SSAS Tabular

Sample manual - first two chapters

Manual 1243 - 202 pages

TABLE OF CONTENTS (1 of 6)

1	OVERVIEW OF SSAS TABULAR	Page
1.1	What Tabular Models Do	8
	Database Level	8
	Model Level	9
	View Level	9
1.2	Deployed Tabular Models	10
1.3	Compatibility Levels	11
	Viewing the Compatibility Level of your Model	11

2	CREATING PROJECTS IN VISUAL STUDIO	Page
2.1	Ensuring Analysis Services is Running	12
2.2	Running Visual Studio	13
	Running Visual Studio	13
	Changing Start-up Options	13
	Changing Analysis Services Settings	14
	Installing the SSAS Extension	15
2.3	Projects and Solutions	16
	Creating a New Project	16
	Files and Folders Created	17
	Having Multiple Projects in a Solution	17
2.4	Visual Studio Windows	18
	Moving and Auto-Hiding Windows	18
	The Three Main Windows to Show	18

3	GETTING STARTED	Page
3.1	Working with Models	19
	Renaming Models	19
3.2	Adding Data	20
3.3	Workspace Databases	21
	Using a Workspace Database	21
	Using an Integrated Workspace	22
3.4	Deploying your Database	23
	Checking the Production Server Used	23
	Deploying a Model	24
	Viewing Deployment Progress	24
	Viewing the Deployed Database	25
3.5	Viewing your Model's Data	26
	Analysing a Model in Excel	26
	Browsing a Model in SSMS	27
	Creating a Pivot Table Based on a Model	28
3.6	Generating Measures	29
	Using Generated Measures	29

4	IMPORTING DATA	Page
4.1	Our Example Database	30
4.2	Loading Data	31
	Step 1 – Choosing to Import Data	31
	Step 2 – Choosing your Data Format	32
	Step 3 – Choosing the Data Source	32
	Step 4 – Passing Security	32
	Step 5 – Encryption Support Warning	33
	Step 6 – Choose your Tables	33
4.3	Existing Connections	34
4.4	Importing from Excel	35
4.5	Importing CSV or Text Files	36

5	CREATING DATA MODELS	Page
5.1	Data and Diagram View	37
5.2	Relationships	38
	Viewing Relationships	38
	Editing Relationships	39
	Deleting Relationships	39
	Creating Relationships	40
	Managing Relationships	40
5.3	Hiding Columns and Tables	41
	The Need to Hide Columns/Tables	41
	Hiding Tables	41
	Hiding Columns	42
	Choosing not to Display Hidden Columns and Tables	42
5.4	Renaming Tables and Columns	43
	Renaming Columns	43
	Renaming Tables	43
5.5	Changing what you've Imported for a Table	44
	Deleting Columns from a Model	44
	Adding Columns to a Model, or Changing Filtering	44

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TABLE OF CONTENTS (2 of 6)

6	TRANSFORMING DATA	Page
6.1	Transforming Data during Loading	45
6.2	Changing Data after Loading	46
6.3	Working with Queries	47
	The Power Query Editor	47
	Default Query Steps	47
	Viewing Data at Different Steps	48
	Editing a Query Step	48
	Deleting a Query Step	49
	Adding a New Step	49
	Applying Query Changes	49
	The Advanced Editor	50
6.4	Transforming Data	51
	Changing Data Types	51
	Renaming Columns	51
	Removing Columns	51
	Removing or Keeping Rows	52
	Sorting and Filtering Rows	52
	Splitting Columns	53
	Replacing Values	53
6.5	Creating New Columns	54
	Creating a Formula	54
	Creating a Column by Example	55
6.6	Conditional Columns	56

7	EXCEL PIVOT TABLES	Page
7.1	Creating a Data Model	57
7.2	Creating a Pivot Table	57
7.3	Drill Down	59
7.4	Working with Pivot Tables	60
	Renaming Fields	60
	Refreshing Changes to the Model	60
	Changing Number Formatting	61
	Moving Rows and Columns	62
	Sorting Pivot Tables	62
7.5	Filtering	63
7.6	Slicers	64
	Creating Slicers	64
	Removing Slicers (or their Filters)	64
	Changing the Number of Slicer Columns	65
	Changing the Style of a Slicer	65
7.7	Controlling Multiple Pivot Tables with Slicers	66
	First Rename your Pivot Table	66
	Getting a Slicer to Control Multiple Pivot Tables	67
	An Alternative Method – Telling a Pivot Table which Slicers Control it	67
7.8	Formatting Pivot Tables	68
7.9	Choosing what to Display	69
	Hiding Field Captions	69
	Inserting Blank Rows	69
	Subtotals and Totals	70
	Changing Report Layout	70
	Repeating Item Labels	70

8	POWER BI REPORTS	Page
8.1	Overview of Power BI and SSAS	71
8.2	Importing SSAS Data	72
8.3	Linking to an SSAS Model	73

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TABLE OF CONTENTS (3 of 6)

9	CALCULATED COLUMNS	Page
9.1	What are Calculated Columns?	74
	Differences between Calculated Columns and Excel Formulae	74
9.2	Creating Calculated Columns	75
	An Alternative Method, using the Keyboard	75
9.3	Testing Conditions using IF	76
9.4	Editing DAX Formulae	76
	Multi-Line Formulae	77
	Using the Tab Key	77
	Comments	78
	The DAX Editor	78
	Adding Functions	79
9.5	Working with Calculated Columns	79
	Moving Calculated Columns	80
	Sorting by Calculated Columns	80
9.6	Using RELATED to Link Tables	81
9.7	The BLANK Function	82
	Blank Arithmetic	83
	Using Variables to Improve Formulae	83
9.8	Aggregator Columns and SWITCH	84
	The SWITCH Function	84
9.9	Error-Trapping	85

10	MEASURES	Page
10.1	Calculated Columns vs. Measures	86
	Difference 1 - Calculated Columns are Row-Based	86
	Difference 2 - Measures are Aggregated	86
	Difference 3 - Pivot Table Placement	87
10.2	Creating Measures	88
	Step 1 – Choosing a Host Table	88
	Step 2 – Choosing a Cell	88
	Step 3 – Creating the Measure	89
	Step 4 – Naming your Measure	90
	Step 5 - Changing the Default Formatting	90
	Step 6 - Applying Filters to Test your Measure	91
	Step 7 - Testing your Measure in Excel	91
10.3	Using a Separate Measure Table	92
	Creating a Separate Table	92
	Adding Measures	92
10.4	Filter Context	93

11	MEASURE SYNTAX	Page
11.1	Basic Syntax Rules	94
	Data Types	94
	Symbols you can Use	94
11.2	Aggregation Functions	95
	Aggregating a Column	95
	Aggregating an Expression (X-Suffix Functions)	96
11.3	Calculating Ratios	97
	Counting Rows using the COUNTROWS Function	97
	Creating Ratios: the Fields Needed	97
	The Final Pivot Table	98
	Summing Ratios wouldn't Work	98

12	THE CALCULATE FUNCTION	Page
12.1	Syntax of the CALCULATE Function	99
12.2	Removing Filters Using ALL	100
	Removing a Single Filter	100
	Removing Multiple Filters	100
	Removing All Filters Bar One	101
12.3	Replacing Individual Filters	102
	Replacing a Single Filter	102
	Replacing More than One Filter	102
12.4	Using VALUES to Edit a Constraint	102
	On its own, VALUES is pointless	103
	Amending the Filter Context Filter	103

13	THE FILTER FUNCTION	Page
13.1	Syntax of the FILTER Function	104
13.2	Filtering to Show Subsets of Data	105
13.3	Removing Filters using ALL	106
	Removing and Partially Reinstating Filters	106

14	THE EARLIER FUNCTION	Page
14.1	Overview of the EARLIER Function	107
	Our Three Worked Examples	107
	What the EARLIER Function Does	107
14.2	Case Study: Running Totals	108
14.3	Case Study: Ranking using EARLIER	109
14.4	Case Study: Group Averages	110

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TABLE OF CONTENTS (4 of 6)

15	BANDING	Page
15.1	What is Banding?	111
	Creating and Loading a Banding Table	111
15.2	Creating a Banding Formula	112
15.3	Sorting the Bands	113

16	RANKING	Page
16.1	The RANKX Function	114
	Syntax of the Rank Function	114
	Entering RANKX in a Calculated Column	114
16.2	Using RANKX in Measures	114
	Step 1 – Creating the Measure to Rank	115
	Step 2 – using ALL	115
16.3	Changing the Sort Order	116

17	CALENDARS	Page
17.1	The Need for a Separate Date Table	117
	The Excel Approach – Date Functions	117
	The Tabular Approach – Create a Separate Table	117
17.2	Creating your Dates Table	117
	Creating a Calendar Table in Excel	118
	Creating a Calendar Table in SQL Server	119
17.3	Creating Relationships	119
	Creating Relationships	120
	Using Integer Date Keys	120
17.4	Announcing your Date Table to the World	121
17.5	Using Calendars in Pivot Tables	122
	Sorting Months (and Other Fields)	122
17.6	Managing Date Granularity	123
17.7	Timelines	124
17.8	Creating New Aggregator Columns	125
	Incorporating a Bank Holiday Table	125
	Creating a Calculated Column for Working Days	126

18	MULTIPLE CALENDAR TABLES	Page
18.1	The Problem, and Two Solutions	127
	Repeat the Table or the Relationship?	127
18.2	Solution One: Duplicate the Calendar Table	128
	Importing and Linking to the Calendar Tables	128
	Creating the Pivot Table	129
18.3	Solution Two: Duplicate the Relationship	130
	Creating the Duplicate Relationships	130
	The CALCULATETABLE Function	131
	The USERELATIONSHIP Function	131
	Our Measures	132

19	DATE FUNCTIONS	Page
19.1	Contents	133
19.2	Period to Date	134
	Using DATESYTD (and how Date Functions Work)	134
	TOTALYTD, TOTALQTD and TOTALMTD	135
	Changing the Financial Year End	135
19.3	Comparing with Previous Periods	136
	The SAMEPERIODLASTYEAR Function	136
	Using DATEADD to Compare with any Previous Period	136
19.4	Parallel Periods	137
19.5	Moving Averages	138
	Definition of a Moving Average	138
	Moving Average using DATESINPERIOD and LASTDATE	139
	Moving Average using DATESBETWEEN, NEXTDATE and LASTDATE	139
19.6	Semi-Additive Measures	140
	Useful Semi-Additive Functions	140
	Using the FIRSTDATE and LASTDATE Functions	140
	Using FIRSTNONBLANK and LASTNONBLANK	141
	Detecting Relationships in FIRSTNONBLANK / LASTNONBLANK	141

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TABLE OF CONTENTS (5 of 6)

20	KEY PERFORMANCE INDICATORS (KPIS)	Page
20.1	About KPIs	142
	Three Parts of a KPI	142
20.2	Creating a KPI	143
	Step 1 – Create the Measures Needed	143
	Step 2 – Starting to Create the KPI	143
	Step 3 – Customising your KPI	144
	Step 4 – Displaying the KPI in Excel	145
20.3	Absolute Targets	146

21	HIERARCHIES	Page
21.1	Using Hierarchies	147
	Advantages and Disadvantages of Hierarchies	147
21.2	Creating Hierarchies	148
	Step 1 – Getting the Correct Fields in a Single Table	148
	Step 2 – Creating the Hierarchy	148
	Step 3 – Including Fields in your Hierarchy	149
	Step 4 – Using a Hierarchy	149

22	PROTOTYPING IN POWERPIVOT	Page
22.1	Enabling PowerPivot	150
22.2	Using PowerPivot	151
22.3	Summary of Differences between PowerPivot and SSAS Tabular	152
	Difference 1: Pivot Table Field List	152
	Difference 2: Implicit Measures	153
	Difference 3: Creating Measures in the Client	154
	Difference 4: Linked Excel Tables	154
22.4	Uploading PowerPivot Models into Tabular	155
	Importing a PowerPivot Model	156

23	PERSPECTIVES	Page
23.1	What are Perspectives?	157
23.2	Creating Perspectives	158
23.3	Using Perspectives	159
	Switching Perspectives in a Model	159
	Choosing a Perspective when Analysing Data in Excel	159
	Choosing Perspectives for Data Connections	160
	Changing the Perspective for an Existing Pivot Table	160

24	SECURITY	Page
24.1	Overview of Security	161
	Types of Role in SSAS Tabular	161
	Levels of Database Access	161
24.2	Server Administrators	162
24.3	Managing Roles	163
	Managing Roles in Visual Studio	163
	Managing Roles in Management Studio	164
24.4	Controlling Data Access (Row Filters)	165
	Row Filters in Visual Studio	165
	Row Filters in SSMS	166
24.5	Two Ways to Test Row Filters	167
	Testing using Excel	167
	Testing using Connection Strings	167
24.6	Creating a Permissions Table	168
24.7	Dynamic Security	169
	Two DAX Functions Needed	169
	Using CustomData for Dynamic Security	169
	Incorporating a Test for the User Name	170

25	DAX STUDIO	Page
25.1	Using DAX Studio	171
	Installing DAX Studio	171
	Connecting to your Model	171
	Refreshing your Model	171
25.2	Five Uses of DAX Studio	172
	Use 1 - Getting at DAX Functions	172
	Use 2 – Writing DAX Queries	172
	Use 3 – Better Formatting	173
	Use 4 – Saving DAX	173
	Use 5 – Getting at Internal Data	173

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TABLE OF CONTENTS (6 of 6)

26	DAX QUERIES	Page
26.1	Overview of DAX Queries	174
	DAX and MDX	174
	Creating a DAX Query in SQL Server Management Studio	174
26.2	SQL versus DAX Querying	175
26.3	Listing Tables (EVALUATE)	176
	Listing All Rows	176
	Ordering Rows	176
	Starting at a Particular Row	176
	Returning N Rows Only	177
	Sampling Rows	177
26.4	Summarising	178
	Summarisation Syntax	178
	Examples of Summarisation	179
	Using ROLLUP to get All Combinations	179
26.5	Filtering in DAX Queries	180
	Example: Summarising Sales for Birds Only	180
	Example: Summarising Centre Size for Selected Towns	180
26.6	Adding Columns	181
	Example: Counting Rows	181
	Example: Transaction Statistics by Town	182
	Defining Measures First	182
26.7	Combining Table Results	183
	GENERATE and GENERATEALL	183
26.8	Other Useful Functions	184
	Using ROW to Display One Row of Data	184
	Using CONTAINS to Check if a Field Value Exists	184

27	PROCESSING	Page
27.1	Column Storage	185
	Row versus Column Storage	185
	Data Compression	185
27.2	Ways to Speed up Processing	186
	Sort Tables First	186
	Omit High-Cardinality Columns where Possible	186
	Avoid Calculated Columns	187
	Avoid Expensive Queries	188
	Use Server Timings	188
	Don't Store DateTime Columns	189
	Consider Splitting Id Columns	189
27.3	Processing Concepts	190
	What Processing Involves (Data/Metadata)	190
	Two Stages of Processing	190
	Types of Processing	191
	The Most Efficient Strategy	191
27.4	Processing in Visual Studio	192
	Processing an Individual Table	192
	Processing All Tables for a Given Connection	192
	Processing an Entire Model	193
	Changing Processing Options for Deployment	193
27.5	Processing in SSMS	194
	Processing an Entire Database	194
	Processing Tables	194

28	PARTITIONS	Page
28.1	Partitions	195
28.2	Partitions in Visual Studio	196
	Creating Partitions in Visual Studio	196
	Processing Partitions in Visual Studio	197
28.3	Partitions in SSMS	198
	Processing Partitions in SSMS	199

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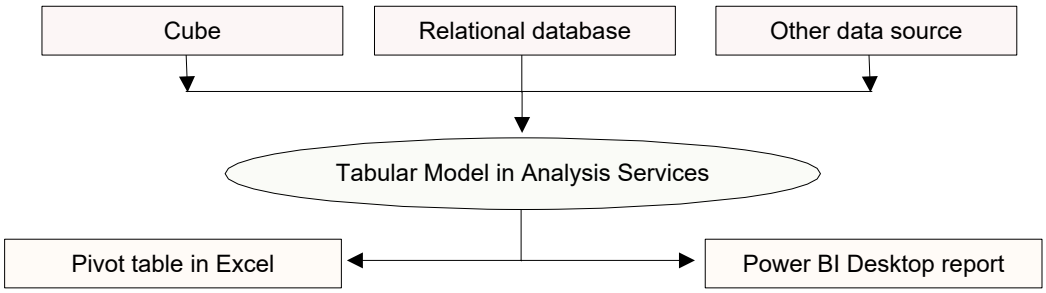
CHAPTER 1 - OVERVIEW OF SSAS TABULAR

1.1 What Tabular Models Do

The diagram below shows how tabular models combine data from tables, cubes and other data sources, to present a single easy-to-read data source for business users:



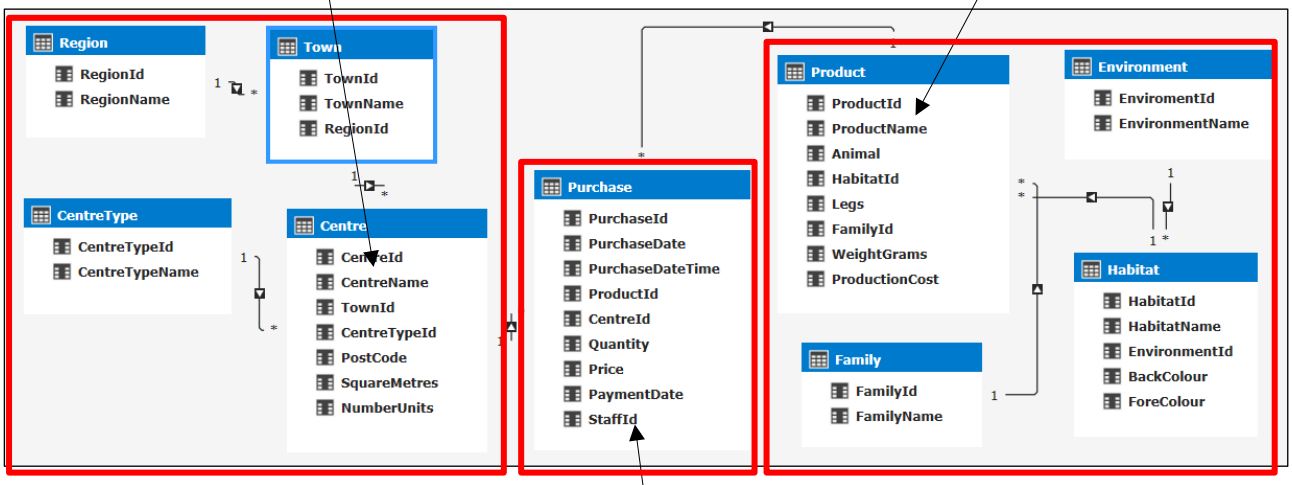
Examples for each of the 3 levels of this diagram are shown under separate headings below.

Database Level

Here's the structure of the **Construct-a-Creature** database used throughout this courseware:

Each purchase takes place in a particular shopping centre (for example, the **Trafford Centre**) which belongs to a town (**Manchester**) and region (**North-West**), as well as having a centre type (such as **Retail Park** or **Shopping Park**).

Each purchase is for a particular product (for example, one of the products sold is **Fenella the Frog**). This belongs to a family (**Amphibians**) and has a habitat (**Fresh Water**) which is part of a larger environment (**Water**).



The **Purchase** table records one row for each time a customer buys one or more items of a particular product in a given shopping centre.

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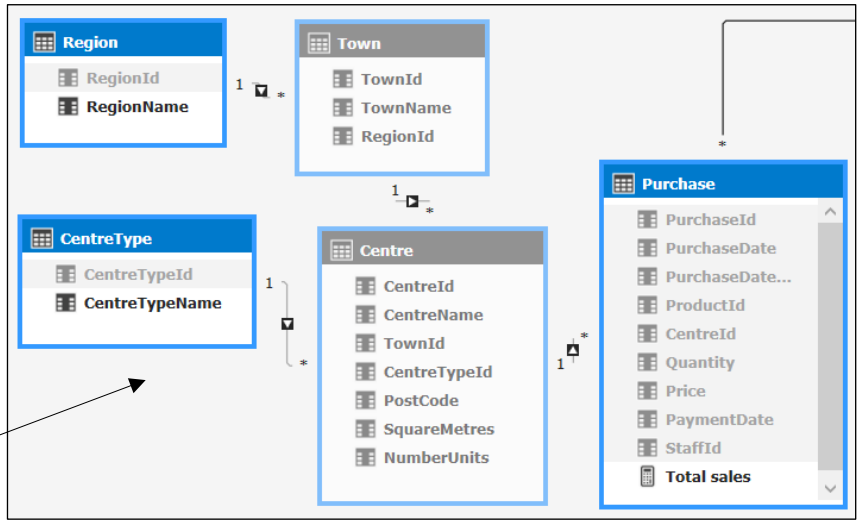
Model Level

Here's what a model based upon this database might look like:



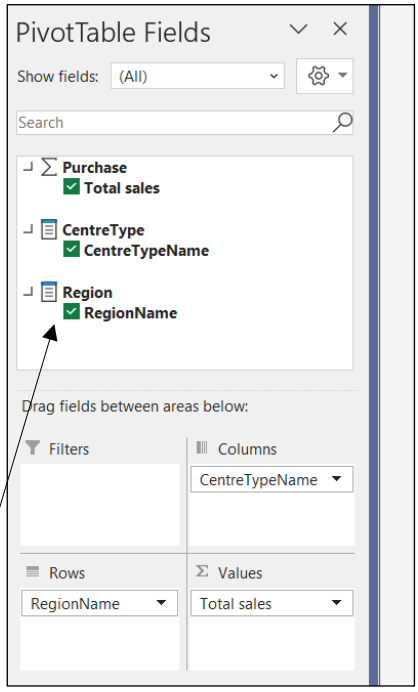
Only certain tables and fields have been included in the model.

View Level

You could use this model to create (for example) a pivot table:

Total sales	Factory Outlet	Retail Park	Shopping Centre	Shopping Park	Grand Total
East Anglia		2,202	14,758		16,960
East Midlands		3,068	27,008	3,857	33,933
London		2,640	64,882	533	68,055
North		5,166	28,024		33,190
North West	2,449	20,499	62,182	5,187	90,316
South East	5,625	7,902	115,776	1,074	130,376
South West	561	4,865	19,915	5,552	30,893
West Midlands		9,569	51,998	1,131	62,698
Yorkshire & Humberside	2,616	15,337	42,738	1,446	62,138
Grand Total	**11,250**	**71,248**	**427,280**	**18,780**	**528,558**

A pivot table based on this model, showing total sales by region and by centre type.



The pivot table field list. Notice that all of the other fields and tables have been hidden from client view, so you see a nice clean field list.

SQL Server Analysis Services (SSAS) comes in two flavours: tabular models *(the subject of this courseware) and the legacy* multi-dimensional models *(still supported by Microsoft, but unchanged for at least the last 10 years). The future lies with tabular models, and this is the version of SSAS installed by default.*

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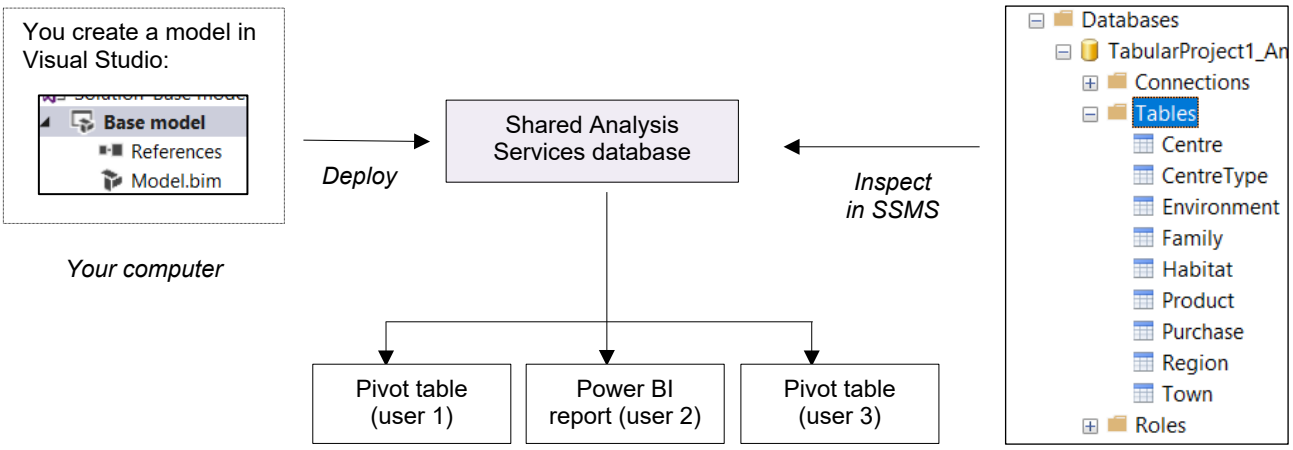
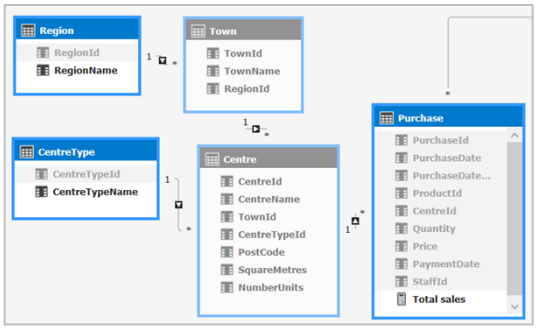
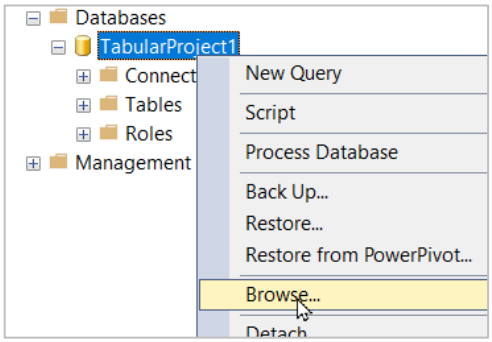
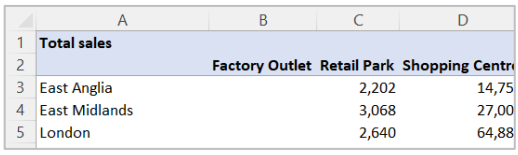
1.2 Deployed Tabular Models

Typically you will create a tabular model on your local machine, then *deploy* it to the Analysis Services database on your production server:



Thus you can look at a model in three different ways:

When	Software	Who can see	Example
While building	Visual Studio	Just you	
When deployed	SQL Server Management Studio	IT department	
In a client view	Excel, Power BI, etc	Business users	

	A	B	C	D
1	Total sales			
2		Factory Outlet	Retail Park	Shopping Centr
3	East Anglia		2,202	14,75
4	East Midlands		3,068	27,00
5	London		2,640	64,88

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1.3 Compatibility Levels

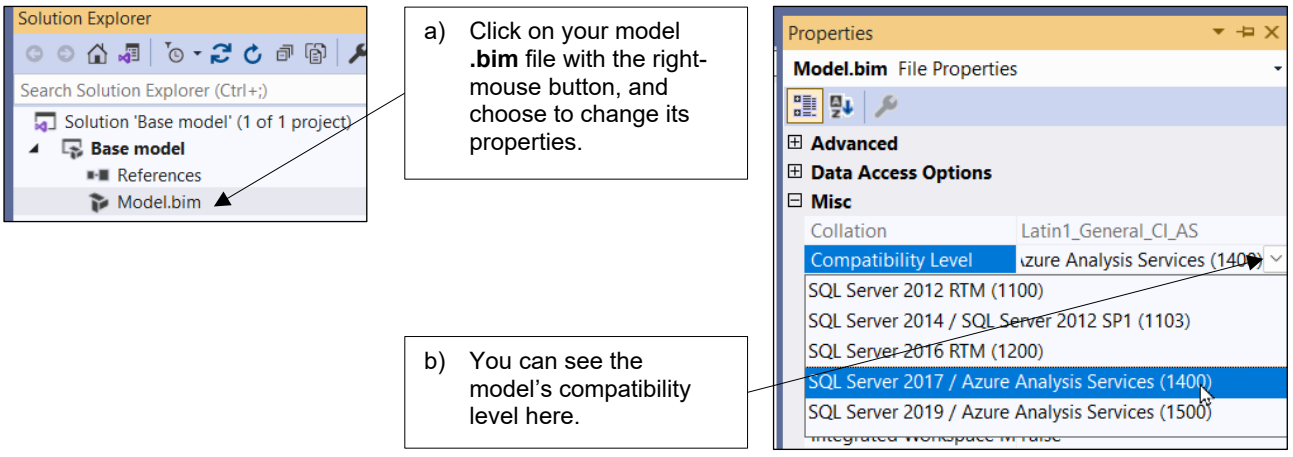
Any SSAS tabular model has a *compatibility level*. At the time of writing, here are the possible compatibility levels that you may see:

Level	Used by	New features
1100	SQL Server 2012	The first version of SQL Server to include tabular models. These are deprecated from SQL Server 2017 on.
1103	SQL Server 2012 SP1 / SQL Server 2014	
1200	SQL Server 2016	A better DAX editor, DAX variables and some useful new DAX functions; parallel processing of partitions; less restrictions on the use of DirectQuery; support for R.
1400	SQL Server 2017	The incorporation of Power Query to transform data before loading it; customisation of Excel drill-down; hiding blank members from hierarchies. a new DAX editor; small DAX improvements.
1500	SQL Server 2019	Calculation groups of measures, many-to-many relationships.

At the time of writing SQL Server 2022 is in preview, but it doesn't include any significant updates to SSAS Tabular. This courseware assumes that you have at least compatibility level 1400, and hence are using Power Query to load your data (as for Power BI).

Viewing the Compatibility Level of your Model

Here's how to find out which compatibility level your model uses:



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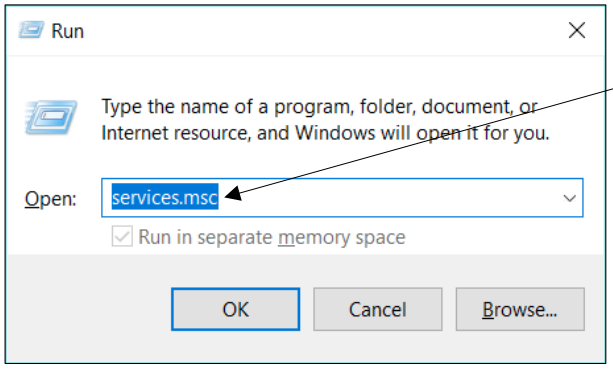
CHAPTER 2 - CREATING PROJECTS IN VISUAL STUDIO

This chapter shows how to create a new project to contain your model in Visual Studio. The first thing you should do is check that you have an instance of Analysis Services running.

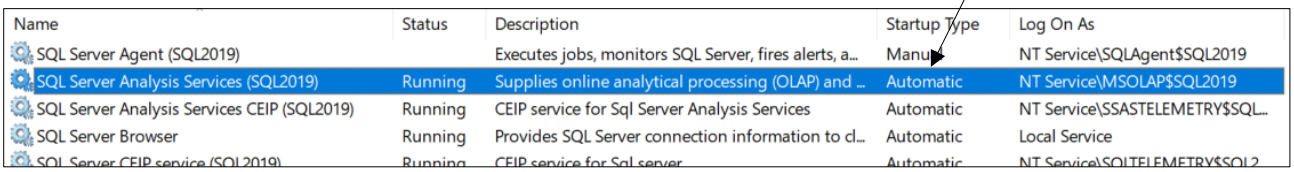
2.1 Ensuring Analysis Services is Running

You won't be able to create an Analysis Services (*SSAS*) database unless the SSAS service is running! To check this:

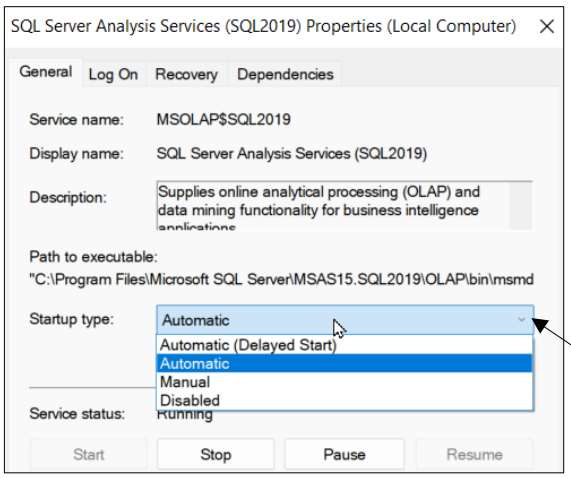


a) Press ⊞ + R to bring up the command dialog box, and type in **services.msc** (there are many other ways to list the services running on your computer!).

b) Check that you have a running service for SQL Server Analysis Services (Tabular Model).



Name	Status	Description	Startup Type	Log On As
SQL Server Agent (SQL2019)		Executes jobs, monitors SQL Server, fires alerts, a...	Manu	NT Service\SQLAgent$SQL2019
SQL Server Analysis Services (SQL2019)	Running	Supplies online analytical processing (OLAP) and ...	Automatic	NT Service\MSOLAP$SQL2019
SQL Server Analysis Services CEIP (SQL2019)	Running	CEIP service for Sql Server Analysis Services	Automatic	NT Service\SSASTELEMETRY$SQL...
SQL Server Browser	Running	Provides SQL Server connection information to cl...	Automatic	Local Service
SQL Server CEIP service (SQL2019)	Running	CEIP service for Sql server	Automatic	NT Service\SQLTELEMETRY$SQL2



c) If the service isn't running automatically when you load Windows, it may be an idea to double-click on its entry in the list of services, then on the **General** tab change the default **Startup type** of Analysis Services to **Automatic**.

*If you get a message about **ImpersonationMode not being supported for processing operations** when you run SSAS, make sure that you have the SQL Server Browser service running too.*

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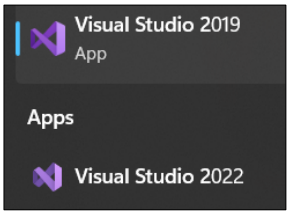
2.2 Running Visual Studio

Running Visual Studio

To create a tabular model you'll need to run Visual Studio. It doesn't matter too much which version you use (this courseware uses Visual Studio 2019).

At the time of writing, the two most recent versions of Visual Studio.

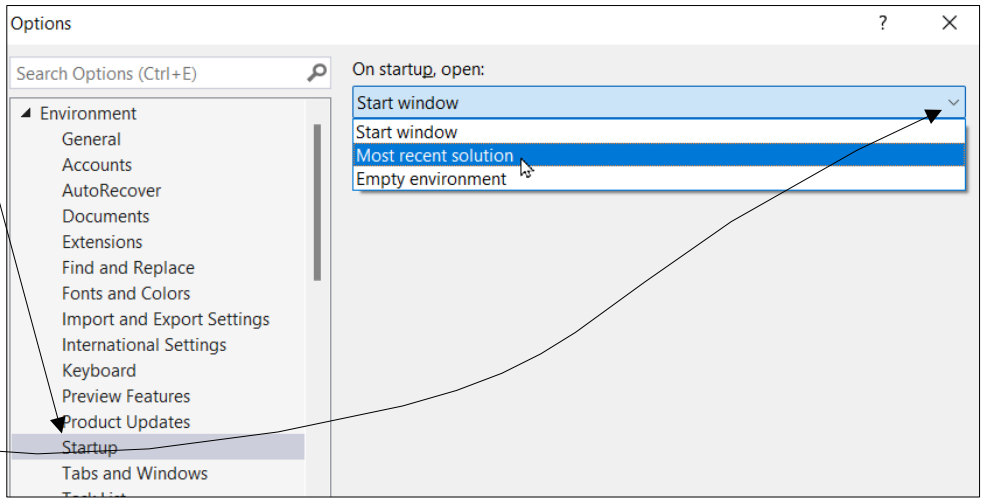


Changing Start-up Options

Here's how to tell Visual Studio to load the last thing you were working with when you shut it down (to this owl's mind, the most useful option):

a) From the menu select **Tools** → **Options**, then select **Startup** on the **Environment** tab in the **Options** dialog box.

b) Choose this option from the startup list.



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Changing Analysis Services Settings

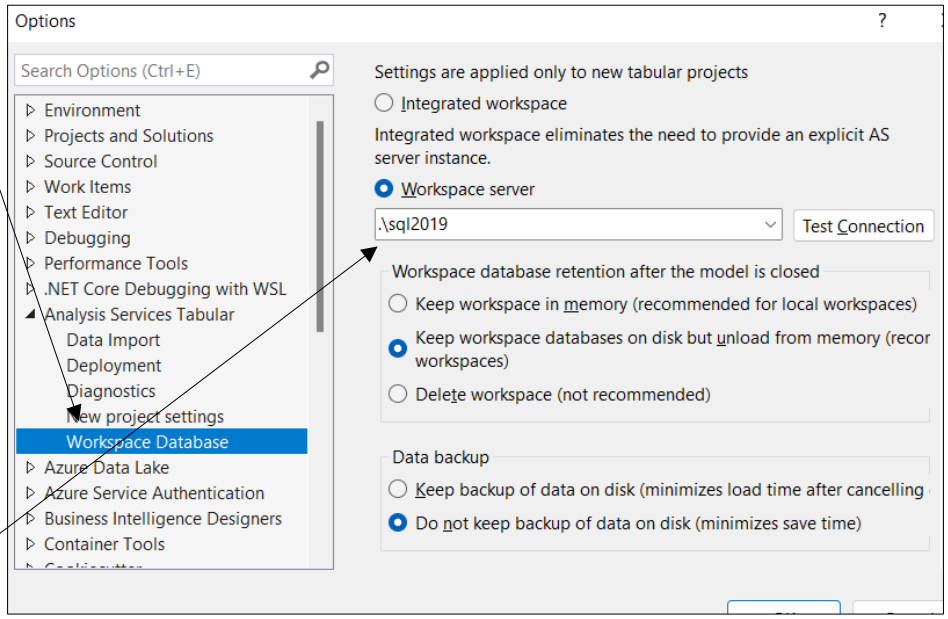
SSAS Tabular uses two different databases:

Database	Notes
Workspace	The local copy of changes you're making in Visual Studio (usually held on your local machine).
Deployment	Essentially a copy of the workspace database, but copied to the production server so other people can see and use your model.

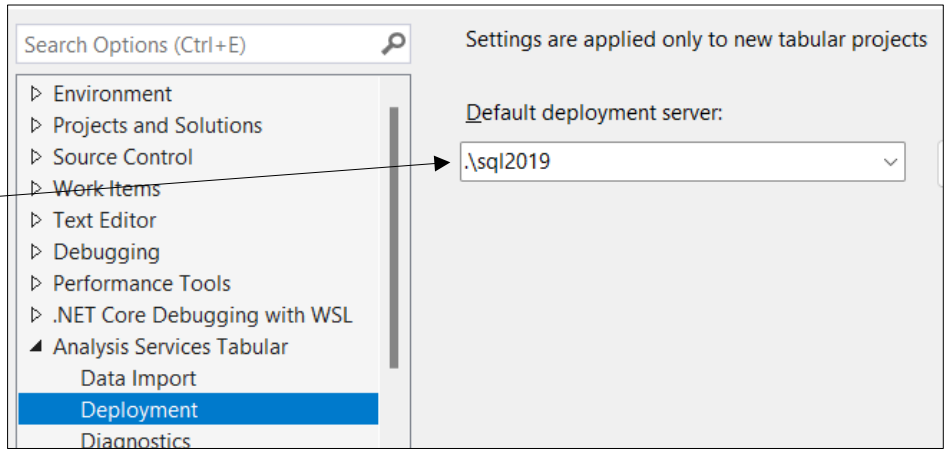
You can select **Tools** → **Options** in Visual Studio to change the default location of either/both databases as follows:

a) Choose **Workspace Database** under the **Analysis Services Tabular** tab in the **Options** dialog box.

b) Choose an Analysis Server instance running tabular models (although the easiest option may be **Integrated workspace** – see later in this chapter for what this means).



c) Now click on the **Deployment** tab and choose the Analysis Services instance running tabular models to which you want to deploy models that you've created (this will usually be on a different computer to the workspace server).



It may also be a good idea to keep the workspace in memory when you close down a model (providing you have enough memory on your computer), as this will make it reload more quickly.

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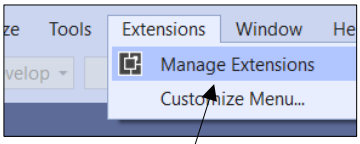
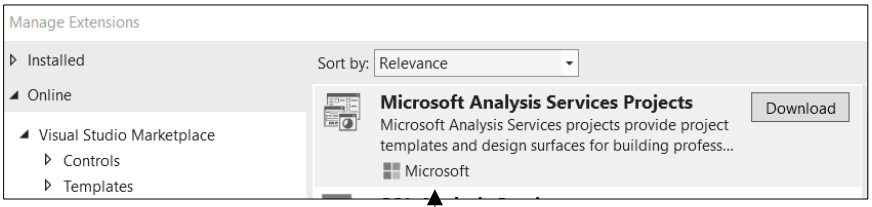
Installing the SSAS Extension

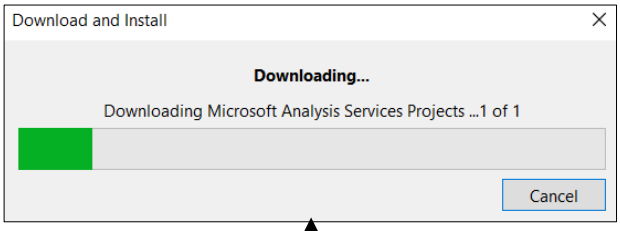
Before you can create an SSAS project in Visual Studio, you first need to install the appropriate extension. Here's how to do this in Visual Studio 2019, for example:



a) Choose this menu option to configure your VS extensions.

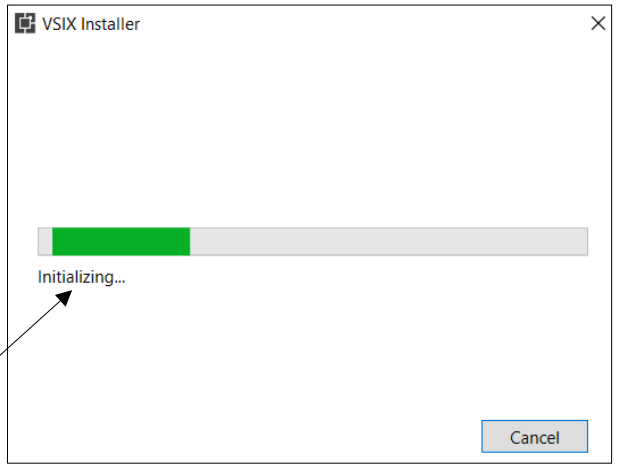


b) Search for and download the Microsoft Analysis Services Projects extension.



c) Visual Studio will download your extension.

d) When the download has finished, exit Visual Studio: the installer will then automatically install your requested extension.



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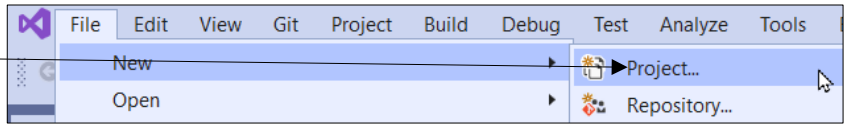
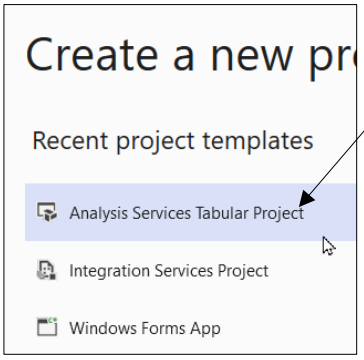
2.3 Projects and Solutions

Creating a New Project

To create a tabular model, you'll need a *project* to put it in. Here's how to create one:

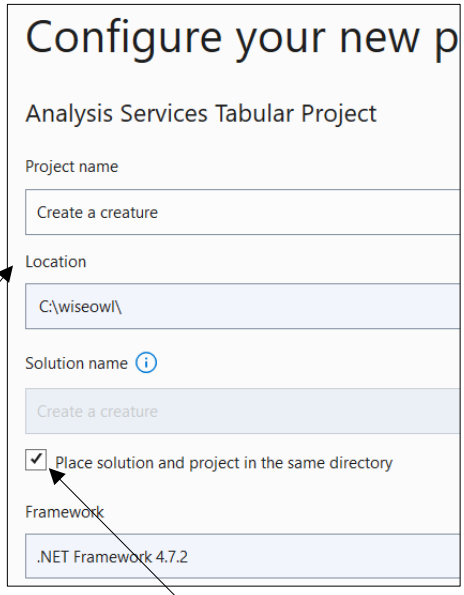
a) Choose this menu option (or press Shift + Ctrl + N) to create a new project.



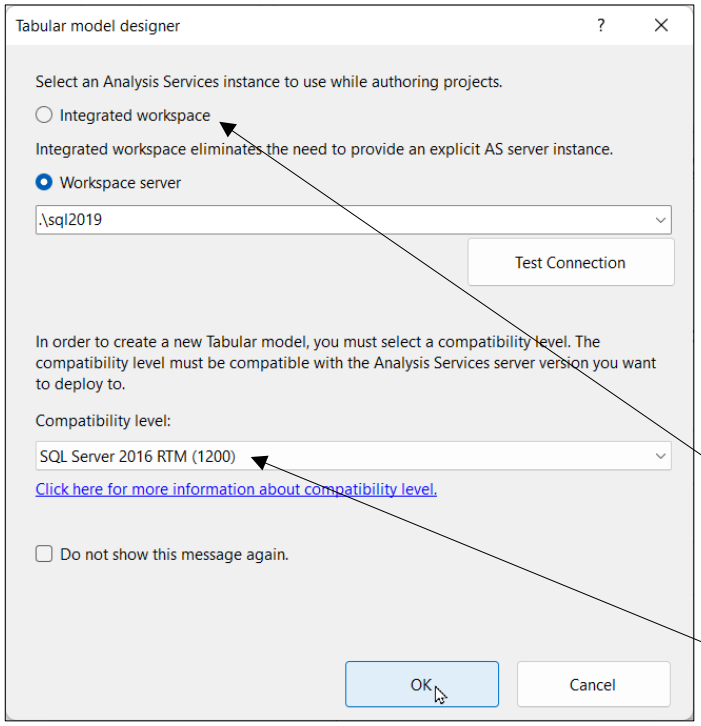


b) Choose the sort of project that you want to create (SSAS will only appear in this list if you've installed the appropriate VS extension, as shown on the previous page).

c) Give your project a name and choose where to store it.



d) See overleaf for a bit more about the difference between projects and solutions. There's little point putting your solution and project in different directories.



e) If you choose to use an integrated workspace, SSAS will internally create a temporary model database – there's no need for you to specify an instance of SSAS Tabular to connect to.

f) Visual Studio will normally suggest the highest compatibility level that your version of SQL Server will support.

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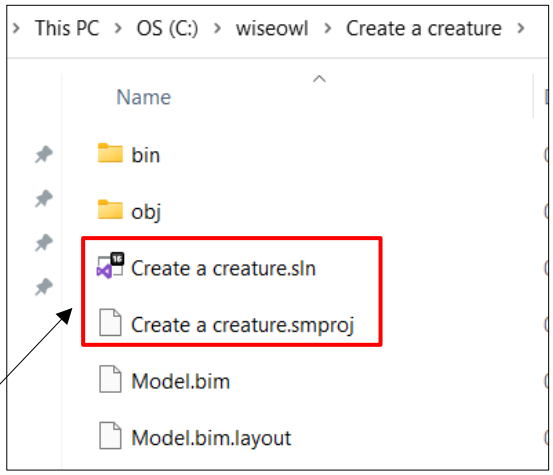
Files and Folders Created

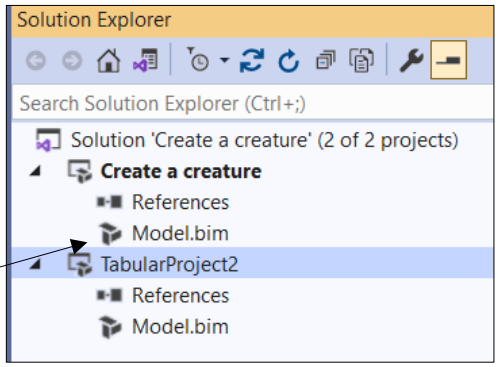
When you create a project, you get these files:



These two files give details of the configuration of your solution and its project. They're both text format XML files, and easily read.

Having Multiple Projects in a Solution

You can use a *solution* to work with more than one project at the same time:



You can right-click on your solution in the Solution Explorer window and choose to add another project to it. Here we've got two projects open, with the default one being **Create a creature**. Having more than one project open at a time like this is rarely useful!

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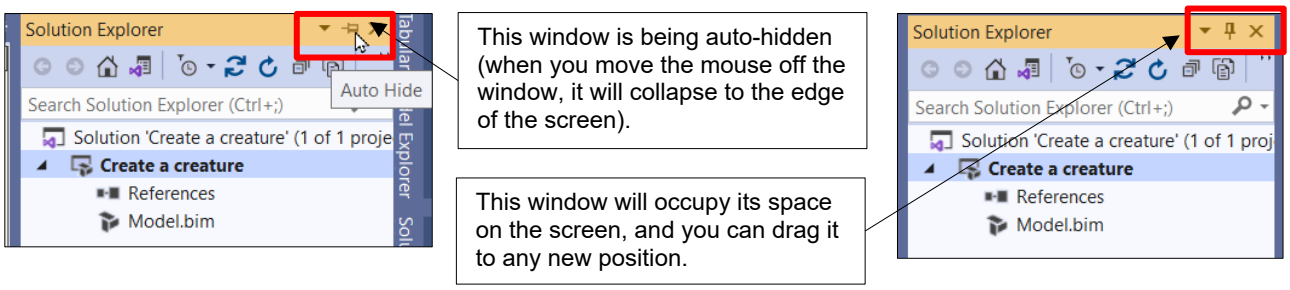
2.4 Visual Studio Windows

Moving and Auto-Hiding Windows

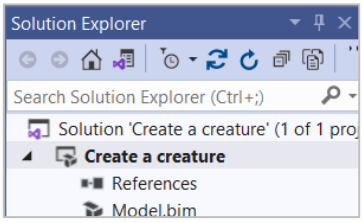
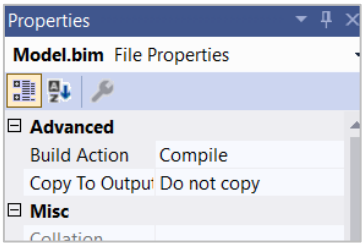
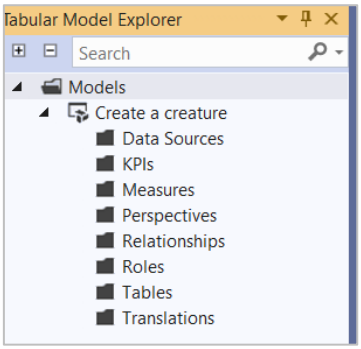
Any of the (many) windows in Visual Studio can be in one of two modes:



You can click on the map pin symbol to toggle between the two states shown.

The Three Main Windows to Show

You'll probably want always to have these three windows open in Visual Studio:

Window	Keystroke to display	View menu option	Example
Solution Explorer	Alt + Ctrl + L	**Solution Explorer**	
Properties	F4	**Properties Window**	
Tabular Model Explorer	This window automatically appears when you edit a model, and is unavailable otherwise.		

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