

# Microsoft Power BI

Slides cedidos pela Microsoft Portugal  
para uso nas aulas do ISEG

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# Presentation outline

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01: Microsoft Power BI overview

02: Working with the Power BI service

03: Connecting to Power BI data sources

04: Creating Power BI Desktop solutions

06: Summary

# 01: Microsoft Power BI overview

- A new generation of BI
- Introducing Microsoft Power BI
- Power BI overview
- Signing up for Power BI
- Power BI announcements

# A new generation of BI

Today, BI extends to everyone

3rd wave  
End user BI



Everyone

2nd wave  
Self-service BI



Analyst to end user

1st wave  
Technical BI



IT to end user

# A new generation of BI

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Turning data into business insights is challenging

Common BI challenges include...



End-to-end view

Data often resides in disparate locations, making it difficult to see a complete picture of your business



Multiple data sources

Data residing in SaaS solutions, and other external locations, is difficult to access and refresh securely



Right data for the right users at the right time

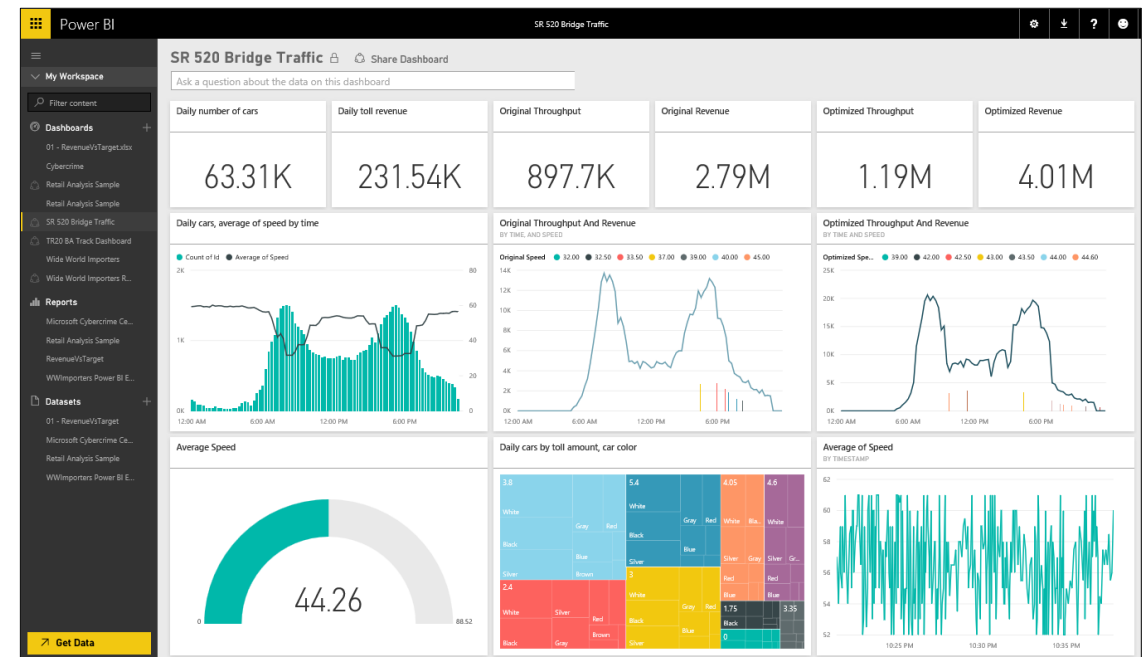
Different roles have different needs, and business users need the latest operational data

# Introducing Microsoft Power BI

Experience your data. Any data, any way, anywhere.

Power BI is a cloud-based business analytics service that enables:

- Fast and easy access to data
- A live 360° view of the business
- Data discovery and exploration
- Insights from any device
- Collaboration across the organization
- Anyone to visualize and analyze data



# Introducing Microsoft Power BI

## Key benefits and differentiators



Pre-built content packs, consisting of dashboards and reports, for popular SaaS solutions



Real-time dashboard updates



Secure, live connection to your data sources, on-premises and in the cloud



Intuitive data exploration by using natural language query



Integration with familiar Microsoft products, and commitment for scale and availability in Azure



Fast deployment, hybrid configuration, secure, and integrated with existing IT systems










# Power BI overview


## Data sources

-  SaaS solutions  
*E.g. Marketo, Salesforce, GitHub, Google analytics*
-  On-premises data  
*E.g. Analysis Services*
-  Organizational content packs  
*Corporate data sources, or external data services*
-  Azure services  
*E.g. Azure SQL, Stream Analytics*
-  Excel files  
*Workbook data or data models*
-  Power BI Desktop files  
*Related data from files, databases, Azure, and other sources*

## Power BI service

-  Content packs
-  Live dashboards
-  Visualizations
-  Reports
-  Datasets
-  Data refresh

 Natural language query

 Sharing & collaboration





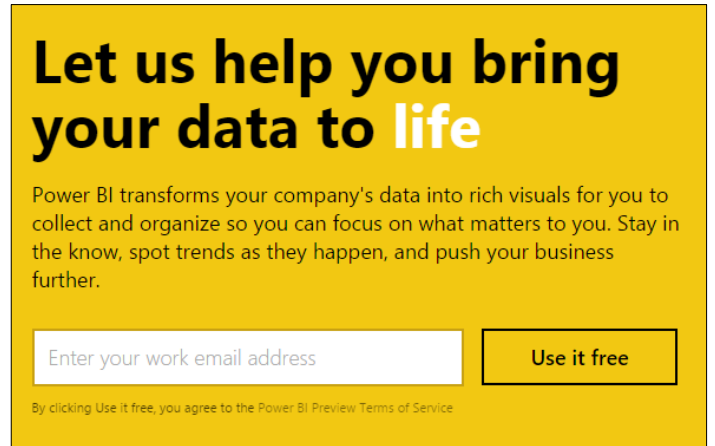
# Signing up for Power BI

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Sign up can be achieved for free, and within seconds

- Power BI works only with an organizational account, associated with a work or school email address

Encourage customers to trial Power BI for free, and to realize the benefits of **Power BI Pro** features

A screenshot of the Power BI sign-up interface. It features a yellow background with the heading "Let us help you bring your data to life" in bold black text. Below the heading is a paragraph of text: "Power BI transforms your company's data into rich visuals for you to collect and organize so you can focus on what matters to you. Stay in the know, spot trends as they happen, and push your business further." At the bottom, there is a white input field with the placeholder text "Enter your work email address" and a yellow button with the text "Use it free". Below the button, there is a small line of text: "By clicking Use it free, you agree to the Power BI Preview Terms of Service".

**Let us help you bring your data to life**

Power BI transforms your company's data into rich visuals for you to collect and organize so you can focus on what matters to you. Stay in the know, spot trends as they happen, and push your business further.

Enter your work email address

**Use it free**

By clicking Use it free, you agree to the Power BI Preview Terms of Service

Note: Pricing and licensing will be described in the final module

# Key takeaways

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- Power BI is a cloud-based business analytics service, delivering end user BI
- Power BI delivers numerous benefits and differentiators
  - Pre-built content packs
  - Real-time dashboard updates
  - Live connections to on-premises and cloud data sources
  - Intuitive data exploration by using natural language query
  - Integration with familiar Microsoft products and services
  - Fast deployment, hybrid configuration, secure, and integrated with existing IT systems
- Microsoft is placed furthest in vision within the **BI and Analytics Platform** Leaders quadrant



# Resources

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## Power BI site

- <http://powerbi.microsoft.com>

## Power BI documentation

- <http://support.powerbi.com/>

## Power BI community

- <http://community.powerbi.com/>

## Power BI blog

- <http://blogs.msdn.com/b/powerbi/>

Tip: Power BI is evolving at a rapid rate. One of the best ways to keep pace with updates is to subscribe to the Power BI blog.



# Resources

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Continued

## Microsoft Cloud and Enterprise Partner Resources

- <http://aka.ms/powerbipartners>
- Includes up-to-date resources:
  - Customer-ready materials
  - Customer evidence
  - Training and labs
  - Demos
  - “What to do next”

## Gartner positions Microsoft as a leader in BI and Analytics Platforms

- <https://powerbi.microsoft.com/en-us/blog/gartner-positions-microsoft-as-a-leader-in-bi-and-analytics-platforms/>

# 02: Working with the Power BI service

- Introducing the Power BI online service
- Creating and exploring reports
- Assembling dashboards
- Exploring with Q&A
- Mobile applications
- Sharing and collaborating
- Describing additional capabilities
- Tenant settings

# Introducing the Power BI online service

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The Power BI online service offers a simple, intuitive experience for interacting with data

The service and features have been designed to:

- Simplify engaging with data from heterogeneous sources
- Fuel faster, more insightful business decisions
- Deliver a rich, consolidated view of key information, no matter where the underlying data is stored
- Share data insights

# Introducing the Power BI online service

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Continued

Users engage with the service by using a supported web browser, or mobile application

- Microsoft Edge
- Internet Explorer, 10 or 11
- Chrome desktop, latest version
- Safari Mac, latest version
- Firefox desktop, latest version



Note: Mobile applications will be covered later in this module

# Introducing the Power BI online service

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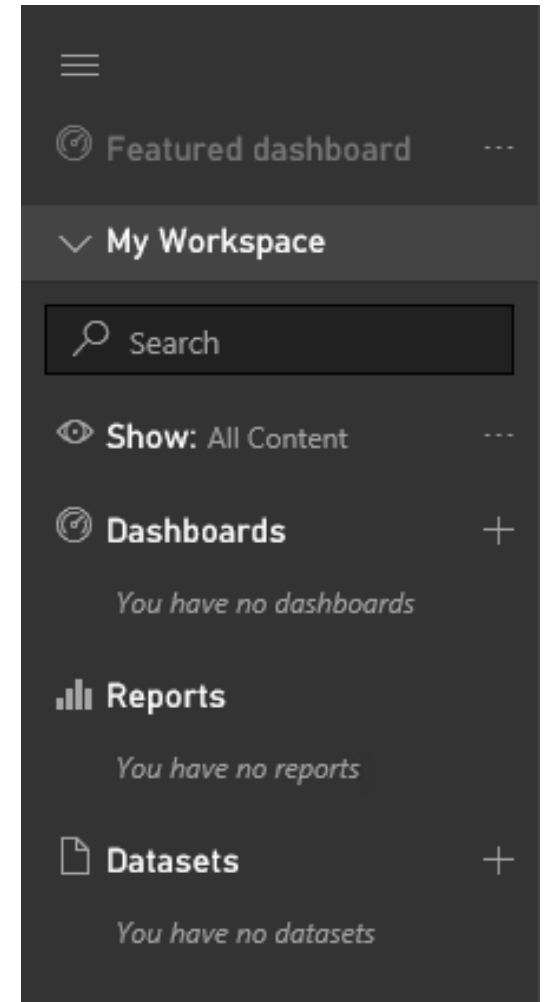
Continued

Users typically work with Power BI “building blocks”:

- Datasets
- Reports
- Dashboards

Use the **Navigation Pane** to create, or select items of interest

Note: Creating and managing datasets will be covered in the next module





# Creating and exploring reports

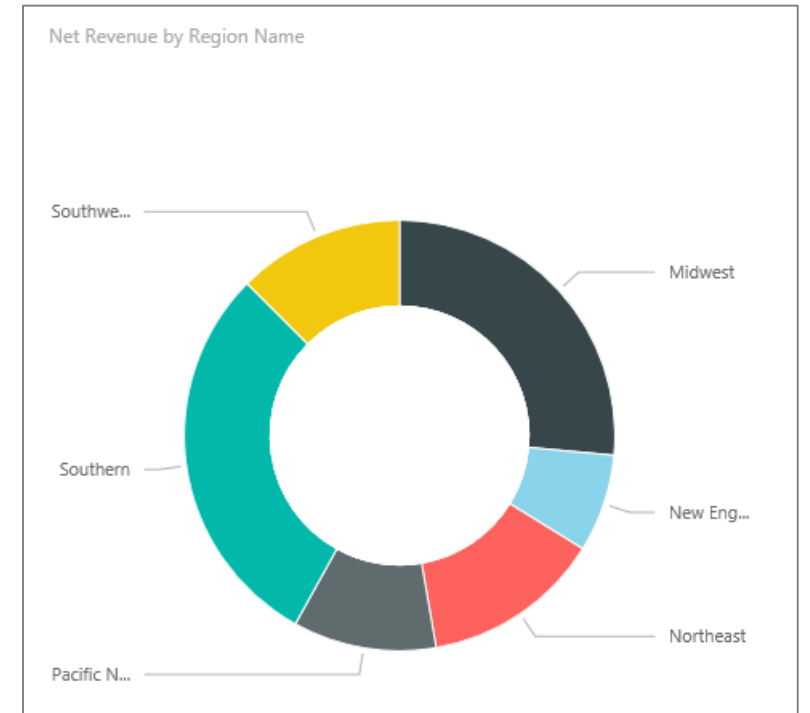
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## Creating reports

Use reports to layout visualizations across one or more pages

Rich, interactive reports can be created, updated and explored in the web browser experience

- A report is based on a single dataset
- Reports consist of one or more pages
- Each page can be named, and consists of visualizations and shapes



# Creating and exploring reports

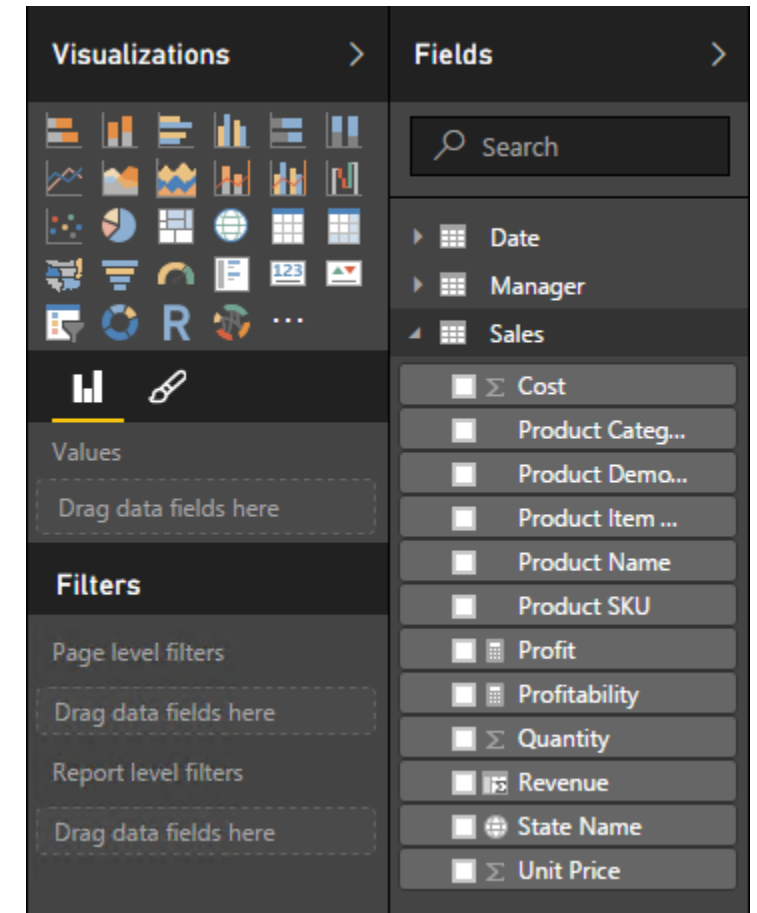
## Creating reports

Dataset fields are used to layout a visualization

- Visualization type and format can be adjusted to suit

Filtering can be applied at report, page or visualization level

Sorting can be set at visualization level



# Creating and exploring reports

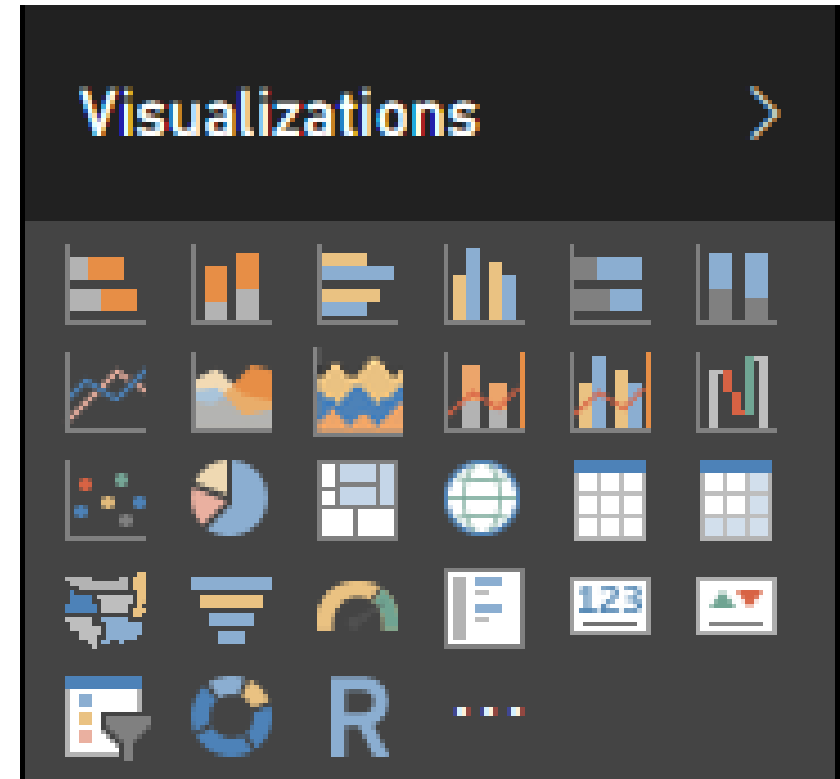
Creating reports: Visualization types

Choose from numerous modern visualization types:

- Filter data:
  - Slicer
- Display numeric values:
  - Card, Multi Row Card, Table, Matrix, KPI
- Graphically visualize data:
  - Bar, Column, Line, Combo, Scatter, Waterfall, Pie, Donut, Funnel, Treemap, Gauge, R Script
- Spatially visualize data:
  - Map, Filled map, Shape map (preview)

## Import custom visuals

Custom visuals are covered later in this training course



Tip: Hover the cursor of each icon to reveal a tooltip description of the visualization type

# Creating and exploring reports

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## Exploring reports

Reports are either in **Reading View** or **Editing View**

- In both views, report pages can be opened in **Full Screen Mode**, or individual visualizations can be popped out/in to see them zoomed in/out

In Reading View:

- Users cannot change the report definition
- Users can interact by changing filters or sorting
- Users can highlight values in one visualization to filter other page visualizations
- Shared reports can only be opened in Reading View

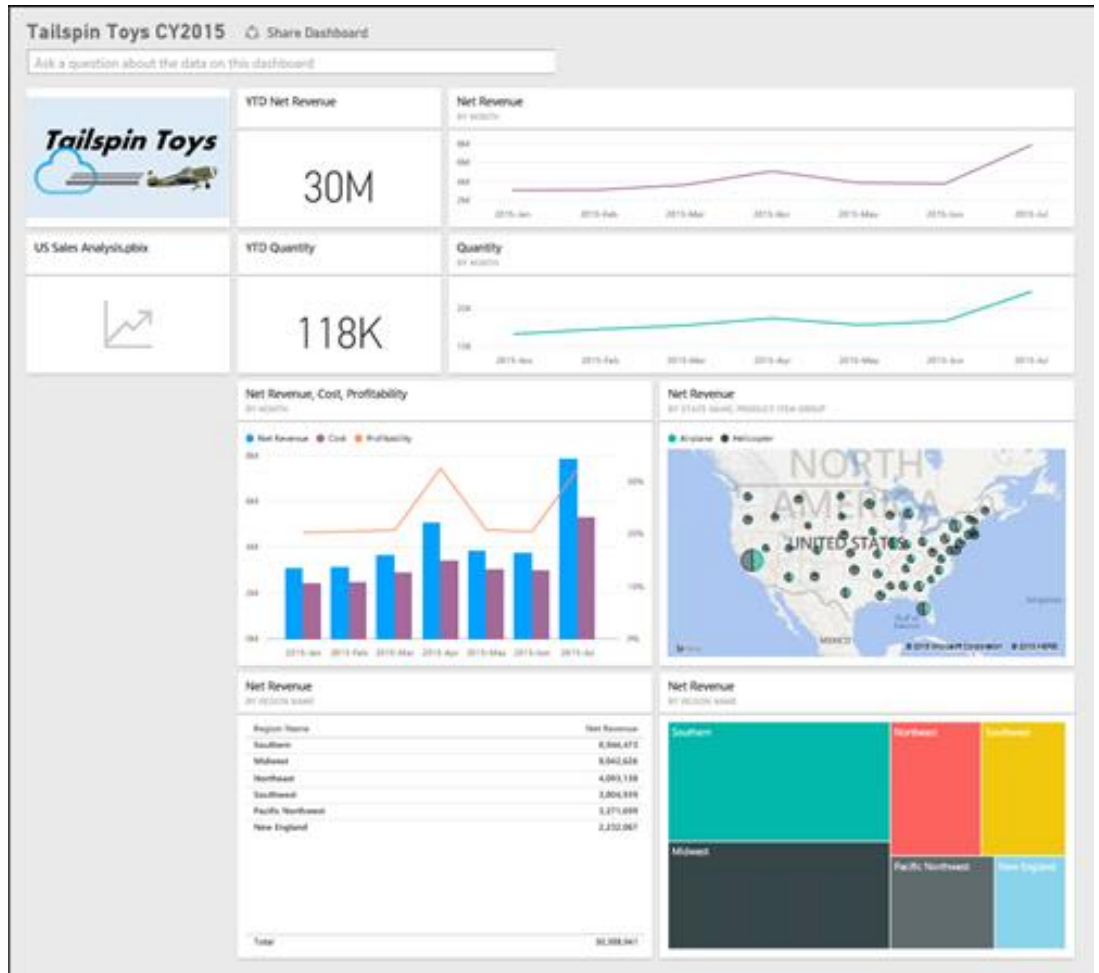
In Editing View:

- Users can interact, as in Reading View
- Users can also update the report (add/remove/reorder pages or visualizations)

# Assembling dashboards

Dashboards display tiles in a single canvas

- A tile is sourced by “pinning” either a report, report visualization, or a Q&A response
- A dashboard can be based on one or more datasets
- Tiles can be resized and repositioned, and their titles/subtitles can be updated
  - Tiles can be sized to 1-5 units wide/high



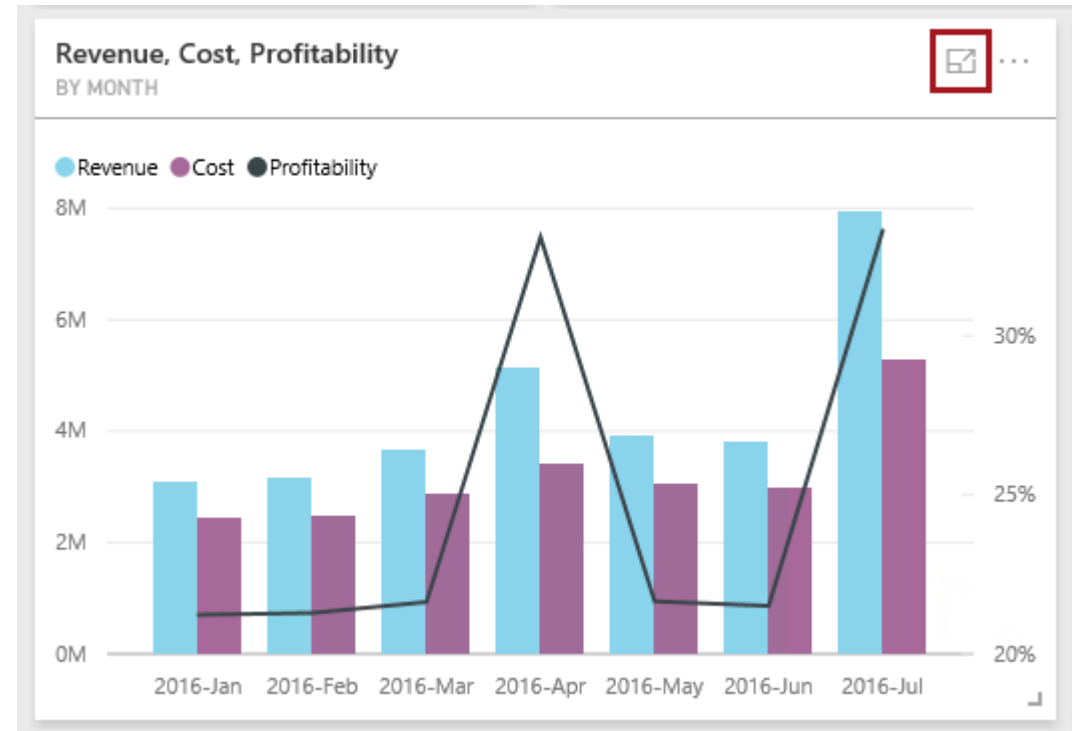
# Assembling dashboards

Continued

Tiles can be opened in **In-Focus Mode**, filling the dashboard space

- The data last updated date is displayed
- Not available for tiles sourced from Q&A questions

Data can also be exported



LAST REFRESH:08/20/2016 21:12:15



Get Insights



Pin visual



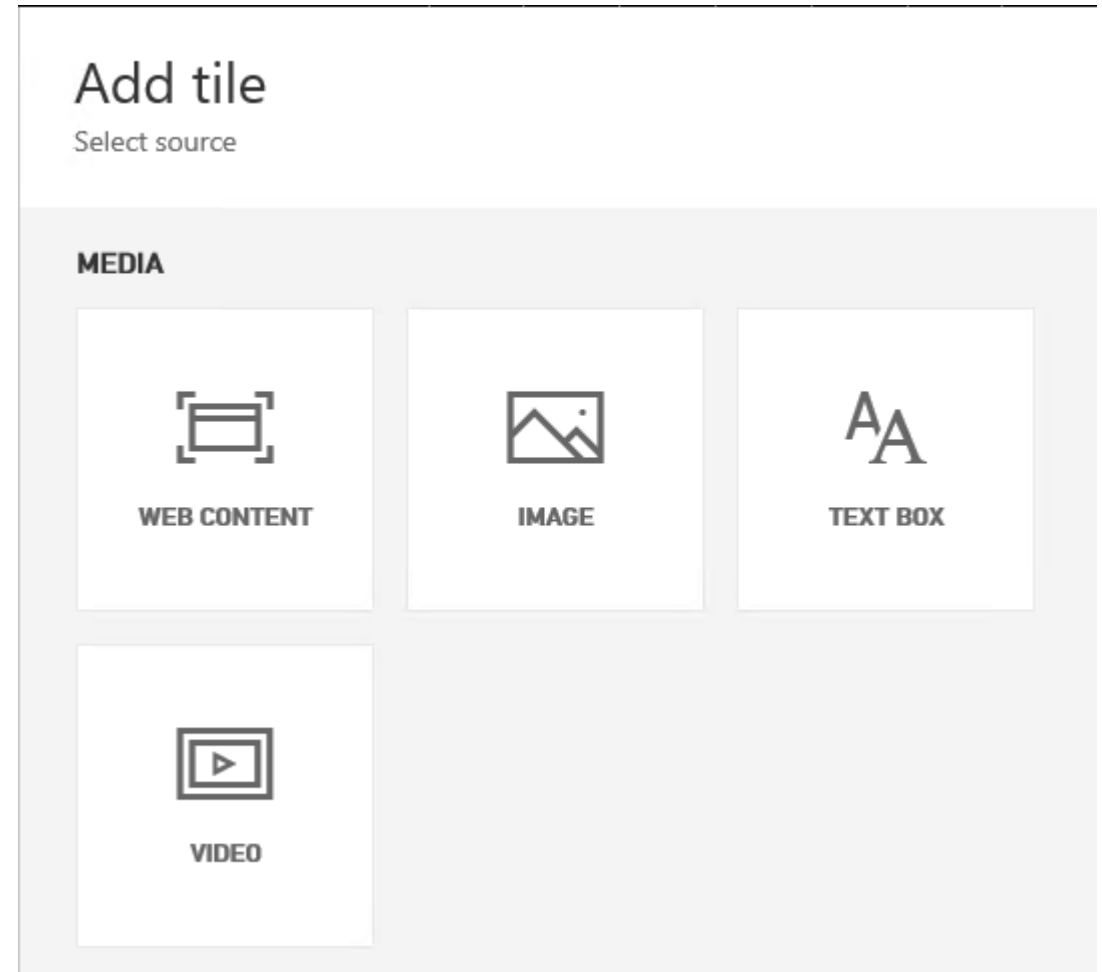
# Assembling dashboards

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Continued

Additionally, non data-related tiles can be added to a dashboard, using:

- Web content
- Images
- Text boxes
- Videos



# Assembling dashboards

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Continued

Dashboards enable interactivity

- By default, clicking on a tile will drill through to its source
- However, a custom link (URL) can be set to override this default behavior

Dashboard tiles can reflect live, real-time data

- For non real-time datasets, tile thumbnails are automatically cached every 15 minutes

Dashboards can be displayed in **Full Screen Mode**

- Additionally, all tiles can be displayed by using Fit to Screen

Note: Live dashboards can be achieved with Azure Stream Analytics integration or the Power BI REST API. Both topics are covered later in this course.



# Mobile applications

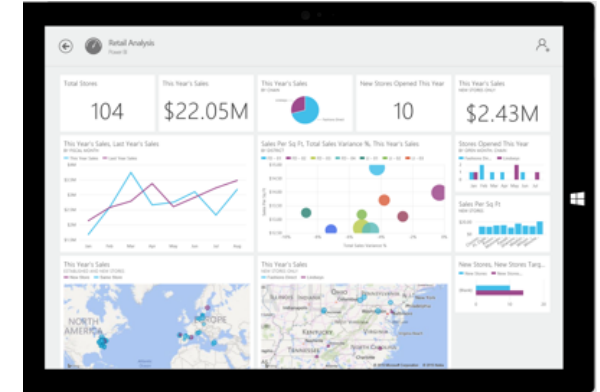
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Install native mobile applications to access dashboards, available for:

- Windows
- iOS (iPhone and iPad)
- Android

Supported capabilities:

- Set favorites for important visualizations
- Zoom in and out of visualizations
- Annotate visualizations and share snapshots with others
- Configure alerts to receive notifications of critical business KPIs



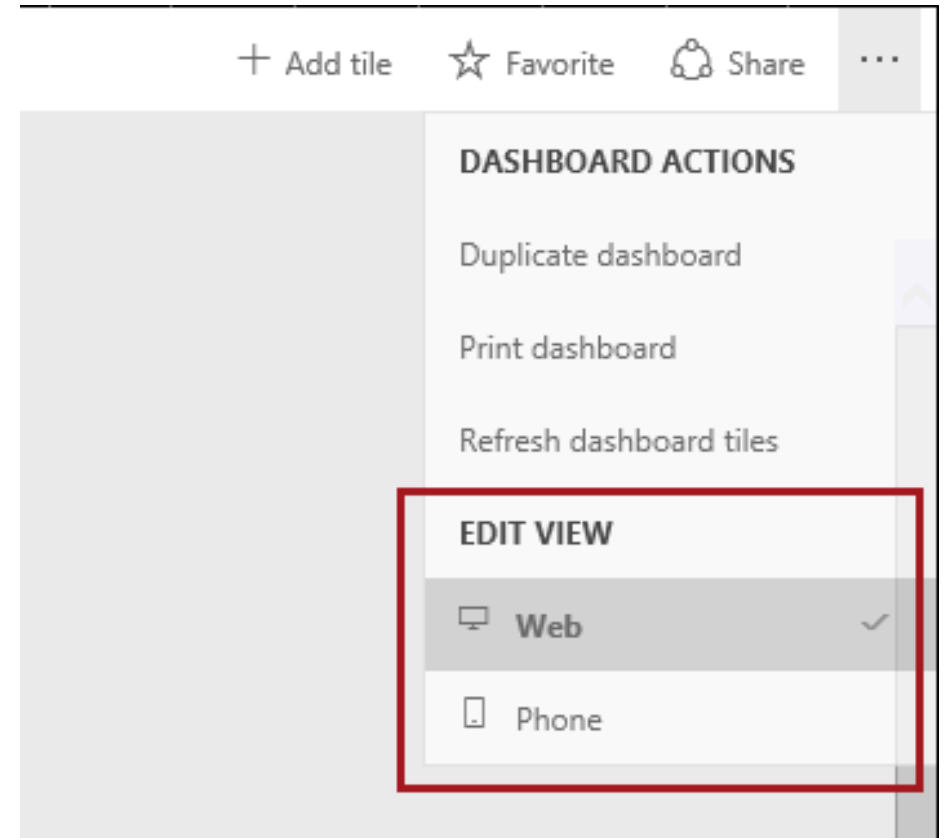
# Mobile applications

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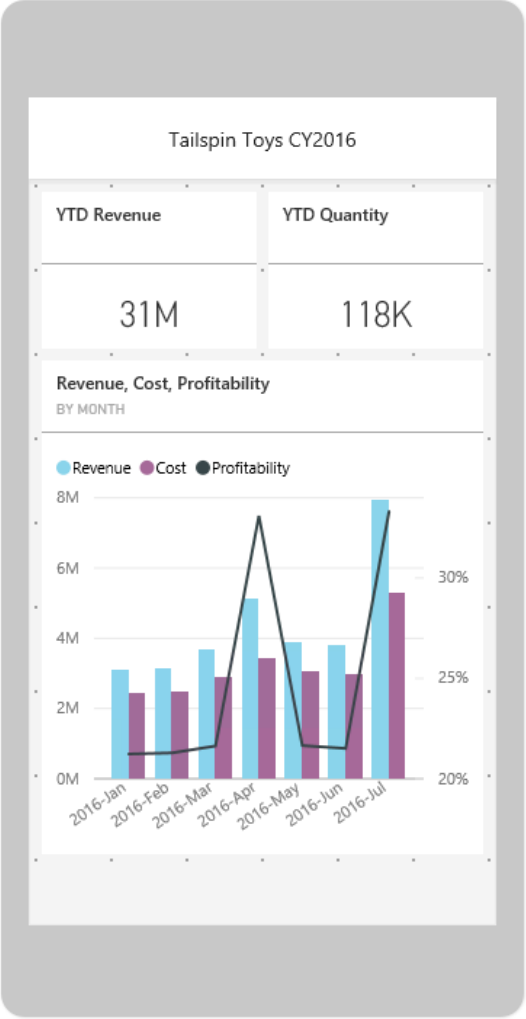
Dashboards can be configured for **Phone** view also

- Existing dashboard tiles can be resized, repositioned, or removed



# Mobile applications

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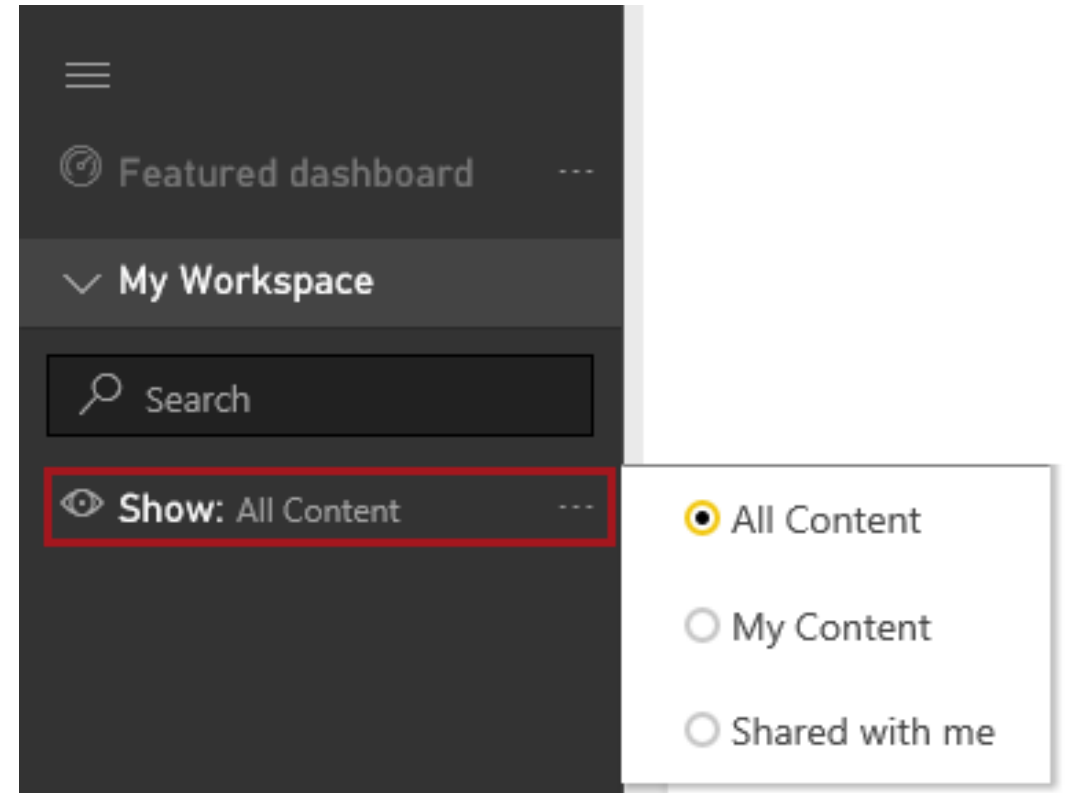


# Sharing and collaboration

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Sharing dashboards and tiles: Navigation pane

It is possible to filter the workspace content by showing/hiding shared assets



# Sharing and collaboration

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## Office 365 groups

Use **Office 365 groups** to manage and share content

- Typically suitable for teams/collaborators with whom you work closely for a common purpose/project

Like a user, groups can own content

- The owner of the group is by default, an admin
- Group admins can manage the membership, and promote others users as admins
- Every member of the group:
  - Must belong to the same tenant
  - Has either read-only permission, or complete permissions to update, create and delete the group content
  - Must have the Power BI Pro license

Note: Groups can also share dashboards

# Sharing and collaboration

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Organizational content packs

Use **organizational content packs** to make content available to broad audiences, and to allow personalization

- Typically suitable for anyone who might be interested in this content

A content pack is defined in terms of a title, description, image, and specific items:

- Datasets
- Reports
- Dashboards

# Sharing and collaboration

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Organizational content packs: Continued

Content packs are discoverable in the **Content Gallery** and can be made available to:

- Entire organization—if enabled in the Admin portal
- Members of a security or Office 365 group
- Individuals within the same tenant

By default, dashboards and reports are read-only

- However, members can unlock and personalize them

Updates made to a content pack will:

- Apply automatically to non-personalized content
- Notify a user that has personalized content, so they may take appropriate action

# Sharing and collaborating

Summary and comparison of sharing techniques

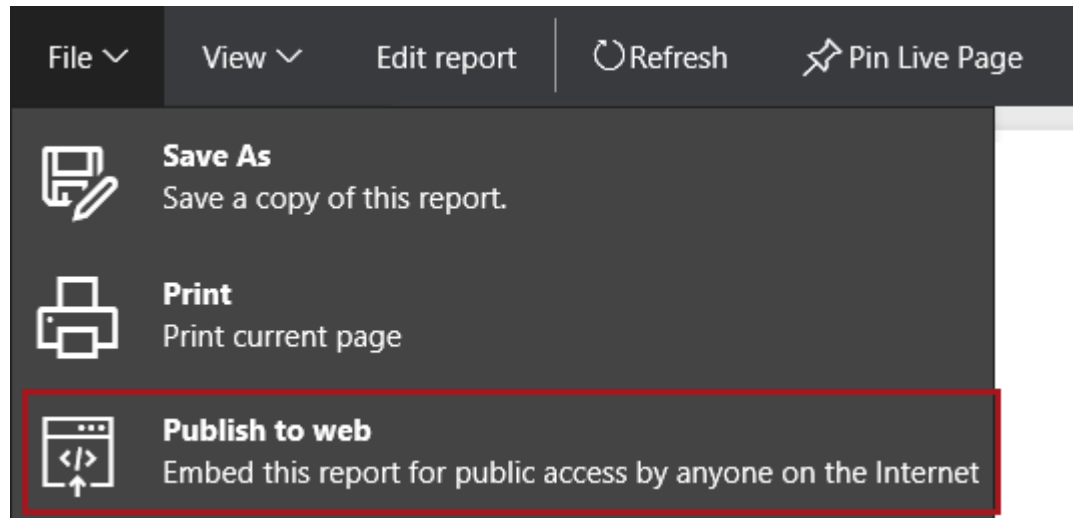
	Share	Office 365 Group	Org Content Pack
Purpose	Ad hoc	Collaboration	Broader content delivery
Target audience	Individuals, or colleagues inside or outside of the organization <i>Typically suitable for users that work closely together, and that need to view dashboards or specific tiles</i>	Office 365 group members <i>Typically suitable for teams/collaborators with whom you work closely for a common purpose/project</i>	The entire organization, or members of security or Office 365 groups, or individuals <i>Typically suitable for anyone who might be interested in this content</i>
Applies to	Dashboards, or specific tiles	All content	All content
Discovery	Automatic, or Invitation email	Office 365 group	Get Data ► My Organization
Permission	Read-only <i>Datasets are not visible. Reports are in Reading View. Resharing permission can be granted.</i>	Read-only, or Edit <i>Members of the group will have equal rights to manage the group content</i>	Primarily read-only <i>Members can create a personal copy. Updated content packs that have been personalized will raise a notification.</i>
License	Power BI, and Power BI Pro	Power BI Pro only	Power BI Pro only



# Describing additional capabilities

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## Web publishing



Warning: Only publish reports and data that the anyone on the Internet (unauthenticated members of the public) should be able to see. Before publishing this report, ensure you have the right to share the data and visualizations publicly. Do not publish confidential or proprietary information.

**Publish to Web** enables easily publishing reports into blogs and websites

- When you use Publish to web, the report or visual you publish can be viewed by anyone on the Internet
  - There is no authentication used when viewing these reports
- An embed code is generated, and can be deleted to instantly remove access
- This feature can be disabled in the Admin portal



# Resources

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Power BI Dashboards knowledge base

- <https://support.powerbi.com/knowledgebase/articles/424868-dashboards-in-power-bi>

Q&A in Power BI knowledge base

- <https://support.powerbi.com/knowledgebase/articles/474566-q-a-in-power-bi>

Power BI mobile

- <https://powerbi.microsoft.com/mobile>

# 03: Connecting to Power BI data sources

- Connecting to Power BI data sources
- Keeping data current in Power BI
- Integration with Azure services

# Connecting to Power BI data sources

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↗ Get Data

Connecting to data through Power BI is easy, and can be achieved with a variety of data source formats:

- Content packs:
  - My Organization
  - Services
- Files, including:
  - Power BI Desktop files
  - Excel workbooks
- Databases and data services—cloud and on-premises

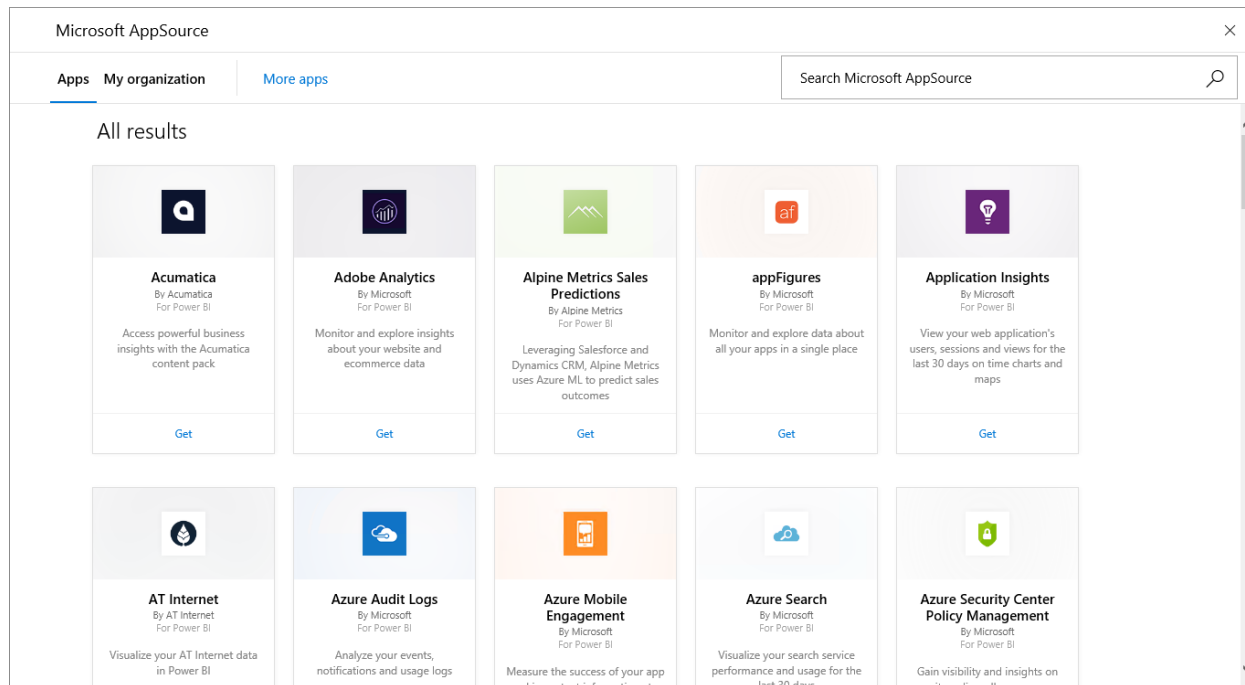
Note: Organizational content packs were introduced in the previous module

# Connecting to Power BI data sources

Formats: Content packs: SaaS applications

Power BI enables connections to SaaS applications

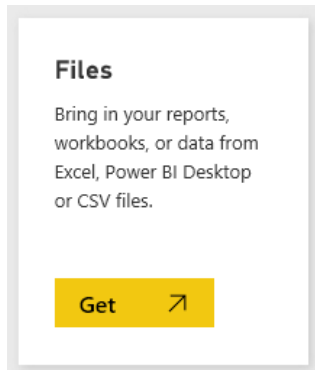
- Connections require an existing subscription
- Each content pack provides pre-built dashboards and reports



# Connecting to Power BI data sources

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## Formats: Files



Files can be uploaded, or connected to on OneDrive for Business, OneDrive Personal or SharePoint Online

- Updates to OneDrive files will appear automatically in dashboards and reports

Supported file types:

- Power BI Desktop files
- Excel workbooks
- CSV files

Note: Power BI Desktop files will be covered in the next module

Maximum size for uploaded files: 250MB

# Connecting to Power BI data sources

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Formats: Files: Excel 2016

Excel 2016 supports direct publication to the Power BI service

- Publication must be made to OneDrive for Business
- Updates made from Excel 2016 will be reflected automatically in Power BI datasets



# Connecting to Power BI data sources

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Formats: Files: Transposition to Power BI

Power BI Desktop files:

- File ► Power BI dataset
- Report ► Power BI report
- An empty dashboard is automatically created, with a token tile to connect to the dataset (drills through to the report)

Excel workbooks:

- Data model content takes precedence over worksheet content
- Workbook data model ► Power BI dataset
- Power View sheets ► Pages of a Power BI report
- PivotTables, PivotCharts and custom fields are not recognized



# Connecting to Power BI data sources

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## Authentication

Power BI connects to data sources as the user

- Connections require valid accounts that meet the requirements of the specific data source

Authentication method is specific to connection type

Method	Applies to
Basic	Azure SQL Database   Marketo   OData feeds
Account key	Azure Blob Store   Azure Table Store   Azure HDInsight
OAuth	Salesforce   Google Analytics   OData feeds
Marketplace key	Azure Marketplace
Anonymous	OData feeds   Web

# Keeping data current in Power BI

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Power BI enables online and on-premises data refresh for datasets uploaded from:

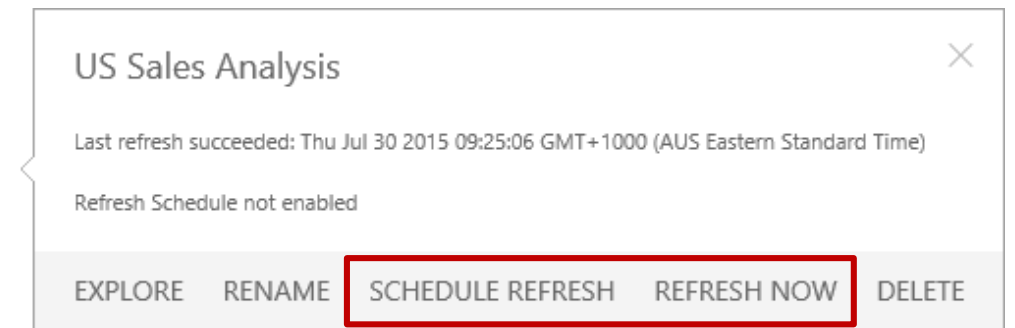
- Power BI Desktop files
- Excel workbooks, where Power Query or Power Pivot is used to query data

Data refresh can be on-demand, or scheduled

- Minimum schedule frequency is hourly

Achieved via a gateway

- Personal
- On-Premises Data Gateway



Note: Gateway access requires the **Power BI Pro** license

# Keeping data current in Power BI

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## Authentication

In order for Power BI to refresh a dataset, credentials must be provided for the data sources included in the dataset

Credentials are securely stored so Power BI can connect to the data source on behalf of the user

- Once specified, the credentials are retained, and may be updated



# Resources

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## Power BI Get Data knowledge base

- <https://support.powerbi.com/knowledgebase/topics/63369-get-data>

## Azure and Power BI knowledge base

- <https://support.powerbi.com/knowledgebase/articles/568614-azure-and-power-bi>

## Power BI Security whitepaper

- <https://support.powerbi.com/knowledgebase/articles/667840-power-bi-security>
- Addresses commonly asked Power BI security questions

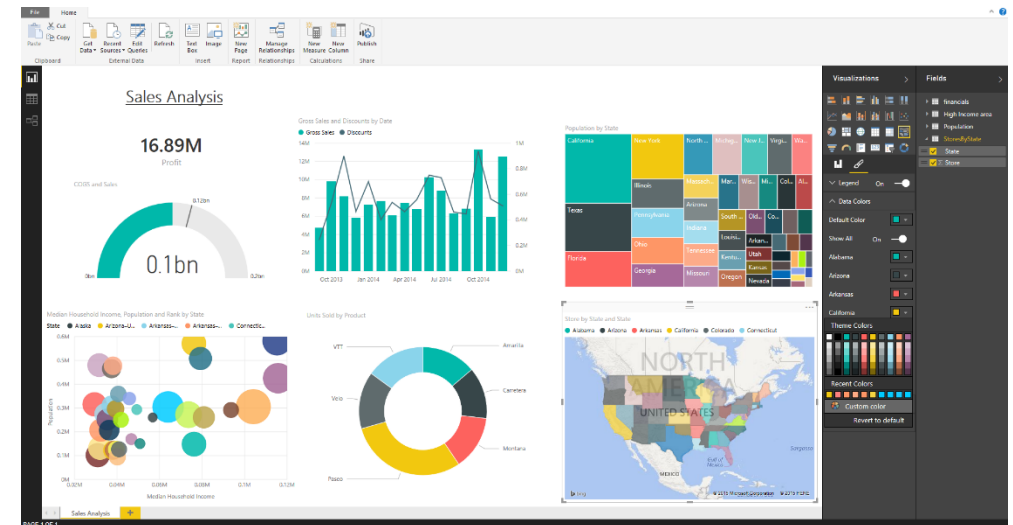
# 04: Creating Power BI Desktop solutions

- Introducing Power BI Desktop
- Creating queries
- Configuring relationships
- Enhancing the model
- Securing the model
- Designing reports
- Publishing to Power BI
- Describing additional capabilities

# Introducing Power BI Desktop

Power BI Desktop is a visual data exploration and reporting tool

- A freely downloadable 32- or 64-bit desktop application optimized for use with the Power BI service
- Integrates proven Microsoft technologies
  - Excel add-ins: Power Query, Power Pivot and Power View
- Enables multiple ways to transform schema and data
- Updated (at least) on a monthly basis



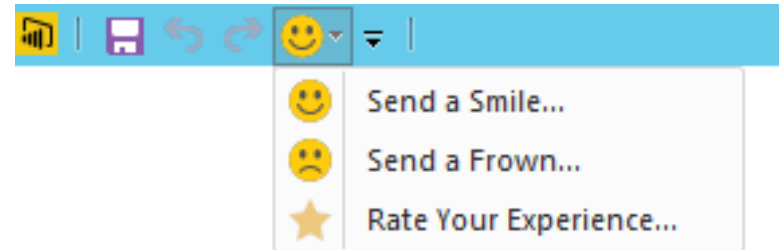
# Introducing Power BI Desktop

Providing feedback

Feedback can be provided:

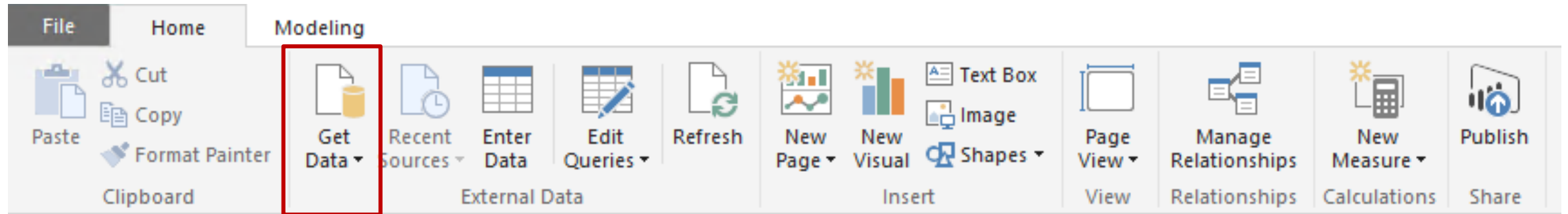
- **Send a Smile** to convey satisfaction with the tool, or a specific feature
- **Send a Frown** to convey the opposite
- Both options open a mail message, with the opposition to include a screenshot and/or formulas

Specific feedback can be sent directly by rating the experience

A screenshot of the Power BI Desktop feedback form. The form is titled 'How was your overall experience?' and includes a five-star rating system. Below the rating, there is a text input field containing the text 'Power BI Desktop rocks!'. At the bottom of the form, there is a link to view the Power BI Privacy Policy and a yellow 'Submit' button.

# Introducing Power BI Desktop

User experience: Getting data



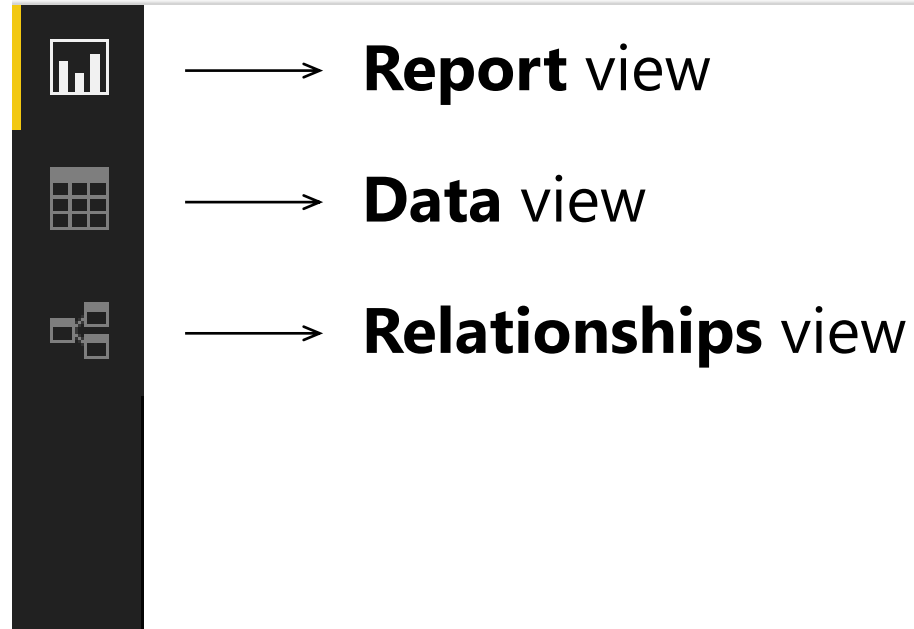
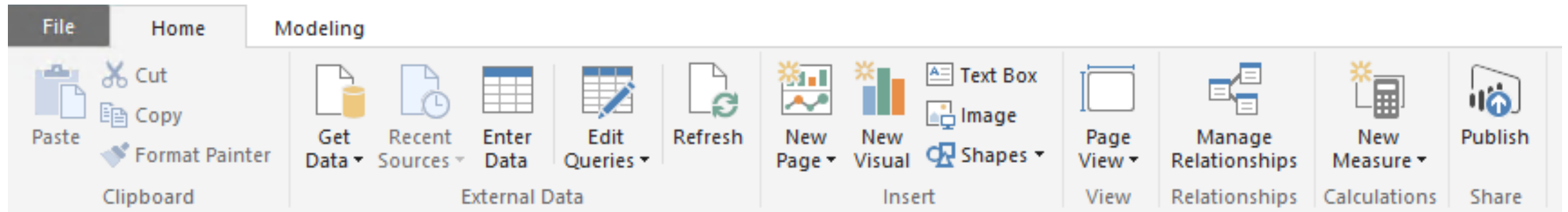
A query is defined by “getting data”

- Source types include File, Database, Azure, Online Services and Other
- Data can be simply and quickly loaded “as is”
- Typically: Select type ► Define connection ► Authenticate ► Load
  - Optionally, the **Query Editor** can be used to transform queries



# Introducing Power BI Desktop

User experience: Three views



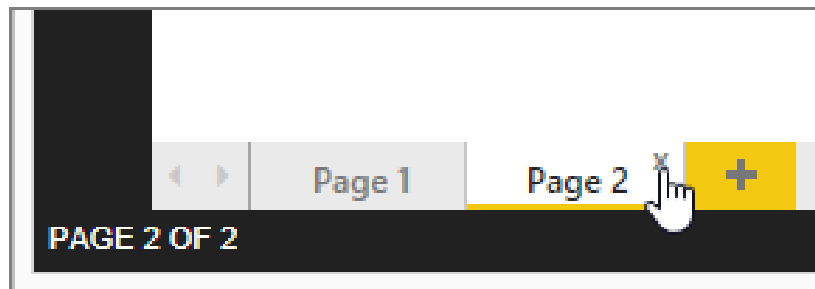
# Introducing Power BI Desktop

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User experience: Report view

Work in **Report View** to create any number of report pages with visualizations

- It provides almost the same design experience as the report Editing View in the Power BI service
- A report will have at least one blank page to start, and any number of pages can be added
- Pages appear, and can be managed, in the navigator pane



# Introducing Power BI Desktop

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User experience: Report view: Continued

The intent of the application is to land the user on the report canvas as quickly as possible

- Built-in intelligence will often infer relationships, and detect data types and categories
- Evidence suggests that most schemas are relatively simple, and so the optimized path is: Load data ► Visualize

Many model transformations can be applied while working in Report View

- Change data types, formats, calculation formulas
- Rename fields
- Sort columns
- Manage relationships

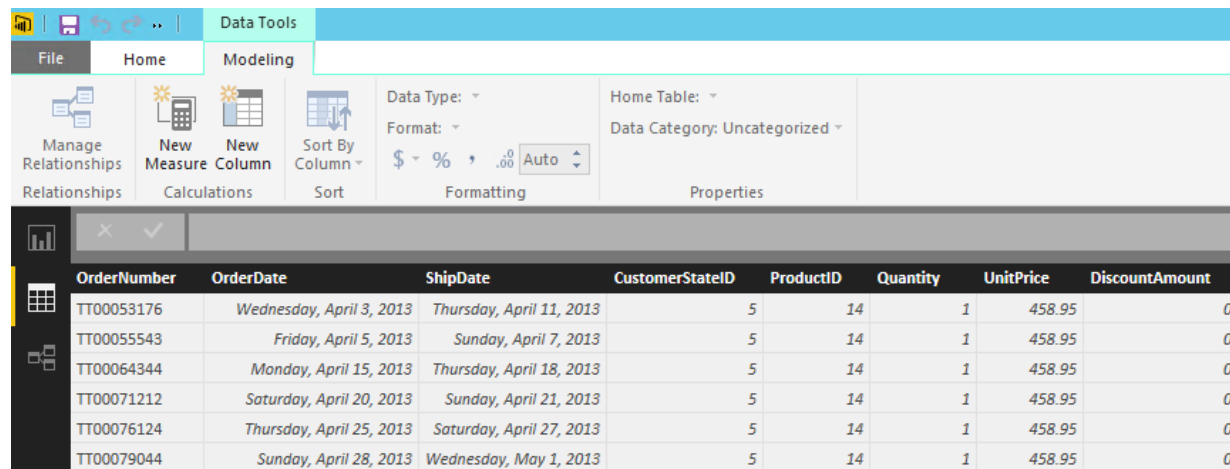
Note: The versatility of Report View, and the immediate visualization of model transformations, is a strong competitive advantage over many other data analysis and reporting products

# Introducing Power BI Desktop

User experience: Data view

Work in **Data View** to inspect, explore, and understand data in the model

- It is a different experience from how you can view tables, columns, and data in **Query Editor**
- This is a view of the data after it has been loaded into the model



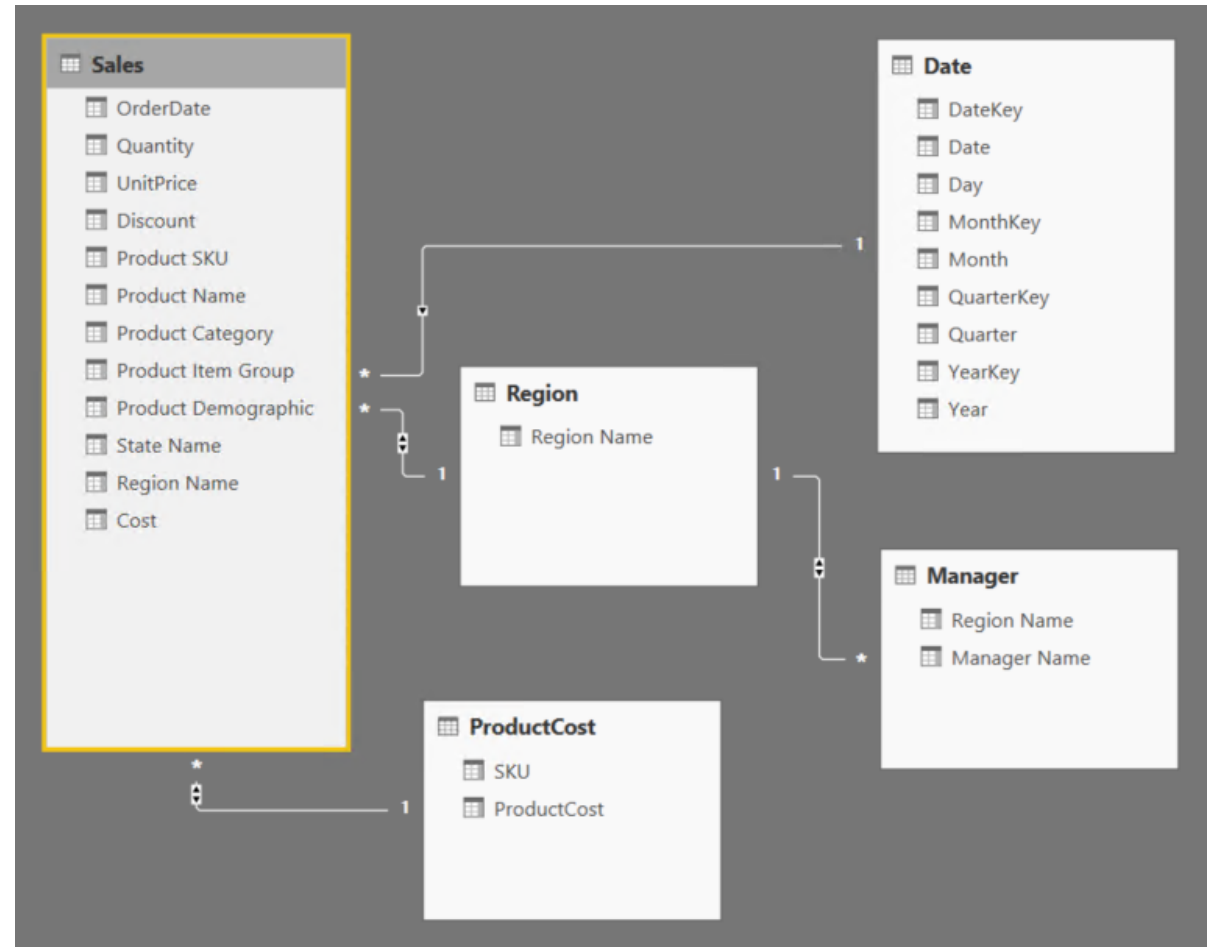
The screenshot shows the Power BI Desktop interface. The top ribbon is 'Data Tools' with sub-ribbons 'File', 'Home', and 'Modeling'. The 'Modeling' ribbon is active, showing options for 'Manage Relationships', 'New Measure', 'New Column', and 'Sort By Column'. Below the ribbon is a table with the following data:

OrderNumber	OrderDate	ShipDate	CustomerStateID	ProductID	Quantity	UnitPrice	DiscountAmount
TT00053176	Wednesday, April 3, 2013	Thursday, April 11, 2013	5	14	1	458.95	0
TT00055543	Friday, April 5, 2013	Sunday, April 7, 2013	5	14	1	458.95	0
TT00064344	Monday, April 15, 2013	Thursday, April 18, 2013	5	14	1	458.95	0
TT00071212	Saturday, April 20, 2013	Sunday, April 21, 2013	5	14	1	458.95	0
TT00076124	Thursday, April 25, 2013	Saturday, April 27, 2013	5	14	1	458.95	0
TT00079044	Sunday, April 28, 2013	Wednesday, May 1, 2013	5	14	1	458.95	0

# Introducing Power BI Desktop

User experience: Relationships view

Work in **Relationships View** to view all tables, columns, measures and relationships in the model



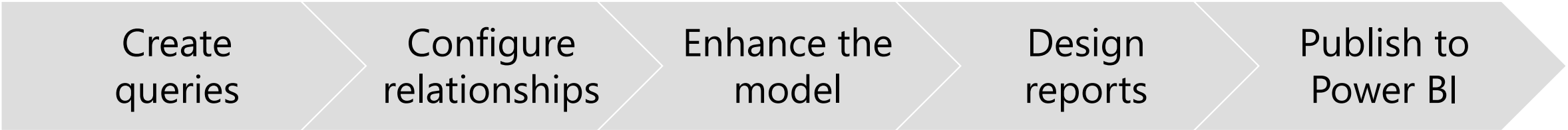
# Introducing Power BI Desktop

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Complex schemas: Development methodology

In contrast to the simple and quick “get then visualize” approach, more complex schemas may follow this methodology:

1. Create queries and use the **Query Editor** to filter, cleanse and reshape data
2. Configure/refine relationships to establish the foundations of a model
3. Enrich the model with calculation logic and formatting
4. Design interactive reports with a broad range of modern data visualizations
5. Publish solutions directly to the Power BI service



Create queries

Configure relationships

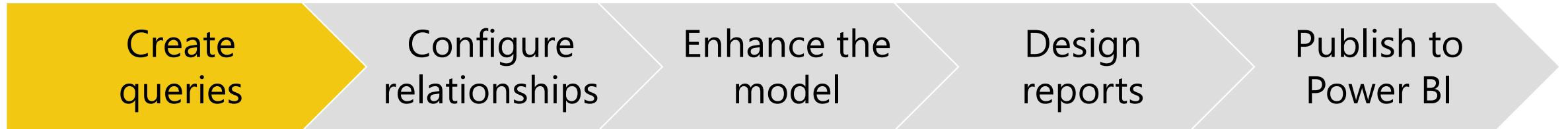
Enhance the model

Design reports

Publish to Power BI

# Creating queries

---



Queries can be edited before loading into the model

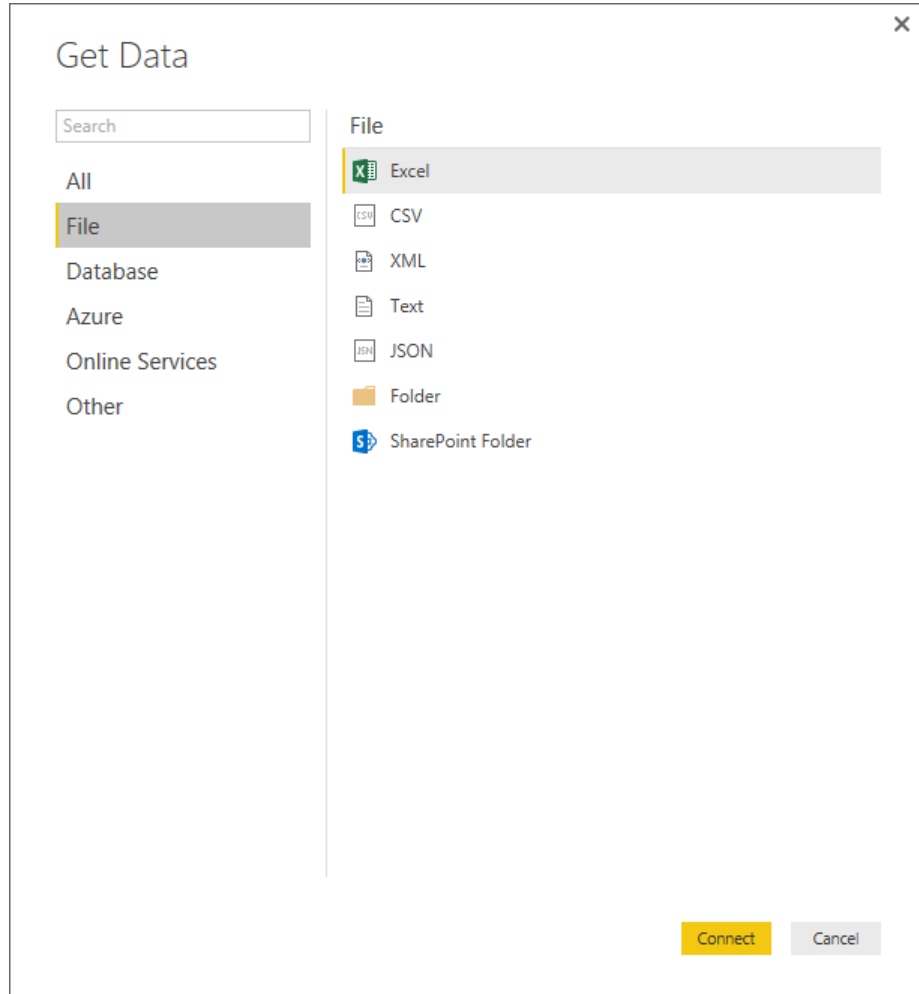
Once created, each query:

- Is referenced by a unique name
- Defines query steps by using the language “M”
  - Most query step logic does not require writing formulas
  - Advanced logic can be written, and even exposed as functions
- Is used to load data into a model table

# Creating queries

---

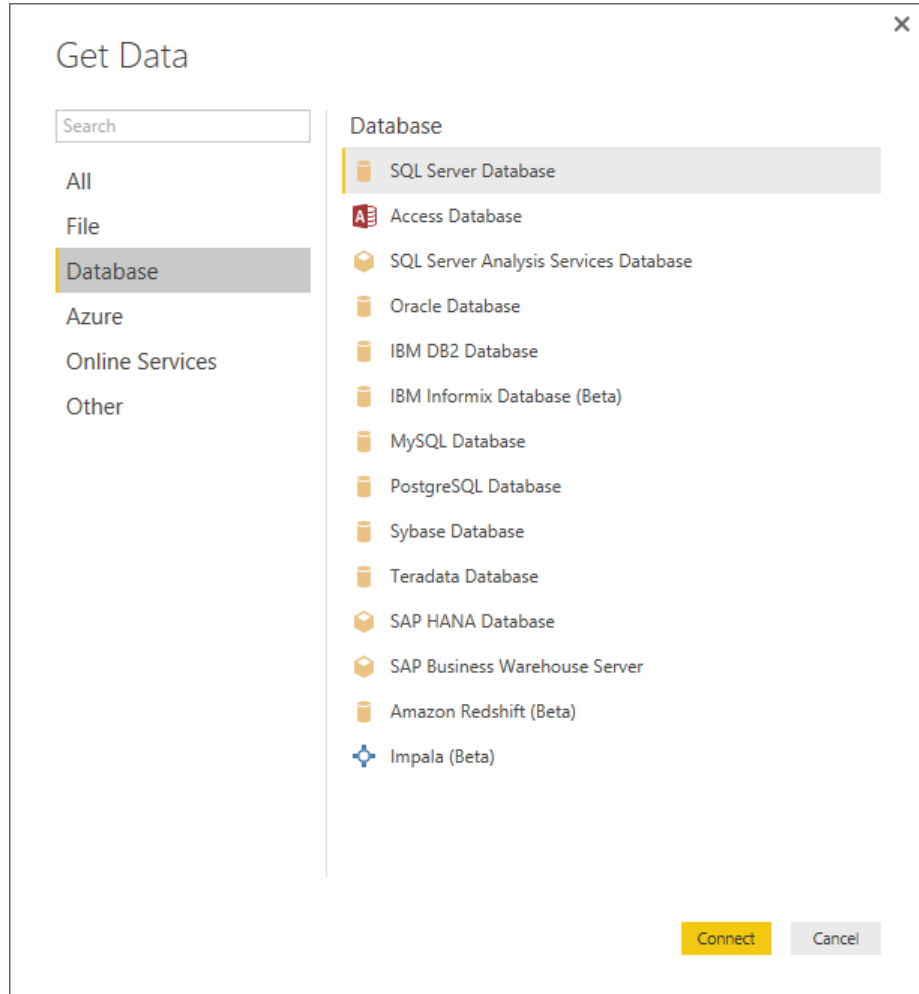
Source types: File





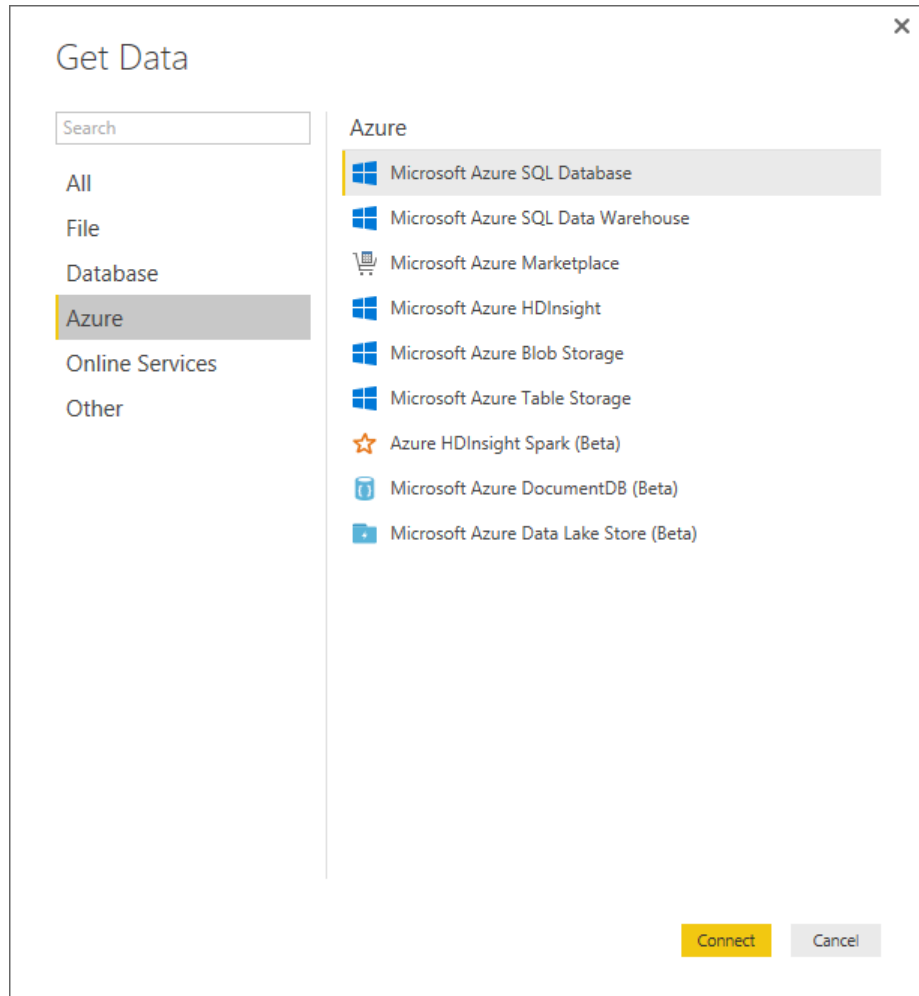
# Creating queries

Source types: Database



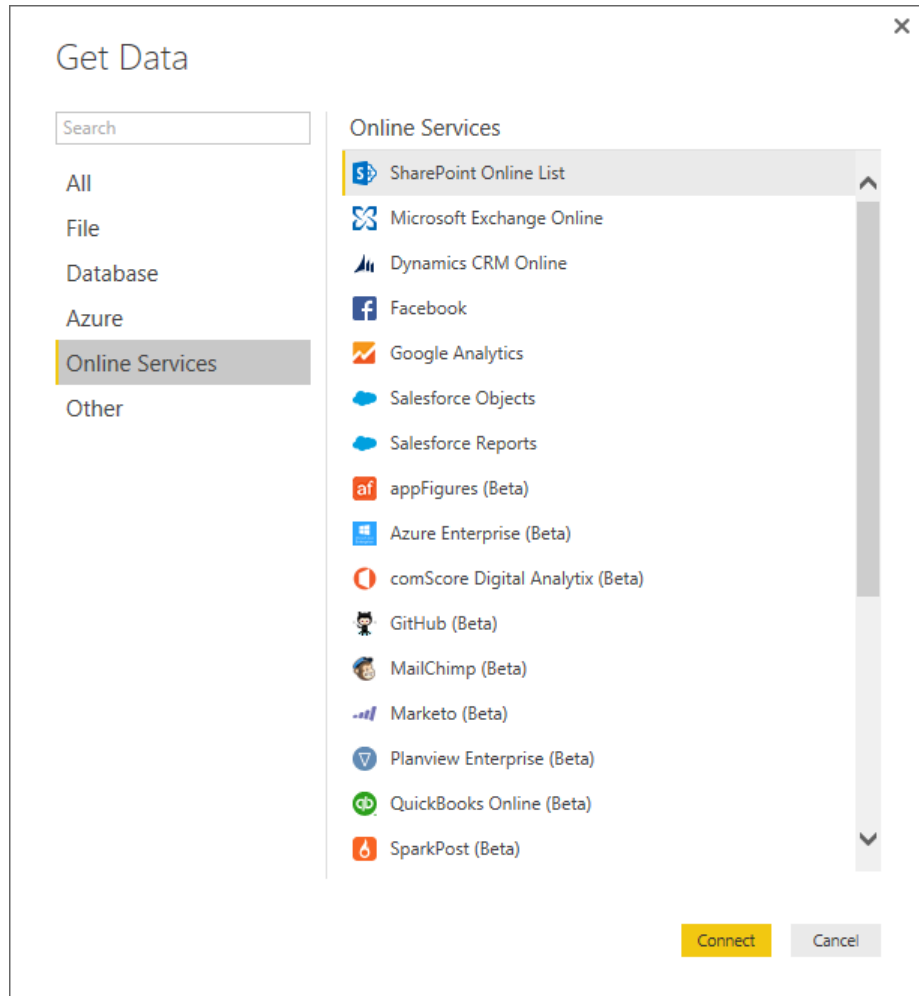
# Creating queries

Source types: Azure



# Creating queries

Source types: Online Services



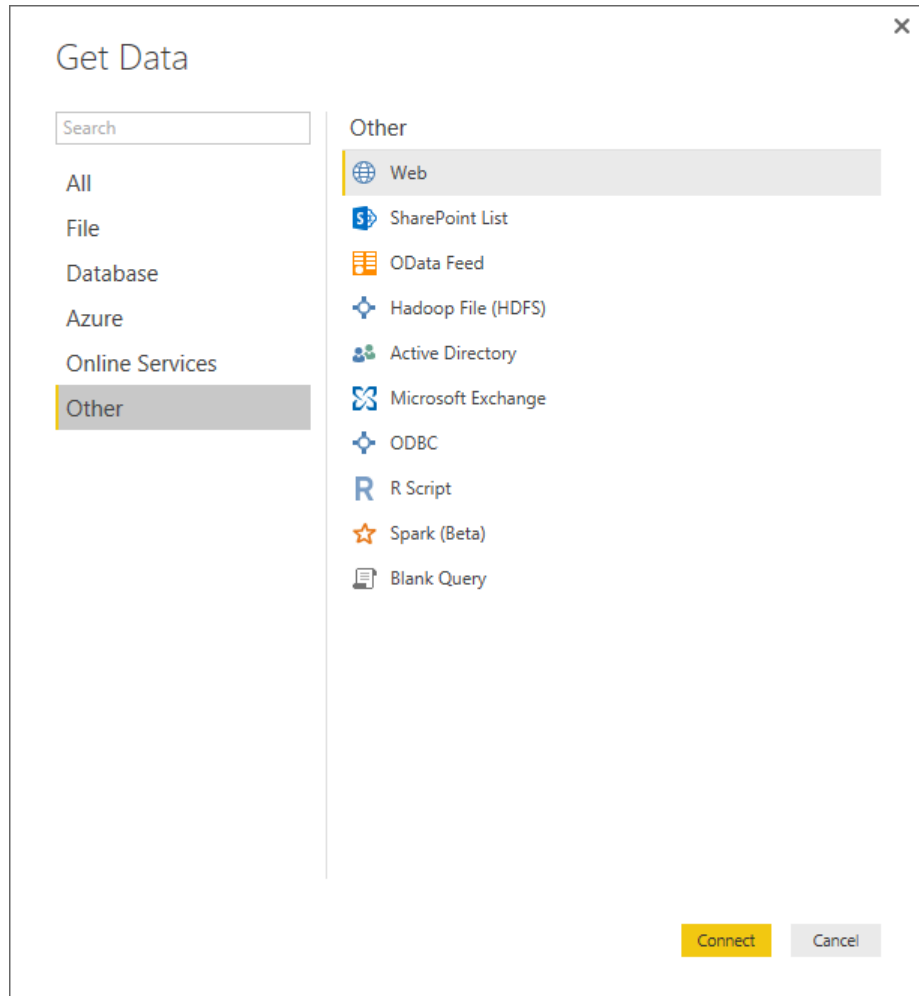
The list also includes:

- Smartsheet
- SQL Sentry (Beta)
- Stripe (Beta)
- SweetIQ (Beta)
- Troux (Beta)
- Twilio (Beta)
- tyGraph (Beta)
- WebTrends (Beta)
- Zendesk (Beta)

\* As at  
August, 2016  
And the list is  
growing!

# Creating queries

Source types: Other



Note: The following are not supported for on-premises refresh

- Hadoop File (HDFS)
- Microsoft Exchange

# Creating queries

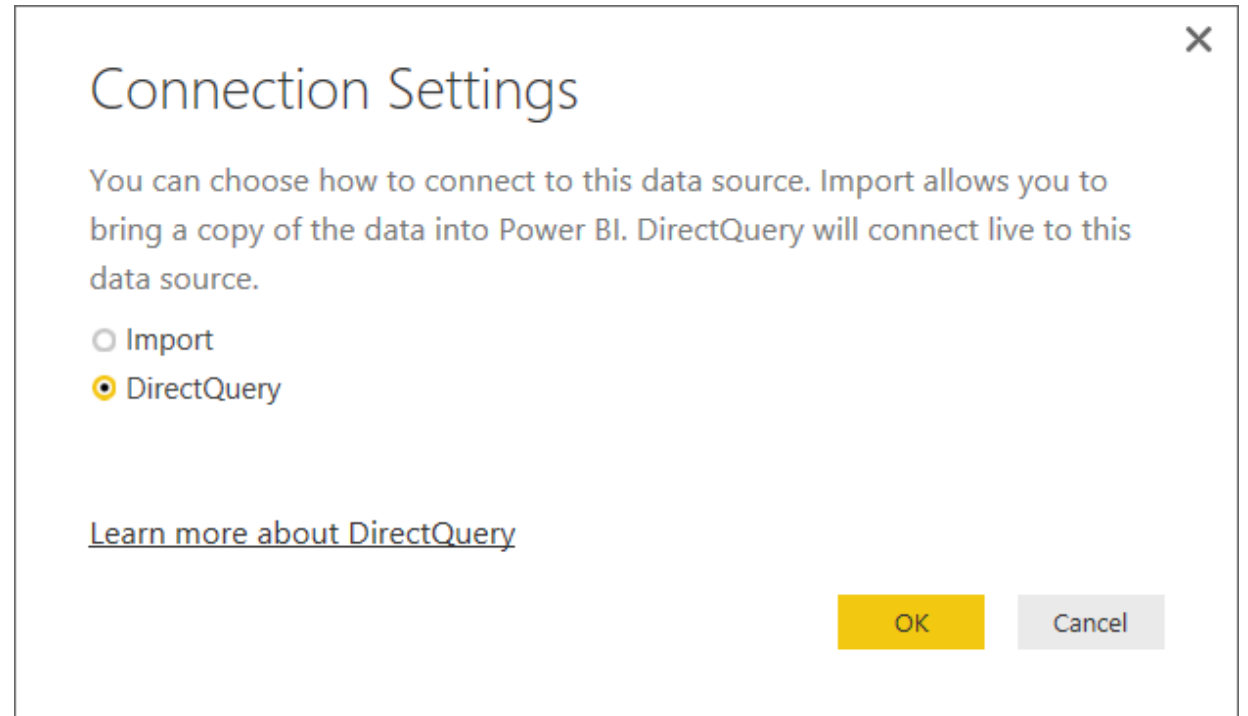
---

DirectQuery mode

Connections made to supported data sources can connect directly by using

**DirectQuery:**

- SQL Server
- Azure SQL Database
- Azure SQL Data Warehouse
- SAP HANA
- Oracle Database
- Teradata Database
- Amazon Redshift (Preview)



# Creating queries

---

DirectQuery mode: Continued

When published to the Power BI Service:

- Until credentials are supplied, opening a published report or exploring a dataset created with a DirectQuery connection to an online service results in an error
- For on-premises data sources that use DirectQuery, an On-Premises Data Gateway must be installed and the data sources must be registered to establish a data connection

Benefits:

- Allows building visualizations over very large datasets
- Reports always use current data

# Creating queries

---

DirectQuery mode: Continued

Limitations:

- All tables must come from a single database
- The **Query Editor** query cannot be overly complex
- DAX formula are restricted to a subset of the DAX functions
- Relationship filtering is limited to a single direction, rather than both directions
  - If enabled, a preview feature allows cross filtering in both directions
- The data type of a column cannot be changed
- Q&A is not supported
- Quick Insights are not available

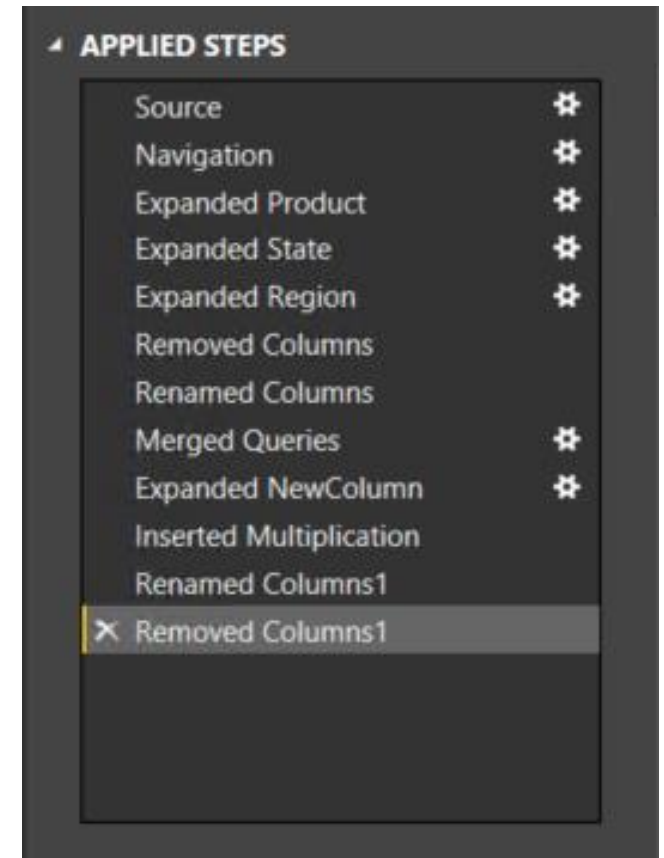
# Creating queries

---

## Defining query steps

The **Query Editor** can be used to filter, cleanse and reshape data into the desired result

- Steps can easily be produced by applying column filters, and by using the commands available from the ribbon, or the query and column context menus
- It is possible to select a step and preview the data at that step
- Steps can be removed – but take care not to remove a step that downstream steps depend on
- Step formulas can be viewed or edited in the formula bar





# Creating queries

---

Defining query steps: Commands

Numerous commands are available on the **Query Editor** ribbons and context menus to:

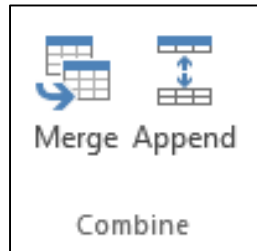
- Manage columns
- Reduce rows, including removing errors
- Transform
- Split
- Add columns, by using formulas

As the editor experience is WYSIWYG, users can easily experiment and rollback changes

# Creating queries

---

Defining query steps: Combining queries



New queries can be created by:

- Merging two queries (joining on a common column)
- Appending two queries (union)

Merge join options include:

Join Kind

Left Outer (all from first, matching from second)

Right Outer (all from second, matching from first)

Full Outer (all rows from both)

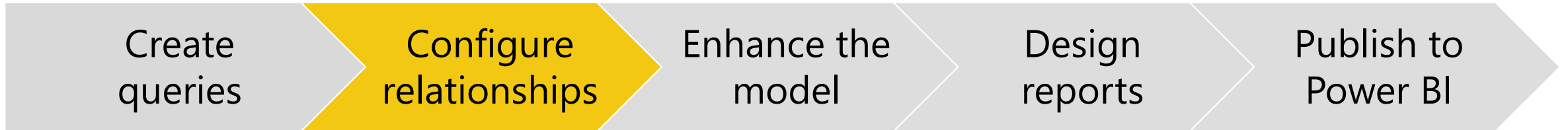
Inner (only matching rows)

Left Anti (rows only in first)

Right Anti (rows only in second)

# Configuring relationships

---



Relationships enable filters on one table to appropriately propagate filter to other tables

- Note: Relationships are not foreign key (integrity) constraints

They can be defined between any two tables, regardless of their data connection or source type

- However, they must be based on single columns with matching data types
- There is no support for self-referencing relationships

# Configuring relationships

---

## Advanced options

It is possible to define multiple relationship paths between two tables

- One relationship must be **active**, and will be used by default during model browsing
- The remaining relationships are **inactive**, and can be used explicitly in model calculations

# Configuring relationships

---

Advanced options: Continued

Configure relationship advanced options to set:

- Cardinality
- Cross filter direction
  - The **Both** option enables many-to-many analysis
- Active/inactive

▾ Advanced options

Cardinality

Many to One (\*:1)

One to One (1:1)

One to Many (1:\*)

Cross filter direction

Single

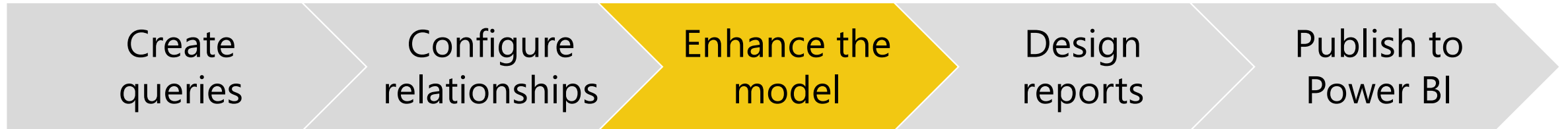
Both

Make this relationship active

Tip: All options can be interpreted from symbols used in the relationship diagram

# Enhancing the model

---



Model tables can be extended with hierarchies, calculations, and may be hidden (i.e. not available for reporting)

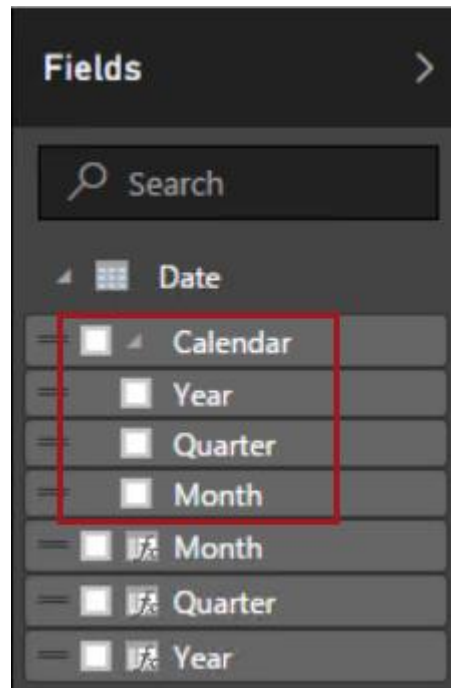
Model column properties can be set:

- Data type
- Format
- Categorization
  - Spatial types, or web URLs
- Sort order, based on another column from the same table
- Default summarization (numeric, text and date columns)
- Visibility

# Enhancing the model

## Hierarchies

Hierarchies can be added to a table, enabling navigation between columns (in the one-to-many direction)



Year	Quarter	Month
CY2013	CY2013 Q1	CY2013 Jan
CY2013	CY2013 Q1	CY2013 Feb
CY2013	CY2013 Q1	CY2013 Mar
CY2013	CY2013 Q2	CY2013 Apr
CY2013	CY2013 Q2	CY2013 May
CY2013	CY2013 Q2	CY2013 Jun
CY2013	CY2013 Q3	CY2013 Jul
CY2013	CY2013 Q3	CY2013 Aug
CY2013	CY2013 Q3	CY2013 Sep
CY2013	CY2013 Q4	CY2013 Oct
CY2013	CY2013 Q4	CY2013 Nov
CY2013	CY2013 Q4	CY2013 Dec
CY2014	CY2014 Q1	CY2014 Jan
CY2014	CY2014 Q1	CY2014 Feb
CY2014	CY2014 Q1	CY2014 Mar
CY2014	CY2014 Q2	CY2014 Apr

# Enhancing the model

---

## Calculations

There are three different types of calculations, and each are defined by using DAX:

- Calculated columns
- Calculated tables
- Measures

DAX = Data Analysis Expressions (DAX), consisting of:

- Excel functions (~80 functions)
- Table functions
- Aggregate functions
- Relationship navigation functions
- Context modification functions
- Time Intelligence functions

Note: DAX theory is not covered in this training course



# Enhancing the model

---

Calculations: Calculated columns

Define **Calculated Columns** to add new columns to tables

Column values for each row are materialized and stored in the model

- If possible, to reduce the model size, avoid creating them

Column values are recalculated when:

- The table is refreshed
- Formula dependencies are refreshed

# Enhancing the model

---

Calculations: Calculated tables

Define **Calculated Tables** to add new tables to the model, based on existing data from other tables

- Calculated tables are generally best for intermediate calculations of data stored in the model, rather than calculated on the fly
- Calculated tables appear in Relationship View, and relationships can be defined with other tables
- If possible, to reduce the model size, avoid creating them
- Calculated tables are recalculated in the same circumstances as calculated columns

Note: This is an advanced design concept

# Enhancing the model

---

Calculations: Measures

Define **Measures** to add aggregation logic to the model

Values are not materialized in the model

- Formulas are evaluated at query time

Common aggregate functions:

- SUM
- COUNT, DISTINCTCOUNT
- AVERAGE
- MIN, MAX

Note: Summarizable columns are aggregated by reports—so defining measures is not necessary for simple aggregation requirements

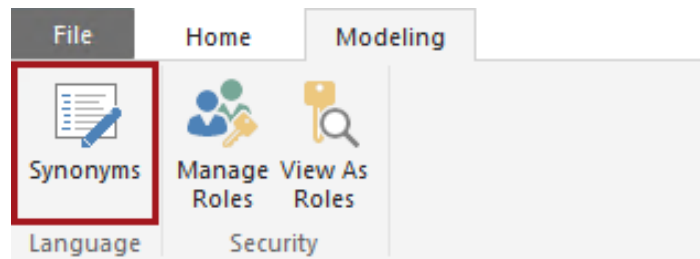
# Enhancing the model

---

## Tuning the model

The model design can be tuned to improve its usefulness and Q&A response accuracy

- Set appropriate column data types, formats and categorization
- Ensure relationships are configured
- Ensure table and columns are visible/hidden
- Ensure table, column and measure names are unique and concise
- Define synonyms (in Relationships view) for tables, columns, and calculations



# Securing the model

---

It is possible to restrict data access to datasets for given users

- Filters restrict data at the row level, and are assigned to roles
- Users are also assigned to roles

Roles are defined in Power BI Desktop

- DAX expressions are used to filter tables, and can use the USERNAME() function to retrieve the current user name
  - Within Power BI Desktop, USERNAME() will return a user in the format of DOMAIN\User
  - Within the Power BI service, USERNAME() will return the user's User Principal Name (UPN)—looks similar to an email address

Users are assigned in the Power BI service

# Securing the model

---

Row-level security: Continued

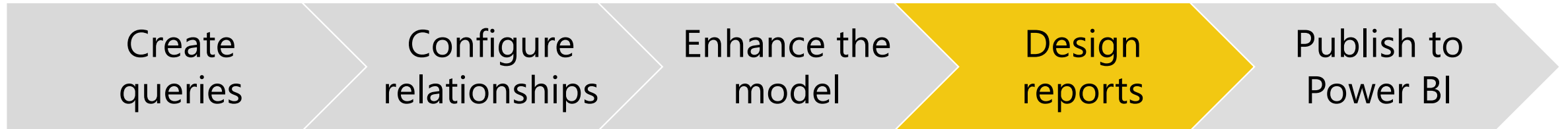
Limitations:

- Only imported data and DirectQuery connections are supported
- Q&A and Cortana are not supported
- Analyze in Excel is not supported
- External sharing is not supported

Row-level security is a Power BI Pro feature

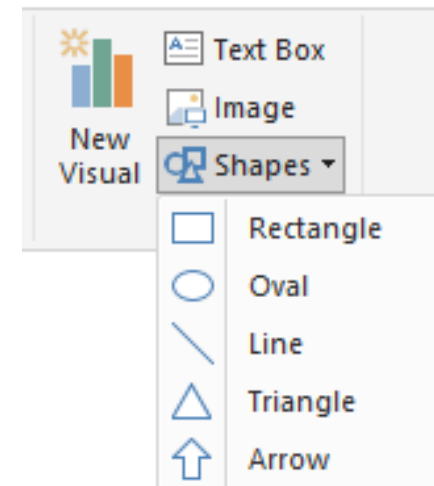
# Designing reports

---



Reports can be designed based on the visible model interface  
The design experience is almost the same as is available in the Power BI online service

- Text boxes, images and shapes can be added
- Text boxes can contain hyperlinks



# Designing reports

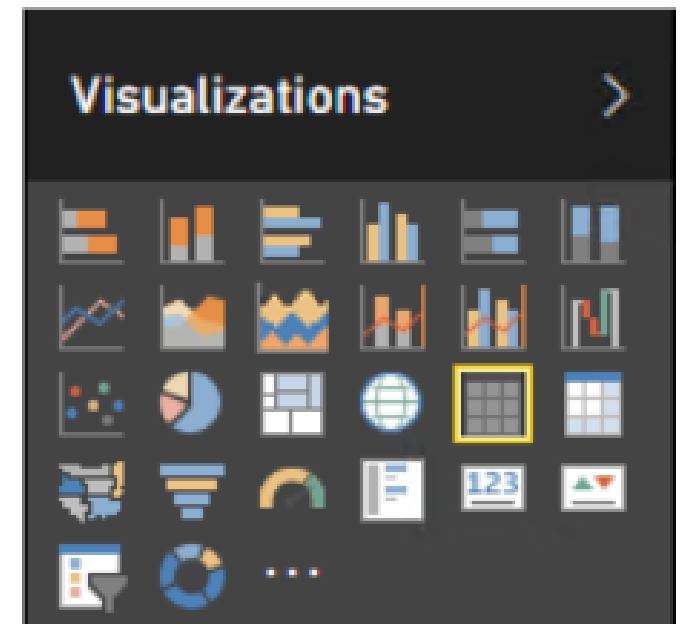
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## Custom visuals

Custom visuals can be imported to extend beyond the out-of-the-box visualizations

- A gallery of visuals created by the Power BI community is available at <https://app.powerbi.com/visuals>
- Browse through the visuals or submit one of your own for others to use
- The list of available visuals is growing each month
- Custom visuals will render in the Power BI service

Note: The topic of custom visual development is covered later in this training course





# Designing reports

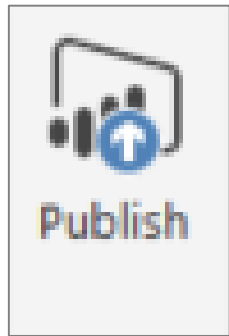
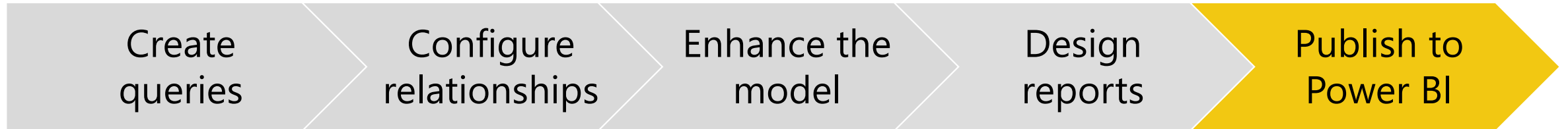
Custom visuals: Gallery (subset)



\* And the list is growing!

# Publishing to Power BI

---



The Power BI Desktop file can be uploaded to the Power BI service, or published directly

- Publish directly to your workspace or a group

Note, if overwriting an existing dataset:

- If there are two or more datasets with the same name, remove one, or rename the Power BI Desktop file
- Renaming columns or measures can break existing reports or dashboard tiles

# Publishing to Power BI

---

Continued

If row-level security roles have been defined, once published, assign users to roles



# Resources

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## Power BI Desktop knowledge base

- <https://support.powerbi.com/knowledgebase/topics/68530-power-bi-desktop>

## Tips and tricks for creating reports in Power BI Desktop

- <https://support.powerbi.com/knowledgebase/articles/464157-tips-and-tricks-for-creating-reports-in-power-bi-d>

## DAX Resource Center

- "Your one stop shop for all things DAX"
- <http://social.technet.microsoft.com/wiki/contents/articles/1088.dax-resource-center.aspx>



# Resources

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## Power BI Visuals Gallery






- <https://app.powerbi.com/visuals>


# 06: Summary


- Power BI overview
- Power BI benefits by role
- Power BI licensing
- Signing up for Power BI

# Power BI overview

-  **SaaS solutions**  
*E.g. Marketo, Salesforce, GitHub, Google analytics*
-  **On-premises data**  
*E.g. Analysis Services*
-  **Organizational content packs**  
*Corporate data sources or external data services*
-  **Azure services**  
*E.g. Azure SQL, Stream Analytics*
-  **Excel files**  
*Workbook data and data models*
-  **Power BI Desktop files**  
*Related data from files, databases, Azure, and other sources*

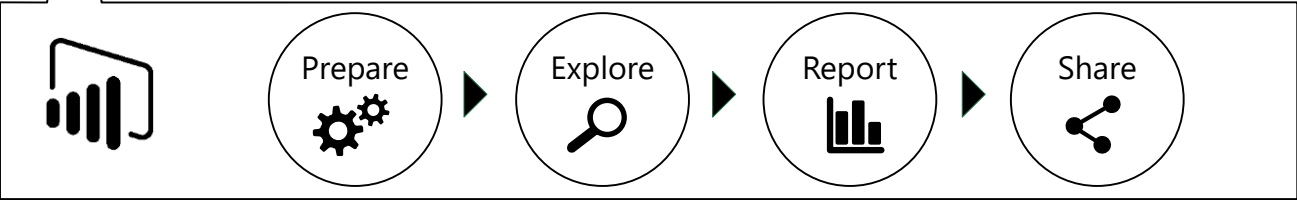
-  Content packs
-  Live dashboards
-  Visualizations
-  Reports
-  Datasets
-  Data refresh

 Natural language query

 Sharing & collaboration



## Power BI Desktop



## Power BI REST API



```

{
  "name":(String),
  "tables":[
    ...
  ]
}

{
  "name":(String),
  "columns":[
    {
      "name":(String),
      "dataType":(String)
    },
    ...
  ]
}
    
```

# Power BI benefits by role

---

Whatever the role, Power BI brings all data together

## Business user

- Import data from SaaS sources, and work with dashboards and reports

## Business analyst

- Import, reshape and model data
- Create compelling reports and visualizations
- Create content packs to share insights

## BI professional

- Connect to live Azure data services
- Connect to on-premises Analysis Services databases
- Empower colleagues to create their own reports

## Developer

- Integrate applications with Power BI
- Create real-time dashboards
- Develop custom visuals



# Power BI licensing

---

Two licenses are available, subject to change:

- **Power BI:** Free! 😊
- **Power BI Pro:** Currently USD 9.99/month with an annual subscription (Academic, government and non-profit pricing is available)

Encourage customers to review the pricing and feature matrix

- <https://powerbi.microsoft.com/pricing>

Power BI Pro trial license can be obtained for 60 days

# Power BI licensing

---

## Feature differences

In short, the differences between the two licenses:

Feature	Power BI (Free)	Power BI Pro
Data capacity limit	1 GB/user	10 GB/user
Consume content that is scheduled to refresh	Daily	Up to 8 times per day
Data streaming rate	10K rows/hour	1M rows/hour
Consume live data sources with full interactivity	No	Yes
Access on-premises data with gateways	No	Yes
Share dashboards	Yes	Yes
All other collaboration features	No	Yes
Row-level security for users and groups	No	Yes

Non-“Power BI Pro” users can share dashboards. However, a Power BI Pro license is required to interact with, or consume, content using features that are only available to users with a Power BI Pro license.



# Resources

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Power BI site

- <http://powerbi.microsoft.com>

Power BI documentation

- <http://support.powerbi.com/>

Power BI community

- <http://community.powerbi.com/>

Power BI blog

- <http://blogs.msdn.com/b/powerbi/>

Tip: Power BI is evolving at a rapid rate. One of the best ways to keep pace with updates is to subscribe to the Power BI blog.



# Resources

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Continued

Power BI pricing

- <https://powerbi.microsoft.com/pricing>

Microsoft Cloud and Enterprise Partner Resources

- <http://aka.ms/powerbipartners>
- Includes up-to-date resources:
  - Customer-ready materials
  - Customer evidence
  - Training and labs
  - Demos
  - “What to do next”



# Resources

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Continued

## Explore Virtual Labs!

Immerse yourself in a virtual hands-on lab and experience the product first hand, or try our guided experiences, and click through a tour of the various product features.

[View system requirements for virtual labs](#)



- <https://technet.microsoft.com/en-us/virtuallabs>
- Search the growing library of Power BI technical labs

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➔ Take the Power BI Tour

Enter your work email address

Use it free

By clicking Use it free, you agree to the Power BI Preview Terms of Service

