Power BI for the Business Analyst

Introduction to Power BI

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Why Power BI is So Great

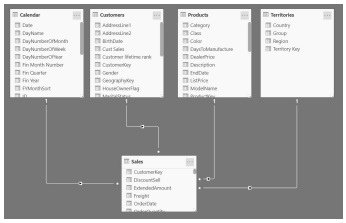
Data Capacity

Speed

Accessible* to Excel Users

* But you will likely need some formal learning to get started

Focuses on Reuse



Works over multiple tables

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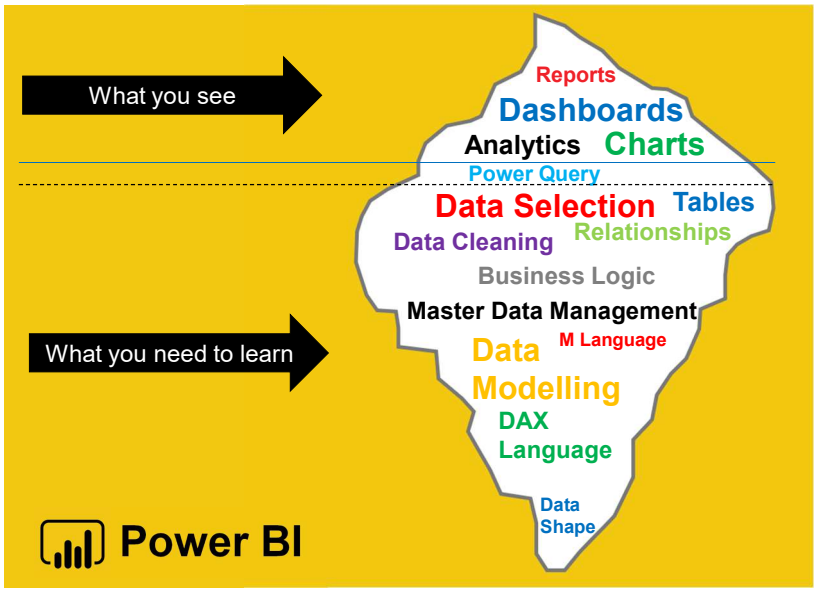
Yet Power BI is Deceptive



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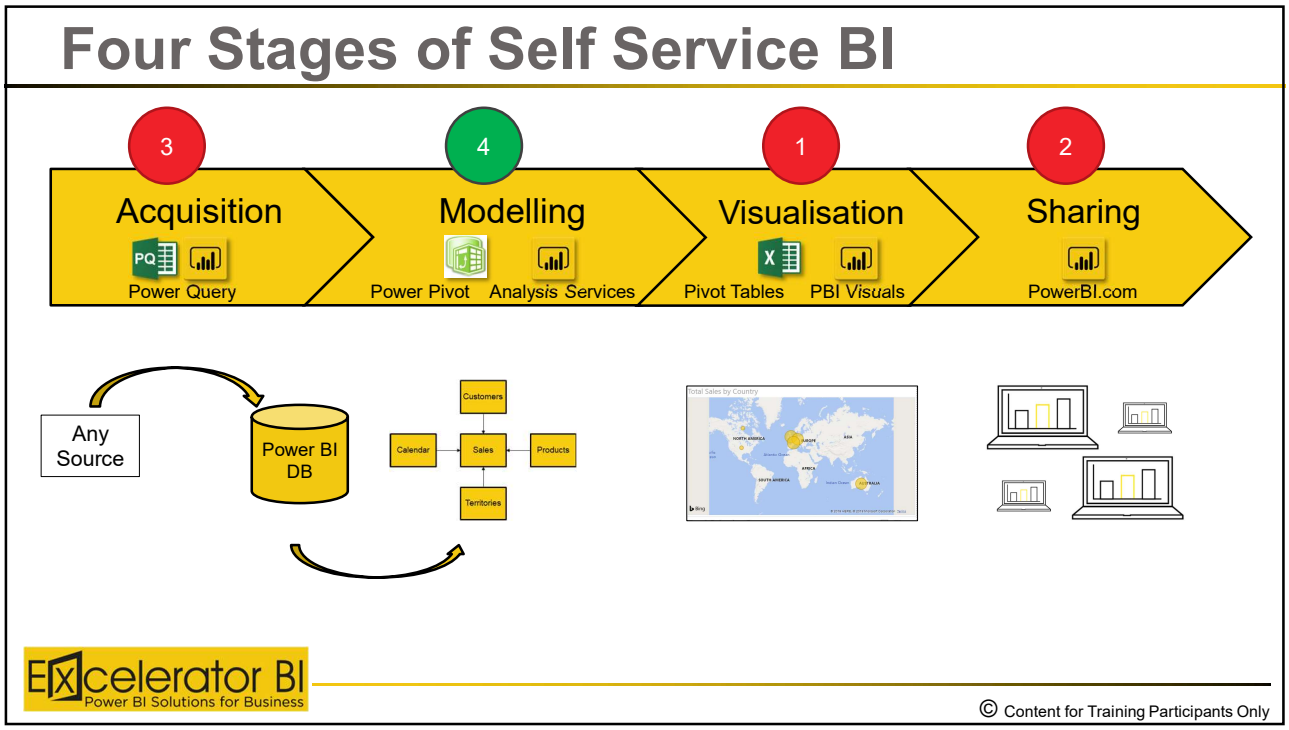
Four Stages of Self Service BI
3
Acquisition
Power Query
4
Modelling
Power Pivot
Analysis Services
1
Visualisation
Pivot Tables
PBI Visuals
2
Sharing
PowerBI.com
Any Source
Power BI DB
Customers
Calendar
Sales
Products
Territories
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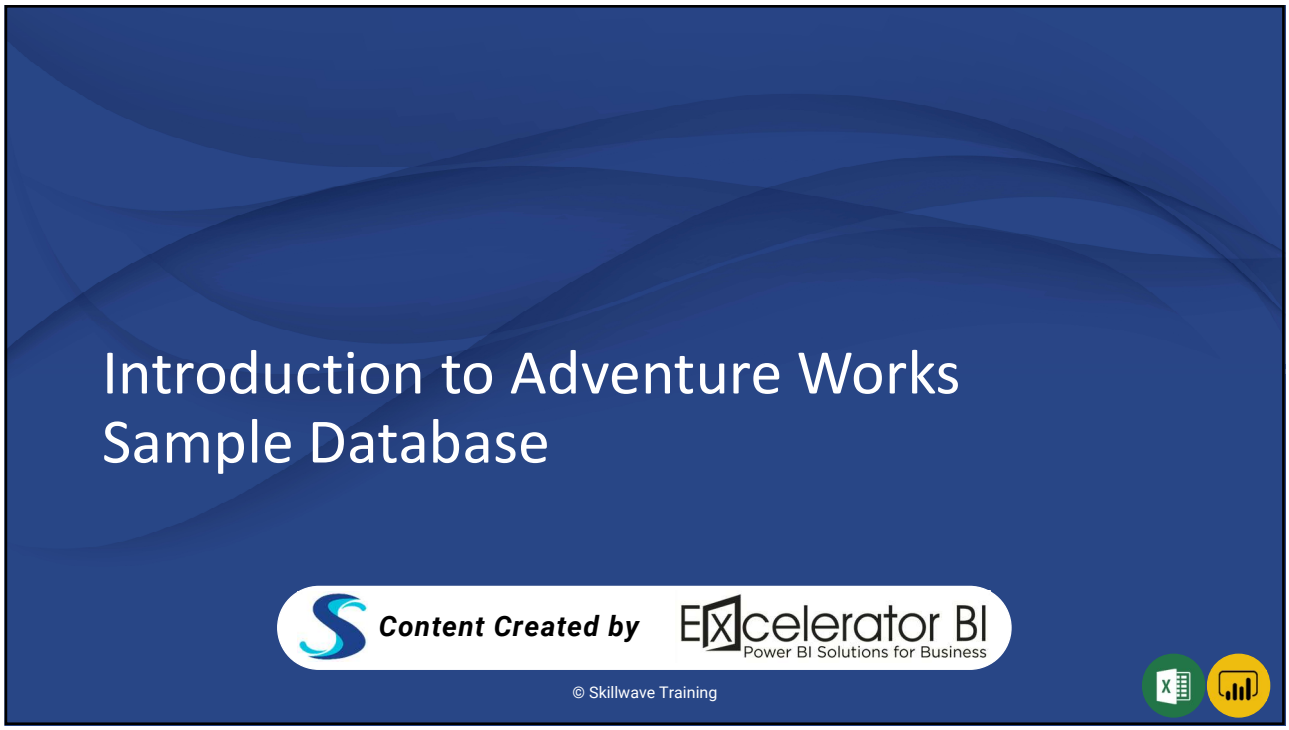
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Introduction to Adventure Works*

Tax Invoice / Receipt
Adventure Works
Australia

OrderNo.: **SO57418** 4/11/2003

Bill To: Jon Yang
Cust No.: 11000

Item	Description	Amount
573	Touring-1000 Blue, 46	$ 2,384.07
541	Touring Tire	$ 28.99
530	Touring Tire Tube	$ 4.99
214	Sport-100 Helmet, Red	$ 34.99
488	Short-Sleeve Classic Jersey, S	$ 53.99

Subtotal:	$ 2,507.03
Total ex tax:	$ 2,507.03
Tax (8%):	$ 200.56
Total Inc tax:	$ 2,707.59

Adventure Works – Sales Table

ProductKey	OrderDate	CustomerKey	SalesOrderNumber	OrderQuantity	UnitPrice	ExtendedAmount
605	Tuesday, 4 November 2003	22170	SO57417	1	539.99	539.99
538	Tuesday, 4 November 2003	22170	SO57417	1	21.49	21.49
480	Tuesday, 4 November 2003	22170	SO57417	1	2.29	2.29
573	Tuesday, 4 November 2003	11000	SO57418	1	2384.07	2384.07
541	Tuesday, 4 November 2003	11000	SO57418	1	28.99	28.99
530	Tuesday, 4 November 2003	11000	SO57418	1	4.99	4.99
214	Tuesday, 4 November 2003	11000	SO57418	1	34.99	34.99
488	Tuesday, 4 November 2003	11000	SO57418	1	53.99	53.99
599	Tuesday, 4 November 2003	15833	SO57419	1	539.99	539.99
363	Tuesday, 4 November 2003	12689	SO57420	1	2294.99	2294.99
485	Tuesday, 4 November 2003	12689	SO57420	1	21.98	21.98
478	Tuesday, 4 November 2003	12689	SO57420	1	9.99	9.99
477	Tuesday, 4 November 2003	12689	SO57420	1	4.99	4.99
563	Tuesday, 4 November 2003	25064	SO57421	1	2384.07	2384.07

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*simplified version

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Totalling the Adventure Works Sales Data

Order Quantity	Unit Price	Extended Amount
3	$3.00	$9.00
2	$4.00	$8.00
1	$6.00	$6.00

Total Quantity	Total Sales
6	$23.00

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Introduction to Building Reports

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Data Visualisation

Acquisition → Modelling → Visualisation → Sharing

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Adding a Visual to the Report
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Visual Fields Options & Tooltips
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Adding a Visual using Q&A Feature
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Visual Headers
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Data Hierarchies
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Repurposing an Existing Visual
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Cross Filtering
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Slicers and Filters
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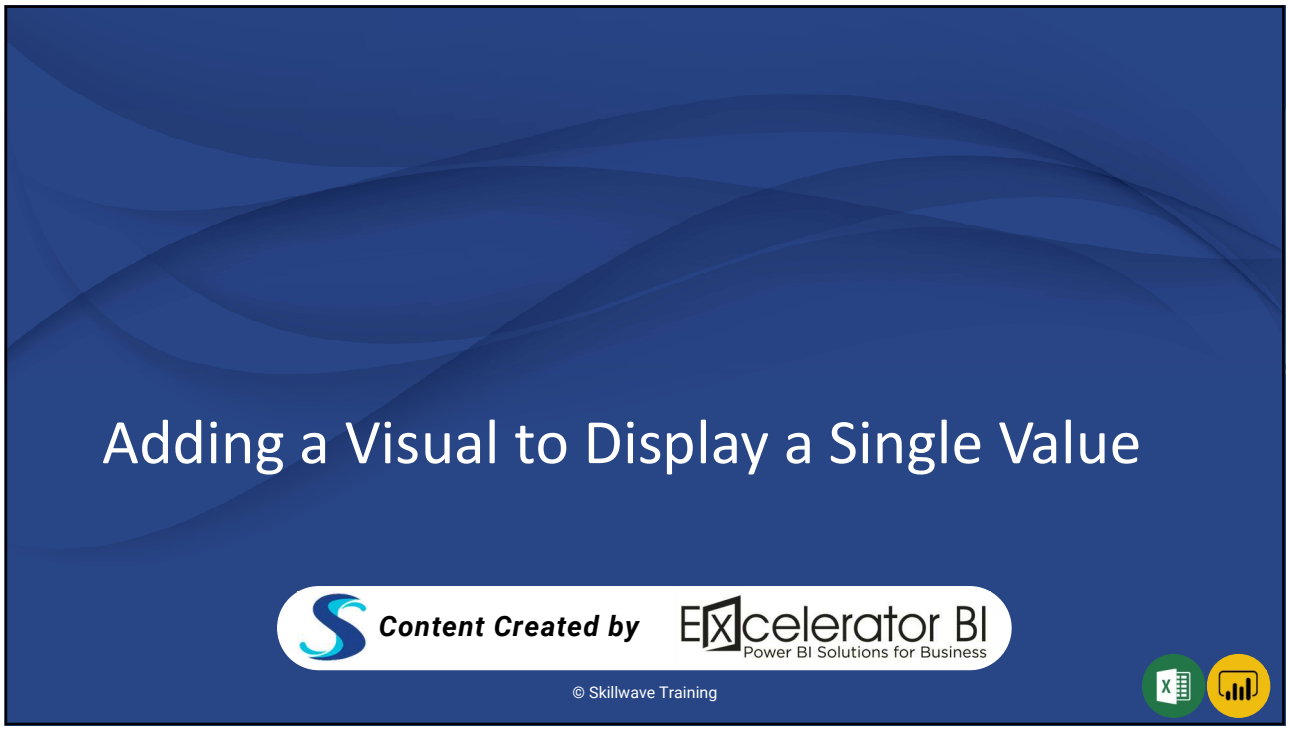
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More Formatting Features
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Adding a Visual from Visualizations Pane
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Analytics Features in Power BI
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AI Capability of Power BI
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Bookmarks and Buttons
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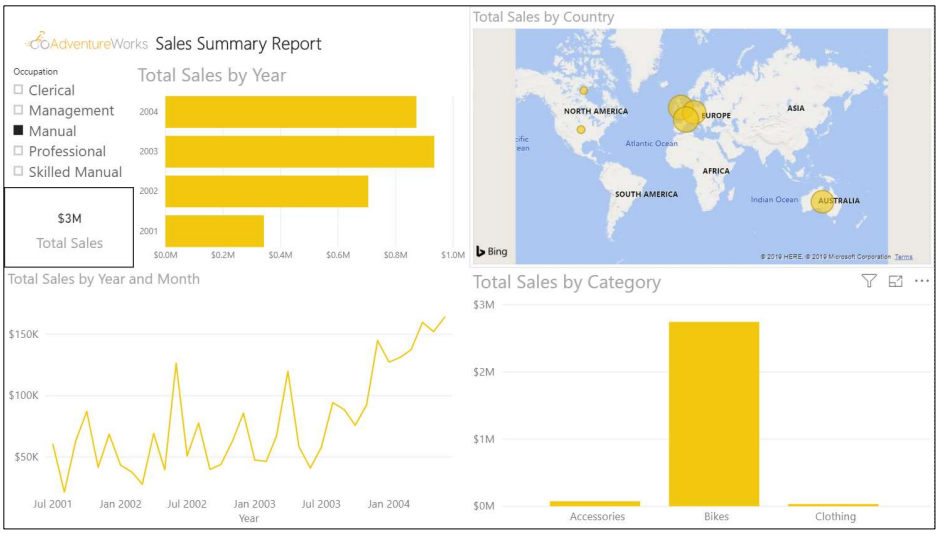
Build a Report

Acquisition | Modelling | Visualisation | Sharing



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Summary - Building Your First Report

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Summary

Acquisition | Modelling | Visualisation | Sharing

- Opened a desktop file
- Covered a cross section of different visuals
- Drill through hierarchies
- Understanding Slicers and Filters
- Repurposing Visuals
- Cross filter interactions
- Date hierarchies
- Analytics Features
- Explain the Increase
- Bookmarks
- Buttons

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Creating a New Report in the Same Workbook

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Visual to Display Top 20 Customers
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Conditional Formatting
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Build another Report

Acquisition | Modelling | Visualisation | Sharing

AdventureWorks Top 20 Customers

CustomerKey	Name	Total Sales	OrderQuantity
12301	Nichole Nara	$13,295	13
12132	Kaitlyn Henderson	$13,294	14
12308	Margaret He	$13,269	14
12131	Randall Dominguez	$13,266	11
12300	Adriana Gonzalez	$13,243	10
12321	Rosa Hu	$13,216	15
12124	Brandi Gill	$13,196	12
12307	Brad She	$13,173	11
12296	Francisco Sara	$13,165	12
11433	Maurice Shan	$12,910	12
11439	Janet Munoz	$12,489	14
11241	Lisa Cai	$11,469	25
11417	Lacey Zheng	$11,248	17
11420	Jordan Turner	$11,201	17
11242	Larry Munoz	$11,068	12
12655	Larry Vazquez	$10,900	11
13263	Kate Anand	$10,872	12
12323	Lawrence Alonso	$10,837	11
Total		**$243,753**	**263**

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Drill through Report

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Build a Drill Through Report

AdventureWorks

Lisa Cai

Year	Quarter	Month	Day	Inv	Qty	Total Sales	Total Margin
2003	Qtr 1	March	14	SO49675	1	$2,049	$943
2003	Qtr 3	July	2	SO51192	1	$2,330	$1,065
2003	Qtr 4	October	6	SO55623	1	$708	$325
2003	Qtr 4	November	13	SO57891	1	$811	$324
2003	Qtr 4	December	31	SO61171	1	$554	$205
2004	Qtr 1	February	20	SO64592	1	$2,588	$1,026
2004	Qtr 2	May	1	SO69624	1	$2,428	$926
Total						**$11,469**	**$4,815**

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Bookmarks and Buttons Revisited

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Tool Tip Report (Custom Tool Tips)

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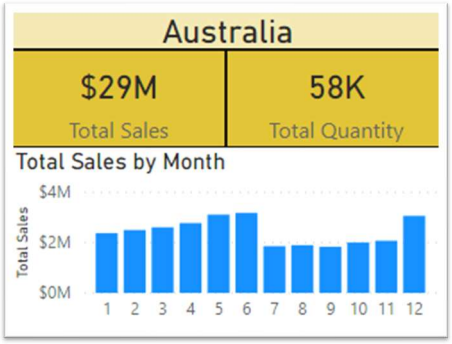
Custom Tool Tips

Steps to create a tool tip

1. Create a new blank page and rename as desired
2. Format\Page Information\Tooltip\On
3. Format\Page Size\Type\Tooltip
4. View Menu\Page View\Actual Size
5. To control Tooltip
   1. Push: Drag column to the Fields\Tool Tip Fields area.
   2. Pull: Go to a visual and edit the tooltip settings to point to the tooltip report



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Mobile Layout
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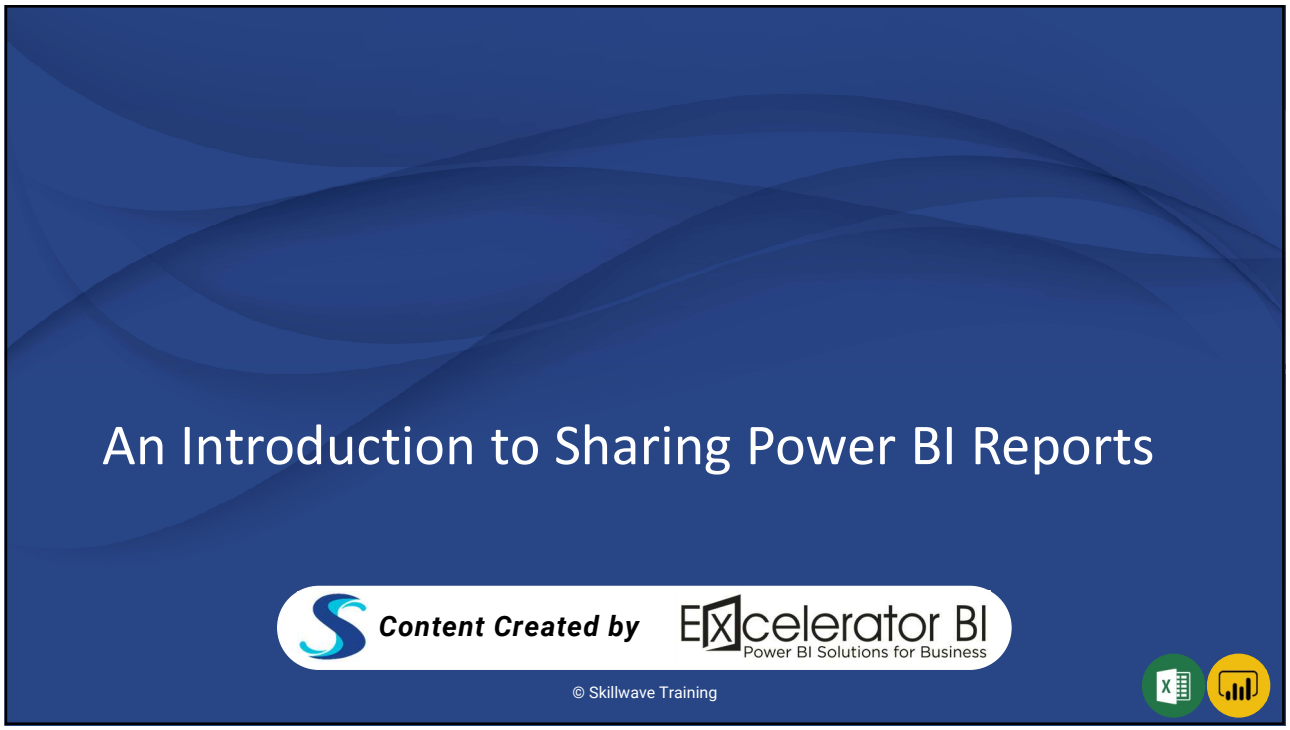
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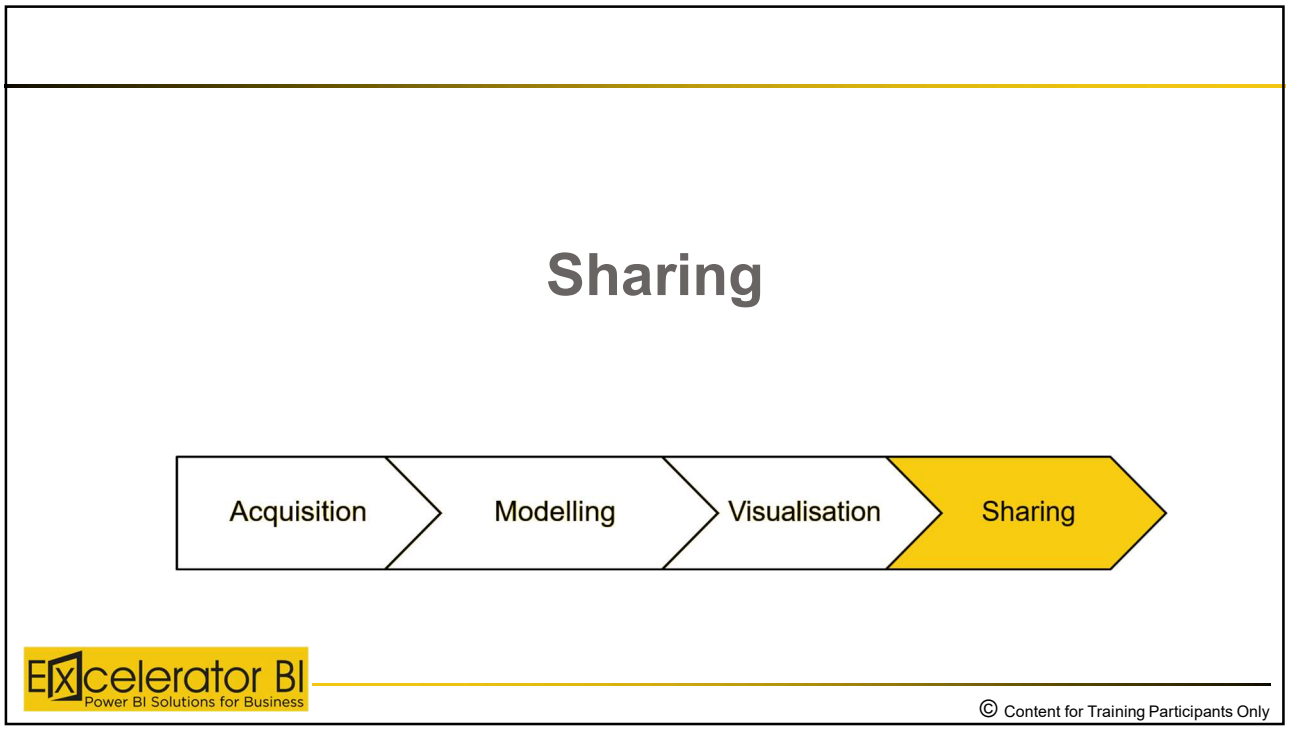
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Modelling
Visualisation
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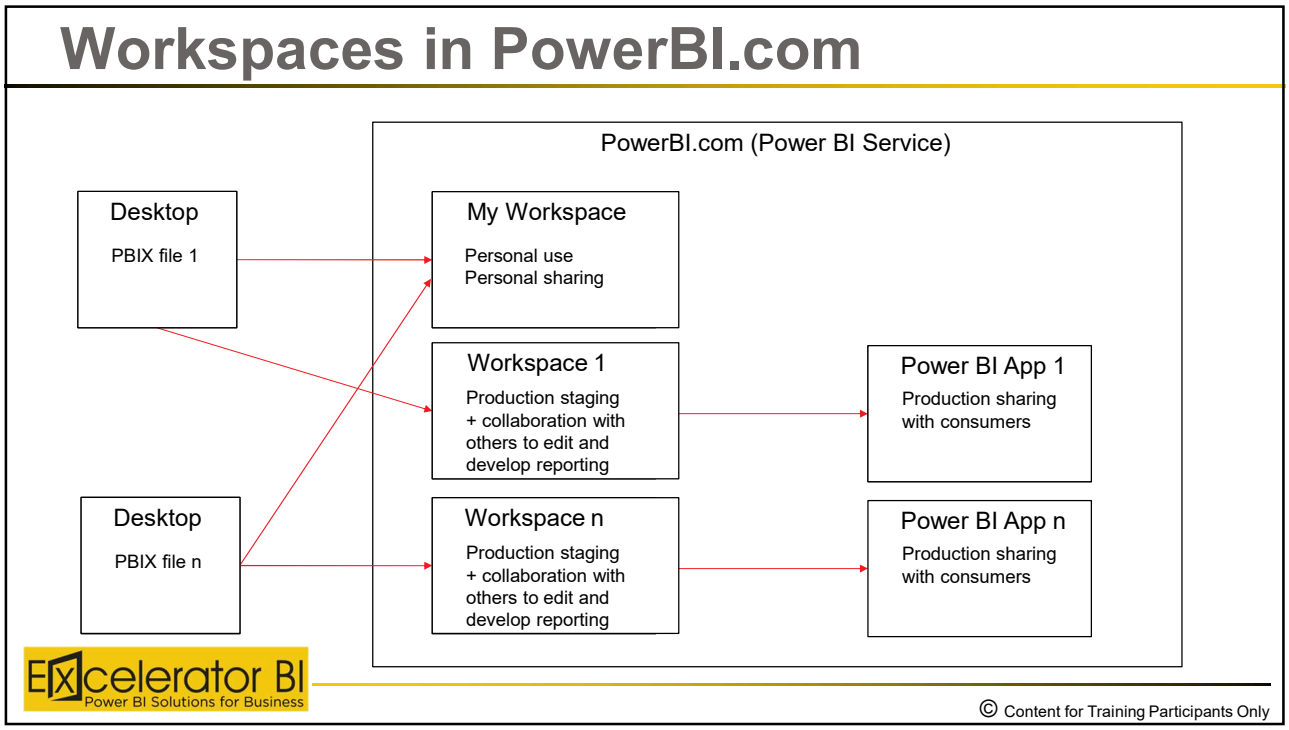
Workspaces in PowerBI.com
PowerBI.com (Power BI Service)
Desktop
PBIX file 1
My Workspace
Personal use
Personal sharing
Workspace 1
Production staging
+ collaboration with
others to edit and
develop reporting
Power BI App 1
Production sharing
with consumers
Desktop
PBIX file n
Workspace n
Production staging
+ collaboration with
others to edit and
develop reporting
Power BI App n
Production sharing
with consumers
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My Workspace for Personal Use and Personal Sharing
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Creating a Group Workspace
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Editing Reports in Power BI.com
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Providing Access to Group Workspace
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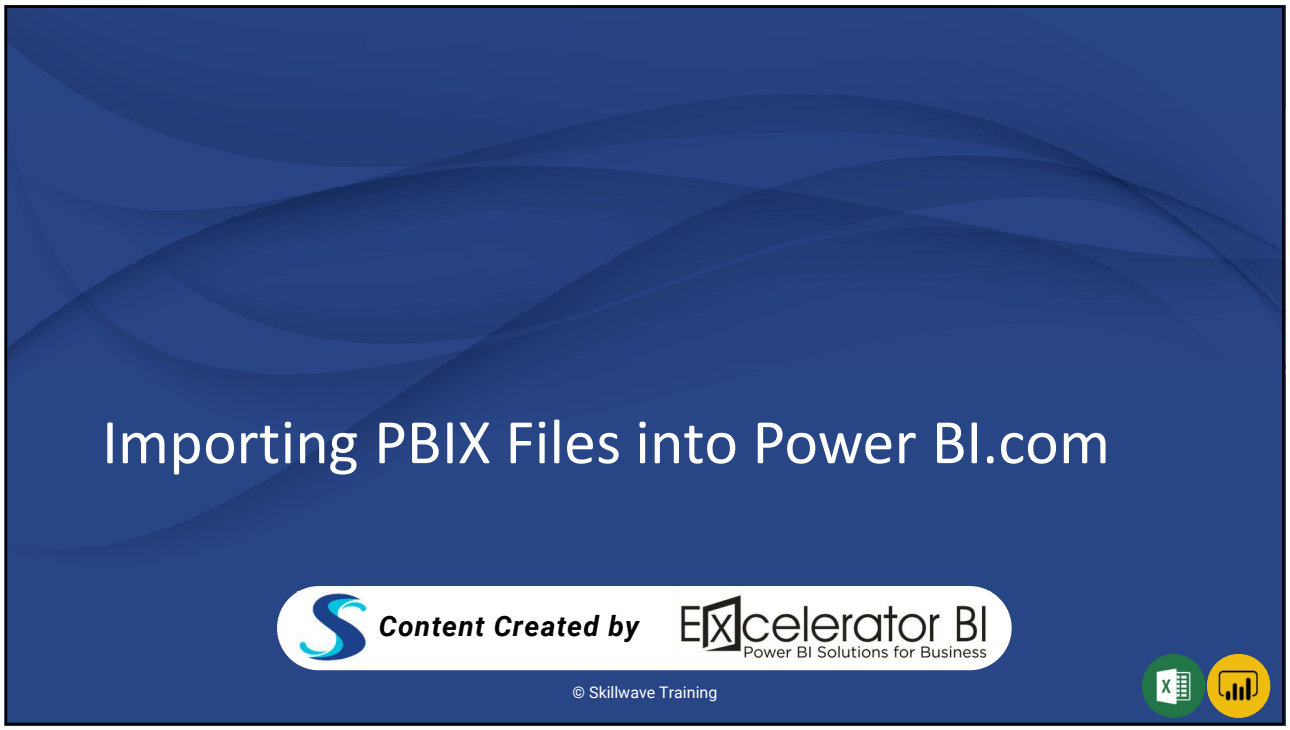
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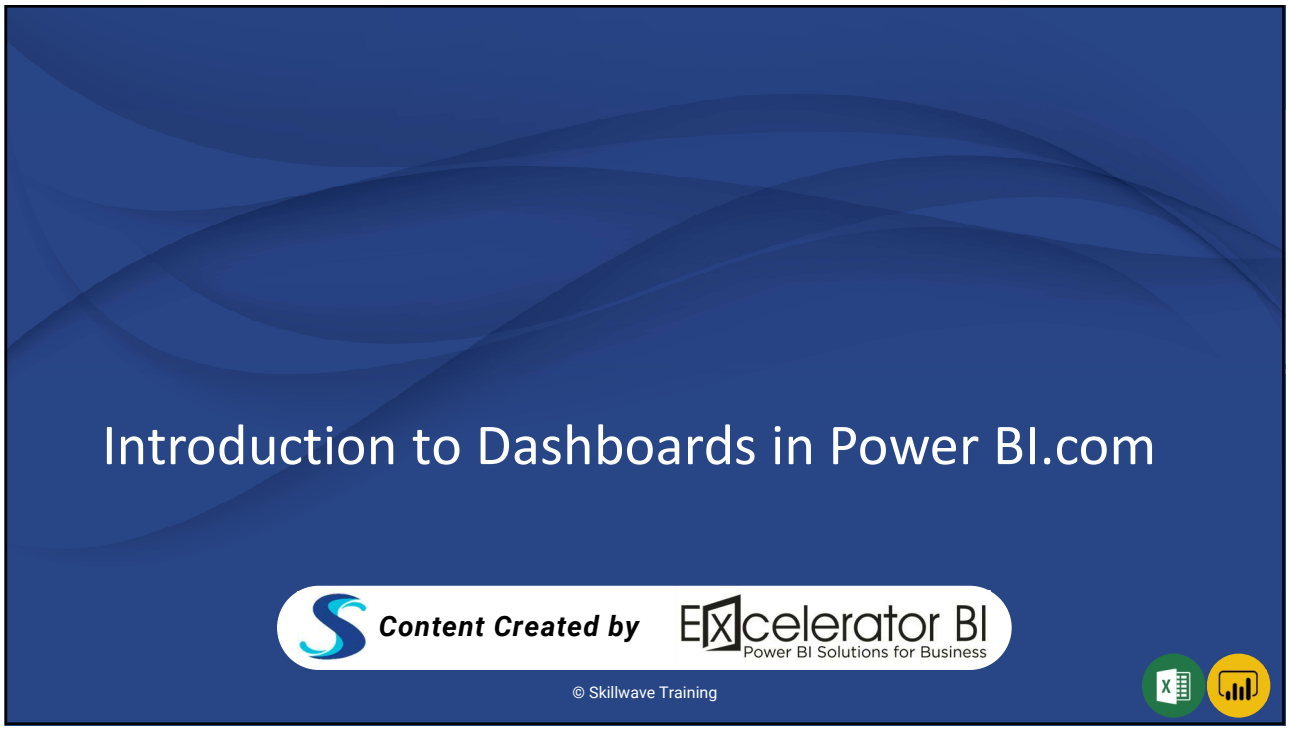
Introduction to Dashboards in Power BI.com
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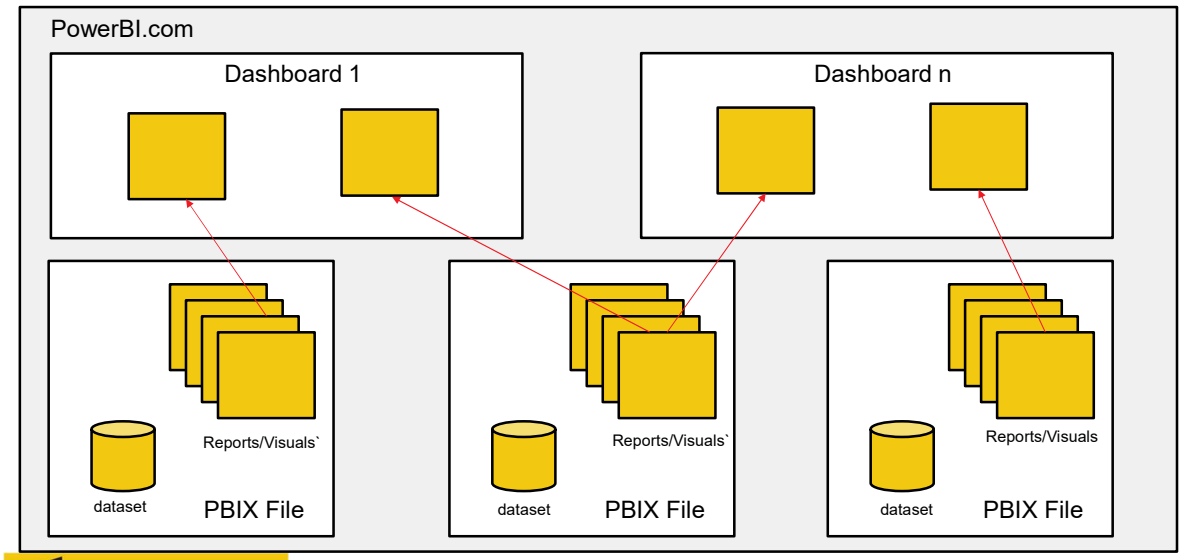
What is a Dashboard in PowerBI.com?



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Creating Dashboards

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Importing Excel Files into Power BI.com
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Creating and Sharing
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Data Acquisition

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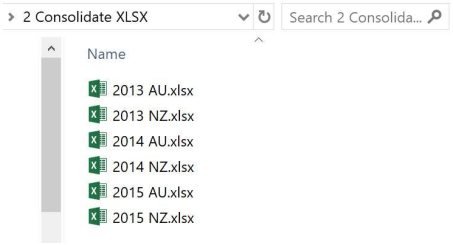
Power Query (Get Data)

Data that needs Cleansing

7.3 POPULATION, By state and territory(a)(b)

Qld '000	SA '000	WA '000	Tas. '000
1 496	945	722	344
1 793	1 158	991	388
2 266	1 308	1 269	424
2 899	1 432	1 613	462
3 562	1 505	1 874	471
3 995	1 553	2 017	486
4 091	1 568	2 059	490
4 196	1 586	2 113	493
4 309	1 604	2 177	498
4 425	1 625	2 244	503
4 506	1 644	2 291	507

File Consolidation Exercise



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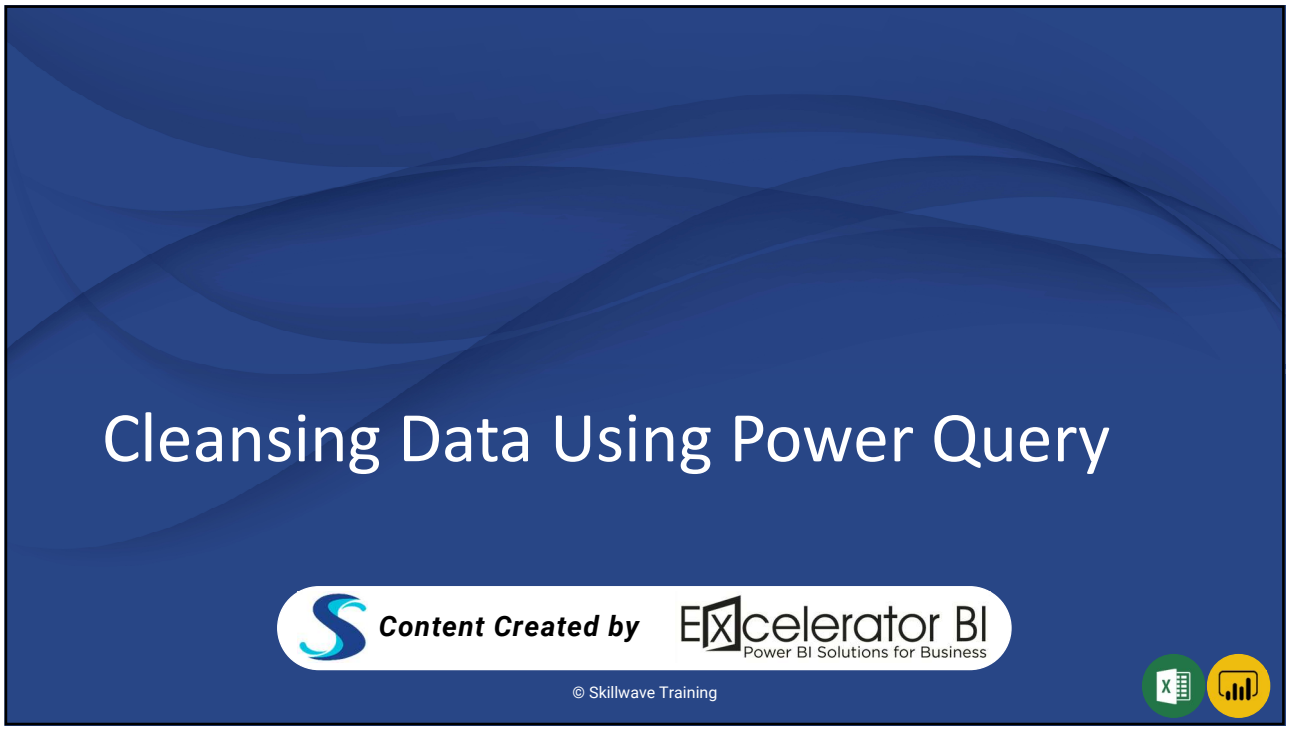
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Visualising the Cleansed Data
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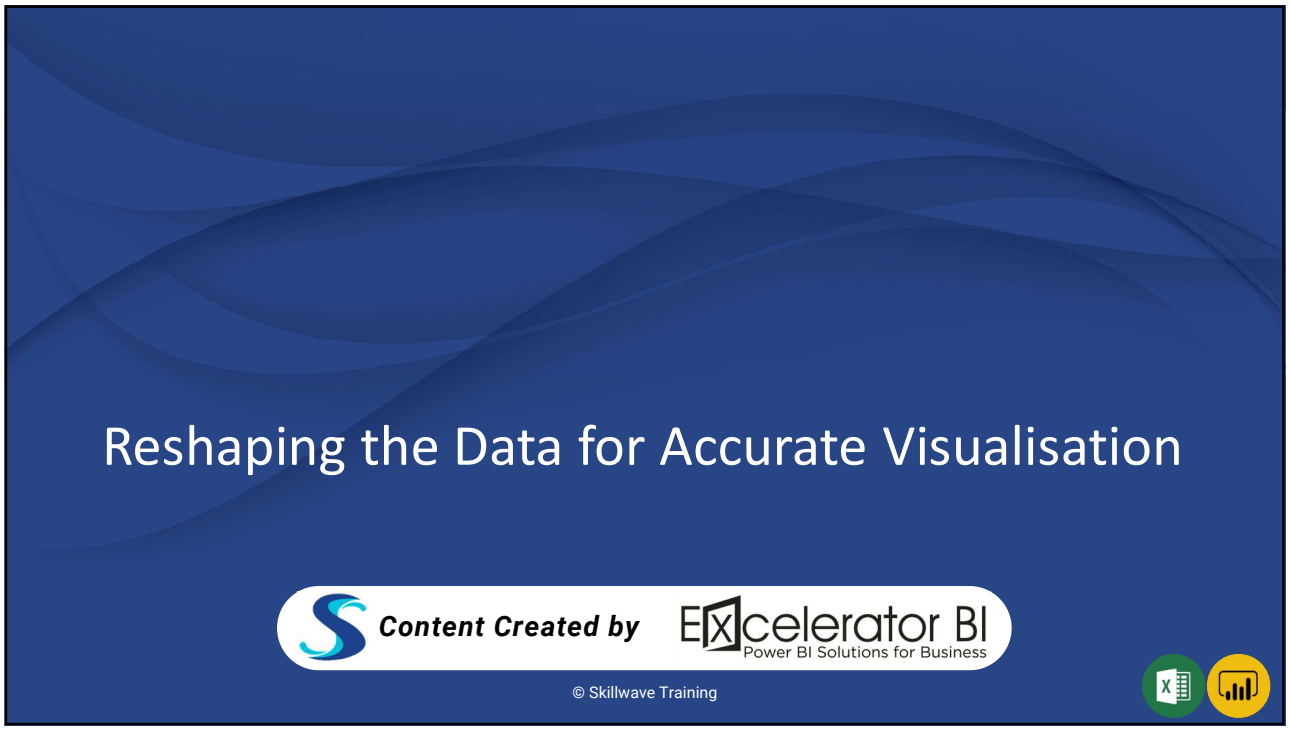
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Visualising the Reshaped Data
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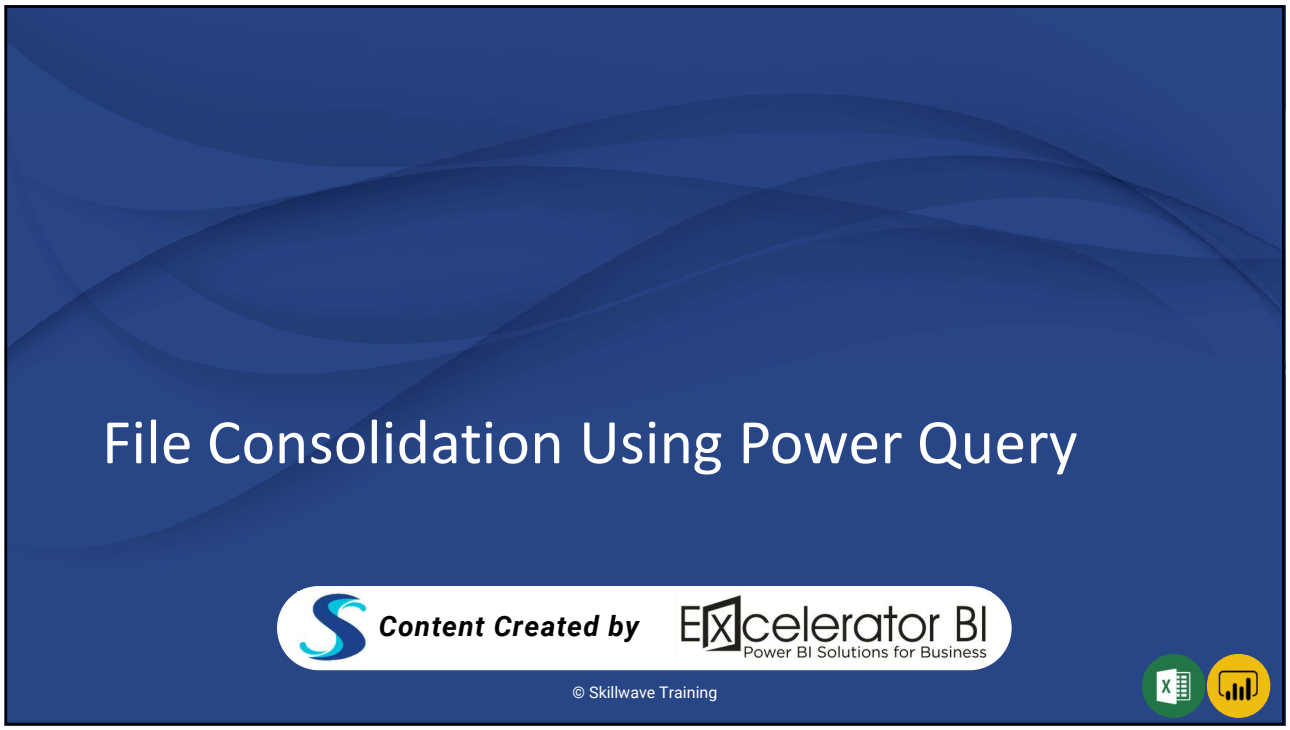
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Visualising the Consolidated Data
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Power Query Resources

- Power Query Training
  - http://skillwave.training
- Review of Ken and Miguel's book
  - http://exceleratorbi.com.au/m-is-for-data-monkey-book-review/
- Blog Articles
  - https://exceleratorbi.com.au/combine-excel-workbooks-power-query-method-1/
  - https://powerpivotpro.com/2015/07/consolidated-worksheets-with-power-query/
  - https://exceleratorbi.com.au/build-reusable-calendar-table-power-query/
  - https://exceleratorbi.com.au/understanding-power-query-combine/

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Review of the Four Stages of Self-Service BI

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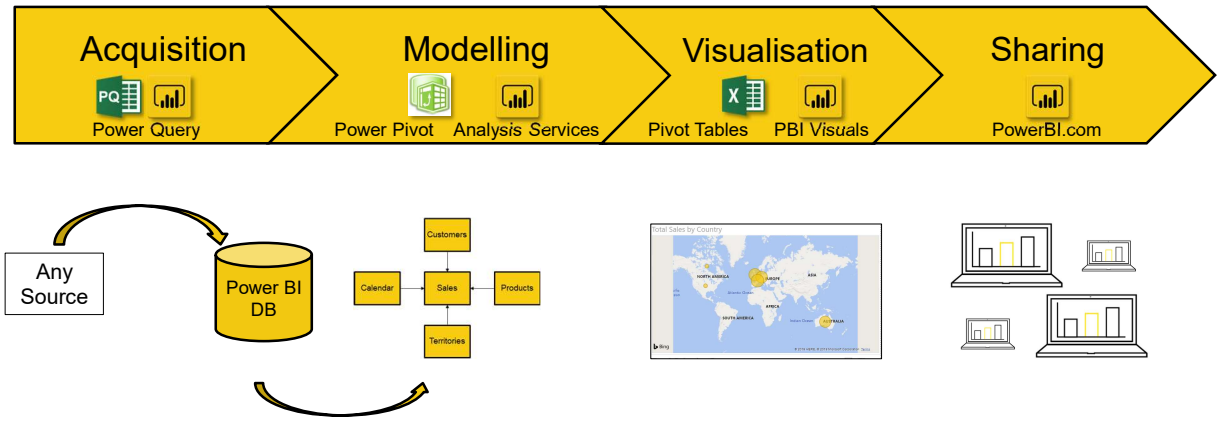
Review of the Four Stages of Self Service BI



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Introduction to Data Modelling

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What is Data Modelling?

Data Acquisition | **Data Modelling** | Visualisation & Analysis | Sharing

Objective: Allow easy access to insights without writing a new query every time.

- Deciding which data to load
- Deciding in which tables and columns to put the data
- Creating relationships between tables (**VLOOKUP Replacement**)
- Applying business logic to the data to create measures
- Assigning meaningful business names
- Applying suitable formatting

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Data Modelling

One Table or Many Tables?

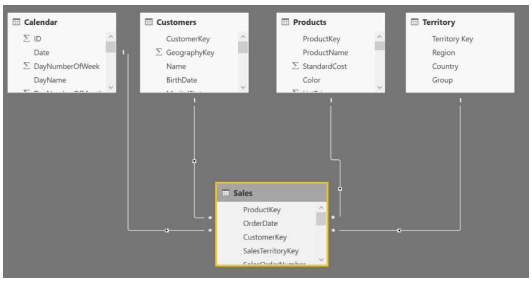
Data Acquisition | **Data Modelling** | Visualisation & Analysis | Sharing

Flat Single Table

Date Sales Customer Product Territory

Recommended (by Jeffrey) for basic, simple models only

Multiple Related Tables



Star Schema is the Optimal Structure

On September 18, 2018 at 12:16 PM Jeffrey Wang <[redacted]@microsoft.com> wrote:

I don't know if there is such a document. But for whatever it's worth, you can tell your client that the owner of DAX engine has told you that a star schema will save them a lot of time in the long run when their model and reports naturally evolve from simple to complex over time. I am not only talking about performance benefits, but also desirable calculation results when they start to write non-trivial DAX measures.

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http://exceleratorbi.com.au/the-optimal-shape-for-power-pivot-data/

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Thinking of Data in Tables

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Tables and Scalars

A Table is a Two Dimensional Object

CustomerKey	Name	Gender	YearlyIncome	NumberChildrenAtHome	Occupation	HouseOwnerFlag	NumberCarsOwned
11000	Jon Yang	M	$90,000.00	0	Professional	1	0
11001	Eugene Huang	M	$60,000.00	3	Professional	0	1
11002	Ruben Torres	M	$60,000.00	3	Professional	1	1
11003	Christy Zhu	F	$70,000.00	0	Professional	0	1
11004	Elizabeth Johnson	F	$80,000.00	5	Professional	1	4
11005	Julio Ruiz	M	$70,000.00	0	Professional	1	1
11006	Janet Alvarez	F	$70,000.00	0	Professional	1	1
11007	Marco Mehta	M	$60,000.00	3	Professional	1	2
11008	Rob Verhoff	F	$60,000.00	4	Professional	1	3
11009	Shannon Carlson	M	$70,000.00	0	Professional	0	1
11010	Jacquelyn Suarez	F	$70,000.00	0	Professional	0	1
11011	Curtis Lu	M	$60,000.00	4	Professional	1	4
11012	Lauren Walker	F	$100,000.00	0	Management	1	2
11013	Ian Jenkins	M	$100,000.00	0	Management	1	3
11014	Sydney Bennett	F	$100,000.00	0	Management	0	3
11015	Chloe Young	F	$30,000.00	0	Skilled Manual	0	1
11016	Wyatt Hill	M	$30,000.00	0	Skilled Manual	1	1
11017	Shannon Wang	F	$20,000.00	0	Skilled Manual	1	2
11018	Clarence Rai	M	$30,000.00	0	Clerical	1	2
11019	Luke Lal	M	$40,000.00	0	Skilled Manual	0	2
11020	Jordan King	M	$40,000.00	0	Skilled Manual	0	2
11021	Destiny Wilson	F	$40,000.00	0	Skilled Manual	0	1
11022	Ethan Zhang	M	$40,000.00	0	Skilled Manual	1	1
11023	Seth Edwards	M	$40,000.00	0	Skilled Manual	1	1
11024	Russell Xie	M	$60,000.00	0	Skilled Manual	1	2
11025	Alejandro Beck	M	$10,000.00	1	Clerical	1	2
11026	Harold Sai	M	$30,000.00	0	Clerical	0	2

A Scalar is a Single Value

- Examples of scalars
  - 24
  - 5-Jan-2015
  - TRUE
  - Some text
- A scalar can be placed in a single cell in Excel

A scalar tells you 1 piece of information whereas a table contains lots of information but it needs to be 'extracted' from the table.

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What insights can we find in this table?

A Table is a Two Dimensional Object

CustomerKey	Name	Gender	YearlyIncome	NumberChildrenAtHome	Occupation	HouseOwnerFlag	NumberCarsOwned
11000	Jon Yang	M	$90,000.00	0	Professional	1	0
11001	Eugene Huang	M	$60,000.00	3	Professional	0	1
11002	Ruben Torres	M	$60,000.00	3	Professional	1	1
11003	Christy Zhu	F	$70,000.00	0	Professional	0	1
11004	Elizabeth Johnson	F	$80,000.00	5	Professional	1	4
11005	Julio Ruiz	M	$70,000.00	0	Professional	1	1
11006	Janet Alvarez	F	$70,000.00	0	Professional	1	1
11007	Marco Mehta	M	$60,000.00	3	Professional	1	2
11008	Rob Verhoff	F	$60,000.00	4	Professional	1	3
11009	Shannon Carlson	M	$70,000.00	0	Professional	0	1
11010	Jacquelyn Suarez	F	$70,000.00	0	Professional	0	1
11011	Curtis Lu	M	$60,000.00	4	Professional	1	4
11012	Lauren Walker	F	$100,000.00	0	Management	1	2
11013	Ian Jenkins	M	$100,000.00	0	Management	1	3
11014	Sydney Bennett	F	$100,000.00	0	Management	0	3
11015	Chloe Young	F	$30,000.00	0	Skilled Manual	0	1
11016	Wyatt Hill	M	$30,000.00	0	Skilled Manual	1	1
11017	Shannon Wang	F	$20,000.00	0	Skilled Manual	1	2
11018	Clarence Rai	M	$30,000.00	0	Clerical	1	2
11019	Luke Lal	M	$40,000.00	0	Skilled Manual	0	2
11020	Jordan King	M	$40,000.00	0	Skilled Manual	0	2
11021	Destiny Wilson	F	$40,000.00	0	Skilled Manual	0	1
11022	Ethan Zhang	M	$40,000.00	0	Skilled Manual	1	1
11023	Seth Edwards	M	$40,000.00	0	Skilled Manual	1	1
11024	Russell Xie	M	$60,000.00	0	Skilled Manual	1	2
11025	Alejandro Beck	M	$10,000.00	1	Clerical	1	2
11026	Harold Sai	M	$30,000.00	0	Clerical	0	2
11027	Jessie Zhao	M	$30,000.00	0	Clerical	1	2
11028	Jill Jimenez	F	$30,000.00	0	Clerical	1	2
11029	Jimmy Moreno	M	$30,000.00	0	Clerical	1	2
11030	Bethany Yuan	F	$10,000.00	1	Clerical	1	2
11031	Theresa Ramos	F	$20,000.00	0	Skilled Manual	1	2
11032	Denise Stone	F	$20,000.00	0	Skilled Manual	1	2
11033	Jaime Nath	M	$20,000.00	0	Skilled Manual	1	2
11034	Ebony Gonzalez	F	$20,000.00	0	Skilled Manual	1	2

Insights

- How many customers
- How many male and female customers
- Total income
- Average income per customer
- Etc

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Review of Adventure Works Sample Database

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Introduction to Adventure Works*

Tax Invoice / Receipt
Adventure Works
Australia

OrderNo.: **SO57418** 4/11/2003

Bill To: Jon Yang
Cust No.: 11000

Item	Description	Amount
573	Touring-1000 Blue, 46	$ 2,384.07
541	Touring Tire	$ 28.99
530	Touring Tire Tube	$ 4.99
214	Sport-100 Helmet, Red	$ 34.99
488	Short-Sleeve Classic Jersey, S	$ 53.99

Subtotal:	$ 2,507.03
Total ex tax:	$ 2,507.03
Tax (8%):	$ 200.56
Total Inc tax:	$ 2,707.59

Adventure Works – Sales Table

ProductKey	OrderDate	CustomerKey	SalesOrderNumber	OrderQuantity	UnitPrice	ExtendedAmount
605	Tuesday, 4 November 2003	22170	SO57417	1	539.99	539.99
538	Tuesday, 4 November 2003	22170	SO57417	1	21.49	21.49
480	Tuesday, 4 November 2003	22170	SO57417	1	2.29	2.29
573	Tuesday, 4 November 2003	11000	SO57418	1	2384.07	2384.07
541	Tuesday, 4 November 2003	11000	SO57418	1	28.99	28.99
530	Tuesday, 4 November 2003	11000	SO57418	1	4.99	4.99
214	Tuesday, 4 November 2003	11000	SO57418	1	34.99	34.99
488	Tuesday, 4 November 2003	11000	SO57418	1	53.99	53.99
599	Tuesday, 4 November 2003	15833	SO57419	1	539.99	539.99
363	Tuesday, 4 November 2003	12689	SO57420	1	2294.99	2294.99
485	Tuesday, 4 November 2003	12689	SO57420	1	21.98	21.98
478	Tuesday, 4 November 2003	12689	SO57420	1	9.99	9.99
477	Tuesday, 4 November 2003	12689	SO57420	1	4.99	4.99
563	Tuesday, 4 November 2003	25064	SO57421	1	2384.07	2384.07

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*simplified version

81

Totalling the Adventure Works Sales Data

Order Quantity	Unit Price	Extended Amount
3	$3.00	$9.00
2	$4.00	$8.00
1	$6.00	$6.00

Total Quantity	Total Sales
6	$23.00

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Introduction to Loading Data

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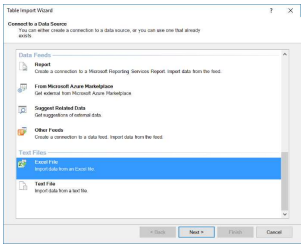
Loading Data

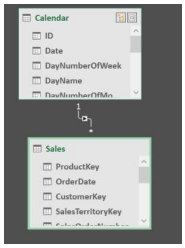
Data Acquisition | Data Modelling | Visualisation & Analysis | Sharing

Import data from Excel



Compression

Join Tables



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http://xbi.com.au/training_files

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Loading Data
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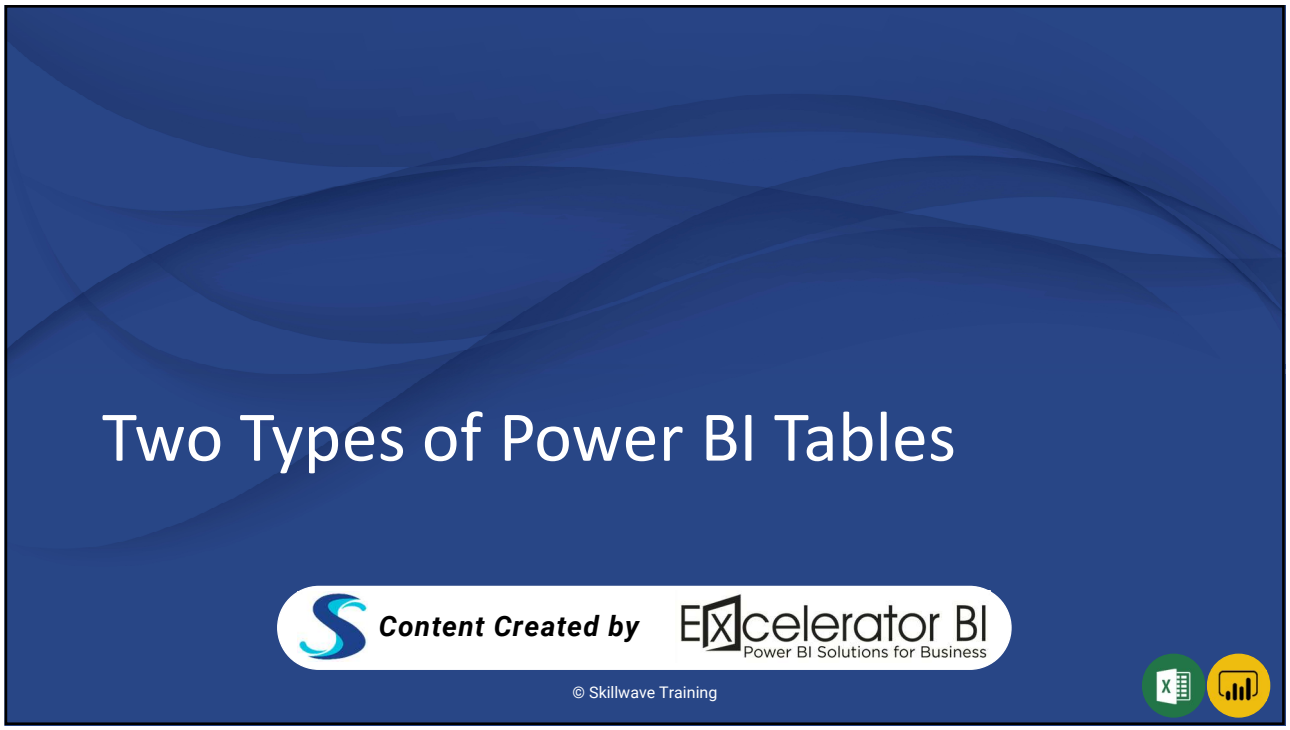
Two Types of Power BI Tables
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86

Concept: Data tables vs. Lookup tables

CustomerKey	ProductKey	SalesTerritoryKey	OrderDate	ExtendedAmount
29483	360	7	13/03/03	2,049.10
29482	358	7	22/03/03	2,049.10
29481	349	8	13/02/02	3,374.99
29480	217	10	18/01/04	34.99
29480	225	10	18/01/04	8.99
29480	477	10	18/01/04	4.99
29480	479	10	18/01/04	8.99
29480	562	10	18/01/04	2,384.07
29479	358	7	8/03/03	2,049.10
29478	477	10	28/12/03	4.99
29478	479	10	28/12/03	8.99
29478	575	10	28/12/03	2,384.07
29477	222	10	20/12/03	34.99
29477	225	10	20/12/03	8.99
29477	575	10	20/12/03	2,384.07
29476	346	8	21/01/02	3,399.99

Data Tables

- Contain the "transactions"
- Sales, Budget, Inventory, etc.
- Sometimes called "fact" tables
- Measures tend to come from data tables
- Can contain many millions of rows
- Each ID column can have multiple entries

CustomerKey	FirstName	LastName	AddressLine1	DateFirstPurchase
11000	Jon	Yang	3761 N. 14th St	22/07/01
11001	Eugene	Huang	2243 W St.	18/07/01
11002	Ruben	Torres	5844 Linden Land	10/07/01
11003	Christy	Zhu	1825 Village Pl.	1/07/01
11004	Elizabeth	Johnson	7553 Harness Circle	26/07/01
11005	Julio	Ruiz	7305 Humphrey Drive	2/07/01
11006	Janet	Alvarez	2612 Berry Dr	27/07/01
11007	Marco	Mehta	942 Brook Street	12/07/01
11008	Rob	Verhoff	624 Peabody Road	28/07/01
11009	Shannon	Carlson	3839 Northgate Road	30/07/01
11010	Jacquelyn	Suarez	7800 Corrinne Court	17/07/01
11011	Curtis	Lu	1224 Shoenic	2/07/01
11012	Lauren	Walker	4785 Scott Street	17/09/03
11013	Ian	Jenkins	7902 Hudson Ave.	15/10/03
11014	Sydney	Bennett	9011 Tank Drive	24/09/03
11015	Chloe	Young	244 Willow Pass Road	22/07/03

Lookup Tables

- Tend to have fewer rows than data tables
- Columns tend to have "Words" rather than "Numbers"
- Calendar, Customers, Stores, Products, etc.
- Sometimes called "dimension," "reference," or "master" tables
- Row, Column, Report Filter, and Slicer fields
- Must have a unique ID column

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Concept: Data tables vs. Lookup tables

Data Tables

Cust #	Date	Product	Qty
123	4-Jan	ABC	2
123	4-Jan	XYZ	1
123	23-Mar	ABC	2
456	5-Jan	JKL	1
456	5-Jan	XYZ	1
...			

Lookup Tables

Cust #	Cust Name	Address	Age
123	Peter	34 Long Street	36
456	Jenny	27 Short Street	52
...			

Date	Day Name	Month	Year
4-Jan	Thu	Jan	2018
5-Jan	Fri	Jan	2018
...			
23-Mar	Fri	Mar	2018

Product #	Product Name	Description	Size
ABC	65 cm MB Tube	Inflatable tube	65
JKL	Pro Helmet	Polystyrene cove	XL
XYZ	Mountain Bike	Full size male mc	26
...			

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Relationships in Power BI
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Data Compression
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Default Aggregations in Power BI

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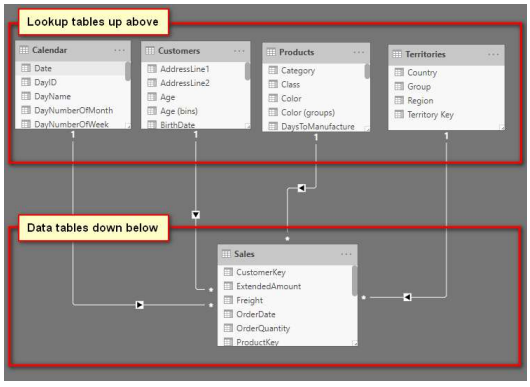
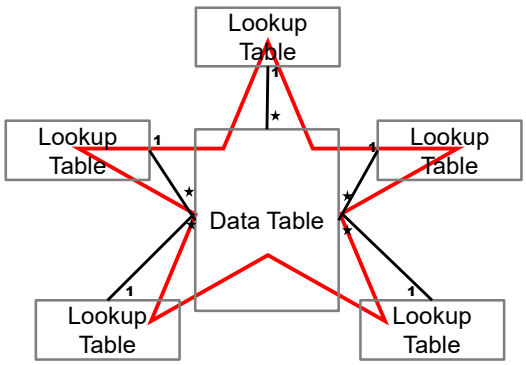
Star Schema





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93

First Create a High Level Model Plan

Who | What | When | Where

1. Review the transactions
2. Remove repeating columns
3. Ask
   1. Who
   2. What
   3. When
   4. Where
4. Load the tables
5. Join the tables

Transactions

The training data is prepared for you. When you do it yourself with your own data, you will need to start with a high level plan for your data structure.

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95

Best practice notes & tips

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- Aim for single noun names for your tables
  - Sales
  - Products
  - Customers etc
- Remove prefixes (eg dim, fct) from your table names
- Only bring in the columns of data you need
- Place your lookup tables at the top, and the data tables underneath.
- Resize default fonts https://exceleratorbi.com.au/changing-defaults-in-power-bi/

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https://exceleratorbi.com.au/best-practices-power-pivot-power-query-power-bi/

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Measures and Calculated Columns

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Writing DAX Formulas, and Why?

Measures

Year	Total Sales	Total Service Fee	Total Sales inc Service Fee
2001	$3,266,374	$65,327	$3,331,701
2002	$6,530,344	$130,607	$6,660,950
2003	$9,791,060	$195,821	$9,986,882
2004	$9,770,900	$195,418	$9,966,318
Total	**$29,358,677**	**$587,174**	**$29,945,851**

Calculated Columns

Fin Year	Fin Month Number	Day Type
2002	1	Weekday
2002	1	Weekend
2002	1	Weekend
2002	1	Weekend
2002	1	Weekend
2002	1	Weekend
2002	1	Weekday

Portability and Reuse

Category	Total Sales inc Service Fee
Accessories	**$714,775**
Bike Racks	$40,147
Bike Stands	$40,383
Bottles and Cages	$57,934
Cleaners	$7,363
Fenders	$47,552
Helmets	$229,842
Hydration Packs	$41,114
Tires and Tubes	$250,440
Bikes	**$28,884,508**
Mountain Bikes	$10,151,815
Road Bikes	$14,810,996
Touring Bikes	$3,921,697
Total	**$29,945,851**

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Compare: Calc Columns vs Measures

Calculated columns:

- Must have a column to use in row/column/filter/slicer.
- Results are pre-calculated and stored
  - Take up memory and disk space.

Measures:

- Can only be used in the Values area of a visual.
- Never pre-calculated, always built on the fly.

When in doubt, use a measure in preference to a calculated column

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DAX Functions

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New DAX Functions

- DISTINCTCOUNT ( )
- COUNTROWS ( )
- DIVIDE( )

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1. Good Calculated Column.pbix

101

Why to Write DAX Formulas?

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Practice Exercises

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Some exercises for you

Create the following measures

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[Total Customers] in our customer database

- Tip - Use the customer table

[Total Customers that Purchased]

- Tip – use the Sales table, not the Customer table

Only use the functions we have learnt so far today:

SUM, DISTINCTCOUNT
COUNTROWS, DIVIDE

For those customers that have actually purchased - don't use AVERAGE()

[Avg Invoices per Customer that Purchased]

[Avg Sales per Customer that Purchased]

Category	Total Sales	Total Customers	Total Customers that Purchased	Avg Invoices per Customer that Purchased	Avg Sales per Customer that Purchased
Accessories	$700,760	18,484	15,114	1.2	$46.36
Bikes	$28,318,145	18,484	9,132	1.7	$3,100.98
Clothing	$339,773	18,484	6,852	1.1	$49.59
Components		18,484			
Total	**$29,358,677**	**18,484**	**18,484**	**1.5**	**$1,588.33**

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Answers to Practice Exercises

105

Answers to exercises

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Total Customers =
COUNTROWS(customers)

Category	Total Sales	Total Customers	Total Customers that Purchased	Avg Invoices per Customer that Purchased	Avg Sales per Customer that Purchased
Accessories	$700,760	18,484	15,114	1.2	$46.36
Bikes	$28,318,145	18,484	9,132	1.7	$3,100.98
Clothing	$339,773	18,484	6,852	1.1	$49.59
Components		18,484			
Total	**$29,358,677**	**18,484**	**18,484**	**1.5**	**$1,588.33**

Total Customers that Purchased =
DISTINCTCOUNT(Sales[customerkey])

Average Invoices per Customer that Purchased =
DIVIDE([Total Invoices] , [Total Customers that Purchased])

Average Sales per Customer that Purchased =
DIVIDE([Total Sales] , [Total Customers that Purchased])

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Accurate Visualisation of Data Insights

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Answers to exercises

What is going on here?

Category	Total Sales	Total Customers	Total Customers that Purchased	Avg Invoices per Customer that Purchased	Avg Sales per Customer that Purchased
Accessories	$700,760	18,484	15,114	1.2	$46.36
Bikes	$28,318,145	18,484	9,132	1.7	$3,100.98
Clothing	$339,773	18,484	6,852	1.1	$49.59
Components		18,484			
Total	**$29,358,677**	**18,484**	**18,484**	**1.5**	**$1,588.33**

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Filter Behaviour
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Bidirectional Filtering
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The CALCULATE Function

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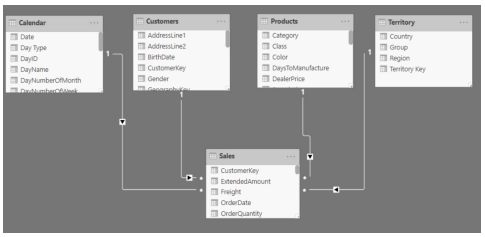
Multiple tables and CALCULATE

- Leveraging multiple tables in a single model
- CALCULATE () – your new best friend
- Debugging your DAX Formulas



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2. Simple Functions.pbix

112

The CALCULATE ( ) function

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Changing the **natural filter behaviour*** of a visualisation

Country	Total Sales	% Sales of Bikes
United States	$9,389,790	95.8%
Australia	$9,061,001	97.7%
United Kingdom	$3,391,712	96.8%
Germany	$2,894,312	97.0%
France	$2,644,018	96.6%
Canada	$1,977,845	92.1%
Total	**$29,358,677**	**96.5%**

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* Technical term is “filter context”

113

CALCULATE()

The most important function in DAX (it can change the natural filter behaviour)

=CALCULATE(<measure expression>, <filter1>, <filter2>,…)

Zero, 1 or more filters

<simple filter>
Table[Column] = <fixed value>

<table filter>
eg: Products
eg: ALL(Products), FILTER( )

CALCULATE() can add, remove, or modify filters, then it re-runs the filter propagation engine.

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Function: CALCULATE()

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=CALCULATE(<measure expression>, <filter1>, <filter2>,…)

<measure expression>
Name of an existing measure, or formula that is valid for a measure
eg: [Total Sales]
eg: SUM(Sales[ExtendedAmount])

<simple filter>
A simple filter expression like Table[Column] = <fixed value>
eg: Products[Category]="Bikes", Calendar[Year]=2003
eg: SalesTable[ExtendedAmount]>=100

or <table filter>
eg: Products
eg: ALL(Products), FILTER( )

Operation
Like SUMIF(), but more like "anything IF"
Modifies the filter context, but ONLY for this measure!

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Debugging Your DAX Formulas

6 Step Process

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Data Acquisition | Data Modelling | Visualisation & Analysis | Sharing

Debugging Your DAX Formulas

The 6 Step Process

6 Step Process for Debugging DAX Formulas

1 Detect Initial Filters

Day Type	Country	2001	2002	2003	2004	Total
Weekday	Australia	$447,158	$690,280	$996,041	$859,125	**$2,992,604**
Weekend	Canada	$48,420	$200,459	$189,935	$210,302	**$649,115**
	France	$66,602	$155,434	$304,789	$258,098	**$784,923**
	Germany	$72,320	$179,794	$301,623	$338,924	**$892,661**
	United Kingdom	$92,975	$205,044	$374,421	$367,090	**$1,039,530**
	United States	$386,286	$570,091	$884,663	$1,060,386	**$2,901,426**
	Total	**$1,113,762**	**$2,001,101**	**$3,051,473**	**$3,093,925**	**$9,260,261**

- Select a single cell in a visual.
- Determine ALL filters that are affecting this cell.
  - Rows
  - Columns
  - Slicers
  - Filters
  - Cross Filters from other visuals
- These are the "initial" set of filters.

2 Apply Filters from CALCULATE

If there is a filter applied by a calculate then add, modify, remove filters as appropriate. This is then the final set of filters. Note that a CALCUATE could be in the formula in the selected cell or in another formula referenced by the cell.

3 Filter All Required Tables

One by one, apply these filters in the data model.

4 Follow the Relationships

If the tables receiving the filters in step 3 are joined, follow the relationships in the direction indicated.

5 Complete the Calculation

Then and only then do you complete the calculation on the "filtered copy" of the data model.

6 Return the Result to the Cell

Get the result and return it to the cell.

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Walkthrough of Live Examples

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Thinking like the Power BI engine

(aka "troubleshooting your formulas")

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Filter Behaviour Revisited

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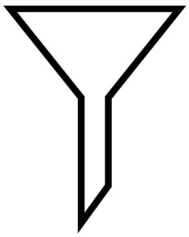
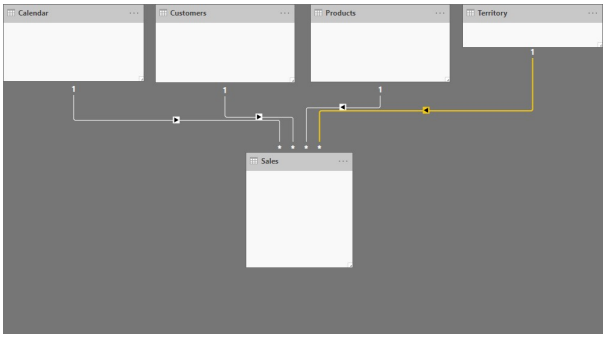
Category	Country	Total Sales
Accessories	Australia	$9,051,766
Bikes	Canada	$1,966,991
Clothing	France	$2,640,526
Components	Germany	$2,890,708
	United Kingdom	$3,387,491
	United States	$9,370,355
	Total	**$29,307,837**



Filter First



Calculation Second

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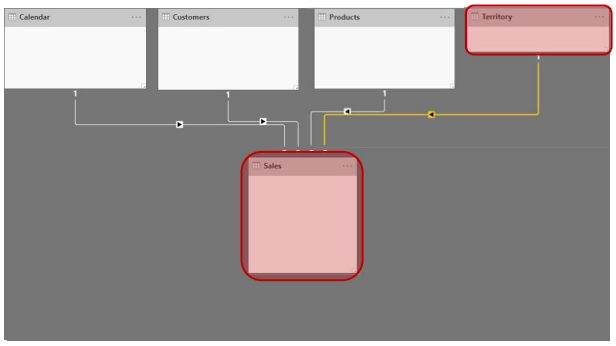
Filters

Territory[Country]="Australia"

Category	Country	Total Sales
Accessories	Australia	$9,051,766
Bikes	Canada	$1,966,991
Clothing	France	$2,640,526
Components	Germany	$2,890,708
	United Kingdom	$3,387,491
	United States	$9,370,355
	Total	**$29,307,837**



First Apply Filters

Then Calculate Expression

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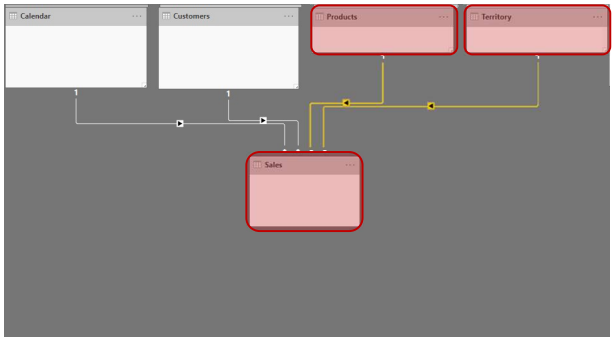
Filters

Territory[Country]="Australia"

Products[Category]="Bikes"

Category
Accessories
■ Bikes
Clothing
Components

Country	Total Sales
Australia	$8,852,050
Canada	$1,821,302
France	$2,553,576
Germany	$2,808,514
United Kingdom	$3,282,843
United States	$8,999,860
Total	**$28,318,145**



First Apply Filters

Then Calculate Expression

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123

CALCULATE([Total Sales], Products[Category]="Bikes")

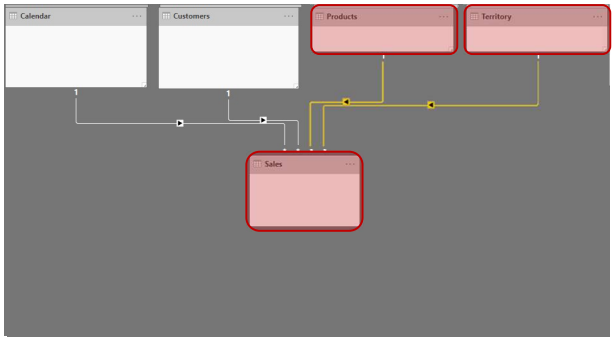
Filters

Territory[Country]="Australia"

?

Category
Accessories
Bikes
Clothing
Components

Country	Total Sales	Total Bike Sales
Australia	$9,051,766	$8,852,050
Canada	$1,966,991	$1,821,302
France	$2,640,526	$2,553,576
Germany	$2,890,708	$2,808,514
United Kingdom	$3,387,491	$3,282,843
United States	$9,370,355	$8,999,860
Total	**$29,307,837**	**$28,318,145**



First Apply Filters

Then Calculate Expression

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124

CALCULATE([Total Sales], Products[Category]="Bikes")

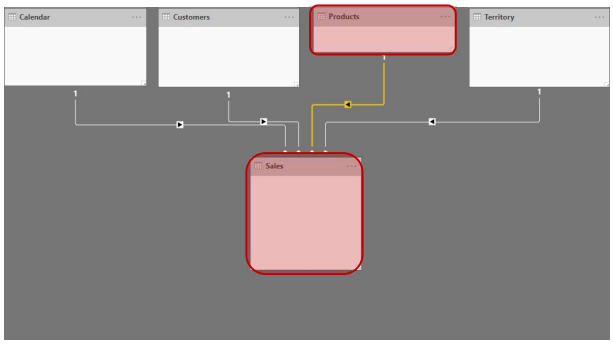
Filters

~~Products[Category]="Accessories"~~

?

Category
- Accessories
- Bikes
- Clothing
- Components

Category	Total Sales	Total Bike Sales
Accessories	$667,015	$28,318,145
Bikes	$28,318,145	$28,318,145
Clothing	$322,677	$28,318,145
Components		$28,318,145
Total	**$29,307,837**	**$28,318,145**



First Apply Filters

Then Calculate Expression

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Key Points

```
=CALCULATE(
    [Total Sales],
    Products[Category] = "Bikes"
)
```

Replaces the filter from the visual with a new filter.

Category	Total Sales	Total Sales from Bikes
Accessories	$700,760	$28,318,145
Bikes	$28,318,145	$28,318,145
Clothing	$339,773	$28,318,145
Components		$28,318,145
Total	**$29,358,677**	**$28,318,145**

```
=CALCULATE(
    [Total Sales],
    KEEPFILTERS(Products[Category] = "Bikes")
)
```

Keeps the filter from the visual and adds a new filter.

Category	Total Sales	Total Sales from Bikes
Accessories	$700,760	
Bikes	$28,318,145	$28,318,145
Clothing	$339,773	
Total	**$29,358,677**	**$28,318,145**

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KEEPFILTERS Function
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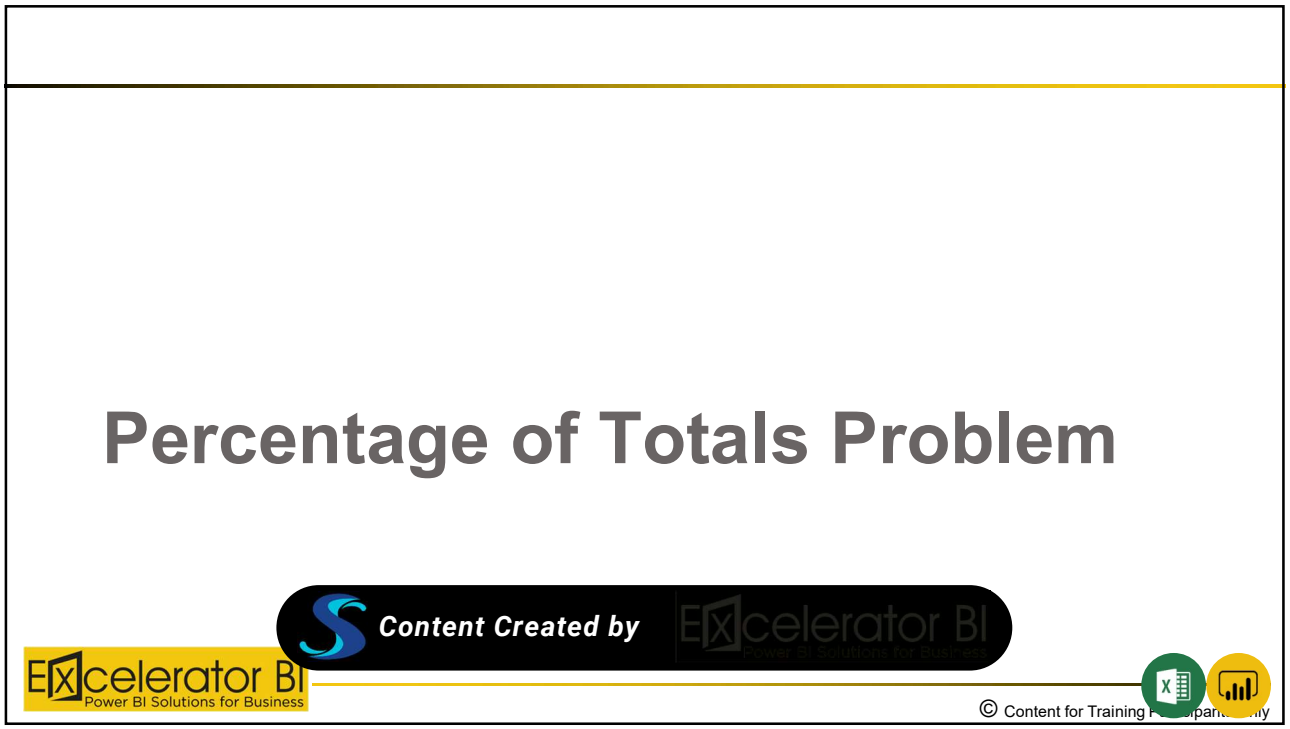
Percentage of Totals Problem
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Measures cont.

ALL(), percentage of totals, and "cancelling filters"

Color	Total Sales	% of All Product Sales
Black	$8,838,412	30.10%
Red	$7,724,331	26.31%
Silver	$5,113,389	17.42%
Yellow	$4,856,756	16.54%
Blue	$2,279,096	7.76%
NA	$435,117	1.48%
Multi	$106,471	0.36%
White	$5,106	0.02%
Total	**$29,358,677**	**100.00%**

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The ALL Function

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CALCULATE()

The most important function in DAX (it can change the natural filter behaviour)

=CALCULATE(<measure expression>, <filter1>, <filter2>,…)

Zero, 1 or more filters

<simple filter>
Table[Column] = <fixed value>

<table filter>
eg: Products
eg: ALL(Products), FILTER( )

CALCULATE() can add, remove, or modify filters, then it re-runs the filter propagation engine.

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Alternatives in Using ALL Function

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Enhancing the Readability of the Data Model
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Alternatives in Using ALL Function
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Practice Exercises
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Exercises for you

Data Acquisition | Data Modelling | Visualisation & Analysis | Sharing

Create some new measures to produce the following table

Occupation	Total Sales	Total All Customer Sales	% of All Customer Sales
Professional	$9,907,977	$29,358,677	33.7%
Skilled Manual	$6,440,081	$29,358,677	21.9%
Management	$5,467,862	$29,358,677	18.6%
Clerical	$4,684,787	$29,358,677	16.0%
Manual	$2,857,971	$29,358,677	9.7%
Total	**$29,358,677**	**$29,358,677**	**100.0%**

If you finish the first one (tricky)

Region	Total Sales	% of All Region Sales
Australia	$9,061,001	30.9%
Southwest	$5,718,151	19.5%
Northwest	$3,649,867	12.4%
United Kingdom	$3,391,712	11.6%
Germany	$2,894,312	9.9%
France	$2,644,018	9.0%
Canada	$1,977,845	6.7%
Southeast	$12,239	0.0%
Northeast	$6,532	0.0%
Central	$3,001	0.0%
Total	**$29,358,677**	**100.0%**

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Answers to Practice Exercises

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Exercises for you

Data Acquisition | Data Modelling | Visualisation & Analysis | Sharing

Create some new measures to produce the following table

Occupation	Total Sales	Total All Customer Sales	% of All Customer Sales
Professional	$9,907,977	$29,358,677	33.7%
Skilled Manual	$6,440,081	$29,358,677	21.9%
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Clerical	$4,684,787	$29,358,677	16.0%
Manual	$2,857,971	$29,358,677	9.7%
Total	**$29,358,677**	**$29,358,677**	**100.0%**

Total Sales to All Customers
= CALCULATE([Total Sales], All(Customers))

% of All Customer Sales
= DIVIDE ([Total Sales], [Total Sales to All Customers])

If you finish the first one (tricky)

Region	Total Sales	% of All Region Sales
Australia	$9,061,001	30.9%
Southwest	$5,718,151	19.5%
Northwest	$3,649,867	12.4%
United Kingdom	$3,391,712	11.6%
Germany	$2,894,312	9.9%
France	$2,644,018	9.0%
Canada	$1,977,845	6.7%
Southeast	$12,239	0.0%
Northeast	$6,532	0.0%
Central	$3,001	0.0%
Total	**$29,358,677**	**100.0%**

Total Sales to All Regions
= CALCULATE([Total Sales], All(Territory[Region]))

% of All Region Sales
= DIVIDE ([Total Sales], [Total Sales to All Regions])

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Introduction to Time Intelligence

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Time Intelligence

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- Introduction to Time Intelligence: Date/Calendar Tables
- Running totals such as Year to Date
- Change versus Prior Month/Year Etc.

Year	MonthName	Total Sales	Total Sales YTD
2001	July	$473,388	$473,388
	August	$506,192	$979,580
	September	$473,943	$1,453,523
	October	$513,329	$1,966,852
	November	$543,993	$2,510,846
	December	$755,528	$3,266,374
	Total	**$3,266,374**	**$3,266,374**
2002	January	$596,747	$596,747
	February	$550,817	$1,147,563
	March	$644,135	$1,791,698
	April	$663,692	$2,455,391
	May	$673,556	$3,128,947
	June	$676,764	$3,805,711
	July	$500,365	$4,306,076
	August	$546,001	$4,852,077
	September	$350,467	$5,202,544
	October	$415,390	$5,617,934
	November	$335,095	$5,953,030
	December	$577,314	$6,530,344

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Three Types of Time Intelligence

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3 Types of Time Intelligence

Auto Time Intelligence

- Automatically creates a calendar table for every date field.
- Easy to get started but limited capability.
- Can make your files really large.

Inbuilt Intelligence

- You must have a day level calendar table in your data model.
- Only works with standard calendar.

Custom Intelligence

- You must have a calendar table, but can be any granularity.
- Most flexible and can do anything you want.
- Hardest to learn, but you can learn it.

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Rules of a Date Table

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Rules of a date table

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Rules only apply if you want to use inbuilt Time Intelligence

- Must have a calendar table
- Calendar table must have contiguous date range
  - Don't skip any days
- Good date tables
  - Have all the columns that you will want to use in your filters and formulae.
  - Have numeric sort columns to control the way text is displayed
- Gregorian Calendar only (not 445)
  - Can have any financial year you specify

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http://exceleratorbi.com.au/power-pivot-calendar-tables/

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Removing Aggregations on Calendar Columns

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Sorting Calendar Values
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Auto Time Intelligence
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Running Totals
TOTALYTD Function
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Change vs Prior Year/Month
SAMEPERIODLASTYEAR and DATEADD Functions
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