

BI4Dynamics D365FO

Proof-of-concept on Tier 2 environment

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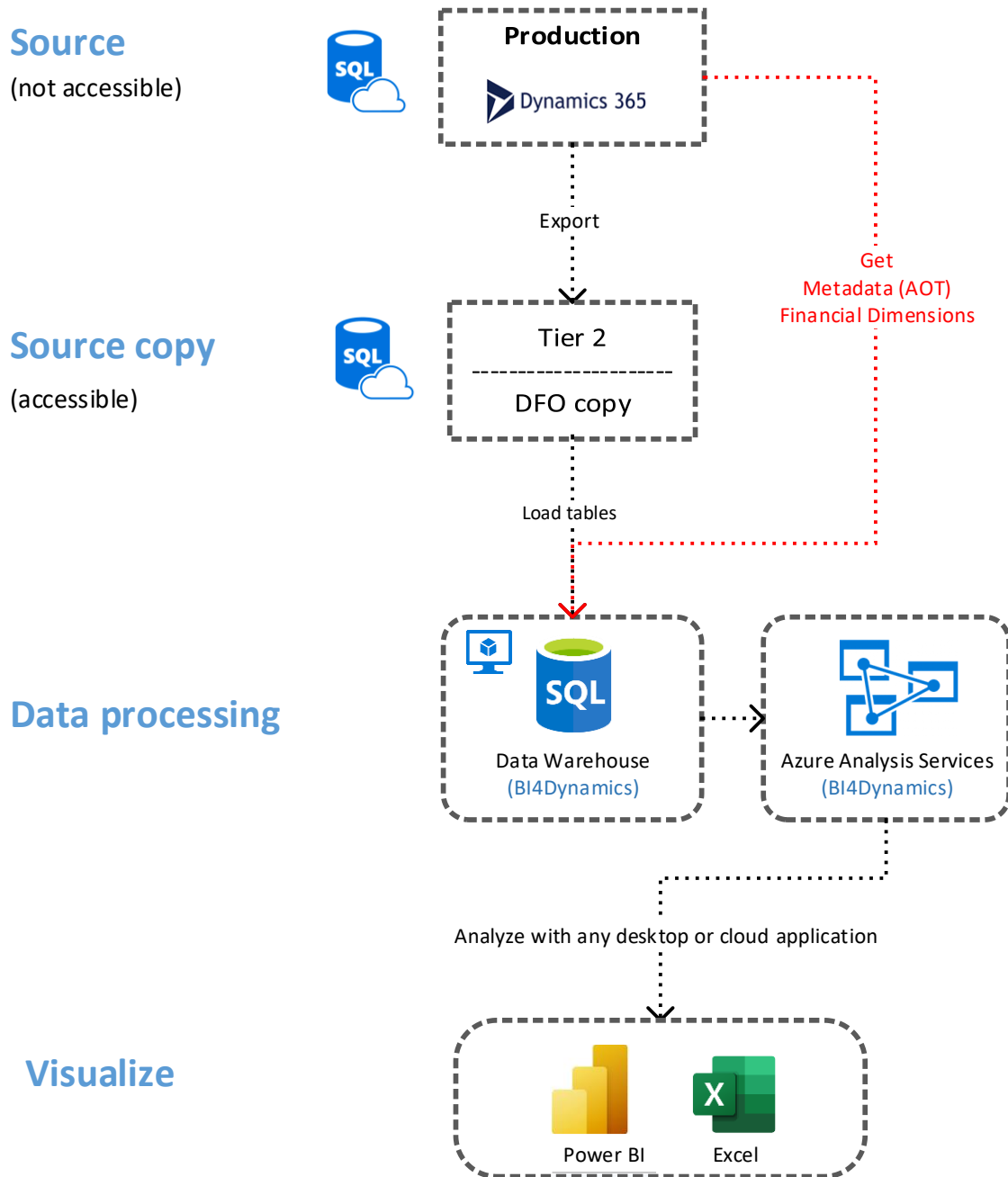
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1 Data transformation process

This document describes the data transformation process from Microsoft Dynamics D365 DFO SaaS Tier 2 environment to visualization tools (Power BI, Excel). Data transformation is done in the following steps

1. Export Production DFO data to Tier 2 environment
2. Load data to Data Warehouse, process data in Data Warehouse and Analysis Services
3. Analyze data with visualization tools



1 Production to Tier 2 environment

Production environment Azure SQL is not accessible to any external tool.

1 Exporting DFO data

This process is used to get data from DFO.

Export Production to Tier 2 environment.

- Request is triggered from within DFO to Microsoft. Request is automatically granted.
- Microsoft creates a copy of SQL database in Azure SQL environment
- SQL database has specific name with timestamp, admin user and password; let's call this database **Tier2**.
- SQL database is available (accessible) for 8 hours
- It takes about 2 hours to copy 120 GB of DFO database to Azure SQL database (Microsoft subscription).
- Customers can make 10 requests per month (this equals 10 updates of DFO per month).

Tier 2 data are in Azure SQL database that must be provisioned before copying data.

Backup Tier 2 database Azure SQL

- From within DFO create a backup of Azure SQL database; backup is available in DFO repository as bacpac file (not bak file) with the same name as Azure SQL database; this process will take 10 – 15 minutes for database size 120 GB; bacpac file size will be 10% of original Azure SQL database.
- Copy bacpac file to VM (or any other computer in order to restore the file)
- Restore (import data tier) bacpac to Azure SQL database with name **DFO copy** (customer subscription)

Note: Importing data-tier bacpac file from DFO to SQL server currently won't work. When importing bacpac to SQL some (very new) SQL functions are executed that are currently only supported in Azure SQL and not yet by SQL. The workaround is that you edit bacpac file by restoring the files, removing the SQL function that causes import error, calculating hashtag and compressing the files back. Restore – edit – backup process would take about 5 hours (2 for restore, 1 hour for edit, 2 hours for backup). Microsoft is describing this process here.

<https://techcommunity.microsoft.com/t5/azure-database-support-blog/editing-a-bacpac-file/ba-p/368931>

Due to unnecessary hassle, we would not recommend this process.

2 Getting Metadata and Financials dimensions

This process is used to get metadata (schemas) from DFO. BI4Dynamics requests access to DFO services that provides:

- DFO database Metadata (AOT): used for DW customizations
- Structure of Financial dimensions: used for mapping dimensions to transactional tables across DW

Getting metadata from another environment may take from 15 minutes to 2 hours. It is needed only once as metadata are saved to BI instance locally and retrieved locally. Getting this from DFO again is needed only if DFO metadata (new tables or columns), that will be used in modeling, have been changed.

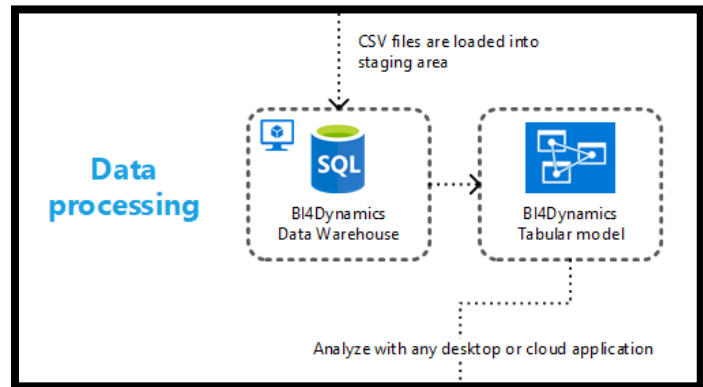
2 Tier 2 to Analysis Services

1 Loading data from DFO copy to the data warehouse

DFO copy database and Data Warehouse database are connected with linked server connection. Data are loaded on request or periodically, depending how often DFO copy is updated. Request for load always comes from DW. Loading 180 staging table can take about 30 minutes on fast Azure SQL database.

2 Data Warehouse transformations

BI4Dynamics will load SQL tables from DFO Copy to SQL server (stage), where DW transformation will be started. Data warehouse objects (stored procedures, views, dimensions, facts) are created and processed in one data transformation process (details are available on BI4Dynamics web). Users will not access data warehouse.



Data warehouse is hosted on virtual machine in Azure.

3 Analytics

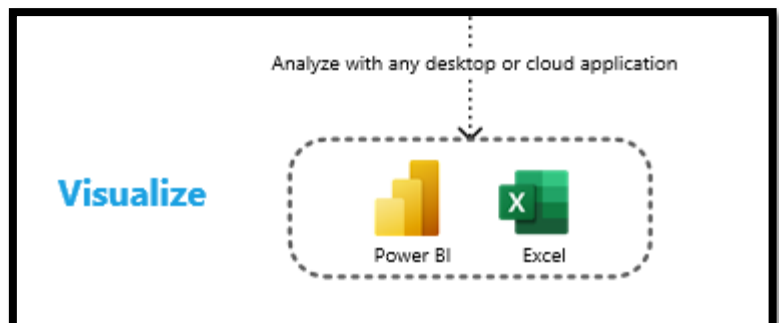
DW tables (dimensional and transactional) are copied to

- Analysis services on same VM as DW: VM runs when processing and querying; this option is used for development, but can be used also for production (if VM is set to company network)
- Azure Analysis database: VM runs when processing and Analytics runs when querying. this option is used for production and database is exposed to users for querying. Roles and permissions are set here.

3 Visualizing and querying

Users query data in Analysis Services. Data are in Memory, so querying is very fast.

Any BI client that can connect to the Tabular model can be used for querying. BI4Dynamics has standardized ready-made reports for Excel and Power BI.



Both tools can do the job a usage is not exclusive. BI4Dynamics recommends using both tools in the same BI project:

- A free desktop version of Power BI is used for best visualizations and dashboarding,
- Excel 2013 or higher version is best for ad-hoc reporting and analytics.

Which tool to use depends on the reporting or analysis process – not person or job description.

2 Implementation options (Azure)

Although it is possible to implement BI solution on-premise, most common it will be implemented in Azure as this environment can be created in few minutes.

1 Virtual machine (VM)

VM hosts SQL server that is used for DW and analytics. VM can be pause only when data are not being processed or queried.

2 VM + Azure services (Hybrid)

VM hosts SQL server used for DW. Analytics is installed on Azure Analysis Services. VM can be paused after processing (most of the time), Azure Analytics can be paused when users are not querying.

1 Use case scenarios

Architecture		
Option	1	2
Architecture	Virtual Machine (VM)	VM + Azure Services (Hybrid)
BI4Dynamics	Desktop client installed on VM	
Available	Yes	
Data Warehouse	SQL server on VM	
Analysis Service	SSAS on VM	Azure SSAS
System requirements		
Data warehouse	VM with SQL server	VM with SQL server
Analytics	SSAS on VM	Azure SSAS
Processing	SSIS on VM	SSIS on VM

2 Scalability

Both options rely on easily scalable cloud resources.

3 Preferred implementation option

Both options are delivering the same results by using slightly different azure resources. The strong influencer may be customers' preference for a specific technology.

Virtual Machine: best for reusing existing resources (hardware and software) in a private cloud

Hybrid: best for economical cautious customers as it maximizes the benefits and minimizes the costs

3 Usage and Costs

1 Daily usage

1 Usage and processing time of data warehouse

SQL server that hosts data warehouse needs to run in order to:

- Load data from Tier 2
- Process data within data warehouse
- Avail data to Analysis Services while Analysis Services is processing

2 Usage and processing time of Analysis services

Analysis services is available during times when users are querying data.

3 Daily usage by implementation option

1. VM is hosting Data warehouse and Analysis Services therefore VM must be running also during querying.
2. In Hybrid option VM is running only when DW is processing. After that, it is paused, and no cost occurs.

SQL resource	Virtual Machine	Hybrid (VM + Azure)
Data Warehouse	10 h	1 h
Analysis Services	10 h	10 h

2 Cost of Azure services

1 Azure VM

Azure VM is not expensive and can be easily created. It needs to be set up (IP, users) to operate right.

<https://azure.microsoft.com/en-us/services/virtual-machines/>

2 Azure Analysis Services

Azure Analysis Services is available in a developer, basic, and standard tiers. The key feature differentiators between the tiers are in the table below:

<https://azure.microsoft.com/en-us/services/analysis-services/>

3 Example of Azure Cost running 100 GB of DFO data

These is an example of monthly costs of Azure services base on:

- Database size: 100 GB
- Year of operation: 2 years
- Monthyl add to database: 4 GB

Phase 1: Using a this VM as a start would usually be fine for 6 – 9 months of operations.

	Size	Key paramether	Cost per hour	Hours per day	Days per Month	Hours per Month	Amount
VM	E8-4as v4	4 cores, 64 GiB	\$ 1,30	1,5	20	30	\$ 39
Analytics	B2	80 QPUS, 16 GB	\$ 0,86	11	20	220	\$ 189
Disk	P15	256 GB					\$ 38
							\$ 266

Phase 2: This VM would be used when DFO data are bigger.

	Size	Key paramether	Cost per hour	Hours per day	Days per Month	Hours per Month	Amount
VM	E8as v4	8 cores, 64 GiB	\$ 1,67	2	21	42	\$ 70
Analytics	S1	100 QPUS, 25 GB	\$ 2,00	11	21	231	\$ 462
Disk	P20	512 GB					\$ 73
							\$ 605

It is very diffictul to predict when the move to Phase 2 will happen. Most expensive resourse is Analysis services. When the instance in Phase 1 is too small to host the data than we have to move to Phase 2 and select bigger instance for Analysis services.

The size of the database in Analysis services is not primary related to number of row. Really not. Analysis Services is using Vertipaq compression and data size depends on:

1. Number of columns
2. Format of columns
3. Cardinality of data (distinc members)
4. Number of rows

4 System requirements

1 System resources

Most common installation will be in Azure.

1 Azure resource

- Azure SQL database

This database is used for restoring bacpac but must be available at all times. After restoring bacpac it is used only when loading data to DW, at that time it should be set to higher tier, so that data load to DW faster. When not used, it should be set to lower tier, only to keep SQL data on the disk fully intact.

- Azure VM (SQL database, SSAS and SSIS), SQL server 2019 Standard edition

This VM is used for data warehouse

- Azure Analysis services

Used for analytics.

2 On-premise resource

On-premise installation setup requires SQL server 2019 Standard edition with SQL database, SSAS and SSIS.

2 Permissions

This information must be provided ahead of installation. All data below are used **as example of field format**.

1 D365 DFO database information

This is Tier2 database on Azure SQL server. It is used to reading tables and columns (data).

- **SQL Server Instance:** abccorp-srv-emea-d365opsprod-49243z432.database.windows.net
- **Database name:** db_d365opsprod_abccorp_ax_20201008_050505_e641
- **Username:** axadm
- **Password:** 2#4398qpo%2

2 D365 DFO tenant informations

This is the tenant information. It is used for accessing Metadata and Financial dimensions.

- **Services hostname URL:** abccorp-uat.sandbox.operations.dynamics.com
- **Tenant Id:** 4893fdsq-554f-84b2-b22c-f2aee1a0111
- **Client app ID:** b6b08c0f-d544-5155-9ert-r4rr79f11de9
- **Client secret key:** _w_Aw_aCR0ce3kSa4S5RZx_aQ.r23a215Ci
- **Username:** bi4dynamics@abccorp.com
- **Password:** 37#ie\$2l1&

3 IP access to D365 DFO database

DW database (SQL server) will connect to Tier2 database with linked object functionality. DW database server must have access to Tier2 server.

- **Whitelist DW server IP:** If DW server is not in the same domain /environment as Tier2 server, then DW server's IP must be whitelisted on Azure SQL server service, so that Azure SQL allow this connection.

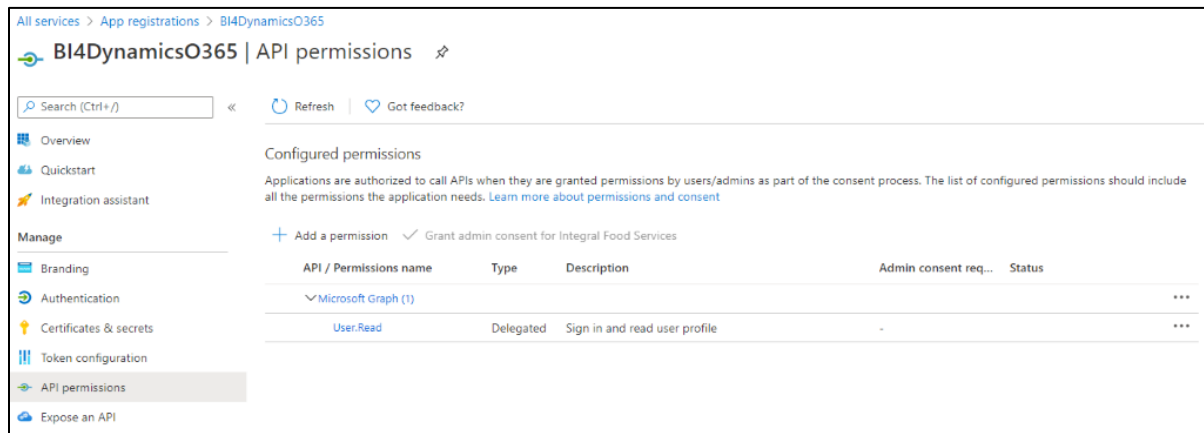
5 Environment set-up

This chapter explains the steps that are done on Azure portal and D365 DFO part before the installation and how to test the connection.

1 Azure portal

1 Register BI4Dynamics as application

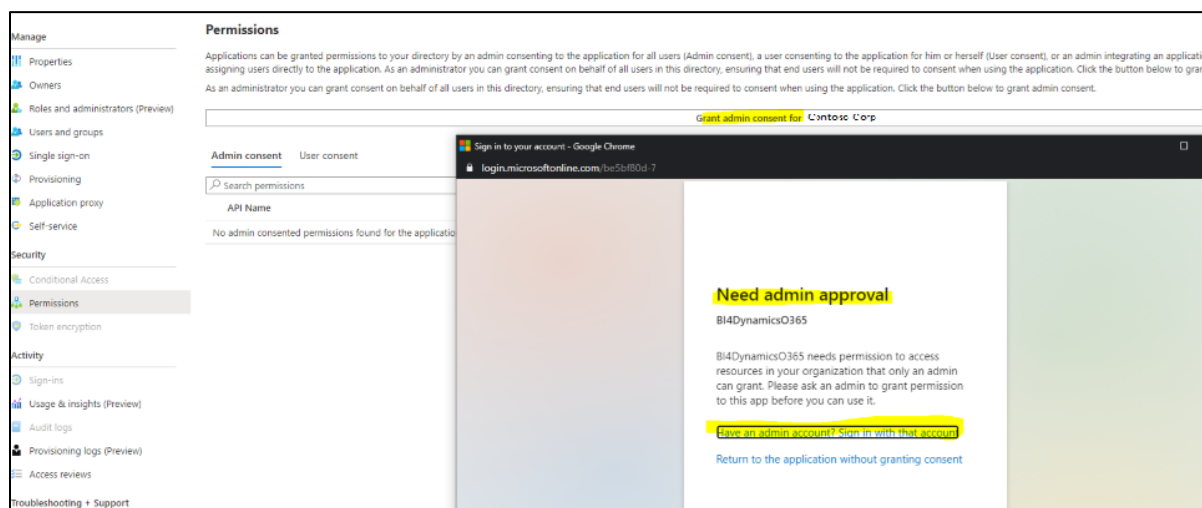
BI4Dynamics application must be registered as application in Azure tenant:



2 Grant tenant-wide admin consent to an application

Grant admin consent in App registration:

1. **Sign-in** to the Azure portal as a Global, Application or Cloud Application Administrator.
2. Select **Azure Active Directory** then **App registrations**.
3. Select the application to which you want to grant tenant-wide admin consent.
4. Select **API permissions** and then click **Grant admin consent**.
5. Carefully review the permissions the application requires.
6. If you agree with the permissions the application requires, grant consent. If not, click **Cancel** or close the window.



2 D365 DFO

1 Register your external application

1. In Finance and Operations apps, go to **System administration > Setup > Azure Active Directory applications**.
2. Select New.
3. Fill in the fields for the new record:
 - In the **Client Id** field, enter the application ID that you registered in Azure AD.
 - In the **Name** field, enter a name for the application.
 - In the **User ID** field, select an appropriate service account user ID. For this example, we have selected the **Admin** user. However, as a better practice, you should provision a dedicated service account that has the correct permissions for the operations that must be performed.

When you've finished, select **Save**.



3 Testing the connection

These information are needed to test connection from BI4Dynamics application to D365FO:

- **Services hostname URL:** abccorp-uat.sandbox.operations.dynamics.com
- **Tenant Id**
- **Client app ID:** information from Azure portal where BI4Dynamics app has been registered.
- **Client secret key:** available from the same registration page
- **Username:** email (from last picture) from within the organisation
- **Password:** password for this user

It is suggested that a temporary use is created for testing purposes and is deleted after testing is successful. Example of this information is provided in previous chapter under **D365 DFO tenant information**