

Module 2: Introducing Power BI

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Module overview

Self-service Business Intelligence (BI) has rapidly grown in popularity because of its ability to empower users to generate reports, process data, perform analysis, and more—all without having to depend on a report developer. The self-service BI trend is driven by Microsoft's commitment to improving Excel® and Power BI, both products having seen many enhancements in recent years. However, despite Microsoft enabling deeper data analysis with the four tools added to Excel—Power Pivot, Power View, Power Query, and Power Map—they are not fully integrated into the Excel interface. Instead, they exist in separate windows. Add to this the complexity of

publishing to SharePoint® to share reports with colleagues, and it all becomes a time-consuming effort.

Using Power BI eliminates complications and barriers with a simple integrated user interface, and has the ability to publish rapidly to either a cloud-based or an on-premises portal to share reports easily. This module introduces Power BI, and explores the features that enable the rapid creation and publication of sophisticated data visualizations.

Objectives

After completing this module, you will be able to:

- Develop reports using the Power BI Desktop app and use report items to create dashboards on the Power BI portal.
- Understand the components of the Power BI Service, including licensing and tenant management.

Lesson 1: Power BI

In this lesson, you'll learn about the main features of Power BI that will help you create and publish reports.

Lesson objectives

After completing this lesson, you will be able to:

- Describe the features and architecture of Power BI.
- Understand the main functionality of the PowerBI.com portal.
- Understand the functionality of Power BI Report Server.
- Download and use Power BI Desktop.
- Create reports using Power BI Desktop.
- Use report items on the Power BI portal to create dashboards.

What is Power BI?

- The Power BI suite comprises Power BI Desktop, Power BI Service, Power BI Report Server, and Power BI Mobile. Use it to:
 - Quickly create reports using the app or portal
 - Import data from files, on-premises databases, and SaaS providers
 - Combine multiple data sources into one report
 - Publish reports in the cloud or on-premises
 - Create dashboards on the portal from report items
 - Share dashboards with colleagues
 - View reports and dashboards with the Power BI Mobile app for iOS and Android devices
 - Gain insights in your data with Power BI Q&A

Microsoft has demonstrated a commitment to its Power BI suite of tools by producing a monthly software release of fixes and new features. As a data visualization tool, Power BI Desktop is quickly maturing and, with its cohesive user interface and ability to integrate with Office 365®, it is an obvious choice for the rapid creation of reports.

Power BI comprises the Power BI Desktop app, the Power BI Service, Power BI Report Server, and Power BI Mobile. You import data and create reports using the desktop app, transforming your data into rich, interactive visualizations. Using Power BI Desktop, you can connect to a wide range of data sources, and combine data from multiple sources within one report. You connect to, but are not limited to, Microsoft SQL Server, Microsoft Azure SQL Database, Excel, Oracle, and MySQL. You can

also connect to software as a service (SaaS) providers, such as Facebook, Salesforce, MailChimp, and Google Analytics.

You can then publish your reports and datasets to the Power BI Service portal or Power BI Report Server to create and share dashboards with your colleagues. You do not have to use the desktop app to create reports; you can also sign in to the portal, import data, and create reports online. The report items are then used in dashboards. You can also view and interact with reports and dashboards using the Power BI Mobile app for iOS and Android mobile devices.

You can use the natural query language to ask questions from your data through Power BI Q&A. This interactive service quickly finds the answers within your data.

PowerBI.com

- The Power BI Service is a web portal for sharing reports, data, and dashboards
- My Workspace comprises:
 - Dashboards
 - Reports
 - Workbooks
 - Datasets
- App workspaces:
 - Package contents into an app
 - Share app with other users
 - More granular security than traditional workspaces

The PowerBI.com web portal, part of the Power BI Service, is the cloud location for publishing your reports, creating dashboards, and sharing data with others in your organization. Microsoft is applying weekly updates to the portal, continuously enhancing the service. Furthermore, if you require functionality that is not on the portal, you use the feedback facility to request a new feature and send ideas, rate the service, and vote on which features you think Microsoft should add next.

My Workspace

When you sign in to the portal, you have a personal workspace, called **My Workspace**. This workspace is comprised of the following areas:

- **Dashboards.** You create dashboards from your reports by pinning report items such as bar or pie charts, to new or existing dashboards.
- **Reports.** All the reports you have published from Power BI Desktop are listed alphabetically in this section.
- **Workbooks.** You import Excel workbooks into your workspace to access the data and reports they contain.
- **Datasets.** When you add a dataset to a report and publish it, the datasets used in the report are published to the portal, and listed alphabetically. You use these datasets to create new reports while signed in to the portal.

App workspaces

The app workspaces area enables you to share dashboards and reports with colleagues. You add dashboards and reports to an app and then publish that app to other people in your organization.

The original group workspaces implementation uses Office 365 groups, but the updated app workspace technology enables you to work with security groups, distribution lists, and individuals, in addition to Office 365 groups. You add users to admin, member, or contributor roles in a new workspace to control the access and capabilities they are allowed. This increased granularity provides a more flexible approach to securing your data.

Power BI Report Server

- On-premises enterprise reporting solution
- Combines the functionality of SSRS with Power BI
- Licensed with:
 - Power BI Premium
 - SQL Server Enterprise Edition with Software Assurance
- Download from Microsoft Download Center
- Configure using Report Server Configuration Manager

Power BI Report Server is the on-premises location for publishing your reports, creating dashboards and apps, and sharing data with others in your organization. It's designed for those organizations that have strict data protection policies that require them to keep all their data in house.

There are two ways to purchase Power BI Report Server:

- Purchasing Power BI Premium provides you with a Power BI Report Server license for on-premises reporting, in addition to capacity for cloud-based reporting.

- Purchasing SQL Server Enterprise Edition with Software Assurance enables you to use your Enterprise licenses to run Power BI Report Server for on-premises reporting.

To use Power BI Report Server, you need to install and configure the product, and then install the version of Power BI Desktop optimized for the version of Power BI Report Server that you are running. You download Power BI Report Server and the matching version of Power BI Desktop from the Microsoft Download Center.

Microsoft Download Center

<https://aka.ms/Xa0153>

On the Download page, in the search box, type **Microsoft Power BI Desktop (Optimized for Power BI Report Server)**, and then click **Search**. On the results page, click the link for the newest version that includes downloads for both Power BI Report Server and Microsoft Power BI Desktop (optimized for Power BI Report Server).

After running the installation program for Power BI Report Server, you use the Report Server Configuration Manager to configure the server. At this stage, you need access to an instance of SQL Server to host the report server database. After configuration is complete, you run the installation program for Power BI Desktop, and then start using the products.

Note: At the time of writing, you can only connect to SQL Server Analysis Services or Azure Analysis Services data sources when you publish to Power BI Report Server.

The Power BI Desktop (optimized for Power BI Report Server) user interface is very similar to Power BI Desktop. You use it to create reports that users then access in a browser or in a Power BI mobile app.

When you save a report, you save it directly to the Power BI Report Server—if you later need to make changes to the report, you open it directly from the server and update it there. You also upload reports from this version of Power BI Desktop to Power BI Service.

Power BI Desktop

- Power BI Desktop:
 - Combines Microsoft's Power Query engine, with data modeling, and visualizations
 - Free, stand-alone application for creating reports
 - Download from Microsoft website or Power BI portal
 - Report files can be saved with a .pbix extension
- Create reports using three-step process:
 1. Connect to data sources
 2. Shape the data to create the model
 3. Create reports to share with colleagues
- Workspace views: Report, Data, Model

Power BI Desktop combines the Microsoft Power Query engine, also known as M, with data modeling and visualizations, to provide data analysts with a flexible tool for quickly creating interactive reports.

Power BI Desktop is a stand-alone Windows® app, which you download from the Microsoft website, or from the Power BI portal. The Power BI Desktop app can be downloaded free of charge. You use this powerful tool to connect to a plethora of data sources, to create datasets and reports that can be shared. You save report files in the Power BI Desktop format, with a **.pbix** extension. Although you can save reports locally, or to a file share location, a trusted way to share data is by publishing reports and datasets to the Power BI portal.

There is a straightforward three-step process to creating reports:

1. Connect to your data sources.
2. Shape the data by using queries to create the data model.
3. Create reports that can be shared with, and enhanced by, others.

Download Power BI Desktop

<http://aka.ms/C0fbvk>

The Power BI Desktop features a workspace for creating reports. It comprises three key views in which you work:

1. **Report view.** This is your main workspace for adding report items, such as bar charts, maps, and pie charts, and displaying data using these report items.
2. **Data view.** You use the data view to see imported datasets, in addition to shaping the data using transformations and M expressions.
3. **Model view.** Power BI autodetects relationships from structured data sources, such as SQL Server or Microsoft Access®. Autodetection might not work for flat files, but after you have imported data, you can create relationships, and set the cardinality and cross-filter properties of the relationships.

Signing in to Power BI

When you first launch Power BI Desktop, the start screen gives you the option to sign in to your Power BI account. If you choose not to sign in at this point, you can optionally sign in later using the **Sign in** link in the top right corner of the screen. You can also use this link to switch accounts when signed in. To sign out, on the **File** menu, click **Sign out**.

Reports

- Create multipage reports in Power BI Desktop
 - Load datasets into a report, or use DirectQuery to query the data source and always return latest data
 - DirectQuery is useful for large datasets with long load time
 - Report view:
 - Add visualizations and additional report pages
 - Publish reports to the portal
 - Data view:
 - Shape data using transformations and Power Query Editor tools
 - Model view:
 - Manage relationships between datasets
 - Relationship autodetection runs by default
 - Use templates to share and reuse shaped data and formatted visuals

You create multipage reports using Power BI Desktop or the PowerBI.com portal, but the Power BI Desktop app is likely to be your main tool for designing reports. The first step in creating a report is to connect to your data. Power BI Desktop supports a wide range of database, file, and SaaS connections and, along with the monthly software updates, new compatible data sources are continuously added. Data is imported into datasets, which can be transformed before using in visualizations.

You can choose to load the data into the report—either refresh manually or on a schedule—or you can use DirectQuery, which does not import any data. After you import data, it is used as you create and customize your visualizations. If you use DirectQuery, the tables and columns are visible in the **Fields** list; as you work with the fields, Power BI queries the data source so that you always see the latest data. If you choose DirectQuery, remember that each time the data is queried the performance is dependent on the data source system, and how fast the data source system responds to the data request. DirectQuery is useful if you have very large datasets, and want to create your visualizations without loading large volumes of data. However, DirectQuery is not without its limitations, so you should shape data before you create your dataset. Note that you can only use tables from a single data source.

The Report view

After opening the Power BI Desktop app, you see the Report view. This workspace is initially blank, unless you have clicked a **.pbix** file to open the app. The **External data** ribbon menu is your main starting point for adding data. You click **Get Data** to choose a new data source, or **Recent Sources** to connect to data sources that you

previously created. This includes data sources used in previous reports, as Power BI retains a list for future reference.

You add pages to your report from the **Insert** ribbon menu, which gives you the option of **Blank Page**, or **Duplicate Page**. Report pages are added and deleted using the tab at the bottom of each page. You can also right-click a tab to duplicate or rename the report page. After you add a dataset, the **Calculations** menu is activated, and enables you to create measures and add columns. The **Publish** option on the **File** menu prompts you to sign in to your Power BI account, so you can upload reports to the portal.

The Data view

You use the Data view to perform transformation operations on your imported datasets, so you can shape data appropriately for the reports you are producing. Click a dataset to view the imported rows and see the data you want to work with. You right-click any column to refresh the data, set the sort order of the data to either ascending or descending, rename a column, add or delete a column, and add a new measure. For more sophisticated transformation tools, right-click any column and click **Edit query**, which will open the **Power Query Editor** window. This opens the **Power Query Editor** window where you can split columns, apply statistical functions, pivot and unpivot columns, and more. From the **View** menu, you can open the **Advanced Editor** which displays a code view of the query.

You can also transform your data before you import it. Connect to your data source and, after you select the data you want to import, choose **Edit** rather than **Load**. This

opens the **Power Query Editor** window where you shape your data.

The Model view

Power BI Desktop autodetects relationships in your data when the data is structured in a format in which the relationships can be adequately established. The Model view enables you to manage and create relationships. You can set the cardinality to **Many to one (*:1)**, **One to one (1:1)**, **One to many (1:*)**, or **Many to Many (*:*)**. The cross filter can be switched between **Both** or **Single**. You can also delete relationships.

Creating report templates

After creating a report, you can optionally save it as a template. Templates are useful for reusing data that has already been shaped, and visuals that have been customized using corporate colors. If you are producing several reports that share data, visuals, and formatting, templates are a useful feature for avoiding the duplication of work, while ensuring consistency across reports.

You edit an existing template and resave the file as a **.pbix** template, or edit and save as a standard **.pbix** report file. To create a template file, design the report you want to use as the basis for the template, then on the **File** menu, click **Save As**, and then select **Save as type: Power BI template files (*.pbix)**. Alternatively on the **File** menu, click **Export**, and then click **Power BI template**. To open an existing template, on the **File** menu, click **Import**, and then **Power BI template**, or on the **File** menu, click **Open**, and then go to the location of the template file, selecting **Power BI template files (*.pbix)** from the file type list.

Dashboards

- Power BI dashboards are created by pinning visuals to a new or existing dashboard
- Pin Live Page creates a dashboard tile from a report page, including all items in the report
- Pin from one dashboard to another dashboard for easy duplication
- Dashboard sharing with other users for a read-only view
- Full Screen Mode displays the dashboard without menus or browser—ideal for presentations or TVs
- Last Refresh Time can be enabled for each tile
- Favorite dashboards for most frequently used
- Featured dashboard to return to most used first

After you have created the reports, you publish them to the PowerBI.com portal so they can be used to create dashboards. By sharing your reports with colleagues, you enable them to create their own dashboards and data insights. To publish a report, open the report in Power BI Desktop, and click **Publish**. You might be prompted to sign in to Power BI. After your credentials are confirmed, the report is published. If the report already exists on the portal, you are prompted to confirm the overwriting of any existing datasets that have changed.

Creating dashboards

A Power BI user can create personalized dashboards using the reports and data that are available. Dashboards are an easy and effective method for combining data from disparate sources and reports. Any chart or item (known as a visual) from one or more reports can be intermixed on a dashboard. With this flexibility, users build profiles of data and search for trends or answers to questions. Dashboards are created by pinning visuals to a new or existing dashboard. These visuals are created as tiles on the dashboard.

Pin Live Page

You can pin a complete report page to a dashboard as a single tile item. A page can be pinned on its own, or combined with other tile items. Changes to the report appear in the dashboard whenever the page is refreshed. To pin a report, click the one you want to pin, and then, on the horizontal menu bar at the top of the webpage, click **Pin Live Page**. This provides the option to add the page to an existing dashboard, or create a new one.

Pin from dashboard

You can pin a tile from one dashboard straight onto another. Click **More options** (the ellipsis) on a tile, and then click **Pin tile**. This opens the **Pin to dashboard** window with the option to pin to an existing dashboard, or create a new one. This works in the same way as pinning a report visual to a dashboard.

Dashboard sharing

You can share, or unshare, a dashboard with other users in a group. After a colleague accepts an invitation to share a dashboard, it appears in their **My Workspace** menu, along with the reports associated with the dashboard. The dashboard is read-only for the recipient of the shared invitation. To share a dashboard from Power BI, right-click the name of the dashboard in the **My Workspace** menu, and then click **SHARE** to open the **Share dashboard** window. You then enter one or more email recipients, along with a message to describe the dashboard.

Focus mode

To view a tile in greater detail, use the focus mode feature. In the top right corner of the tile you want to view, click **More options**, and then click **Open in focus mode**. This expands the tile so it is the only tile in view. You then begin filtering and drilling through your data as appropriate. Click **Exit Focus mode** to return to the dashboard.

This works equally within reports. Click **Focus mode** to expand the visual, and then click **Back to report** to return to the main report view. When used in your dashboards, this differs from the **Full Screen Mode**, as the focus mode retains menus and controls to enable you to filter the data.

Full Screen Mode

Power BI dashboards can be displayed in full screen mode, which is ideal for presentations, or TV screens. The browser and Power BI menu are hidden from view, and the dashboard expands to fill the screen. By moving the mouse over tile

elements, text pop-ups continue to show. To enter the presentation mode, click **Enter Full Screen Mode** from the dashboard toolbar in Power BI. Press **Esc** or click **Exit Full Screen Mode** to return to Power BI.

The **Fit to Width** and **Fit to Screen** buttons in full screen mode improve a dashboard that does not have enough tiles to fill the full screen, and has excess background space. For example, if there are only a few small charts on a dashboard, the buttons zoom in to enlarge the items and fill as much width or space as possible—this makes the charts easier to read and improves the presentation of the dashboard.

Last Refresh Time

Items that you add to a dashboard can now display the last updated date and time. This is useful for checking when data was last loaded, and ensuring users have the most up-to-date figures. The Last Refresh Time, which is visible in **Full Screen Mode**, is enabled at an individual tile level by using the **Tile details** menu.

Favorite dashboards

You make a dashboard a favorite so you can access it from anywhere within the Power BI Service. To do this, select a dashboard from the navigation pane on the left. When the dashboard loads, on the toolbar, click **Favorite**. Click **Favorites** on the navigation pane to see all your favorite dashboards. To remove a dashboard from your favorites, hover your mouse over the dashboard tile to bring up the icons, and click **Unfavorite**. Alternatively, open the dashboard from the navigation menu to view it, and then on the toolbar, click **Unfavorite**.

Featured dashboard

A featured dashboard is like a favorite dashboard, but is given the status of being the first dashboard you see when you log in. You can also view it immediately by clicking **Featured Dashboard** on the navigation pane. To make a dashboard the featured dashboard, select it from the **My Workspace** pane to open the dashboard, and then click **Set as featured**. You can now view this dashboard from the navigation pane.

Designing reports and dashboards

- Use techniques to design your reports and dashboards to make them easy to digest:
 - **Customize visuals:** use colors, labels, borders, and titles to enhance and group related visuals together
 - **Positioning:** most important information at top of report or dashboard, especially for viewing on mobile device
 - **Audience:** what metrics are most useful to end users? Think about displaying on TV screen or large monitor
 - **Storytelling:** only show relevant and related data, use multipage reports to break up data into context/subject
 - **Choosing a formatting a visual:** bigger visuals for more important data; try out charts to find best for scenarios

One of the most attractive features of Power BI is the stunning visualizations you use to create reports and dashboards. Along with these visuals, you can apply various techniques to make your reports and dashboards easier to consume. In addition to looking great, important information is conveyed quickly.

Customize visuals

You can fully customize each visual, with colors, labels, borders, and titles. You change colors so they match corporate colors or, when creating reports for departments, colors could be used to distinguish departments—for example, blue for finance, yellow for sales, red for marketing. Labels and titles enhance the descriptive text given to a visual—you can also include a text box next to a visual to add a lengthier description where appropriate. Visuals that are related, or work with a slicer, can be grouped together using shapes. Rectangle and line shapes help to contextually group or partition visuals.

Positioning

Published reports might not be editable to the end user, so users cannot move the visuals around on the canvas if they are placed inappropriately. When a user creates a dashboard, they can move pinned tiles around on the canvas. When creating a report or dashboard, the most important information should be presented first, in the top left corner of the screen. This is particularly important when designing for mobile devices; a user will not be able to move pinned items, so it's vital to have the most important visual at the top—so it is visible first on a small mobile phone screen.

Audience

Think about the person who will consume your reports and dashboards. What metrics are important to them? Are specific key performance indicators (KPIs) needed for them to measure the effectiveness of their department, or their role? A salesperson might want to see how close they are to their sales target, whereas the sales director will want to see how each salesperson is progressing.

You might also consider where the dashboard will be viewed. If it is to be displayed on a TV or large monitor, then you include more content than you would for displaying on a mobile phone. Furthermore, displaying your dashboard in full screen mode removes menu bars and other distractions.

Storytelling

Reports and dashboards should not be cluttered, and show only relevant and related data. When creating reports, use multiple pages to group related visuals by department or subject. Rename the tabs at the bottom of the screen to help users quickly find data. Try to avoid having so many visuals on a report or dashboard that make the user scroll across or down.

Choosing and formatting a visual

The most important information should not only be displayed first, but also have the biggest visual suitable for presenting it. You should size visuals so that important information is displayed in bigger visuals, and less important information in smaller

visuals. This guides the user to interpret and digest the report or dashboard more efficiently. A card at the top of the screen showing sales means executives can immediately see organizational performance. Consider the following design principles when choosing a visual to represent your data:

- Look at both the fields and the data values you want to present in a chart. If the data includes geographic fields, a map chart might be best. However, if values need to be displayed proportionately, then perhaps a pie or tree map would be appropriate. Would a constant or reference line add value to a chart? If you are unsure, try a few chart types, then you'll see how the data is presented and what works best.
- Your charts should be consistent, both in terms of design and axes. Ensure scales on axes and the order of dimensions are consistent, and be aware of how you use colors.
- When displaying numbers, avoid using too many numerals, as this makes it difficult to read. Rather than displaying a card with \$145,000,000, present the data as \$145m or \$145 million, because this is quicker and easier for the mind to interpret.
- Charts that present data over time should also be consistent, especially if you apply filtering. For example, don't have one chart that displays data for the last quarter next to a chart showing data for April last year.
- In addition to avoiding showing different time precision, apply the same principle to measures, and avoid mixing measures of different scales. Showing one scale in millions and another in thousands makes them difficult to compare.

- How you sort charts can make a difference to how well the data is interpreted. If you want the user's attention to be drawn to the highest or lowest number, sort the chart by that measure.
- Avoid using pie charts when you have many categories. When the number exceeds about seven or eight categories, choose another visual such as a bar or column chart. If there are too many, this makes it difficult to compare in a pie chart.

Demonstration: Creating a report with Power BI Desktop

In this demonstration, you will see how to:

- Create a new report in Power BI Desktop.
- Connect to the AdventureWorksLT Azure SQL Database.
- Add a chart to the report using AdventureWorksLT data.

Check your knowledge

Select the best answer

Which of the following statements is false?

You can import data and create reports with the Power BI Desktop app.

You can create and share dashboards on the PowerBI.com online portal.

You can use SQL Server Standard Edition licenses to run Power BI Report Server for on-premises reporting.

Data can be imported from an on-premises SQL Server or Azure SQL Database.

Data can be imported from Facebook.

[Check answer](#)[Show solution](#)[Reset](#)

Lesson 2: The Power BI Service

In this lesson, you will learn about the licensing structure of Power BI, and explore the many options available when creating datasets. You will also be introduced to apps, learn how the natural query language answers questions about your data, and understand tenant management.

Lesson objectives

At the end of this lesson, you will be able to:

- Explain the different Power BI licensing options.
- Understand tenant management.
- Describe how to incorporate datasets into Power BI reports.
- Explain how to create and use apps.
- Describe the benefits of the natural query language.

Licensing

- Per-user licensing:
 - Choice of Power BI Pro or free licenses
 - Only Power BI Pro accounts can publish shared content
- Capacity licensing:
 - Power BI Premium licenses
 - Dedicated capacity to improve performance
 - Enable free users to access shared content

Power BI offers a straightforward licensing model, with a choice of per-user or capacity-based licenses.

Per-user licenses are Power BI Pro licenses and free licenses. Both of these can do the following:

- Connect to 70-plus data sources.
- Create reports and datasets by using Power BI Desktop.

- Publish content to the web.
- Export content to PowerPoint, Excel, and CSV files.

Only Power BI Pro users can publish to, and consume content from, app workspaces, share dashboards, and subscribe to content. The free license only allows users to consume shared content that is published to Power BI Premium capacity. A free account requires a work or school email address, so personal domains such as Gmail, Hotmail, or Yahoo, are not permissible.

Capacity-based licenses are Power BI Premium licenses. By purchasing these licenses, organizations have access to their own dedicated capacity to improve performance and support higher volumes of data than shared capacity allows. Both Power BI Pro and free users can access content published to Power BI Premium capacity.

Organizations can have a mix of free and Power BI Pro accounts and use Power BI Premium capacity. For full service details and local pricing, see *Power BI pricing* in the Power BI documentation:

Power BI pricing

<http://aka.ms/Qz9yz8>

Tenant management

- Power BI uses a self-service sign-up model:
 - Users can sign up without dependency on an Office 365 account, or organizational Office 365 administrator
 - When a user signs up, a tenant is created for the domain, or the user joins the tenant—for example, contoso.com
 - Users within a tenant can collaborate and share content
- Office 365 admins sign up using the Power BI portal or Office 365 Admin portal:
 - Users can be assigned a license, or sign up and join the tenant and acquire a license
 - Qualifying organizations receive 1 million licenses, and can request more from Microsoft

Power BI uses a self-service sign-up model so that users can create an account without dependency upon either an Office 365 administrator, or an Office 365 subscription. When an individual from an organization signs up to Power BI, a tenant is created automatically. A tenant is a domain within your organization; for example, contoso.com. If another user from the same organization signs up, that user is added to the existing tenant. All users within the same tenant become part of the same network; this means they share reports, dashboards, and datasets. In this situation, the agreement is between Microsoft and the user, so no organization intervention or responsibility is required. Users can also reset their password directly from Microsoft, using an email verification process.

Administrator sign-up

Administrators sign up to Power BI via the PowerBI.com website, or through the **Purchase Services** section within the **Office 365 Admin Portal**. Administrators then assign licenses to users within the tenant. In addition, users can still sign up individually, and be automatically assigned an available Power BI license. If the user does not already have an Office 365 account, an account is also created for them.

For more information on managing tenants, including the prevention of users joining a tenant, see *Power BI licensing in your organization* in the Power BI Documentation:

Power BI licensing in your organization

<https://aka.ms/M2nhu6>

Organizations without Office 365

If your organization does not have an Office 365 environment, users can still create accounts, but the organization will not be able to collectively administer the accounts. The Power BI Service is built on the Microsoft Azure platform, so these accounts are created in a cloud-only user directory—that your organization can claim—to manage the tenant and users.

Acquiring Power BI licenses for an Office 365 tenant

Qualifying organizations with an Office 365 tenant receive 1 million licenses. Licenses are provided free of charge for using the Power BI free service. If your organization requires more than 1 million licenses, you should contact Microsoft. When a user within the organizational domain signs up for Power BI, they are assigned one of these available licenses. Administrators can also assign licenses through the portal.

For more information on the Power BI architecture and Power BI security, see *Power BI Security* in the Power BI documentation:

Power BI security

<http://aka.ms/Bk38nc>

Datasets

- Create a dataset by importing data into Power BI Desktop or the PowerBI.com portal
 - Import data from data sources including on-premises or cloud databases, files, SaaS connectors
 - Scrape data from a webpage into Power BI tables
 - Copy and paste data from Excel into a Power BI table
- Load data into Power BI, or transform it first
 - Datasets in the Data view and Power Query Editor
 - Power Query Editor offers transformations such as column splits, rounding, aggregations, statistical operations
- Refresh datasets in Power BI Desktop and portal
 - Schedule the refresh of datasets on the portal

A dataset is created when you import data into Power BI Desktop, or through the Power BI portal. The dataset can be used across multiple reports; you can shape and combine the data in your datasets.

Data sources

In Power BI Desktop, you have a wide choice of sources to import from, including database, file, and SaaS connections, as described here.

Database connectors

Power BI supports the main industry database and file connections for importing data from on-premises sources. Database connectors include:

- SQL Server
- SSAS tabular and multidimensional models
- Microsoft Access
- Oracle
- IBM Db2
- MySQL
- SAP HANA
- PostgreSQL
- Sybase
- Teradata

File connectors

You can import from a single file, or choose a folder to select multiple files to import. This is useful when you have a folder location used to store files created on a schedule. File connectors include:

- Microsoft Excel
- CSV
- XML
- Text
- JSON

SaaS connectors

An increasing number of connectors to Power BI Desktop make it easy to connect to external SaaS applications for analyzing data such as web traffic, sales, marketing, financial, and social media. SaaS connectors include popular services such as:

- Google Analytics
- QuickBooks Online
- MailChimp
- Facebook
- Dynamics 365 for Customer Insights
- Salesforce
- GitHub

Users connect to SaaS applications and import the data to create reports and dashboards. Due to its flexibility, Power BI combines multiple sources of data from disparate SaaS vendors into one central reporting space. For example, figures from Salesforce can be combined with a recent marketing campaign that was delivered using MailChimp, alongside marketing data from Facebook.

Other data sources

You can also connect to any webpage to scrape the data into tables within the dataset. You might not be able to determine the table names or structure of the data, but you can perform some operations to rename fields and tables after you have imported the data into Power BI Desktop.

You can quickly create a table by copying and pasting data directly from an Excel or text file. On the **Home** ribbon, click **Enter Data** to open the **Create Table** window. Right-click in the table and then click **Paste** to paste data from another file. You work with the contents of this table within your dataset, just as you would with data from any other source.

Working with datasets

You import data by connecting to a data source, such as SQL Server, or Excel. To begin, choose **Get Data** or **Recent Sources** from the **Home** ribbon, and then select your data source from the list. The **Navigator** window shows all the tables, views, or worksheets you can import. You preview and select the data you want to import.

From here, you click **Load** to pull in the data as it is, or click **Edit** to make transformations. If you choose to edit the data, it opens in the Power Query Editor window, so you have access to the full range of transformations. This is a useful step if you have a large dataset, but want to reduce the amount of data that you import by excluding columns or filtering rows. Conversely, if you choose to load the data, all columns and rows are imported before you can apply transformations.

You can perform some basic operations on your datasets in the Report view. In the Fields pane, you can add or delete columns, rename the table and columns, refresh the data, and create a new measure. However, most of the work you perform on your datasets will be in the Data view window or the Power Query Editor. The Power Query Editor offers more complex transformations than the Data view—such as column splits, rounding, aggregations, statistical and scientific operations.

Refreshing data

When you publish a report to the Power BI portal, the datasets are published too. You can use the Power BI portal to refresh the data within your datasets. In the left pane, click the ellipsis next to a dataset to open the dataset menu. You can choose to **Refresh Now** or **Schedule Refresh**. If you want to schedule a data refresh, you should follow the instructions for downloading the **Power BI Gateway**.

You can also refresh your data in Power BI Desktop by clicking **Refresh** on the **Home** ribbon. When viewing a dataset in the Power Query Editor window, you might see a message such as “This preview may be up to 35 days old”. Click the **Refresh** button to update the data, though the data might not have been altered. This applies

to each table within your dataset, so you have control over exactly which tables to update.

Row-level security

- Row-level security (RLS) uses roles and rules to restrict the data a user can see:
 - Configure RLS on imported datasets, and DirectQuery connections
 - Create new role, select table, and add filter in the form of a DAX expression—for example, [Region] = "North"
 - Combine with USERNAME() function and table relationships in model
 - Use View As Roles to filter report or data view
- Limitations
 - Needs a Power BI Pro subscription
 - Roles and rules created in the service must be recreated in Power BI Desktop
 - To use with Excel datasets, the Excel file must first be converted to a Power BI (.pbix) file

Row-level security (RLS) enables you to restrict the data that a user can view, based on filters. These filters work at the row level to control what data is returned to the user, and can be managed using roles. In addition to configuring RLS on your data models in the Power BI Desktop, you can also configure datasets using DirectQuery. In Power BI Desktop, roles cannot be defined for SQL Server Analysis Services live connections; this must be done within the Analysis Services model. If you enable the

option **Enable cross filtering in both directions** in Power BI Desktop, this applies the cross filter and the security in both directions.

To configure RLS, you start by defining roles and rules within Power BI Desktop, and then publish these to the Power BI Service:

1. Import data into Power BI Desktop, or configure a DirectQuery connection.
2. From the **Security** group on the **Modeling** ribbon, click **Manage Roles**.
3. In the **Manage roles** dialog box, click **Create**.
4. When the text box appears, type in a name for the role.
5. From the **Tables** list, select a table to apply the filter.
6. The filter will be a DAX rule that returns true or false; for example, `[Region] = "South West"`. In the **Table filter DAX expression** box, type in the DAX expression, and then click the tick button to validate the expression. Alternatively, you right-click the table name and click **Add filter**. You then insert a column from the table into the DAX filter text box.
7. Repeat steps 5 and 6 to create further filters on other tables.
8. Click **Save**.

In Power BI Desktop, you cannot assign users to roles, because this is done in the Power BI Service. However, you can use the `USERNAME()` function alongside table

relationships to dynamically restrict data to the current user. After creating a role, you can then test it:

1. From the **Security** group on the **Modeling** ribbon, select **View As Roles**.
2. Select one or more roles, and click **OK** to apply the filtering. Additionally, select **Other user**, and type in the name of another user for whom you want to test: for testing as it would appear in the Power BI Service, type the user principal name (UPN), such as jane@contoso.com.
3. You can use this in the Report or Data view to see the restricted results.
4. Click the **Stop viewing** button at the top of the view to remove the applied filters.

Limitations

There are limitations to using row-level security that you need to be aware of:

- To use RLS, you need to have a Power BI Pro subscription.
- Roles and rules created in the Power BI Service need to be recreated in Power BI Desktop.
- RLS can only be defined on datasets created in Power BI Desktop. If you want to use RLS with datasets created in Excel, you must first convert the Excel file to a Power BI (.pbix) file.

- Only imported data and DirectQuery connections are supported. Live connections to SSAS are handled in the on-premises data model.
- Cortana and Q&A do not support RLS.

Apps

- Power BI apps are packaged reports, dashboards and datasets
 - Can be shared with other Power BI users
 - Can be customized for different users
 - Created in app workspaces
 - Give access to specific groups, or entire organizations
 - Add title, description and image or company logo
 - Can automatically install
- Import apps from SaaS providers, such as MailChimp, Insightly, Marketo, and Twilio

Apps are packaged reports, dashboards, and datasets, which can be shared with other Power BI users in your organization. When you install an app on the PowerBI.com portal, the report items are merged into your workspace lists. Users

with a free Power BI account can only view apps that are published to Power BI Premium capacity—they cannot create them. You can create apps to customize reports or dashboards for users in different departments within your organization. For example, you could create a set of reports with targeted visuals for finance, sales, and manufacturing, because each department is likely to want different data with which to measure performance.

You create apps in app workspaces in Power BI Desktop. Because changes that you make in the app workspace are not propagated to the app until you publish or update it, you can use the app workspace as a staging area when designing or revising your app.

When you publish an app, you choose who you want to give access to. You can choose specific groups, such as Sales, or Human Resources, or you can give access to your entire organization. You customize the app with a title, and a description to help users determine if it is applicable to their needs. You can also upload an image or company logo for the app and assign a background color to match your corporate or departmental identity. You choose the reports, dashboards, and datasets you want to include; however, when you choose a report or dashboard, it automatically includes any required datasets, and these cannot be excluded. The app is then available in your organization's content gallery. Users who have access to the app can create new dashboards from the contents.

In addition to choosing who can access the app, you can also automatically install it for end users. Provided you have been granted permission to do this, when you publish your app you can check the **Install app automatically** box and Power BI pushes the app to all the users or groups you have selected to access your app.

Those end users will then find your app when they refresh their apps list without having to search for it. When using this functionality, remember that installing apps can take time and bandwidth, so it is best to do so out of office hours.

If you need to remove an app from users, in the app workspace, right-click the ellipsis, and then click **Unpublish app**. Users will no longer have access to the app and will lose any personal bookmarks, comments, or subscriptions associated with the content in the app. After unpublishing an app, the app workspace is still available for you to work in and you can republish the app later.

In addition to creating your own apps, you can also import apps from SaaS providers such as Adobe Analytics, Alpine Metrics Sales Prediction, Insightly, Marketo, and Twilio. To add an app from an SaaS provider that you have an account with, in PowerBI.com, click **Get Data** then under **Services**, click **Get**. In the **AppSource** window, under **Apps**, either click the SaaS logo to view provider details, or click **Get it now**. You will be prompted to enter your customer details for the service. After authentication, you can import an app with reports and dashboards designed to visualize your data.

Natural language queries

- Power BI Q&A helps you ask questions about your data using natural query language
 - Anyone who has access to the data in Power BI can ask a question and receive a quick response
 - Users ask questions, just as they would with a search engine
 - Q&A helps you phrase your question, uses auto-complete, restates questions, and corrects spelling
 - Terminology for names, date keywords, date ranges, aggregations, equality, sort order, and verbs
 - Searches are done with datasets used by the dashboard
 - Pin the answers to your dashboard for future reference
 - Answer can be presented in chosen chart type—for example, a map

Finding answers to questions can be difficult if your organization has many data sources, and users do not know which data to use. Also, if existing reports do not slice data the right way, or do not show up-to-date aggregations, or enough data, users cannot find the answers they need. This becomes particularly arduous when users frequently have questions that need an immediate answer—but it takes time for the report developer to create and publish the report. With Power BI, you use the Q&A feature to ask questions using a natural language, just as you would by using a search engine. With Q&A, anyone in the organization with access to Power BI can quickly find answers, because no additional programming skills are needed.

Q&A box

The Q&A box sits at the top of the screen when viewing dashboards. When you click in the box, Q&A displays a prebuilt list of suggestions to help you get started. This list comprises the questions that were used to create the tiles that were pinned to the dashboard, in addition to the names of the tables in the datasets that were used to build the report. You select any of the suggestions from the list, or type in your own question. Q&A helps you phrase your question, using auto-complete, restating your questions, and using appropriate textual or visual aids. It also corrects spelling and dims the color of words it does not understand.

Terminology

Q&A automatically recognizes the following keywords and terms:

- **Names.** If a column in the dataset contains a phrase such as "name", for example FirstName, then Q&A knows the column values are names. You can phrase a question using the search for a particular name.
- **Tenses.** "Sell" and "sold" are treated the same.
- **Possessives.** "What is the total of Pamela's sales"?
- **Plurals.** "Opportunity" and "opportunities" are treated the same.
- **Date keywords.** This month, last year.
- **Date ranges.** Before, after.
- **Aggregations.** Minimum, maximum, count of, average, less than, between,

before.

- **Equality keywords.** Equal, more than, less than, between.
- **Sort order.** Ascending, descending, alphabetical.
- **Display verb.** Show, what is, are, what are.

How Q&A finds the answer

Q&A searches for the answer to your question using any of the datasets that have a tile on the dashboard on which you are asking the question. It returns the best answer it can from the available data. If you remove tiles from a dashboard, be aware that the underlying datasets are also removed, so you cannot use this data for your Q&A. This is particularly important if you pin the visualization answer to your dashboard.

Visualizing the answer

Power BI Q&A decides on the best visualization to present the answer. In addition to requesting the data you need, you can also ask for it be presented using a specific visualization, such as a chart or map. For example, you could ask “show sales by store as a map”, or “show sales by territory as a tree map”.

Demonstration: Creating an App

In this demonstration, you will see how to:

- Publish a report to the Power BI Service.
- Use the report to create a dashboard.
- Create an app using the dashboard and dataset.

Check your knowledge

Discovery

Discuss the benefits of using Power BI in an organization looking to create reports to analyze their data.

Show solution

Reset

Lab: Creating a Power BI dashboard

Scenario

Adventure Works employees are increasingly frustrated by the time it takes to implement managed BI services. The existing managed BI infrastructure, including a data warehouse, enterprise data models, and reports and dashboards, are valued sources of decision-making information. However, users increasingly want to explore relationships with other, currently unmanaged data—and it takes too long for the IT department to incorporate these requirements into the corporate BI solution.

As a BI professional, you have been asked to explore ways in which Adventure Works can empower business users to augment their managed enterprise BI solution with self-service BI.

Objectives

After completing this lab, you will be able to:

- Connect to an on-premises SQL Server database from Power BI Desktop, create a new report, and publish it to the Power BI portal.
- Create a Power BI dashboard.

Note: Because of updates to Microsoft Power BI, the lab steps for this course change frequently. Microsoft Learning regularly updates the lab steps, so they are not available in this manual – but you can access them on GitHub.

Lab setup

Estimated time: 60 minutes

Virtual machine: **20778C-MIA-SQL**

User name: **ADVENTUREWORKS\Student**

Password: **Pa55w.rd**

All the lab steps are contained in 20778C_LAB_02.md.

Exercise 1: Connecting to Power BI data

Scenario

You are a business analyst for Adventure Works who will be creating reports in Power BI Desktop using the corporate database stored in SQL Server 2017. You have been given a set of business requirements for data and will now connect to the database from Power BI Desktop. You will publish your report to the Microsoft Power BI portal, and use the reports to create a dashboard.

The main tasks for this exercise are as follows:

1. Prepare the lab environment.
2. Connect to SQL Server from the Power BI Desktop.
3. Add charts to the report.
4. Publish the report to the Power BI portal.

Result: After this exercise, a report will be published on the Power BI portal.

Exercise 2: Create a Power BI dashboard

Scenario

You have created a management report showing Adventure Works sales data, and have published this to the Microsoft Power BI portal. Next, you will create a dashboard on the portal, so managers can use this to bring data together in one place.

The main tasks for this exercise are as follows:

1. Create a new dashboard.
2. Add chart items to the dashboard.
3. Customize the dashboard.
4. Display the dashboard in Full Screen Mode.

Result: After this exercise, a dashboard will be created on the Power BI portal.

Review question(s)

Check your knowledge

Discovery

Self-service BI empowers business users with the ability to use corporate data to compile reports without the dependency on an IT department, or a dedicated report developer. Giving users access to live data means they gain insights into the most up-to-date transactions. Real-time analysis is critical to organizations in certain industry sectors. While this is advantageous to the users, you must consider the security and performance of your on-premises databases. What tools can you use to ensure the safety and performance of your databases?

Show solution Reset

Check your knowledge

Discovery

Discuss the different SaaS providers that your organization uses, and how this data could be used in Power BI dashboards. How could this data be combined with data from production databases to create greater insights into data?

Show solution Reset

Module review and takeaways

Using Power BI eliminates complications and barriers with a simple integrated user interface, and has the ability to publish rapidly to a cloud-based portal to share reports easily. This module introduced Power BI and explored the features that enable the rapid creation and publication of sophisticated data visualizations.