

[MS-DPBACPAC]:

Data-Tier Application Schema and Data Data Portability Overview

Intellectual Property Rights Notice for Open Specifications Documentation

- **Technical Documentation.** Microsoft publishes Open Specifications documentation for protocols, file formats, languages, standards as well as overviews of the interaction among each of these technologies.
- **Copyrights.** This documentation is covered by Microsoft copyrights. Regardless of any other terms that are contained in the terms of use for the Microsoft website that hosts this documentation, you may make copies of it in order to develop implementations of the technologies described in the Open Specifications and may distribute portions of it in your implementations using these technologies or your documentation as necessary to properly document the implementation. You may also distribute in your implementation, with or without modification, any schema, IDL's, or code samples that are included in the documentation. This permission also applies to any documents that are referenced in the Open Specifications.
- **No Trade Secrets.** Microsoft does not claim any trade secret rights in this documentation.
- **Patents.** Microsoft has patents that may cover your implementations of the technologies described in the Open Specifications. Neither this notice nor Microsoft's delivery of the documentation grants any licenses under those or any other Microsoft patents. However, a given Open Specification may be covered by Microsoft [Open Specification Promise](#) or the [Community Promise](#). If you would prefer a written license, or if the technologies described in the Open Specifications are not covered by the Open Specifications Promise or Community Promise, as applicable, patent licenses are available by contacting iplg@microsoft.com.
- **Trademarks.** The names of companies and products contained in this documentation may be covered by trademarks or similar intellectual property rights. This notice does not grant any licenses under those rights. For a list of Microsoft trademarks, visit www.microsoft.com/trademarks.
- **Fictitious Names.** The example companies, organizations, products, domain names, e-mail addresses, logos, people, places, and events depicted in this documentation are fictitious. No association with any real company, organization, product, domain name, email address, logo, person, place, or event is intended or should be inferred.

Reservation of Rights. All other rights are reserved, and this notice does not grant any rights other than specifically described above, whether by implication, estoppel, or otherwise.

Tools. The Open Specifications do not require the use of Microsoft programming tools or programming environments in order for you to develop an implementation. If you have access to Microsoft programming tools and environments you are free to take advantage of them. Certain Open Specifications are intended for use in conjunction with publicly available standard specifications and network programming art, and assumes that the reader either is familiar with the aforementioned material or has immediate access to it.

Revision Summary

Date	Revision History	Revision Class	Comments
7/7/2011	0.1	New	Released new document.
11/3/2011	0.1	None	No changes to the meaning, language, or formatting of the technical content.
1/19/2012	0.1	None	No changes to the meaning, language, or formatting of the technical content.
2/23/2012	0.1	None	No changes to the meaning, language, or formatting of the technical content.
3/27/2012	0.1	None	No changes to the meaning, language, or formatting of the technical content.
5/24/2012	0.1	None	No changes to the meaning, language, or formatting of the technical content.
6/29/2012	0.1	None	No changes to the meaning, language, or formatting of the technical content.
7/16/2012	0.1	None	No changes to the meaning, language, or formatting of the technical content.
10/8/2012	1.0	Major	Updated and revised the technical content.
10/23/2012	1.0	None	No changes to the meaning, language, or formatting of the technical content.
3/26/2013	1.0	None	No changes to the meaning, language, or formatting of the technical content.
6/11/2013	1.0	None	No changes to the meaning, language, or formatting of the technical content.
8/8/2013	1.0	None	No changes to the meaning, language, or formatting of the technical content.
12/5/2013	1.0	None	No changes to the meaning, language, or formatting of the technical content.
2/11/2014	1.0	None	No changes to the meaning, language, or formatting of the technical content.
5/20/2014	1.0	None	No changes to the meaning, language, or formatting of the technical content.
5/10/2016	1.0	None	No changes to the meaning, language, or formatting of the technical content.

Table of Contents

1	Introduction	4
1.1	Glossary	4
1.2	References	5
2	Data Portability Scenarios	6
2.1	Retrieve Data and Schema from .bacpac File	6
2.1.1	Data Description.....	6
2.1.2	Format and Protocol Summary	6
2.1.3	Data Portability Methodology.....	7
2.1.3.1	Preconditions.....	7
2.1.3.2	Versioning.....	7
2.1.3.3	Error Handling	7
2.1.3.4	Coherency Requirements	7
2.1.3.5	Additional Considerations	7
3	Change Tracking.....	8
4	Index.....	9

1 Introduction

The Data-Tier Application Schema and Data Data Portability Overview document provides an overview of exporting and importing data between Microsoft SQL Server and a vendor's application by using a .bacpac file as a portable artifact.

A data-tier application component (DAC) is a self-contained unit of database deployment and management that enables data-tier developers and database administrators (DBAs) to package SQL Server objects, including **database objects** and instance objects, into a single entity called a DAC package (.dacpac or .bacpac file), as specified in [\[MSDN-DACOVERVIEW\]](#). A .dacpac file is a package of XML parts that represent the following:

- The metadata of the data-tier application and SQL Server object, the **schema** of the SQL Server database that the package represents.
- Data from the source representation (project, database, scripts).

The .bacpac file format extends the .dacpac file format to include all table data in addition to schema data.

Both .dacpac and .bacpac files are Open Packaging Conventions (OPC) packages that comply with the OPC specification [\[ECMA-376-2/2\]](#). A .dacpac file can optionally also contain data from a set of user tables defined in the schema. Procedures similar to those defined in this document also apply to .dacpac packages that contain user table data. For more information, see [\[MSDN-DACDeploy\]](#).

This document provides an overview of the data portability scenario to retrieve data and schema from a .bacpac file. In this scenario, a vendor must use the Microsoft Data-Tier Application Framework (DACFx) API [\[MSDN-DACAPI-3\]](#) or SQLPackage.exe to consume the .bacpac file.

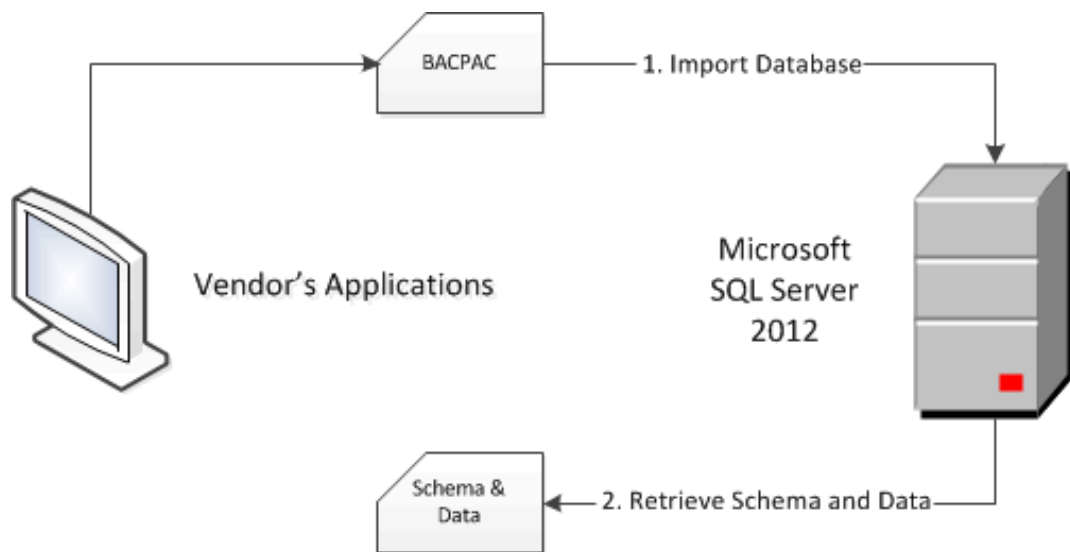


Figure 1: Conceptual overview of .bacpac data portability

A vendor can implement an application by using the DACFx API to create a .bacpac file and import that file into SQL Server or Azure SQL Database. Then, the vendor can retrieve the schema and data as described in section [2.1](#).

1.1 Glossary

This document uses the following terms:

database object: An object such as a table, query, form, report, macro, or module that can be referenced by name in a database, database application, or database project.

schema: The set of attributes and object classes that govern the creation and update of objects.

1.2 References

Links to a document in the Microsoft Open Specifications library point to the correct section in the most recently published version of the referenced document. However, because individual documents in the library are not updated at the same time, the section numbers in the documents may not match. You can confirm the correct section numbering by checking the [Errata](#).

[ECMA-376-2/2] ECMA, "Information technology – Document description and processing languages – Office Open XML File Formats – Part 2: Open Packaging Conventions", 2nd edition, Standard ECMA-376-2, December 2008, <http://www.ecma-international.org/publications/files/ECMA-ST/ECMA-376,%20Second%20Edition,%20Part%202%20-%20Open%20Packaging%20Conventions.zip>

[MSDN-BCPU] Microsoft Corporation, "bcp Utility", [http://msdn.microsoft.com/en-us/library/ms162802\(SQL.105\).aspx](http://msdn.microsoft.com/en-us/library/ms162802(SQL.105).aspx)

[MSDN-CREATEFF] Microsoft Corporation, "Create a Format File (SQL Server)", <http://msdn.microsoft.com/en-us/library/ms191516.aspx>

[MSDN-DACAPI-3] Microsoft Corporation, "Microsoft.SqlServer.Dac Namespace", <http://msdn.microsoft.com/en-us/library/hh753459.aspx>

[MSDN-DACDeploy] Microsoft Corporation, "Deploy a Data-tier Application", <http://msdn.microsoft.com/en-us/library/ee210569.aspx>

[MSDN-DACOVERVIEW] Microsoft Corporation, "Data-tier Applications", <http://msdn.microsoft.com/en-us/library/ee210546.aspx>

[MSDN-DacSvcExc] Microsoft Corporation, "DacServicesException Class", <http://msdn.microsoft.com/en-us/library/microsoft.sqlserver.dac.dacservicesexception.aspx>

[MSDN-DacSvcImport] Microsoft Corporation, "DacServices.ImportBacpac Method", <http://msdn.microsoft.com/en-us/library/hh753310.aspx>

[MSDN-FFIED] Microsoft Corporation, "Format Files for Importing or Exporting Data (SQL Server)", <http://msdn.microsoft.com/en-us/library/ms190393.aspx>

[MSDN-SIOPN] Microsoft Corporation, "System.IO.Packaging Namespace", <http://msdn.microsoft.com/en-us/library/system.io.packaging.aspx>

2 Data Portability Scenarios

2.1 Retrieve Data and Schema from .bacpac File

The retrieve data and schema scenario describes importing a .bacpac file that contains database schema and table data to a Microsoft SQL Server database or an Azure SQL Database, as shown in the following figure.

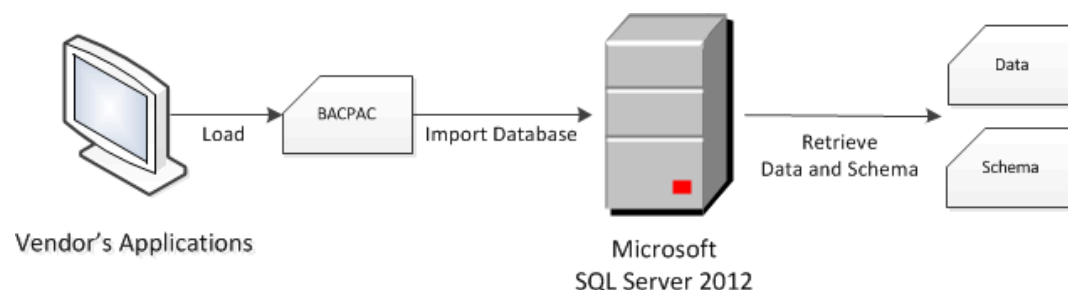


Figure 2: Retrieve data and schema from .bacpac file

2.1.1 Data Description

Customer data

Customer data is a schema representation of a SQL Server database or a SQL database and user data contained within the tables that are included in the package. Customer data is serialized into the .bacpac by using the Bulk Copy Program (BCP) file format [\[MSDN-FFIED\]](#).

Intended user

The intended user is a customer or vendor who can import SQL Server object schema and table data from a .bacpac file to SQL Server or SQL Database and then retrieve the data and schema.

2.1.2 Format and Protocol Summary

The following table provides a comprehensive list of the formats and protocols used in a retrieve data and schema data portability scenario.

Format name	Description	Reference
Data-Tier Application File (BACPAC) Format	The BACPAC file format serves as the packaging format for an exported database that contains database schema and user data.	None.
Microsoft.SqlServer.Dac Namespace	The Microsoft.SqlServer.Dac namespace contains classes that represent DAC Framework objects.	[MSDN-DACAPI-3]
System.IO.Packaging Namespace	The System.IO.Packaging namespace of the .NET Framework provides classes that support storage of multiple data objects in a single container.	[MSDN-SIOPN]
Bulk Copy File Format	The Bulk Copy File Format is used for the data streams contained within the package.	[MSDN-FFIED]

2.1.3 Data Portability Methodology

The data portability methodology describes the packaging and deployment steps to take when using the DACFx API [\[MSDN-DACAPI-3\]](#).

Import a data-tier application

To import a data-tier application, load the .bacpac file, and then import it to a SQL Server database or a SQL database. For more information about the **DacServices.ImportBacpac** method, see [\[MSDN-DacSvcImport\]](#).

Retrieve data and schema

The vendor can then use a variety of methods to retrieve the database schema and user data from the database into the file format desired. This document describes one possible method of doing so, which consists of using the Bulk Copy Program (BCP) Utility [\[MSDN-BCPU\]](#).

1. First, use bcp.exe to create a format file to record the data format as described in [\[MSDN-BCPU\]](#) and [\[MSDN-CREATEFF\]](#). The bcp utility supports XML and other file formats.
2. Then, use bcp.exe to extract table data as per the format file.

The BCP file format is described in further detail in [\[MSDN-FFIED\]](#).

2.1.3.1 Preconditions

The SQL Server user must be a member of the **dbcreator** fixed server role on the SQL Server instance to import the .bacpac file. The Azure SQL Database user must be a member of the **dbmanager** fixed logical server role.

2.1.3.2 Versioning

This version of the retrieve data and schema scenario is applicable to Microsoft SQL Server 2005 Service Pack 2 (SP2), Microsoft SQL Server 2008 Service Pack 1 (SP1), Microsoft SQL Server 2008 R2 Service Pack 1 (SP1), Microsoft SQL Server 2012, and Azure SQL Database.

2.1.3.3 Error Handling

The data-tier application error and exception class is described in [\[MSDN-DacSvcExc\]](#).

2.1.3.4 Coherency Requirements

When importing a .bacpac file to a database, the database must either not exist or be a new, empty database. Otherwise, the import operation will fail.

2.1.3.5 Additional Considerations

There are no additional considerations.

3 Change Tracking

No table of changes is available. The document is either new or has had no changes since its last release.

4 Index

C

[Change tracking](#) 8

G

[Glossary](#) 4

I

[Informative references](#) 5

[Introduction](#) 4

R

[References](#) 5

[Retrieve data and schema scenario](#) 6

T

[Tracking changes](#) 8