Connecting Microsoft Power BI Desktop (BI) to Oracle Autonomous Database

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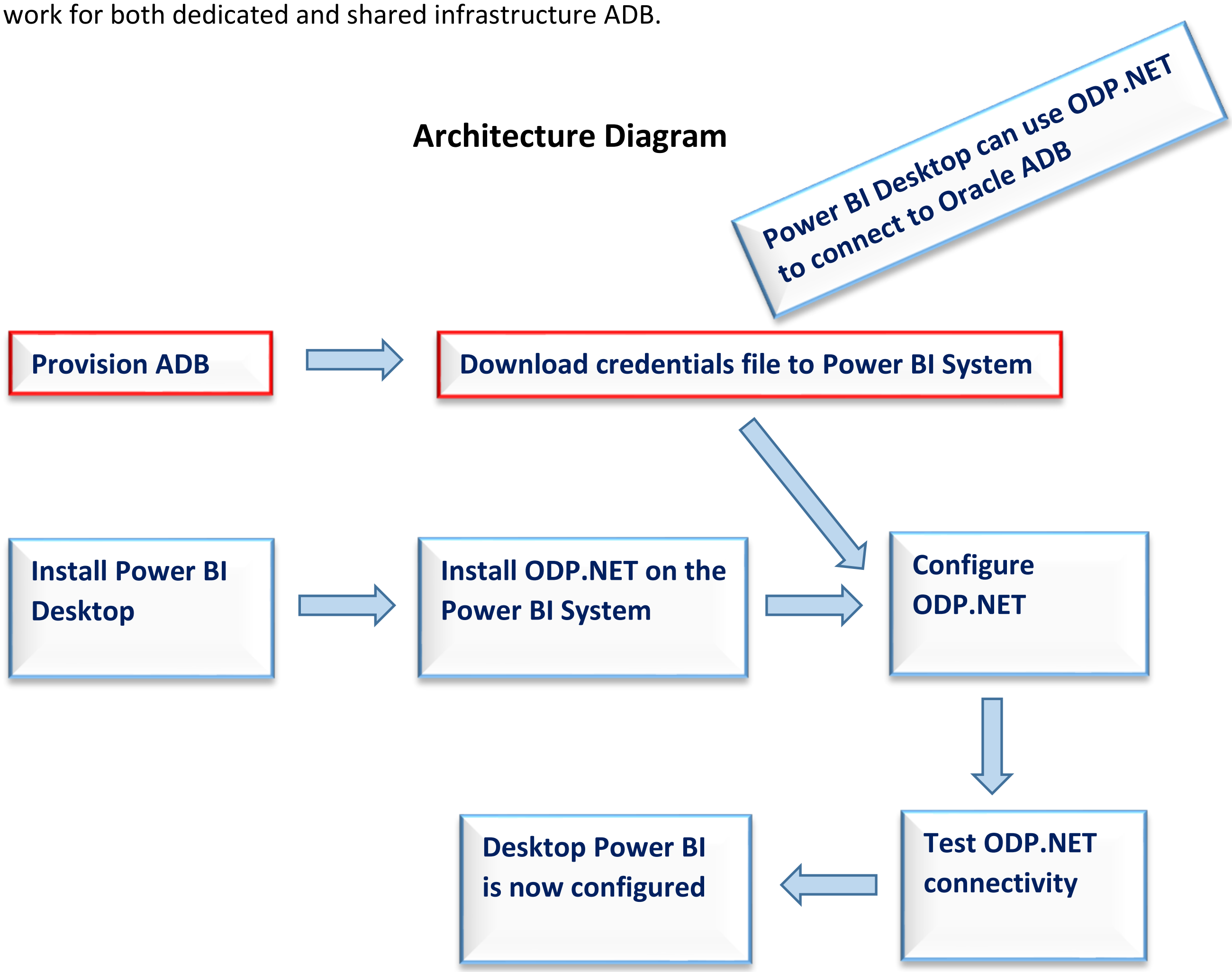
This step by step tutorial guides how to configure Microsoft Power BI Desktop (BI) connectivity to Oracle Autonomous Database (ADB).

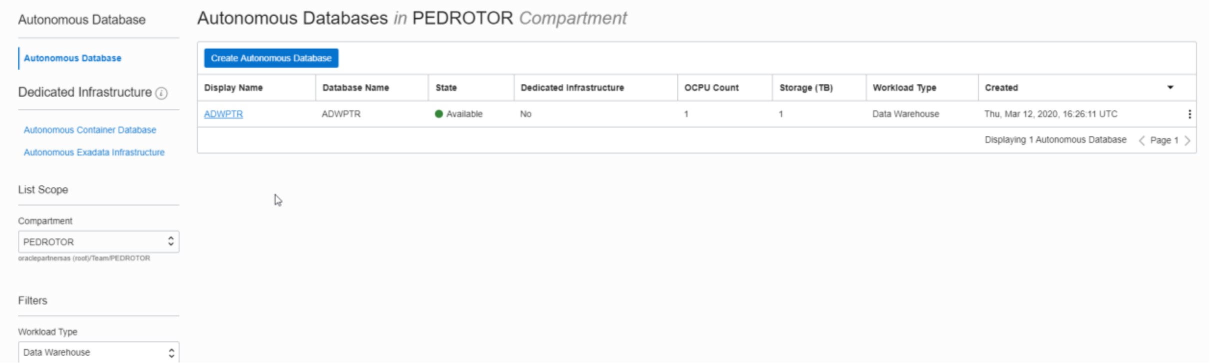
These instructions use managed or unmanaged Oracle Data Provider for .NET (ODP.NET) for data access and work for both dedicated and shared infrastructure ADB.

Architecture Diagram


Power BI Desktop can use ODP.NET to connect to Oracle ADB
Provision ADB
Download credentials file to Power BI System
Install Power BI Desktop
Install ODP.NET on the Power BI System
Configure ODP.NET
Test ODP.NET connectivity
Desktop Power BI is now configured

Prerequisites

This document assumes that an ADB, such as Autonomous Data Warehouse (ADW) or Autonomous Transaction Processing (ATP), or Autonomous JSON Database (AJD) was provisioned and Power BI Desktop is installed on a Windows machine (local, in Azure, or OCI).


Autonomous Database
Autonomous Database
Dedicated Infrastructure
Autonomous Container Database
Autonomous Exadata Infrastructure
List Scope
Compartment
PEDROTOR
oraclepartnersas (root)/Team/PEDROTOR
Filters
Workload Type
Data Warehouse
Create Autonomous Database

Autonomous Databases *in* PEDROTOR *Compartment*

Display Name	Database Name	State	Dedicated Infrastructure	OCPU Count	Storage (TB)	Workload Type	Created
ADWPTR	ADWPTR	● Available	No	1	1	Data Warehouse	Thu, Mar 12, 2020, 16:26:11 UTC

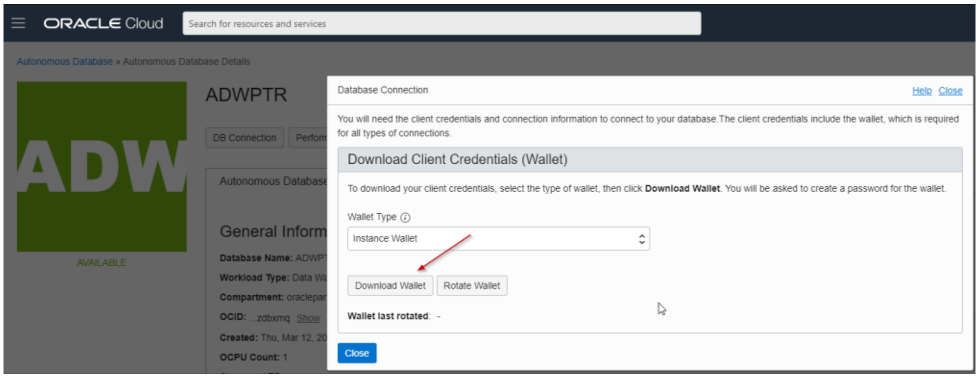
Displaying 1 Autonomous Database ‹ Page 1 ›

*Note: Please check here for the Oracle documentation to provision ADW.

Power BI may use managed ODP.NET or unmanaged ODP.NET for its ADB connectivity. This tutorial was tested with Power BI's May 2021 version, which requires unmanaged ODP.NET for Oracle database connectivity. It is possible that Microsoft will update Power BI to use managed ODP.NET in a future version. This tutorial guides you on using either unmanaged or managed ODP.NET with Power BI.

Installation and Setup Steps

1. Download the corresponding Oracle ADB credentials zip file to the system that has or will have Power BI Desktop installed. These credential files will be used to connect Power BI Desktop to ADB.



Database Connection

You will need the client credentials and connection information to connect to your database.The client credentials include the wallet, which is required for all types of connections.

Download Client Credentials (Wallet)

To download your client credentials, select the type of wallet, then click **Download Wallet**. You will be asked to create a password for the wallet.

Wallet Type: Instance Wallet

Wallet last rotated: -

Database Name: ADWPT

Workload Type: Data Wa

Compartment: oraclepar

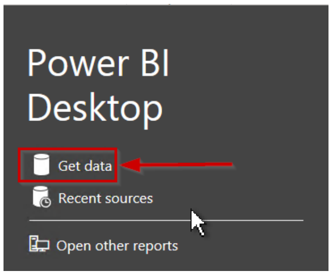
OCID: ...zdbxmq Show

Created: Thu, Mar 12, 20

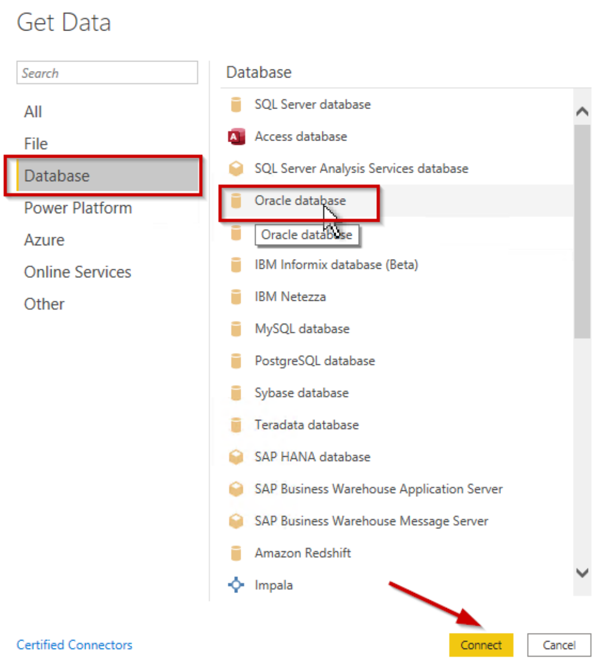
OCPU Count: 1

*Note: Also check Downloading Client Credentials (Wallets).

2. Open Power BI Desktop and create a project.

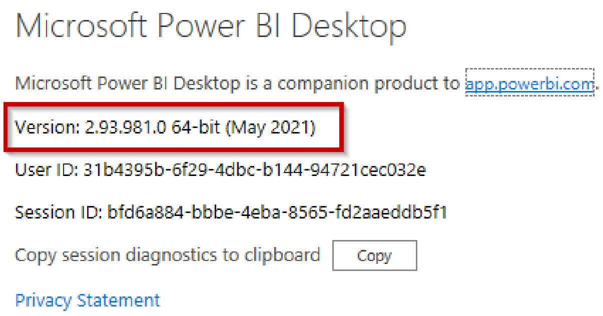


3. At this point, we are merely determining which ADO.NET provider your Power BI Desktop instance is hard-coded to use. We will configure the correct provider once we learn this information. Select Database > Oracle database > Connect to attempt to connect to an Oracle database.



4. If the error indicates it is trying to use **Oracle.DataAccess.dll** assembly, then set up Power BI Desktop with **unmanaged ODP.NET**. If the error says it is trying to use **Oracle.ManagedDataAccess.dll**, then use **managed ODP.NET**.

   If you need to use unmanaged ODP.NET, determine if Power BI is either 32-bit or 64-bit. To look up Power BI Desktop's bitness, select File > Help > About.



Microsoft Power BI Desktop

Microsoft Power BI Desktop is a companion product to app.powerbi.com.

Version: 2.93.981.0 64-bit (May 2021)

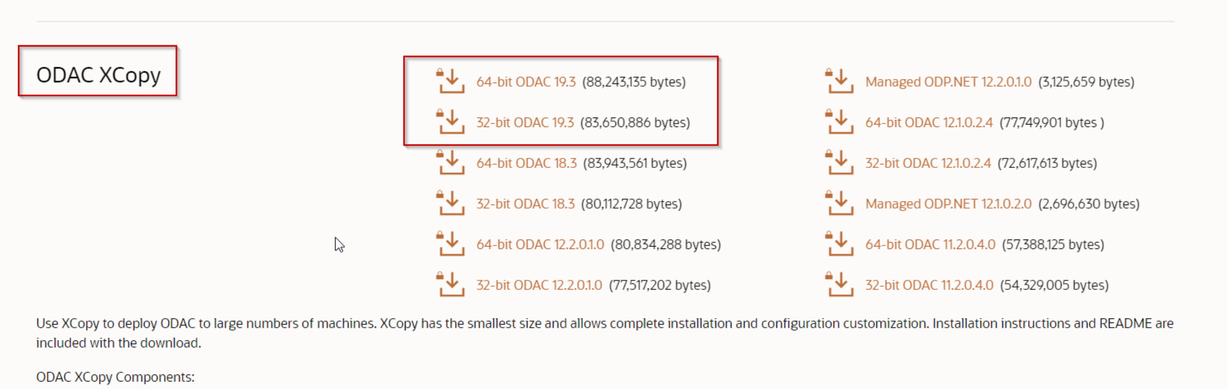
User ID: 31b4395b-6f29-4dbc-b144-94721cec032e

Session ID: bfd6a884-bbbe-4eba-8565-fd2aaeddb5f1

   In the above screen shot, we see that 64-bit Power BI Desktop is being used. That means 64-bit unmanaged ODP.NET must be installed and configured for Power BI to connect to ADB. If 32-bit Power BI Desktop was being used, then 32-bit unmanaged ODP.NET would be required.

   The following instructions cover all scenarios, whether you are using managed or unmanaged ODP.NET or you are using 32-bit or 64-bit Power BI.

5. If you require managed ODP.NET or 64-bit unmanaged ODP.NET, download 64-bit ODAC 19.3 from the ODAC Xcopy section in the middle of this Oracle.com web page. If you require 32-bit unmanaged ODP.NET, download 32-bit ODAC 19c from the ODAC Xcopy section.



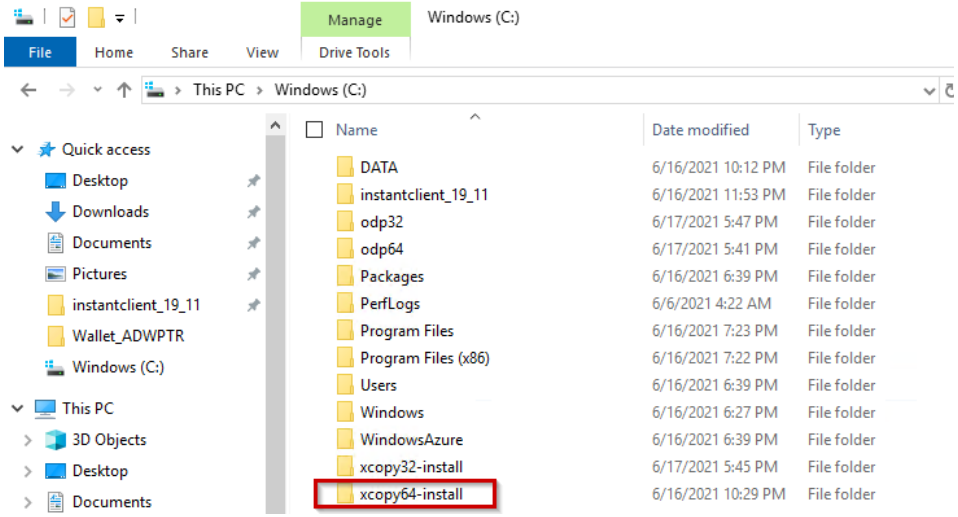
ODAC XCopy

- 64-bit ODAC 19.3 (88,243,135 bytes)
- 32-bit ODAC 19.3 (83,650,886 bytes)
- 64-bit ODAC 18.3 (83,943,561 bytes)
- 32-bit ODAC 18.3 (80,112,728 bytes)
- 64-bit ODAC 12.2.0.1.0 (80,834,288 bytes)
- 32-bit ODAC 12.2.0.1.0 (77,517,202 bytes)
- Managed ODP.NET 12.2.0.1.0 (3,125,659 bytes)
- 64-bit ODAC 12.1.0.2.4 (77,749,901 bytes)
- 32-bit ODAC 12.1.0.2.4 (72,617,613 bytes)
- Managed ODP.NET 12.1.0.2.0 (2,696,630 bytes)
- 64-bit ODAC 11.2.0.4.0 (57,388,125 bytes)
- 32-bit ODAC 11.2.0.4.0 (54,329,005 bytes)

Use XCopy to deploy ODAC to large numbers of machines. XCopy has the smallest size and allows complete installation and configuration customization. Installation instructions and README are included with the download.

ODAC XCopy Components:

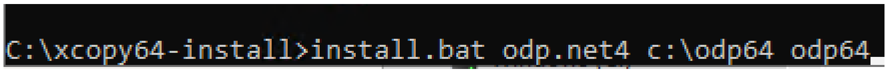
6. Now, we'll install ODP.NET. Installation instructions are the same for managed ODP.NET, 32-bit unmanaged ODP.NET, and 64-bit unmanaged ODP.NET. Unzip the download contents to a staging directory (e.g. c:\xcopy64-install or c:\xcopy32-install).



Name	Date modified	Type
DATA	6/16/2021 10:12 PM	File folder
instantclient_19_11	6/16/2021 11:53 PM	File folder
odp32	6/17/2021 5:47 PM	File folder
odp64	6/17/2021 5:41 PM	File folder
Packages	6/16/2021 6:39 PM	File folder
PerfLogs	6/6/2021 4:22 AM	File folder
Program Files	6/16/2021 7:23 PM	File folder
Program Files (x86)	6/16/2021 7:22 PM	File folder
Users	6/16/2021 6:39 PM	File folder
Windows	6/16/2021 6:27 PM	File folder
WindowsAzure	6/16/2021 6:39 PM	File folder
xcopy32-install	6/17/2021 5:45 PM	File folder
xcopy64-install	6/16/2021 10:29 PM	File folder

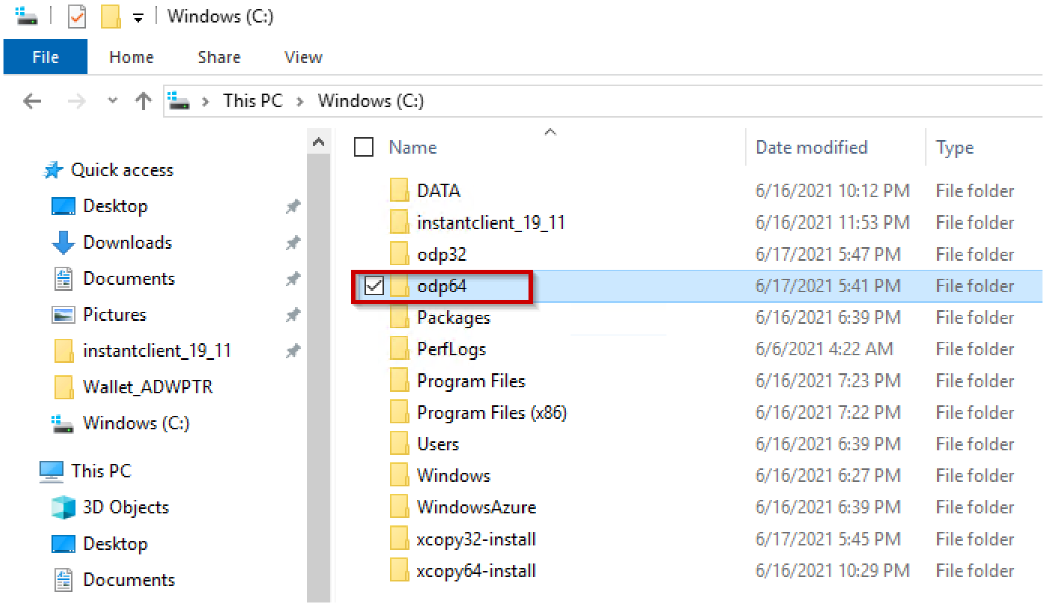
7. Open a Windows command prompt ***in administrator mode*.** Navigate to the staging directory, then execute the next command to install ODP.NET:

```
install.bat odp.net4 <installation directory> odp64
```



```
C:\xcopy64-install>install.bat odp.net4 c:\odp64 odp64
```

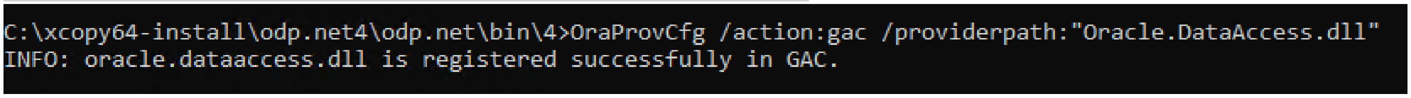
*Note: Enter the installation location (e.g. c:\odp64 or c:\odp32) for the directory parameter.



Name	Date modified	Type
DATA	6/16/2021 10:12 PM	File folder
instantclient_19_11	6/16/2021 11:53 PM	File folder
odp32	6/17/2021 5:47 PM	File folder
☑ odp64	6/17/2021 5:41 PM	File folder
Packages	6/16/2021 6:39 PM	File folder
PerfLogs	6/6/2021 4:22 AM	File folder
Program Files	6/16/2021 7:23 PM	File folder
Program Files (x86)	6/16/2021 7:22 PM	File folder
Users	6/16/2021 6:39 PM	File folder
Windows	6/16/2021 6:27 PM	File folder
WindowsAzure	6/16/2021 6:39 PM	File folder
xcopy32-install	6/17/2021 5:45 PM	File folder
xcopy64-install	6/16/2021 10:29 PM	File folder

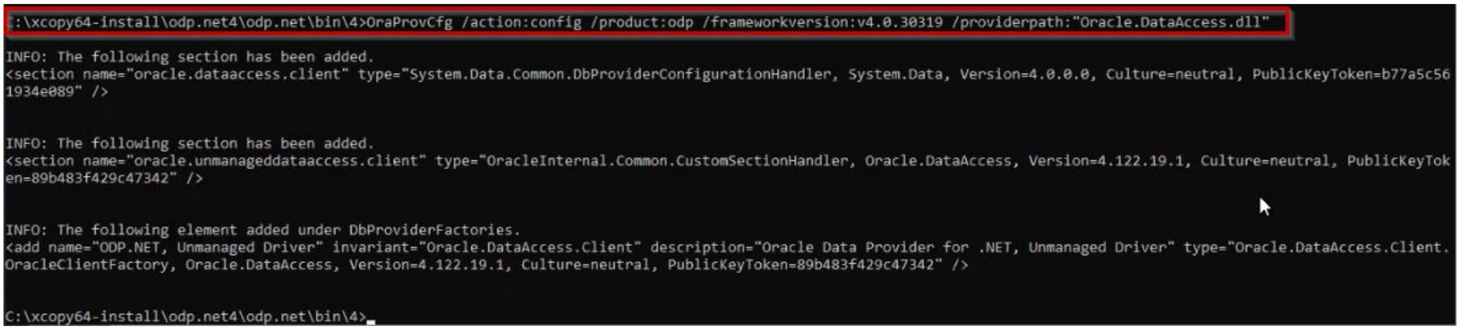
8. Configuration instructions differ between managed ODP.NET and unmanaged ODP.NET. In the same command prompt **with administrator privileges,** navigate to the installation subdirectory, <installation directory>\odp.net\bin\4. Then, execute the following command:
    a. To configure unmanaged ODP.NET:

```
OraProvCfg /action:gac /providerpath:"Oracle.DataAccess.dll"
```



```
C:\xcopy64-install\odp.net4\odp.net\bin\4>OraProvCfg /action:gac /providerpath:"Oracle.DataAccess.dll"
INFO: oracle.dataaccess.dll is registered successfully in GAC.
```

```
OraProvCfg /action:config /product:odp /frameworkversion:v4.0.30319 /providerpath:"Oracle.DataAccess.dll"
```



```
:\xcopy64-install\odp.net4\odp.net\bin\4>OraProvCfg /action:config /product:odp /frameworkversion:v4.0.30319 /providerpath:"Oracle.DataAccess.dll"

INFO: The following section has been added.
<section name="oracle.dataaccess.client" type="System.Data.Common.DbProviderConfigurationHandler, System.Data, Version=4.0.0.0, Culture=neutral, PublicKeyToken=b77a5c56
1934e089" />


INFO: The following section has been added.
<section name="oracle.unmanageddataaccess.client" type="OracleInternal.Common.CustomSectionHandler, Oracle.DataAccess, Version=4.122.19.1, Culture=neutral, PublicKeyTok
en=89b483f429c47342" />


INFO: The following element added under DbProviderFactories.
<add name="ODP.NET, Unmanaged Driver" invariant="Oracle.DataAccess.Client" description="Oracle Data Provider for .NET, Unmanaged Driver" type="Oracle.DataAccess.Client.
OracleClientFactory, Oracle.DataAccess, Version=4.122.19.1, Culture=neutral, PublicKeyToken=89b483f429c47342" />


C:\xcopy64-install\odp.net4\odp.net\bin\4>_
```

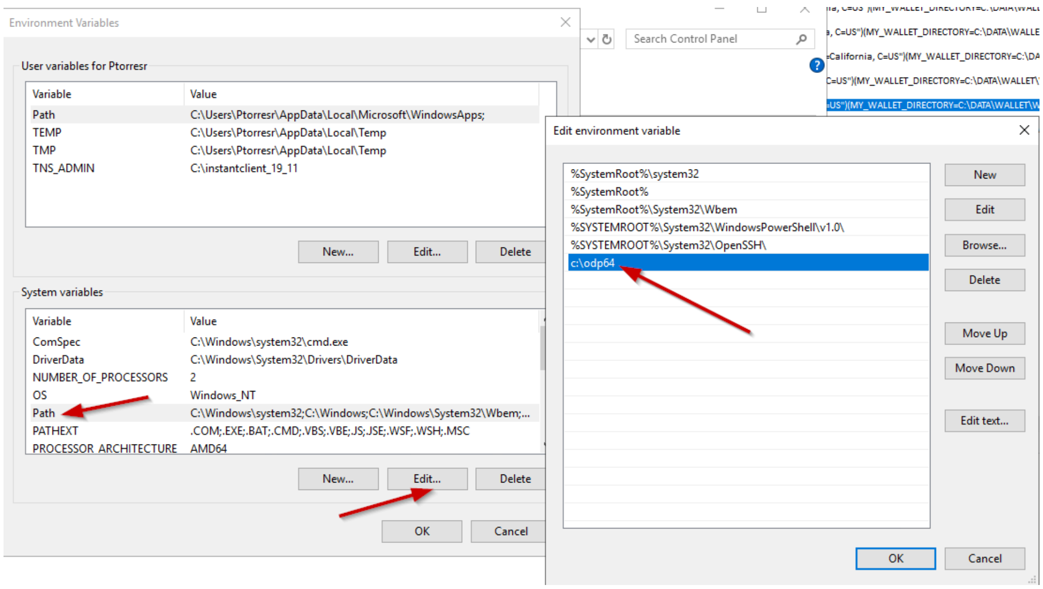
Note: Please validate that you are using the correct path for Oracle.DataAccess.dll file.

    b. To configure managed ODP.NET

```
OraProvCfg /action:gac /providerpath:"../../managed/common/Oracle.ManagedDataAccess.dll"
```

```
OraProvCfg /action:config /product:odpm /frameworkversion:v4.0.30319 /providerpath:"../../managed/common/Oracle.ManagedDataAccess.dll"
```

9. (For unmanaged ODP.NET only) Edit the Windows environment variables by adding the path value of the 64-bit Oracle Client directory (e.g. c:\odp64) or 32-bit Oracle Client directory (e.g. c:\odp32) depending on the version Power BI will use.



Environment Variables

User variables for Ptorresr

Variable	Value
Path	C:\Users\Ptorresr\AppData\Local\Microsoft\WindowsApps;
TEMP	C:\Users\Ptorresr\AppData\Local\Temp
TMP	C:\Users\Ptorresr\AppData\Local\Temp
TNS_ADMIN	C:\instantclient_19_11

System variables

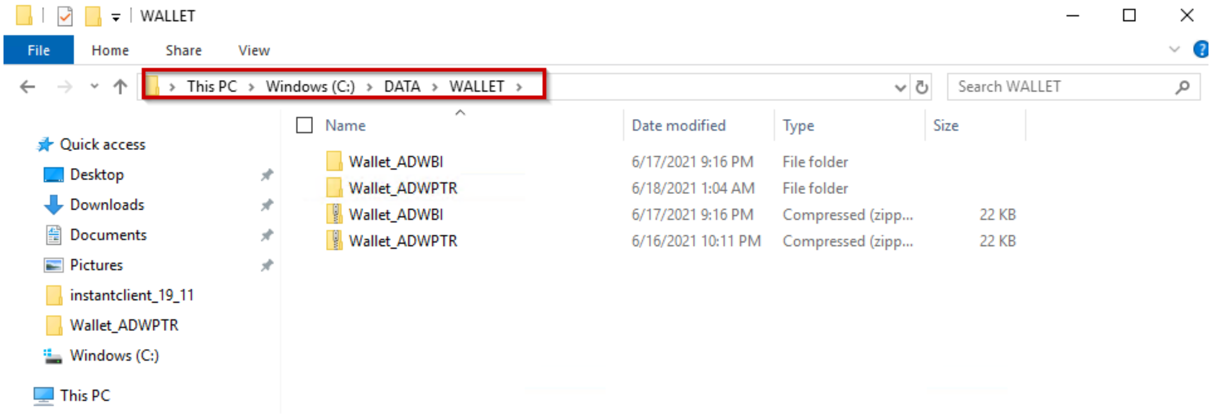
Variable	Value
ComSpec	C:\Windows\system32\cmd.exe
DriverData	C:\Windows\System32\Drivers\DriverData
NUMBER_OF_PROCESSORS	2
OS	Windows_NT
Path	C:\Windows\system32;C:\Windows;C:\Windows\System32\Wbem;...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC
PROCESSOR_ARCHITECTURE	AMD64

Edit environment variable

```
%SystemRoot%\system32
%SystemRoot%
%SystemRoot%\System32\Wbem
%SYSTEMROOT%\System32\WindowsPowerShell\v1.0\
%SYSTEMROOT%\System32\OpenSSH\
c:\odp64
```

To ensure this directory path setting has precedence over existing Oracle Homes, move the setting up to the highest possible level in the directory order with the “Move Up” button.

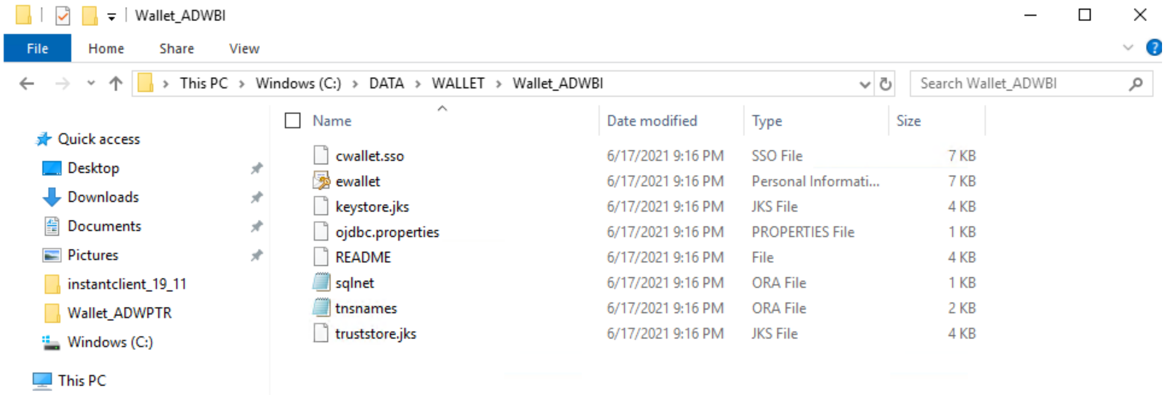
10. Navigate to where you downloaded the Oracle ADB credentials on your Windows machine. Unzip the contents to a directory.



WALLET

This PC > Windows (C:) > DATA > WALLET >

Name	Date modified	Type	Size
Wallet_ADWBI	6/17/2021 9:16 PM	File folder	
Wallet_ADWPTR	6/18/2021 1:04 AM	File folder	
Wallet_ADWBI	6/17/2021 9:16 PM	Compressed (zipp...	22 KB
Wallet_ADWPTR	6/16/2021 10:11 PM	Compressed (zipp...	22 KB

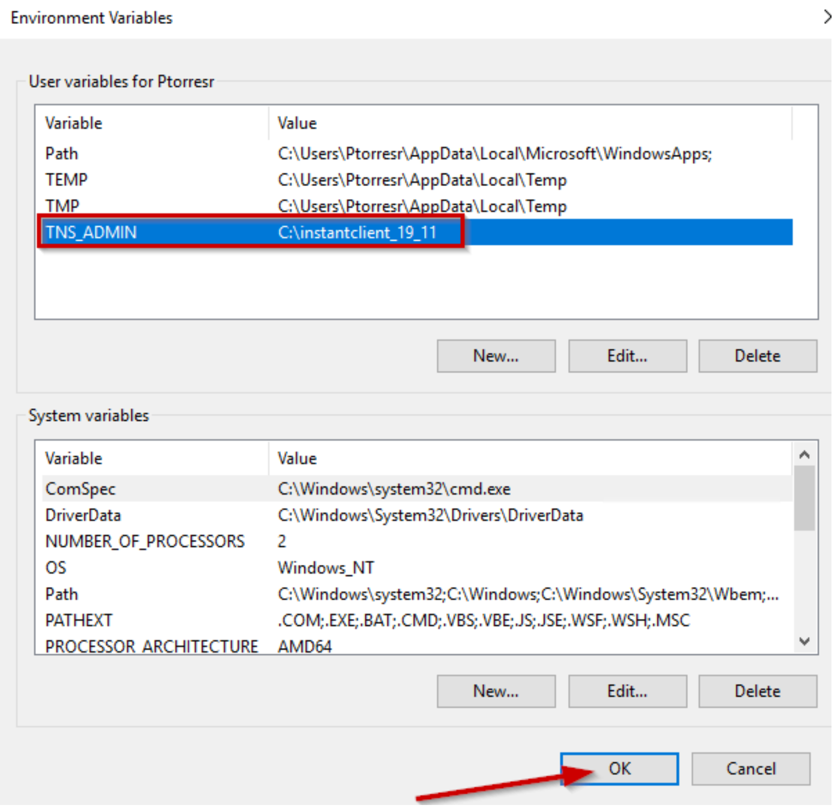


Wallet_ADWBI

This PC > Windows (C:) > DATA > WALLET > Wallet_ADWBI

Name	Date modified	Type	Size
cwallet.sso	6/17/2021 9:16 PM	SSO File	7 KB
ewallet	6/17/2021 9:16 PM	Personal Informati...	7 KB
keystore.jks	6/17/2021 9:16 PM	JKS File	4 KB
ojdbc.properties	6/17/2021 9:16 PM	PROPERTIES File	1 KB
README	6/17/2021 9:16 PM	File	4 KB
sqlnet	6/17/2021 9:16 PM	ORA File	1 KB
tnsnames	6/17/2021 9:16 PM	ORA File	2 KB
truststore.jks	6/17/2021 9:16 PM	JKS File	4 KB

11. In the Windows environment variables dialog, create the TNS_ADMIN variable. Set its value to the directory location where you unzipped the ADB wallet contents.



Environment Variables

User variables for Ptorresr

Variable	Value
Path	C:\Users\Ptorresr\AppData\Local\Microsoft\WindowsApps;
TEMP	C:\Users\Ptorresr\AppData\Local\Temp
TMP	C:\Users\Ptorresr\AppData\Local\Temp
TNS_ADMIN	C:\instantclient_19_11

System variables

Variable	Value
ComSpec	C:\Windows\system32\cmd.exe
DriverData	C:\Windows\System32\Drivers\DriverData
NUMBER_OF_PROCESSORS	2
OS	Windows_NT
Path	C:\Windows\system32;C:\Windows;C:\Windows\System32\Wbem;...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC
PROCESSOR_ARCHITECTURE	AMD64

Note: The tnsnames.ora net service names will be used to connect to ADB's.

12. If you are connecting to **one ADB instance**, open the SQLNET.ORA configuration file in the wallet directory in a text editor. You will see the following line:
WALLET_LOCATION = (SOURCE = (METHOD = file) (METHOD_DATA = (DIRECTORY="?/network/admin")))

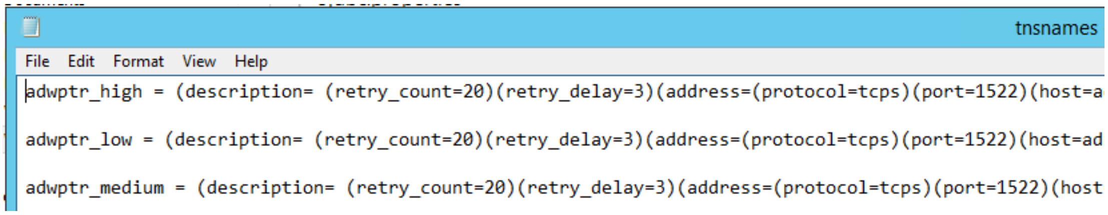
Set the DIRECTORY value to the ADB wallet directory location on the machine, such as:
WALLET_LOCATION = (SOURCE = (METHOD = file) (METHOD_DATA = (DIRECTORY= *C:\DATA\WALLET\Wallet_ADWBI*)))

Save the file and proceed to the next step.

If you are connecting to **multiple ADBs** from the same machine with a different wallet for each one, add the parameter MY_WALLET_DIRECTORY to the connect descriptor with each descriptor's specific wallet location in TNSNAMES.ORA. For example:
adwptr_high = (description= (retry_count=20)(retry_delay=3)(address=(protocol=tcps)(port=1522)(host=adb.us-phoenix-1.oraclecloud.com))(connect_data=(service_name=bk8ui2h_adwptr_high.adwc.oraclecloud.com))(security=(ssl_server_cert_dn="CN=adwc.uscom-east-1.oraclecloud.com, OU=Oracle BMCS US, O=Oracle Corporation, L=Redwood City, ST=California, C=US")(MY_WALLET_DIRECTORY=C:\DATA\WALLET\Wallet_ADWPTR)))
adwbi_low = (description= (retry_count=20)(retry_delay=3)(address=(protocol=tcps)(port=1522)(host=adb.us-phoenix-

1.oraclecloud.com))(connect_data=(service_name=bk8uqvi2h_adwbi_low.adb.oraclecloud.com))(security=(ssl_server_cert_dn="CN=adwc.uscom-east-1.oraclecloud.com, OU=Oracle BMCS US, O=Oracle Corporation, L=Redwood City, ST=California, C=US")(MY_WALLET_DIRECTORY=C:\DATA\WALLET\Wallet_ADWBI)))

13. Open the TNSNAMES.ORA file in the wallet directory to see which ADB net service names are available to connect to. Below you see three different ones: adwptr_high, adwptr_low, and adwptr_medium. Your ADB net service names will likely be named differently.

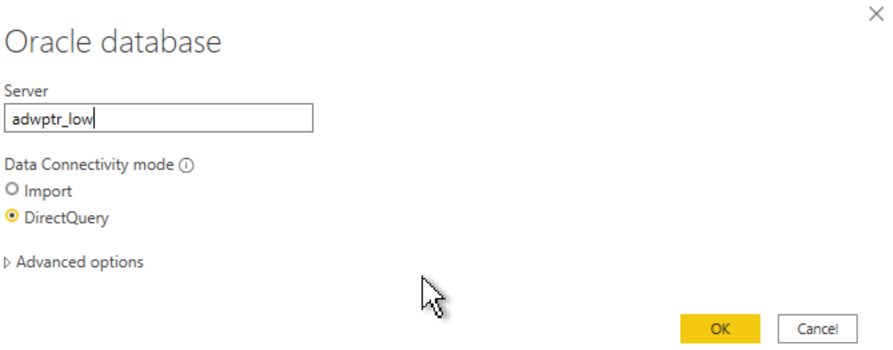


```
adwptr_high = (description= (retry_count=20)(retry_delay=3)(address=(protocol=tcps)(port=1522)(host=a

adwptr_low = (description= (retry_count=20)(retry_delay=3)(address=(protocol=tcps)(port=1522)(host=ad

adwptr_medium = (description= (retry_count=20)(retry_delay=3)(address=(protocol=tcps)(port=1522)(host
```

14. Open Power BI Desktop again and click OK to connect using one of your net service names.

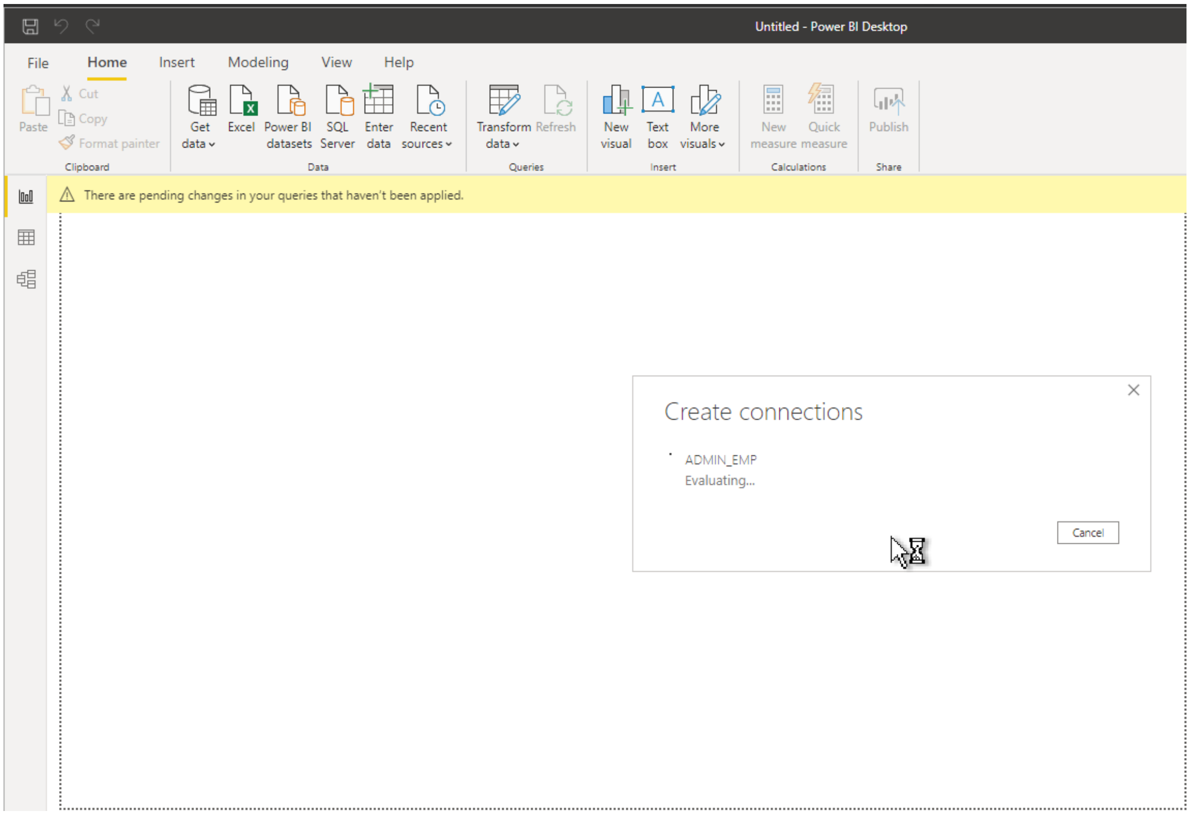


Oracle database

Server
adwptr_low

Data Connectivity mode ⓘ
○ Import
● DirectQuery

▷ Advanced options

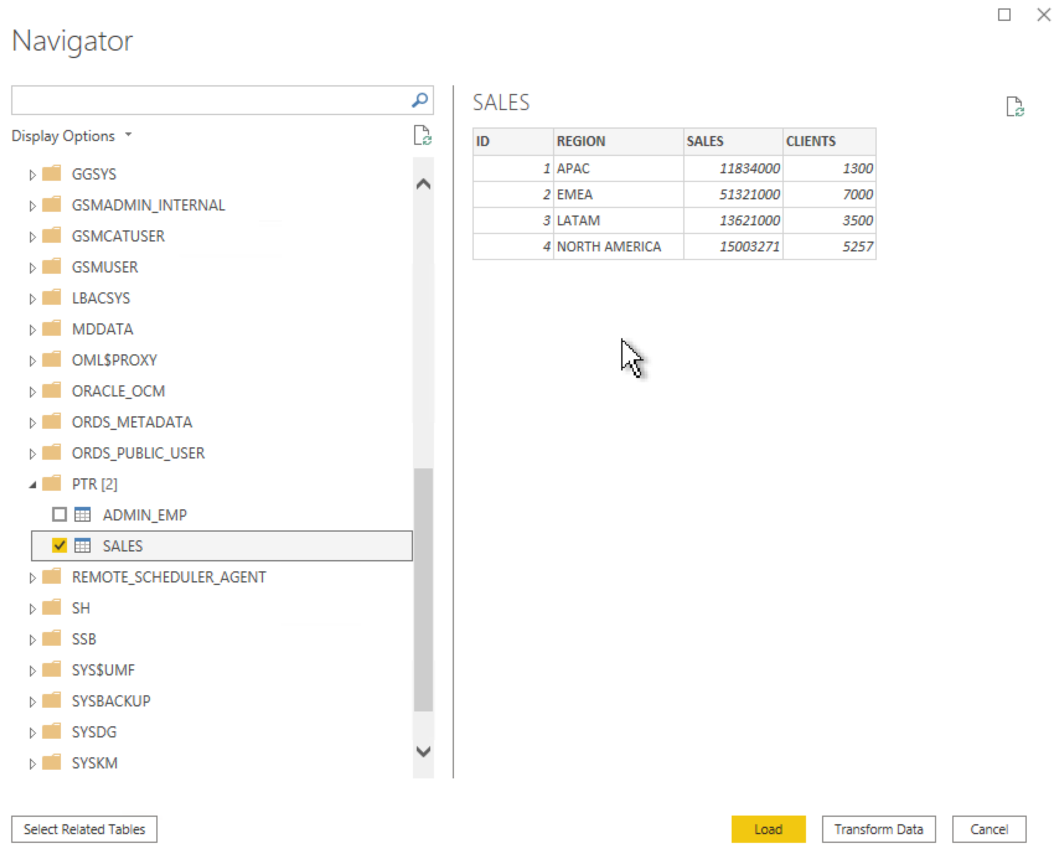


⚠ There are pending changes in your queries that haven't been applied.

Create connections

ADMIN_EMP
Evaluating...

15. Congratulations! Your Power BI Desktop instance should now be connect to ADB. Open in Navigator the tables that you need data to create your own Microsoft Power BI Desktop Document (.pbix) and load the data.



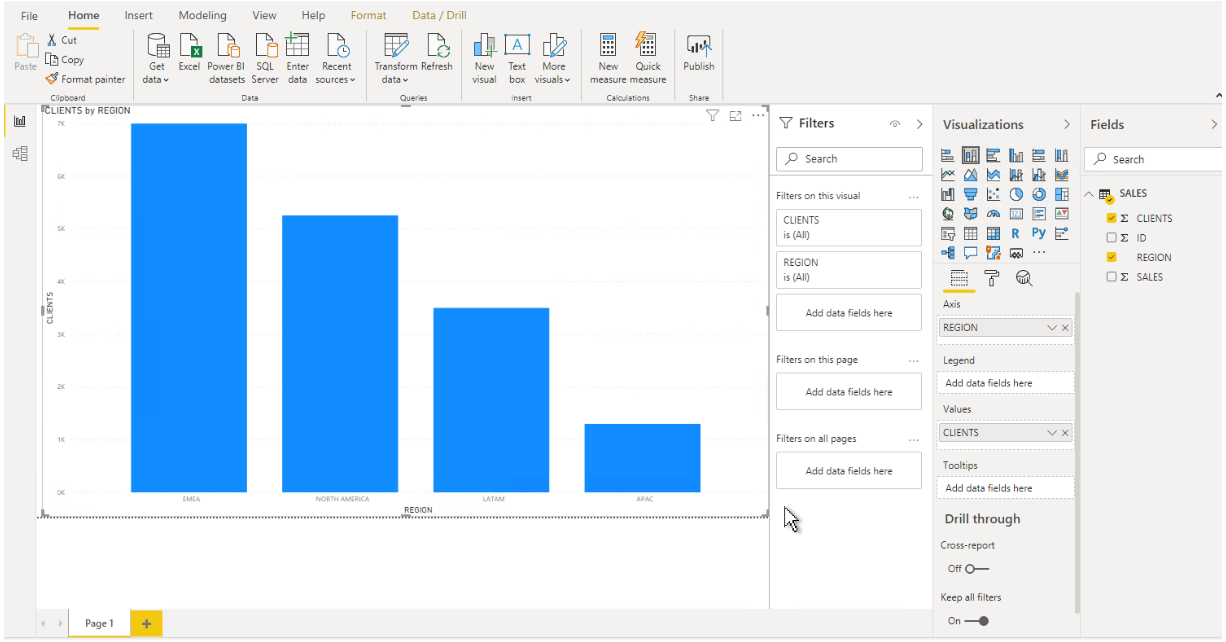
Navigator

SALES

ID	REGION	SALES	CLIENTS
1	APAC	11834000	1300
2	EMEA	51321000	7000
3	LATAM	13621000	3500
4	NORTH AMERICA	15003271	5257

- PTR [2]
  - □ ADMIN_EMP
  - ☑ SALES

16. Create your own graph or retrieve the data in other Table



Axis: REGION

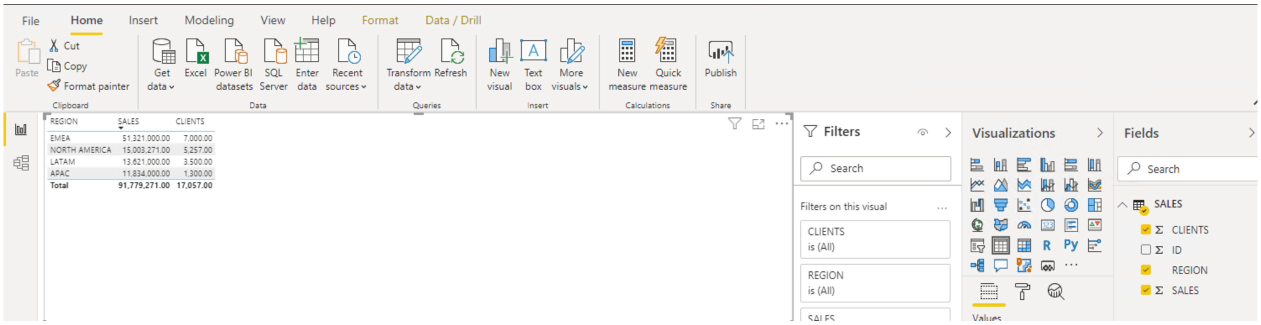
Values: CLIENTS

Filters on this visual: CLIENTS is (All); REGION is (All)

Fields: SALES — ☑ CLIENTS, □ ID, ☑ REGION, □ SALES

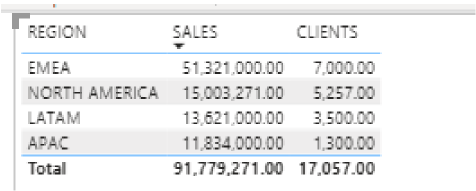
Cross-report: Off

Keep all filters: On



CLIENTS
is (All)

REGION
is (All)



REGION	SALES	CLIENTS
EMEA	51,321,000.00	7,000.00
NORTH AMERICA	15,003,271.00	5,257.00
LATAM	13,621,000.00	3,500.00
APAC	11,834,000.00	1,300.00
Total	91,779,271.00	17,057.00

Performance Tuning for Large Data Retrievals

Typically, BI and ETL applications retrieve large data amounts from a source database for further processing. To speed up Oracle data retrieval via Power BI Desktop, the ODP.NET FetchSize can be increased from its default 128K value (131,072 bytes) to as large as int.MaxValue. The FetchSize determines the amount of data ODP.NET fetches into its internal cache upon each database round trip. It's possible to improve performance by an order of magnitude by significantly increasing FetchSize when retrieving large result sets.

Unmanaged ODP.NET Instructions

To increase the 32-bit or 64-bit unmanaged ODP.NET's FetchSize, launch the Windows Registry editor (regedit.exe) and go to the following Registry key:
HKEY_LOCAL_MACHINE\SOFTWARE\Oracle\ODP.NET\4.122.19.1

Add the String Value "FetchSize" and set it to a value larger than the default (131072), such as 4194304 (4 MB).

Restart Power BI Desktop and run your queries with the new setting.

Managed ODP.NET Instructions

To increase managed ODP.NET's FetchSize, modify the .NET machine.config file. Modifying the machine.config requires Windows Administrator privileges. This file is generally located in the following directory: **C:\WINDOWS\Microsoft.NET\Framework\v4.0.30319\Config**.

Add an <oracle.manageddataaccess.client> section in the machine.config file for managed ODP.NET. This section should be placed within the <configuration> section and after the <configSections> </configSections>. Here's an example setting the FetchSize to 4 MB:

```
<configuration>
  <configSections>
…
   </configSections>

  <oracle.manageddataaccess.client>
```

```
    <version number="*">
      <settings>
        <setting name="FetchSize" value="4194304" />
      </settings>
    </version>
  </oracle.manageddataaccess.client>

</configuration>
```

Once done, restart Power BI Desktop so that ODP.NET will use the new setting.