Aspecto destacado Nota

Module 7: Direct Connectivity

Contents:

Module overview

Power BI service supports live direct connections to Azure SQL database, Azure SQL Data Warehouse, big data sources such as Azure HDInsight® Spark, and SQL Server Analysis Services. DirectQuery means that whenever you slice data or add another field to a visualization, a new query is issued directly to the data source.

Power BI works with SQL Server Analysis Services models that are running in multidimensional mode, so that you can use OLAP cubes and models in reports and

dashboards. It doesn't matter if you are using the Power BI service in the cloud, and an on-premises SQL Server Analysis Services implementation; the On-premises data gateway enables live connections between the cloud and on-premises data servers.

Objectives

After completing this module, you will be able to:

- Use Power BI direct connectivity to access data in Azure SQL Database and Azure SQL Data Warehouse, in addition to big data sources, such as Hadoop.
- Use Power BI with SQL Server Analysis Services data, including Analysis Services models running in multidimensional mode.

Lesson 1: Cloud data

In this lesson, you will learn how to use Power BI to directly connect to Azure SQL Database and Azure SQL Data Warehouse, and then use these datasets with visualizations, reports, and dashboards. You will then learn how Power BI works with big data sources, including Hadoop and Spark.

Lesson objectives

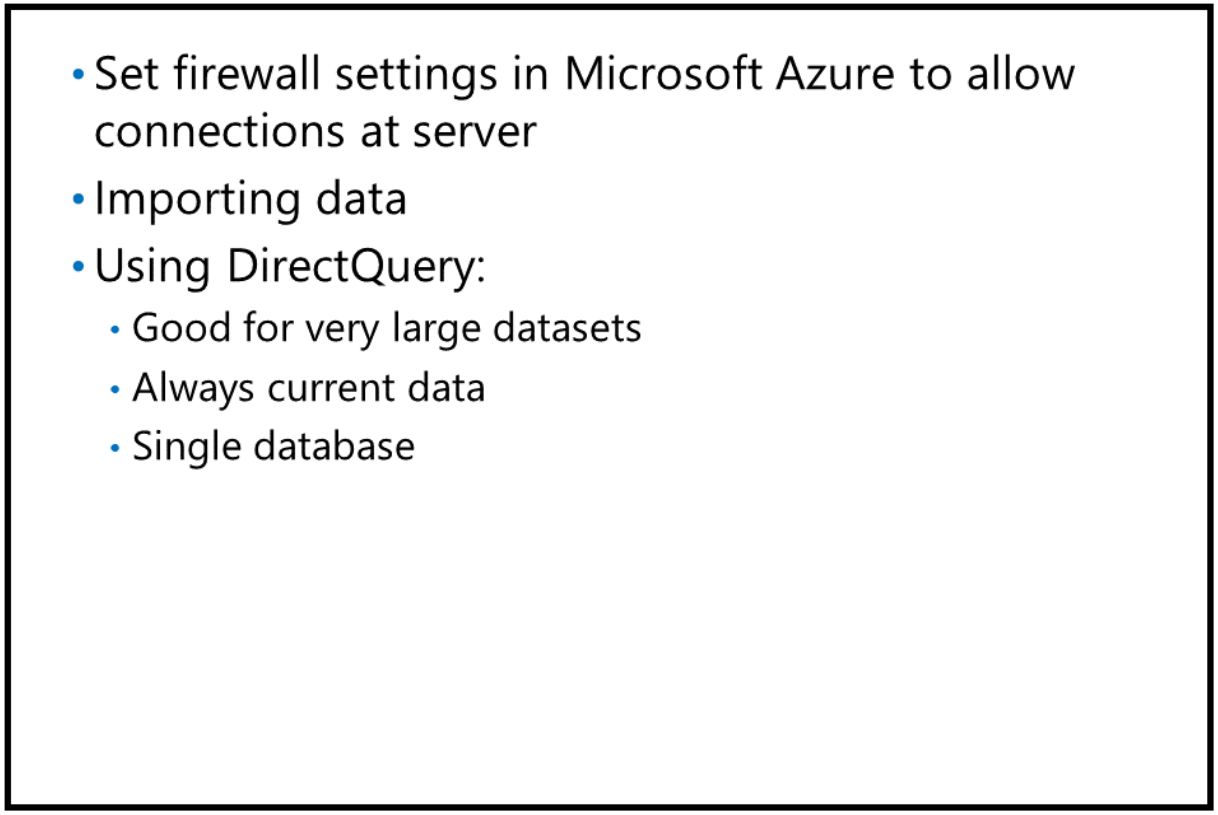
After completing this lesson, you will be able to:

-

Use direct connectivity in Power BI to access data in Azure SQL Database and in Azure SQL Data Warehouse.

- Connect Power BI to big data sources and use these sources with BI reports and visualizations.

Direct connectivity to SQL Services in Azure



You use Power BI to connect to your cloud-based instances of SQL Server as easily as connecting to your on-premises servers.

Before connecting to a database in Azure, ensure that you have configured the firewall settings in Azure to allow remote connections:

1. In Microsoft Azure, click **SQL databases**, and then click the name of the database to which you want to grant access.
2. Click **Set server firewall**, click **Add client IP** to add your current workstation, or add a range of IP addresses, and then click **Save**.

> **Note:** Microsoft recommends that you allow access at the database level in Azure, rather than at the server level.

You can either import the data into Power BI Desktop or use DirectQuery to create a live connection to the data. DirectQuery restricts you to using a single database, but it is useful when you want to connect to very large datasets that could take a long time to load into Power BI. Loading data can also be problematic when making changes to report items that cause a refresh of the data—this can mean further delays and make it cumbersome to work with the data.

Importing data

To import data into Power BI Desktop:

1. Open Power BI Desktop, and then click **Get Data**.

2. In the **Get Data** dialog box, click **Azure**, click **Azure SQL database** or **Azure SQL Data Warehouse**, and then click **Connect**.

3. In the **Server** name box, type or paste the full name of the server—for example, **<*server name*>.database.windows.net**—then optionally in the **Database (optional)** box, type the name of the database. If you have previously created a parameter, Power BI gives you the option of using a parameter value for the server and database names.

4. Type or paste an optional query into the **SQL Statement (optional)** box, and then click **OK**.

5. If you did not specify a database name in the previous step, the Navigator screen displays a list of available databases; otherwise, it just shows the database that you specified. Expand a database to view the objects in it, and then click to select the tables and views that you want to import. You can select objects from multiple databases to combine the data into a single dataset.

6. Click **Load** to import the data into Power BI, or click **Edit** to open the Power Query Editor window and apply transformations. Transformations can also be performed at any point after loading the data.

Using DirectQuery

To connect using DirectQuery:

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Open Power BI Desktop, and then click **Get Data**.

2. In the **Get Data** dialog box, click **Azure**, click **Azure SQL database** or **Azure SQL Data Warehouse**, and then click **Connect**.

3. In the **Server** name box, type or paste the full name of the server—for example, **<*server name*>.database.windows.net**—then optionally in the **Database (optional)** box, type the name of the database. If you have previously created a parameter, Power BI gives you the option of using a parameter value for the server and database names.

4. Under the **Data Connectivity** mode, click **DirectQuery**.

5. Type or paste an optional query into the **SQL Statement (optional)** box, and then click **OK**.

6. If you did not specify a database name in the previous step, the Navigator screen displays a list of available databases; otherwise, it just shows the database that you specified. Expand a database to view the objects in it, and then click to select the tables and views that you want to import. You select objects from multiple databases to combine the data into a single dataset.

7. Click **Load** to create the DirectQuery connection, or click **Edit** to open the Power Query Editor window and apply transformations. You can perform transformations at any point after loading the data.

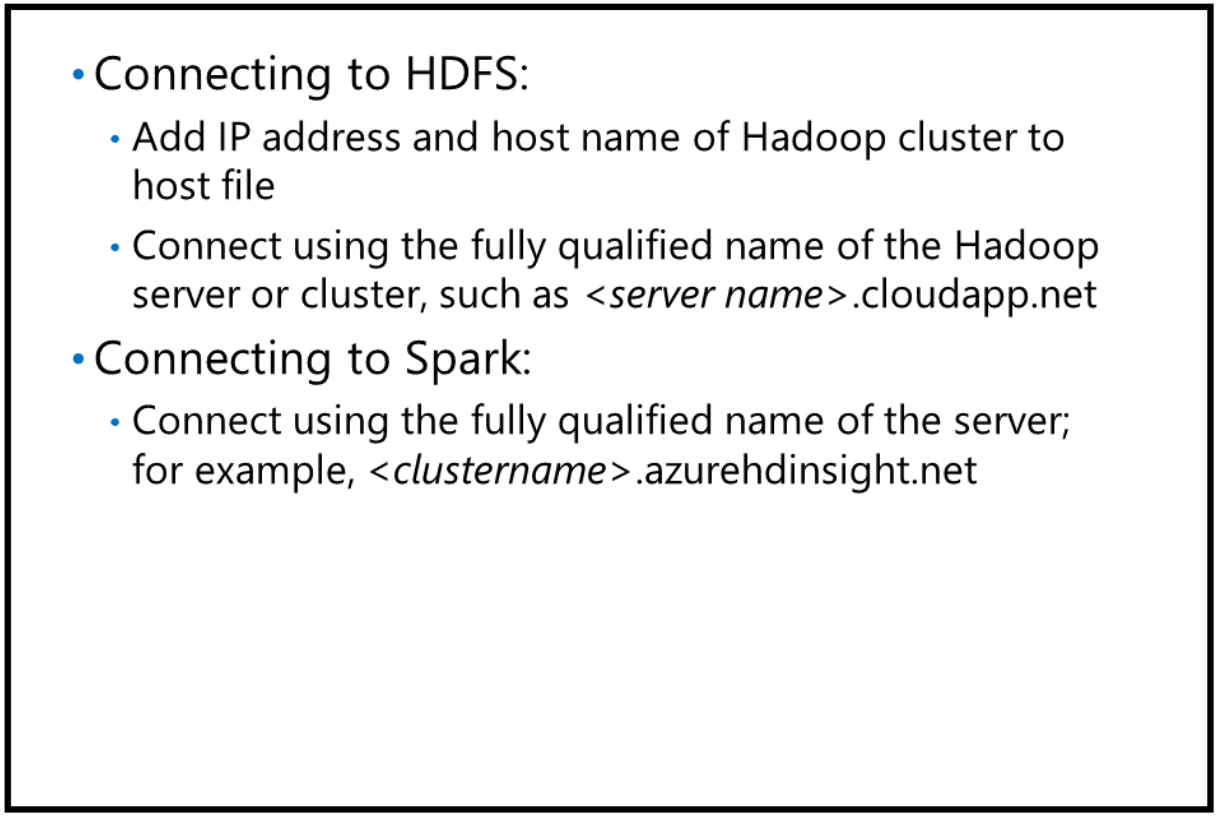
> **Note:** The Power BI Q&A natural language feature is not available when using DirectQuery. Q&A uses the data that is imported into datasets to build answers and cannot create this without the data being present.

After creating a report by using DirectQuery, you can publish to the Power BI service. You might need to provide credentials for the database in Azure SQL database to run the report. To provide credentials:

1. In Power BI, click the **Settings** gear icon, and then on the menu, click **Settings**.
2. Click the **Datasets** tab, and then click the dataset that connects to the database in Azure SQL Database by using DirectQuery.
3. Expand **Data source credentials**, click **Edit Credentials**, and then add your user name and password.

You cannot connect to Azure SQL database or Azure SQL Data Warehouse from the Power BI Service. You must connect from Power BI Desktop and then publish the report to Power BI Service.

Connecting to big data



Big data describes data sets that are typically too large and complex to process using standard techniques such as data cubes, denormalized relational tables, and batch-based extract, transform and load (ETL) engines. Instead, you should use other approaches—Hadoop has become the standard for distributed data processing of big data. You can either run your own Hadoop servers and clusters, or use a hosted Hadoop service, such as HDInsight or Hortonworks Data Platform (HDP). HDInsight is an Apache Hadoop implementation based on HDP, which runs in globally distributed Microsoft datacenters. You use the HDInsight service to build Hadoop clusters easily and quickly when you need them.

There are several ways to use Power BI to connect to big data sources, and to use Power BI reports and visualizations with big data.

Connecting to HDFS

If you have an Azure virtual machine running Hadoop, or are using a Hortonworks Sandbox (if you don't have access to a Hadoop cluster), you can connect to the Hadoop Distributed File System (HDFS) for reporting with Power BI Desktop:

1. In Power BI Desktop, click **Get Data**.
2. In the **Get Data** dialog box, click **Hadoop File (HDFS)**, and then click **Connect**.
3. In the **Server** box, type the name of your server, and then click **OK**.

> **Note:** To avoid potential name resolution problems, you should add the IP address and host name of the Hortonworks or Hadoop cluster details to the host file of the computer running the queries.

Connecting to Spark

Azure HDInsight provides a fully managed Spark service. Apache Spark is an open-source parallel processing framework that supports in-memory processing to boost the performance of big data analytic applications. This capability allows for scenarios such as iterative machine learning and interactive data analysis.

You use Power BI Desktop to connect directly to your Spark cluster then explore and monitor data without requiring a data model as an intermediate cache. It's a live connection, so any field selection or filter sends a query back to the source and the visual is updated with the new results. After saving your report, any of the visuals can be pinned to your customized dashboard. The data in the dashboard will be refreshed approximately every 15 minutes—no refresh schedule is required.

To connect to Spark in Power BI desktop:

1. In Power BI Desktop, click **Get Data**.
2. In the **Get Data** dialog box, click **Azure HDInsight Spark**., and then click **Connect**.
3. In the **Server** box, type or paste the fully qualified name of the server, such as**<*clustername*>.azurehdinsight.net**, and then click **OK**.
4. On the **Username/Password** page, enter your credentials, and then click **Connect**.
5. Select the newly created Spark dataset to begin exploring the data. Note that every field selection will generate a query back to the source data so, depending on the size of the query and any database optimizations, there might be some loading indicators while the visuals are created.

Demonstration: Using Azure SQL Database as a Power BI data source

In this demonstration, you will see how to:

- Import data from tables in a database in Azure SQL Database.
- View relationships between the tables.

Lesson 2: Connecting to Analysis Services

In this lesson, you will learn how to use Power BI Desktop to connect to a local SQL Server Analysis Services server, and then use the results in visualizations and reports. You will also learn how to access on-premises SQL Server Analysis Services data from the Power BI service in the cloud, through the On-premises data gateway. Finally, you will learn how to use Power BI with SQL Server Analysis Services models that are running in multidimensional mode, and how to use OLAP cubes and models in reports and dashboards.

Lesson objectives

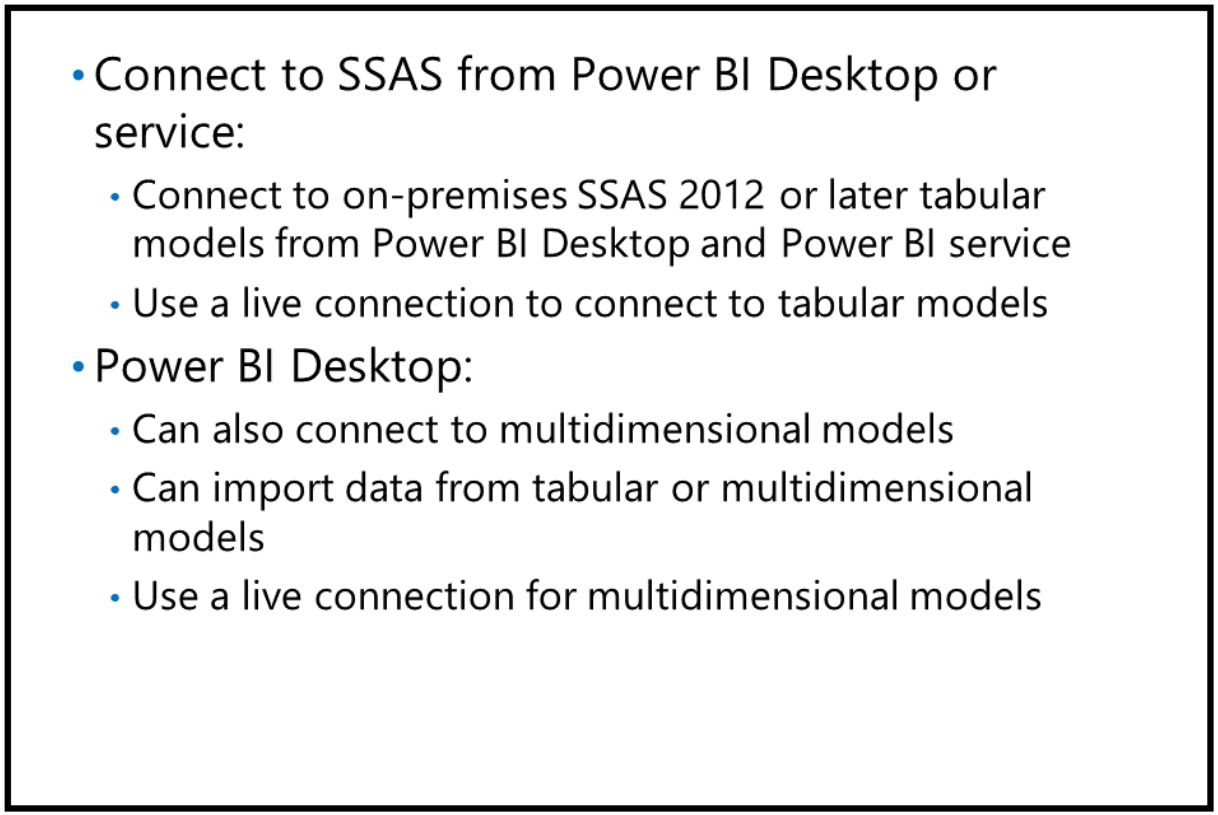
After completing this lesson, you will be able to:

- Use Power BI Desktop to access SQL Server Analysis Services data.
- Use the Power BI service, and the On-premises data gateway, to access on-

premises SQL Server Analysis Services data.

- Use Power BI Desktop to connect to SQL Server Analysis Services models in multidimensional mode.

Direct connectivity to Analysis Services



SQL Server Analysis Services (SSAS) supports additional security options, including role-based security. For example, you may have Finance users who should only have access to a particular set of information in a dataset, and Sales users who need

access to a slightly different set of data. These roles are managed in SSAS, and Power BI applies the SSAS security so that users only see the data that they are permitted to access. This delegation applies whether you are using the Power BI Desktop, or whether you are using a report that has been published to the Power BI service.

You connect to an on-premises tabular model database in SQL Server Analysis Services (SSAS) from both Power BI Desktop and the Power BI service. You also have the option of connecting to SQL Server Analysis Services by using Excel®, and then uploading the workbook. By using Excel, you can explore and edit your tabular data in Power BI. In Power BI Desktop, you can also connect to multidimensional models in SQL Server Analysis Services.

> **Note:** You must configure a Power BI gateway on your server before you connect to SSAS using a live connection from the Power BI service.

Connecting from Power BI Desktop

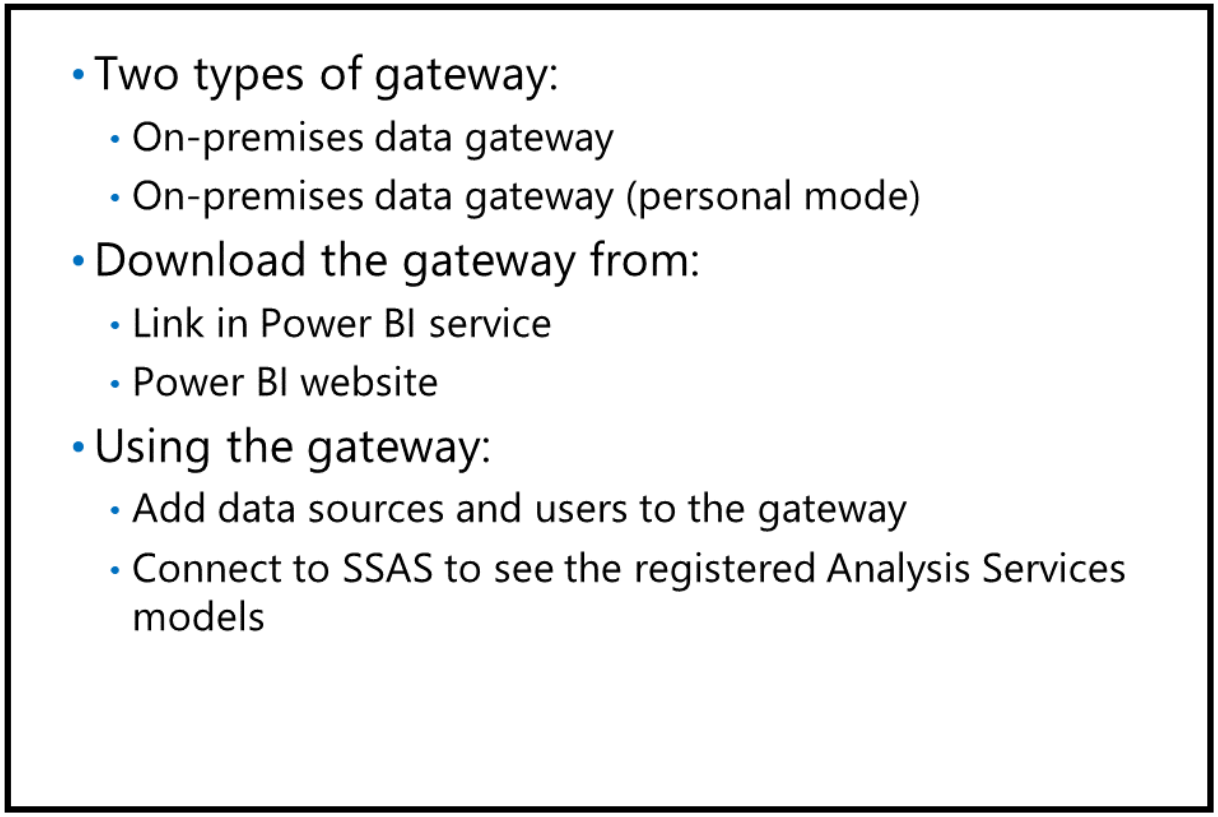
To connect to a database in SQL Server Analysis Services from Power BI Desktop:

1. Click **Get Data**, click **SQL Server Analysis Services database**, and then click **Connect**.
2. In the **Server** box, type the name of the server, and then optionally in the **Database (optional)** box, type the name of the database. If you have

previously created a parameter, Power BI gives you the option of using a parameter value for the server and database names.

3. Use the **Connect live** or **Import** button to specify the type of connection you want to create. You also have the option to enter Multidimensional Expressions (MDX) code or a Data Analysis Expressions (DAX) query. Click **OK**.
4. In the next dialog box, enter your credentials, and then click **Connect**.
5. Click to add dimensions and measures from the list of available objects.
6. Click **Load** to create the dataset and import the data if you previously selected this option, or click **Edit** to open the Power Query Editor window and apply transformations. You can also edit the dataset later, after loading it.

Using the On-Premises data gateway



You can connect directly to SQL Server Analysis Services from Power BI Desktop, but if you want to upload a report file and start using it the Power BI service, you need to download and install the On-premises data gateway (previously called the Power BI Analysis Services connector). When the gateway is set up, it acts in a similar way to the personal gateway, providing a connection between your on-premises Analysis Services and the Power BI service. There is a single download and installer for both the On-premises data gateway and the Personal gateway. For information about the On-premises data gateway, see *On-premises data gateway* in the Power BI documentation:

On-premises data gateway

https://aka.ms/iddied

Two types of On-premises data gateway are available:

- **On-premises data gateway**. Multiple users can share and reuse a gateway in this mode. This gateway can be used by Power BI, PowerApps, Logic Apps, or Microsoft Flow. For Power BI, this includes support for both schedule refresh and DirectQuery.
- **On-premises data gateway (personal mode)**. This is for Power BI only and can be used by an individual without any administrator configuration. This can only be used for scheduled refresh.

Installing the gateway

To download and install the gateway:

1. From the Power BI service, on the **Downloads** menu, click **Data Gateway**. The gateway should be installed on a machine that can be constantly left running. The gateway is only supported on 64-bit Windows operating systems.
2. Click **DOWNLOAD GATEWAY**, and then run the installer.
3. Select the mode of the gateway to use, and then click **Next**.
4. On the reminder page, click **Next**.

5. On the getting ready page, select an installation folder. Review the terms of use and privacy statement, and then if you accept them, select the box, and then click **Install**.

6. On the **Installation was successful!** page, enter your Azure credentials and sign in.

7. On the register page, enter a name and recovery key for the new gateway, and then click **Configure**.

8. When the message confirming that the gateway is online appears, click **Close**.

> **Note:** If you install the gateway in personal mode, you cannot install another gateway on the same machine.

After installing the data gateway, if it is for Power BI, log in to the Power BI service and add your data sources to the gateway to register the models in the Power BI service.

1. In Power BI service, on the **Settings** menu, click **Manage gateways**.

2. On the **Gateway Cluster Settings** page, click **Add data sources to use the gateway**.

3. On the **Data Source Settings** page, enter a name for the source and choose a type.

4. Enter the data source type specific information, and then click **Add**.

Installing and configuring a gateway is usually done by an administrator. It might require specialist knowledge of your on-premises servers and, in some cases, may require Server Administrator permissions. A Power BI Pro license is required to use the gateway. For more information about the gateway, see *On-premises data gateway in-depth* in the Power BI documentation:

On-premises data gateway in-depth

https://aka.ms/qkkwfu

Using the gateway

To use the On-premises data gateway to access SSAS from the Power BI service:

1. In the Power BI service, click **Get Data**, click **Databases**, and then click **SQL Server Analysis Services**.
2. Click **Connect** to see a list of all the Analysis Services models that were registered when the gateway was configured. If there are no servers listed here, it means either that the gateway and data source are not configured, or that your account is not listed in the **Users** tab of the data source, in the gateway.

When you select one of the tabular models that are available on the SSAS machine and click **Connect**, a dataset is added for you to use within the Power BI service; this is a pointer to the Analysis Services model. When you open this dataset in Power BI, the list of tables that are available in the model is shown in the right pane.

You can now build your visuals in the normal way, but by working on live data from the Analysis Services computer. You can save your work as an Analysis Services Report and pin the report to a dashboard. The gateway passes credentials to Analysis Services so that, if this dashboard is shared with other users in your organization, they will only see the data that they are permitted to access from within Analysis Services.

> **Note:** If you pin visuals from a report to the dashboard, the pinned tiles are automatically refreshed every 10 minutes. So, if data in your on-premises Analysis Services server is updated, the tiles will get auto-updated within this 10-minute period.

SSAS multidimensional models

- SQL Server Analysis Services multidimensional mode (SSAS MD)
  - Supported in Power BI service and Power BI Desktop
- For direct connection to an OLAP cube, select option to **Connect live**
- Browse databases, and select cubes, models, or perspectives
  - Perspectives show preview of available dimensions or measures
  - Cubes show KPIs that are defined in the cube

You can also use the Power BI Desktop to connect to SQL Server Analysis Services models that are running in multidimensional or OLAP mode. This feature of the Power BI Desktop is commonly referred to as SSAS MD.

> **Note:** SSAS multidimensional models in live connection mode are supported in both the Power BI service and in Power BI Desktop. You can also publish and upload reports that use SSAS multidimensional models in live mode to the Power BI service.

To connect to a multidimensional model from Power BI Desktop:

1. Click **Get Data**, and then click **Analysis Services**.

2. In the **Server** box, type the name of the server that is running a multidimensional model.

3. Ensure that the option to **Connect live** is selected, and click **OK**.

4. You can now browse the databases and the cubes, models, or perspectives that are available to you on that server. When you connect to a perspective, you get a preview of the dimensions or measures that are available—click **OK** and the fields list is populated. You are not importing any data into the Power BI Desktop; in the bottom right corner, you'll see that you are using a direct connection and that you are connected to an OLAP cube.

You can now build visualizations in the same way as you would do with any other data source; the only difference is that you are sending queries to the multidimensional cube every time you make a change to a visual. You can also use KPIs that are defined in the cube, and visuals display an indicator showing you where the KPI is in relation to a target. If you then break data down by category, you can get status indicators for each category. For more information about connecting to multidimensional models, see *Connect to SSAS multidimensional models in Power BI Desktop* in the Power BI documentation:

Connect to SSAS Multidimensional Models in Power BI Desktop

https://aka.ms/xfumh5

Lab: Direct connectivity

Scenario

Adventure Works employees wish to extend the scope of their business intelligence (BI) activities, and include cloud-based data sources that are hosted in Azure. These employees would like live connections to Azure SQL Database and Azure SQL Data Warehouse. They want to be able to make these connections whether they are using the Power BI Desktop or the Power BI service.

As a BI professional, you have been asked to create a report in the Power BI Desktop that uses DirectQuery pull data from the AdventureWorks data sources in Azure SQL Database. You have also been asked to ensure that this information is made available from the cloud, by publishing this desktop report to the Power BI service.

Objectives

After completing this lab, you will be able to:

- Configure a live connection from the Power BI Desktop to an Azure SQL Database, by using DirectQuery.
- Publish a desktop report that includes a DirectQuery to an Azure SQL Database, for use from the Power BI service.

> **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_07.md.

Exercise 1: Direct connections in Power BI

Scenario

As a data analyst for AdventureWorks, you are investigating the use of live connections to Azure SQL Database and Azure SQL Data Warehouse.

In this exercise, you will create a Power BI Desktop report and use DirectQuery to pull data from the AdventureWorks database hosted in Azure. You will then publish

this report to the Power BI service, so that this information is also available for cloud use.

The main tasks for this exercise are as follows:

1. Prepare the lab environment.
2. Direct connectivity from the Power BI Desktop.
3. Direct connectivity from the Power BI service.

Result: At the end of this exercise, data from the AdventureWorks Azure SQL Database will be available for use in Power BI Desktop and in a desktop report that has been published to the Power BI service.

Review question(s)

Check your knowledge

Discovery

Discuss the different online data sources that your organization could use to create Power BI reports. Can you think of a scenario where users perhaps have Azure SQL database for one set of reports, and data in another online database for another set of reports? Could this be combined into a single dataset in Power BI?

Show solution Reset

Check your knowledge

Discovery

Discuss the issues to consider as you decide whether to import data or use DirectQuery when building reports against large online databases. Ask students about their own organizations—ask how they would make such a decision.

Show solution Reset

Module review and takeaways

In this module, you learned how to:

- Use Power BI direct connectivity to access data in Azure SQL Database and Azure SQL Data Warehouse, in addition to big data sources, such as Hadoop.
- Use Power BI with SQL Server Analysis Services data, including Analysis Services models running in multidimensional mode.

Review question(s)

Check your knowledge

Discovery

Discuss the different ways in which your organization could use Power BI to connect to online data sources. What would be some of the potential benefits of direct connectivity to services such as Azure SQL Database? Are there any scenarios in your organization that could use the On-premises data gateway?

Show solution Reset