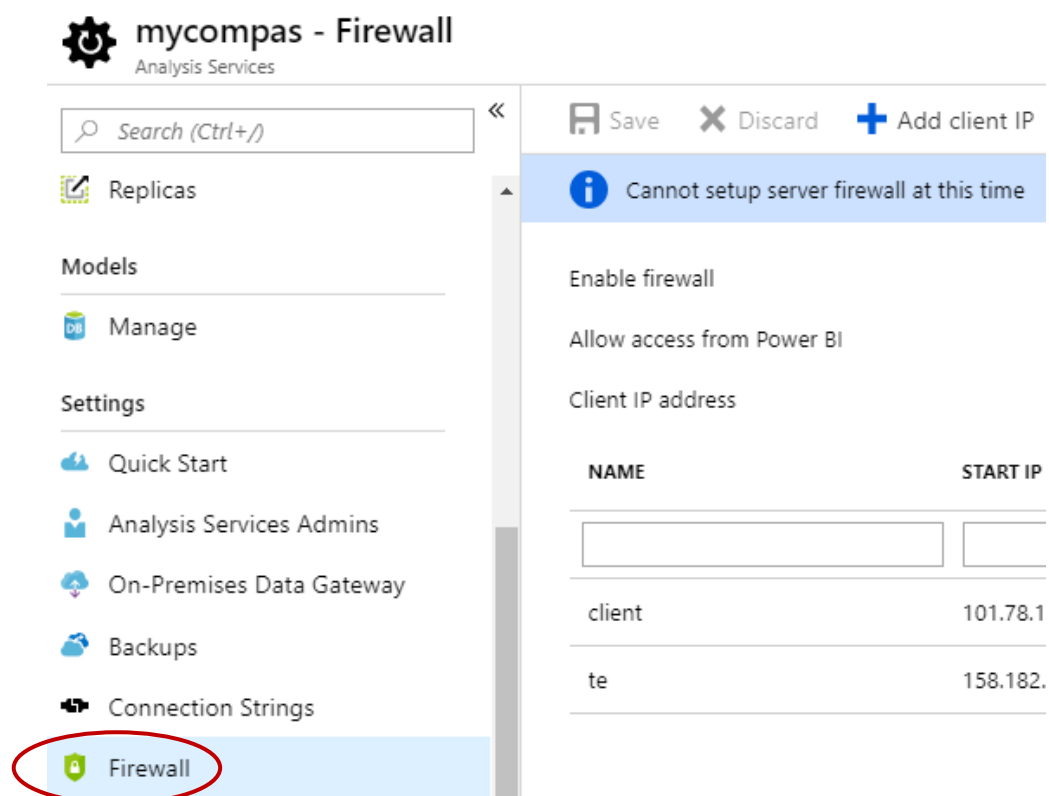
Pricing of Analysis Service:

<https://azure.microsoft.com/en-au/pricing/details/analysis-services/>



### III. Azure Analysis Services Firewall setting

Azure Analysis Services Firewall blocks all client connections other than those IP addresses specified in rules. Therefore, you need to add the IP address of your local machine in Azure portal.



#### IV. Create on-premises data gateway in Azure portal

<ul style="list-style-type: none"> <li>✓ Search for the resources <b>on-premises data gateway</b></li> <li>✓ <b>Name:</b> Enter a name for your gateway resource.</li> <li>✓ <b>Resource group:</b> select the existing resource group.</li> <li>✓ <b>Location:</b> Select the region you registered your gateway in.</li> <li>✓ <b>Installation Name:</b> If your gateway installation isn't already selected, select the gateway registered.</li> </ul>	<div> <div>Create connection gateway</div> <div>On-premises data gateway</div> <div> <div> <div>Resource Name</div> <div>HKBUGateway</div> </div> <div> <div>Subscription</div> <div>Azure for Students</div> </div> <div> <div>Resource group</div> <div>myResourceGroup</div> <div>Create new</div> </div> <div> <div>Location</div> <div>Southeast Asia</div> </div> <div> <div>Installation Name</div> <div>HongKongHKBUGateway</div> </div> </div> </div>
---	--

#### V. Download and install on-premises data gateway

**Install** and configure **on-premises data gateway in your local machine** so that it can connect with the Azure cloud. This gateway creates an outbound connection to Azure Service. \*\*Remember to select the location you set before in section II.

To download the gateway:

<https://docs.microsoft.com/en-us/azure/analysis-services/analysis-services-gateway-install>

<div>On-premises data gateway</div> <div>You are signed in as [user] and are ready to register the gateway.</div> <div>Determine where your new on-premises data gateway will be deployed.</div> <div> <div>Select Region:</div> <div>Southeast Asia</div> </div> <div> <div>⊗ Changing the gateway region will restrict the regions in which you can use the gateway in. For Power BI, the gateway can only be used in your default tenant region.</div> </div> <div>Individual Service Regions</div> <div> <div>Logic Apps, Azure Analysis Services</div> <div>Canada Central</div> </div> <div> <div>PowerApps, Microsoft Flow</div> <div>Not available</div> <div>Can't be used outside your default environment</div> </div> <div> <div>Power BI</div> <div>Not available</div> <div>Can't be used outside your default environment</div> </div>	<div>On-premises data gateway</div> <div> <div>Status</div> <div>Service Settings</div> <div>Diagnostics</div> <div>Network</div> <div>Connectors</div> </div> <div> <div>✓ The gateway HongKongHKBUGateway is online and ready to be used.</div> <div>Gateway version number: 3000.0.265 (December 2018)</div> <div> <div>✓ Help us improve the on-premises data gateway by sending usage information to Microsoft.</div> <div>Read the privacy statement online</div> </div> <div> <div>Logic Apps, Azure Analysis Services</div> <div>Southeast Asia</div> <div>Create a gateway in Azure</div> </div> <div> <div>PowerApps, Microsoft Flow</div> <div>Default environment</div> <div>Ready</div> </div> <div> <div>Power BI</div> <div>Default environment</div> <div>Ready</div> </div> </div>
---	---

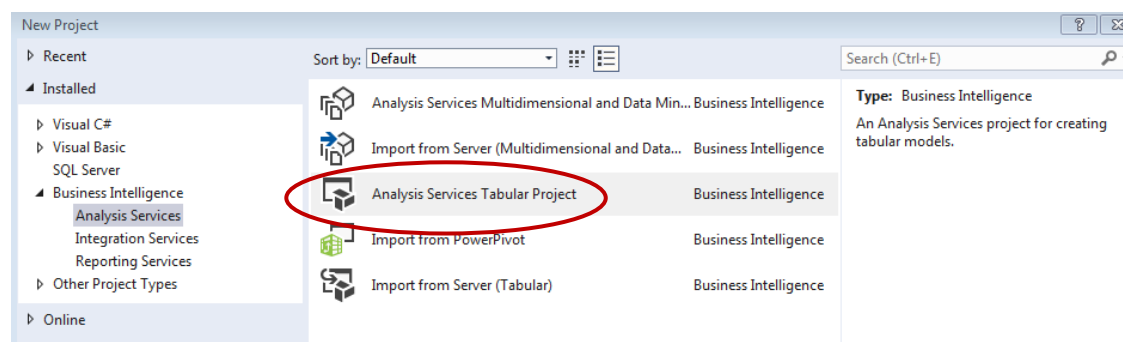
## Configure the gateway in Azure portal:

The screenshot shows the Azure portal interface for configuring an On-premises Data Gateway. The left sidebar lists various settings like Activity log, Access control (IAM), Tags, Settings, Locks, Automation script, and Support + troubleshooting. The main area displays the 'mycompass - On-Premises Data Gateway' dashboard. The 'Connected On-premise: HKBUGateway' status is highlighted with a red circle.

<https://docs.microsoft.com/en-us/azure/analysis-services/analysis-services-gateway>

## VI. Install the latest version of SSDT

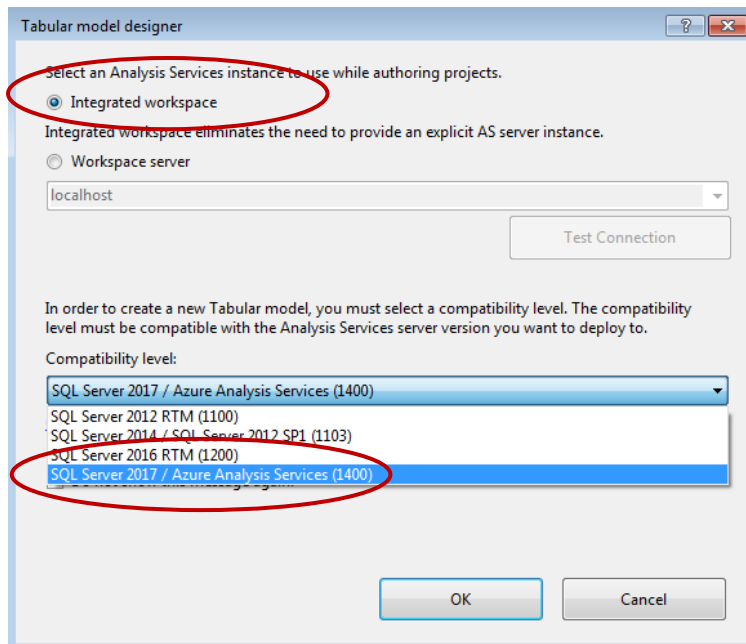
In the latest version of SSDT, it supports **Tabular** Project. But if you are using the current version of SSDT in your VM with Visual Studio 2010 in FSC801 or RRS638, you may encounter a problem that workspace database server is not running in tabular mode. Therefore, using the latest version of SSDT is suggested. (e.g. Visual studio 2017 with SSDT)



Choose **Integrated workspace** to eliminate the need for installing a Tabular instance for development purposes. **Integrated workspace** should be chosen so that you can deploy your model to Azure Analysis Services. (Visual Studio 2015 and Visual Studio 2017 offer integrated workspace server)

When creating a new tabular model project in SQL Server Data Tools (SSDT), you have to specify the compatibility level on the **Tabular model designer**. Azure Analysis Services supports tabular models at the 1200 and higher compatibility levels. In order to deploy the model to the Azure cloud, **compatibility level 1400** is suggested.





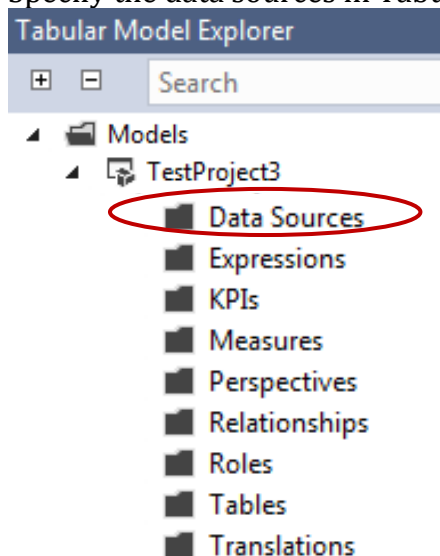
<https://docs.microsoft.com/en-us/sql/analysis-services/tabular-models/compatibility-level-for-tabular-models-in-analysis-services?view=sql-server-2017>

### Supported compatibility levels by version

Compatibility level	Server version
1400	Azure Analysis Services, SQL Server 2017
1200	Azure Analysis Services, SQL Server 2017, SQL Server 2016
1103	SQL Server 2017*, SQL Server 2016, SQL Server 2014, SQL Server 2012 SP1

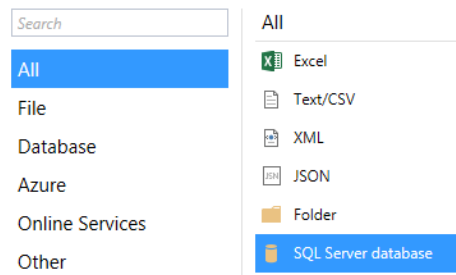
## VII. Create a tabular model using SSDT

a) Specify the data sources in Tabular Model Explorer



## b) Get data from SQL Server Database

Get Data



## c) Enter credentials and select database

SQL Server database

Server ⓘ

localhost

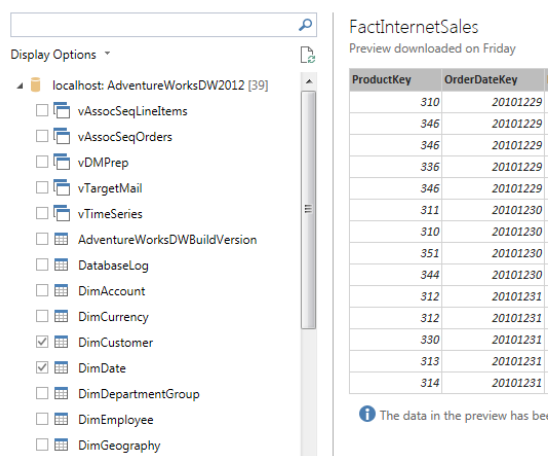
Database (optional)

AdventureWorksDW2012

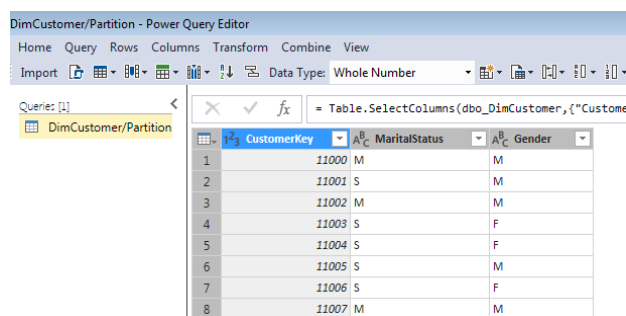
▶ Advanced options

## d) Import some tables and load the data into Tabular Data Model

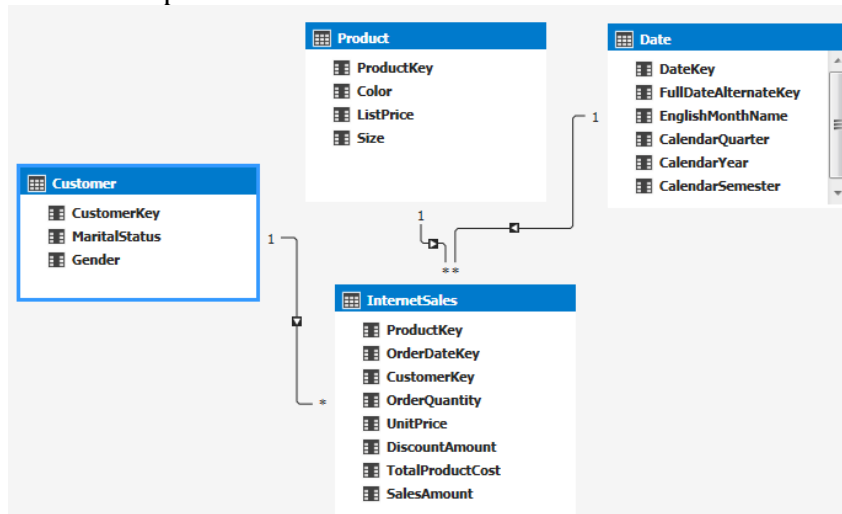
Navigator



## e) Edit the tables, choose columns, rename tables



f) Relationship:



g) Create measures

Model.bim\* - X

[OrderQuantity]

	Produ...	OrderDa...	Custom...	OrderQuantity	UnitPrice	DiscountAmount	TotalProductCost	SalesAmount
1	477	20121228	11245	1	\$4.99	0	\$1.87	\$4.99
2	477	20121228	16313	1	\$4.99	0	\$1.87	\$4.99
3	477	20121229	12390	1	\$4.99	0	\$1.87	\$4.99
4	477	20121229	18906	1	\$4.99	0	\$1.87	\$4.99
5	477	20121229	11448	1	\$4.99	0	\$1.87	\$4.99
6	477	20121229	11006	1	\$4.99	0	\$1.87	\$4.99
7	477	20121229	21440	1	\$4.99	0	\$1.87	\$4.99
8	477	20121230	18208	1	\$4.99	0	\$1.87	\$4.99
9	477	20121230	11240	1	\$4.99	0	\$1.87	\$4.99
10	477	20121230	11400	1	\$4.99	0	\$1.87	\$4.99
11	477	20121230	11338	1	\$4.99	0	\$1.87	\$4.99
12	477	20121230	19765	1	\$4.99	0	\$1.87	\$4.99
13	477	20121230	11117	1	\$4.99	0	\$1.87	\$4.99
14	477	20121230	26826	1	\$4.99	0	\$1.87	\$4.99
15	477	20121231	11402	1	\$4.99	0	\$1.87	\$4.99
16	477	20121231	11292	1	\$4.99	0	\$1.87	\$4.99
17	477	20121231	11061	1	\$4.99	0	\$1.87	\$4.99
18	477	20121231	25625	1	\$4.99	0	\$1.87	\$4.99
19	477	20130101	11249	1	\$4.99	0	\$1.87	\$4.99
20	477	20130101	11334	1	\$4.99	0	\$1.87	\$4.99
				Count of OrderQuantity: 60398				Sum of SalesAmount: \$29,358,677.22

## VIII. Change deployment properties

Change the deployment server to Azure Analysis service server

TestProject3 Property Pages

Configuration: Active(Development) Platform: Active(x86) Conf

Configuration Properties

Deployment

Deployment Options

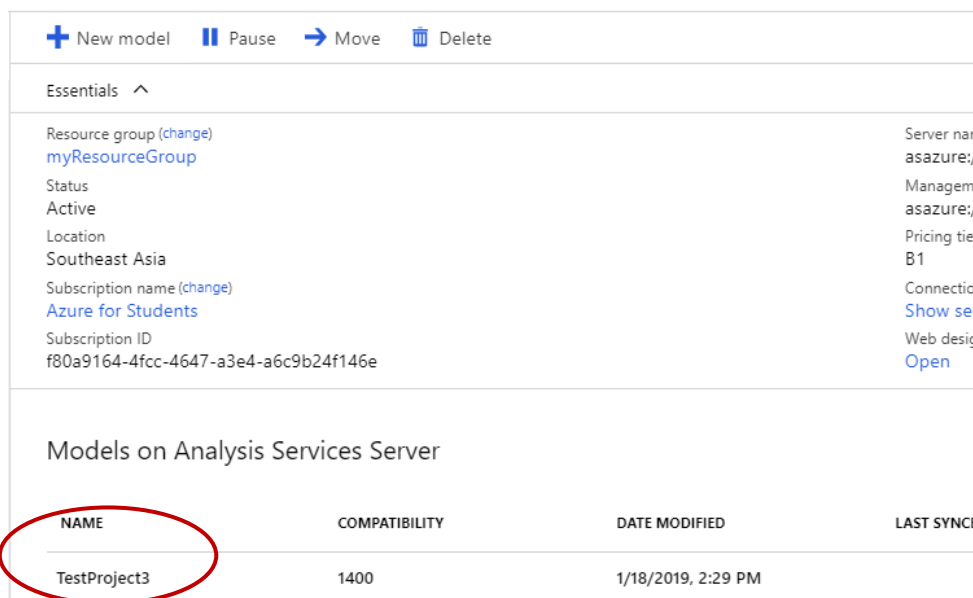
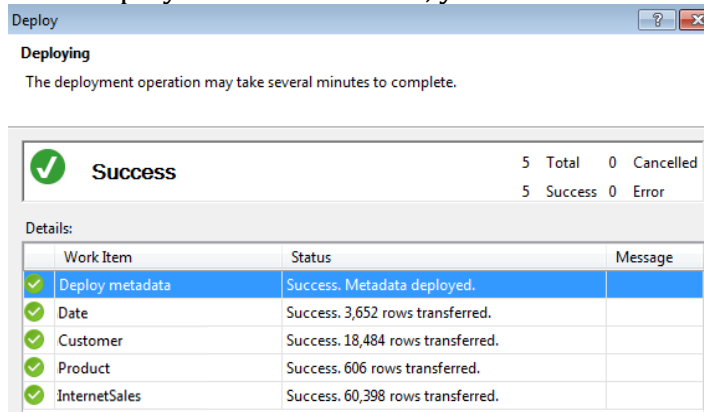
Processing Option	Default
Transactional Deployment	False
ADAL Cache	Default

Deployment Server

Server	asazure://southeastasia.asazure.wi
Edition	Developer
Database	TestProject3
Model Name	Model
Version	Unknown

## IX. Deployment

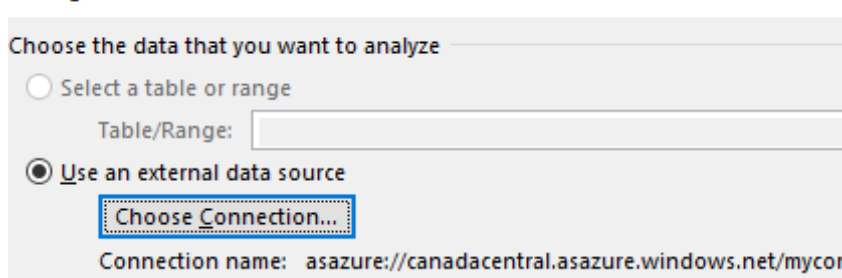
1. Grant the rights to some users under *NT SERVICE* group for connecting to the SQL server DW on your local machine.
2. If the deployment is successful, you can see the model via Azure portal.

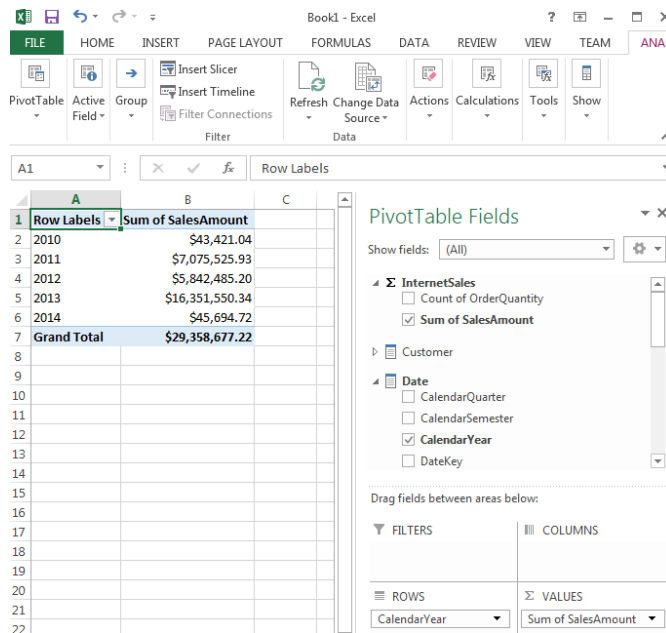


3. Once you have deployed a tabular model on cloud, clients can connect and begin exploring data using some client tools like Power BI or Excel.

- a) Connect with excel: <https://docs.microsoft.com/en-us/azure/analysis-services/analysis-services-connect-excel>

Change PivotTable Data Source





- b) Connect with Power BI: <https://docs.microsoft.com/en-us/azure/analysis-services/analysis-services-connect-pbi>

#### X. Install the latest version of SSMS to manage the tabular project

To manage the Analysis Services project, you also need to install **latest version of SSMS**, you can delete a certain model with the SSMS.

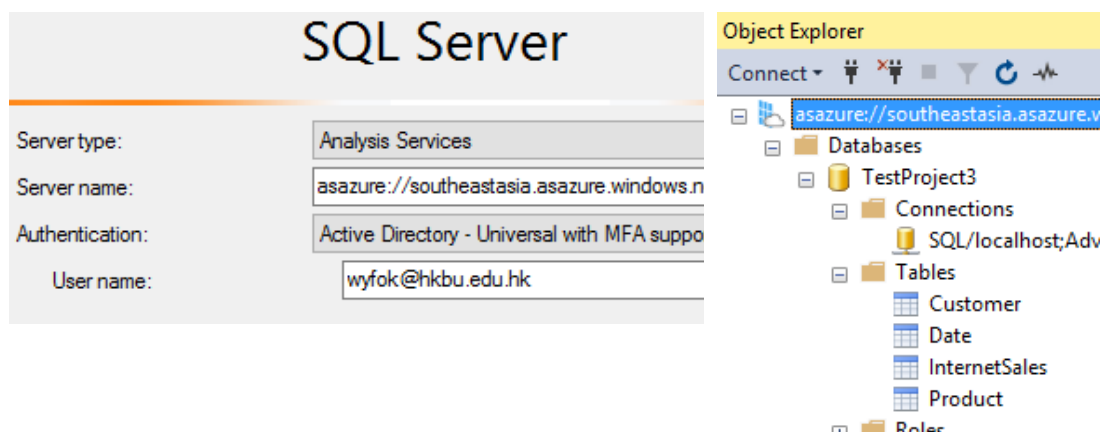
To download the latest version of SSMS:

<https://docs.microsoft.com/sql/ssms/download-sql-server-management-studio-ssms>

To connect Azure with SSMS:

Before connecting to your server the first time, make sure your username is included in the Analysis Services Admins group, check the server name from Azure portal.

1. In SSMS > **Object Explorer**, click **Connect** > **Analysis Services**.
2. In the **Connect to Server** dialog box, paste in the server name, then in **Authentication**, choose **Active Directory - Universal with MFA support**
3. **Username:** must be in your Azure Active Directory and must be specified by organizational email address (e.g. your school email address)



The screenshot shows the SQL Server Enterprise Manager interface. The top pane displays the MDX query: `select [Measures].[Sum of SalesAmount] on 0, non empty [Date].[CalendarYear].children on 1 from [Model]`. The left pane shows the model structure with the following hierarchy:

- Model
  - Measures
    - InternetSales
      - Count of OrderQuantity
      - Sum of SalesAmount
  - KPIs
  - Customer
  - Date
    - CalendarQuarter
    - CalendarSemester
    - CalendarYear
    - DateKey
    - EnglishMonthName
    - FullDateAlternateKey

The right pane shows the query results in a table format:

	Sum of SalesAmount
2010	\$43,421.04
2011	\$7,075,525.93
2012	\$5,842,485.20
2013	\$16,351,550.34
2014	\$45,694.72

#### XI. Reminder

**Pause the Azure Analysis Services** when you are not using it, thereby minimizing the costs.