

# Understanding Data Refresh, Gateways and DirectQuery Mode



# Agenda

- Comparing Imported Datasets to Live Connect
- Refreshing Data using Storing Credentials
- Configuring a Dataset for Auto Refresh
- Installing and Configuring Personal Gateway
- Installing and Configuring On-premises Gateway
- Designing Datasets using DirectQuery Mode



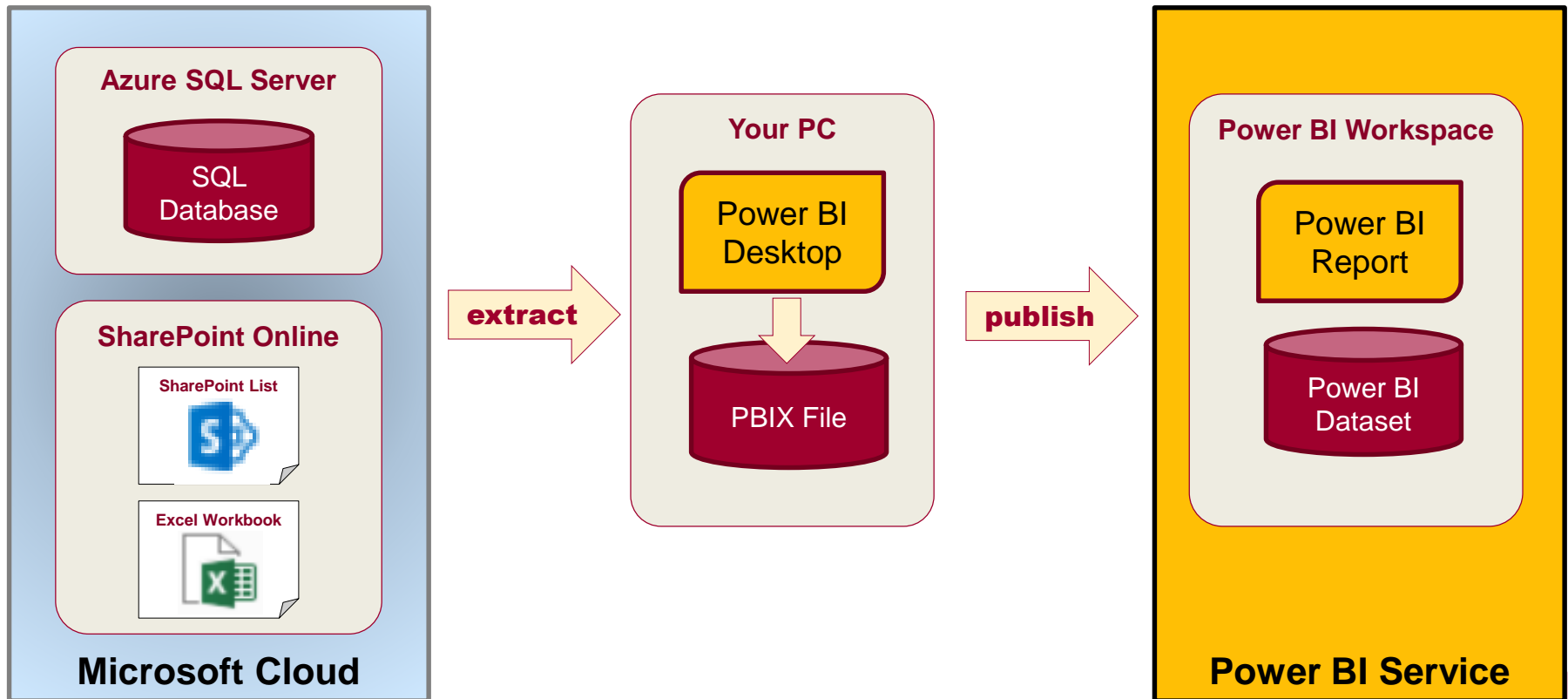
# Imported Datasets Versus Live Connect

- Imported Dataset
  - Data is imported into storage within Power BI service
  - Entire dataset loaded into memory when in use
  - Reports and Datasets query data in imported dataset
  - Dataset size is maxed out at 1GB
  - Dataset must be refreshed when source data changes
- Dataset based on Live Connection
  - No data is imported or cached in the Power BI service
  - Reports and Datasets query data with live connection
  - No need to refresh data
  - No need to worry about 1GB dataset size limitation
  - Limitation are placed on features for querying and data modeling



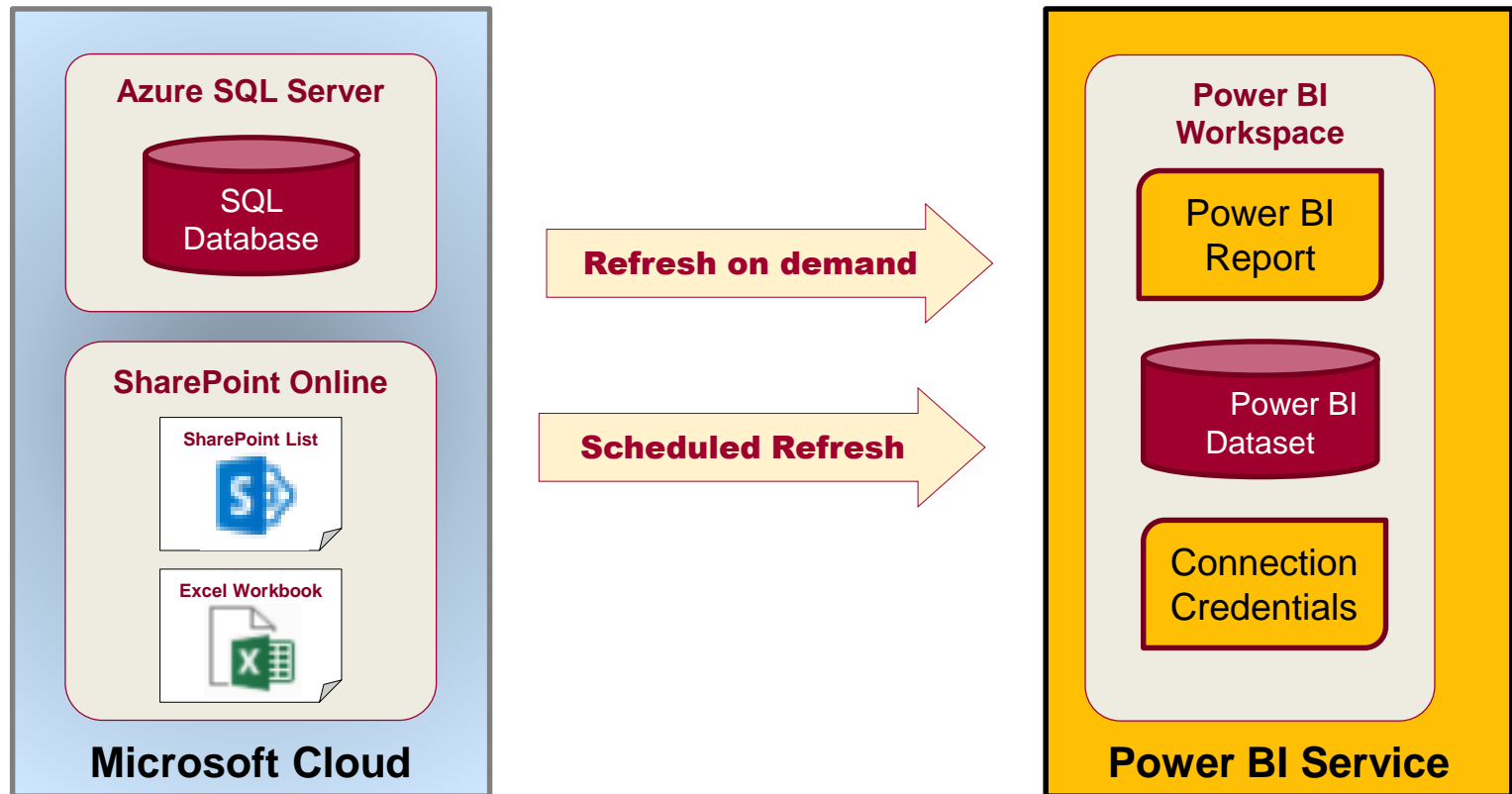
# Importing Data from Cloud Data Sources

- Importing Datasets from Cloud Data Sources
  - Power BI Desktop saves data locally in PBIX file
  - PBIX file published to import dataset into Power BI Service



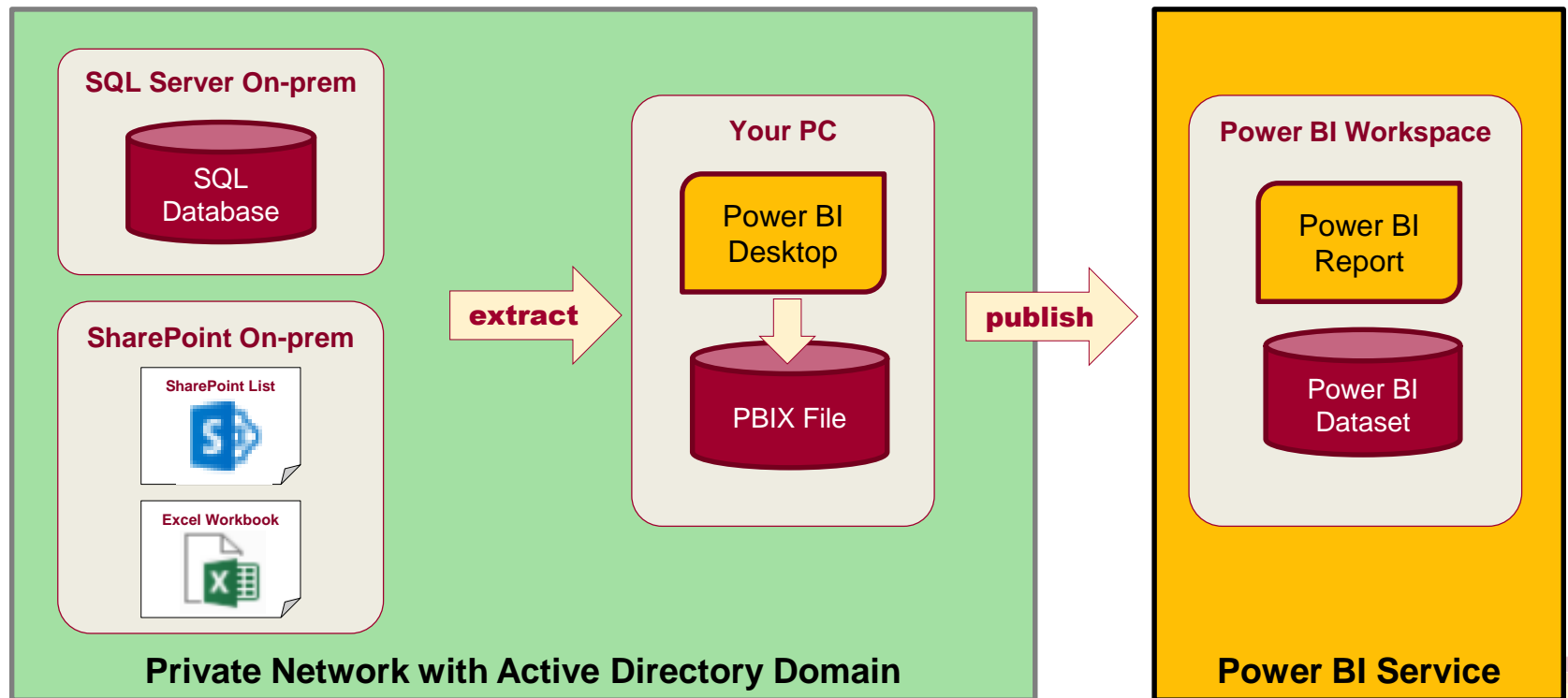
# Refreshing Data from Cloud Data Sources

- Power BI Service Can Be Configured to Refresh Data
  - Power BI Desktop will never publish login credentials
  - You must configure data source credentials in Power BI service



# Importing Data from On-premises Data Sources

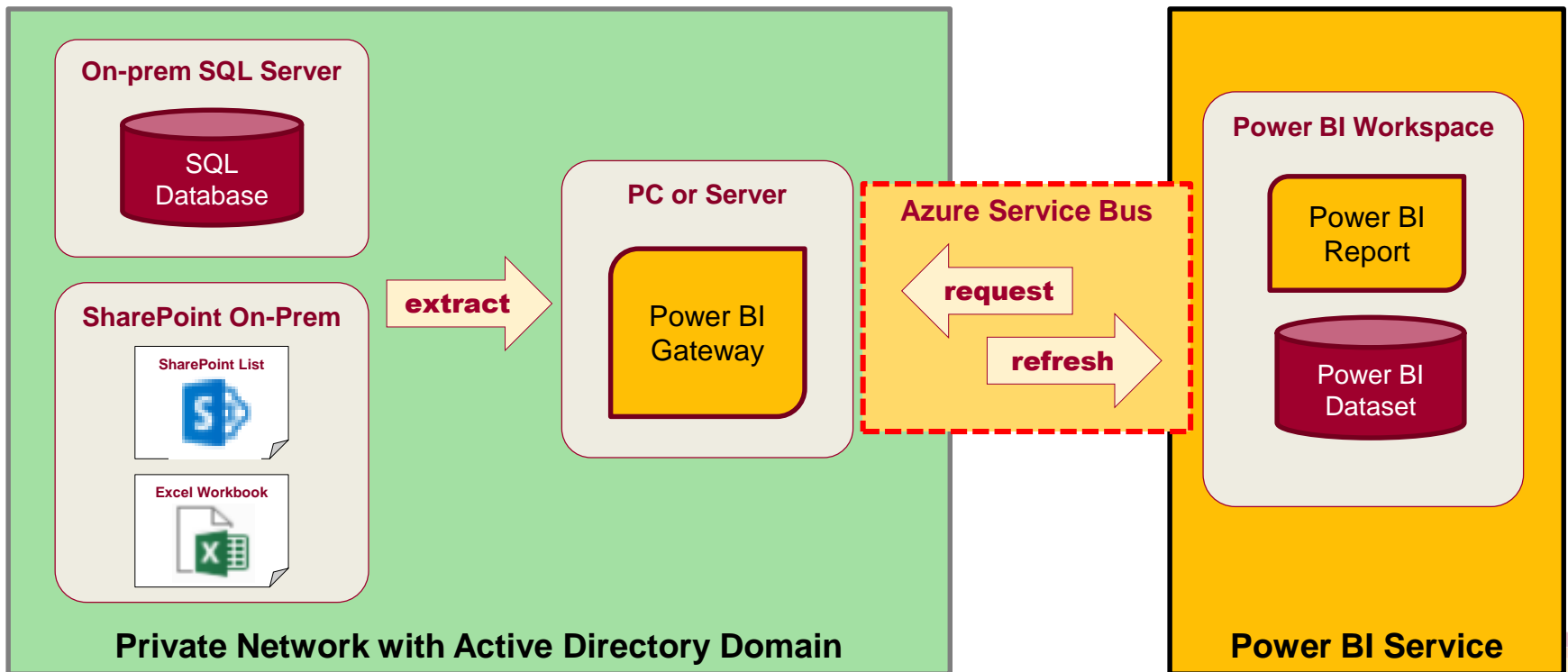
- What If Your Data Sources Live Inside an AD Domain?
  - Extracting and Publishing Data with PBIDT remains the same
  - Refreshing Data Becomes More Complicated
  - Power BI Service Cannot Directly Connect to Data Sources





# What is a Power BI Gateway?

- Gateway connects Power BI to data source
  - Runs on PC or server joined to domain
  - Extracts data and returns it to Power BI service



# Power BI Gateway Types

- Power BI Personal Gateway
  - Data transferred under identity of single user
  - Requires Power BI Pro and x64 bit Operating Systems
  - Can refresh data up to 8 times per day
  - Does not support DirectQuery mode
- Power BI On-premises Gateway
  - Data transferred under identity of any user
  - Requires Power BI Pro and x64 bit Operating System
  - Adds support for DirectQuery mode





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# Configuring Credentials in the Cloud

- Power BI Desktop never Publishes Credentials
  - PBIDT caches credentials locally for its own use
  - Connection credentials must be configured in cloud
  - Power BI stores credentials in encrypted format

The image shows a screenshot of the Power BI Desktop interface. On the left, a 'Data source credentials' pane is open, displaying a yellow error message: 'Your data source can't be refreshed because the credentials are invalid. Please update your credentials and try again. [Show details](#)'. Below the message, two data sources are listed: 'Web' and 'WingtipSalesDB-cpt.database.windows.net', each with an 'Edit credentials' link. On the right, a 'Configure Imported from Cloud' dialog box is open, showing fields for 'Server' (cpt.database.windows.net), 'Database' (WingtipSalesDB), 'Authentication method' (Basic), 'User name' (CptStudent), and 'Password' (masked with dots). The dialog has 'Sign in' and 'Cancel' buttons at the bottom right.

▲ Data source credentials

⊗ Your data source can't be refreshed because the credentials are invalid. Please update your credentials and try again. [Show details](#)

Web [⊗ Edit credentials](#)

WingtipSalesDB-cpt.database.windows.net [⊗ Edit credentials](#)

Configure Imported from Cloud <sup>×</sup>

Server  
cpt.database.windows.net

Database  
WingtipSalesDB

Authentication method  
Basic ▾

User name  
CptStudent

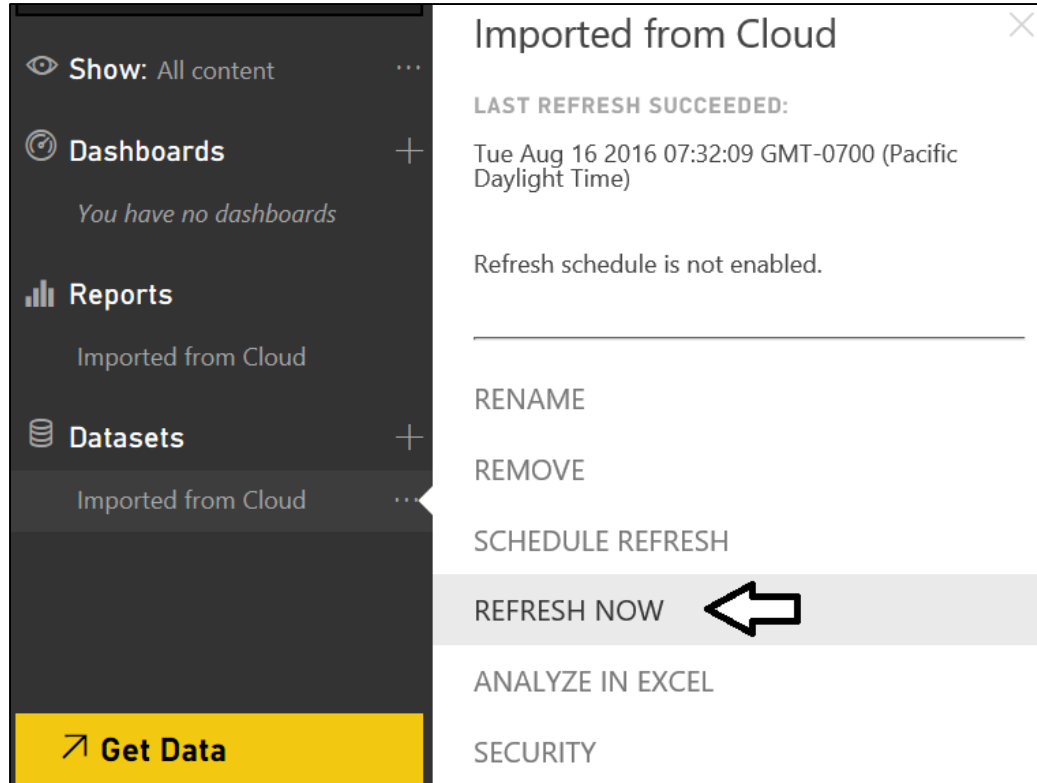
Password  
●●●●●●●●

Sign in Cancel



# Manual Refresh

- Once you have configured credentials...
  - You can refresh on demand from Dataset flyout menu



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# Configuring Scheduled Refresh

- Very easy to configure
  - Power BI Pro allows up to 8 refreshes per day
  - Power BI Standard allows one refresh per day

Schedule Refresh

Keep your data up to date

Yes ☒

Refresh frequency

Daily

Time zone

(UTC-05:00) Eastern Time (US and Canada)

Time

2 00 AM

[Add another time](#)

☒ Send refresh failure notification email to me

Apply Discard



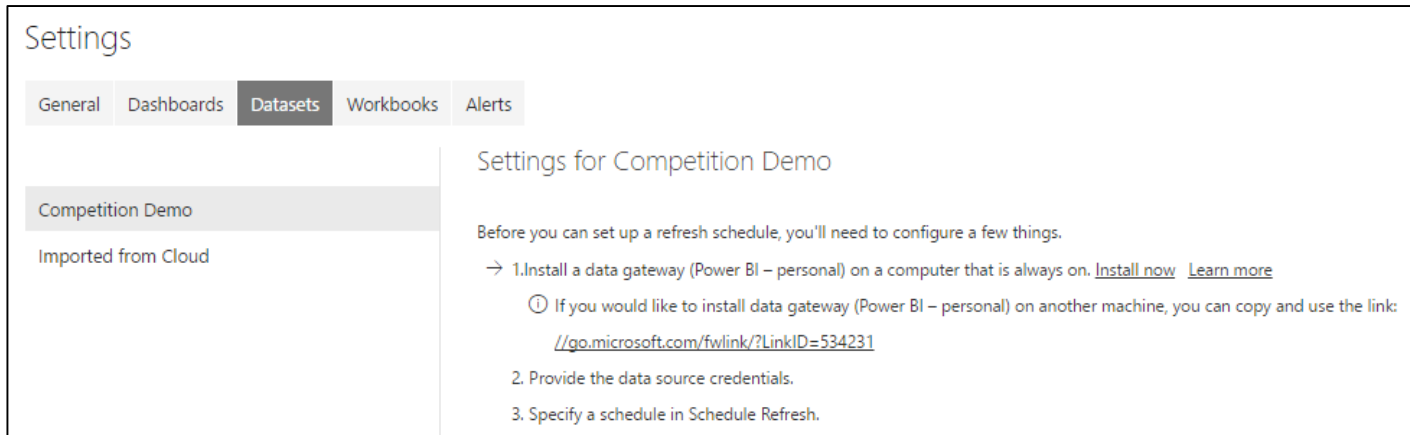
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# Data Refresh Might Require a Gateway

- Power Service cannot connect directly to...
  - Local files on your PC
  - Files in your local network
  - Data sources in an Active Directory domain



The screenshot shows the 'Settings' page in Power BI. The 'Datasets' tab is selected. On the left, a list of datasets includes 'Competition Demo' (Imported from Cloud). The main content area is titled 'Settings for Competition Demo'. It contains a message: 'Before you can set up a refresh schedule, you'll need to configure a few things.' followed by a list of steps: 1. Install a data gateway (Power BI – personal) on a computer that is always on. (with links 'Install now' and 'Learn more'), 2. Provide the data source credentials, and 3. Specify a schedule in Schedule Refresh. A note with an icon indicates that the gateway can be installed on another machine using a specific link: [//go.microsoft.com/fwlink/?LinkID=534231](https://go.microsoft.com/fwlink/?LinkID=534231).

Settings

General Dashboards **Datasets** Workbooks Alerts

Competition Demo

Imported from Cloud

Settings for Competition Demo

Before you can set up a refresh schedule, you'll need to configure a few things.

→ 1. Install a data gateway (Power BI – personal) on a computer that is always on. [Install now](#) [Learn more](#)

① If you would like to install data gateway (Power BI – personal) on another machine, you can copy and use the link: [//go.microsoft.com/fwlink/?LinkID=534231](https://go.microsoft.com/fwlink/?LinkID=534231)

2. Provide the data source credentials.

3. Specify a schedule in Schedule Refresh.





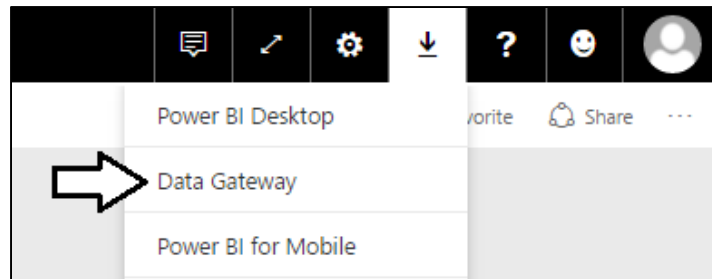
# Install Gateway As Service vs Application

- Installing Personal Gateway with Admin Perms
  - Gateway runs as Windows service
  - Requires configuring Windows password for connecting
  - Refresh fails if password has expired
- Installing Personal Gateway w/o Admin Perms
  - Gateway runs as standard Windows application
  - User must be logged into PC for refresh to occur
  - Gateway runs under identity of currently logged in user

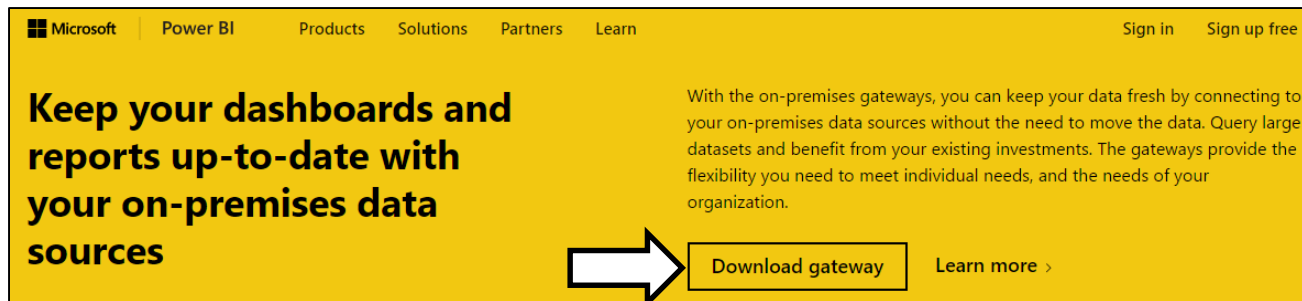


# Downloading Power BI Gateway Install File

- Select **Data Gateway** from Download menu



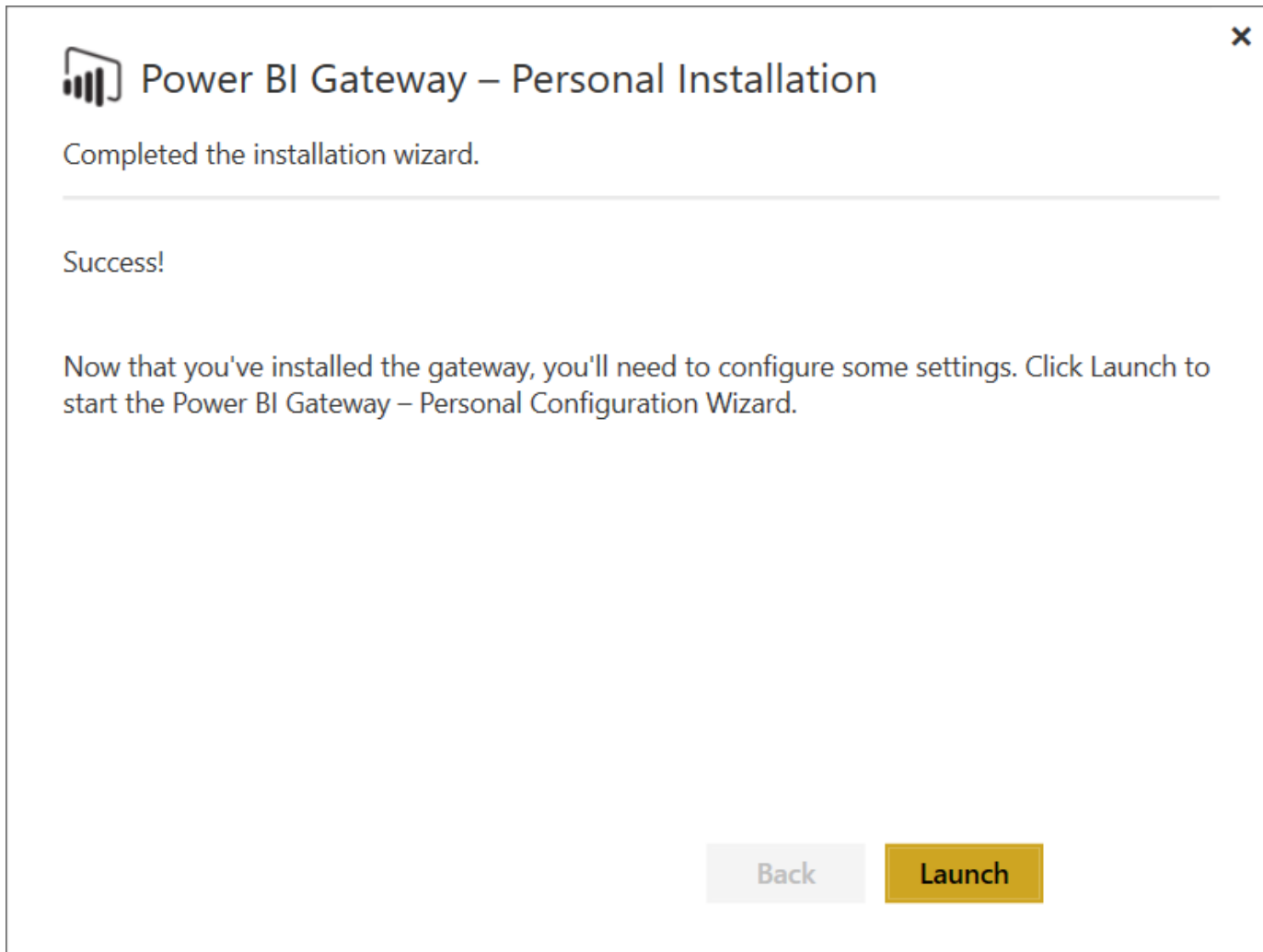
- Click **Download** button on download page  
<https://powerbi.microsoft.com/en-us/gateway/>




- Installation file for all gateways named **PowerBIGatewayInstall.exe**



# Personal Gateway Installation



# Personal Gateway Sign-in

 Power BI Gateway – Personal

Sign in to PowerBI.com

Please [Sign in to PowerBI.com](#) The gateway can't be configured unless you are signed in.

Sign in to your account

Microsoft Azure

Work or school account


Sign in

Back

[Can't access your account?](#)

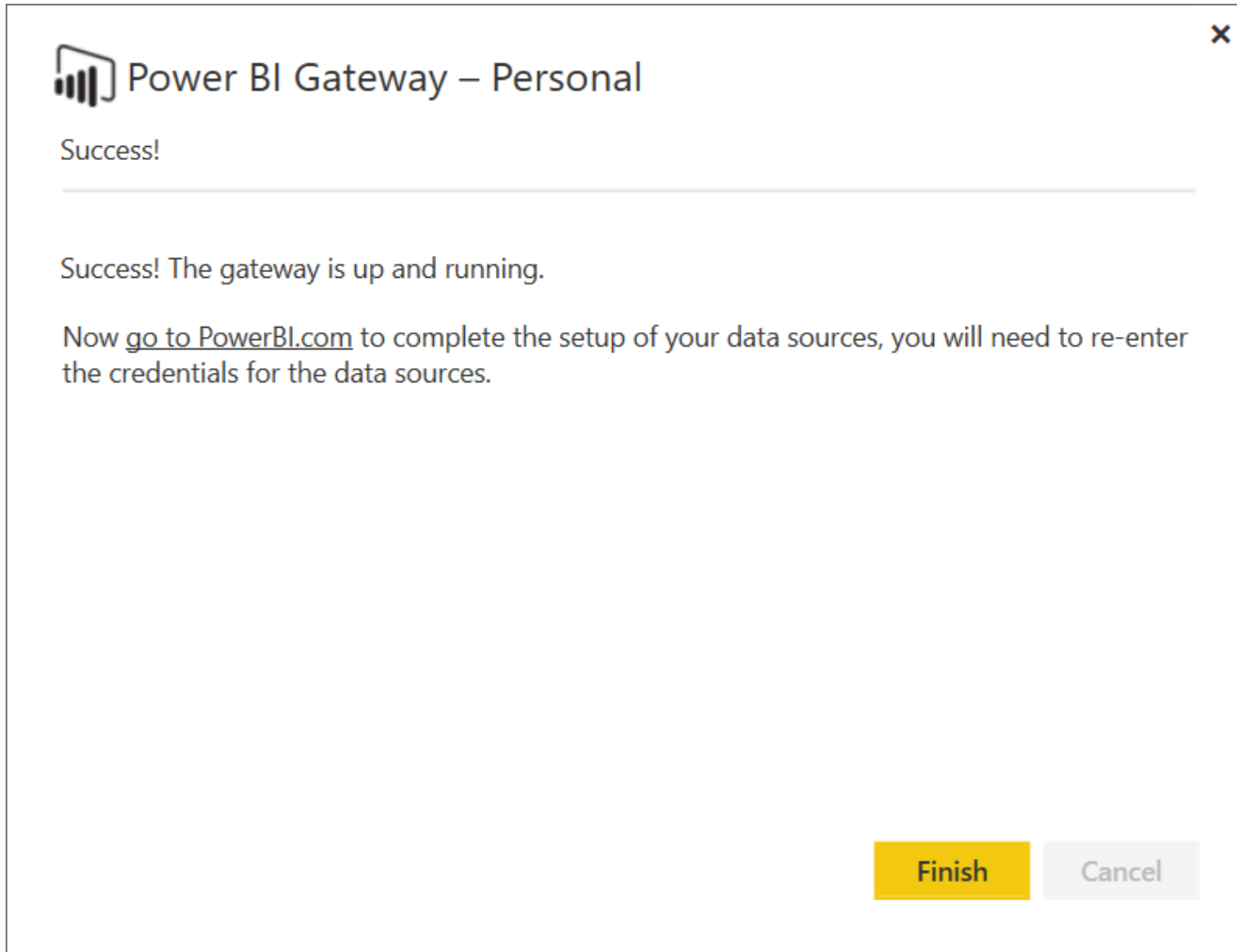
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# Personal Gateway Configuration



# Configuring Data Source Through Gateway

Settings

General Dashboards **Datasets** Workbooks Alerts

Competition Demo

Imported from Cloud

Settings for Competition Demo

[Refresh history](#)

► Gateway connection

▾ Data source credentials

⊗ Your data source can't be refreshed because the credentials are invalid. Please update your credentials and try again. [Show details](#)

Configure Competition Demo

Path

C:\Demo\Competition Demo.xlsx

Authentication method

Windows

For Windows authentication, you don't need to provide your Windows credentials.

Sign in Cancel



# Outbound Ports – Personal Gateway

- Gateway communicates through outbound ports
  - Gateway does not require inbound ports

Domain names	Outbound ports	Description
*.powerbi.com	443	HTTPS
*.analysis.windows.net	443	HTTPS
*.login.windows.net	443	HTTPS
*.servicebus.windows.net	5671-5672	Advanced Message Queuing Protocol (AMQP)
*.servicebus.windows.net	443, 9350-9354	Listeners on Service Bus Relay over TCP (requires 443 for Access Control token acquisition)
*.frontend.clouddatahub.net	443	HTTPS
*.core.windows.net	443	HTTPS
login.microsoftonline.com	443	HTTPS
login.windows.net	443	HTTPS





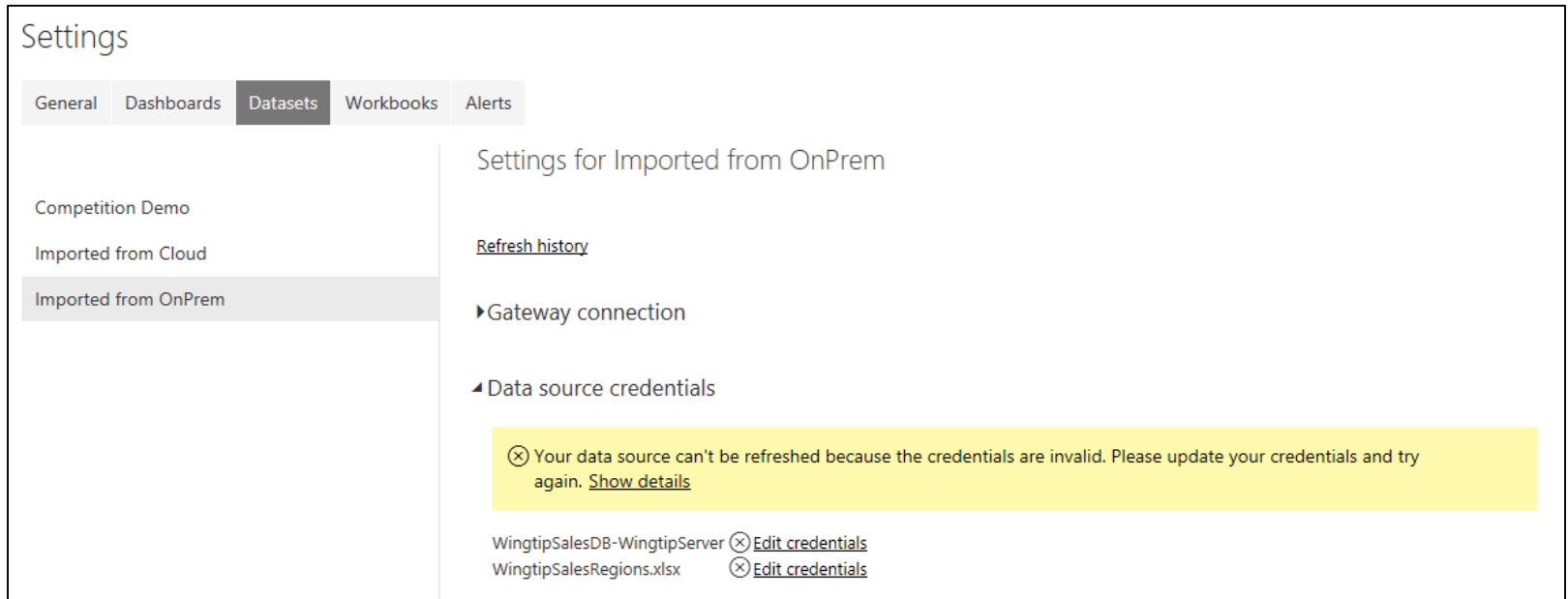
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# When to Use On-Premises Gateway

- Common Motivation
  - Connecting to on-premises data sources for refresh



The screenshot shows the 'Settings' page in Power BI, specifically the 'Datasets' tab. The left sidebar lists three dataset types: 'Competition Demo', 'Imported from Cloud', and 'Imported from OnPrem', with the latter being selected. The main content area is titled 'Settings for Imported from OnPrem'. It includes a 'Refresh history' link, a 'Gateway connection' section with a right-pointing arrow, and a 'Data source credentials' section with a left-pointing arrow. A prominent yellow error message states: 'Your data source can't be refreshed because the credentials are invalid. Please update your credentials and try again. [Show details](#)'. Below this, two data sources are listed: 'WingtipSalesDB-WingtipServer' and 'WingtipSalesRegions.xlsx', each with an 'Edit credentials' link preceded by a red 'X' icon.

Settings

General Dashboards **Datasets** Workbooks Alerts

Competition Demo

Imported from Cloud

Imported from OnPrem

Settings for Imported from OnPrem

[Refresh history](#)

► Gateway connection

◄ Data source credentials

⊗ Your data source can't be refreshed because the credentials are invalid. Please update your credentials and try again. [Show details](#)

WingtipSalesDB-WingtipServer ⊗ [Edit credentials](#)

WingtipSalesRegions.xlsx ⊗ [Edit credentials](#)

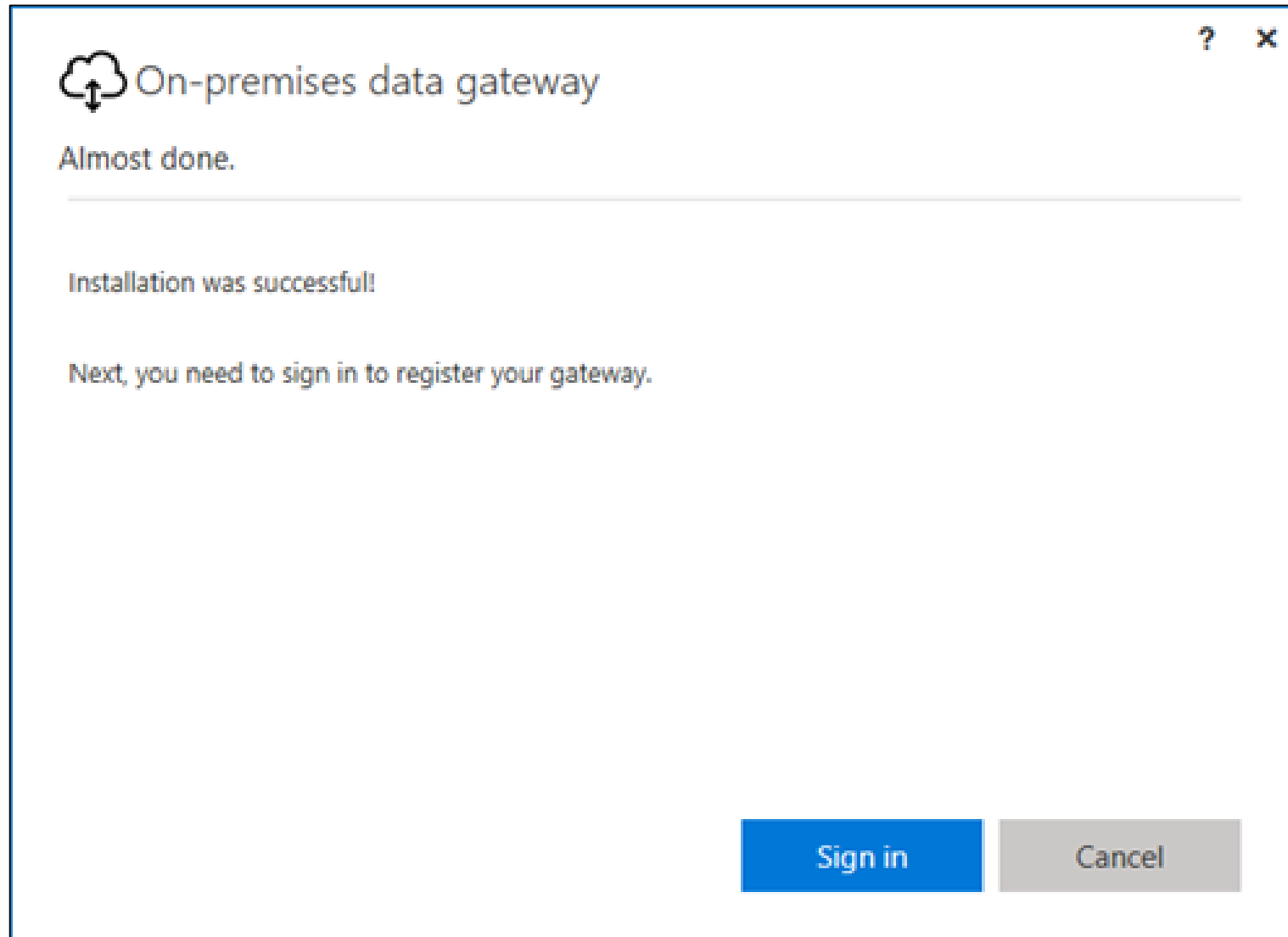


# On-Premises Gateway


- Enables IT to deploy & manage shared gateways
  - Each gateway can service large number of users
  - IT can install and manage multiple gateways
  - Eliminates need to for individual users to install personal gateways
  - Replaces several older Power BI Gateways
- On-premises Gateway gives more control to IT
  - IT can centrally manage user access to underlying data sources
  - IT can monitor and gain visibility into gateway usage
- Does On-Premises Gateway support High Availability?
  - Not yet as of Q3 of 2016
  - Microsoft working on plans to provide high availability architecture



# On-Premises Gateway Installation




# On-prem Gateway Names & Recovery Keys

 On-premises data gateway ? ✕

You are signed in as Student@PowerBiBootcamp.onmicrosoft.com and are ready to register the gateway.

New on-premises data gateway name

Recovery key (8 character minimum)

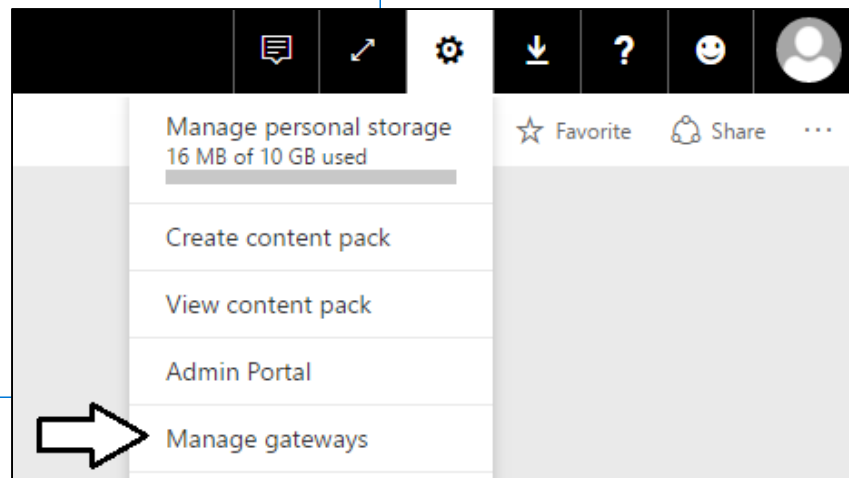
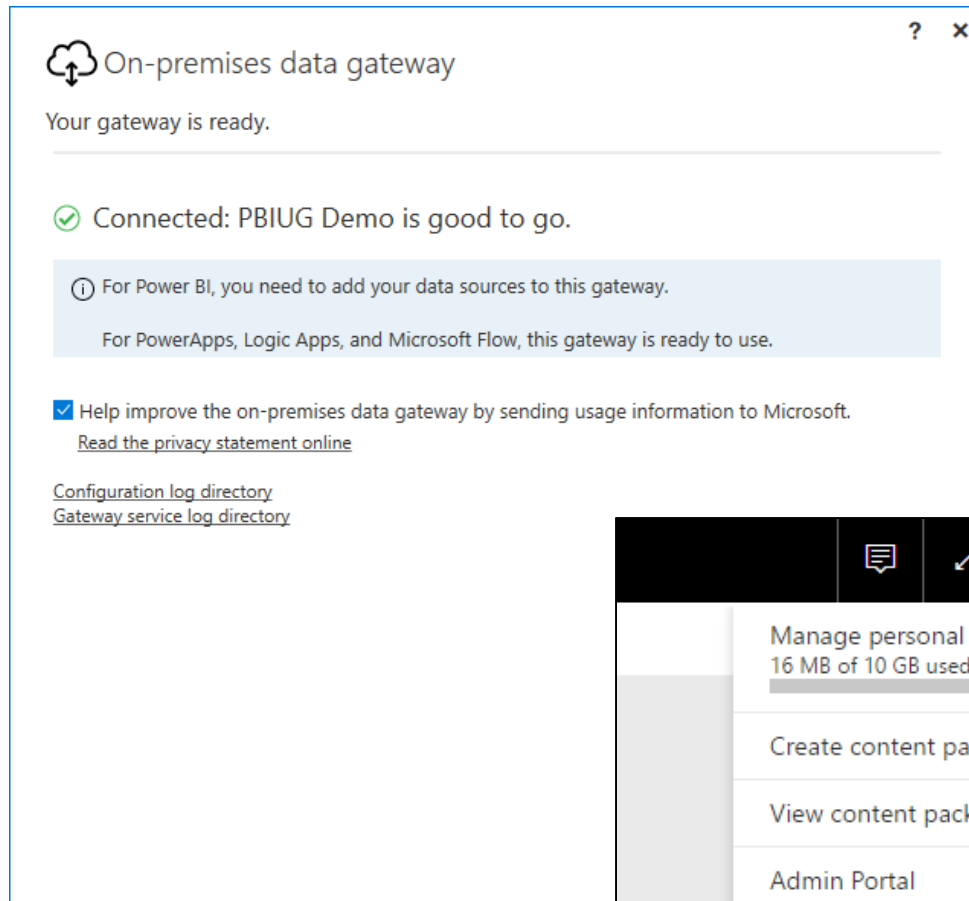
 This key is needed to restore the gateway and can't be changed. Record it in a safe place.

Confirm recovery key

< < Back Configure Cancel



# Getting the Gateway Up and Running



# Configuring Gateway in Power BI Service

Gateway Settings

Administrators

✓ Online: You are good to go.

① Add data sources to use the gateway

Gateway Name

PBIUG Demo

Department

Critical Path Trainig

Description

Contact Information

Student@PowerBiBootcamp.onmicrosoft.com

Apply

Discard

Gateway Settings

Administrators

People who can Administer this gateway

Enter email addresses

Add

☐ Ted Pattison

Remove





# Configuring Data Sources in Gateway

## Data Source Settings

Data Source Name

Data Source Type

Server

Database

Authentication Method

The credentials are encrypted using the key stored on-premises on the gateway server. [Learn more](#)

Username

Password

> Advanced settings

AddDiscard



# Configuring Users

Data Source Settings Users

✓ Connection Successful

❗ Next Step: Go to the Users tab above and add users to this Data Source

Data Source Settings Users

People who can publish reports that use this data source

Enter email addresses

Add

☐ Ted Pattison



# Outbound Ports – On-Premises Gateway

- Gateway communicates through outbound ports
  - Gateway does not require inbound ports

Domain names	Outbound ports	Description
*.powerbi.com	443	HTTPS
*.analysis.windows.net	443	HTTPS
*.login.windows.net	443	HTTPS
*.servicebus.windows.net	5671-5672	Advanced Message Queuing Protocol (AMQP)
*.servicebus.windows.net	443, 9350-9354	Listeners on Service Bus Relay over TCP (requires 443 for Access Control token acquisition)
*.frontend.clouddatahub.net	443	HTTPS
*.core.windows.net	443	HTTPS
login.microsoftonline.com	443	HTTPS
*.msftncsi.com	443	Used to test internet connectivity if the gateway is unreachable by the Power BI service.



# On-premises Gateway with SSAS

- On-premises Gateway adds functionality to SSAS
  - Sets EffectiveUserName property for Power BI user
  - EffectiveUserName is email of current user
  - Office 365 UPN should match a UPN within local AD
  - Associated Windows account added to SSAS roles
  - Allows for role-based security and row-level security
  - EffectiveUserName settings is in the format
    - UPN must be same in local AD and Azure AD



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# Supported Data Sources

Data source	Live/DirectQuery	User configured manual or scheduled refresh
Analysis Services Tabular	Yes	Yes
Analysis Services Multidimensional	Yes	Yes
SQL Server	Yes	Yes
SAP HANA	Yes	Yes
Oracle	Yes	Yes
Teradata	Yes	Yes
File	No	Yes
Folder	No	Yes
SharePoint list (on-premises)	No	Yes
Web	No	Yes
OData	No	Yes
IBM DB2	No	Yes
MySQL	No	Yes
Sybase	No	Yes



# Limitations of DirectQuery

- DirectQuery imposes the following limitations
  - All tables must come from a single database
  - Many types of query steps are not supported
  - Relationship filtering limited to single direction
  - Time intelligence capabilities are not available
  - No special treatment of date columns
  - Calculated columns not allowed
  - By default, limitations placed on DAX in measures





# Summary

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