

The flexibility to connect various data services within Azure and Power BI is a powerful feature, however this flexibility does introduce risk in terms of securely connecting these data services. We can configure secure connections using authentication methods, but what happens if we want to “lockdown” an Azure data resource so that no traffic from the public internet or even within the Azure network itself can attempt a connection? We can use **Private Endpoints** within supported services and configure Power BI to connect to these private endpoints.

In this blog post we’ll walkthrough the steps necessary to allow a Power BI dataset/report deployed to the Power BI Service to connect to an Azure SQL Database which has no access via the public internet and also no access to Azure services. This process uses a **VNet** (virtual network), a **Private Endpoint** on the Azure SQL Server, and a **VNet Data Gateway** configured in the Power Platform environment.

Considerations

Please note that this walkthrough contains default settings when creating the VNet and subnets, these default settings may not conform to a particular organisations networking strategy. Therefore an [Azure Network Engineer](#) should be consulted to ensure any specific settings are configured correctly for the specific environment. The walkthrough contains generic settings, which may need modifying.

Pricing

Private Endpoint	£0.008 per hour
Inbound Data Processed	0-1 PB - £0.0073 per GB 1-5 PB - £0.0044 per GB 5+ PB - £0.0030 per GB
Outbound Data Processed	0-1 PB - £0.0073 per GB 1-5 PB - £0.0044 per GB 5+ PB - £0.0030 per GB

Basic Sequence

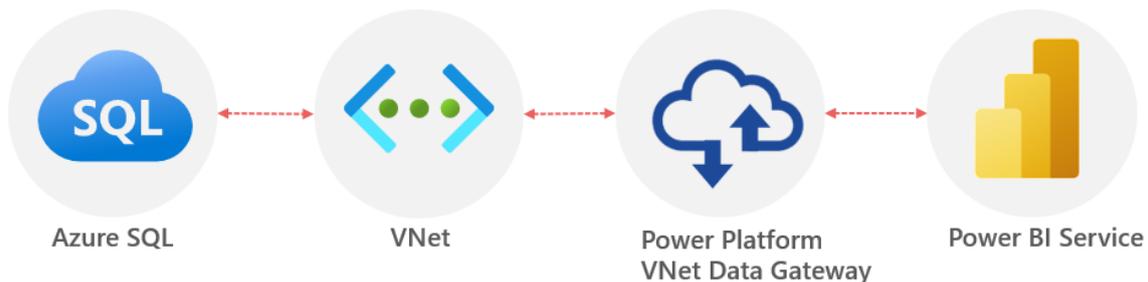
In the walkthrough we’ll be going through several steps to allow the Power BI Service to communicate with an Azure SQL Server which has been configured with a Private Endpoint and all other traffic disabled.

- Create Virtual Network (VNet)
- Create Private Endpoint in Azure SQL Server and configure Network settings
- Configure VNet Subnet for Power Platform
- Create VNet Data Gateway in Power Platform Admin Centre

- Configure VNet Data Gateway in Power BI and add Azure SQL Database as a data source
- Create and upload Power BI report to PBI Service
- Configure Power BI Dataset to use VNet Data Gateway
- Test data refresh

Basic Architecture

The following diagram shows a simple architectural flow from Power BI to Azure SQL using the Power Platform VNet Data Gateway and a VNet.



Walkthrough

We'll now walkthrough the steps to create a VNet and secure the connection between Power BI and the Azure SQL Database.

Create VNet

First, we'll create a VNet which will be used to isolate the data services.

- Login to <https://portal.azure.com>
- Search for **Virtual networks** and click on the service
- Click **Create** and enter the following information
 - **Basics** tab
 - Select a **Resource Group** or create a new one
 - Provide a name E.G. **dhpowerbivnet**
 - Select the appropriate region E.G. **UK South**
 - **IP Addresses** tab
 - Accept the default IPv4 address space and ensure there is a **default** subnet (we'll add another subnet).
 - Click **Add Subnet**, provide the name for the subnet E.G. **PowerBISubnet** and ensure the IP Address is the same as the VNet with **/24** E.G. **10.1.0.0/24** then click **Add**
 - Click **Review & Create**

You should now have a VNet configured as follows (or similar depending on the IP range).

dhpowerbivnet | Address space ...
Virtual network

The address space for a virtual network is composed of one or more non-overlapping address ranges that are specified in CIDR notation.

Address space	Address range	Address count
10.2.0.0/16	10.2.0.0 - 10.2.255.255	65536

Add additional address range

Peered virtual network address space

Peering name	Peered to	Address space
No results.		

dhpowerbivnet | Subnets ...
Virtual network

+ Subnet + Gateway subnet Refresh Manage users Delete

Search subnets

Name ↑↓	IPv4 ↑↓	IPv6 ↑↓
PowerBISubnet	10.2.0.0/24	-

Configure Azure SQL Networking

Now that the VNet has been created, we can configure the Azure SQL Server. For this section we'll be using an existing Azure SQL Server rather than creating a new server. However, the process will be the same if you need to create a new Azure SQL Server.

- In the Azure portal, browse to an Azure **SQL Server** (not an individual SQL Database)
- Under the **Security** section, select the **Networking** sub-section
- Set the following:
 - **Public Access** tab:
 - **Public Network Access:** Deny
 - **Connection** tab:
 - **Minimum TLS Version:** 1.2
 - **Connection Policy:** Redirect
- Click **Save**



Search (Ctrl+ /)



Save



Discard



Add client IP



Overview



Activity log



Access control (IAM)



Tags



Diagnose and solve problems



Quick start

Settings



Azure Active Directory



SQL databases

Deny public network access ⓘ

Yes

No



Click here to create a new private endpoint.
[Create Private Endpoint](#)

Minimum TLS Version ⓘ

1.0

1.1

1.2

Connection Policy ⓘ

Default

Proxy

Redirect

Allow Azure services and resources to access this server ⓘ

Yes

No

Create Private Endpoint in Azure SQL

- In the Azure portal, browse to an Azure **SQL Server** (not an individual SQL Database)
- Under the **Security** section, select **Private Endpoint Connections**
- Click **+ Private Endpoint** to create a new private endpoint
- On the **Basics** tab, enter the following information:
 - Select a **Resource Group** or create a new one
 - Provide a name E.G. **dhsqprivateendpoint**
 - Select the appropriate region E.G. **UK South**
- On the **Resource** tab, enter the following information:
 - **Connection Method:** Connect to an Azure resource in my directory
 - **Resource Type:** Microsoft.Sql.Servers
 - **Resource:** Select the appropriate Azure SQL Server
 - **Target Sub-Resource:** sqlServer
- On the **Configuration** tab, enter the following information:
 - **Virtual Network:** Select the VNet created in the first step
 - **Subnet:** The default subnet should be automatically selected
 - **Integrate With Private DNS Zone:** Yes
- Click **Review & Create**

Create a private endpoint ...

✓ Basics **2 Resource** ③ Configuration ④ Tags ⑤ Review + create

Private Link offers options to create private endpoints for different Azure resources, like your private link service, a SQL server, or an Azure storage account. Select which resource you would like to connect to using this private endpoint. [Learn more](#)

Connection method ⓘ Connect to an Azure resource in my directory. Connect to an Azure resource by resource ID or alias.

Subscription * ⓘ

Resource type * ⓘ

Resource * ⓘ

Target sub-resource * ⓘ

Once we have created the Private Endpoint we can see the internal IP address that the VNet has assigned.

- Browse to the Azure SQL Server resource in the Azure portal
- Under the **Security** section, select **Private Endpoint Connections**
- Click on the **Private endpoint name**
- Then click on the **Network interface** name
- You will now see the internal VNet IP assigned to the Private endpoint.

+ Private endpoint ✓ Approve ✕ Reject 🗑 Remove ↻ Refresh

Private Endpoint Connection

Private endpoint connections allow connections from within a Virtual Network to a private IP using the private endpoint feature. Connections using these private endpoints specified below provide access to all databases in this server dhsqprivate

Search...	3 selected			
<input type="checkbox"/>	Connection name	State	Private endpoint name	Request/Response Message
<input type="checkbox"/>	dhsqprivateendpoint-73176f04-6be3-4cd6-885e-9da43a5756f6	Approved	dhsqprivateendpoint	Auto-approved

Delete Refresh

Essentials

JSON View

Resource group (change) dhrgrnetworkingnew2	Virtual network/subnet dhvnetnew/default
Location UK South	Network interface dhsqprivateendpoint.nic.a891a66c-9881-4194-9341-790515e0d424
Subscription (change) Microsoft Partner Network	Private link resource dhsqprivate
Subscription ID	Target sub-resource sqlServer
Provisioning state Succeeded	Connection status Approved
	Request/Response Auto-approved

Move Delete Refresh Enable accelerated networking

Essentials

JSON View

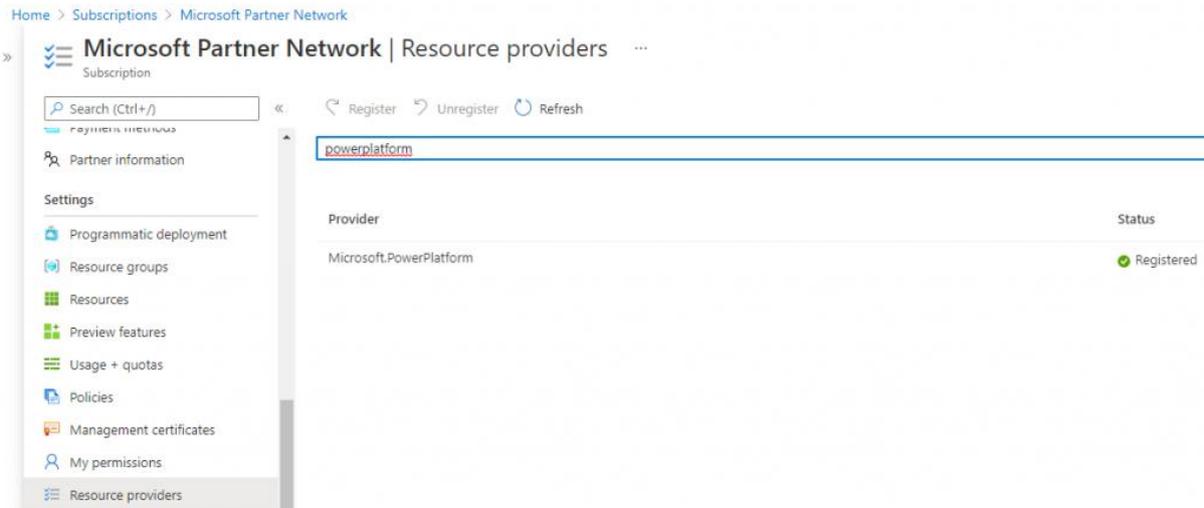
Resource group (change) dhrgrnetworkingnew2	Private IP address 10.3.0.4
Location UK South	Public IP address -
Subscription (change) Microsoft Partner Network	Private IP address (IPv6) -
Subscription ID	Public IP address (IPv6) -
Accelerated networking Disabled	Attached to -

Configure VNet Subnet for Power Platform

We must now add a new Subnet to our new VNet configured for use with the Power Platform.

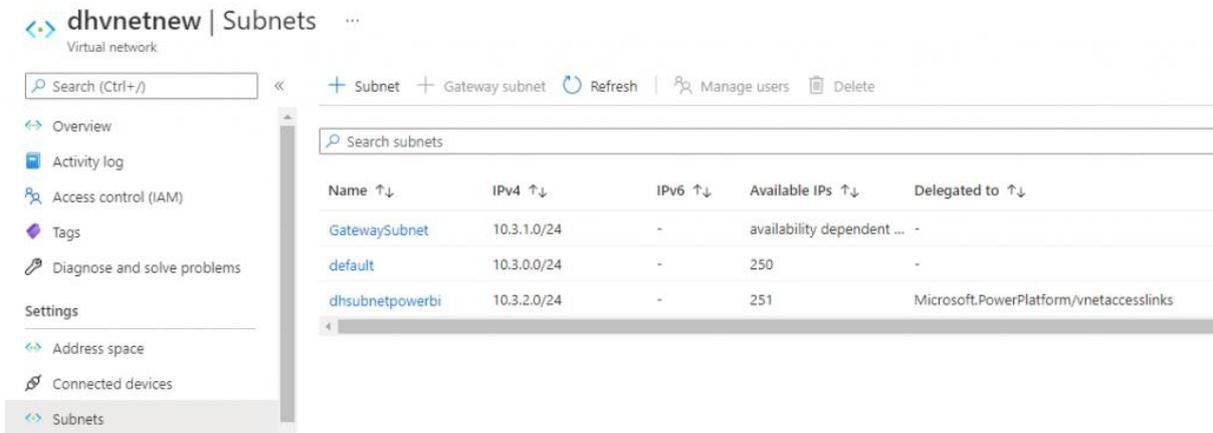
Add Microsoft.PowerPlatform as a Resource Provider

- In the Azure portal, browse to the subscription that you are using in the **Subscriptions** area
- Under the **Settings** category, select **Resource Providers**
- Search for **Microsoft.PowerPlatform** then click **Register**



Add New Subnet

- In the Azure portal, browse to the **Virtual network** created in the first step
- Under the **Settings** section, click **Subnets**
- Click **+ Subnet** to add a new subnet
 - Give the subnet a name E.G. **dhpowerbisubnet**
 - Set the **Delegate Subnet to a service** drop-down to **Microsoft.PowerPlatform/vnetaccesslinks**
 - Click **Save**

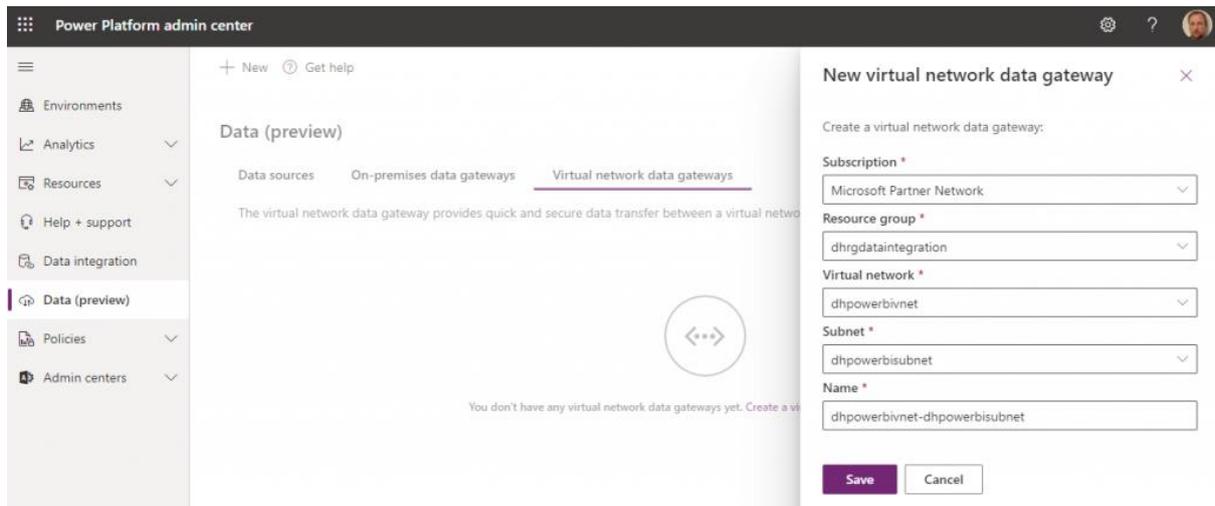


Please note that the **GatewaySubnet** is a subnet created by a **Virtual Network Gateway** to allow VPN connections from local computers to the VNet. This is out of scope for this blog.

Create VNet Data Gateway in Power Platform Admin Centre

We must now login to the [Power Platform Admin Centre](#) and create a new VNet Data Gateway connected to the new Power Platform-specific subnet created earlier.

- Login as as admin user to the [Power Platform Admin Centre](#)
- Click on **Data (Preview)** in the left-hand menu
- Click on the **Virtual Network Data Gateways** tab
- Ensure the **Tenant Administration** toggle switch is set to **off** (top-right of the Admin Centre)
- Click on **+ New** and enter the following information
 - Select the appropriate **subscription**
 - Select the **resource group** that the virtual network was created in
 - Select the **virtual network** that was created earlier
 - Select the Power Platform specific **subnet** created earlier
 - Provide a **name** for the VNet Data Gateway
 - Click **Save**



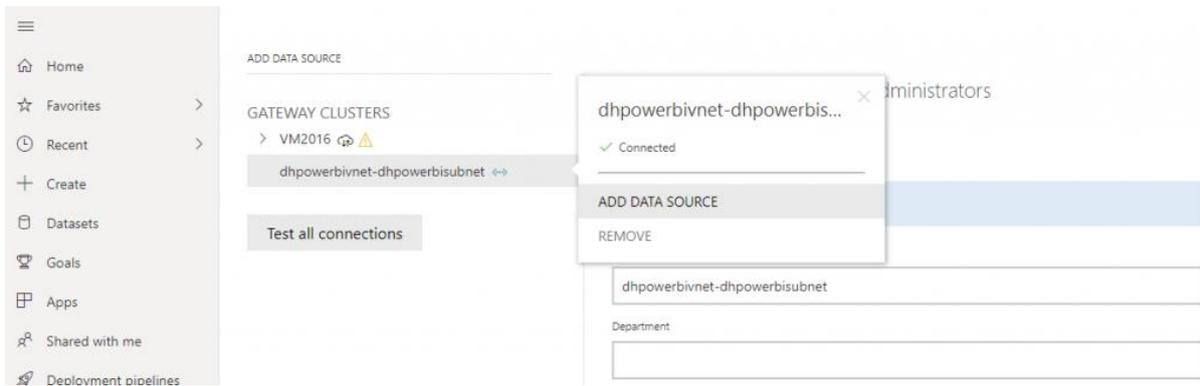
Once the VNet Data Gateway has been created, click the icon under the **Status** column. This can take a few minutes to return the gateway's status, if all has been successful during creation then the status should show as **Online**.

Configure VNet Data Gateway in Power BI

We now turn our attention to Power BI where we must add the Azure SQL Database as a data source to the VNet Data Gateway.

- Login to <https://app.powerbi.com>
- Under **Settings**, click **Manage Gateways**
- Click the ellipsis to the right of the VNet Data Gateway and select **ADD DATA SOURCE**
- Provide the following information:
 - Enter an appropriate name for the data source
E.G. **AzureSQLDatabaseReporting**
 - Select **SQL Server** as the data source type
 - Enter the full URL of the Azure SQL Server
E.G. **dhsqlserverreporting.database.windows.net**
 - Enter the database name E.G. **dhsqlreporting**
 - Select the appropriate authentication method, E.G. OAuth.

- Click **Apply**



Configure Power BI Dataset to use VNet Data Gateway

We can now configure the specific Power BI dataset to use the VNet Data Gateway. Please note that steps to create a report and upload to the Power BI Service is out of scope of this blog post. The Power BI report deployed to the service has an **import** connection to the Azure SQL Database.

- In the Power BI Service, browse to the workspace containing the relevant **Power BI dataset**.
- Select the ellipsis to the right of the relevant Power BI dataset and select **Settings**
- Expand the **Gateway Connection** section and switch **Use an On-premises or VNet data gateway to On**
- In the **Maps to:** drop-down, select the appropriate data source connection. In this case, the Azure SQL Database.
- Click **Apply**

Gateway connection

You don't need a gateway for this dataset, because all of its data sources are in the cloud, but you can use a gateway for enhanced control over how you connect. [Learn more](#)

Use an On-premises or VNet data gateway

On

Gateway	Department	Contact information	Status	Actions
<--> dhpowerbivnet-d...		andycutler@datahai.co...	Running	
Data sources included in this dataset:				
<div style="border: 1px solid #ccc; padding: 5px;"> SqlServer{"server":"dhsqprivate.database.windows.net","database":"dhsqreporting"} <div style="float: right; margin-top: -20px;"> Maps to: AzureSQLDatabase </div> </div>				

Test Data Refresh

We can now browse to the Power BI dataset and attempt a refresh, if all has been configured correctly then the dataset will refresh successfully. If the Power BI

Service is unable to connect to the Azure SQL Database successfully, it is likely to result in this error message:

There was an error when processing the data in the dataset. [Hide details](#)

Data source error: {"error":{"code":"DM_GWPipeline_Gateway_MashupDataAccessError","pbi.error":{"code":"DM_GWPipeline_Gateway_MashupDataAccessError","parameters":{},"details":{"code":"DM_ErrorDetailNameCode_UnderlyingErrorCode","detail":{"type":1,"value":"-2147467259"},"code":"DM_ErrorDetailNameCode_UnderlyingErrorMessage","detail":{"type":1,"value":"Microsoft SQL: Reason: An instance-specific error occurred while establishing a connection to SQL Server. Connection was denied since Deny Public Network Access is set to Yes (https://docs.microsoft.com/azure/azure-sql/database/connectivity-settings#deny-public-network-access). To connect to this server, use the Private Endpoint from inside your virtual network (https://docs.microsoft.com/azure/sql-database/sql-database-private-endpoint-overview#how-to-set-up-private-link-for-azure-sql-database)."},"code":"DM_ErrorDetailNameCode_UnderlyingHResult","detail":{"type":1,"value":"-2147467259"},"code":"Microsoft.Data.Mashup.ValueError.Class","detail":{"type":1,"value":"14"},"code":"Microsoft.Data.Mashup.ValueError.DataSourceKind","detail":{"type":1,"value":"SQL"},"code":"Microsoft.Data.Mashup.ValueError.DataSourcePath","detail":{"type":1,"value":"dhsqprivate.database.windows.net:dhsqreporting"},"code":"Microsoft.Data.Mashup.ValueError.ErrorCode","detail":{"type":1,"value":"-2146232060"},"code":"Microsoft.Data.Mashup.ValueError.Message","detail":{"type":1,"value":"Reason: An instance-specific error occurred while establishing a connection to SQL Server. Connection was denied since Deny Public Network Access is set to Yes (https://docs.microsoft.com/azure/azure-sql/database/connectivity-settings#deny-public-network-access). To connect to this server, use the Private Endpoint from inside your virtual network (https://docs.microsoft.com/azure/sql-database/sql-database-private-endpoint-overview#how-to-set-up-private-link-for-azure-sql-database)."},"code":"Microsoft.Data.Mashup.ValueError.Number","detail":{"type":1,"value":"47073"},"code":"Microsoft.Data.Mashup.ValueError.Reason","detail":{"type":1,"value":"DataSource.Error"}},"exceptionCulprit":1}}} Table: Sales.

Cluster URI: WABI-UK-SOUTH-B-PRIMARY-redirect.analysis.windows.net

Activity ID: 832714d3-eea0-432a-8a71-fd0d34b8d06a

Request ID: 102b212d-b5f9-716d-fa4f-50789529c681

Conclusion

In this blog post we have walked through the steps necessary to disable access to an Azure SQL Database, configure a Virtual Network and Private Endpoint, create a VNet Data Gateway and finally to connect a Power BI dataset to the Azure SQL Database via the VNet Data Gateway. As previously noted in the Considerations section, care must be taken when securing Azure resources and an Azure Network Engineer is best placed to confirm configurations.

References

- <https://docs.microsoft.com/en-us/azure/virtual-network/quick-create-portal>
- <https://docs.microsoft.com/en-us/azure/private-link/create-private-endpoint-portal>
- <https://docs.microsoft.com/en-us/data-integration/vnet/create-data-gateways>
- <https://docs.microsoft.com/en-us/data-integration/vnet/use-data-gateways-sources-power-bi>
- <https://docs.microsoft.com/en-gb/azure/azure-sql/database/connectivity-architecture>

- <https://docs.microsoft.com/en-us/azure/virtual-network/virtual-networks-overview>
- <https://docs.microsoft.com/en-us/azure/azure-sql/database/private-endpoint-overview>
- <https://azure.microsoft.com/en-us/pricing/details/private-link/>