

Multidimensional Modeling (Adventure Works Tutorial)

Prerequisite: 1. Install SQL Server Analysis Services

**This step is required if you did not already add to your SQL Server
Installation the Analysis Services feature**

SQL Server Analysis Services is installed by using the [SQL Server Installation Wizard](#).

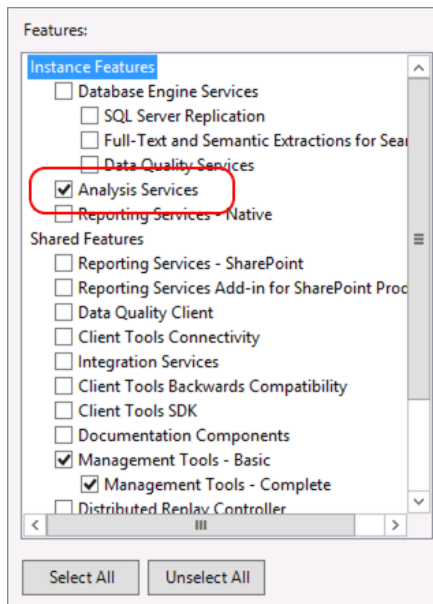
SQL Server Analysis Services is multi-instance, which means that you can install more than one copy on a single computer, or run new and old versions side-by-side. Any instance you install runs in one of three modes, as determined during setup: Multidimensional and Data Mining, Tabular, or SharePoint. If you want to use multiple modes, you'll need a separate instance for each one.

After you install the server in a particular mode, you can use it host solutions that conform to that mode. For example, a tabular mode server is required if you want tabular model data access over the network.

Install using the wizard

The following shows which pages in the SQL Server Installation wizard are used to install Analysis Services.

1. Select **Analysis Services** from the Feature Tree in Setup.



2. On the Analysis Services Configuration page, select a mode : **Choose the Multidimensional and Data Mining Mode.**

Tabular mode uses the VertiPaq in-memory analytics engine (VertiPaq), which is the default storage for tabular models. After you deploy tabular models to the server, you can selectively configure tabular solutions to use DirectQuery disk storage as an alternative to memory-bound storage.

Multidimensional and Data Mining mode use MOLAP as the default storage for models deployed to Analysis Services. After deploying to the server, you can configure a solution to use ROLAP if you want to run queries directly against the relational database rather than storing query data in an Analysis Services multidimensional database.

Memory management and IO settings can be adjusted to get better performance when using non-default storage modes. See [Server properties in Analysis Services](#) for more information.

Prerequisite: 2. Get tools and designers (Analysis services projects extension)

SQL Server Setup no longer installs the model designers or management tools used for solution design or server administration. In this release, tools have a separate installation, which you can get from the following links:

- [Download Visual Studio 2019](#)

- [Download Analysis Services projects extension](#)

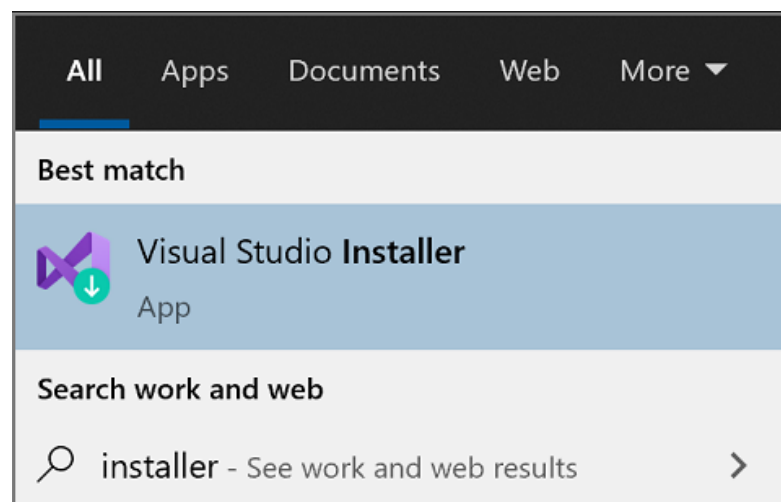
You'll need both Visual Studio and SSMS to create, deploy, and work with Analysis Services instances and databases. Tools can be installed anywhere, but be sure to configure ports on the server before attempting a connection. See [Configure the Windows Firewall to Allow Analysis Services Access](#) for details.

Install SSDT with Visual Studio 2019

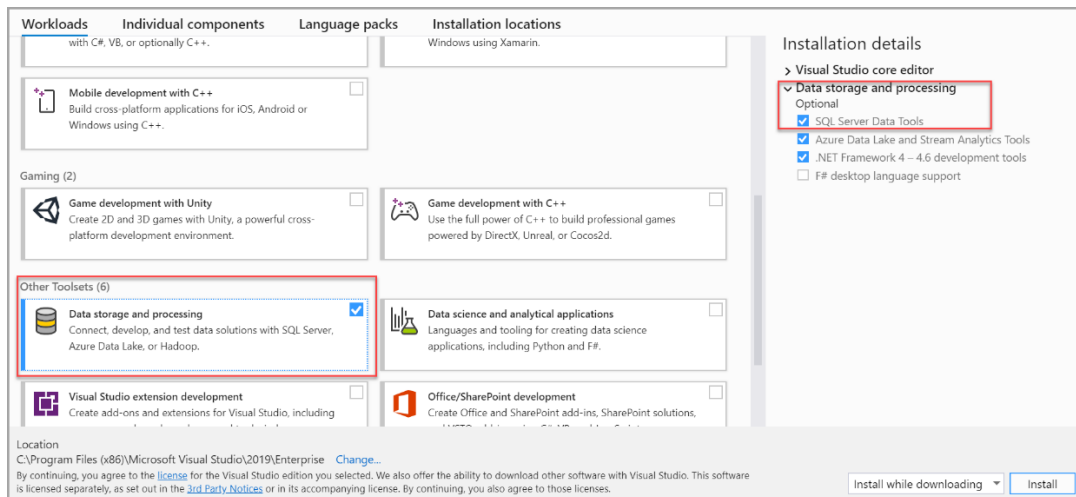
If [Visual Studio 2019](#) is already installed, you can edit the list of workloads to include SSDT. If you don't have Visual Studio 2019 installed, then you can download and install [Visual Studio 2019 Community](#).

To modify the installed Visual Studio workloads to include SSDT, use the Visual Studio Installer.

1. Launch the Visual Studio Installer. In the Windows Start menu, you can search for "installer".



2. In the installer, select for the edition of Visual Studio that you want to add SSDT to, and then choose **Modify**.
3. Select **SQL Server Data Tools** under **Data storage and processing** in the list of workloads.



For Analysis Services, Integration Services, or Reporting Services projects, you can install the appropriate [extensions](#) from within Visual Studio with **Extensions > Manage Extensions** or from the [Marketplace](#).

- [Analysis Services](#)
- [Integration Services](#)
- [Reporting Services](#)

Now we are ready for the multidimensional modeling

STEP 1: Defining a Data Source View within an Analysis Services Project

Creating an Analysis Services Project

In this task, you create the SQL Server Analysis Services Tutorial project, based on an SQL Server Analysis Services multidimensional model template.

In the following task, you use SQL Server Data Tools to create a new SQL Server Analysis Services project named **Analysis Services Tutorial**, based on the SQL Server Analysis Services Project template. A *project* is a collection of related objects. Projects exist within a solution, which includes one or more projects. For more information, see [Create an Analysis Services Project \(SSDT\)](#).

To create a new Analysis Services project

1. Open SQL Server Data Tools. (Visual Studio 2019)
2. Create a new Analysis Services Multidimensional project. Choose the **Analysis Services Multidimensional and Data Mining Project** template.

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

3. Choose a project Name, which also changes the **Solution name** box, and then click **OK**.

You have successfully created the **Analysis Services Tutorial** project, based on the **Analysis Services Multidimensional and Data Mining Project** template, within a new solution that is also named **Analysis Services Tutorial**.

Defining a Data Source

In this task, you specify the **AdventureWorksDW** database as the data source for the SQL Server Analysis Services dimensions and cubes that you define in subsequent lessons.

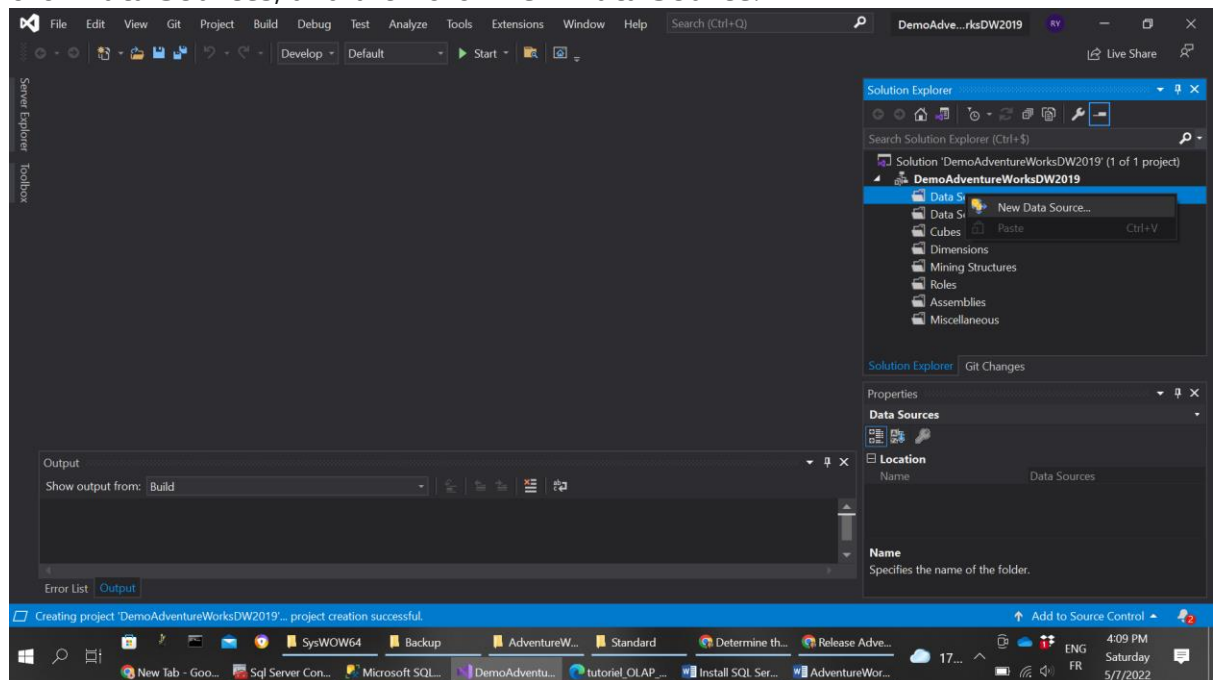
After you create an SQL Server Analysis Services project, you generally start working with the project by defining one or more data sources that the project will use. When you define a data source, you are defining the connection string information that will be used to connect to the data source. For more information, see [Create a Data Source \(SSAS Multidimensional\)](#).

In the following task, you define the AdventureWorksDW2019 sample database as the data source for your project. While this database is located on your local

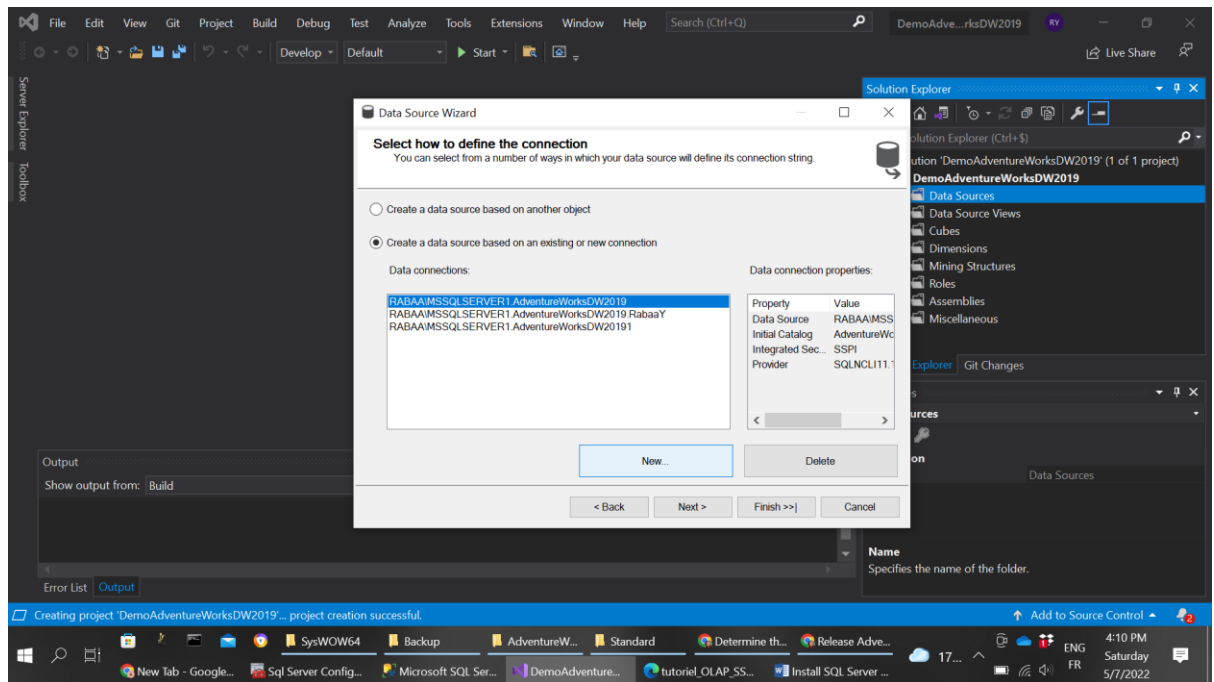
computer for the purposes of this tutorial, source databases are frequently hosted on one or more remote computers.

To define a new data source

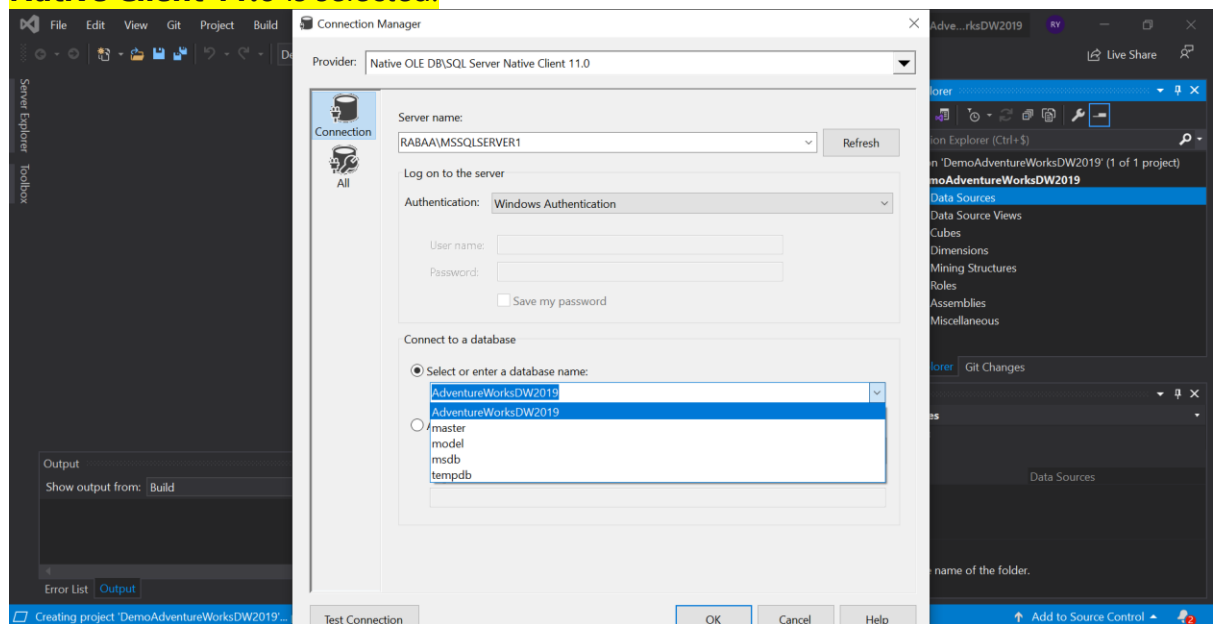
1. In Solution Explorer (on the right of the Microsoft Visual Studio window), right-click **Data Sources**, and then click **New Data Source**.



2. On the **Welcome to the Data Source Wizard** page of the **Data Source Wizard**, 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 box, verify that **Native OLE DB\SQL Server Native Client 11.0** is selected.



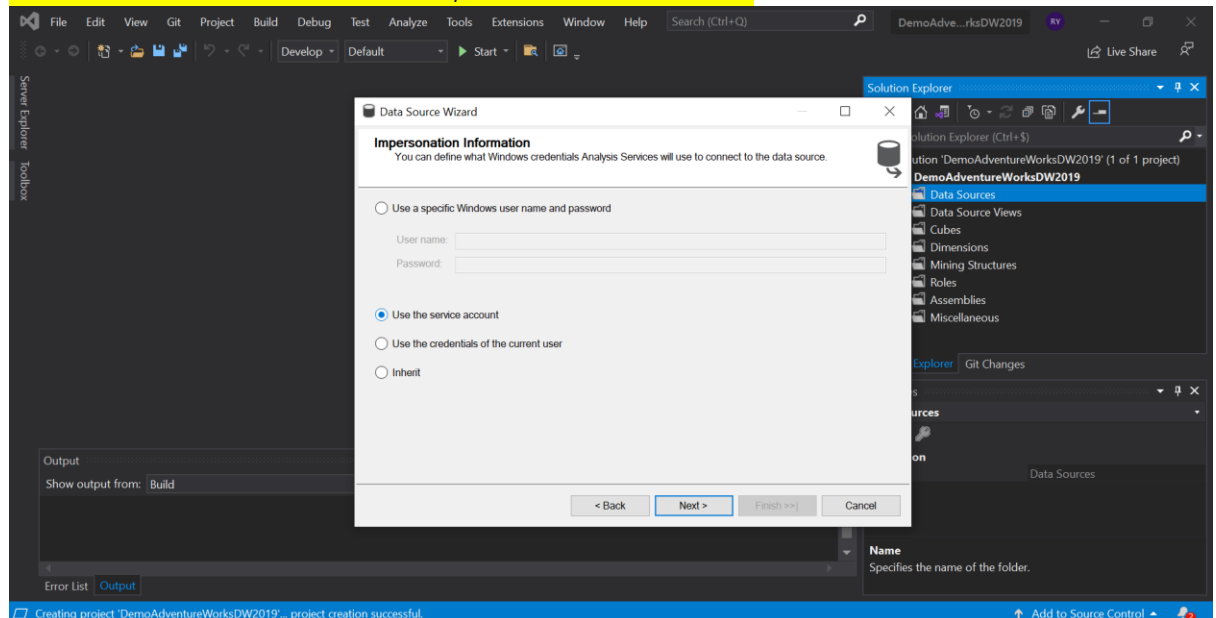
5. In the **Server name** text box, type **your own server name**.

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 **AdventureWorksDW2019**.
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 SQL Server 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. SQL Server Analysis Services does not support impersonation for processing OLAP objects.

Select **Use the service account**, and then click **Next**.

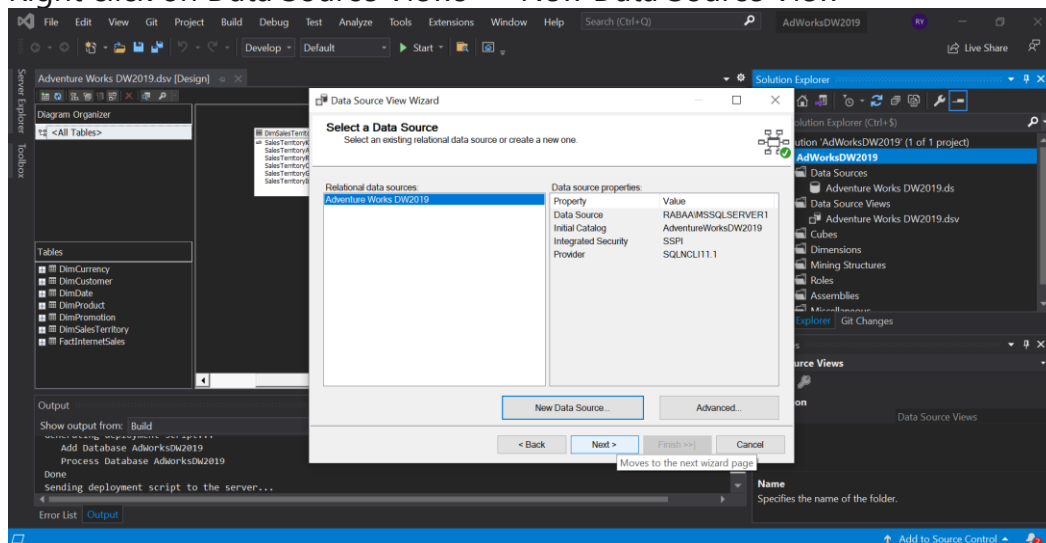


10. On the **Completing the Wizard** page, accept the default name, **Adventure Works DW 2019**, and then click **Finish** to create the new data source.

Defining a Data Source View

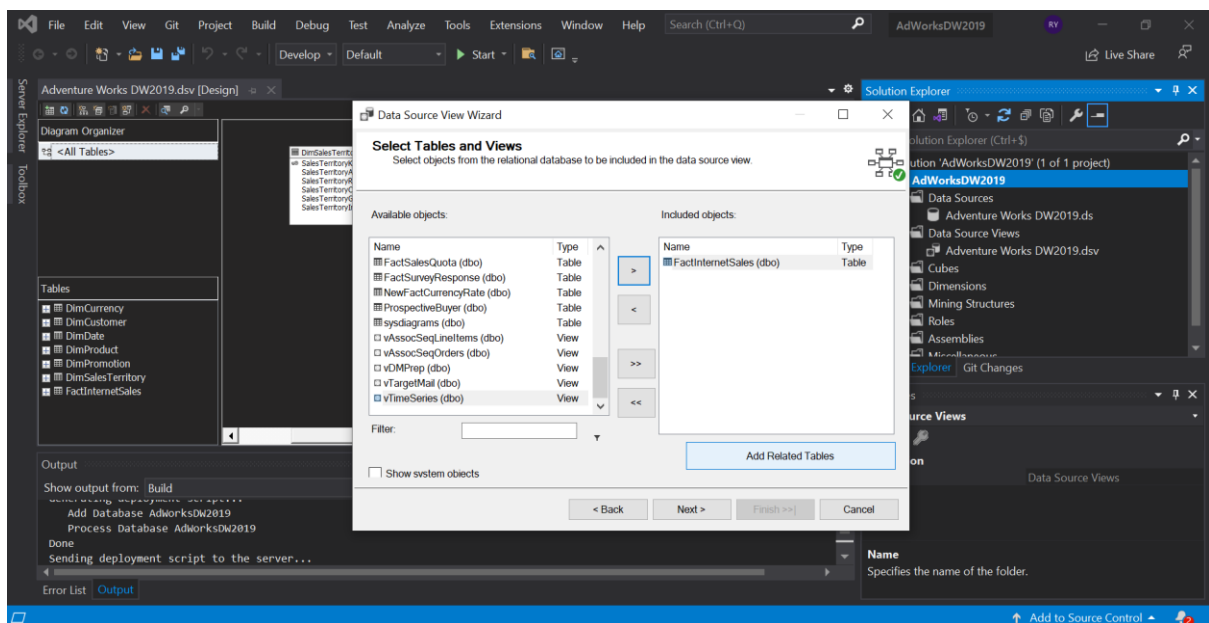
In this task, you define a single unified view of the metadata from selected tables in the **AdventureWorksDW** database.

1. Right click on Data Source Views -> New Data Source View

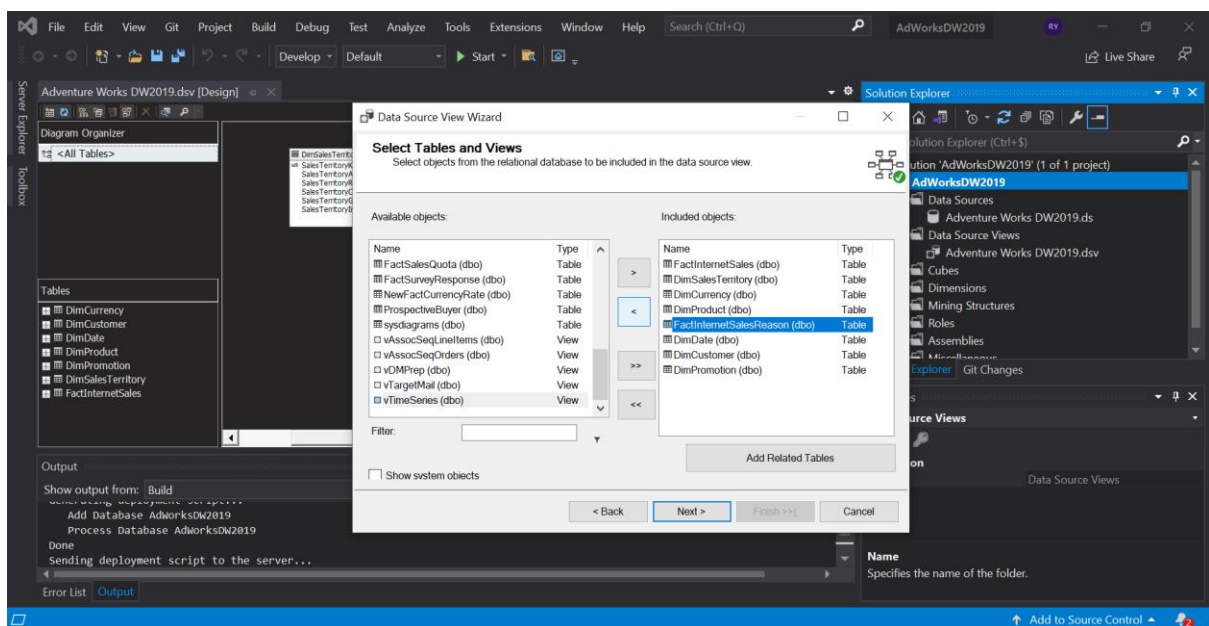


2. Select the Data Source you already created

3. Add FactInternetSales + Add related tables

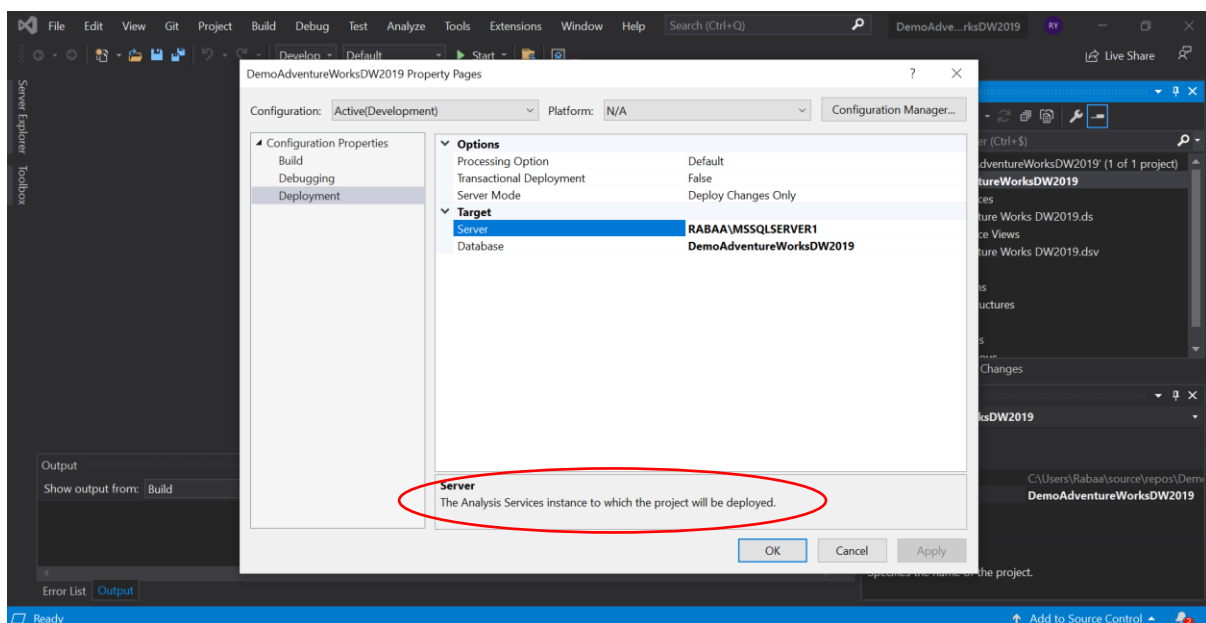
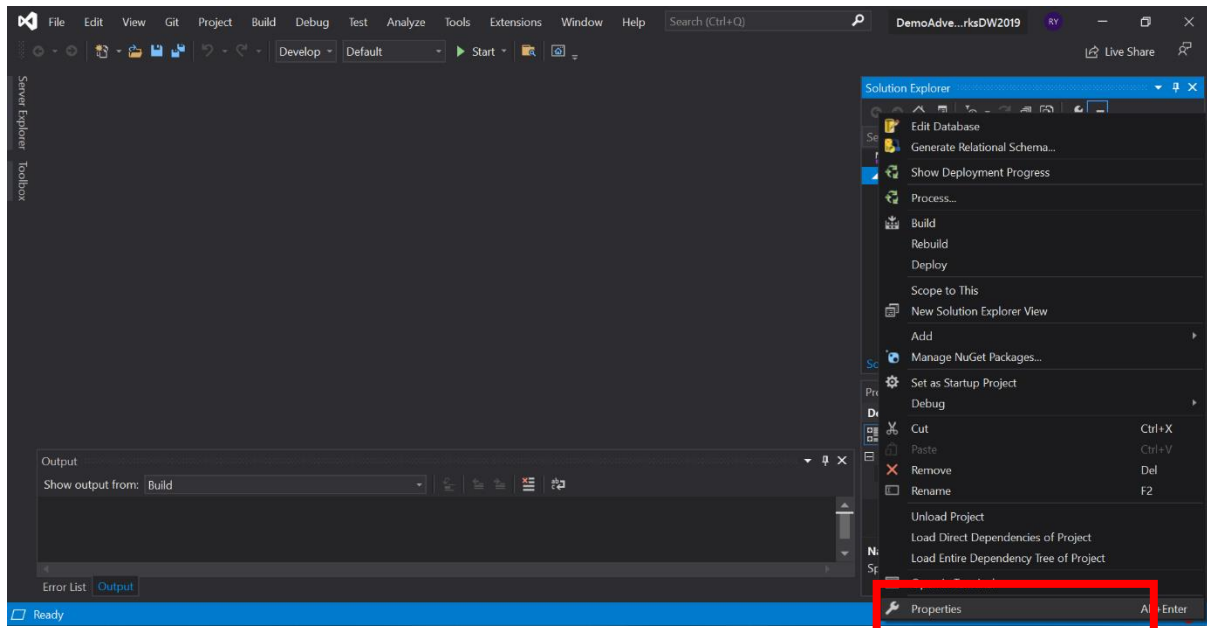


4. Remove FactInternetSalesReasons



5. And finally Next and Finnish.

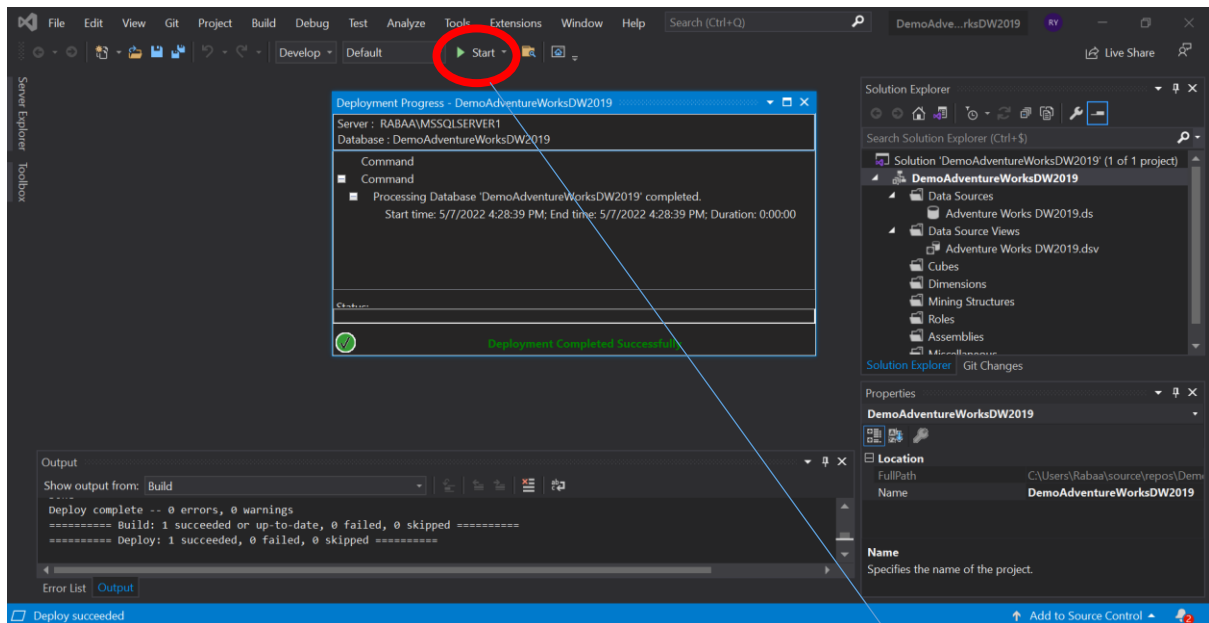
Check in the project properties that the server name is correct: choose the same server name used to add data source. (Right click on project name and select properties)



Notice: The server name is the Analysis service instance server to which the project will be deployed. Not in a tabular mode but a multidimensional one!

Deployment step:

First we will try to deploy the solution before creating the cube, in order to make sure that everything is working.



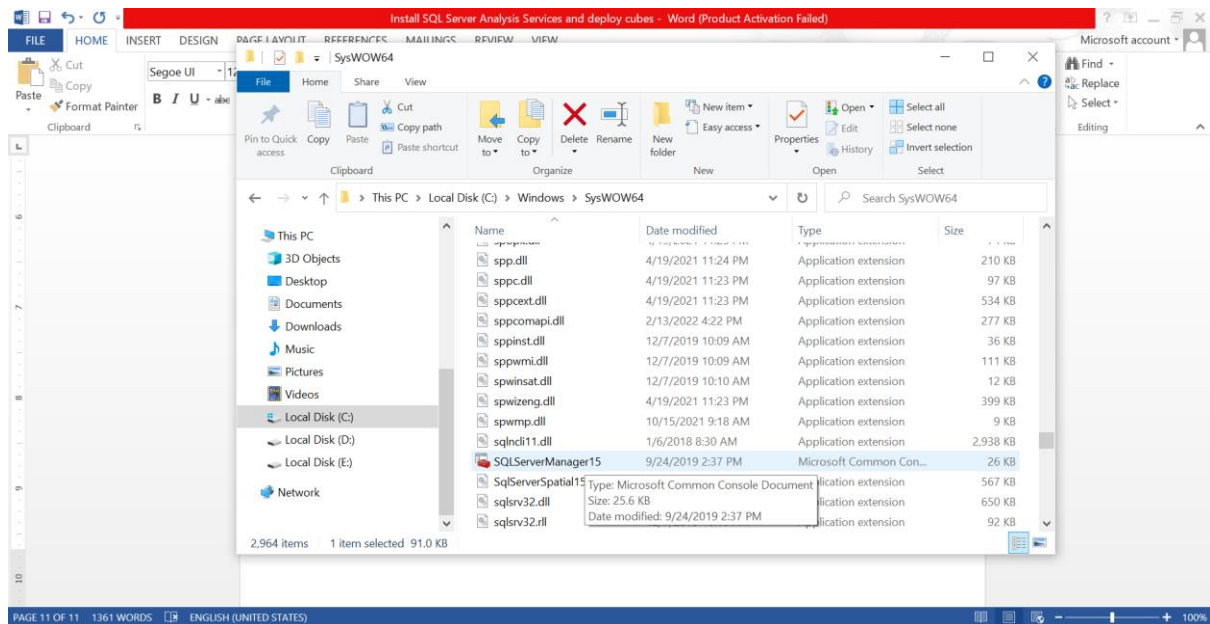
Right click on project name and select Deploy or click on start to deploy your project

In case deployment ends up with errors:

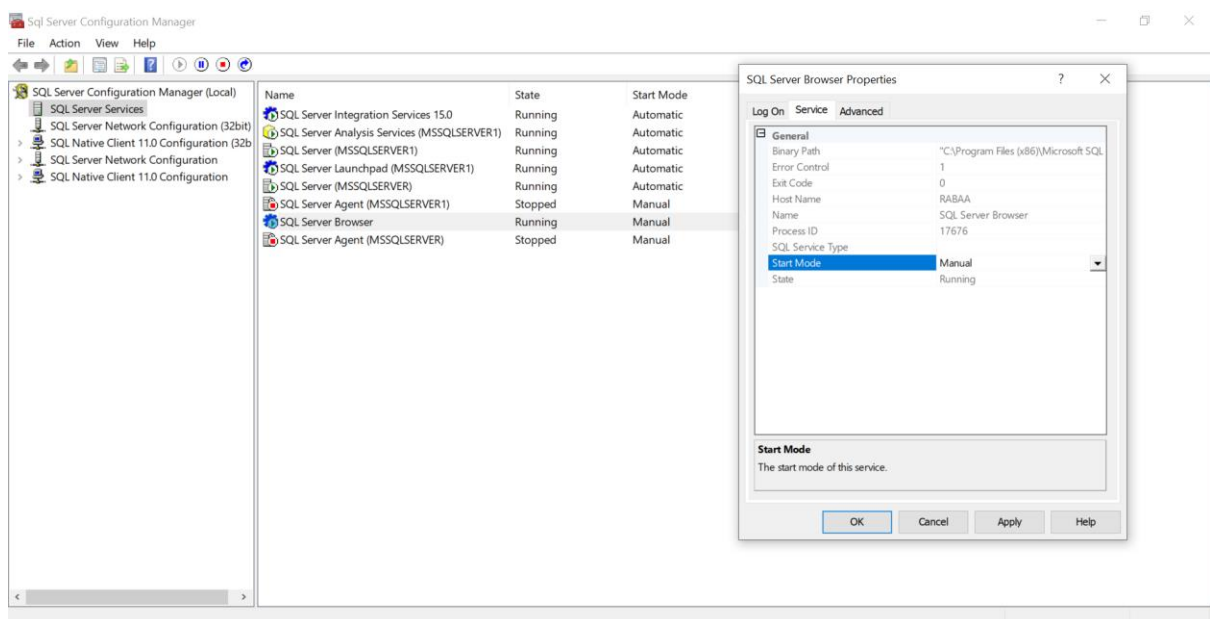
a. Make sure Browsing server is enabled:

Open SQL Server Configuration Manager=> If you are using Windows 10, here is the way to open it:

Go to: C:\Windows\SysWOW64 and find **SQLServerManager15.msc** and double click



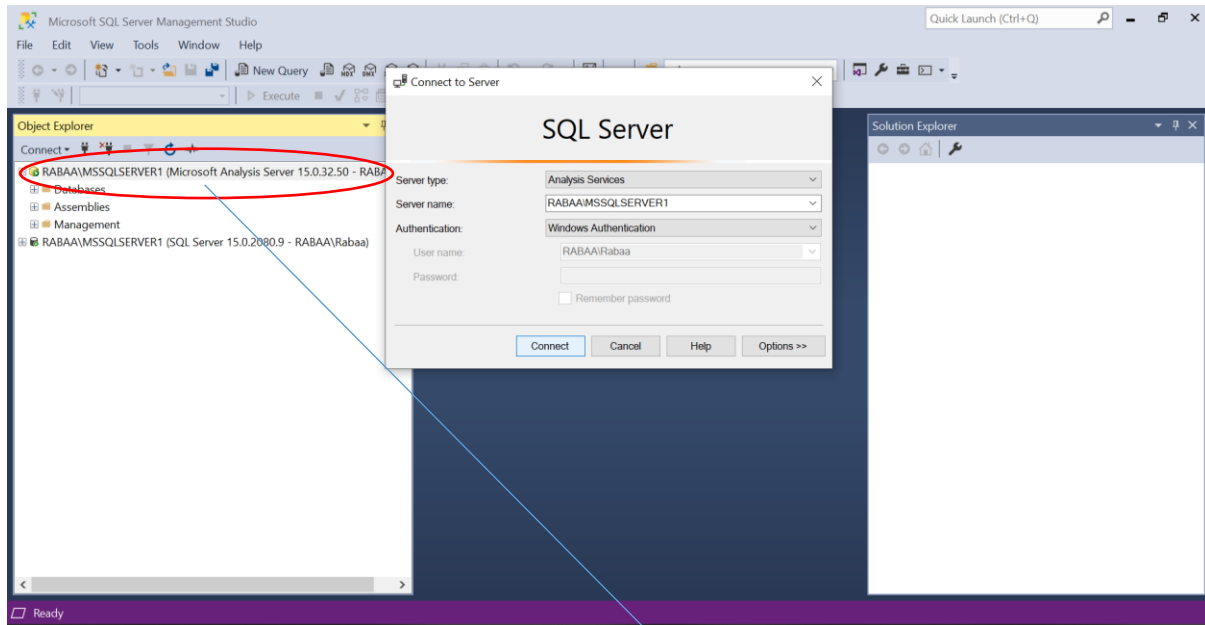
Check if SQL Server Browser is running, if it's not the case, right click = > properties
=> Service => set Start mode to *manual* => Apply and OK
Finally, right click and Start the SQL Server Browser.



b. Make sure your SQL server is running in multidimensional mode (not tabular mode)

If not, open SQL Server Management Studio -> File -> Connect Object Explorer -> Choose Server type: Analysis Services

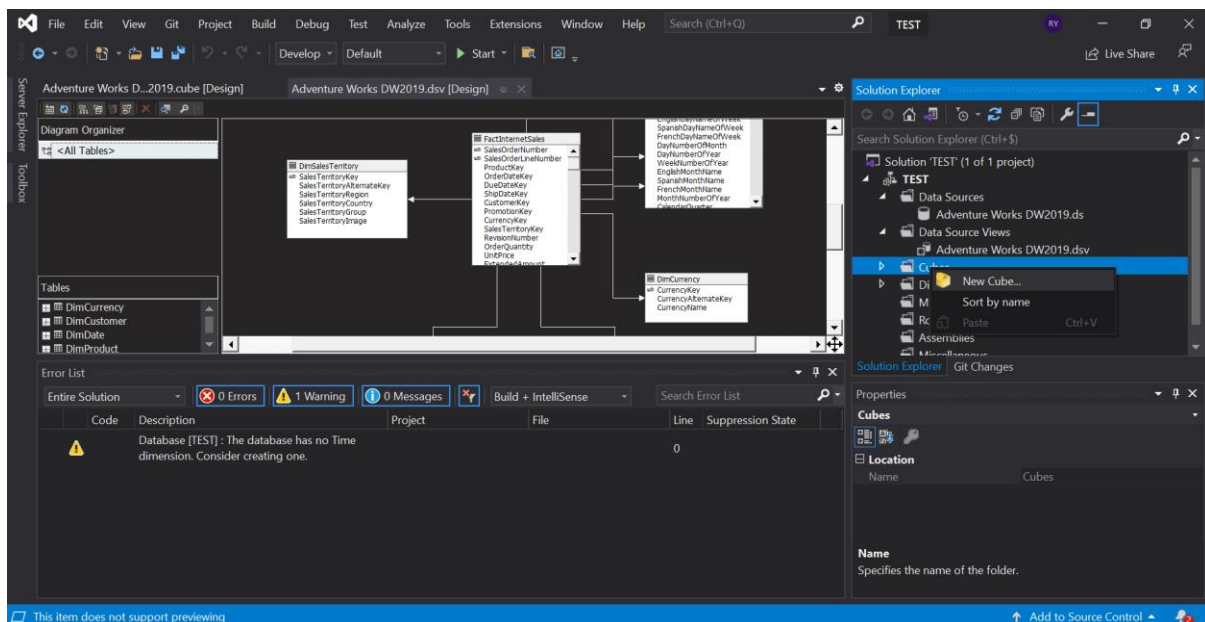
Keep the same server name as Server Engine and choose Windows Authentication -> Connect



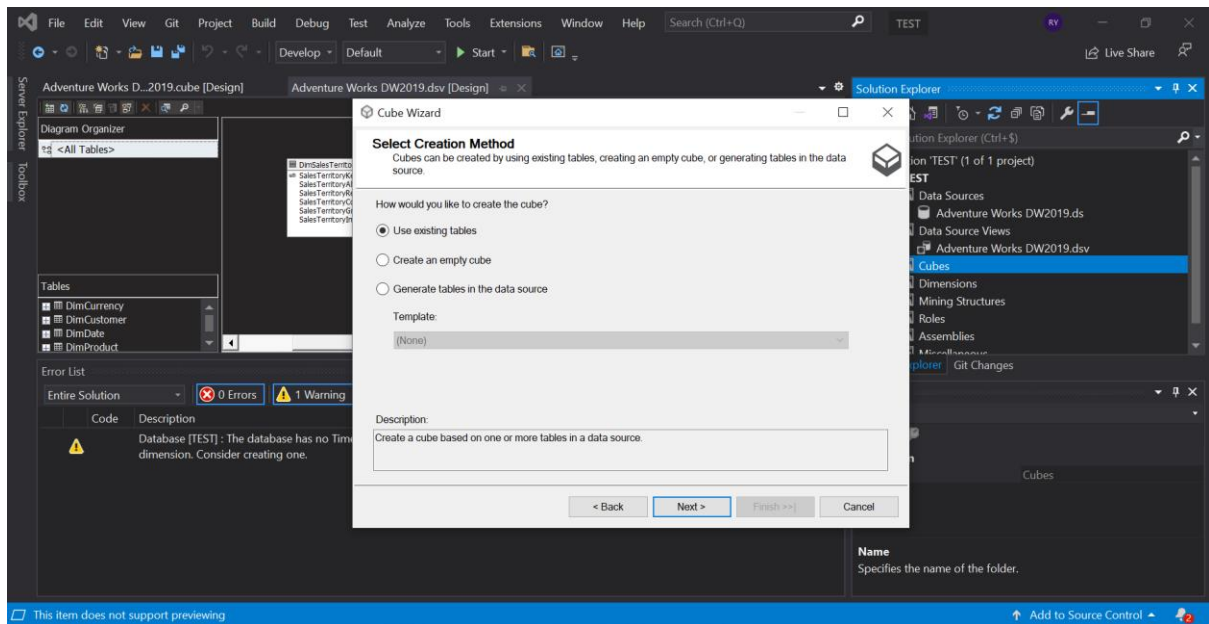
Now you can see in Object Explorer an Analysis Services Server connected.

Now we are ready to Deploy the Cube

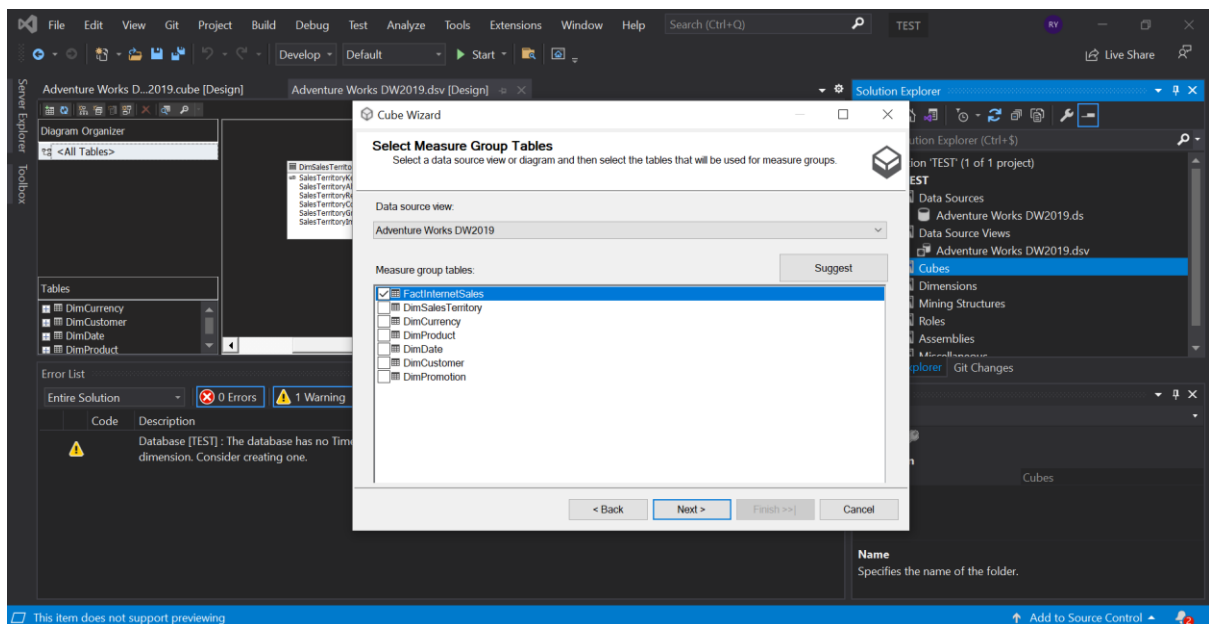
1. First, use the wizard to create a New cube (Right click on Cube-> New Cube)



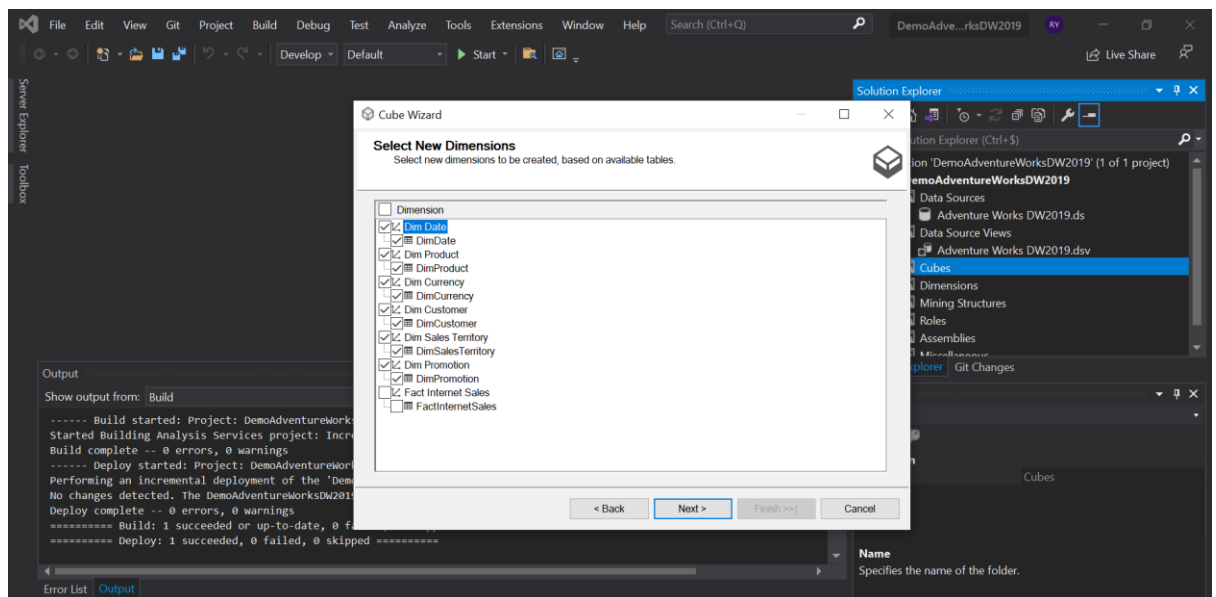
2. Select Use existing tables option and click Next



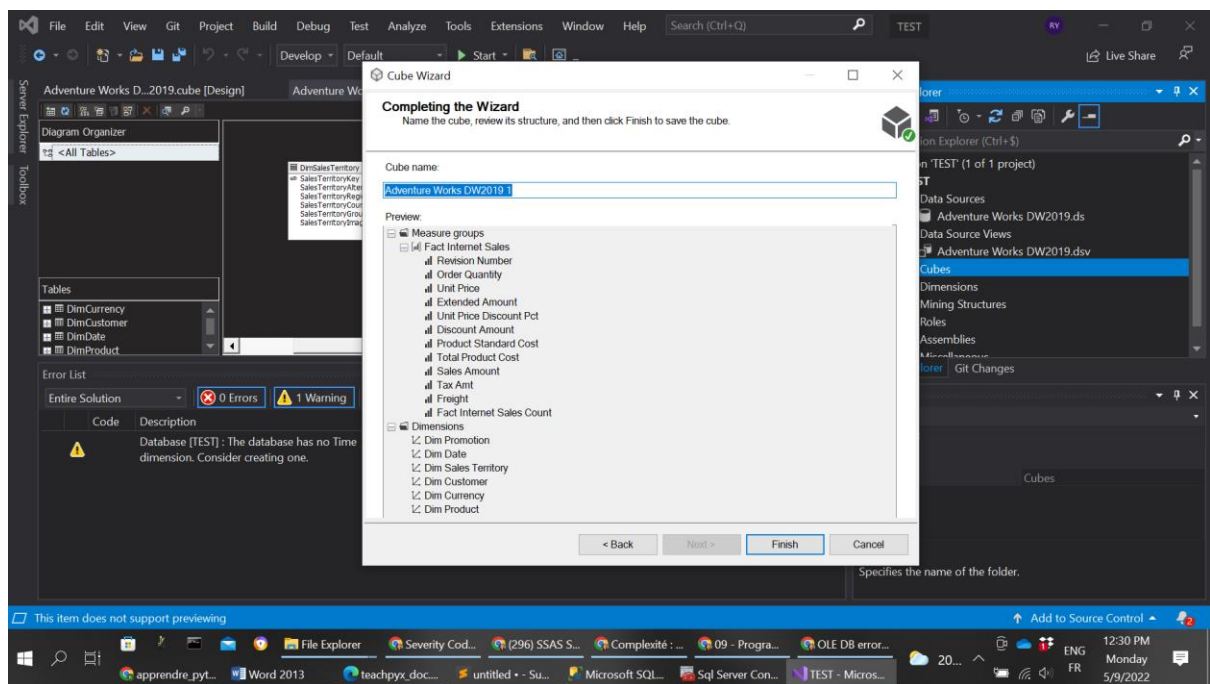
3. Check Fact Internet Sales to extract measures, and in the next step keep all measures checked:



4. In the "Select Existing dimensions", choose all dimensions and **uncheck Fact Internet Sales** (It will not be a dimension!)



5. Finish the cube creation

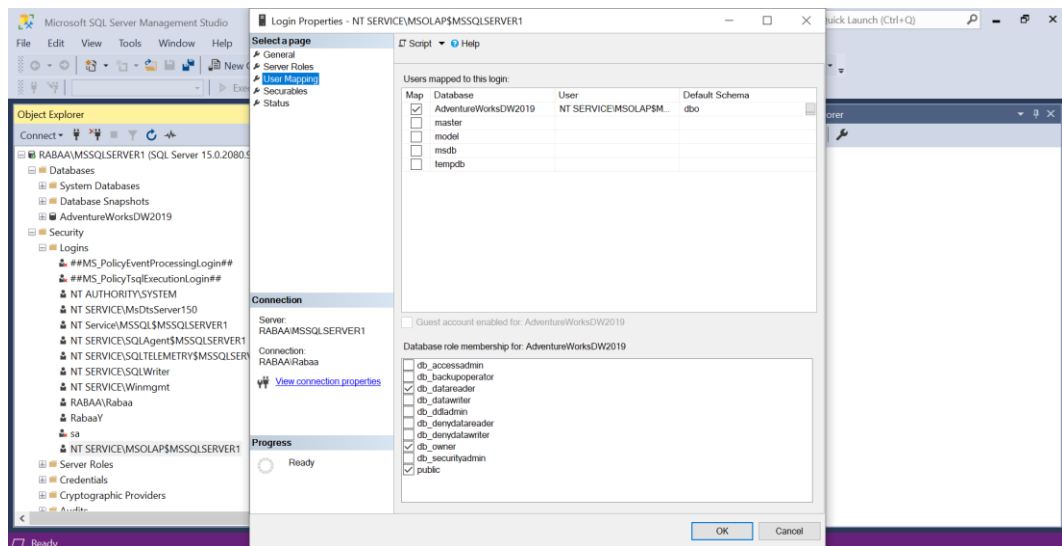


Important Notice: If you try to deploy in this stage, you will get an error because you didn't grant the NT SERVICE\MSOLAP\$MSSQLSERVER the right permissions to access your data. To avoid this error, do the following:

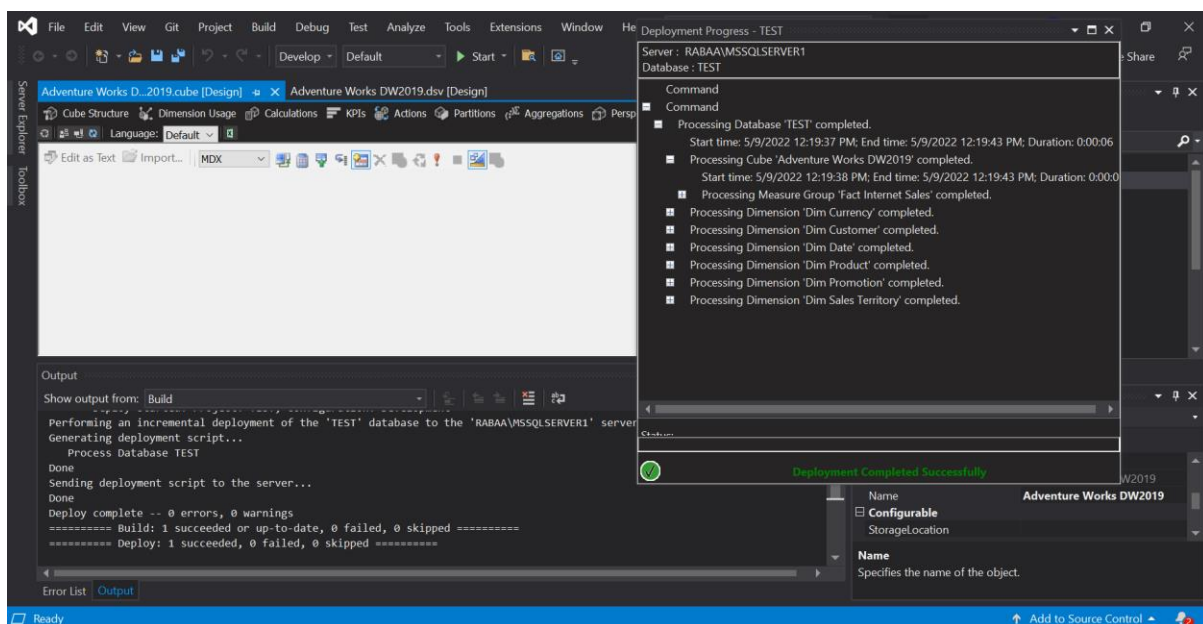
6. In Microsoft SQL Management Studio, you need to :

- Open up SQL Server Management Studio [login to the database engine]>
Security > Login (Right click) > New Login > add user: make sur you use the correct login
(For me it is NT SERVICE\MSOLAP\$MSSQLSERVER1)
- Select the database being analyzed in the drop-down list at the bottom >

- c. User Mapping [click on the database in the list] >
In the window database role membership click on db_datareader [this grants access to read the data]

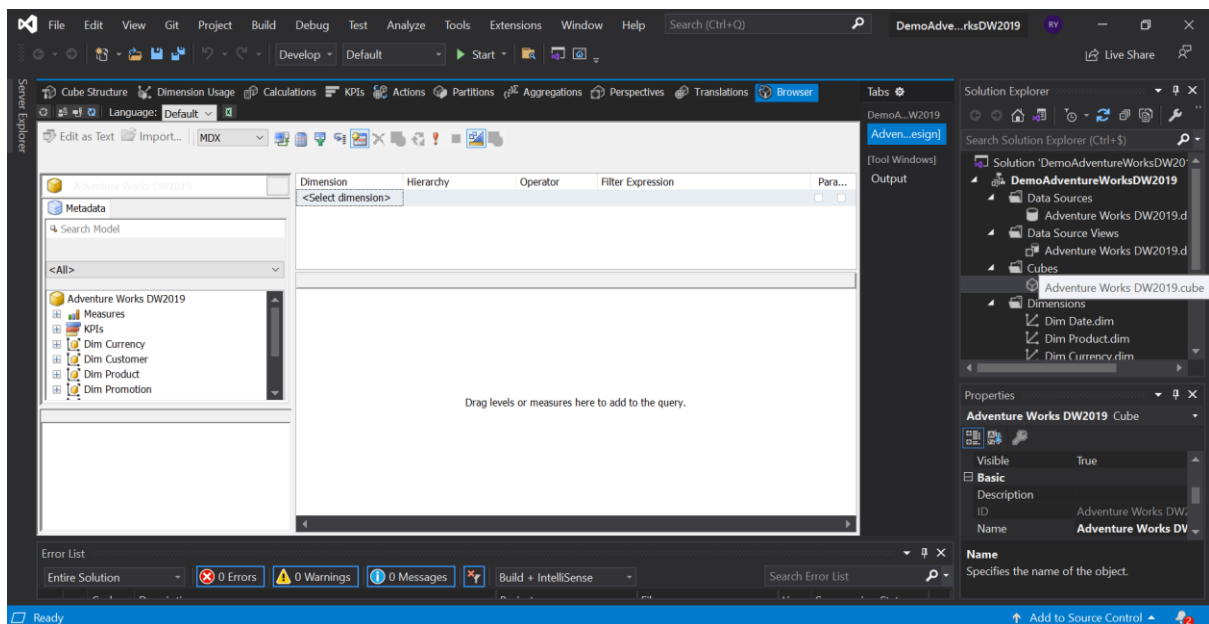


Now we are ready to deploy the cube: In visual studio, right click on solution name and choose deploy or use directly START.



STEP 2: First use of Cube

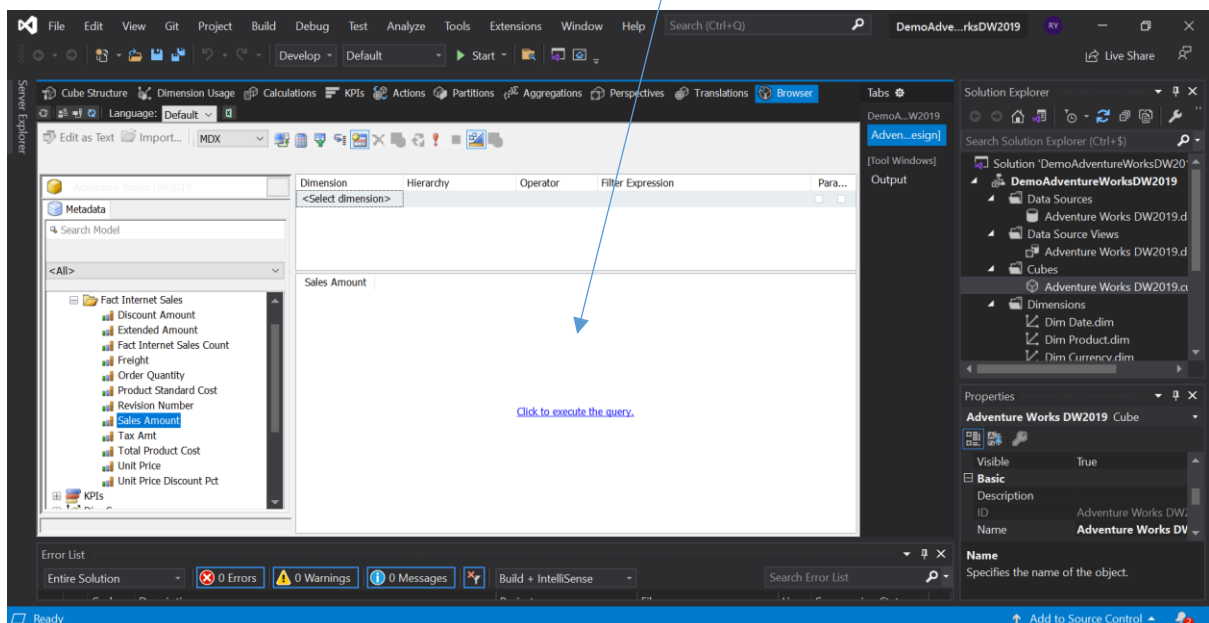
Double click on the cube in the solution explorer and choose the Brower mode



You can drop measures and dimensions in the center of the screen to visualize some elements of the cube. **Remember to "Click to execute the query".**

In our case, we will try to create a multidimensional table for the sales amount depending on 2 dimensions: Dim Product and Dim Sales Territory.

You just need to drag and drop the needed dimensions.



And here is the final table:

Dimension	Hierarchy	Operator	Filter Expression	Parameters
Product Key	Sales Territory Key	Sales Amount		
214	1	10147.1		
214	2	34.99		
214	4	15045.6999...		
214	5	69.98		
214	6	9622.24999...		
214	7	8537.55999...		
214	8	8782.48999...		
214	9	15675.5199...		
214	10	10112.11		
217	1	10776.9199...		
217	2	69.98		
217	4	14800.7699...		
217	5	34.99		
217	6	9517.27999...		
217	7	6997.99999...		

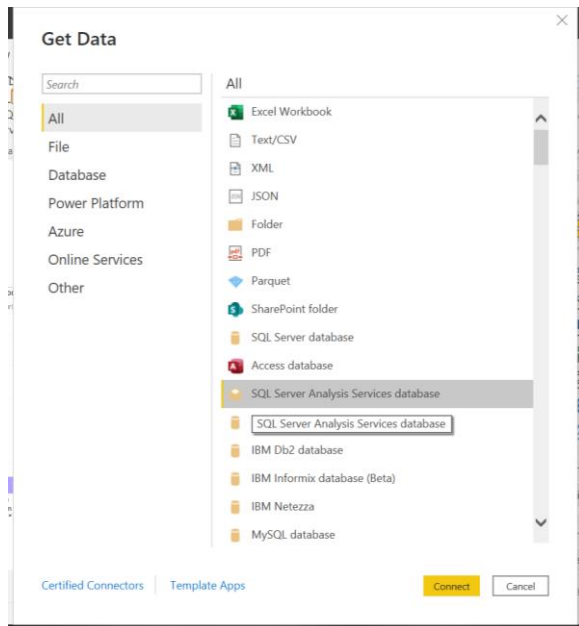
We would like to indicate more than keys in the multidimensional table. We would like to analyze the sales amount by Sales Territory Region and English Subcategory Product Name.

Try to complete the next steps based on this video

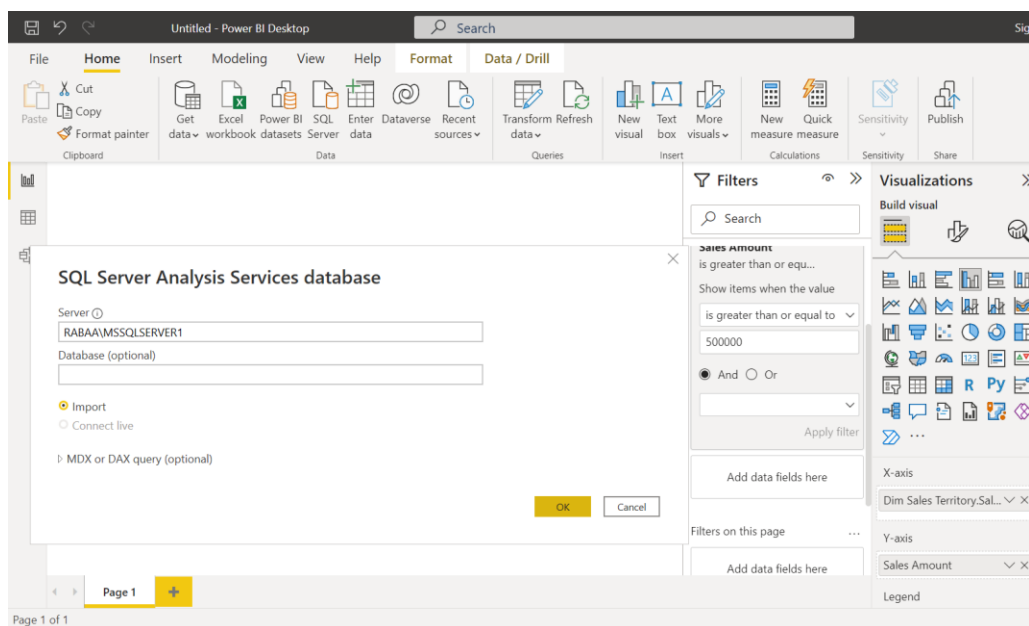
(<https://youtu.be/PHckRz8vpuM?t=294>)

Step 3: Explore Cube in PowerBi

1. Now, try to import your cube to PowerBi Desktop: Get Data-> SQL Server Analysis Services Database



2. Put the correct name of your server



3. Choose to load: Sales Amount, English Product Subcategory Name and Sales Territory Region

Navigator

Adventure Works DW2019

Dim Product.English Product Subcategory Name	Dim Sales Territory.Sales Territory Region	Sales Amount
Bike Racks	Australia	6000
Bike Racks	Canada	7080
Bike Racks	France	3000
Bike Racks	Germany	2880
Bike Racks	Northwest	7560
Bike Racks	Southeast	120
Bike Racks	Southwest	9240
Bike Racks	United Kingdom	3480
Bike Stands	Australia	10335
Bike Stands	Canada	5088
Bike Stands	France	3021
Bike Stands	Germany	3180
Bike Stands	Northwest	5724
Bike Stands	Southwest	7791
Bike Stands	United Kingdom	4452
Bottles and Cages	Australia	11245.27
Bottles and Cages	Canada	7683.16
Bottles and Cages	Central	13.98
Bottles and Cages	France	4967.13
Bottles and Cages	Germany	5416.43
Bottles and Cages	Northeast	29.96
Bottles and Cages	Northwest	8633.79

Display Options: Product Standard Cost, Revision Number, Sales Amount, Tax Amt, Total Product Cost, Unit Price, Unit Price Discount Pct, Dim Currency, Dim Customer, Dim Product [3], English Product Name, English Product Subcategory Name, Product Key, Dim Promotion, Dim Sales Territory [2], Sales Territory Key, Sales Territory Region, Due Date, Order Date.

Fields: Adventure Works DW2..., Dim Product.Eng..., Dim Sales Territo..., Sales Amount.

Buttons: Load, Transform Data, Cancel.

4. Now, finish by creating an histogram of sales amount by Sales Territory Region and Product Subcategory Name. Then filter the sales <500 000

