
axisAnalyzing & Visualizing Data with Power BI

What is Business Intelligence or Insights?

in·sight

/'in,sīt/ 

noun

the capacity to gain an accurate and deep intuitive understanding of a person or thing.

"this paper is alive with sympathetic **insight** into Shakespeare"

synonyms: intuition, discernment, perception, awareness, understanding, comprehension, apprehension, appreciation, penetration, acumen, perspicacity, judgment, acuity;

- a deep understanding of a person or thing.

plural noun: **insights**

"the signals would give marine biologists new **insights** into the behavior of whales"

synonyms: understanding of, appreciation of, revelation about; [More](#)

- **PSYCHIATRY**

new understanding by a mentally ill person of the causes of their disorder.

Data analysts translate numbers into plain English Every business collects data, whether it's sales figures, market research, logistics, or transportation costs.

Where do I start?

1. What is my question or what I am looking for?
2. What data connections do I need to answer the question?
 - a. For starters... data sources may lead to more questions or too much information that needs to be "hidden" from search tools.
3. What columns from the grouped data do I use?
4. What "dimensions" are missing?
5. What visuals represent the "answer" well?

Power BI is a collection of software services, apps, and connectors that work together to turn your unrelated sources of data into coherent, visually immersive, and interactive insights.

Whether your data is a simple Excel spreadsheet, or a collection of cloud-based and on-premises hybrid data warehouses, **Power BI** lets you easily connect to your data sources, visualize (or discover) what's important, and share that with anyone or everyone you want.

- Modeling and real-time analytics
- custom development
- Personal report and visualization tool
- The analytics and decision engine (Projects/Groups/Organizations)

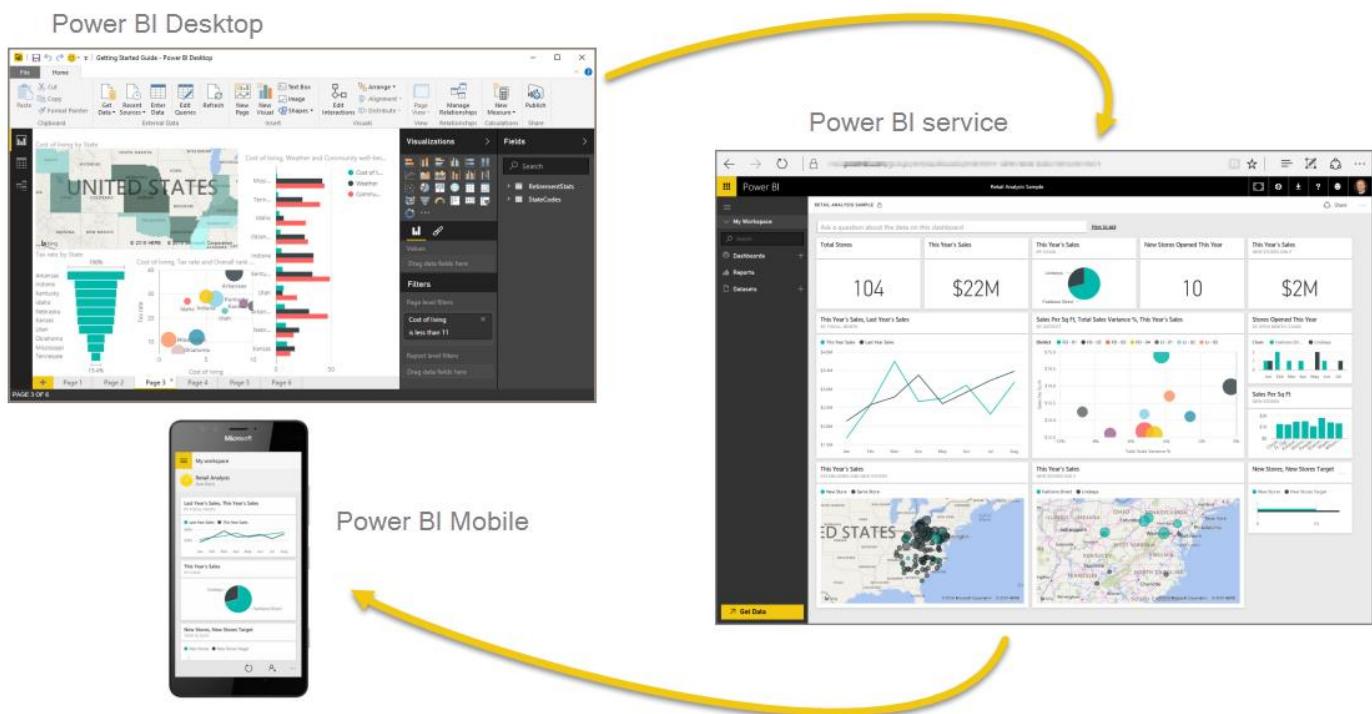
The 4 major building blocks of Power BI are: **dashboards**, **reports**, **workbooks**, and **datasets**. And they're all organized into **workspaces**.



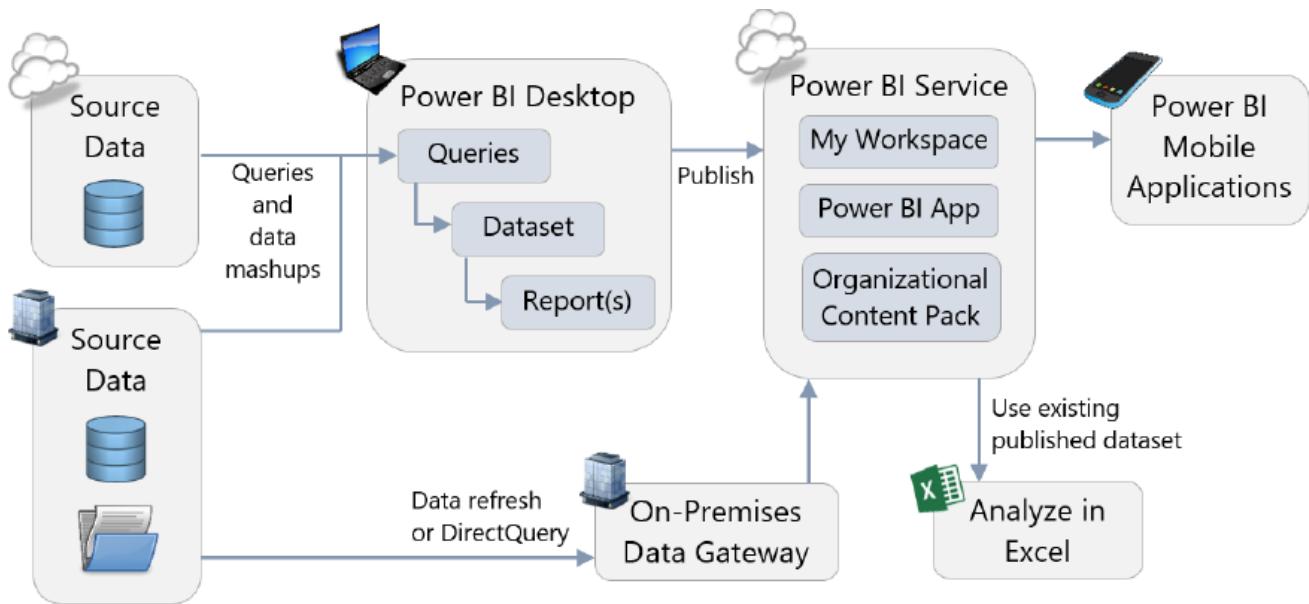
Power BI is also robust and enterprise-grade, ready for extensive modeling and real-time analytics, as well as custom development. So, it can be your personal report and visualization tool, and can also serve as the analytics and decision engine behind group projects, divisions, or entire corporations.

Power BI consists of 3 basic parts:

- Windows desktop application called **Power BI Desktop**
- An online SaaS (*Software as a Service*) service called the **Power BI service**
- Mobile **Power BI apps** available on Windows, iOS and Android phones, tablets and devices.

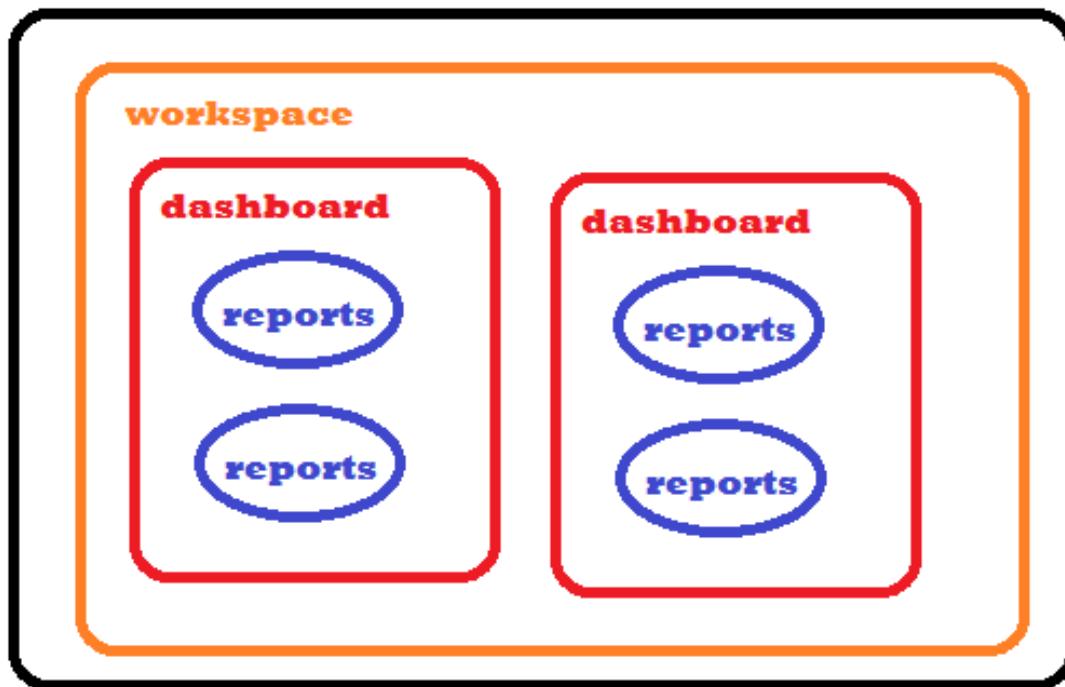


Power BI – Free Online, Power BI Desktop, Power BI Service/Pro/License & Power BI Mobile – Gateway for Auto-refresh



Account holds Workspaces – Dashboards – Reports – Free vs. Pro affects Sharing, Collaborating, Auto-refresh

Power BI Account



Examples: What Each Power BI Part Does

- a) **Power BI Desktop**
 - a. Query, load and transformation of data from external data sources, extend your data model with measures and relationships with data modeling concepts.
 - b. Import your Power BI Desktop file into your Power BI site. (.pbix)
- b) Publish **Power BI Desktop** reports to the **Power BI service** for sharing.
- c) Use **Power BI (Mobile) apps** to monitor progress on her sales quotas, and to drill into new sales lead details.
- d) Developer, use **Power BI APIs** to push data (into datasets or to embed dashboards and reports into custom applications).

3 Main Power BI elements

1. Connecting to data sources and building a report in **Power BI Desktop**.
2. Published from **Desktop** to **Power BI service** shared in **service**
3. **Mobile apps** can *consume* (view and interact with) the report.
4. *Create* permissions

Cloud vs. behind a Firewall

- Cloud uses Azure
- On Premise uses server

Power BI Report Server

- A solution that deployed behind a firewall
- Deliver reports to the authenticated users via web browser, mobile device, or email.
- Power BI Report Server is compatible with Power BI in the cloud

The Parts

Workspaces

Workspaces are containers for dashboards, reports, workbooks, and datasets in Power BI. There are two types of workspaces: *My workspace* and *app workspaces*.

What is an *app*? A Power BI *app* is a collection of dashboards and reports built to deliver key metrics for your organization. Apps are interactive but can't be edited.

My workspace

- *My workspace* is the personal workspace for any Power BI customer to work with your own content.
- *Only you have access to your My workspace.*
- You can share dashboards and reports from your My Workspace.
- If you want to collaborate on dashboards and reports, or create an app, then you want to work in an app workspace.

App workspaces

- App workspaces are *used to collaborate and share content with colleagues*.
- They are also the places where you create, publish, and manage apps for your organization. Think of them as staging areas and containers for the content that will make up a Power BI app.
- You can add colleagues to your app workspaces and collaborate on dashboards, reports, workbooks, and datasets.
- (*Req**) All app workspace members need Power BI Pro licenses, but app consumers (the colleagues who have access to the apps) don't necessarily need Pro licenses.

To learn more, see the [Share your work](#) section of the Table of contents, starting with [How should I collaborate and share dashboards and reports](#)

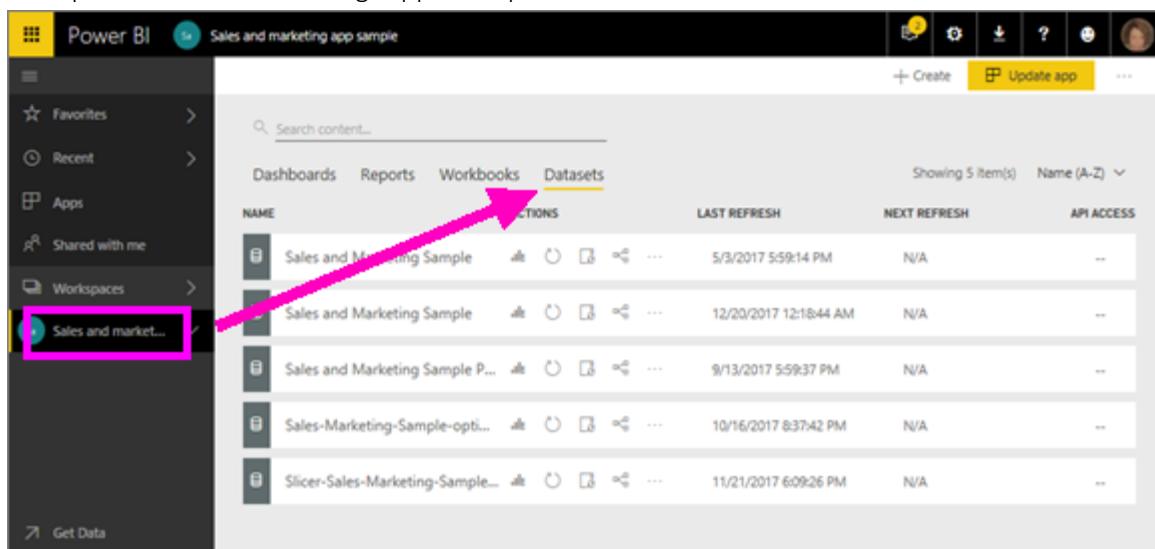
Now on to the Power BI building blocks. You can't have dashboards or reports without data (well, you can have empty dashboards and empty reports, but they're not very useful until they have data), so let's start with **datasets**.

Datasets

A *dataset* is a collection of data that you *import* or *connect* to. Power BI lets you connect to and import all sorts of datasets and bring all of it together in one place.

Datasets are [associated with workspaces](#) and a single dataset can be part of many workspaces. When you open a workspace, the associated datasets are listed under the **Datasets** tab. Each listed dataset represents a single source of data, for example, an Excel workbook on OneDrive, or an on-premises SSAS tabular dataset, or a Salesforce dataset. There are many different data sources supported, and we're adding new ones all the time. [See the list of dataset types that can be used with Power BI](#).

Example: "Sales and marketing" app workspace is selected and clicked the tab for **Datasets**.



The screenshot shows the Power BI application interface. On the left, there is a sidebar with navigation options: Favorites, Recent, Apps, Shared with me, Workspaces (with a dropdown menu showing 'Sales and market...', which is highlighted with a pink box and arrow), and Get Data. The main content area has a title bar 'Power BI' and 'Sales and marketing app sample'. Below the title bar is a toolbar with 'Create', 'Update app', and other icons. The main content area has a search bar 'Search content...'. Underneath the search bar are tabs: Dashboards, Reports, Workbooks, and Datasets (which is highlighted with a yellow underline). Below the tabs is a table listing datasets. The table columns are NAME, LAST REFRESH, NEXT REFRESH, and API ACCESS. The table contains five rows of dataset information.

NAME	LAST REFRESH	NEXT REFRESH	API ACCESS
Sales and Marketing Sample	5/3/2017 5:59:14 PM	N/A	--
Sales and Marketing Sample	12/20/2017 12:18:44 AM	N/A	--
Sales and Marketing Sample P...	9/13/2017 5:59:37 PM	N/A	--
Sales-Marketing-Sample-opti...	10/16/2017 8:37:42 PM	N/A	--
Slicer-Sales-Marketing-Sample...	11/21/2017 6:09:26 PM	N/A	--

ONE dataset...

- Can be used over and over in one or in many workspaces.

- Can be used in many different reports.
- Visualizations from that one dataset can display on many different dashboards.



To connect to or import a dataset, select **Get Data** (at the bottom of the left navigation) or select **+ Create > Dataset** (in the upper right corner). Follow the instructions to connect to or import the specific source and add the dataset to the active workspace. New datasets are marked with a yellow asterisk. **The work you do in Power BI does not change the underlying dataset.**

If you're part of an app workspace, datasets added by one workspace member are available to the other workspace members.

- Datasets can be refreshed, renamed, explored, and removed.
- Use a dataset to create a report from scratch or by running quick insights.
- To see which reports and dashboards are already using a dataset, select **View related**.
- To explore a dataset, select it to open the dataset in the report editor
- Slice, Dice & Dig: Data and Creating Visualizations. So, let's move on to the next topic -- reports.

Dig deeper

- Power BI Premium - what is it?
 - Enables larger data volumes and also enables widespread distribution of content without purchase per-user Pro licenses for content consumers.
- Sample datasets for Power BI

Reports

(Req*) Are feature of Power BI service and Power BI Desktop. The experience of working with reports is almost identical. However, for mobile, you can't create reports but you can view, share, and annotate reports.

A Power BI report is one or more pages of visualizations (charts and graphs like line charts, pie charts, treemaps, and many more). Visualizations are also called **visuals**.

All of the visualizations in a report come from a single dataset.

Reports can be created from scratch within Power BI, can be imported with dashboards that colleagues share with you, or can be created when you connect to datasets from Excel, Power BI Desktop, databases, SaaS applications and apps.

For example, when you connect to an Excel workbook that contains Power View sheets, Power BI creates a report based on those sheets. And when you connect to an SaaS application, Power BI imports a pre-built report.

There are 2 modes to view and interact with reports: Reading view and Editing view.

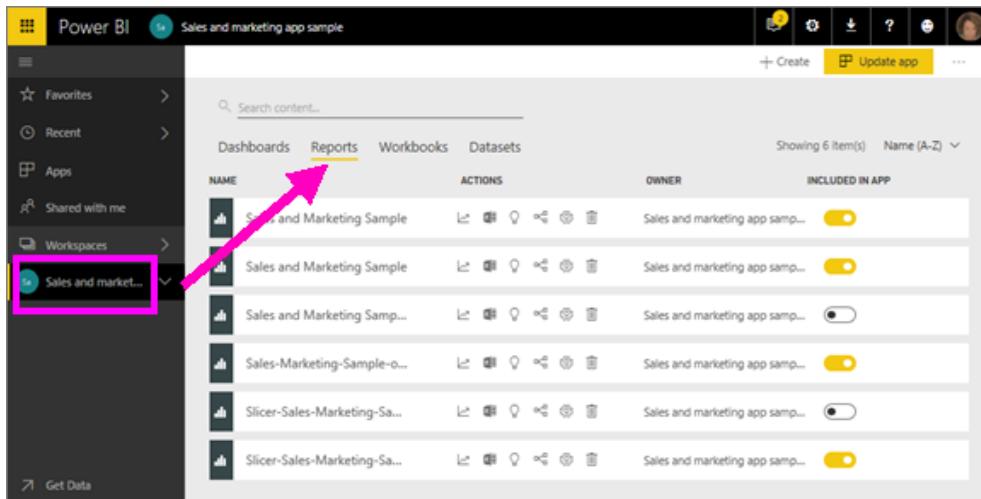
(Req*) Only the person who **created** the report, **co-owners**, and those **granted permission**, have access to all of the exploring, designing, building, and sharing capabilities of **Editing View** for that report.

And the people they share the report with can explore and interact with the report using **Reading View**.

When you open a workspace, the associated reports are listed under the **Reports** tab. Each listed report represents one or more pages of visualizations based on only one of the underlying datasets. To open a report, simply select it. When you open an app, you'll be presented with a dashboard. To access an underlying report, select a dashboard tile (more on these later) that was pinned from a report. Keep in mind that **not all tiles are pinned from reports, so you may have to click a few tiles to find a report**.

By default, the report opens in Reading view. Just select **Edit report** to open it in Editing view (if you have the necessary permissions).

In the example below select the "Sales and marketing" app workspace and clicked the tab for **Reports**.

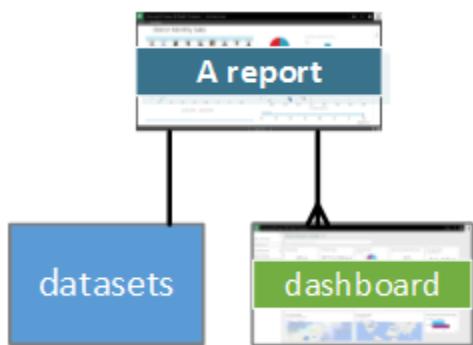


A screenshot of the Microsoft Power BI workspace interface. On the left, there is a sidebar with options like Favorites, Recent, Apps, Shared with me, Workspaces, and Get Data. The 'Workspaces' section is expanded, showing 'Sales and marketing app sample' with a blue icon. A pink arrow points from the text above to this workspace. Inside the workspace, there is a main content area with a search bar at the top. Below the search bar are tabs for Dashboards, Reports, Workbooks, and Datasets. The 'Reports' tab is highlighted with a yellow background. Below the tabs, there is a table listing six items. The columns are NAME, ACTIONS, OWNER, and INCLUDED IN APP. The first item in the list is 'Sales and Marketing Sample'. The table has a light gray background with alternating row colors.

NAME	ACTIONS	OWNER	INCLUDED IN APP
Sales and Marketing Sample	[Edit] [Delete] [Share] [Pin] [Copy]	Sales and marketing app samp...	ON
Sales and Marketing Sample	[Edit] [Delete] [Share] [Pin] [Copy]	Sales and marketing app samp...	ON
Sales and Marketing Samp...	[Edit] [Delete] [Share] [Pin] [Copy]	Sales and marketing app samp...	OFF
Sales-Marketing-Sample-o...	[Edit] [Delete] [Share] [Pin] [Copy]	Sales and marketing app samp...	ON
Slicer-Sales-Marketing-Sa...	[Edit] [Delete] [Share] [Pin] [Copy]	Sales and marketing app samp...	OFF
Slicer-Sales-Marketing-Sa...	[Edit] [Delete] [Share] [Pin] [Copy]	Sales and marketing app samp...	ON

ONE report...

- Is contained in a single workspace
- Can be associated with multiple dashboards within that workspace (tiles pinned from that one report can appear on multiple dashboards).
- Can be created **using data from one dataset**. (the slight exception to this is that Power BI Desktop can combine more than 1 dataset into a single report and that report can be imported into Power BI)



Dashboards

A **dashboard** is something you create **in Power BI service** or something a colleague creates **in Power BI service** and shares with you. It is a single canvas that contains zero or more tiles and widgets.

Each tile pinned from a report or from Q&A displays a single visualization that was created from a dataset and pinned to the dashboard. Entire report pages can also be pinned to a dashboard as a single tile. There are many ways to add tiles to your dashboard; too many to be covered in this overview topic. To learn more, see [Dashboard tiles in Power BI](#).

Why do people create dashboards? Here are just some of the reasons:

- to see, in one glance, all the information needed to make decisions
- to monitor the most-important information about your business
- to ensure all colleagues are on the same page, viewing and using the same information
- to monitor the health of a business or product or business unit or marketing campaign, etc.
- to create a personalized view of a larger dashboard -- all the metrics that matter to you

When you open a workspace, the associated dashboards are listed under the **Dashboards** tab. To open a dashboard, simply select it. When you open an app, you'll be presented with a dashboard. Each dashboard represents a customized view of some subset of the underlying dataset(s).

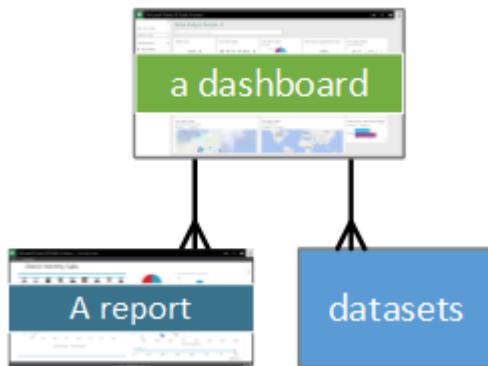
If you own the dashboard, you'll also have edit access to the underlying dataset(s) and reports. If the dashboard was shared with you, you'll be able to interact with the dashboard and any underlying reports, but will not be able to save any changes.

There are many different ways that you, or a colleague, can share a dashboard. *Power BI Pro is required for sharing a dashboard and may be required for viewing a shared dashboard.*

Note: Pinning and tiles are covered in more detail below under the heading "Dashboard with tiles."

ONE dashboard...

- Is associated with a single workspace
- Can display visualizations from many different datasets
- Can display visualizations from many different reports
- Can display visualizations pinned from other tools (e.g., Excel)



- Create a new blank dashboard and then get some data .
- Duplicate a dashboard
- Create a phone view of a dashboard

Workbooks

Workbooks are a special type of dataset.

If you've read the **Datasets** section above, you know almost all you need to know about workbooks. But you may be wondering why sometimes Power BI classifies an Excel workbook as a **Dataset** and other times as a **Workbook**.

- When you use **Get data** with Excel files, you have the option to *Import* or *Connect* to the file.
- When you choose Connect, your workbook will appear in Power BI just like it would in Excel Online.
- Unlike Excel Online, you'll have some great features to help you pin elements from your worksheets right to your dashboards.

You can't edit your workbook in Power BI.

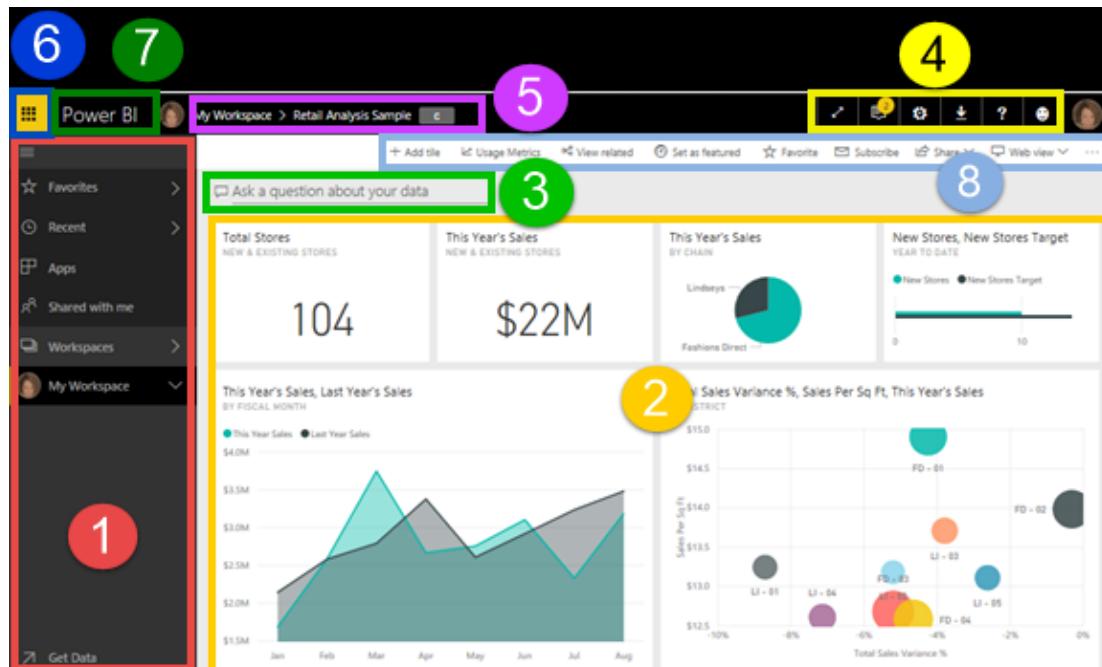
- To make some changes, you can click **Edit**, and then choose to edit your workbook in Excel Online or open it in Excel on your computer.
- Any changes you make are saved to the workbook on OneDrive.

Dig deeper

- [Get data from Excel workbook files](#)
- [Publish to Power BI from Excel](#)

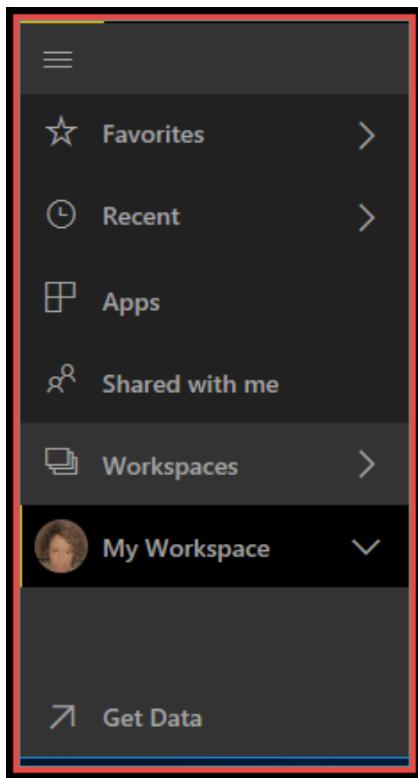
My Workspace

We've covered workspaces and building blocks. Let's take another look at the Power BI interface and review the pieces that make up the landing page for Power BI service.



1. Navigation pane (left navpane)

Use the navigation pane to locate and move between your workspaces and the Power BI building blocks: dashboards, reports, workbooks, and datasets.



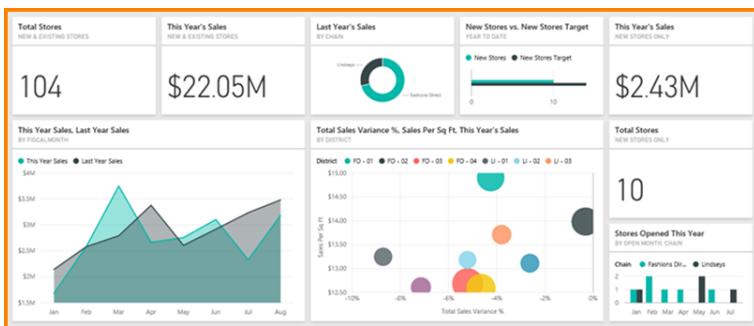
- Select **Get Data** to add datasets, reports, and dashboards to Power BI.
 - Expand and collapse the navbar with this icon .
 - Open or manage your favorite content by selecting **Favorites**.
 - View and open your most-recently visited content by selecting **Recent**.
 - View, open, or delete an app by selecting **Apps**.
 - Did a colleague share content with you? Select **Shared with me** to search and sort that content to find what you need.
 - Display and open your workspaces by selecting **Workspaces**.
- Single-click
- an icon or heading to open in content view
 - an arrow right (>) to open a flyout menu for Favorites, Recent, and Workspaces.
 - a chevron icon () to display the **My Workspace** scrollable list of dashboards, reports, workbooks, and datasets.
 - a dataset to explore it

2. Canvas

Because we've opened a dashboard, the canvas area displays visualization tiles. If, for example, we had opened the report editor, the canvas area would display a report page.

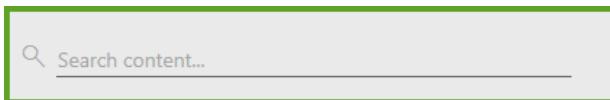
Dashboards are composed of tiles.

- Tiles are created in report Editing view, Q&A, other dashboards, and can be pinned from Excel, SSRS, and more.
- A special type of tile called a widget is added directly onto the dashboard.
- The tiles that appear on a dashboard were specifically put there by a report creator/owner.
- The act of adding a tile to a dashboard is called *pinning*.



3. Q&A question box

- One way to explore your data is to ask a question and let Power BI Q&A give you an answer in the form of a visualization.
- Q&A can be used to add content to a dashboard or report.
- Q&A looks for an answer in the dataset(s) connected to the dashboard.
- A connected dataset is one that has at least one tile pinned to that dashboard.



As soon as you start to type your question, Q&A takes you to the Q&A page. As you type, Q&A helps you ask the right question and find the best answer with re-phrase, autofill, suggestions, and more. When you have a visualization (answer) you like, pin it to your dashboard. For more information, see [Q&A in Power BI](#).

4. Icon buttons

The icons in the upper right corner are your resource for settings, notifications, downloads, getting help, and providing feedback to the Power BI team. Select the double arrow to open the dashboard in **Full screen** mode.



What do the field icons mean?

- Σ Aggregates** An aggregate is a numeric value that will be summed or averaged, for example. Aggregates are imported with the data (defined in the data model your report is based on). For more information, see [Aggregates in Power BI reports](#).
- Calculated measures (also called calculated fields)** Each calculated field has its own hard-coded formula. You can't change the calculation, for example, if it's a sum, it can only be a sum. For more information, [read Understanding measures](#)
- ≡ Unique fields** Fields with this icon were imported from Excel and are set to show all values, even if they have duplicates. For example, your data might have two records for people named 'John Smith', and each will be treated as unique -- they won't be summed.

-  **Geography fields**
Location fields can be used to create map visualizations.
-  **Hierarchy**
Select the arrow to reveal the fields that make up the hierarchy.

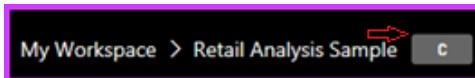
5. Dashboard title (navigation path aka breadcrumbs)

It's **not always easy to figure out which workspace and dashboard are active**, so **Power BI creates a navigation path for you**.

In this example we see the workspace (My workspace) and the dashboard title (Retail Analysis Sample). If we opened a report, the name of the report would be appended to the end of the navigation path. Each section of the path is an active hyperlink.

Notice the "C" icon after the dashboard title.

- This dashboard has a data classification tag of "confidential."
- The tag identifies the sensitivity and security level of the data.
- If your Admin has turned on data classification, every dashboard will have a default tag set.
- Dashboard owners should change the tag to match their dashboard's proper security level.



6. Office 365 app launcher

With the app launcher, all your Office 365 apps are easily available with one click. From here you can quickly launch your email, documents, calendar, and more.



7. Power BI home

Selecting this opens your featured dashboard (if you've set one), otherwise it opens the last dashboard you viewed.



8. Labeled icon buttons

This area of the screen contains additional options for interacting with the content (in this case, with the dashboard). Besides the labeled icons you can see, selecting the ellipses reveals options for duplicating, printing, refreshing the dashboard and more.



The Dashboard

A Power BI **dashboard** is a single page, often called a canvas, that uses visualizations to tell a story. Because it is limited to one page, a well-designed dashboard contains only the most-important elements of that story.



(Req*) Dashboards are a feature of Power BI service and are not available in Power BI Desktop. Dashboards can't be created on mobile devices but they can be viewed and shared.

Dashboard creators and dashboard consumers

Depending on your role,

- you may be someone who creates dashboards for your own use
- or to share with colleagues.
- **Dashboards for creators.**

Receives dashboards from others and interact with the dashboard – BI Service not BI Desktop

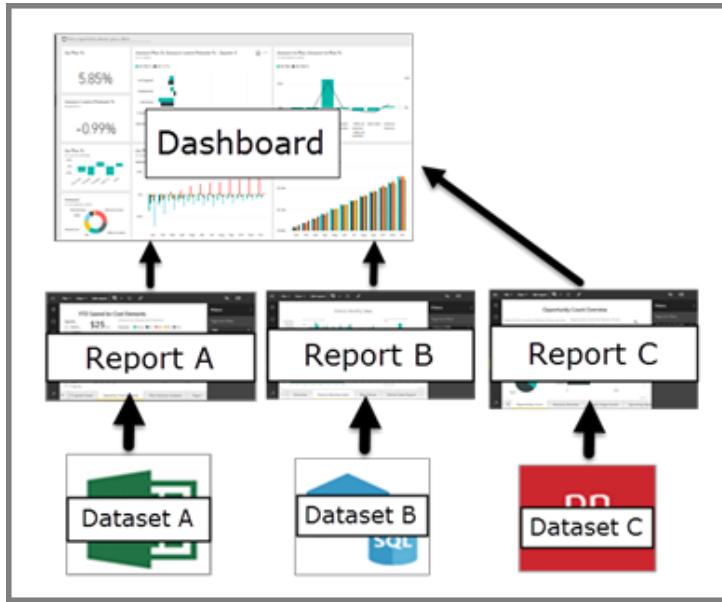
The visualizations you see on the dashboard are called *tiles* and are *pinned* to the dashboard, from reports, by dashboard *creators*.

If you're new to Power BI, you can get a good foundation by reading [Power BI basic concepts](#).

<https://docs.microsoft.com/en-us/power-bi/service-basic-concepts>

(Req*) **Power BI Pro** is *required for viewing a shared dashboard*.

The visualizations on a dashboard come from reports and each report is based on one dataset. In fact, one way to think of a dashboard is as an entryway into the underlying reports and datasets. Selecting a visualization takes you to the report (and dataset) that was used to create it.



Advantages of dashboards

Dashboards are a wonderful way to monitor your business, to look for answers, and to see all of your most-important metrics at a glance. The visualizations on a dashboard may come from one underlying dataset or many, and from one underlying report or many.

A dashboard combines on-premises and cloud-born data, providing a consolidated view regardless of where the data lives.

A dashboard isn't just a pretty picture; it's highly interactive and the tiles update as the underlying data changes.

Dashboards versus reports

Reports are often confused with dashboards since they too are canvases filled with visualizations. But there are some *major differences* for Power BI consumers.

Capability	Dashboards	Reports
Pages	One page	One or more pages
Data sources	One or more reports and one or more datasets per dashboard	A single dataset per report
Available in Power BI Desktop	No	Yes, <i>creators</i> can build and view reports in Desktop

Capability	Dashboards	Reports
Subscribe	Can subscribe to a dashboard	Can subscribe to report pages
Filtering	Can't filter or slice	Many different ways to filter, highlight, and slice
Featured	Can set one dashboard as your "featured" dashboard	Cannot create a featured report
Favorite	Can set dashboards as <i>favorites</i>	Can set reports as <i>favorites</i>
Set alerts	Available for dashboard tiles in certain circumstances	Not available from reports
Natural language queries	Available from dashboard	Not available from reports
Can see underlying dataset tables and fields	No. Can export data but can't see tables and fields in the dashboard itself.	Yes. Can see dataset tables and fields and values.
Customization	No	In Reading view you can publish, embed, filter, export, download as .pbix, view related content, generate QR codes, analyze in Excel, and more.

End Section - Intro

Painting the "Picture": Designing for the "Human" Consumer

The Goal: Make it very easy to see and interpret differences between values...

Why show a picture of the data if the picture can't be decoded and doesn't present the information more meaningfully? The answer is: You shouldn't.



Do you know that some of the most popular Power BI visuals, such as the **Pie/Donut Charts** should mostly be avoided*?



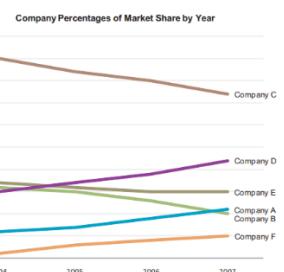
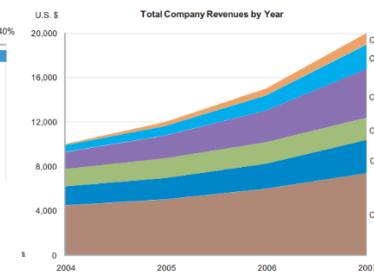
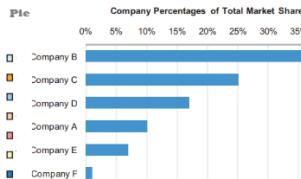
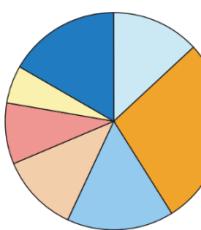
Did you know that about 8% of the population has a different way of perceiving colors? As it happens, one of the patterns affected by color disabilities is the widely used **Red-Green!**



Did you know that you should never use **Bar Charts with time series**? Or that you don't necessarily have to use **Map Charts** every time you are dealing with geographical data? Or that a **Bar Chart** should be preferred to a **Treemap**.

Using effective visualizations to judge the magnitude of a "slice" of "diced" data... and compare multiple part-to-whole relationships. <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-types-for-reports-and-q-and-a>

- Charts and Graphs are useful when a picture of the data makes meaningful relationships visible (patterns, trends, and exceptions) that could not be easily discerned from a table of the same data.
- Pie chart
 - The part-to-whole relationship "message" is built right into it in an obvious way by looking at pies sliced in various ways and decoding the ratio (quarter, half, three quarters, etc.) of each slice.
 - The pie chart is difficult to read from a changed sort order – values must be added.
 - Try to place the slices in order from largest to smallest – as the person interpreting the information without tools to change the view...



- Compare two different measures, such as unit sales versus revenue
 - Bar graphs
 - Provide a much better means to compare the magnitudes of each part.
 - Adds useful meaning by allowing us to compare the magnitudes of the values without labeling them.
 - Line and Stacked Columns charts

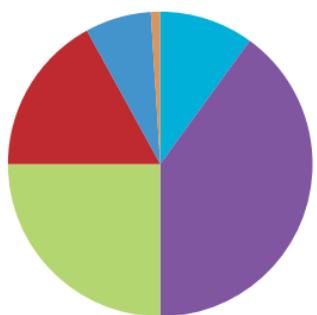
- Area graph
 - Shows totals change from year to year. (Slice)
 - “Gives a sense” of each unit’s totals as a portion of those totals in a particular year. (Dice)
- Scatter chart
- Trends over Time
 - Time Line
 - The up and down changes in part-to-whole percentages from over time.
 - Waterfall charts
 - Used to show changes in a particular value over time.
- Map visualizations:
 - Bubble map that places a bubble over a geographic point
 - Shape map that actually shows the outline of area you want to visualize.
- track a just single Key Performance Indicator (KPI) or metric over time.
 - Gauge
 - Building dashboards to show progress towards a particular target.
 - Single Number Card Visual
 - Show a numeric representation of a field.
 - By default, card visuals use display units to keep the number short, for example displaying "\$5bn" instead of "\$5,000,000,000".

From the original design: Table View...

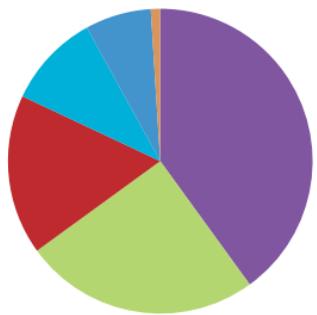
“Paint a picture of the relationships so that values can be compared with relative ease and precision, relying solely on the visualizations without labeling the values.”

Companies	Percentage
Company B	40%
Company C	25%
Company D	17%
Company A	10%
Company E	7%
Company F	1%
Total	100%

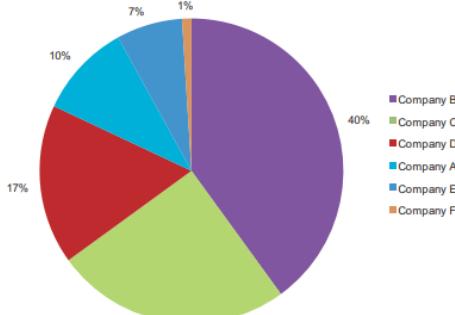
The value of Company C (the green slice) is 25%



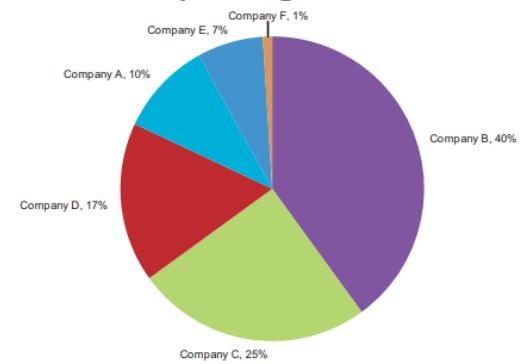
Sorted the slices by size



Labeling the values of each slice



Directly labeling the slices

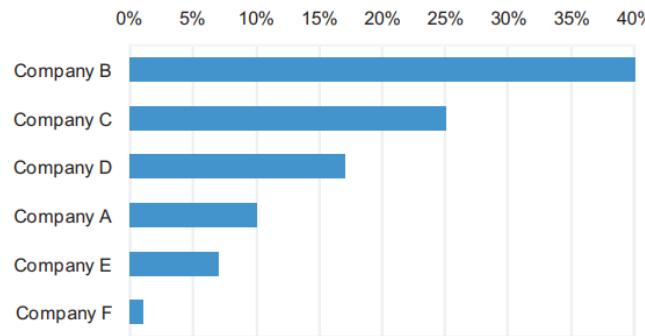
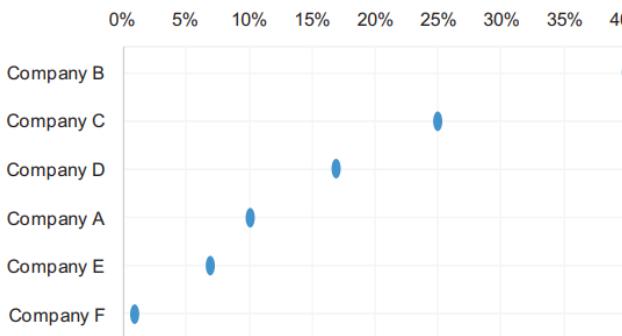


Following the changes of the various “units” and how they compare to one another through time.

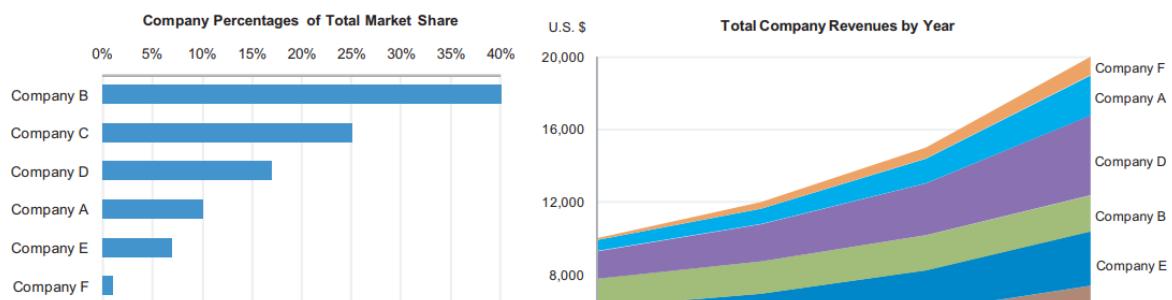
Human eyes are great at comparing differences in 2-D location and differences in line length, but not 2-D areas and angles.

Pie charts encode quantitative values primarily by two means: two-dimensional areas of the slices and the angles formed by the slices as they radiate out from the center of the pie.

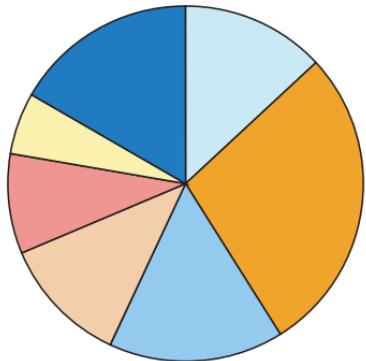
The graph on the left uses the 2-D locations of data points and the one on the right uses line lengths (in this case, the lengths of the bars) to encode values making it very easy to see and interpret differences between values.



Compare the results to determine what conveys the message for the data presented...

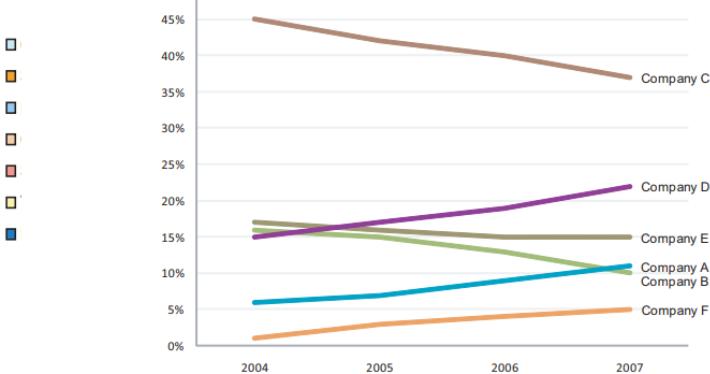
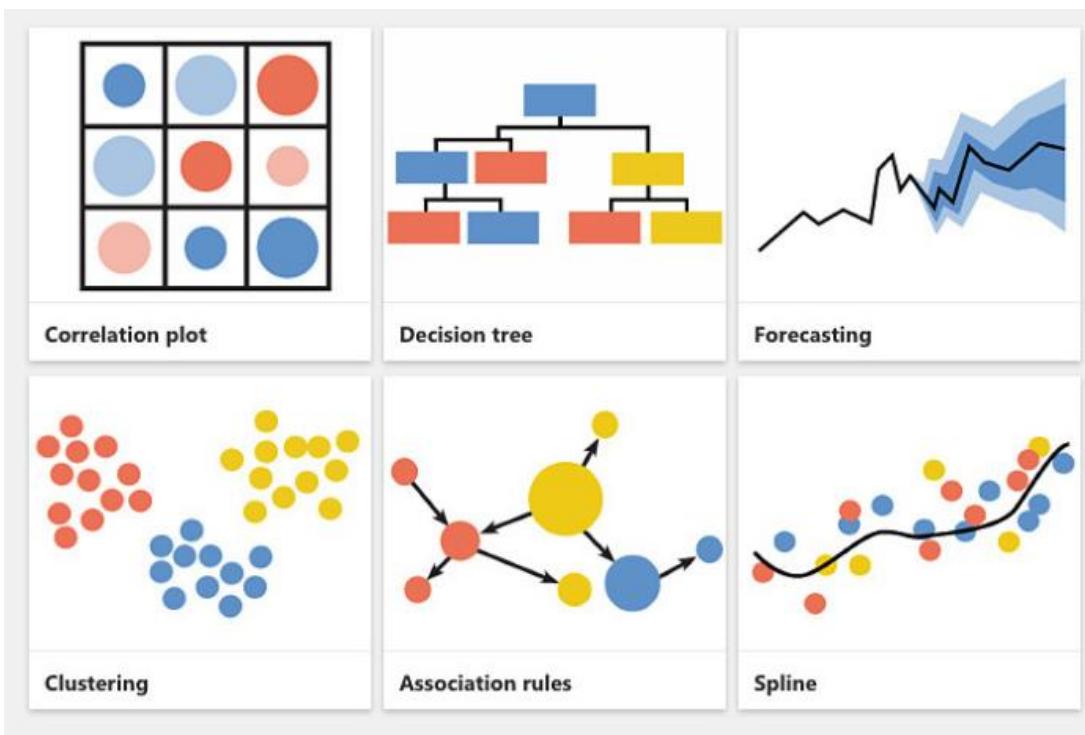


Paint a picture of the relationships



Bar Chart
Area Graph
Timeline

Pie

Correlation plot

Decision tree

Forecasting

Clustering

Association rules

Spline

Choose the chart for reports from the visualizations

COMPARISON

Use these visuals when you want to display measures compared by its magnitude.



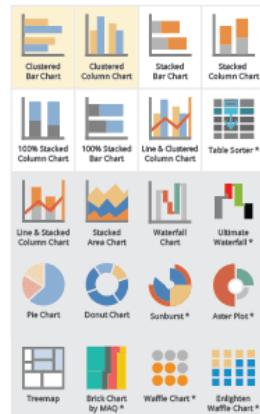
CHANGE OVER TIME

Use these visuals when you want to display the changing trend of measures.



PART-TO-WHOLE

Use these visuals when you want to display parts that compose measures.



FLOW

Use these visuals when you want to display a flow or dynamic relations.



RANKING

Use these visuals when you want to display measures by its rank order.



SPATIAL

Use these visuals when you want to display measures over spatial maps.



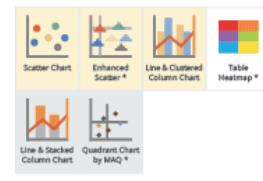
DISTRIBUTION

Use these visuals when you want to display the distribution of a measure.



CORRELATION

Use these visuals when you want to display relations between measures.



SINGLE

Use these visuals when you want to display a single value.



Next --

- Get comfortable with dashboards by taking a tour of one of our [sample dashboards](#).
- Learn about [dashboard tiles](#) and what will happen when you select one.
- Want to track an individual dashboard tile and receive an email when it reaches a certain threshold? [Create alerts on tiles](#).
- Have fun asking your dashboard questions. Learn how to use [Power BI Q&A](#) to ask a question about your data and get the answer in the form of a visualization.

****Tutorial: DO THIS - Automatically generate data insights with Power BI:** <https://docs.microsoft.com/en-us/power-bi/service-insights>

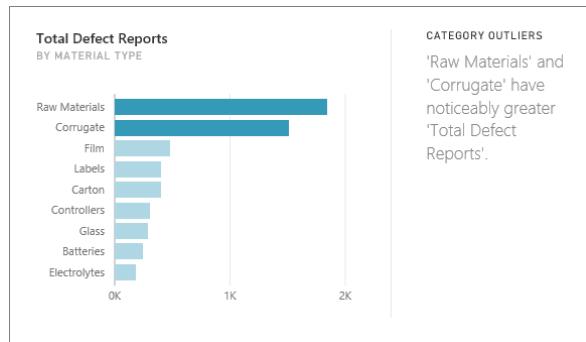
- Build a dashboard quickly
- Look for insights

Run quick insights to generate interesting interactive visualizations based on your data. Quick insights can be run on an entire dataset (quick insights) or on a specific dashboard tile (scoped insights). You can even run insights on an insight!

Types of insights supported by Power BI: <https://docs.microsoft.com/en-us/power-bi/consumer/end-user-insight-types>

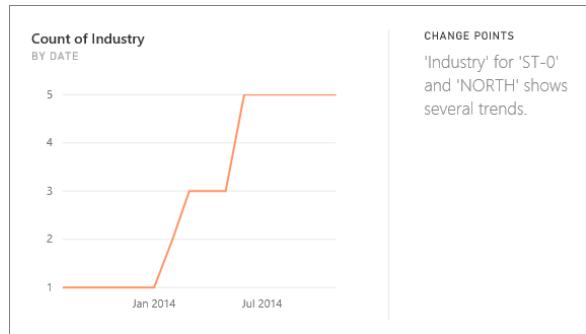
Category outliers (top/bottom)

Highlights cases where, for a measure in the model, *one or two members of a dimension have much larger values than other members* of the dimension.



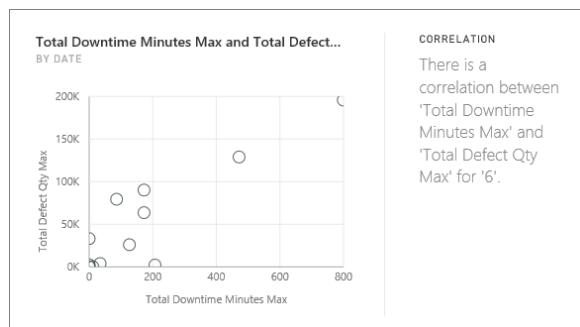
Change points in a time series

Highlights when there are *significant changes in trends in a time series* of data.



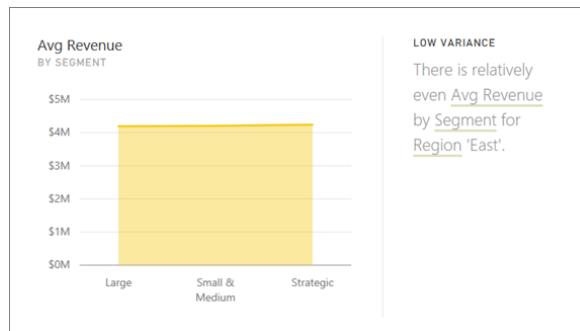
Correlation

Detects cases where *multiple measures show a correlation between each other when plotted against a dimension in the dataset.*



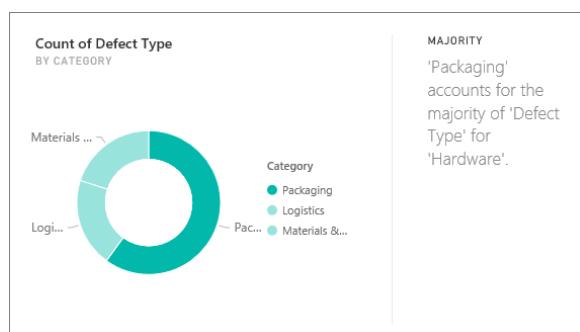
Low Variance

Detects cases where *data points are not far from the mean.*



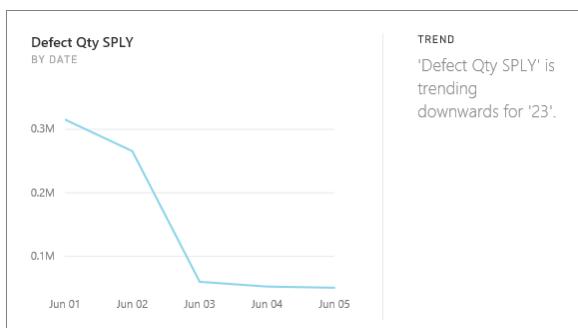
Majority (Major factors)

Finds cases where a *majority of a total value can be attributed to a single factor when broken down by another dimension.*



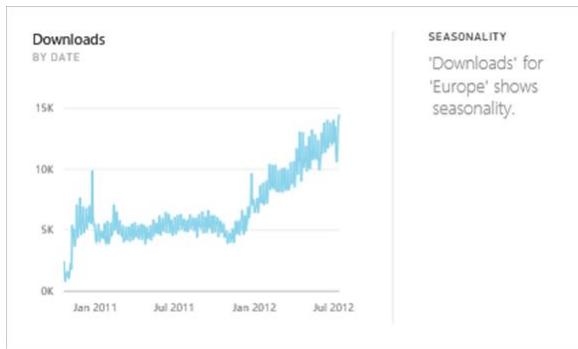
Overall trends in time series

Detects *upward or downward trends in time series data.*



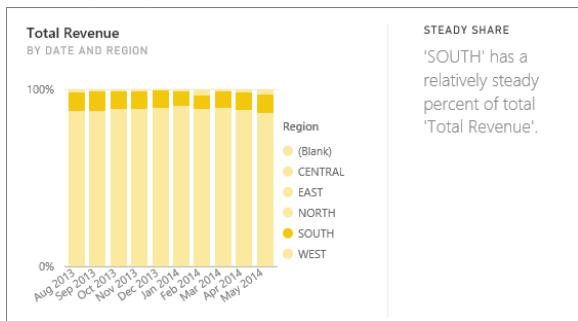
Seasonality in time series

Finds *periodic patterns in time series* data, such as weekly, monthly, or yearly seasonality.



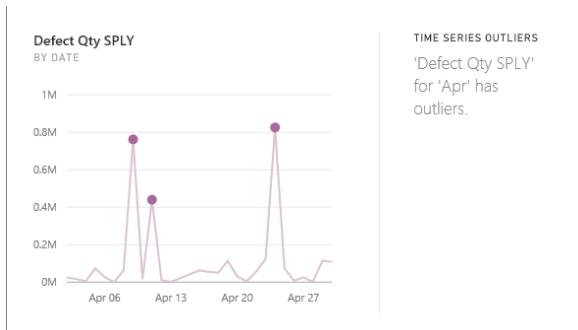
Steady share

Highlights cases where *there is a parent-child correlation between the share of a child value in relation to the overall value of the parent across a continuous variable*.



Time series outliers

For data across a time series, *detects when there are specific dates or times with values significantly different than the other date/time values*.



Optimize your data for Power BI Quick Insights:

<https://docs.microsoft.com/en-us/power-bi/service-insights-optimize>

Improve quick insights results – Role = dataset owner:

To generate insights, your dataset needs to have at least one dimension and one measure.

Note: Power BI quick insights do not search hidden columns.

- Hide or unhide columns in your dataset.
- Use a mix of data types such as names, times, dates, and numbers.
- Avoid (or hide) columns with duplicate, unnecessary information. This takes valuable time away from searching for meaningful patterns. For example, one column with state names spelled out and another column with state name abbreviations.
- Do you get an error message stating that your data isn't statistically significant? This can happen with models that are very simple, or that don't have much data, or that don't have date or numeric columns.

End Section – Dashboard Tutorial

To get started with Power BI Desktop, the first thing you need is to download and install the application:

[Download Power BI Desktop from the web](#)

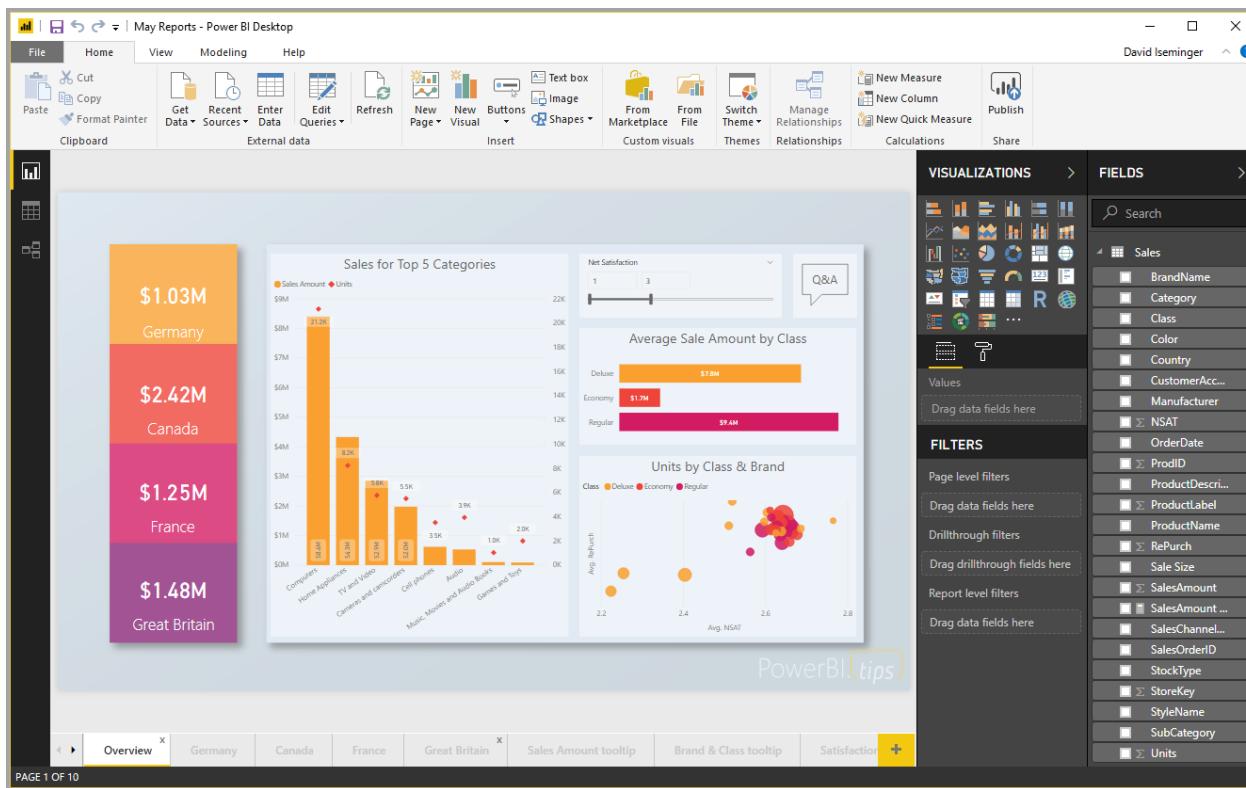
[Get Power BI Desktop from the Windows Store](#)

What is Power BI Desktop?

Power BI Desktop is a **free application you can install on your local computer** that lets you connect to, transform, and visualize your data. (The installer is a download .msi or from the app store – the app store seems to have more options)

With **Power BI Desktop**, you can connect to multiple different sources of data, and combine them (often called modeling) into a data model that lets you build visuals, and collections of visuals you can share as reports, with other people inside your organization.

- Use **Power BI Desktop** to create reports
- Use the **Power BI service** to share their reports with others. (not free)

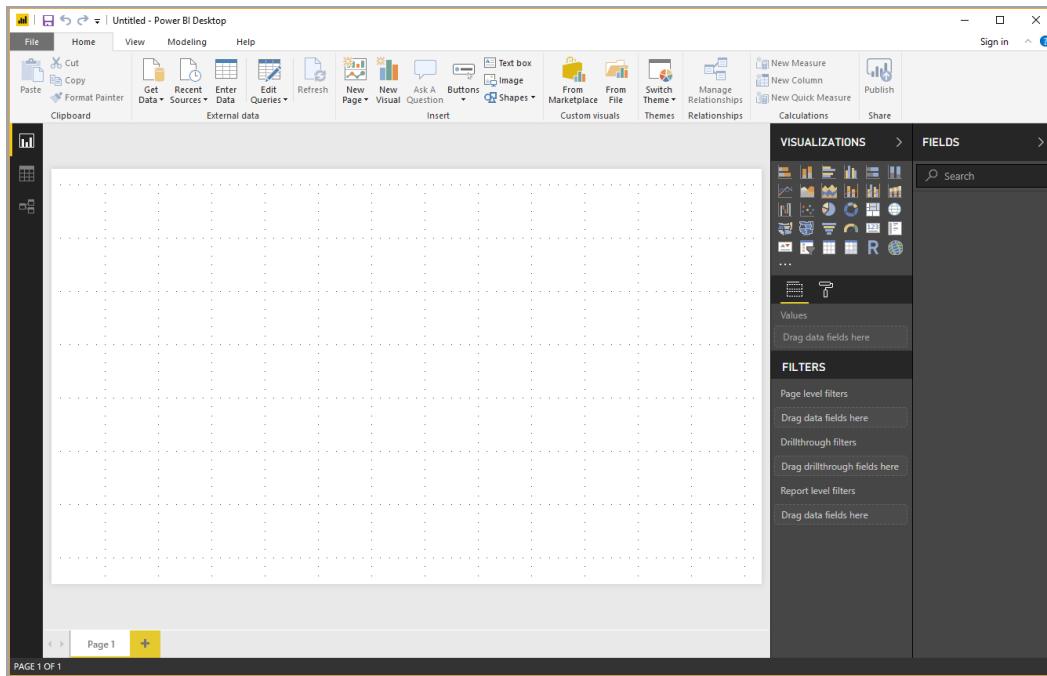


The most common uses for **Power BI Desktop** are the following:

- Connect to data
- Transform and clean that data, to create a data model
- Create visuals, such as charts or graphs, that provide visual representations of the data
- Create reports that are collections of visuals, on one or more report pages
- Share reports with others using the **Power BI service**
- People most often responsible for such tasks are often considered *data analysts* (sometimes just referred to as *analysts*) or Business Intelligence professionals (often referred to as *report creators*).

Launch Power BI Desktop

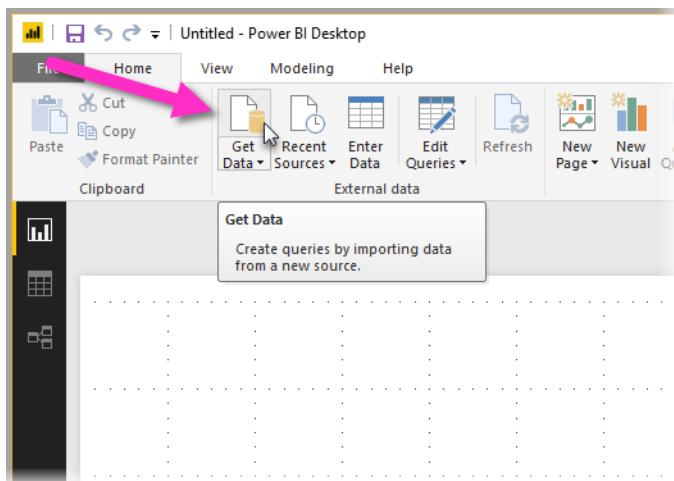
Once you install **Power BI Desktop**, launch the application so it's running on your local computer. You're presented with a blank canvas, which is where you create visuals and reports from data to which you connect.



Connect to data

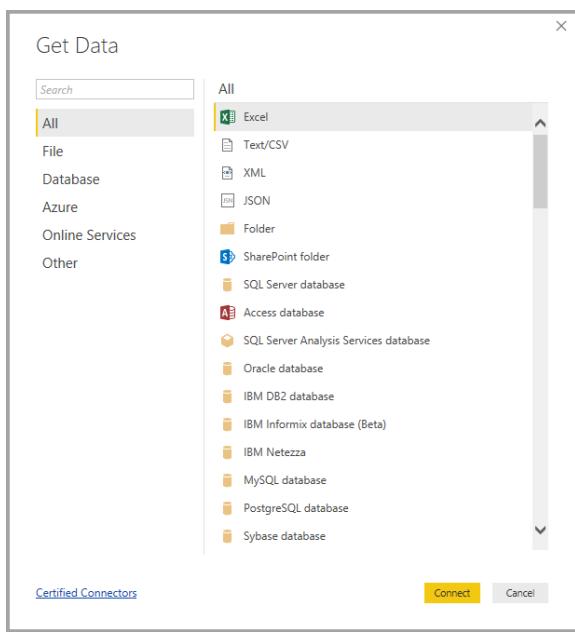
With **Power BI Desktop** you can connect to many different types of data. You can connect to basic data sources such as a Microsoft Excel file, and you can connect to online services that contain all sorts of data such as Salesforce, Microsoft Dynamics, Azure Blob Storage, and many more.

To connect to data, from the **Home** ribbon select **Get Data**.



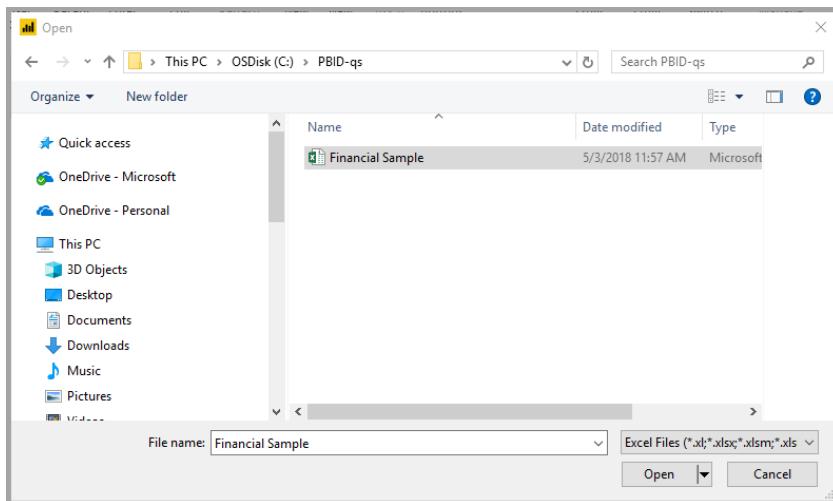
The **Get Data** window appears, where you can choose from the many different data sources to which **Power BI Desktop** can connect.

In this QuickStart we use the Excel workbook that you downloaded, described in the *Prerequisites* section at the beginning of this article.

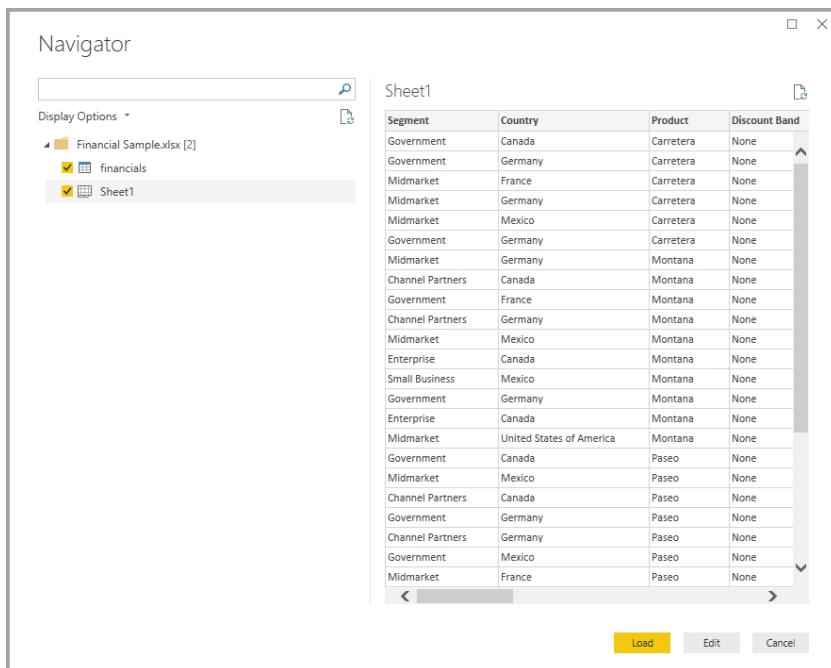


Since this is an Excel file, we select **Excel** from the **Get Data** window, then select the **Connect** button.

We're prompted to provide the location of the Excel file to which we want to connect. The downloaded file is called *Financial Sample* so we select that file, and then select **Open**.



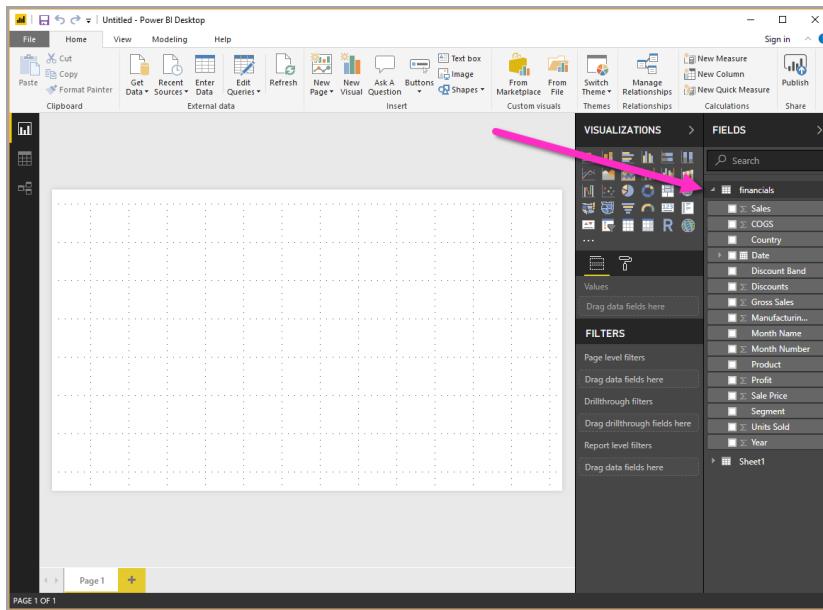
Power BI Desktop then loads the workbook and reads its contents, and shows you the available data in the file using the **Navigator** window, where you can choose which data you would like to load into Power BI Desktop. You select the tables by marking the checkboxes beside each table you want to import. In this case, we'll import both available tables.



Once you've made your selections, select **Load** to import the data into Power BI Desktop.

View data in the Fields pane

Once you've loaded the tables, the **Fields** pane shows you the data. You can expand each table by selecting the triangle beside its name. In the following image, the *financials* table is expanded, showing each of its fields.



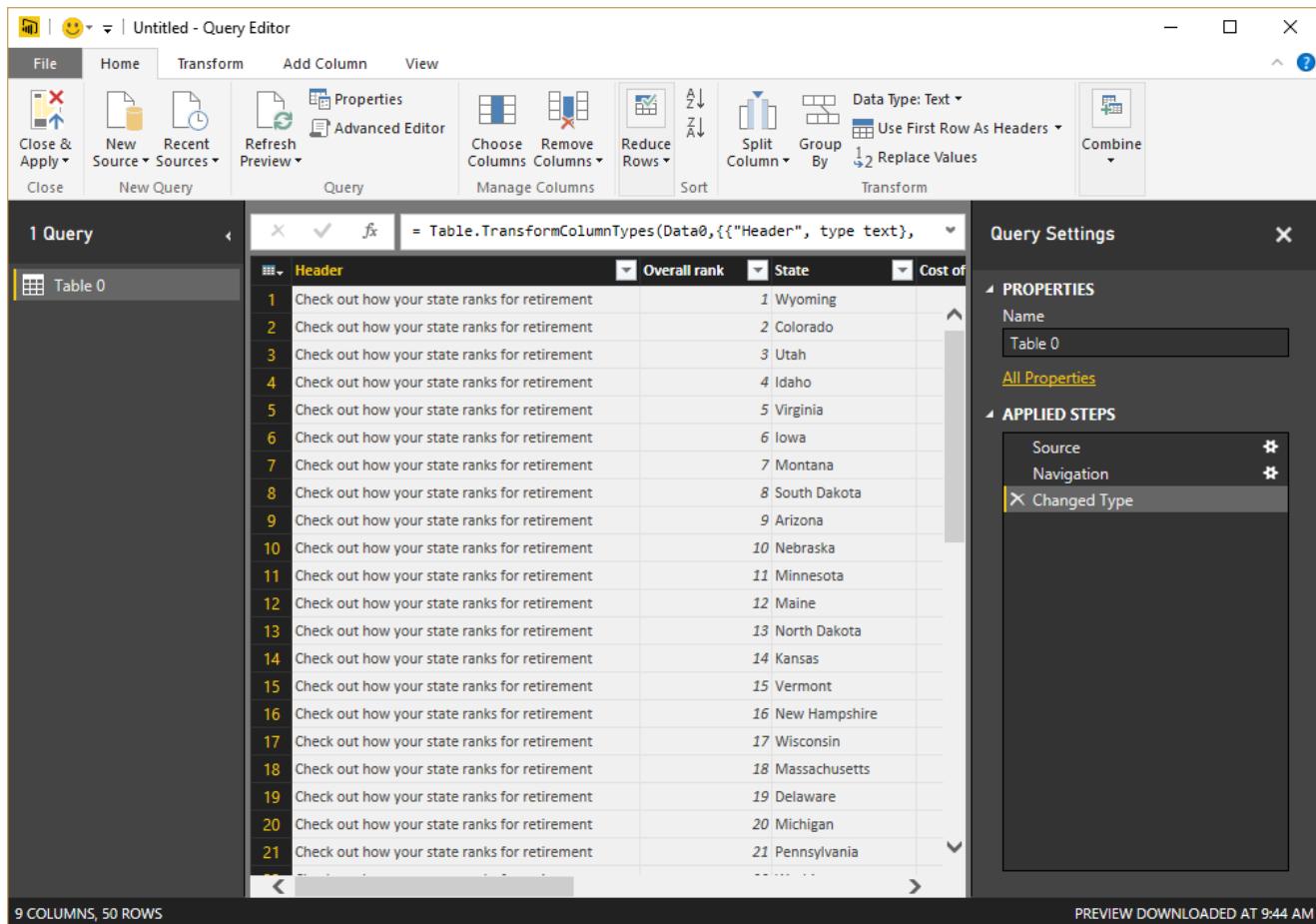
And that's it! You've connected to data in **Power BI Desktop**, loaded that data, and now you can see all the available fields within those tables.

Transform and clean data, create a model

In Power BI Desktop, you can clean and transform data using the built-in **Query Editor**.

With **Query Editor** you can *make changes to your data, such as changing a data type, removing columns, or combining data from multiple sources.*

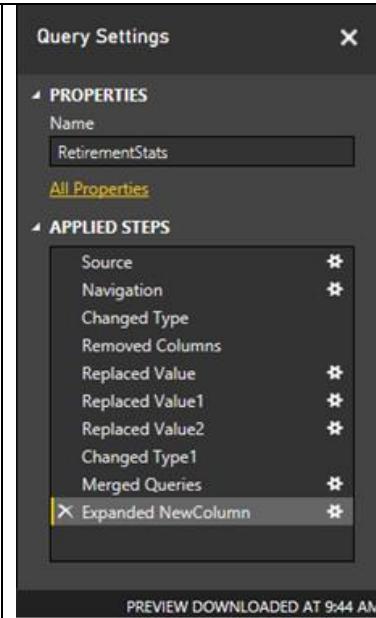
It's a little bit like sculpting - you can start with a large block of clay (or data), then shave pieces off or add others as needed, until the shape of the data is how you want it.



The screenshot shows the Microsoft Power BI Query Editor interface. The main area displays a table titled "Table 0" with 21 rows. The first column is labeled "Header" and the second column is labeled "State". The data consists of 21 entries, each starting with "Check out how your state ranks for retirement" followed by a state name. The states listed are Wyoming, Colorado, Utah, Idaho, Virginia, Iowa, Montana, South Dakota, Arizona, Nebraska, Minnesota, Maine, North Dakota, Kansas, Vermont, New Hampshire, Wisconsin, Massachusetts, Delaware, Michigan, and Pennsylvania. The bottom left corner of the editor window indicates "9 COLUMNS, 50 ROWS". To the right of the editor is a "Query Settings" pane. Under the "PROPERTIES" section, the "Name" is set to "Table 0". Under the "APPLIED STEPS" section, there is a list with "Source" and "Navigation" items, and a step labeled "Changed Type" which is currently selected. The status bar at the bottom right of the editor window shows "PREVIEW DOWNLOADED AT 9:44 AM".

Transformations are logged

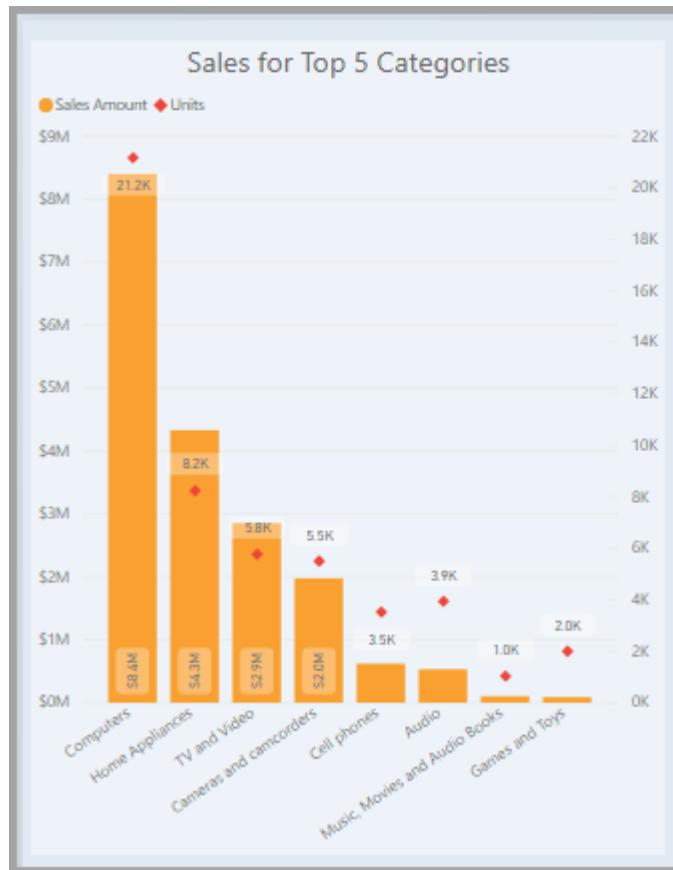
- Each step you take in transforming data (such as rename a table, transform a data type, or delete columns) is recorded by **Query Editor**,
- Each time this query connects to the data source those steps are carried out so that the data is always shaped the way you specified.
- The image shows the **Query Settings** pane for a query that has been shaped, and turned into a model.



Once your data is how you want it, you can create visuals.

Create visuals

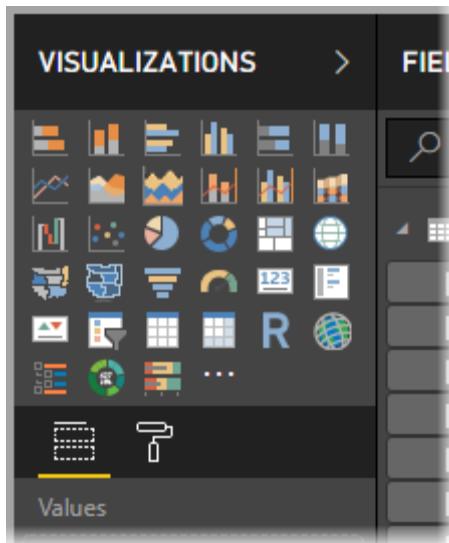
Once you have a data model, you can drag *fields* onto the report canvas to create *visuals*. A *visual* is a graphic representation of the data in your model. The following visual shows a simple column chart.



There are many different types of visuals to choose from in Power BI Desktop.

To create or change a visual, just select the visual icon from the **Visualizations** pane. If you have a visual selected on the report canvas, the selected visual changes to the type you selected.

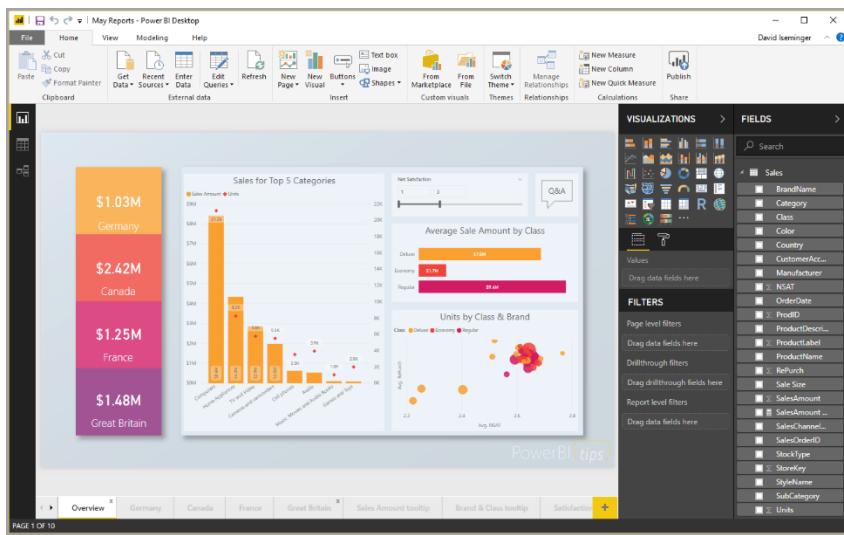
If no visual is selected, a new visual is created based on your selection.



Create reports

More often, you'll want to create a *collection of visuals* that show various aspects of the data you have used to create your model in Power BI Desktop. A collection of visuals, in one Power BI Desktop file, *is called a report*.

A *report can have one or more pages*, just like an Excel file can have one or more worksheets. In the following image you see the first page of a Power BI Desktop report, named Overview (you can see the tab near the bottom of the image). In this report, there are ten pages.

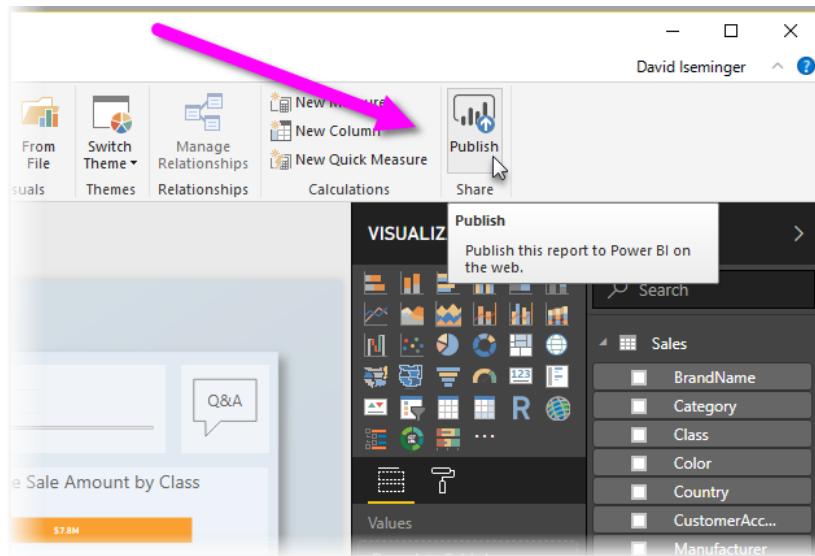


Share reports

(Req*) You must have a Power BI license to share reports to the Power BI service.

Once a report is ready to share with others, you can **Publish** the report to the **Power BI service**, and make it available to anyone in your organization who has a Power BI license.

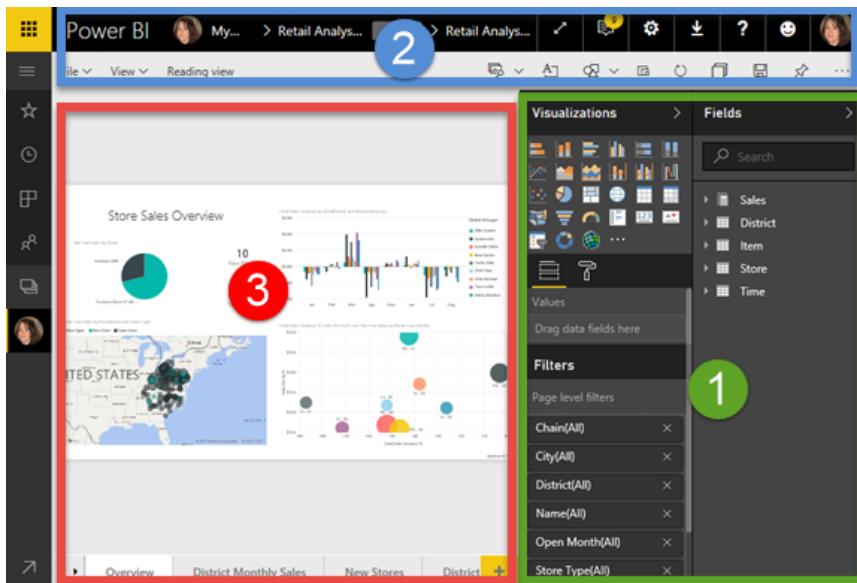
To publish a Power BI Desktop report, you select the **Publish** button from the **Home** ribbon in Power BI Desktop.



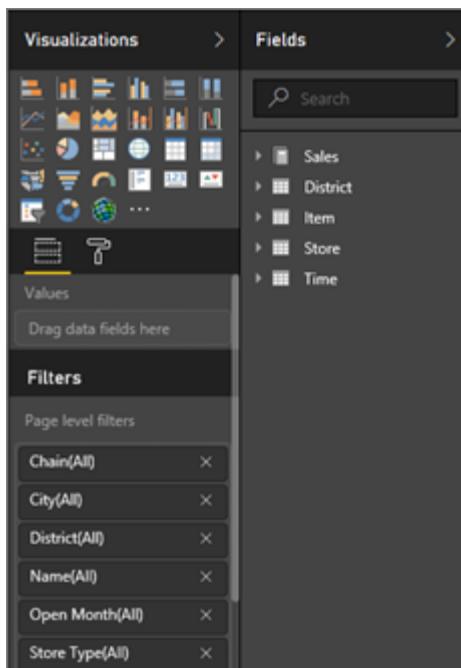
Once you select **Publish**, Power BI Desktop connects you to the **Power BI service** using your Power BI account, and then prompts you to select where in the Power BI service you would like to share the report, such as your workspace, a team workspace, or some other location in the Power BI service.

The Power BI report editor is made up of 3 sections:

1. **Fields, Visualizations, and Filters** panes
2. top navigation bars
3. report canvas

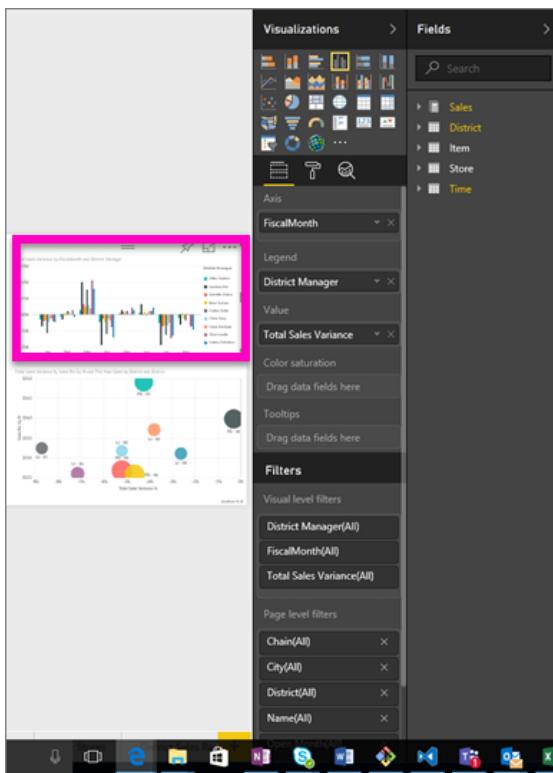


1. The report editor panes



There are 3 panes visible when you first open a report: Visualizations, Filters, and Fields. The panes on the left side, Visualizations and Filters, control what your visualizations look like -- type, colors, filtering, formatting. And the pane on the right side, Fields, manages the underlying data being used in the visualizations.

The content displayed in the report editor varies by selections you make in the report canvas. For example, when you select an individual visual,



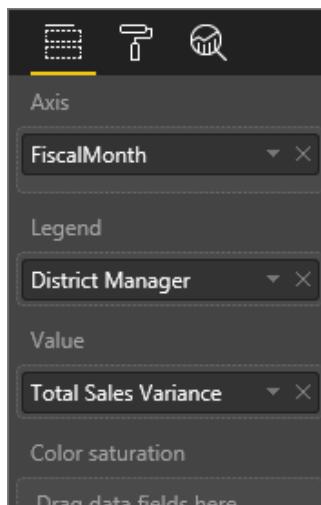
- The top of the Visualization pane identifies the type of visual in use; in this example, a Clustered column chart.
- The bottom of the Visualization pane (you may have to scroll down) displays the fields being used in the visual. This chart is using FiscalMonth, DistrictManager, and Total Sales Variance.
- The Filters pane (you may have to scroll down) displays any filters that have been applied.
- The Fields pane lists the tables available and, if you expand a table's name, the fields that make up that table. Yellow font lets you know that at least one field from that table is being used in the visualization.
- To display the formatting pane, for the selected visualization, select the paint roller icon.
- To display the Analytics pane, select the magnifying glass icon.

The Visualizations pane (from top to bottom)



Here is where you select a visualization type. The small pictures are called *templates*. In the image above, the Clustered bar chart is selected. If you don't select a visualization type first, but instead start building a visualization by selecting fields, Power BI will pick the visualization type for you. You can keep Power BI's selection, or change the type by selecting a different template. Switch as many times as you need to find the visualization type that best represents your data.

Manage the fields used in your visual.



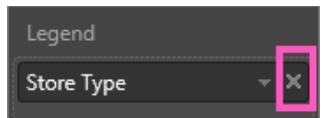
The buckets (sometimes called *wells*) shown in this pane vary depending on what type of visualization you have selected. For example, if you've selected a bar chart, you'll see buckets for: Values, Axis, and Legend.

When you select a field, or drag it onto the canvas, Power BI adds that field to one of the buckets. You can also drag fields from the Fields list directly into the buckets.

Some buckets are limited to certain types of data. For example, **Values** won't accept non-numeric fields. So if you drag an **employeename** field into the **Values** bucket, Power BI changes it to **count of employeename**.

Remove a field

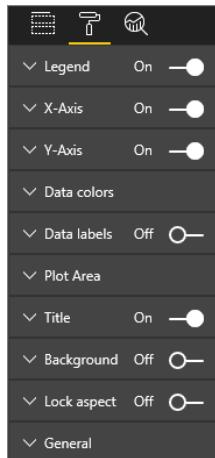
To remove a field from the visualization, select the X to the right of the field name.



For more information, see [Add visualizations to a Power BI report](#)

Format your visuals

Select the paint roller icon to display the Format pane. The option available depend on the type of visualization selected.



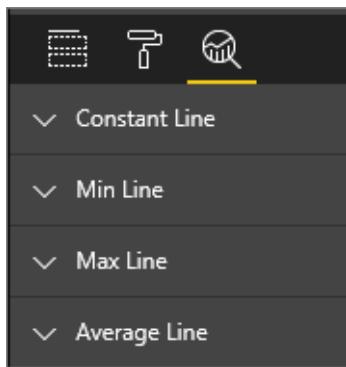
The formatting possibilities are almost endless. To learn more, explore on your own, or visit these articles:

- [Customizing visualization title, background and legend](#)

- [Color formatting](#)
- [Customizing X-axis and Y-axis properties](#)

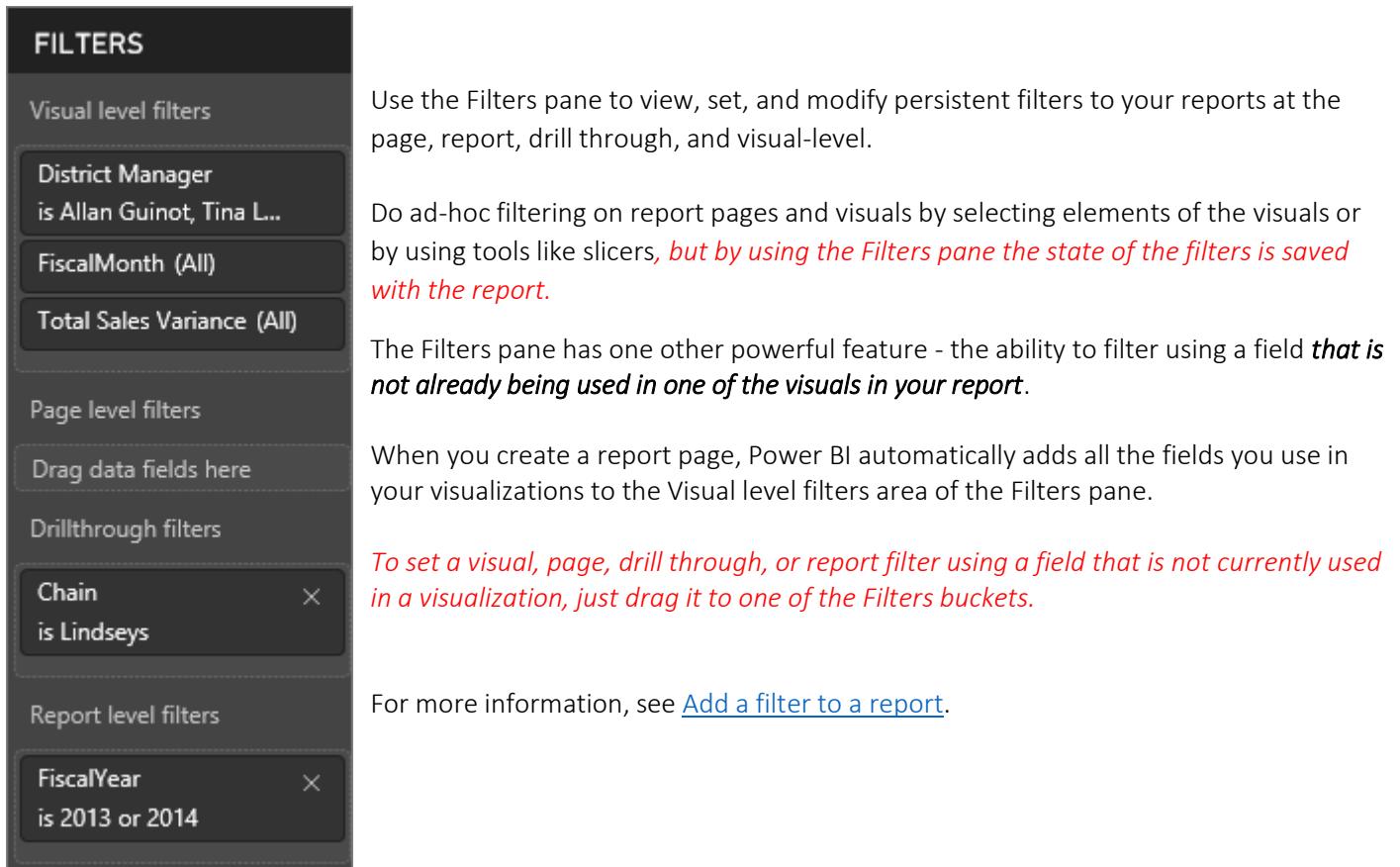
Add analytics to your visualizations

Select the magnifying glass icon to display the Analytics pane. The option available depend on the type of visualization selected.



With the Analytics pane in Power BI service, you can add dynamic reference lines to visualizations, and provide focus for important trends or insights. To learn more, see [Analytics pane in Power BI service](#) or [Analytics pane in Power BI Desktop](#).

The Filters pane



FILTERS

Visual level filters

- District Manager is Allan Guinot, Tina L...
- FiscalMonth (All)
- Total Sales Variance (All)

Page level filters

- Drag data fields here

Drillthrough filters

- Chain is Lindseys

Report level filters

- FiscalYear is 2013 or 2014

Use the Filters pane to view, set, and modify persistent filters to your reports at the page, report, drill through, and visual-level.

Do ad-hoc filtering on report pages and visuals by selecting elements of the visuals or by using tools like slicers, *but by using the Filters pane the state of the filters is saved with the report.*

The Filters pane has one other powerful feature - the ability to filter using a field *that is not already being used in one of the visuals in your report.*

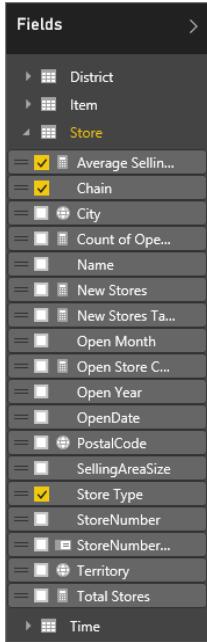
When you create a report page, Power BI automatically adds all the fields you use in your visualizations to the Visual level filters area of the Filters pane.

To set a visual, page, drill through, or report filter using a field that is not currently used in a visualization, just drag it to one of the Filters buckets.

For more information, see [Add a filter to a report](#).

The Fields pane

The Fields pane displays the tables and fields that exist in your data and are available for you to use to create visualizations.



- Drag a field onto the page to start a new visualization. You can also drag a field onto an existing visualization to add the field to that visualization.
- When you add a checkmark next to a field, Power BI adds that field to the active (or new) visualization. And it also decides which bucket to place that field into. For example, should the field be used a legend, axis, or value? Power BI makes a best-guess and you can move it from that bucket to another if necessary.
- Either way, each selected field is added to the Visualizations pane in the report editor.

NOTE: If you're using Power BI Desktop, you'll also have options to show/hide fields, add calculations etc.
What do the field icons mean?

-  **Aggregates** An aggregate is a numeric value that will be summed or averaged, for example. Aggregates are imported with the data (defined in the data model your report is based on). For more information, see [Aggregates in Power BI reports](#).
-  **Calculated measures (also called calculated fields)**
Each calculated field has its own hard-coded formula. You can't change the calculation, for example, if it's a sum, it can only be a sum. For more information, [read Understanding measures](#)
-  **Unique fields**
Fields with this icon were imported from Excel and are set to show all values, even if they have duplicates. For example your data might have two records for people named 'John Smith', and each will be treated as unique -- they won't be summed.
-  **Geography fields**
Location fields can be used to create map visualizations.
-  **Hierarchy**
Select the arrow to reveal the fields that make up the hierarchy.

2. The top navigation bar

The actions available from the top navigation bar are numerous; with new actions being added all the time. For information about a particular action, use the Power BI Documentation Table of Contents or Search box.

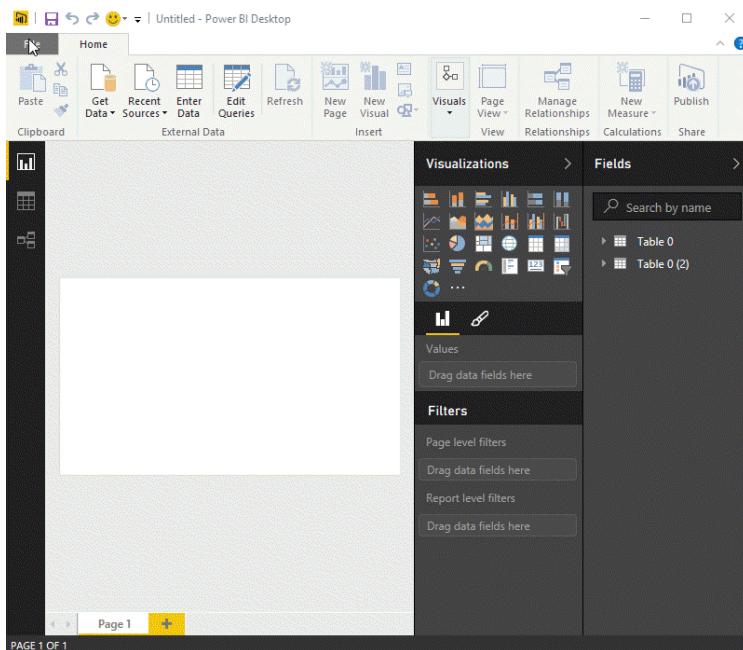
3. The report canvas

The report canvas is where your work displays. When you use the Fields, Filters, and Visualizations panes to create visuals, they are built and displayed on your report canvas. Each tab at the bottom of the canva represents a page in the report. Select a tab to open that page.

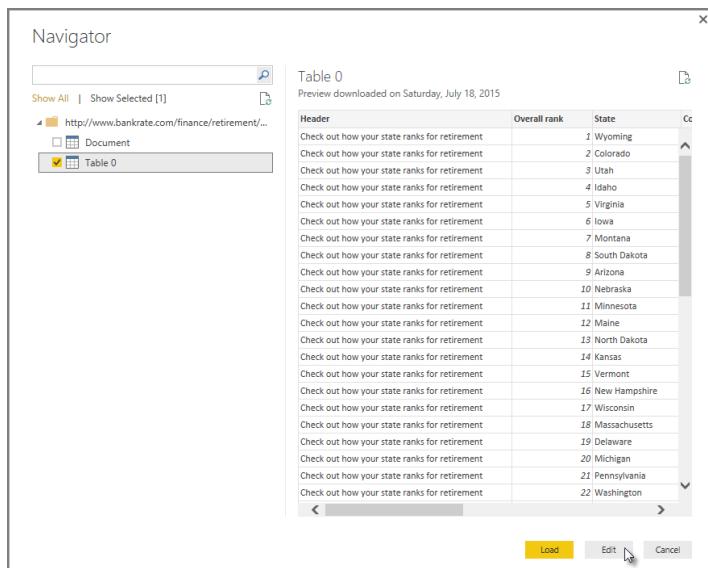
Create & Publish a Report with Power BI Desktop & How the first two parts of Power BI fit together:

- Create a report in Power BI Desktop
- Publish the report in the Power BI service – if correct license – Pro + container?

We'll start in Power BI Desktop, and select **Get Data**. The collection of data sources appears, allowing you to choose a data source. The following image shows selecting a Web page as the source.



Regardless of which data source you choose, Power BI connects to that data source, and shows you the data available from that source. The following image is another example, this one is from a Web page that analyzes different states and some interesting retirement statistics.



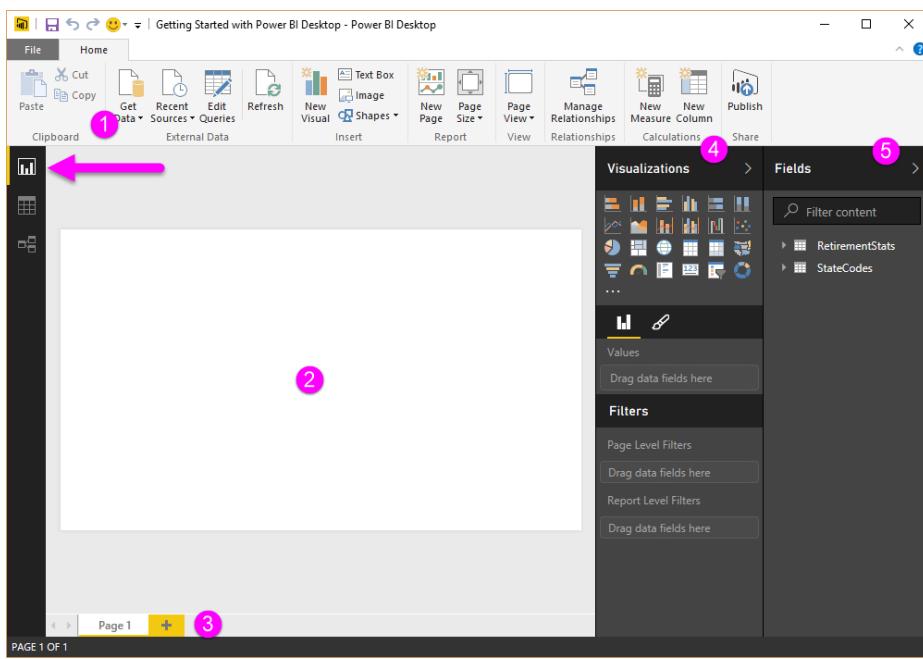
The screenshot shows the Microsoft Power BI Desktop interface. On the left, the Navigator pane displays a list of items, including 'Show All', 'Document', and 'Table 0'. Under 'Table 0', there is a preview titled 'Table 0' with the subtitle 'Preview downloaded on Saturday, July 18, 2015'. The preview shows a table with three columns: 'Header', 'Overall rank', and 'State'. The data consists of 22 rows, each containing a repeating header 'Check out how your state ranks for retirement' followed by a rank number and a state name. The ranks range from 1 (Wyoming) to 22 (Washington). At the bottom of the preview window are 'Load', 'Edit', and 'Cancel' buttons.

Header	Overall rank	State
Check out how your state ranks for retirement	1	Wyoming
Check out how your state ranks for retirement	2	Colorado
Check out how your state ranks for retirement	3	Utah
Check out how your state ranks for retirement	4	Idaho
Check out how your state ranks for retirement	5	Virginia
Check out how your state ranks for retirement	6	Iowa
Check out how your state ranks for retirement	7	Montana
Check out how your state ranks for retirement	8	South Dakota
Check out how your state ranks for retirement	9	Arizona
Check out how your state ranks for retirement	10	Nebraska
Check out how your state ranks for retirement	11	Minnesota
Check out how your state ranks for retirement	12	Maine
Check out how your state ranks for retirement	13	North Dakota
Check out how your state ranks for retirement	14	Kansas
Check out how your state ranks for retirement	15	Vermont
Check out how your state ranks for retirement	16	New Hampshire
Check out how your state ranks for retirement	17	Wisconsin
Check out how your state ranks for retirement	18	Massachusetts
Check out how your state ranks for retirement	19	Delaware
Check out how your state ranks for retirement	20	Michigan
Check out how your state ranks for retirement	21	Pennsylvania
Check out how your state ranks for retirement	22	Washington

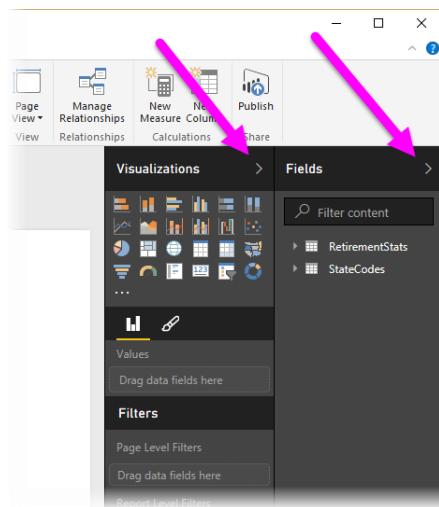
In Power BI Desktop **Report** view, you can begin to build reports.

The **Report** view has five main areas:

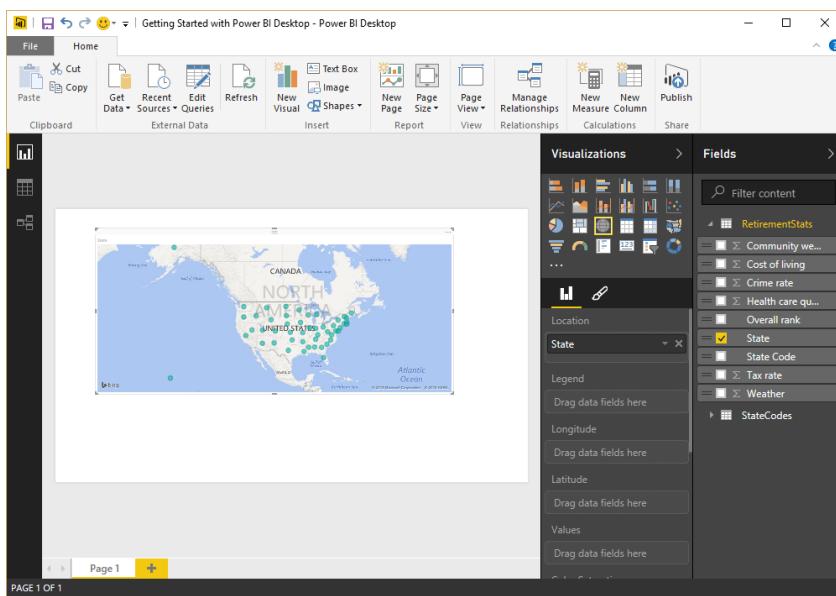
1. The ribbon, which displays common tasks associated with reports and visualizations
2. The **Report** view, or canvas, where visualizations are created and arranged
3. The **Pages** tab area along the bottom, which lets you select or add a report page
4. The **Visualizations** pane, where you can change visualizations, customize colors or axes, apply filters, drag fields, and more
5. The **Fields** pane, where query elements and filters can be dragged onto the **Report** view, or dragged to the **Filters** area of the **Visualizations** pane



The **Visualizations** and **Fields** pane can be collapsed by selecting the small arrow along the edge, providing more space in the **Report** view to build cool visualizations. When modifying visualizations, you'll also see these arrows pointing up or down, which means you can expand or collapse that section, accordingly.

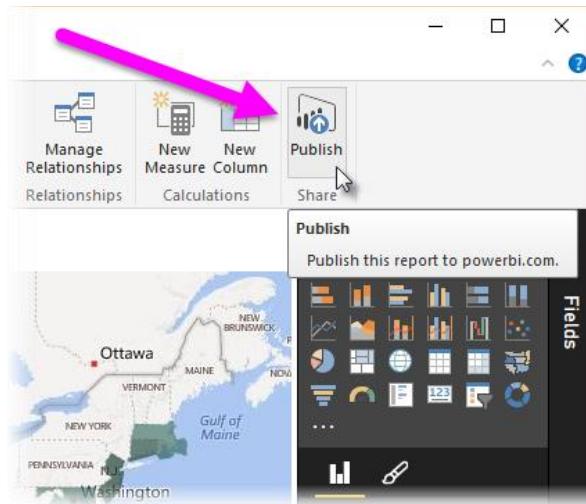


To create a visualization, just drag a field from the **Fields** list onto the **Report** view. In this case, let's drag the State field from *RetirementStats*, and see what happens.

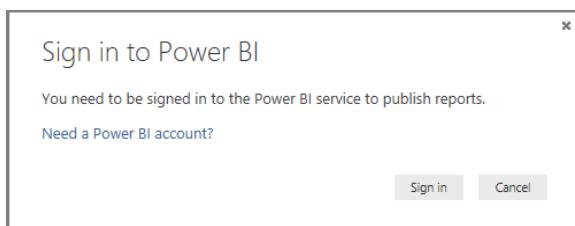


Look at that... Power BI Desktop automatically created a map-based visualization, because it recognized that the State field contained geolocation data.

Now let's fast-forward a bit, and after creating a report with a few visualizations, we're ready to publish this to the Power BI service. On the **Home** ribbon in Power BI Desktop, select **Publish**.



You'll be prompted to sign in to Power BI.



When you've signed in and the publish process is complete, you see the following dialog. You can select the link (below Success!) to be taken to the Power BI service, where you can see the report you just published.

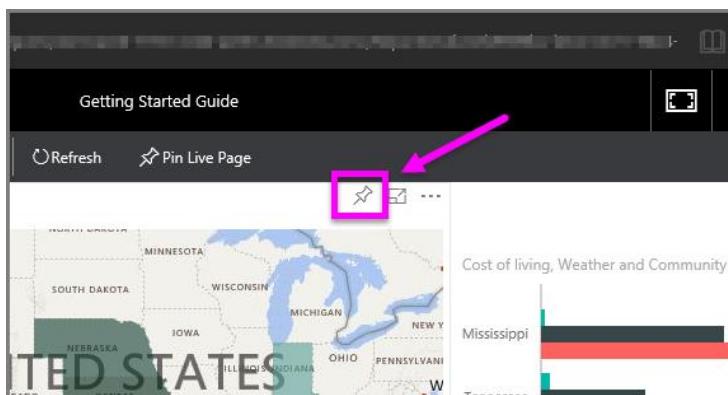


When you sign in to Power BI, you'll see Power BI Desktop file you just published in the service. In the image below, the report created in Power BI Desktop is shown in the **Reports** section.

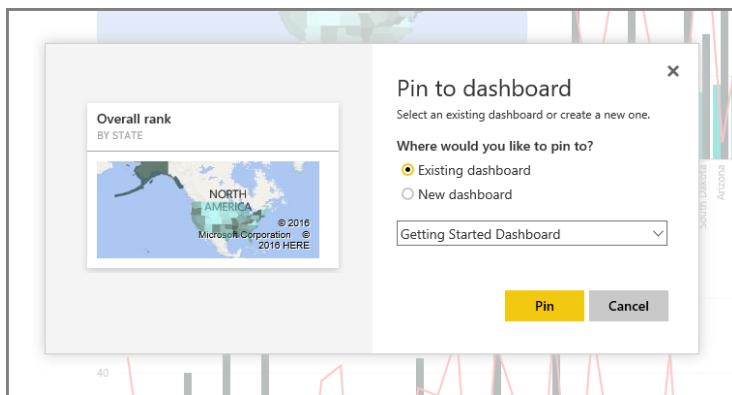


The screenshot shows the Power BI desktop application. On the left, the "My Workspace" sidebar lists "Dashboards", "Reports", and "Datasets". Under "Reports", "Getting Started Guide" is selected. The main area displays a map of the United States with state names. To the right of the map are several data visualizations: a bar chart titled "Cost of living, Weather and Community well-being by State" showing Mississippi at the top; a treemap titled "Tax rate by State" showing Arkansas at 100%; and a bubble chart titled "Cost of living, Tax rate and Overall rank by State and State" showing Kentucky as the largest bubble. The bottom of the screen shows a navigation bar with "Page 1" through "Page 6".

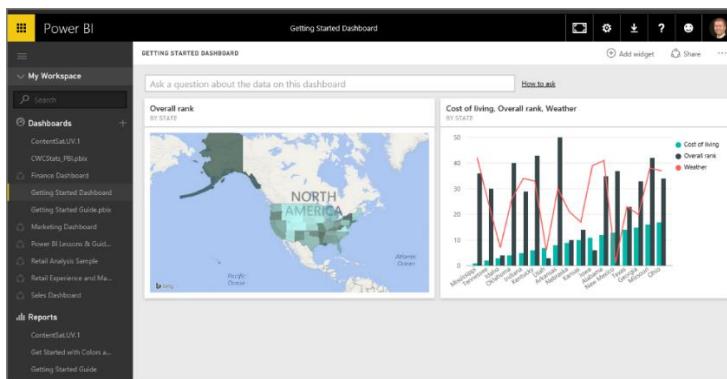
In that report, I can choose the Pin icon to pin that visual to a dashboard. The following image shows the pin icon highlighted with a bright box and arrow.



When I select that, the following dialog appears, letting me pin the visual to an existing dashboard, or to create a new dashboard.



When we pin a couple of visuals from our report, we can see them in the dashboard.



End Section – Create & Publish Reports

Create out-of-box dashboards with cloud services

With Power BI, connecting to data is easy. From the Power BI service, you can just select the **Get Data** button in the lower-left corner of the home page.

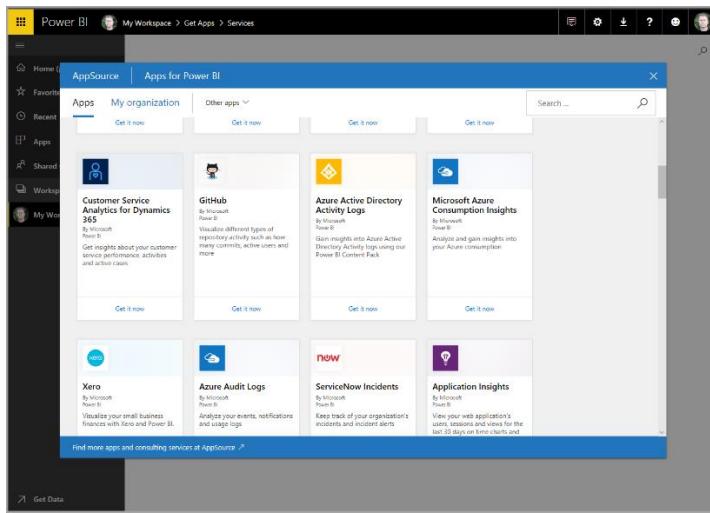
The screenshot shows the Power BI Home (preview) page. On the left, there's a sidebar with navigation links like 'Home (preview)', 'Favorites', 'Recent', 'Apps', 'Shared with me', 'Workspaces', and 'My Workspace'. The main canvas displays several dashboards: 'Good morning, David' (Welcome to your Power BI home), '1 - Power BI Articles' (with a bar chart showing '% Satisfied' and a line chart for 'PBI Articles dashboard views per day'), and 'Favorites + frequents' (listing items like 'Power BI Articles', 'SkyEye PillarView', etc.). At the bottom left of the canvas, there's a 'Get Data' button with a pink arrow pointing to it.

The *canvas* (the area in the center of the Power BI service) shows you the available sources of data in the Power BI service. In addition to common data sources like Microsoft Excel files, databases, or Microsoft Azure data, Power BI can just as easily connect to a whole assortment of **software services** (also called SaaS providers or cloud services): Salesforce, Facebook, Google Analytics, and more.

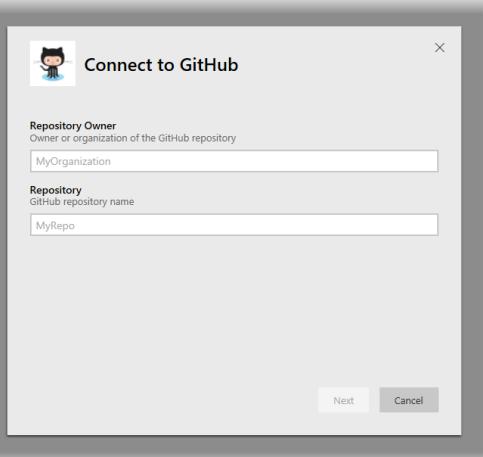
The screenshot shows the 'Get Data' page. The left sidebar has the same navigation as the previous screenshot. The main area is titled 'Get Data' with a sub-instruction 'Need more guidance? Try this tutorial or watch a video'. It's divided into two main sections: 'Discover content' and 'Create new content'. Under 'Discover content', there are four boxes: 'My organization' (Get button), 'Services' (Get button), 'Files' (Get button), and 'Databases' (Get button). Below these are links for 'Content', 'Organizational Content Packs', 'Source Templates', 'Service Content Pack', and 'Partner Showcase'.

For these software services, the **Power BI service** provides a collection of ready-made visuals that are pre-arranged on dashboards and reports for your organization. This collection of visuals is called an **app**. Apps get you up and running quickly, with data and dashboards that your organization has created for you. For example, when you use the GitHub app, Power BI connects to your GitHub account (after you provide your credentials) and then populates a predefined collection of visuals and dashboards in Power BI.

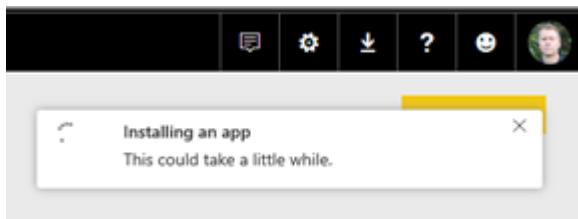
There are apps for all sorts of online services. The following image shows a page of apps that are available for different online services, in alphabetical order. This page is shown when you select the **Get** button in the **Services** box (shown in the previous image). As you can see from the following image, there are many apps to choose from.



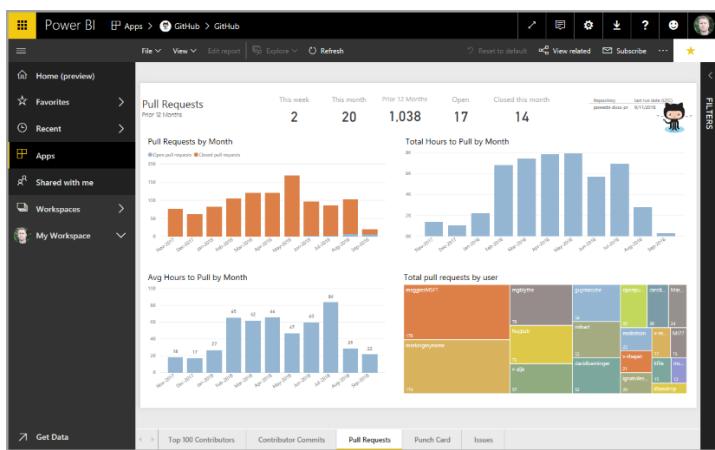
For our purposes, we'll choose **GitHub**. GitHub is an application for online source control. When you select the **Get it now** button in the box for the GitHub app, the **Connect to GitHub** dialog box appears.



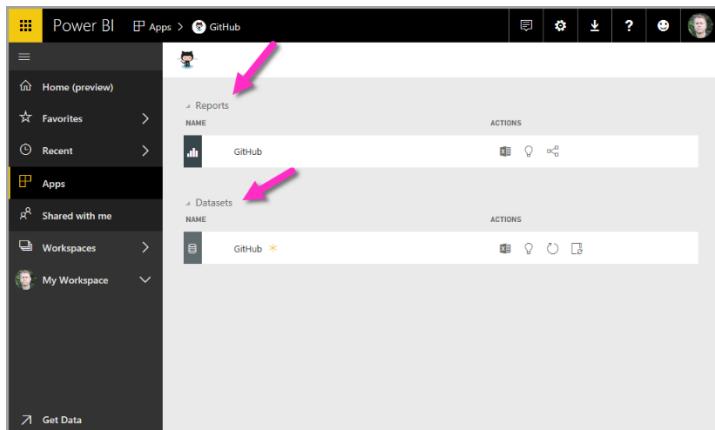
After you enter the information and credentials for the GitHub app, installation of the app begins.



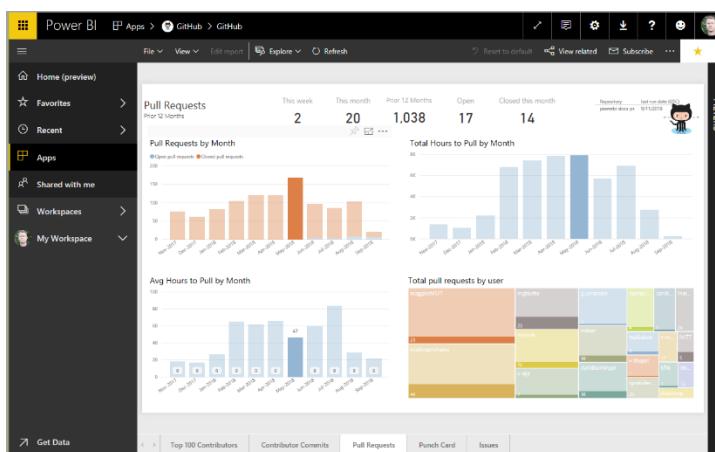
After the data is loaded, the predefined GitHub app dashboard appears.



In addition to the app **dashboard**, the **report** that was generated (as part of the GitHub app) and used to create the dashboard is available, as is the **dataset** (the collection of data pulled from GitHub) that was created during data import and used to create the GitHub report.

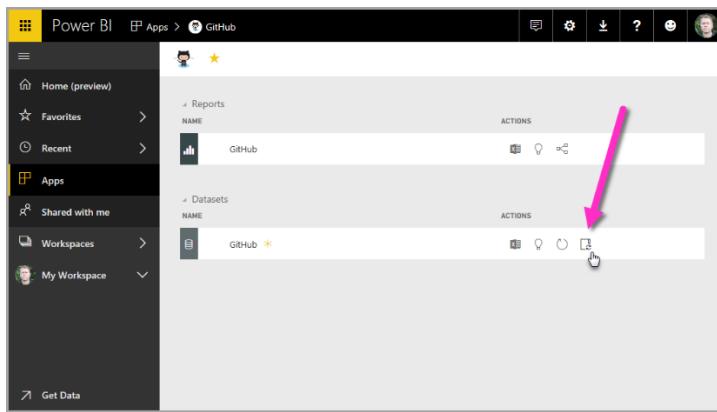


On the dashboard, you can select any of the visuals and interact with them. As you do so, all the other visuals on the page will respond. For example, when the **May 2018** bar is selected in the **Pull Requests (by month)** visual, the other visuals on the page adjust to reflect that selection.

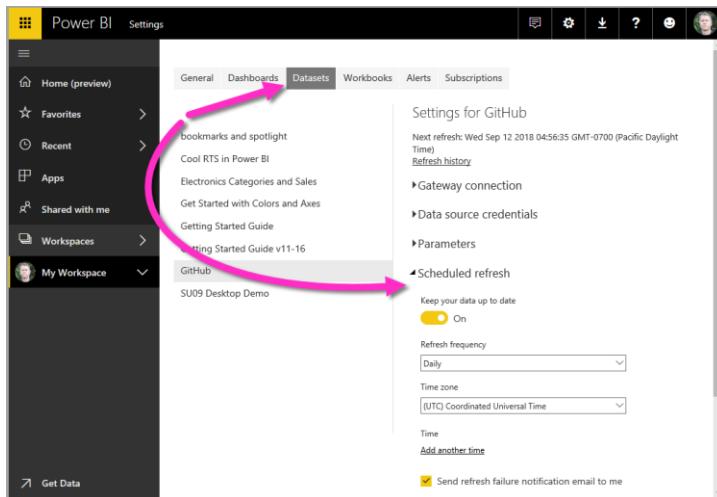


Update data in the Power BI service

You can also choose to **update** the dataset for an app, or other data that you use in Power BI. To set update settings, select the schedule update icon for the dataset to update, and then use the menu that appears. You can also select the update icon (the circle with an arrow) next to the schedule update icon to update the dataset immediately.



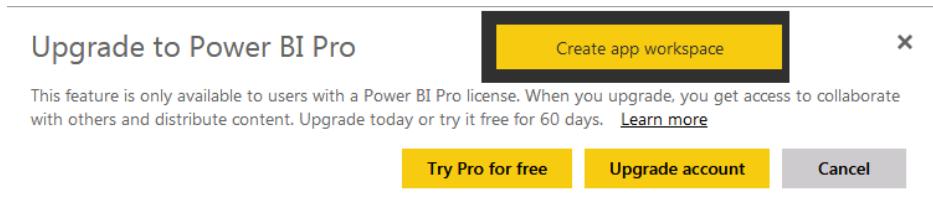
The **Datasets** tab is selected on the **Settings** page that appears. In the right pane, select the arrow next to **Scheduled refresh** to expand that section. The **Settings** dialog box appears on the canvas, letting you set the update settings that meet your needs.



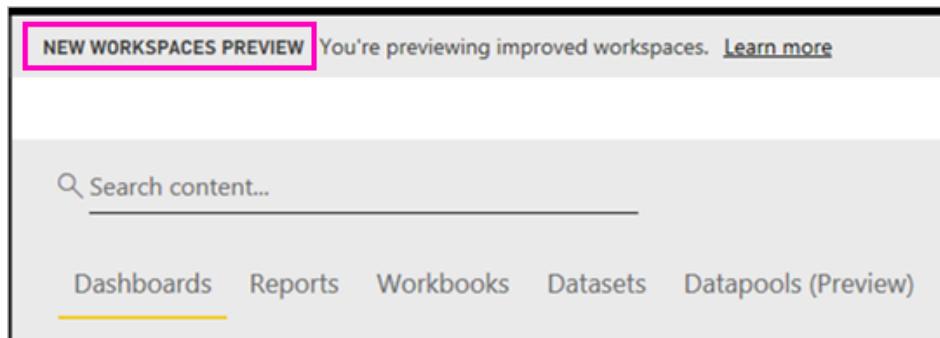
End Section - Create out-of-box dashboards with cloud services

What follows is in preview, troubleshooting or general “Good Practice”

Create New Workspace Preview 08/23/2018



Power BI is introducing a new workspace experience as a preview. Workspaces are still areas to collaborate with colleagues to create collections of dashboards and reports, which you can bundle into *apps* and distribute to your whole organization or to specific people or groups.



A screenshot of the Power BI workspace interface. At the top left, there is a pink-bordered box containing the text "NEW WORKSPACES PREVIEW". To its right, the message "You're previewing improved workspaces." and a "Learn more" link. Below this is a search bar with the placeholder "Search content...". At the bottom of the interface, there is a navigation menu with five items: "Dashboards" (underlined in yellow), "Reports", "Workbooks", "Datasets", and "Datapools (Preview)".

With the new workspaces preview you can now:

- Assign workspace roles to user groups: security groups, distribution lists, Office 365 groups, and individuals.
- Create a workspace in Power BI without creating an Office 365 group.
- Use more granular workspaces roles for more flexible permissions management in a workspace.

When you create one of the new workspaces, you're not creating an underlying, associated Office 365 group. All the workspace administration is in Power BI, not in Office 365. You can still add an Office 365 group to the workspace to continue managing user access to content through Office 365 groups. However, you can additionally use security groups, distribution lists, and add individuals directly within Power BI, giving you a flexible way to manage workspace access. Because workspace administration is now in Power BI, Power BI admins decide who in an organization can create workspaces. See the [Power BI admin portal article, Workspaces section](#) for details.

You add user groups or individuals to the new workspaces as members, contributors, or admins. Everyone in a user group gets the role you've defined. If an individual is in multiple user groups, they get highest level of permission provided by the role. See [Roles in the new workspaces](#) later in this article for an explanation of the different roles.

Everyone you add to an app workspace needs a Power BI Pro license. In the workspace these users can all collaborate on dashboards and reports that you plan to publish to a wider audience, or even to your entire organization. If you want to distribute content to others inside your organization, you can assign Power BI Pro licenses to those users or place the workspace in a Power BI Premium capacity.

With the new workspaces, we are redesigning some features. See [App workspace features that work differently](#) later in this article for an explanation of the changes you can expect to be permanent along with the preview. Because this

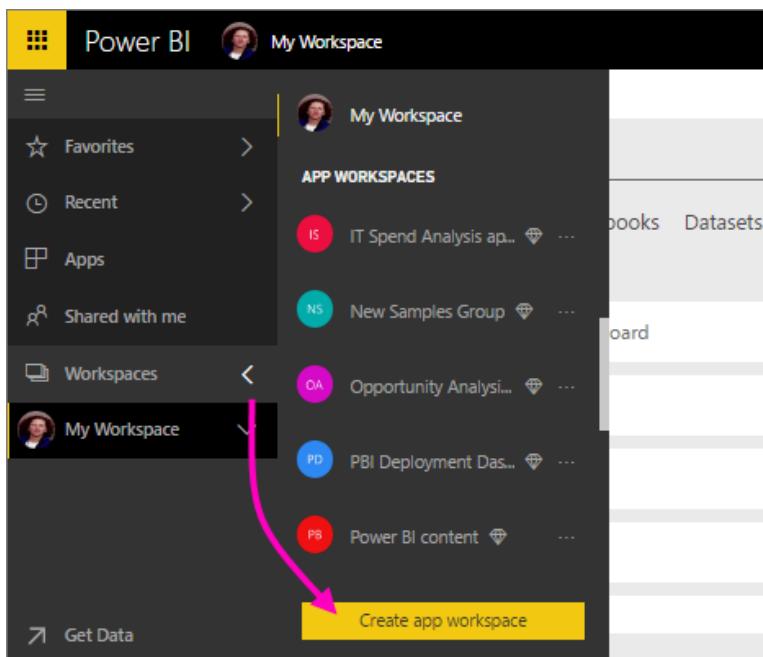
is a preview feature, there are some limitations that you should be aware of. See [Known issues](#) later in this article for an explanation of the current limitations.

Roll out new app workspaces

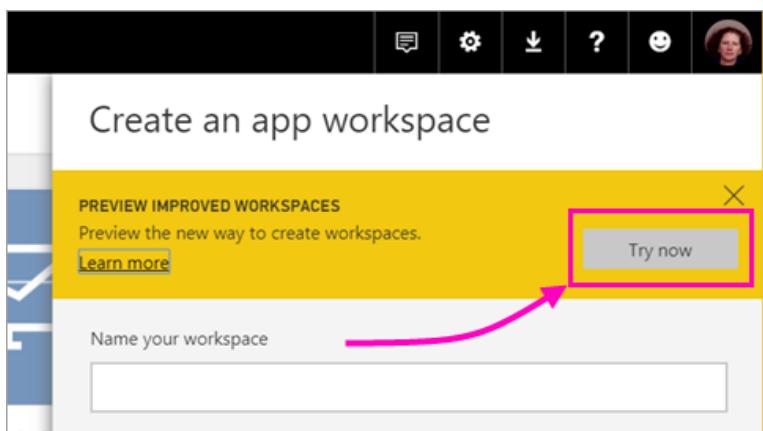
During the preview period, old and new workspaces can coexist side by side, and you can create either. When the preview for new workspaces ends and they're generally available, old workspaces can still exist for a time. You won't be able to create them, and you'll need to prepare to migrate your workspaces to the new workspaces infrastructure. Don't worry, you will have several months to complete migration.

Create one of the new app workspaces

1. Start by creating the app workspace. Select **Workspaces > Create app workspace**.



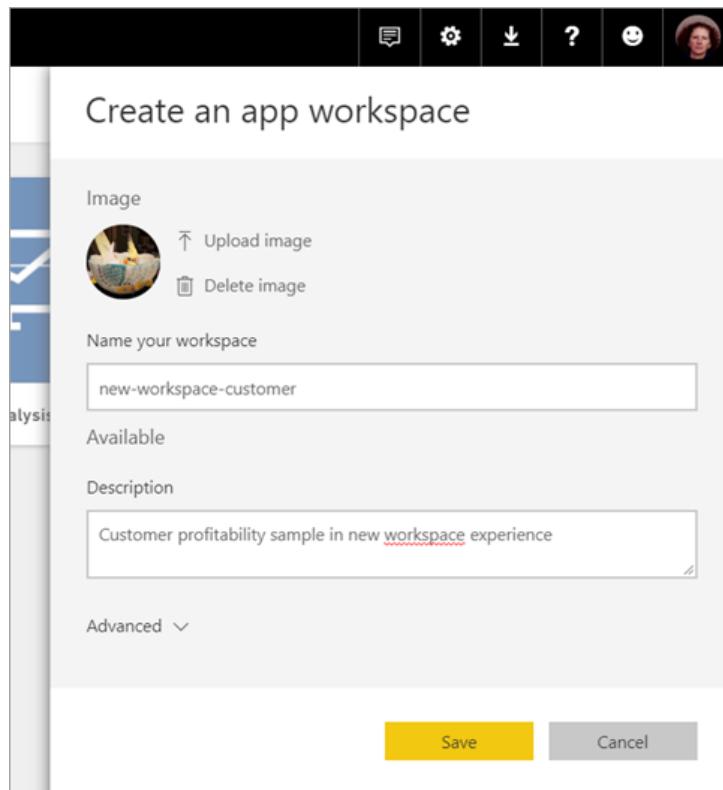
2. In **Preview improved workspaces**, select **Try now**.



3. Give the workspace a name. If the name isn't available, edit it to come up with a unique ID.

The app will have the same name as the workspace.

4. Add an image, if you want. The file size has to be less than 45 KB.



5. Select **Save**.

Here in the **Welcome** screen for your new workspace, you can add data.

Welcome to the new-workspace-customer workspace

You're on your way to exploring your data and monitoring what matters with all your group members. Let's start by getting some data.

Need more guidance? [Try this tutorial](#) or [watch a video](#)

Discover content

- My organization
- Services
- Files
- Databases

Create new content

More ways to create your own content

[Samples](#) [Solution Templates](#) [Partner Showcase](#)

[Get Data](#)

- For example, select **Samples > Customer Profitability Sample**.

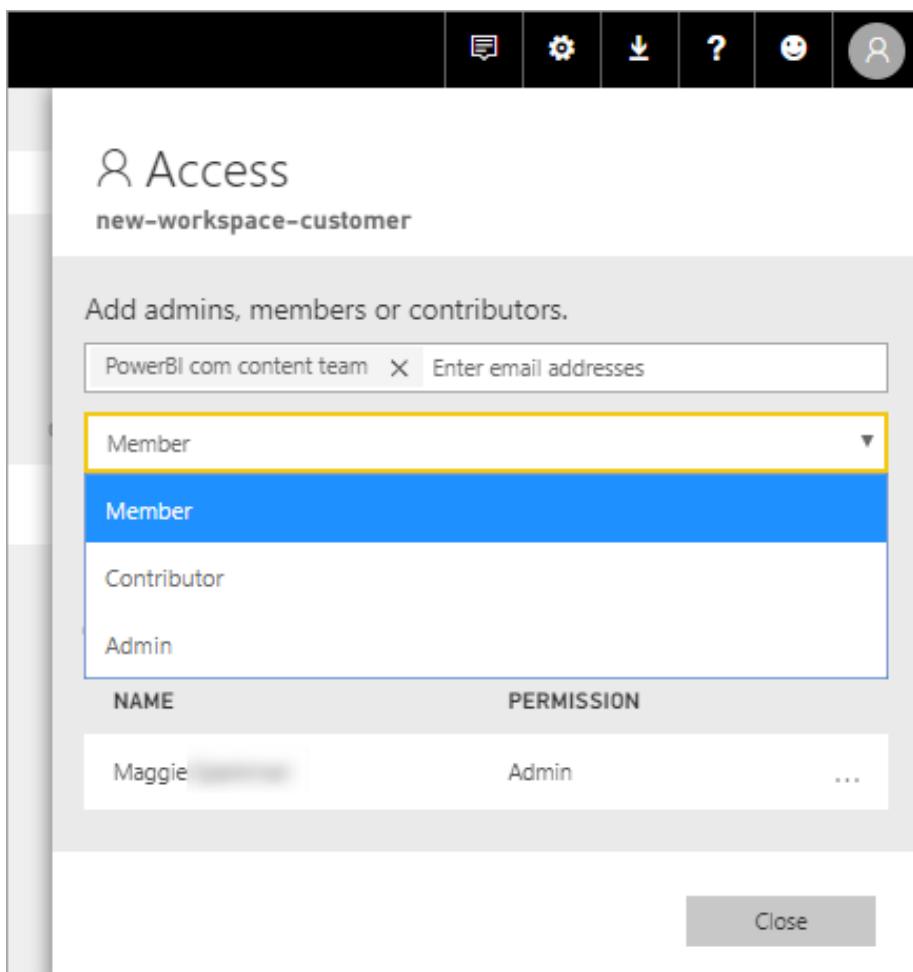
Now in the workspace content list, you see **New workspaces preview**. Because you're an admin, you also see a new action, **Access**.

NEW WORKSPACES PREVIEW You're previewing improved workspaces. [Learn more](#)

+ Create [Access](#) [Settings](#) [Publish app](#)

Showing 1 i					
	NAME ↑	ACTIONS	OWNER	CLASSIFICATION	INCLUDED IN APP
	Customer Profitability Sample		new-work...		

- Select **Access**.
- Add security groups, distribution lists, Office 365 groups, or individuals to these workspaces as members, contributors, or admins. See [Roles in the new workspaces](#) later in this article for an explanation of the different roles.



The screenshot shows the 'Access' dialog box in Microsoft Power BI. At the top, there are several icons: a list icon, a gear icon, a download icon, a question mark icon, a smiley face icon, and a user icon. The title 'Access' and the workspace name 'new-workspace-customer' are displayed. Below this, a message says 'Add admins, members or contributors.' A search bar contains the text 'PowerBI com content team'. A dropdown menu shows 'Member' selected. A table lists one member: Maggie with Admin permission. The table has columns 'NAME' and 'PERMISSION'. At the bottom right is a 'Close' button.

9. Select Add > Close.
10. Power BI creates the workspace and opens it. It appears in the list of workspaces you're a member of. Because you're an admin, you can select the ellipsis (...) to go back and make changes to workspace settings, adding new members, or changing their permissions.



Add content to your app workspace

After you've **created an app workspace** of the new style, it's time to **add content to it**. **Adding content is similar in the new and old-style workspaces, with one exception**. While in either app workspace, you can upload or connect to files, just as you would in your own My Workspace. In the new workspaces, you can't connect to organizational content packs, or third-party content packs such as Microsoft Dynamics CRM, Salesforce, or Google Analytics. In the current workspaces you can connect to content packs.

When you view content in the content list of an app workspace, the app workspace name is listed as the owner.

Connecting to third-party services in new workspaces (preview)

In the new workspaces experience, we are *making a change to focus on apps*.

- Apps for third-party services make it easy for users to obtain data from the services they use, such as Microsoft Dynamics CRM, Salesforce, or Google Analytics.
- Organizational apps give your users the internal data they need.
- We plan to add capabilities to organizational apps so users can customize the content they find within the apps.
- *Remove the need for content packs.* With the new workspaces preview, you can't create or consume organizational content packs.
- Use the apps provided to connect to third-party services, or ask your internal teams to *provide apps for any content packs you're currently using.*

Roles in the new workspaces

Roles let you manage who can do what in a workspace, so teams can collaborate. *New workspaces allow you to assign roles to individuals, and to user groups: security groups, Office 365 groups, and distribution lists.*

When you assign roles to a user group, the individuals in the group have access to content. If you nest user groups, all the contained users have permission. A user who's in several user groups with different roles gets the highest level of permission granted them.

The new workspaces offer three roles: admins, members, and contributors.

Admins can:

- Update and delete the workspace.
- Add/remove people, including other admins.
- Do everything members can do.

Members can:

- Add members or others with lower permissions.
- Publish and update an app.
- Share an item or share an app.
- Allow others to reshare items.
- Do everything contributors can do.

Contributors can:

- Create, edit, and delete content in the workspace.
- Publish reports to the workspace, delete content.

- Can't give new people access to content; can't share new content, but can share with someone with whom the workspace, item, or app is already shared.
- Can't modify the members of the group.

We're building *Request Access workflows throughout the service so users who don't have access can request it. Request Access workflows currently exist for dashboards, reports, and apps.*

Distribute an app

When the content is ready,

- *Choose which dashboards and reports you want to publish, and then you publish it as an app.*
- Create one app from each workspace.
- Get your app:
 - Install it automatically in your coworkers' Power BI accounts if your Power BI administrator gives you permission.
 - Find and install your app from Microsoft AppSource
 - Send them a direct link.
 - App updates automatically
 - Control how frequently the data refreshes.

See [Publish apps with dashboards and reports in Power BI](#) for details.

Convert old app workspaces to new app workspaces

During the preview period, you can't automatically convert your old app workspaces to new ones. You can however create a new app workspace and publish your content to the new location.

When the new workspaces are generally available (GA), you can opt in to migrate the old ones automatically. *At some point after GA, you'll have to migrate them.*

Power BI apps FAQ

How are the new app workspaces different from current app workspaces?

- Creating app workspaces won't create corresponding entities in Office 365 like current app workspaces do. (You can still add an Office 365 group to your workspace by assigning it a role).
- In current app workspaces, you can add only individuals to the members and admin lists. In the new app workspaces, you can add multiple AD security groups, distribution lists, or Office 365 groups to these lists to allow for easier user management.

- You can create an organizational content pack from a current app workspace. You can't create one from the new app workspaces.
- You can consume an organizational content pack from a current app workspace. You can't consume one from the new app workspaces.
- During the preview some capabilities aren't enabled yet for new app workspaces. See the next section, Other planned new workspace features, for details.

Planned new app workspace preview features

Some other new app workspace preview features are still being developed, but aren't available yet as we launch the preview:

- No **Leave workspace** button.
- Usage metrics aren't supported yet.
- How Premium works: You can assign and create workspaces in a Premium capacity, but to move a workspace between capacities, go to the workspace's settings.
- SharePoint web part embedding isn't supported yet.
- No **OneDrive** button for Office 365 groups in Get Data/Files.

App workspace features that work differently

Some features work differently from current app workspaces in the new app workspaces. These differences are intentional, based on feedback we've received from customers, and will enable a more flexible approach to collaboration with workspaces:

- Members can or can't reshare: replaced by the Contributor role
- Read-only workspaces: Instead of granting users read-only access to a workspace, you'll assign users to a forthcoming Viewer role, which allows similar read-only access to the content in a workspace.

Known issues

The following issues are known, and fixes are under development:

- Free users or user groups added as recipients of subscriptions to emails may not receive the emails, though they should. The issue occurs when the new workspaces experience workspace is in a Premium capacity, but the My Workspace of the user creating the subscription isn't in a Premium capacity. If the My Workspace is in a Premium capacity, then free users and user groups will receive the emails.
- After a workspace is moved from a Premium capacity to shared capacity, in some cases, free users and user groups will continue to receive emails, though they should not. The issue occurs when the My Workspace of the user creating the subscription is in a Premium capacity.

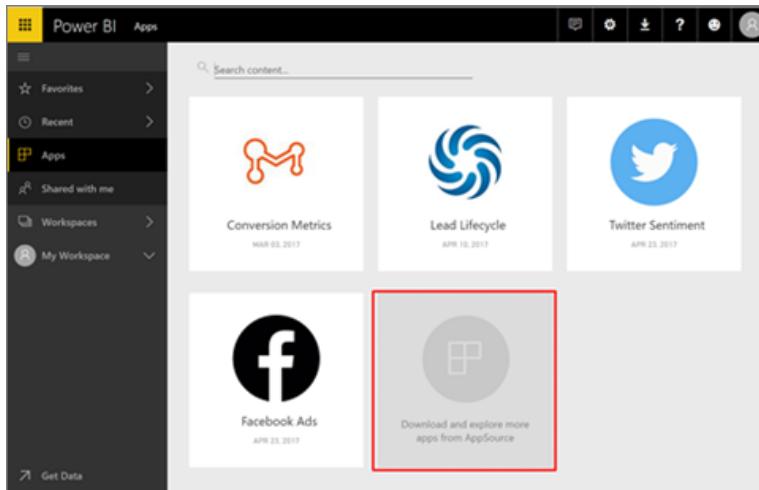
Options for collaborating and sharing in Power BI:

- Collaborating with coworkers to create meaningful reports and dashboards in *app workspaces*.

- Bundling those dashboards and reports into *apps* and publishing them to a larger group or your whole organization.
- Sharing dashboards or reports with a few people, from the service or the Power BI mobile apps.
- Printing reports.
- Publishing to the web for public web sites, where anyone in the world can see and interact with it.

(Req*) No matter which option you choose, to share a dashboard you need a Power BI Pro license, or the content needs to be in a Premium capacity.

License requirements vary for the colleagues who view your dashboards, depending on the option you choose. The following sections spell out details.

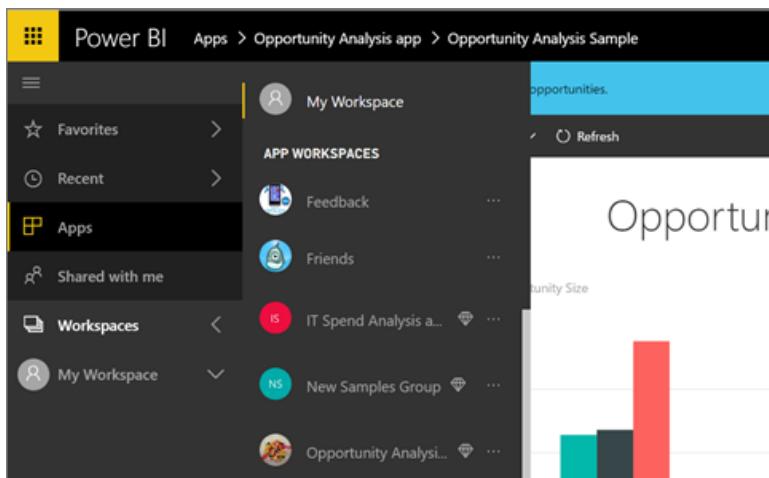


Apps in the Power BI service

Collaborate with coworkers in an app workspace

When teams work together, they need access to the same documents so they can quickly collaborate. App workspaces in Power BI provide the place where teams come together to share the ownership and management of dashboards, reports, datasets, and workbooks that matter to them. Sometimes Power BI users organize their workspaces based on organizational structures, other times they create them for specific projects. Still other organizations use several workspaces to store different versions of reports or dashboards they use.

App workspaces provide roles that determine what permissions your coworkers have. You can use those roles to determine who can manage the entire workspace, or just provide content into it.



Some users naturally put content in their My Workspace and share it out. App workspaces are better at collaboration than My Workspace because they provide co-ownership of content. You and your entire team can easily make updates or give others access. My Workspace is best used by individuals for one-off or personal content.

Let's imagine you have a finished dashboard you need to share with your colleagues. What's the best way to give them access to the dashboard? The answer depends on a number of factors. If a specific colleague needs to own the dashboard and keep it up to date, or needs access to all the content in the app workspace, it may be best to add them to the workspace. If your colleague just needs to see that dashboard and not all the content in the workspace, you again can choose from a set of alternatives. If the dashboard is part of a bigger set of content you need to distribute to many colleagues, then publishing an app is likely the best choice. However, if the colleague just needs that one dashboard, then sharing the dashboard could be the best path forward.

Read more about [creating app workspaces](#).

Did you know? Power BI is previewing a new workspace experience. Read [Create the new workspaces \(preview\)](#) to see how workspaces will change in the future.

Distribute data and insights by creating an app

Say you want to distribute your dashboard to a broad audience. You and your coworkers have created an *app workspace*, then created and refined dashboards, reports, and datasets in the app workspace. Now you select the dashboards and reports you want and publish them as an app — either to a group or to your whole organization.

The screenshot shows the Microsoft Power BI service interface. On the left is a navigation sidebar with options like Favorites, Recent, Apps, Shared with me, Workspaces, and the current workspace, 'Opportunity Analysis app'. The main area displays a list of items under 'Dashboards', 'Reports', 'Workbooks', and 'Datasets'. Two items are listed: 'Opportunity Analysis Sample' and 'Retail Analysis Sample', both owned by 'Opportunity Analysis app'. At the top right, there are buttons for '+ Create', 'Publish app' (which has a pink arrow pointing to it), and other account-related options.

Apps are easy to find and install in the Power BI service (<https://powerbi.com>). You can send your business users a direct link to the app, or they can search for it in AppSource. If your Power BI administrator give you permissions, you can install an app automatically in your coworkers' Power BI accounts. Read more about [publishing your apps](#).

After they install an app, they can view it in their browser or mobile device.

For your users to view your app, either they need to have a Power BI Pro license, too, or the app needs to be stored in a Power BI Premium capacity. Read [What is Power BI Premium?](#) for details.

You can publish apps to those outside your organization, too. They can view and interact with the app content, but can't share it with others.

Share dashboards and reports

Let's say you've finalized a dashboard and a report in your own My Workspace or in an app workspace and you want a few other people to have access to it. One way to get it to them is to *share* it.

The screenshot shows a Power BI dashboard with two visualizations: a pie chart for 'Opportunity Count BY REGION' (West, Central) and a bar chart for 'Opportunity Count BY SALES STAGE' (Lead, Qualify, Solution, Proposal). At the top right, there is a 'Share' button, which is highlighted with a pink arrow and circled in red.

You need a Power BI Pro license to share your content, and those you share it with do too, or the content needs to be in a workspace in a Premium capacity. When you share a dashboard or report, recipients can view it and interact with it, but can't edit it. They see the same data that you see in the dashboard and reports unless row-level security (RLS) is applied to the underlying dataset. The coworkers you share it with can share with their coworkers, if you allow them to.

You can share with people outside your organization, too. They can view and interact with the dashboard or report too, but can't share it.

More about sharing dashboards and reports from the Power BI service. You can also add a filter to a link and share a filtered view of your report.

Annotate and share from the Power BI mobile apps

In the Power BI mobile apps for iOS and Android devices, you can annotate a tile, report, or visual and then share it with anyone via email.



You're sharing a snapshot of the tile, report, or visual, and your recipients see it exactly as it was when you sent the mail. The mail also contains a link to the dashboard or report. If they have a Power BI Pro license, or the content is in a Premium capacity, and you've shared the object with them already, they can open it. You can send snapshots of tiles to anyone — not just coworkers in the same email domain.

More about annotating and sharing tiles, reports, and visuals from the iOS and Android mobile apps.

You can also share a snapshot of a tile from the Power BI app for Windows 10 devices.

Print or save as PDF or another static file

You can print or save as PDF (or other static file format) an entire dashboard, dashboard tile, report page, or visualization from the Power BI service. Reports can only be printed one page at a time -- you can't print the entire report at once. More about printing or saving as a static file.

Publish to the web

Warning

Use **Publish to web** only to share content publicly, not for internal sharing.

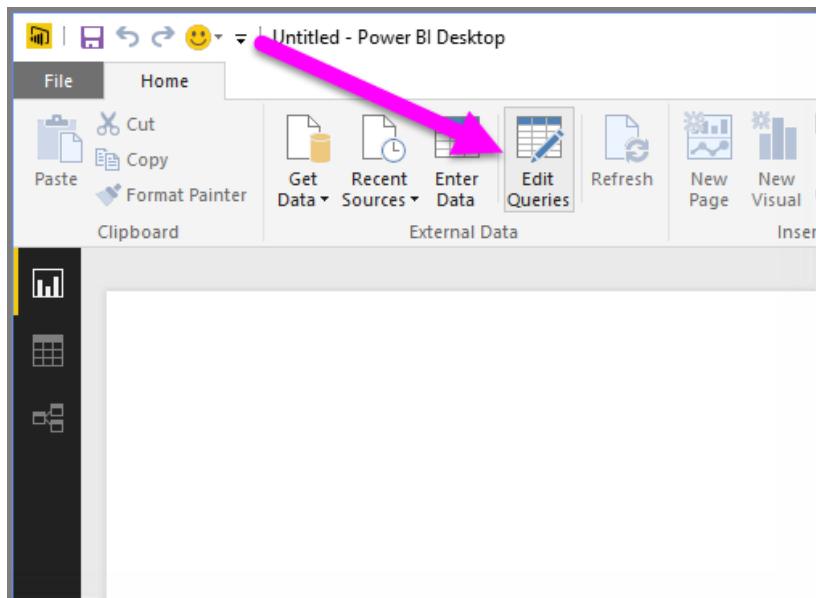
- You can publish Power BI reports to the whole Internet by embedding interactive visualizations in blog posts, websites, social media, and other online communications on any device.
- Anyone on the Internet can view your reports, and you have no control over who can see what you've published.

- They don't need a Power BI license.
- Publishing to the web is available only for reports that you can edit.
- You can't publish reports to the web if they're shared with you or if they're in an app. More about [publishing to the web](#).

Developers Side

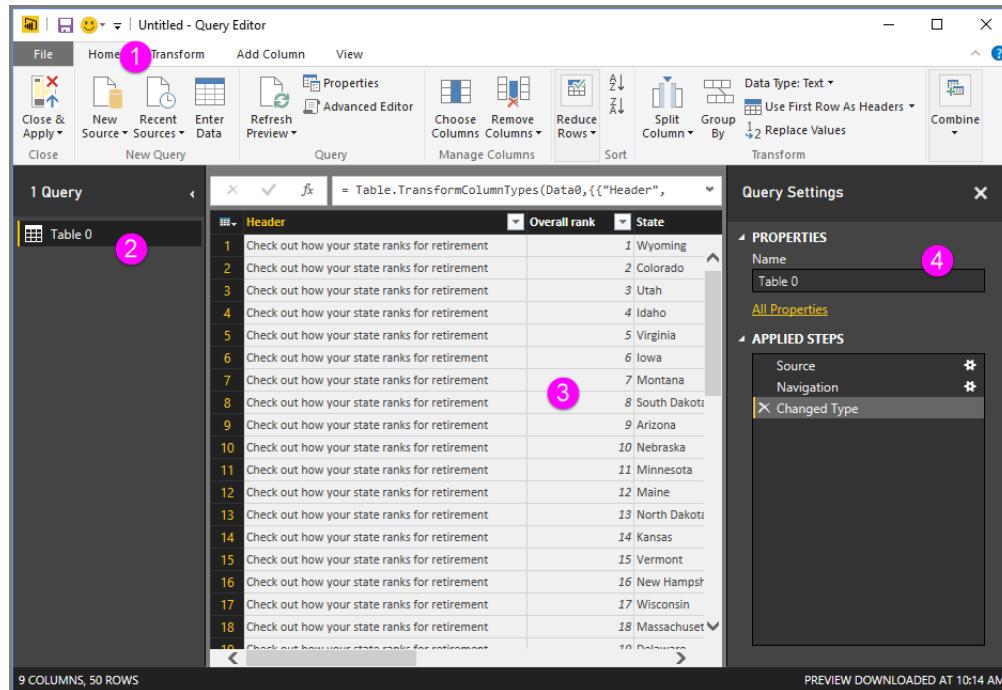
Power BI Desktop includes **Query Editor**, a powerful tool for shaping and transforming data so it's ready for your models and visualizations. When you select Edit from Navigator, Query Editor launches and is populated with the tables or other entities you selected from your data source.

You can also launch **Query Editor** directly from Power BI Desktop, using the **Edit Queries** button on the **Home** ribbon.



Once Query Editor is loaded with data that's ready for you to shape, you see a handful of sections:

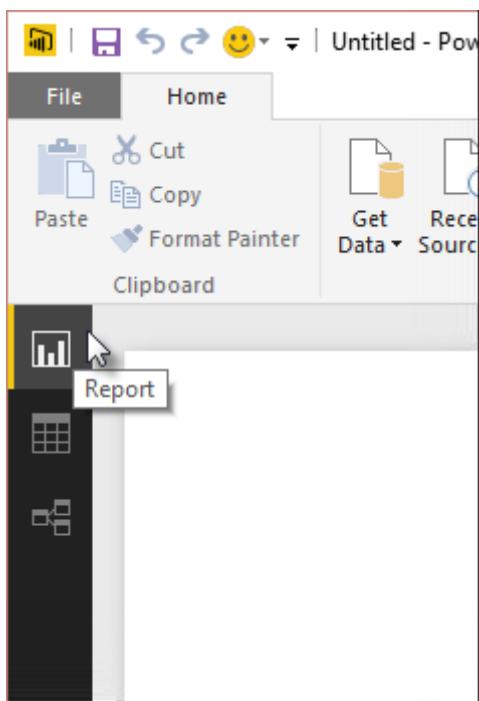
1. In the ribbon, many buttons are now active to interact with the data in the query
2. In the left pane, queries (one for each table, or entity) are listed and available for selection, viewing, and shaping
3. In the center pane, data from the selected query is displayed and available for shaping
4. The Query Settings window appears, listing the query's properties and applied steps



In the center pane, right-clicking on a column displays a number of different available transformations, such as removing the column from the table, duplicating the column under a new name, and replacing values. From this menu you can also split text columns into multiples by common delimiters.

Advanced data import and cleaning techniques for **Power BI Desktop**. Once you've shaped your data in **Query Editor** and brought it into **Power BI Desktop**, you can look at it in a few different ways.

There are three views in Power BI Desktop: **Report** view, **Data** view, and **Relationships** view. You see each view by selecting its icon in the upper left side of the canvas. In the following image, **Report** view is selected. The yellow bar beside the icon indicates which view is active.

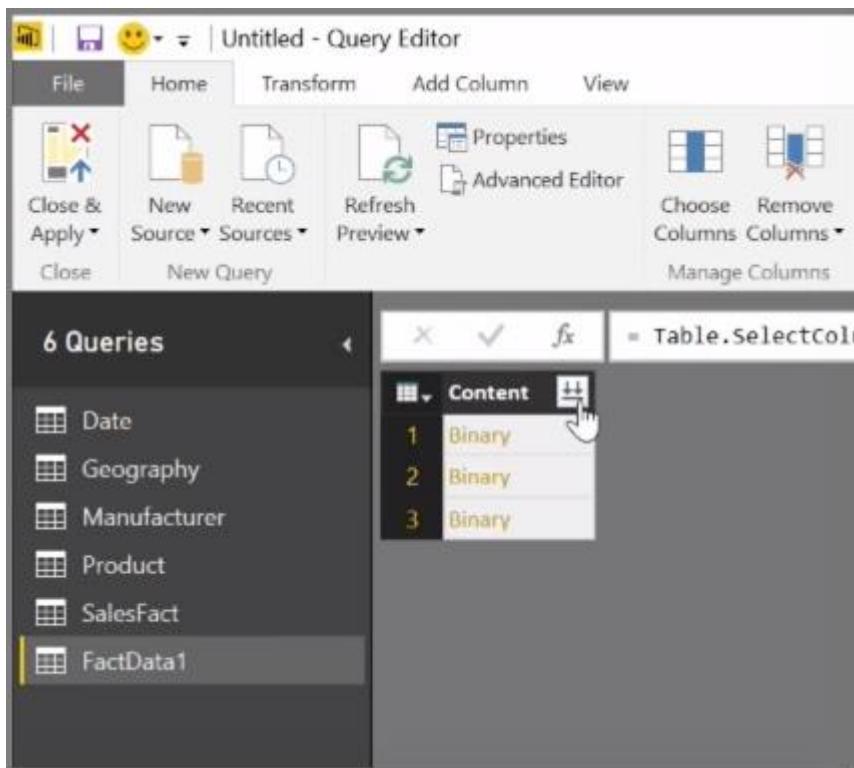


To change the view, just select either of other two icons. The yellow bar beside the icon indicates which view is active.

Power BI Desktop can combine data from multiple sources into a single report, at any time during the modelling process. To add additional sources to an existing report, select **Edit Queries** in the **Home** ribbon and then select **New Source** in **Query Editor**.

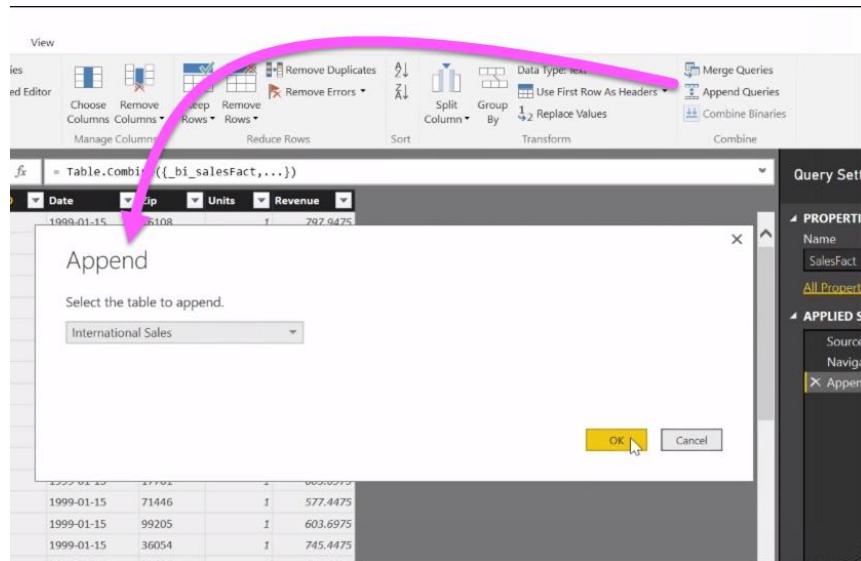
There are many different possible data sources you can use in **Power BI Desktop**, including Folders. By connecting to a folder, you can import data from multiple files at once, such as a series of Excel files or CSV files. The files contained within your selected folder appear in **Query Editor** as binary

content, and clicking the double-arrow icon at the top of the **Content** column loads their values.

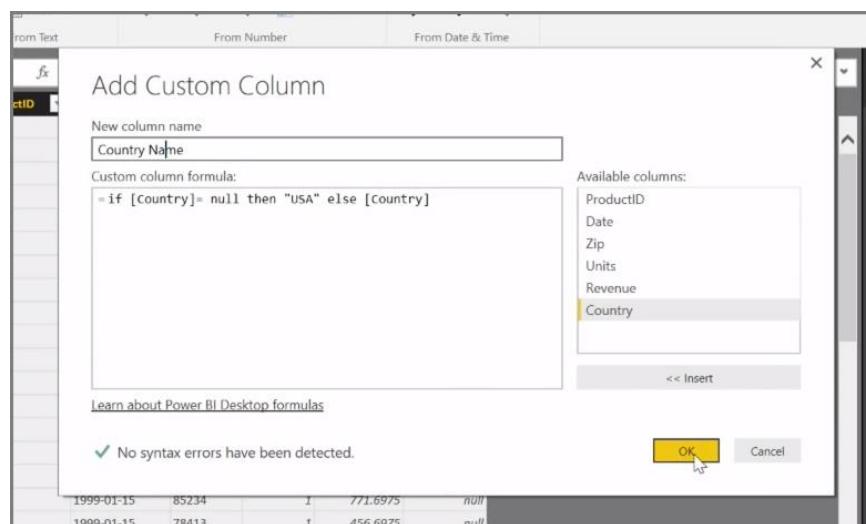
A screenshot of the Microsoft Power BI 201X Query Editor. The ribbon shows 'File', 'Home', 'Transform', 'Add Column', and 'View'. The 'Home' tab is selected. In the main area, there is a list of '6 Queries' on the left: Date, Geography, Manufacturer, Product, SalesFact, and FactData1. On the right, a table is shown with a column header 'Content'. A dropdown arrow next to 'Content' is highlighted with a cursor. The table rows are numbered 1, 2, and 3, each labeled 'Binary'. The formula bar at the top shows '= Table.SelectCol[Content, All]'. Other buttons visible include 'Close & Apply', 'New', 'Recent', 'Refresh', 'Properties', 'Advanced Editor', 'Choose Columns', 'Remove Columns', and 'Manage Columns'.

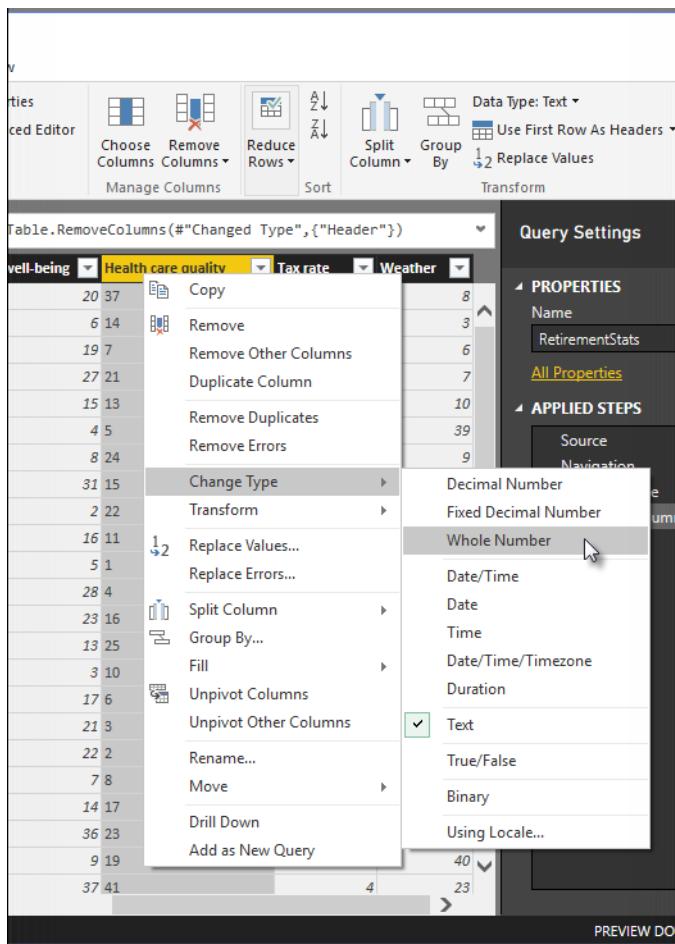
One of Power BI's most useful tools is its *Filters*. For example, selecting the drop-down arrow next to a column opens a checklist of text filters that you can use to remove values from your model.

You can also merge and append queries, and turn multiple tables (or data from various files, in folders) into a single table that contains just the data you want. You can use the **Append Queries** tool to add the data from a new table to an existing query. Power BI Desktop attempt to match up the columns in your queries, which you can then adjust as necessary in **Query Editor**.



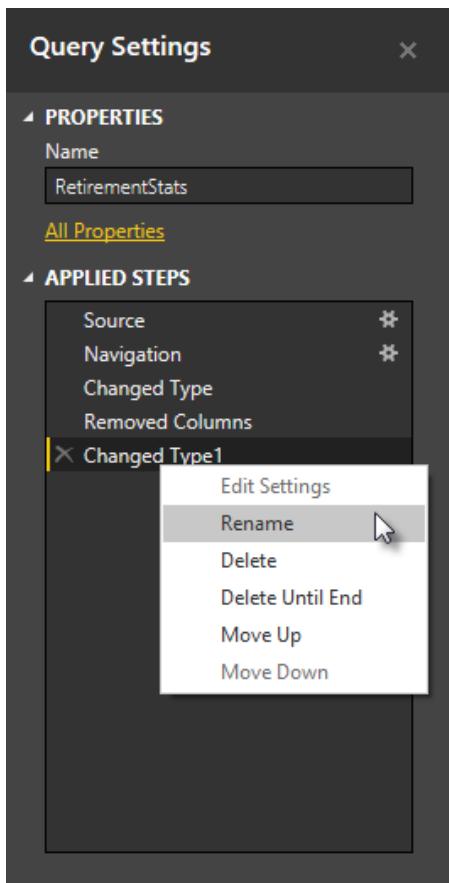
Finally, the **Add Custom Column** tool gives advanced users the option of writing query expressions from scratch using the powerful M language. You can add a custom column based on M query language statements, and get your data just the way you want it.



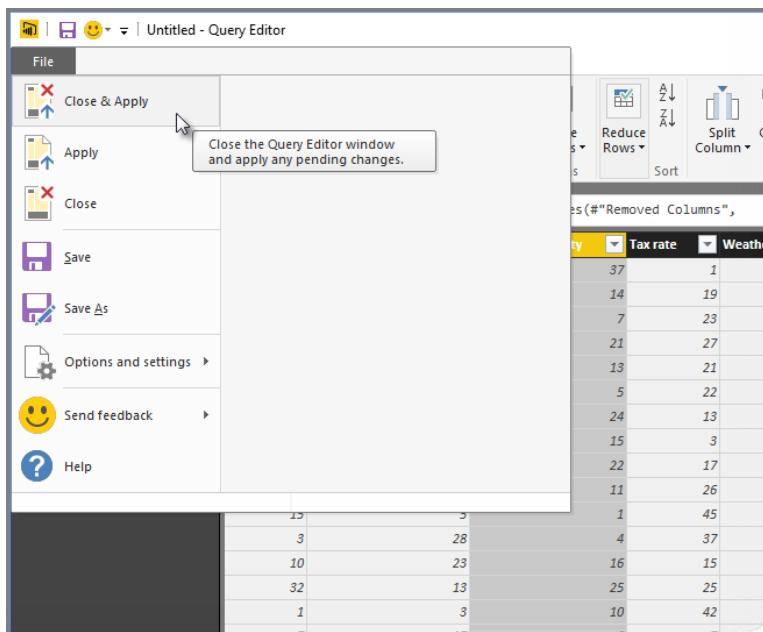


The screenshot shows the Microsoft Power BI Query Editor interface. The ribbon at the top has the 'Transform' tab selected. A context menu is open over a column named 'Health care quality'. The 'Change Type' option is highlighted in the menu. A submenu for data types is open, with 'Whole Number' selected. Other options in the submenu include Decimal Number, Fixed Decimal Number, Date/Time, Date, Time, Date/Time/Timezone, Duration, Text (which is checked), True/False, Binary, and Using Locale... At the bottom of the screen, there is a 'PREVIEW' pane showing a sample of the data.

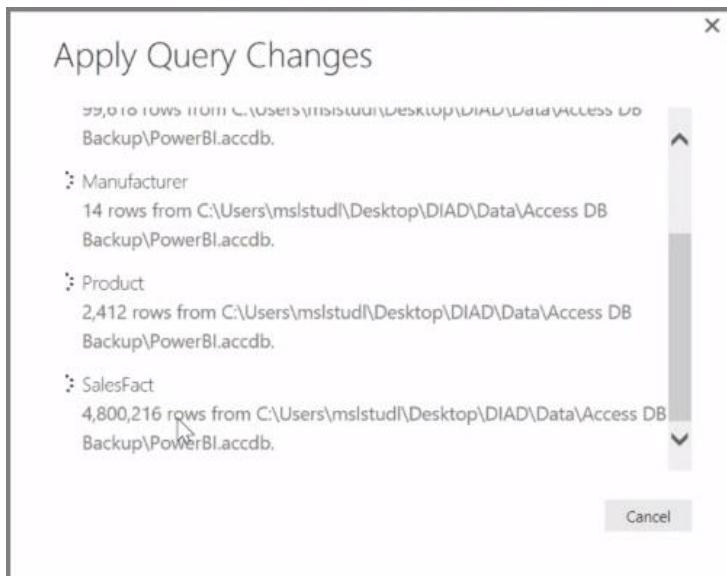
The **Query Editor** ribbon contains additional tools, such as changing the data type of columns, adding scientific notation, or extracting elements from dates, such as day of the week.



As you apply transformations, each step appears in the **Applied Steps** list in the **Query Settings** pane on the right side of **Query Editor**. You can use this list to undo or review specific changes, or even change the name of a step. To save your transformations, select **Close & Apply** on the **Home** tab.



Once you select **Close & Apply**, Query Editor applies the query changes you made, and applies them to Power BI Desktop.



There are all sorts of things you can do when transforming data in **Query Editor**, including advanced transformations. In the next section, we take a look at a few of those advanced transformations, to give you a sense of the almost immeasurable ways you can transform your data with **Query Editor**.

While Power BI can import your data from almost any source, its visualization and modeling tools work best with columnar data. Sometimes your data will not be formatted in simple columns, which is often the case with Excel spreadsheets, where a table layout that looks good to the human eye is not necessarily optimal for automated queries. For example, the following spreadsheet has headers that span multiple columns.

The screenshot shows a Microsoft Excel spreadsheet titled "Multi-Level-Spreadsheet - Excel". The table has 12 columns and 11 rows of data. The first row contains column headers: "Seattle Bikes", "Accessories", "Miscellaneous", "Portland Bikes", "Accessories", "Miscellaneous", "Vancouver Bikes", "Accessories", "Miscellaneous", "Bus", and "Cars". The data rows show values for each year from 2005 to 2013 across these categories. A pink arrow points to the first row of data.

	Seattle Bikes	Accessories	Miscellaneous	Portland Bikes	Accessories	Miscellaneous	Vancouver Bikes	Accessories	Miscellaneous	Bus	Cars
3	2005	33323	13394	4455	33323	13394	4455	33323	13394	4455	5563
4	2006	55342	19983	5563	55342	19983	5563	55342	19983	5563	5563
5	2007	33234	18884	3348	33234	18884	3348	33234	18884	3348	3348
6	2008	33252	18983	2239	33252	18983	2239	33252	18993	2239	2232
7	2009	22332	18840	2232	22332	18840	2232	22332	18840	2232	2232
8	2010	23331	18890	4343	23331	18890	4343	23331	18890	4343	3434
9	2011	33532	18790	3434	33532	18790	3434	33532	18790	3434	3434
10	2012	11001	11000	8840	11001	11000	8840	11001	11000	8840	8840
11	2013	10221	9900	8892	10221	9900	8892	10221	9900	8892	8892

Fortunately, Power BI has tools to quickly transform multi-column tables into datasets that you can use.

Transpose data

For example, using **Transpose** in **Query Editor**, you can flip data (turn columns to rows, and rows into columns) so you can break data down into formats that you can manipulate.

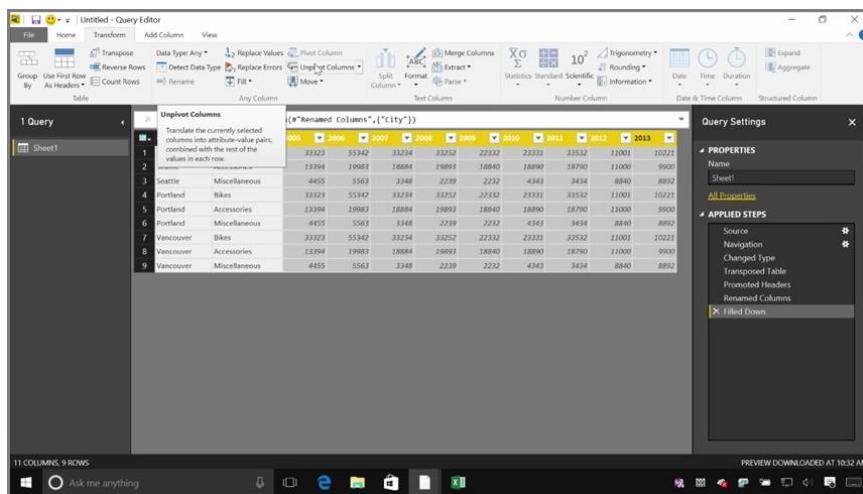
The screenshot shows the Microsoft Power BI Query Editor window. The ribbon at the top has tabs: File, Home, Transform (which is highlighted), Add Column, and View. Below the ribbon, there are several icons: Group By, Use First Row As Headers, Transpose (which has a pink arrow pointing to it), Reverse Rows, Count Rows, Data Type: Text, Detect Data Type, Rename, Split Column, and Format. The main area shows two queries: "CustomerDemographics" and "Table1". A tooltip for the "Transpose" button says "Transpose this table, treating rows as columns and columns as rows." The code pane shows a snippet of M code: "Table.TransformColumnTypes(Table.TransformTextColumnTypes(Tables[CustomerDemographics], Text.Type.Text), Text.Type.Text)".

Once you do that a few times, as described in the video, your table begins to shape into something that Power BI can more easily work with.

Format data

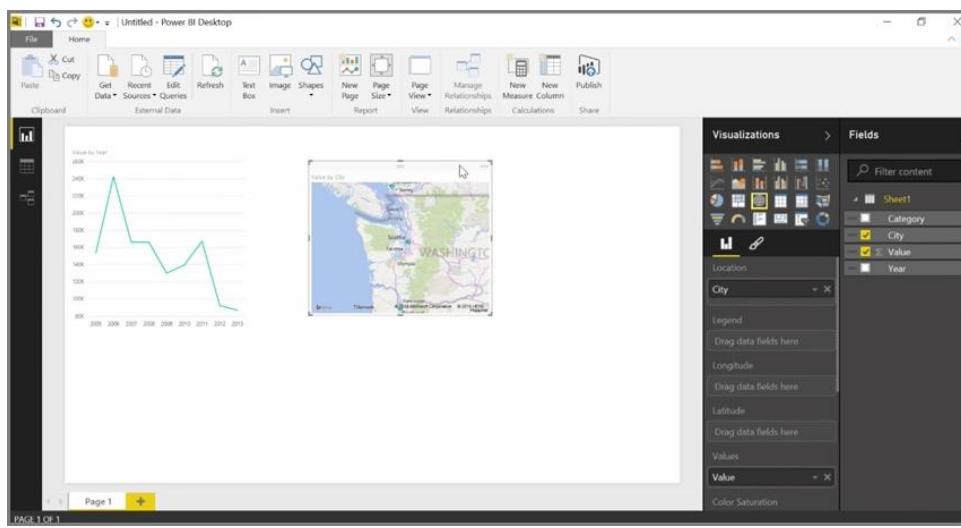
You also may need to format data, so Power BI can properly categorize and identify that data once it's imported.

With a handful of transformations, including *promoting rows into headers* into to break headers, using **Fill** to turn *null* values into the values found above or below in a given column, and **Unpivot Columns**, you can cleanse that data into a dataset that you can use in Power BI.



The screenshot shows the Microsoft Power BI Query Editor interface. On the left, there's a sidebar with options like 'Group By', 'Reverse Rows', 'Count Rows', 'Rename', 'Text Columns', 'Number Column', 'Date & Time Column', and 'Structured Column'. The main area displays a table with 11 columns and 9 rows. The first two columns are labeled '33223' and '19983'. The third column contains city names: 'Seattle', 'Portland', 'Portland', 'Portland', 'Vancouver', 'Vancouver', 'Vancouver', and 'Vancouver'. The fourth column contains category names: 'Miscellaneous', 'Bikes', 'Accessories', 'Miscellaneous', 'Bikes', 'Accessories', 'Miscellaneous', and 'Miscellaneous'. The fifth column contains values: '3342', '3348', '3348', '4455', '3342', '3348', '4455', and '4455'. The sixth column contains values: '33234', '33234', '2239', '3348', '33234', '2239', '3348', and '3348'. The seventh column contains values: '33252', '2232', '2232', '33252', '33252', '2232', '33252', and '33252'. The eighth column contains values: '23331', '18840', '18840', '4343', '23331', '18840', '4343', and '4343'. The ninth column contains values: '33532', '18790', '18790', '3434', '33532', '18790', '3434', and '3434'. The tenth column contains values: '11001', '11000', '11000', '8840', '11001', '11000', '8840', and '8840'. The eleventh column contains values: '10222', '9903', '9903', '8892', '10222', '9903', '8892', and '8892'. A tooltip 'Unpivot Columns' is visible over the third column. On the right, there's a 'Query Settings' pane with sections for 'PROPERTIES' (Name: Sheet1) and 'APPLIED STEPS' (listing steps like 'Source', 'Navigation', 'Changed Type', 'Transposed Table', 'Promoted Headers', 'Renamed Columns', and 'Filled Down').

With Power BI, you can experiment with these transformations on your data, and determine which types get your data into the columnar format that lets Power BI work with it. And remember, all actions you take are recorded in the Applied Steps section of Query Editor, so if a transformation doesn't work the way you intended, you can simply click the **x** next to the step, and undo it.



Create visuals

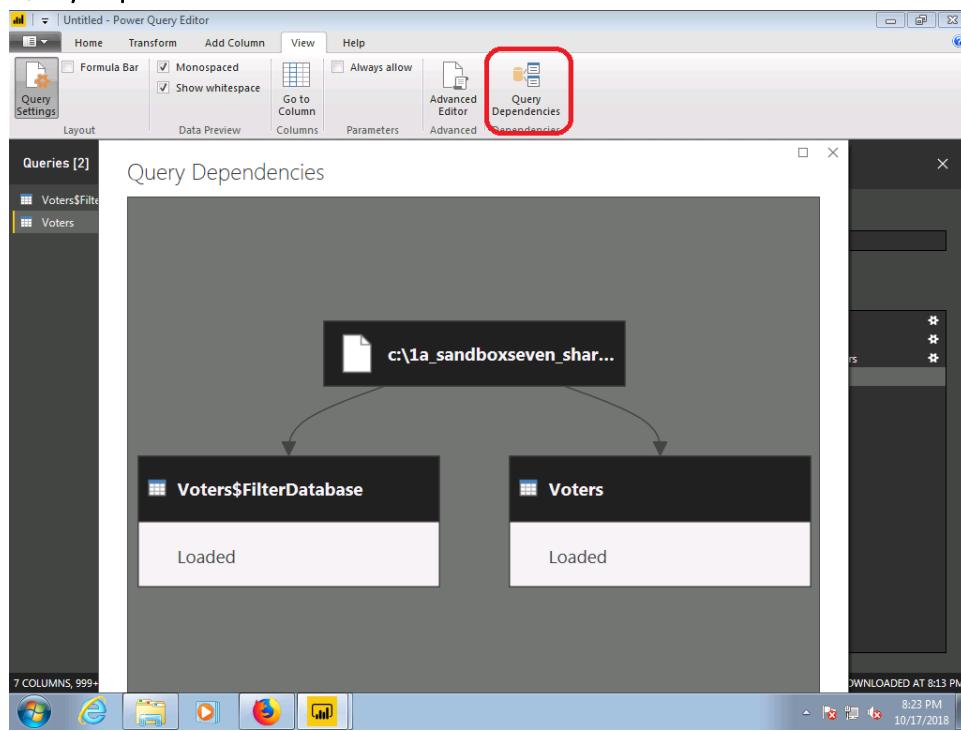
Once your data is in a format that Power BI can use, by transforming and cleansing the data, you can begin to create visuals.

Next steps

Congratulations! You've completed this section of the **Guided Learning** course for Power BI. You now know how to **get data** into Power BI Desktop, and how to *shape* or *transform* that data, so you can create compelling visuals.

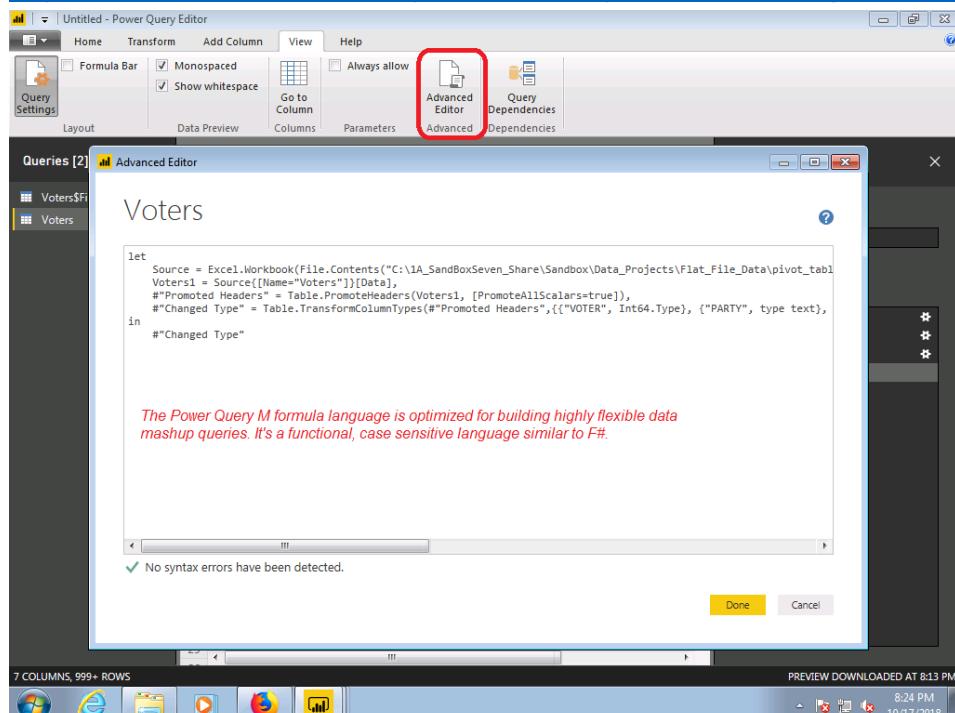
Cool Tools

Query Dependencies

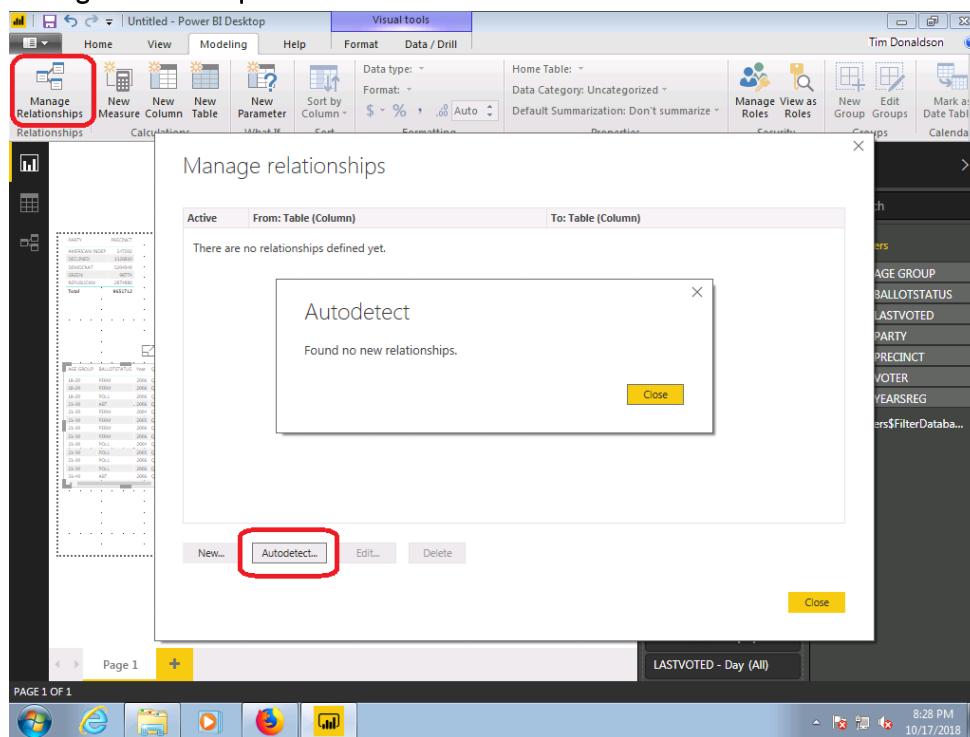


Advanced Editor & Power Query M

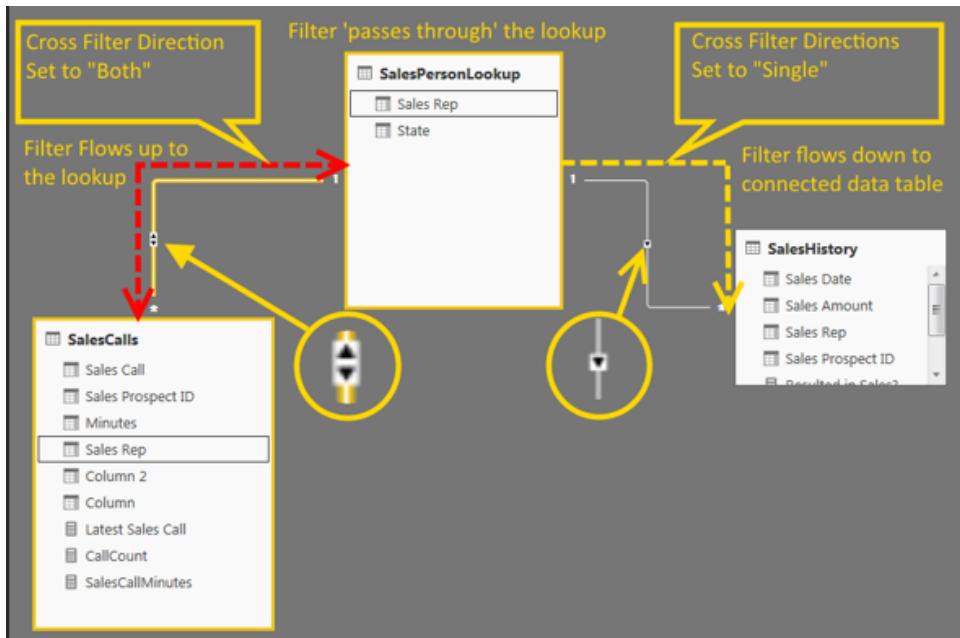
<https://docs.microsoft.com/en-us/power-bi/desktop-create-and-manage-relationships>



Manage Relationships & Autodetect



Cross Filter



Both - The most common, default direction, which means for filtering purposes, both tables are treated as if they're a single table. Both works well with a single table that has a number of lookup tables that surround it. An example is a Sales actuals table with a lookup table for department. This is often called a Star schema configuration (a central table with several lookup tables.) However, if you have two or more tables that also have lookup tables (with some in common) then you wouldn't want to use the Both setting. To continue the previous example, in this case, you also have a budget sales table that records target budget for each department. And, the department table is connected to both the sales and the budget table. Avoid the Both setting for this kind of configuration.

Single - Filtering choices in connected tables work on the table where values are being aggregated. If you import a Power Pivot in Excel 2013 or earlier data model, all relationships will have a single direction.

Every user within Power BI is either Free or Pro.

The main difference between a Free or Pro user is centered around sharing and collaboration.

Pro users can publish content to app workspaces, consume apps without Premium capacity, share dashboards and subscribe to dashboards and reports.

Free users can now connect to all data sources through all connectivity options such as DirectQuery, live connection and the use of the data gateway.

If an app is published, and the app workspace it is for is assigned to Premium capacity, Free users can consume those apps.

<https://docs.microsoft.com/en-us/power-bi/desktop-create-and-manage-relationships#understanding-additional-options>

Single direction means that filtering choices in connected tables work on the table where aggregation work is happening. Sometimes, understanding cross filtering can be a little difficult, so let's look at an example.

CompanyEmployee

Employee	Tenure	City
Brewer, Alan	15	Redmond
Bowen, Eli	10	San Jose
Bento, Nuno	15	Redmond
Hamilton, David	3	San Jose
Han, Mu	1	San Jose
Ito, Shu	1	Redmond

ProjectHours

Ticket	SubmittedBy	Hours	Project	DateSubmit
1001	Brewer, Alan	22	Blue	1/1/2013
1002	Brewer, Alan	26	Red	2/1/2013
1003	Ito, Shu	34	Yellow	12/4/2012
1004	Brewer, Alan	13	Orange	1/2/2012
1005	Bowen, Eli	29	Purple	10/1/2013
1006	Bento, Nuno	35	Green	2/1/2013
1007	Hamilton, David	10	Yellow	10/1/2013
1008	Han, Mu	28	Orange	1/2/2012
1009	Ito, Shu	22	Purple	2/1/2013
1010	Bowen, Eli	28	Green	10/1/2013
1011	Bowen, Eli	9	Blue	10/15/2013

CompanyProject

Project	Priority
Blue	A
Red	B
Green	C
Yellow	C
Purple	B
Orange	C

With single direction cross filtering, if you create a report that summarizes the project hours, you can then choose to summarize (or filter) by CompanyProject, Priority or CompanyEmployee, City. If however, you want to count the number of employees per projects (a less common question), it won't work. You'll get a column of values that are all the same.

In the example below, both relationships cross filtering direction is set to a single direction – towards the ProjectHours table:

The screenshot shows the Power BI desktop interface. On the left is a table visualization titled "Employee Count of Project". The data is as follows:

Employee	Count of Project
Bento, Nuno	6
Bowen, Eli	6
Brewer, Alan	6
Hamilton, David	6
Han, Mu	6
Ito, Shu	6
Total	6

The middle section shows the "Visualizations" pane with various chart icons. The right section shows the "Fields" pane. In the Fields pane, under "ProjectHours", there are filters for "Count of Project (All)", "Employee (All)", and "Project (All)". These filters are applied to the "ProjectHours" table. The "ProjectHours" table then filters back up to the "CompanyEmployee" and "CompanyProject" tables, as indicated by the checked checkboxes for "Employee" and "Project" in the "Fields" pane.

Filter specification will flow from CompanyProject to CompanyEmployee (as shown in the image below) but, it won't flow up to CompanyEmployee. However, if you set the cross filtering direction to Both it will work. The Both setting allows the filter specification to flow up to Employee.

CompanyEmployee

Employee	Tenure	City
Brewer, Alan	15	Redmond
Bower, Eli	10	San Jose
Bento, Nuno	15	Redmond
Hamilton, David	3	San Jose
Han, Mu	1	San Jose
Ito, Shu	1	Redmond

ProjectHours

Ticket	SubmittedBy	Hours	Project	DateSubmit
1001	Brewer, Alan	22	Blue	1/1/2013
1002	Brewer, Alan	26	Red	2/1/2013
1003	Ito, Shu	34	Yellow	12/4/2012
1004	Brewer, Alan	13	Orange	1/2/2012
1005	Bower, Eli	29	Purple	10/1/2013
1006	Bento, Nuno	35	Green	2/1/2013
1007	Hamilton, David	10	Yellow	10/1/2013
1008	Han, Mu	28	Orange	1/2/2012
1009	Ito, Shu	22	Purple	2/1/2013
1010	Bower, Eli	28	Green	10/1/2013
1011	Bower, Eli	9	Blue	10/15/2013

CompanyProject

Project	Priority
Blue	A
Red	B
Green	C
Yellow	C
Purple	B
Orange	C

With the cross filtering direction set to Both, our report now appears correct:

Visualizations

Fields

Values

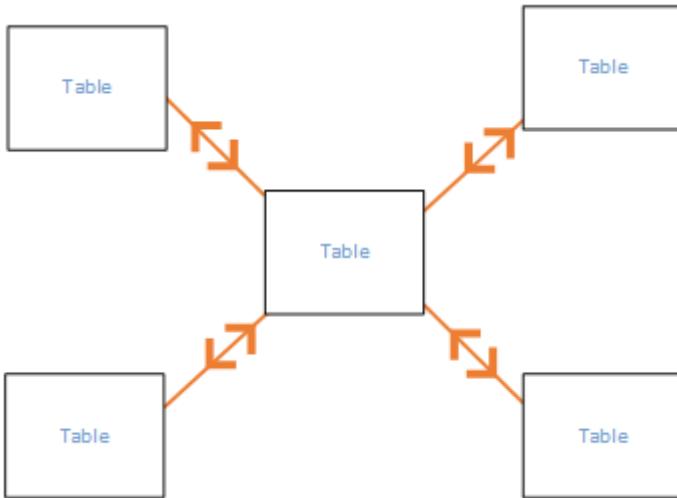
- Employee
- Count of Project

Filters

Visual Level Filters

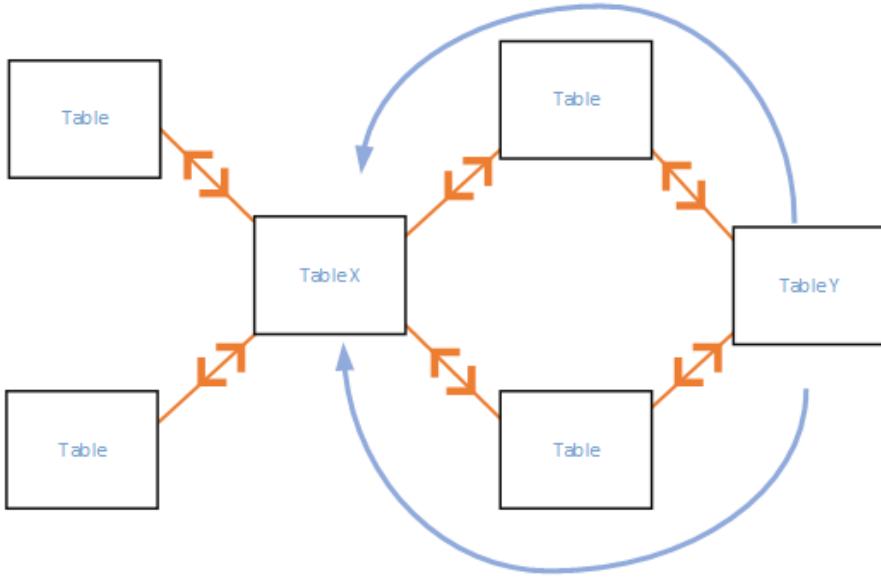
- Count of Project (All)
- Employee (All)
- Project (All)

Cross filtering both directions works well for a pattern of table relationships that look like the pattern above. This is most commonly called a star schema, like this:



Cross filtering direction does not work well with a more general pattern often found in databases, like in this diagram:

If you have a table pattern like this, with loops, then cross filtering can create an ambiguous set of relationships. For instance, if you sum up a field from TableX and then choose to filter by a field on TableY, then it's not clear how the filter should travel, through the top table or the bottom table. A common example of this kind of pattern is with TableX as a Sales table with actuals data and for TableY to be budget data. Then, the tables in the middle are lookup tables that both tables use, such as Division or Region.



Just like with active/inactive relationships, Power BI Desktop won't allow a relationship to be set as Both if it will create ambiguity in reports. There are several different ways you can deal with this and here are the two most common: Delete or mark relationships as inactive to reduce ambiguity. Then you might be able to set a relationship cross filtering as Both.

Bring in a table twice (with a different name the second time) to eliminate loops. This makes the pattern of relationships like a star schema. With a star schema, all of the relationships can be set to Both.

Wrong active relationship

When Power BI Desktop automatically creates relationships, it sometimes encounters more than one relationship between two tables. When this happens only one of the relationships is set to be active. The active relationship serves

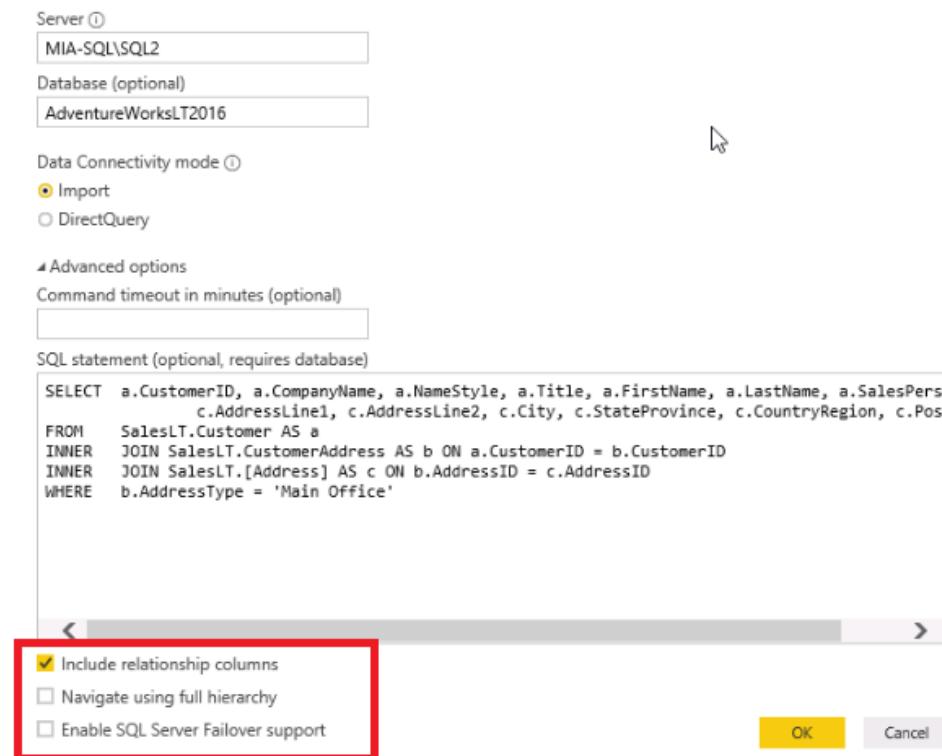
as the default relationship so that when you choose fields from two different tables, Power BI Desktop can automatically create a visualization for you. However, in some cases the automatically selected relationship can be wrong. You can use the Manage Relationships dialog to set a relationship as active or inactive, or you can set the active relationship in the Edit relationship dialog.

To ensure there's a default relationship, Power BI Desktop only allows a single active relationship between two tables at a given time. So, you must first set the current relationship as inactive and then set the relationship you want to be active.

Navigate using full hierarchy

A hierarchy is an ordered set of values that are linked to the level above. An example of a hierarchy could be Country, State, and City. Cities are in a State, and States make up a Country. In Power BI visualizations can handle hierarchy data and provide controls for the user to navigate up and down the hierarchy. This tutorial walks you through how to use hierarchies inside a visual.

SQL Server database



Slicers

A slicer is an alternate way of filtering that narrows the portion of the dataset shown in the other visualizations in a report.



Slicers are a great choice when you want to:

- Display commonly-used or important filters on the report canvas for easier access.
- Make it easier to see the current filtered state without having to open a drop-down list.
- Filter by columns that are unneeded and hidden in the data tables.
- Create more focused reports by putting slicers next to important visuals.

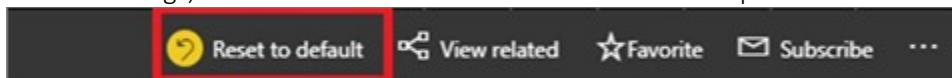
Power BI slicers have the following limitations:

- Slicers do not support input fields.
- Slicers cannot be pinned to a dashboard.
- Drilldown is not supported for slicers.
- Slicers do not support visual level filters.

Create slicers: <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-slicers>

To create a new slicer, you can select the slicer icon and then select the data field to filter on (or drag it to the Filters box in the Visualizations pane), or you can select or drag the data field first to create a visualization, and then select the slicer icon to turn the visualization into a slicer. Different data types create different types of slicers, with different effects and options.

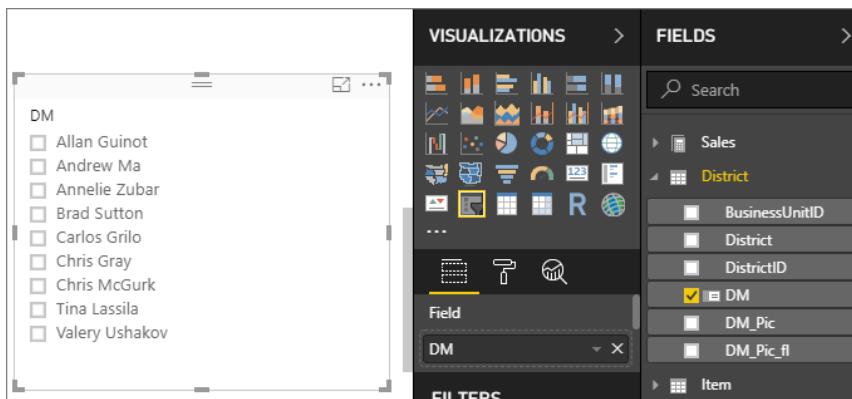
The first time you change a report, the button for Reset to default lights up. This is a reminder that you've made a change to the original report settings. If you navigate away from the report, that change is saved (persists). When you return to the report you don't have to re-slice the report. However, if you'd like to reset the report to the author's default settings, select the Reset to default button from the top menubar.



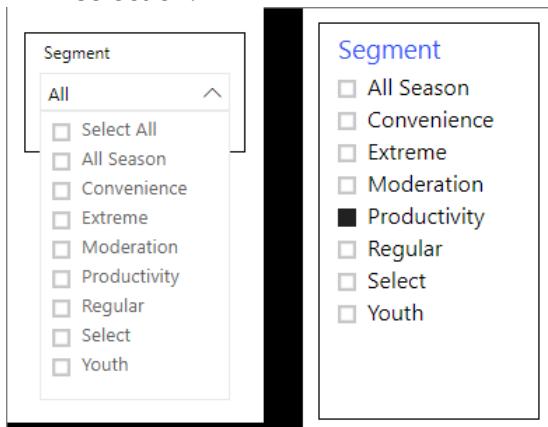
Create a new slicer to filter data by District Manager

1. In Power BI Desktop or the Power BI service, open the [Retail Analysis Sample](#). (In Power BI service, select **Edit Report** at upper left.)

2. On the Overview page, with nothing selected on the canvas, select the **Slicer** icon  in the **Visualizations** pane to create a new slicer.
3. With the new slicer selected, from the Fields pane, select **District > DM** to populate the slicer. The new slicer is a list with selection boxes before the names.



1. Resize and drag the slicer and other elements on the canvas to make room for the slicer. Note that the slicer items are cut off if you resize the slicer too small.
2. Select names on the slicer and note the effects on the other visualizations on the page. Select names again to deselect them, and hold down the **Ctrl** key to select more than one name. Selecting all names has the same effect as selecting none. \
3. Alternately, select the paint roller icon to format your slicer. There are simply too many options to describe them all here - so experiment and create a slicer that works for you. In the examples below, the first slicer has been converted to a dropdown to conserve space and the option to "Select all" has been added. The second slicer has been formatted with colors, fonts sizes, and only allows a single selection.

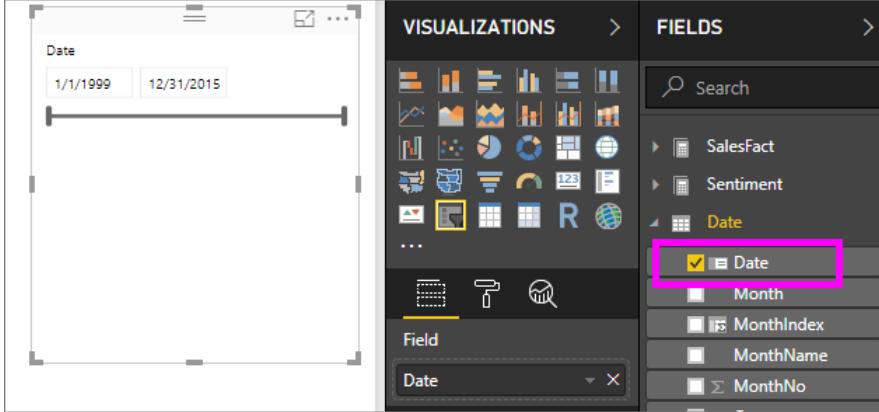


Tip

List slicer items are sorted in ascending alphanumerical order by default. To reverse the sort order to descending, select the ellipsis (...) in the top right corner of the slicer and choose **Sort by District Manager** in the drop-down list.

To create a new slicer to filter data by date range

- With nothing selected on the canvas, drop down **Date** in the Fields pane, and drag **Date** to the **Values** box in the Visualizations pane to create a new visualization.
- With the new visualization selected, select the **Slicer** icon to convert the new visualization to a slicer. This slicer is a slider control with the date range populated.

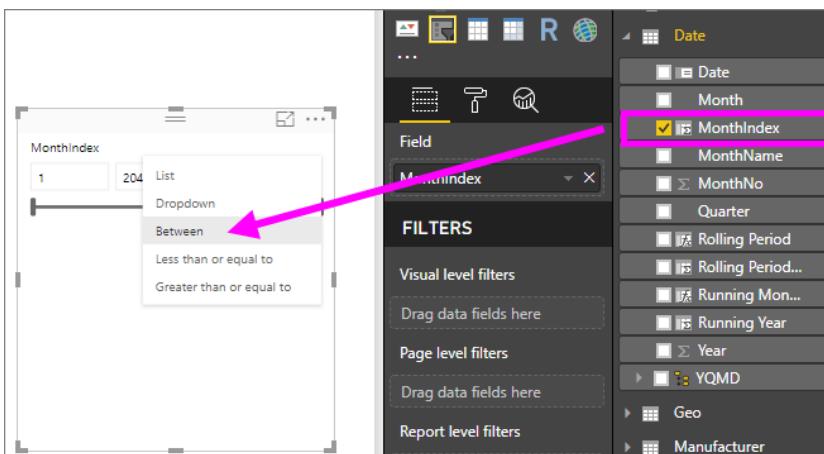


- Resize and drag the slicer and other elements on the canvas to make room for the slicer. Note that the slider resizes with the slicer size, but it disappears and the dates are cut off if you resize the slicer too small.
- Select different date ranges with the slider, or select a date field to type in a value or pop up a calendar for more precise selection. Note the effects on the other visualizations on the page.

Note

Numeric and date/time data types produce range slider slicers by default. Starting with the February 2018 Power BI update, whole number data type range sliders now snap to whole number values rather than showing decimal places.

- Now change the Field value from **Date** to **MonthIndex**. This produces a **Between** range slider slicer type by default, but you can change it to other slicer types and selection options. To change the slicer type, with the slicer selected, hover over the upper-right area of the slicer, drop down the carat that appears, and choose one of the other options, such as **List** or **Before**. Note how the slicer appearance and selection options change.



Control which page visuals are affected by slicers

By default, slicers on report pages affect all the other visualizations on that page, including each other. As you choose values in the list and date sliders you just created, note the effects on the other visualizations. The filtered data is an intersection of the values selected in both slicers.

You can use **Visual interactions** to exclude some page visualizations from being affected by others. On the **Overview** page, the "Total Sales Variance by FiscalMonth and District Manager" chart shows overall comparative data for District Managers by Month, which you want to keep visible at all times. You can use **Visual interactions** to keep slicer selections from filtering this chart.

1. With the District Manager slicer selected:

- In Power BI Desktop, select the **Format** menu under **Visual Tools** and select **Edit interactions**.
- In Power BI service, drop down **Visual interactions** from the menu bar and turn on **Edit interactions**.

Filter controls  appear above all the other visuals on the page. Initially, all the **Filter** icons are selected.

2. Select the **None** icon above the **Total Sales Variance by FiscalMonth and District Manager** chart to make the slicer stop filtering it.
3. Select the **Month** slicer, and again select the **None** icon above the **Total Sales Variance by FiscalMonth and District Manager** chart to make this slicer stop filtering it. Now, as you select names and date ranges in the slicers, the Total Sales Variance by FiscalMonth and District Manager chart is unchanged.

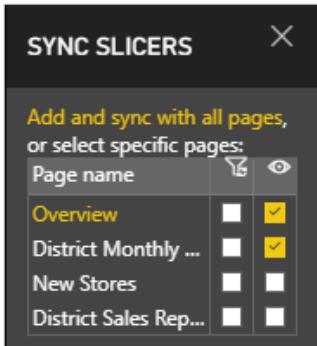
See [Visual interactions in a Power BI report](#) for more information about editing interactions.

Sync and use slicers on other pages

Starting with the February 2018 Power BI update, you can sync a slicer and use it on any or all pages in a report.

In the current report, the **District Monthly Sales** page also has a **District Manager** slicer, but it is not synced with the one you created on the **Overview** page (the two slicers can have different item selections). The **New Stores** page has only a **Store Name** slicer. You can sync your new **District Manager** slicer to these pages, so that slicer selections on any page affect visualizations on all three pages.

1. On the **View** menu, select **Sync slicers** in Power BI Desktop (or turn on **Sync slicers pane** in Power BI service). The **Sync Slicers** pane appears.
2. On the **Overview** page, select the **District Manager** slicer. Note that the **District Monthly Sales** page is already selected in the **Visible** column, because there is also a District Manager slicer on that page, but it is not selected in the **Sync** column.



1. In the **Sync** column, select the **New Stores** page and the **District Monthly Sales** page to sync the **Overview** slicer to those pages.
2. In the **Visible** column, select the **New Stores** page and leave the **District Monthly Sales** page selected.
3. Observe the effects of syncing the slicer and making it visible on the other pages. On the **District Monthly Sales** page, the **District Manager** slicer now shows the same selections as the one on the **Overview** page. On the **New Stores** page, the selections in the **District Manager** slicer affect the selections that are available in the **Store Name** slicer.

Tip

Although the slicer initially appears on the synced pages at the same size and position as on the original page, you can move, resize, and format synced slicers on the various pages independently.

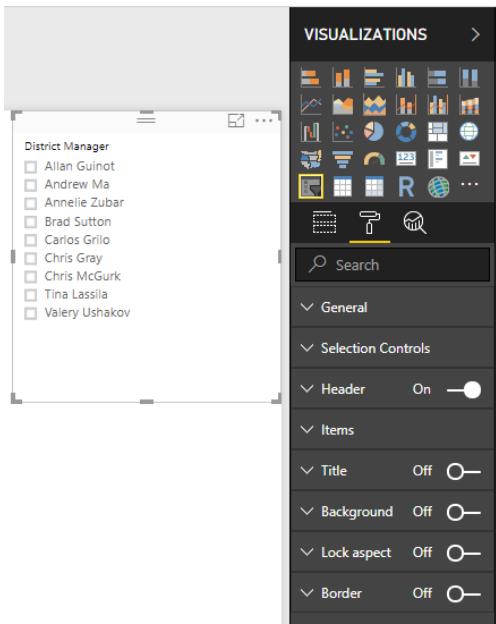
Note

If you sync a slicer to a page but do not make it visible on that page, slicer selections made on the other pages still filter the data on the page.

Format slicers

Different formatting options are available depending on the slicer type. By using **Horizontal** orientation, **Responsive** layout, and **Item** coloring, you can produce buttons or tiles rather than standard list items, and make slicer items resize to fit different screen sizes and layouts.

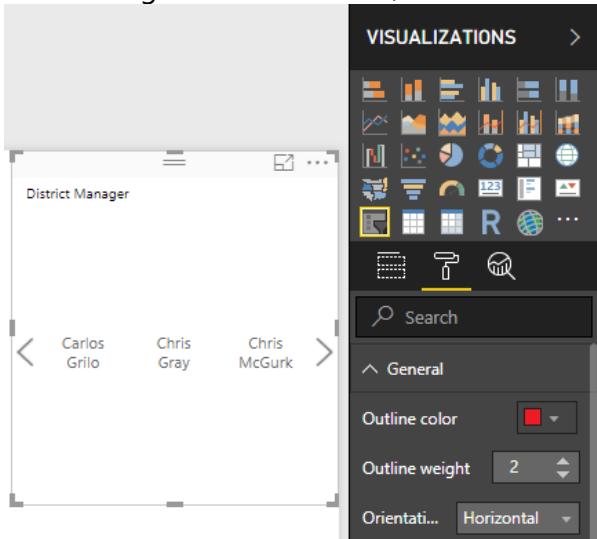
1. With the **District Manager** slicer selected on any page, in the **Visualizations** pane, select the **Format** icon to display the formatting controls.



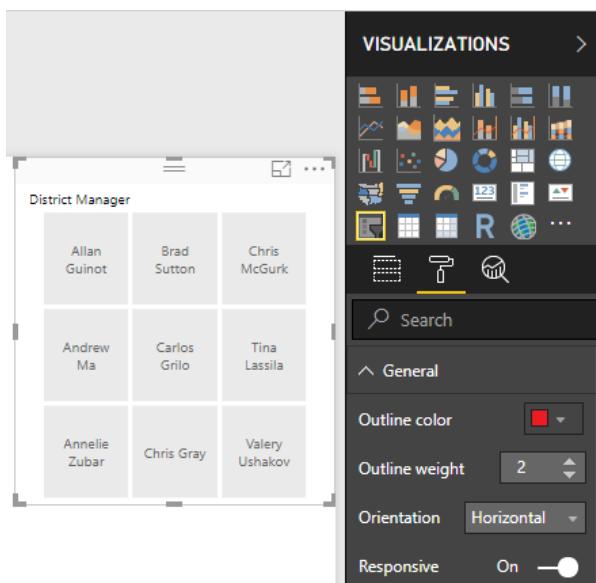
1. Select the drop-down arrows next to each category to display and edit the options.

General options

1. Select red under **Outline color** and change **Outline weight** to "2". This sets the color and thickness of the header and item outlines or underlines, when enabled.
2. Under **Orientation**, **Vertical** is the default. Select **Horizontal** to produce a slicer with horizontally arranged tiles or buttons, and scroll arrows to access items that do not fit in the slicer.



Turn on **Responsive** layout to change the size and arrangement of slicer items according to viewscreen and slicer size. For list slicers, responsive layout is only available in horizontal orientation, and prevents items from being cut off on small screens. For range slider slicers, responsive formatting changes the style of the slider and provides more flexible resizing. Both types of slicers become filter icons at very small sizes.



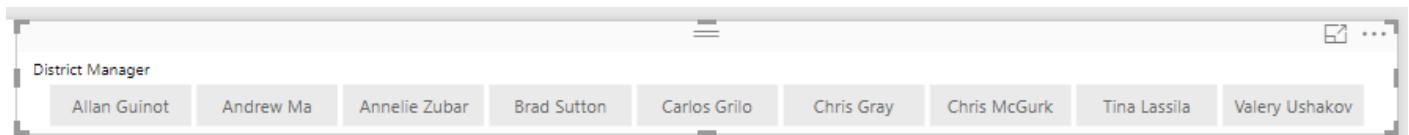
The screenshot shows a Power BI canvas with a 'District Manager' table visual. A 'Slicer' visual is overlaid on the table, containing the names of the district managers: Allan Guinot, Andrew Ma, Annelie Zubar, Brad Sutton, Carlos Grilo, Chris Gray, Chris McGurk, Tina Lassila, and Valery Ushakov. The 'VISUALIZATIONS' ribbon is open, and the 'Slicer' icon is selected. The 'Properties' pane on the right is open, showing the following settings for the slicer:

- Outline color:** Red
- Outline weight:** 2
- Orientation:** Horizontal
- Responsive:** On (switch is on)

1. Note

Responsive layout changes may override specific heading and item formatting that you set.

- Set the slicer position and size with numeric precision under **X Position**, **Y Position**, **Width**, and **Height**, or move and resize the slicer directly on the canvas. Experiment with different item sizes and arrangements, and note how the responsive formatting changes accordingly.

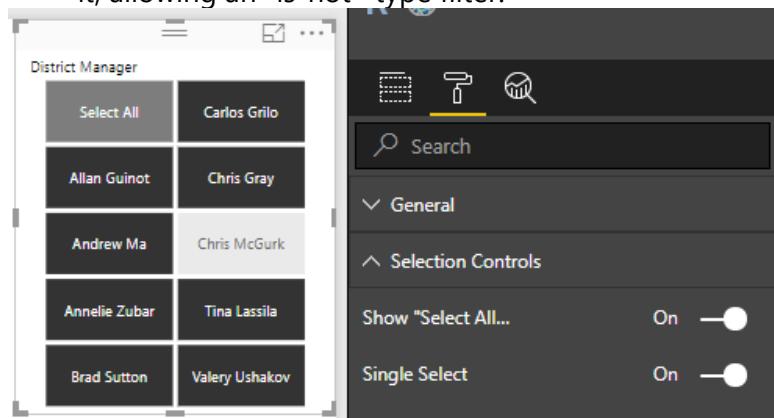


The screenshot shows a horizontal responsive slicer with the same nine items as the previous screenshot. The items are arranged horizontally in a single row. The 'Properties' pane is not visible in this specific view, but the overall layout is horizontal and responsive.

See [Create a responsive slicer you can resize in Power BI](#) for more about horizontal orientation and responsive layout.

Selection Controls options (list slicers only)

- Show Select All** is **Off** by default. Turn it to **On** to add a **Select All** item to the slicer that selects or deselects all items when toggled. When all items are selected, clicking or tapping one item deselects it, allowing an "is-not"-type filter.



The screenshot shows a slicer with the 'Select All' option turned on. The 'Properties' pane on the right shows the following settings for the 'Selection Controls' section:

- Show "Select All..."**: On (switch is on)
- Single Select**: On (switch is on)

- Single Select** is **On** by default. Clicking or tapping each item selects it, and holding down the **Ctrl** key while clicking or tapping selects multiple items. Turn **Single Select** to **Off** to allow selecting multiple items without holding down the **Ctrl** key. Clicking or tapping each item again deselects it.

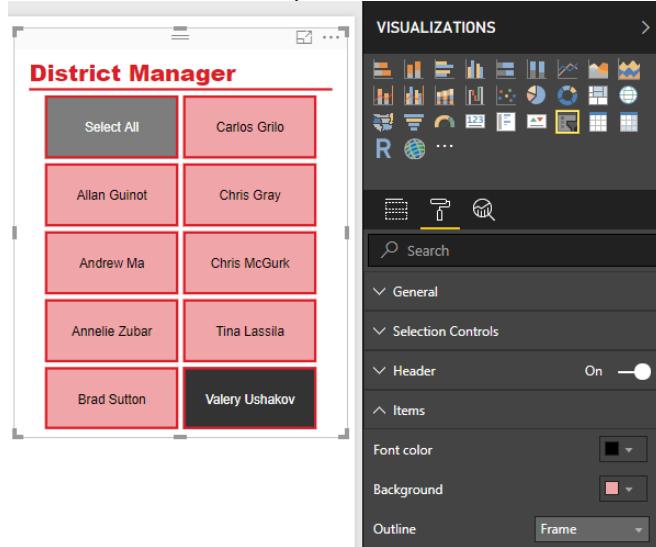
Header options

The **Header** is **On** by default, showing the data field name at the top of the slicer.

- Format the header text to make the **Font color** red, **Text size** 14 pt, and **Font family** Arial Black.
- Under **Outline**, choose **Bottom only** to produce an underline with the size and color that you set under **General** options.

Item options (list slicers only)

- Format item text and background to make the **Font color** black, **Background** light red, **Text size** 10 pt, and **Font family** Arial.
- Under **Outline**, choose **Frame** to draw a border around each item with the size and color you set under **General** options.



1. Tip

- With **Orientation > Horizontal**, deselected items show the chosen text and background colors, while selected items use the system default, usually black background with white text.
- With **Orientation > Vertical**, items always show the set colors, and selection boxes are always black when selected.

Date/numeric inputs and Slider options (range slider slicers only)

- Date/numeric input options are the same as the **Item** options for list slicers, except there is no **Outline** or underline.
- Slider options allow you to set the color of the range slider, or turn the slider to **Off**, leaving only the numeric inputs.

Other formatting options

The other formatting options are off by default. When turned **On**:

- Title:** Adds and formats a title (in addition to and independent of the header) at the top of the slicer.
- Background:** Adds a background color to the overall slicer and sets its transparency.
- Lock aspect:** Retains the shape of the slicer if it is resized.

- **Border:** Adds a 1-pixel border around the slicer and sets its color. (This slicer border is separate from and unaffected by the General Outline settings.)

Free vs Pro comparison

Here is a list of features supported by user type.

	Free	Pro
Connect to 70+ data sources	✓	✓
Publish to Web	✓	✓
Peer-to-peer sharing	✗	✓
Export to PowerPoint, Excel, CSV	✓	✓
Enterprise distribution		
Apps	✗	✓
Email subscriptions	✗	✓
Embed APIs and controls	✗	✓
Collaboration		
App workspaces	✗	✓
Analyze in Excel, analyze in Power BI Desktop	✗	✓

Capacity tiers

Here is a summary of the differences between shared capacity and Premium capacity.

	Shared capacity	Power BI Premium capacity
Refresh rate	8/day	48/day
Isolation with dedicated hardware	✗	✓
Enterprise Distribution to <i>all users</i>		
Apps and sharing	✗	✓ ¹
Embedded API and controls	✗	✓ ²
Publish Power BI reports on-premises	✗	✓

To start using a Power BI Premium capacity, assign a workspace to a capacity. When premium capacity backs a workspace, you get:

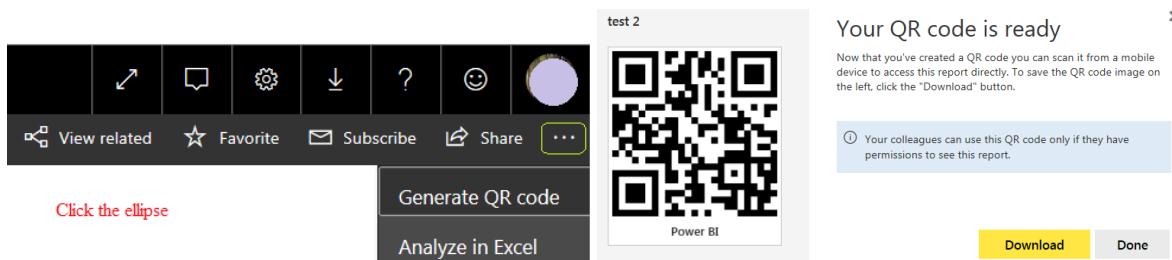
- **Scheduled refreshes:** With shared capacity, scheduled refreshes for imported model datasets are limited to eight times per day.
- For datasets in Premium workspaces, you can schedule refreshes up to 48 times per day.
 - DirectQuery cache refreshes are still limited to eight times a day in Premium capacity.
- **Isolation with dedicated hardware:** In shared capacity, the resource demands of other workloads can affect the performance of your reports and dashboards.
- By contrast, Premium capacity provides more consistent, dependable performance for your workloads by isolating it from unrelated workloads.

If an app is backed by Premium capacity (that is, it was published from an app workspace that is currently assigned to Premium), the published app can then be used by any user in your organization regardless of the license they are assigned.

Notes 2 Ponder & Place

1. Power BI Enterprise gateway
2. DirectQuery
3. First use Power BI Desktop or Excel to connect to, query, and load data into a data model. You can then import your file into Power BI where a dataset is created. If you setup scheduled refresh, Power BI will use connection information from the file along with refresh settings you configure to connect directly to the datasource and query for updates.

4. query and load data from external data sources by using Power Query (Get & Transform in Excel 2016) or Power Pivot
5. When data must be in a table, or import data that is loaded into a data model – Excel
6. XML Table (.xml) or text (.txt) files: use Get & Transform to query, transform, and load that data into an Excel or Power BI Desktop file first, then import the Excel or Power BI Desktop file into Power BI.
7. Storing files on OneDrive for Business provides the greatest amount of flexibility and integration with Power BI and refresh vs. local on-premise storage – See also Power BI Server
8. Content packs contain all of the data and reports you need already prepared for you. In Power BI, there are two types of content packs; those from services like Google Analytics, Marketo, or Salesforce, and those created and shared by other users in your organization.
 - a. Need a Power BI Pro account to create, share, and use content packs
9. Space



Upgrade to Power BI Pro

This feature is only available to users with a Power BI Pro license. When you upgrade, you get access to collaborate with others and distribute content. Upgrade today or try it free for 60 days. [Learn more](#)

[Try Pro for free](#) [Upgrade account](#) [Cancel](#)

References

1. *Course 20778B: Analyzing Data with Power BI:
 - a. <https://www.microsoft.com/en-us/learning/course.aspx?cid=20778>
2. Exam 70-778 Analyzing and Visualizing Data with Microsoft Power BI:
 - a. <https://www.microsoft.com/en-us/learning/exam-70-778.aspx>
3. Power BI Free vs Pro vs. Premium:
 - a. <https://docs.microsoft.com/en-us/power-bi/service-features-license-type>
 - b. All users in the service are either Free or Pro. The main difference between a Free or Pro user is centered around sharing and collaboration.
 - c. Only Pro users can publish content to app workspaces, *consume apps without Premium capacity*, share dashboards and subscribe to dashboards and reports.
 - d. Free users can now connect to all data sources through all connectivity options such as DirectQuery, live connection and the use of the data gateway.
 - e. If an app is published, and the app workspace it is for is assigned to Premium capacity, Free users can consume those apps.
4. **Power BI Learning Guide:
 - a. <https://docs.microsoft.com/en-us/power-bi/guided-learning/>
 - b. <https://powerbi.microsoft.com/en-us/downloads/>
5. Power BI Documentation:
 - a. <https://docs.microsoft.com/en-us/power-bi/>
6. *Sample data:
 - a. <https://docs.microsoft.com/en-us/power-bi/sample-datasets>
7. *Materials:
 - a. https://trainingsupport.microsoft.com/en-us/tcmct/forum/tcmct_moc/labs-for-the-course-20778b-analyzing-data-with/4b025370-0475-4fb9-9f33-a0f54f0e243a
8. *Free Power BI Training and Books:
 - a. <https://zenatti.net/2018/01/27/free-power-bi-training-and-books/>
9. *Vids: Analyze & Visualize Data with Power BI:
 - a. <https://www.youtube.com/playlist?list=PL1N57mwBHtNOJFoKSR0n-tBkUJHeMP2cP&app=desktop>
10. Course: Learn Power BI Basics for Free
 - a. https://www.udemy.com/learn_power_bi_for_free/
11. Free PDF:
 - a. <https://www.sqlbi.com/books/introducing-microsoft-power-bi/>
12. Online Book: Power BI from Rookie to Rockstar:
 - a. <http://radacad.com/online-book-power-bi-from-rookie-to-rockstar>
13. Microsoft App Source:
 - a. Add ins for Power BI & other MSOffice 365
 - b. <https://appssource.microsoft.com/en-us/>
14. Power BI Developer Center:
 - a. <https://powerbi.microsoft.com/en-us/developers/>
15. Power BI REST APIs:
 - a. <https://docs.microsoft.com/en-us/rest/api/power-bi/>
16. Dashboard data classification:

- a. <https://docs.microsoft.com/en-us/power-bi/service-data-classification>
17. **The report editor...and Create vs. Consume roles:
- a. <https://docs.microsoft.com/en-us/power-bi/service-the-report-editor-take-a-tour>
 - b. The ability to create and edit a report is restricted to report owners (aka creators).
 - c. If you are consuming a report that has been shared with you, you'll still be able to open and interact with the report in Power BI service Reading view only.
18. **Sample data is available to use with Power BI:
- a. <https://docs.microsoft.com/en-us/power-bi/sample-datasets>
19. Tutorial: QuickStart: Connect to data in Power BI Desktop:
- a. <https://docs.microsoft.com/en-us/power-bi/desktop-quickstart-connect-to-data>
20. DAX basics in Power BI Desktop:
- a. <https://docs.microsoft.com/en-us/power-bi/desktop-quickstart-learn-dax-basics>
21. Tutorial: Connect to a Web data source:
- a. <https://docs.microsoft.com/en-us/power-bi/desktop-connect-to-data>
22. Tutorial: Get started with **Power BI service** (app.powerbi.com):
- a. <https://docs.microsoft.com/en-us/power-bi/service-get-started>
23. Visualizations:
- a. <https://docs.microsoft.com/en-us/power-bi/guided-learning/visualizations>
24. Tips and Tricks for Power BI Map visualizations:
- a. <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-map-tips-and-tricks>
25. Visualizations in Power BI reports:
- a. <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-report-visualizations>
26. *Visualization Types:
- a. <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-types-for-reports-and-q-and-a>
27. Add a Radial Gauge to the report:
- a. <https://docs.microsoft.com/en-us/power-bi/service-report-create-new#add-a-radial-gauge-to-the-report>
28. Pin a tile to a Power BI dashboard from a report:
- a. <https://docs.microsoft.com/en-us/power-bi/service-dashboard-pin-tile-from-report>
29. Connect to the following Web data source:
- a. <https://docs.microsoft.com/en-us/power-bi/desktop-query-overview>
30. Resolve issues importing Access and .XLS files in Power BI Desktop:
- a. <https://docs.microsoft.com/en-us/power-bi/desktop-access-database-errors>
31. **Intro to organizational content packs in Power BI:
- a. Do you regularly distribute reports by email to your team? Try this instead: Package up your dashboards, reports, Excel workbooks, and datasets and publish them to your team as an organizational content pack. Content packs you create are easy for your team to find — they are all in AppSource.
 - b. <https://docs.microsoft.com/en-us/power-bi/service-organizational-content-pack-introduction>
32. Create the new workspaces (preview) in Power BI:
- a. <https://docs.microsoft.com/en-us/power-bi/service-create-the-new-workspaces>
33. Collaborate and share in Power BI:

- a. <https://docs.microsoft.com/en-us/power-bi/service-how-to-collaborate-distribute-dashboards-reports>
34. Access Database Redistributable download:
 - a. <https://www.microsoft.com/en-us/download/details.aspx?id=13255>
35. Power Query M Reference:
 - a. <https://msdn.microsoft.com/en-us/query-bi/m/power-query-m-reference>
36. Find Power BI users that have signed in:
 - a. <https://docs.microsoft.com/en-us/power-bi/service-admin-access-usage>
37. space

TrainingTodos -

<https://docs.microsoft.com/en-us/power-bi/desktop-quickstart-learn-dax-basics>

Create a new report in Power BI service by importing a dataset:

<https://docs.microsoft.com/en-us/power-bi/service-report-create-new>

About Querying & Displaying

The common query tasks demonstrated here are the following:

- Connect to data
- Shape and combine data
- Group rows
- Pivot columns
- Create custom columns
- Query formulas
- <https://docs.microsoft.com/en-us/power-bi/desktop-common-query-tasks>

1. Can add many new tiles from a report. Each of these tiles, when clicked, is a link back into the report.
2. And entire report pages can be pinned to a dashboard. This is also known as pinning a live tile. Live because you can interact with the tile on the dashboard and because, unlike individual visualization tiles, changes made in the report are synced with the dashboard. Read more about this below.
3. You can't pin tiles from reports that have been shared with you or from Power BI Desktop.
4. TIP: Some visualizations use background images. Pinning may not work if the background image is too large. Try reducing the image size or using image compression.
5. The AppSource is the place to find SaaS apps and add-ins for your Microsoft products and service.
6. *** A Slicers in Power are an alternate way of filtering that narrows the portion of the dataset shown in the other visualizations in a report.
 - a. Select the data field to filter on
 - b. Can select or drag the data field first to create a visualization
 - i. Then select the slicer icon to turn the visualization into a slicer.
 - c. Different data types create different types of slicers, with different effects and options.
 - d. <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-slicers>
7. ***Use Q&A in Power BI Desktop for natural language queries:

- a. <https://docs.microsoft.com/en-us/power-bi/desktop-qna-in-reports>
- 8.

Screens PBIDskTp

Navigator

Sales.Customers

custid	companyname	contactname	contacttitle
1	Customer NRZBB	Allen, Michael	Sales Representative
2	Customer MLTDN	Hassall, Mark	Owner
3	Customer KBUDE	Peoples, John	Owner
4	Customer HFBZG	Arndt, Torsten	Sales Representative
5	Customer HGVLZ	Higinbotham, Tom	Order Administrator
6	Customer XHVJ	Poland, Carole	Sales Representative
7	Customer QXVLA	Bansal, Dushyant	Marketing Manager
8	Customer QUHWH	Ilyina, Julia	Owner
9	Customer RTXGC	Raghav, Amritansh	Owner
10	Customer EEARL	Bassols, Pilar Colome	Accounting Manager
11	Customer UBAU	Jaffe, David	Sales Representative
12	Customer PSNMQ	Ray, Mike	Sales Agent
13	Customer VMLOG	Benito, Almudena	Marketing Manager
14	Customer WNMAF	Jelitto, Jacek	Owner
15	Customer JUWXK	Richardson, Shawn	Sales Associate
16	Customer GYBBY	Birkby, Dana	Sales Representative
17	Customer FEVNN	Jones, TiAnna	Order Administrator
18	Customer BSVAR	Rizaldy, Arif	Owner
19	Customer RFNQC	Boseman, Randall	Sales Agent
20	Customer THHDP	Kane, John	Sales Manager
21	Customer KIDPX	Russo, Giuseppe	Marketing Assistant
22	Customer DTDMN	Bueno, Janaina Burdan, Neville	Accounting Manager
23	Customer WVFAF	Khanna, Karan	Assistant Sales Agen

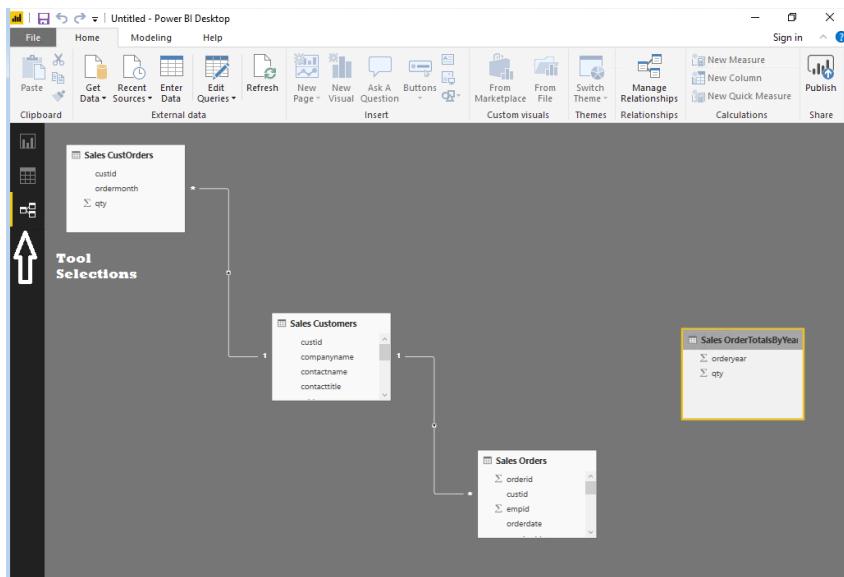
Select Related Tables Select Related Tables Load Edit Cancel

! There are pending changes in your queries that haven't been applied. Apply changes Load Edit Cancel

Load

- Sales CustOrders
 - Loading data to model...
- Sales OrderTotalsByYear
 - Loading data to model...
- Sales Customers
 - Loading data to model...
- Sales Orders
 - Loading data to model...

Cancel



Report creators and report consumers

Depending on your role, you may be someone who creates reports for your own use or to share with colleagues. You want to learn how to create and share reports. Or, you may be someone who receives reports from others.

Creating & Sharing

- Start with a [tour of Power BI service](#) so you know where to find reports and report tools.
- Take a tour of the [report editor](#).
- Learn how to [create a report from a dataset](#).
- [Learn how to use visualization, page, and report-level filters](#)
- Discover all the different ways you can [share a report with colleagues](#).

Receiving & Consuming

- Start with a [tour of Power BI service](#) so you know where to find reports and report tools.
- Learn how to [open a report](#) and all the interaction available in [Reading view](#).
- Get comfortable with reports by taking a tour of one of our [samples](#).
- To see which dataset the report is using and which dashboards have tiles pinned from the report, [view related content](#).

Course Discussions

Go to <http://www.windowsazure.com/en-us/pricing/free-trial> to pre-register for a Windows Azure trial account. **Note that Windows Azure student account provisioning can take up to 48 hours, so please be sure to pre-register at least two full days before class.** You will need to get a Microsoft account if you don't have one already.

The Azure trial lasts 30 days. If you take another class after your trial runs out, you will need to create a new Microsoft account to get a new free trial.

AdvIt – do a setup for others .. create github spot and put your stuff there..

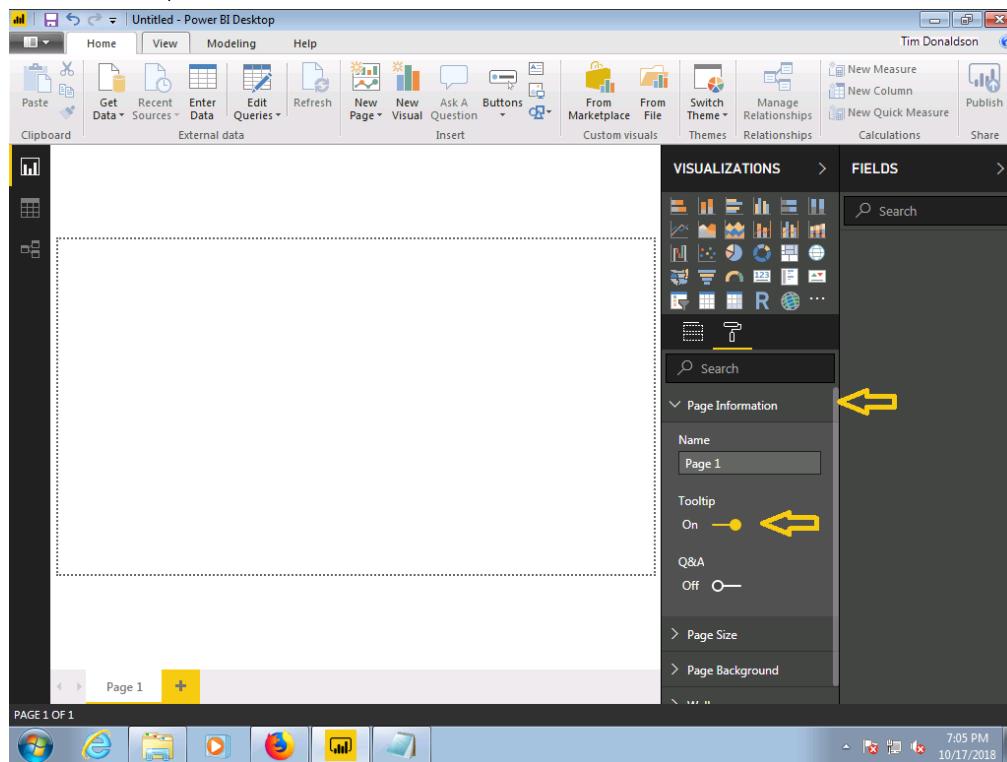
https://trainingsupport.microsoft.com/en-us/tcmct/forum/tcmct_moc/moc-20778-adventureworkslt/26d2ca43-8a7e-42f0-8519-a1b47ad49a1a

- Perform Power BI desktop data transformation.
- Describe Power BI desktop modelling.
- Create a Power BI desktop visualization.
- Implement the Power BI service.
- Describe how to connect to Excel data.
- Describe how to collaborate with Power BI data.

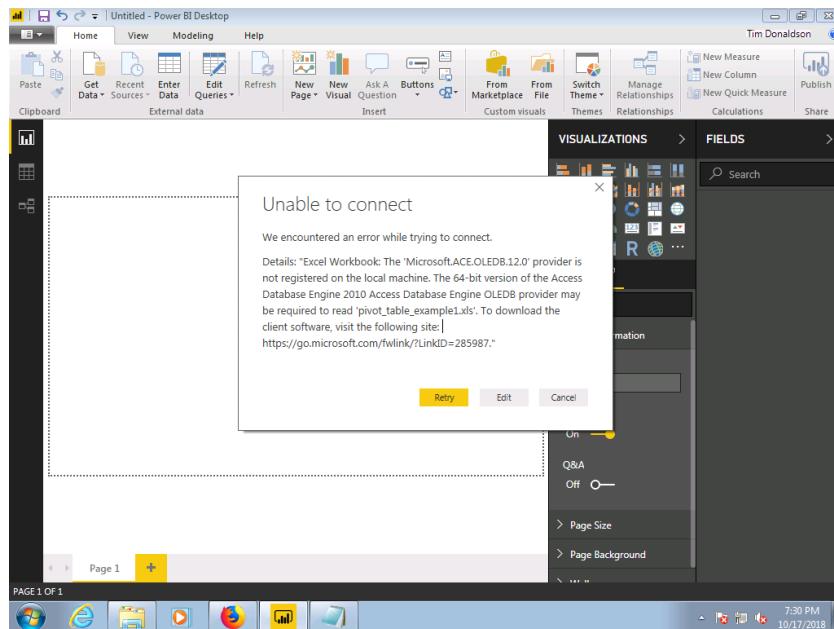
- Connect directly to data stores.
- Describe the Power BI developer API.
- Describe the Power BI mobile app.

Settings & Issues

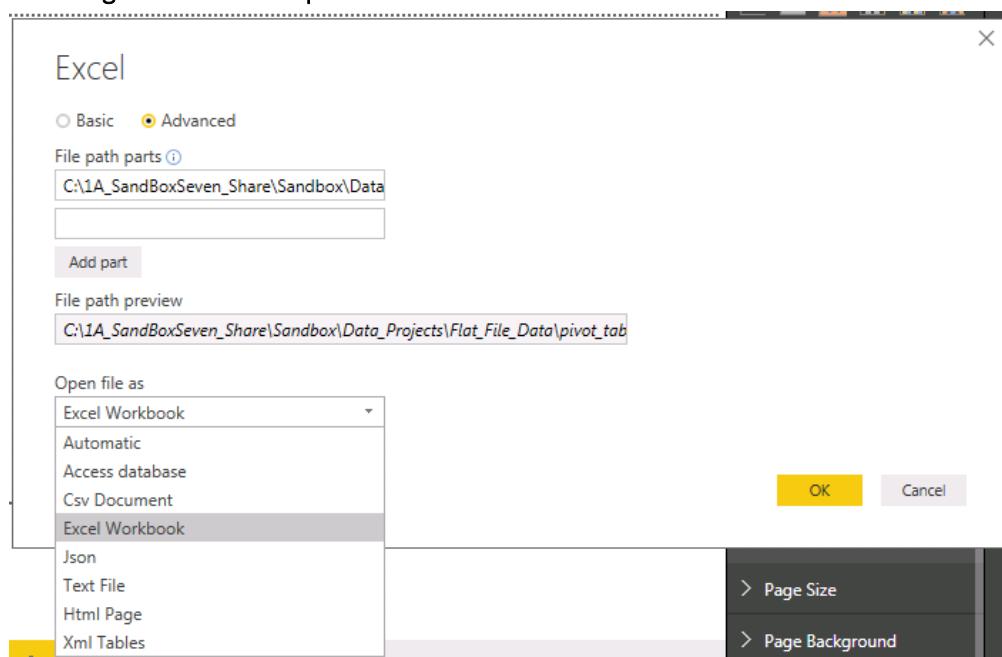
Turn on tooltips



Connection requirements



Choosing Edit has these options



In **Power BI Desktop**, both **Access databases** and early versions of **Excel workbooks** (.XLS files of type Excel 97-2003) use the *Access Database Engine*. There are three common situations that can prevent the Access Database Engine from working properly:

Situation 1: No Access Database Engine Installed

When the Power BI Desktop error message indicates the Access Database Engine is not installed, you must install the Access Database Engine version, either 32-bit or 64-bit, that matches your Power BI Desktop version. You can install the Access Database Engine from the [downloads page](#).

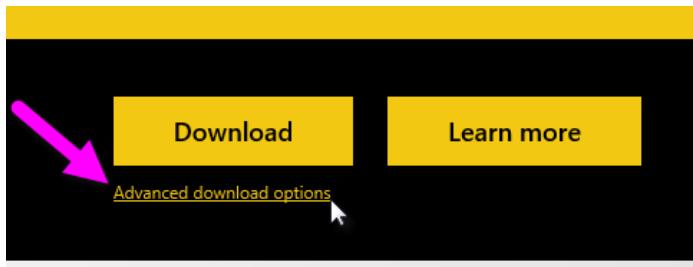
Note

If the installed Access Database Engine bit version is different from your Microsoft Office installation's bit version, Office applications will not be able to use the Access Database Engine.

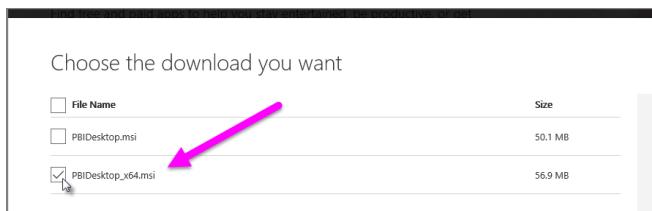
Situation 2: The Access Database Engine bit version (32-bit or 64-bit) is different from your Power BI Desktop bit version

This situation often occurs when the installed version of Microsoft Office is 32-bit, and the version of Power BI Desktop installed is 64-bit. The opposite can occur as well, and the bit-version mismatch will occur in either case (if you're using an Office 365 subscription, see **Situation 3** for a different issue and resolution). Any of the following solutions can remedy this bit-version mismatch error:

1. Change the version of Power BI Desktop to match the bit-version of your Microsoft Office installation. To change the bit-version of Power BI Desktop, uninstall Power BI Desktop, and then install the version of Power BI Desktop that matches your Office installation. To select a version of Power BI Desktop, on the download page for desktop select **Advanced download options**.



On the download page that appears, choose your language and then select the **Download** button. On the screen that appears, select the checkbox beside PBIDesktop.msi for the 32-bit version, or PBIDesktop_x64.msi for the 64-bit version. In the following screen, the 64-bit version is selected.



Note: When using the 32-bit version of Power BI Desktop, when creating very large data models you might experience out-of-memory issues.

2. Change the version of Microsoft Office to match the bit-version of your Power BI Desktop installation. To change the bit-version of Microsoft Office, uninstall Office, and then install the version of Office that matches your Power BI Desktop installation.
3. If the error occurred when attempting to open an .XLS file (an Excel 97-2003 workbook), you can avoid using the Access Database Engine by opening the .XLS file in Excel, and saving it as an XLSX file.
4. If the previous three solutions are not feasible, it is possible to install both versions of the Access Database Engine, but this is *not* a recommended workaround. Installing both versions will resolve this issue for Power Query for Excel and Power BI Desktop, but will introduce errors and issues for any application that automatically (by default) uses the bit-version of the Access Database Engine that was installed first. To install both bit-versions of the Access Database Engine, download both versions, then run each of them using the */passive* switch. For example:

```
c:\users\joe\downloads\AccessDatabaseEngine.exe /passive
```

```
c:\users\joe\downloads\AccessDatabaseEngine_x64.exe /passive
```

Situation 3: Trouble using Access or .XLS files with an Office 365 subscription

If you are using an Office 365 subscription, whether **Office 2013** or **Office 2016**, the Access Database Engine provider is registered in a virtual registry location that is *only* accessible to Office processes. As a result, the Mashup Engine (which

is responsible for running non-Office 365 Excel and Power BI Desktop), which is not an Office process, cannot use the Access Database Engine provider.

To remedy this situation, you can download and install the Access Database Engine redistributable that matches the bit version of your Power BI Desktop installation (see earlier sections for more information about bit-versions).