



Informatica® PowerExchange for Microsoft  
Azure Data Lake Storage Gen1  
10.5.1

# User Guide

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# Preface

Use the *Informatica® PowerExchange® for Microsoft Azure Data Lake Storage Gen1 User Guide* to learn how to read from or write to Microsoft Azure Data Lake Storage Gen1 by using the Developer tool. Learn to create a connection, develop and run mappings and dynamic mappings in the native environment and in the Hadoop and Databricks environments.

## Informatica Resources

Informatica provides you with a range of product resources through the Informatica Network and other online portals. Use the resources to get the most from your Informatica products and solutions and to learn from other Informatica users and subject matter experts.

### Informatica Network

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- View product availability information.
- Create and review your support cases.
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## Informatica Velocity

Informatica Velocity is a collection of tips and best practices developed by Informatica Professional Services and based on real-world experiences from hundreds of data management projects. Informatica Velocity represents the collective knowledge of Informatica consultants who work with organizations around the world to plan, develop, deploy, and maintain successful data management solutions.

You can find Informatica Velocity resources at <http://velocity.informatica.com>. If you have questions, comments, or ideas about Informatica Velocity, contact Informatica Professional Services at [ips@informatica.com](mailto:ips@informatica.com).

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## Informatica Global Customer Support

You can contact a Global Support Center by telephone or through the Informatica Network.

To find your local Informatica Global Customer Support telephone number, visit the Informatica website at the following link:

<https://www.informatica.com/services-and-training/customer-success-services/contact-us.html>.

To find online support resources on the Informatica Network, visit <https://network.informatica.com> and select the eSupport option.

## CHAPTER 1

# Introduction to PowerExchange for Microsoft Azure Data Lake Storage Gen1

This chapter includes the following topics:

- [PowerExchange for Microsoft Azure Data Lake Storage Gen1 Overview, 7](#)
- [Introduction to Microsoft Azure Data Lake Storage Gen1, 8](#)
- [Administration of Microsoft Azure Data Lake Storage Gen1 Connector, 8](#)

## PowerExchange for Microsoft Azure Data Lake Storage Gen1 Overview

You can use PowerExchange for Microsoft Azure Data Lake Storage Gen1 to connect to Microsoft Azure Data Lake Storage Gen1 from Informatica.

Use PowerExchange for Microsoft Azure Data Lake Storage Gen1 to read data from and write data to Microsoft Azure Data Lake Storage Gen1. You can collate and organize the details from multiple input sources and use PowerExchange for Microsoft Azure Data Lake Storage Gen1 to write data to Microsoft Azure Data Lake Storage Gen1. You can use Microsoft Azure Data Lake Storage Gen1 objects as sources and targets in mappings and dynamic mappings. When you use Microsoft Azure Data Lake Storage Gen1 objects in mappings, you must configure properties specific to Microsoft Azure Data Lake Storage Gen1. You can validate and run mappings in native or Hadoop environments.

Use PowerExchange for Microsoft Azure Data Lake Storage Gen1 to read flat files and the industry-standard file formats, such as Avro, Parquet, and JSON files in the Hadoop environments. You can read and write hierarchical data present in the Avro, Parquet, and JSON files. You can read data from and write data to only uncompressed Avro, Parquet, and JSON files. In addition to the industry-standard file formats, you can also read data from intelligent structure sources on the Spark engine. You can read and write Avro and Parquet files that contain only primitive data types in the native environment.

# Introduction to Microsoft Azure Data Lake Storage Gen1

You can use Microsoft Azure Data Lake Storage Gen1 to store data irrespective of size, structure, and format. Use Microsoft Azure Data Lake Storage Gen1 to process large volumes of data to achieve faster business outcomes.

**The Microsoft Azure Data Lake Storage Gen1 is a combination of following primary services:**

Microsoft Azure Data Lake Storage Gen1: Microsoft Azure Data Lake is an Hadoop Distributed File System (HDFS) compatible data repository that stores structured, semi structured, and unstructured data of your organization in native format. Data scientists and data analysts can use data in the Data Lake to find out specific patterns before you move the analyzed data to a data warehouse.

Azure HDInsight: Azure HDInsight is an Apache Hadoop distributed system that is configured with cloud. HDInsight supports the Hadoop components such as Apache HBase, Apache Spark, and Apache Storm and other technologies under the Hadoop system.

Data Lake Analytics: Data Lake Analytics manages the distributed infrastructure. You can dynamically allocate and de-allocate resources with Microsoft Azure Data Lake Storage Gen1 Analytics so that you can pay for services that you use.

## Administration of Microsoft Azure Data Lake Storage Gen1 Connector

Before you use Microsoft Azure Data Lake Storage Gen1, perform the following tasks:

- Create a Microsoft Azure Data Lake Storage Gen1.
- Authorize users to access the Microsoft Azure Data Lake Storage Gen1 and the directory in the Data Lake Storage Gen1.
- Create an Azure AD web application for service-to-service authentication with Azure Data Lake Storage Gen1. For information on service-to-service authentication of your web application, see, <https://kb.informatica.com/howto/6/Pages/20/512374.aspx>.

**Note:** Ensure that you have superuser privileges to access the folders or files created in the application using Microsoft Azure Data Lake Storage Gen1.



## CHAPTER 2

# PowerExchange for Microsoft Azure Data Lake Storage Gen1 Configuration

This chapter includes the following topics:

- [PowerExchange for Microsoft Azure Data Lake Storage Gen1 Configuration Overview, 9](#)
- [Prerequisites, 9](#)
- [Installing TLS Certificate, 10](#)

## PowerExchange for Microsoft Azure Data Lake Storage Gen1 Configuration Overview

PowerExchange for Microsoft Azure Data Lake Storage Gen1 installs with the Informatica services and clients.

To configure PowerExchange for Microsoft Azure Data Lake Storage Gen1, complete the prerequisites.

## Prerequisites

Before you use PowerExchange for Microsoft Azure Data Lake Storage Gen1, you must complete the following prerequisites:

- Install and configure the Informatica services.
- Install and configure the Developer tool. You can install the Developer tool when you install Informatica clients.
- Create a Data Integration Service and a Model Repository Service in the Informatica domain.
- Verify that a cluster configuration is created in the domain.

- To successfully preview data from a local complex file or run a mapping in the native environment, you must configure the INFA\_PARSER\_HOME property for the Data Integration Service in Informatica Administrator. Perform the following steps to configure the INFA\_PARSER\_HOME property:
  - Log in to Informatica Administrator.
  - Click the Data Integration Service and then click the **Processes** tab on the right pane.
  - Click **Edit** in the **Environment Variables** section.
  - Click **New** to add an environment variable.
  - Enter the name of the environment variable as **INFA\_PARSER\_HOME**.
  - Set the value of the environment variable to the absolute path of the Hadoop directory on the machine that runs the Data Integration Service. For example:  
**INFA\_PARSER\_HOME** = <Informatica installation directory>/services/shared/hadoop/CDH\_6.3

## Configure Databricks Connection Advanced Properties

Verify that a Databricks connection is created in the domain. If you want to read NULL values from or write NULL values to an Azure source, configure the following advanced properties in the Databricks connection:

- infaspark.flatfile.reader.nullValue=True
- infaspark.flatfile.writer.nullValue=True

## Configure Azure Data Lake Storage Gen1 Access in Azure Databricks Cluster

You need to set some Hadoop credential configuration options under Spark Config in your Databricks cluster configuration to access the Azure Data Lake Storage Gen1. Add "spark.hadoop" as a prefix to the Hadoop configuration keys as shown in the following text:

```
spark.hadoop.dfs.adls.oauth2.access.token.provider.type ClientCredential
spark.hadoop.dfs.adls.oauth2.client.id <your-service-client-id>
spark.hadoop.dfs.adls.oauth2.credential <your-service-credentials>
spark.hadoop.dfs.adls.oauth2.refresh.url "https://login.microsoftonline.com/<your-
directory-id>/oauth2/token"
spark.hadoop.dfs.adls.oauth2.access.token.provider
org.apache.hadoop.fs.adls.oauth2.ConfCredentialBasedAccessTokenProvider
```

# Installing TLS Certificate

If the domain is TLS-enabled, download the certificate first and then add the certificate in the trust store.

Perform the following steps from Developer tool host machine:

1. Run the following commands to download the certificates and convert them to PEM format:
 

```
openssl s_client -servername <ADLS Gen1_instance_name>.dfs.core.windows.net -connect
<ADLS Gen1_instance_name>.dfs.core.windows.net:<port number> < /dev/null | openssl x509 -
outform pem > gen1.pem.
```

**Example:** openssl s\_client -servername bswar.dfs.core.windows.net -connect  
 bswar.dfs.core.windows.net:443 < /dev/null | openssl x509 -outform pem > gen1.pem
2. Run the following command to import the certificate in the trust store:
 

```
keytool -import -noprompt -trustcacerts -alias gen1 -file /tmp/test/gen1.pem -keystore
<INFA_HOME>/services/shared/security/infa_truststore.jks
```

## CHAPTER 3

# Microsoft Azure Data Lake Storage Gen1 Connections

This chapter includes the following topics:

- [Microsoft Azure Data Lake Storage Gen1 Connections Overview, 11](#)
- [Microsoft Azure Data Lake Storage Gen1 Connection Properties, 11](#)
- [Creating a Microsoft Azure Data Lake Storage Gen1 Connection, 12](#)

## Microsoft Azure Data Lake Storage Gen1 Connections Overview

Microsoft Azure Data Lake Storage Gen1 connection enables you to read data from or write data to Microsoft Azure Data Lake Storage Gen1.

You can use Microsoft Azure Data Lake Storage Gen1 connections to create data objects and run mappings. The Developer tool uses the connection when you create a data object. The Data Integration Service uses the connection when you run mappings.

You can create a Microsoft Azure Data Lake Storage Gen1 connection from the Developer tool or the Administrator tool. Create and manage connections in the Preferences dialog box or the Connection Explorer view.

## Microsoft Azure Data Lake Storage Gen1 Connection Properties

Use a Microsoft Azure Data Lake Storage Gen1 connection to access a Microsoft Azure Data Lake Storage Gen1.

**Note:** The order of the connection properties might vary depending on the tool where you view them.

You can create and manage a Microsoft Azure Data Lake Storage Gen1 connection in the Administrator tool or the Developer tool. The following table describes the Microsoft Azure Data Lake Storage Gen1 connection properties:

Property	Description
Name	The name of the connection. The name is not case sensitive and must be unique within the domain. You can change this property after you create the connection. The name cannot exceed 128 characters, contain spaces, or contain the following special characters: ~ ` ! \$ % ^ & * ( ) - + = { [ ]   \ : ; " ' < , > . ? /
ID	String that the Data Integration Service uses to identify the connection. The ID is not case sensitive. It must be 255 characters or less and must be unique in the domain. You cannot change this property after you create the connection. Default value is the connection name.
Description	The description of the connection. The description cannot exceed 4,000 characters.
Location	The domain where you want to create the connection.
Type	The connection type. Select Microsoft Azure Data Lake Storage Gen1.

The following table describes the properties for metadata access:

Property	Description
ADLS Account Name	The name of the Microsoft Azure Data Lake Storage Gen1.
ClientID	The ID of your application to complete the OAuth Authentication in the Active Directory.
Client Secret	The client secret key to complete the OAuth Authentication in the Active Directory.
Directory	The Microsoft Azure Data Lake Storage Gen1 directory that you use to read data or write data. The default is root directory.
AuthEndpoint	The OAuth 2.0 token endpoint from where access code is generated based on based on the Client ID and Client secret is completed.

For more information about creating a client ID, client secret, and auth end point, contact the Azure administrator or see Microsoft Azure Data Lake Storage Gen1 documentation.

## Creating a Microsoft Azure Data Lake Storage Gen1 Connection

Create a Microsoft Azure Data Lake Storage Gen1 connection before you create a Microsoft Azure Data Lake Storage Gen1 data object.

1. In the Developer tool, click **Window > Preferences**.
2. Select **Informatica > Connections**.
3. Expand the domain in the **Available Connections**.

4. Select the connection type **File System > Microsoft Azure Data Lake Storage Gen1**, and click **Add**.
5. Enter a connection name and an optional description.
6. Select Microsoft Azure Data Lake Storage Gen1 as the connection type.
7. Click **Next**.
8. Configure the connection properties.
9. Click **Test Connection** to verify the connection to Microsoft Azure Data Lake Storage Gen1.
10. Click **Finish**.

## CHAPTER 4

# PowerExchange for Microsoft Azure Data Lake Storage Gen1 Data Objects

This chapter includes the following topics:

- [Microsoft Azure Data Lake Storage Gen1 Data Object Overview, 14](#)
- [Microsoft Azure Data Lake Storage Gen1 Data Object Properties, 15](#)
- [Microsoft Azure Data Lake Storage Gen1 Data Object Read Operation, 15](#)
- [Microsoft Azure Data Lake Storage Gen1 Data Object Write Operation Properties, 20](#)
- [Importing a Microsoft Azure Data Lake Storage Gen1 Data Object, 25](#)
- [Creating a Microsoft Azure Data Lake Storage Gen1 Object Read or Write Operation, 26](#)
- [Creating a Microsoft Azure Data Lake Storage Gen1 Target, 26](#)

## Microsoft Azure Data Lake Storage Gen1 Data Object Overview

A Microsoft Azure Data Lake Storage Gen1 data object is a physical data object that represents Microsoft Azure Data Lake Storage Gen1 table as a source or target. A Microsoft Azure Data Lake Storage Gen1 data object is the representation of data that is based on a Microsoft Azure Data Lake Storage Gen1 object. You can configure the data object read and write operation properties that determine how data can be read from Microsoft Azure Data Lake Storage Gen1 or loaded to Microsoft Azure Data Lake Storage Gen1.

To read data from the Microsoft Azure Data Lake Storage Gen1, create a data object read operation based on the Microsoft Azure Data Lake Storage Gen1 data object. Configure the read operation properties to determine how the Data Integration Service must read data from the Microsoft Azure Data Lake Storage Gen1 table. Add the read operation as a Read transformation in a mapping.

To write data to the Microsoft Azure Data Lake Storage Gen1, create a data object write operation based on the Microsoft Azure Data Lake Storage Gen1 data object. Configure the write operation properties to determine how the Data Integration Service must write data to the Microsoft Azure Data Lake Storage Gen1. Add the write operation as a Write transformation in a mapping.

# Microsoft Azure Data Lake Storage Gen1 Data Object Properties

The Microsoft Azure Data Lake Storage Gen1 Overview view displays general information about the Microsoft Azure Data Lake Storage Gen1 data object and the object properties that apply to the Microsoft Azure Data Lake Storage Gen1 table you import.

## General Properties

You can configure the following properties for a Microsoft Azure Data Lake Storage Gen1 data object:

- Name. Name of the Microsoft Azure Data Lake Storage Gen1 data object.
- Description. Description of the Microsoft Azure Data Lake Storage Gen1 data object.
- Connection. Name of the Microsoft Azure Data Lake Storage Gen1 connection.

# Microsoft Azure Data Lake Storage Gen1 Data Object Read Operation

The Data Integration Service reads data from a Microsoft Azure Data Lake Storage Gen1 table based on the data object read operation properties that you specify.

When you create a data object read operation, the Developer tool creates a Source transformation and an Output transformation.

The Source transformation represents the data that the Data Integration Service reads from the Microsoft Azure Data Lake Storage Gen1 table.

The Output transformation represents the data that the Data Integration Service passes into the mapping pipeline.

## Directory Source in Microsoft Azure Data Lake Storage Gen1 Sources

You can select the type of source from which you want to read data.

You can select the following type of sources from the **Source Type** option under the advanced properties for a Microsoft Azure Data Lake Storage Gen1 data object read operation:

- File
- Directory

**Note:** To read compressed .csv files, the content type of the Microsoft Azure Data Lake Storage Gen1 source must be `application/x-gzip` for both File and Directory source types.

Use the following rules and guidelines to select **Directory** as the source type:

- All the source files in the directory must contain the same metadata.
- The directory read is not applicable to the binary file type.
- All the files must have data in the same format. For example, delimiters, header fields, and escape characters must be same.

- All the files under a specified directory are parsed. The files under subdirectories are not parsed.
- The connector does not perform any validation if there are multiple file formats in the directory you select and might result into errors.

## Microsoft Azure Data Lake Storage Gen1 Object Read Operation Properties

The Data Integration Service reads data from a Microsoft Azure Data Lake Storage Gen1 object based on the data object read operation. The Developer tool displays the data object read operation properties of the Microsoft Azure Data Lake Storage Gen1 data object in the Data Object Operation view.

You can view or configure the data object read operation from the source and output properties.

### Source properties

Represents data that the Data Integration Service reads from the Microsoft Azure Data Lake Storage Gen1 object. Select the source properties to view data, such as the name and description of the Microsoft Azure Data Lake Storage Gen1 object, the ports, and advanced properties.

### Output properties

Represents data that the Data Integration Service passes into the mapping pipeline. Select the output properties to edit the port properties of the data object read operation. You can also use the Tracing Level advanced property to set the amount of detail that the Data Integration Service writes in the log.

## Source Properties of the Data Object Read Operation

When you create a data object, the source properties populate based on the Microsoft Azure Data Lake Storage Gen1 object that you add. The source properties of the data object read operation include general, column, and advanced properties that apply to the Microsoft Azure Data Lake Storage Gen1 object.

You can view the source properties of the data object read operation from the **General**, **Column**, and **Advanced** tabs.

## General Properties - Source

The following table describes the source general properties of the data object read operation:

Property	Description
Name	Name of the Microsoft Azure Data Lake Storage Gen1 source object.
Description	Description of the data object read operation.



## Ports Properties - Source

The column properties display the data types, precision, and scale of the source property in the data object read operation.

The following table describes the source column properties of the data object read operation:

Property	Description
Name	Name of the column.
Type	Native data type of the column.
Precision	Maximum number of significant digits for Numeric data types, or maximum number of characters for String data types. For numeric data types, precision includes scale.
Scale	Maximum number of digits after the decimal point for numeric values.
Description	Description of the column.

## Advanced Properties - Source

You can use the advanced properties to specify data object read operation properties to read data from a Microsoft Azure Data Lake Storage Gen1 server.

The following table describes the Advanced source column properties of the data object read operation:

Property	Description
Directory Path Override	Overrides the default directory path.
File Name Override	Overrides the file name.
Source Type	Select the type of source from which you want to read data. You can select the following source types: <ul style="list-style-type: none"><li>- File</li><li>- Directory</li></ul> Default is File. The directory read is not applicable to the binary file type. You can read compressed .csv files in the native environment.

## Schema Properties

The Developer tool displays schema properties for intelligent structure model, Avro, JSON, and Parquet complex file sources in the **Data Object Operations Details** window.

The following table describes the schema properties that you configure for the complex file sources:

Property	Description
Column Name	Displays the name of the column.
Column Type	Displays the format of the column.

Property	Description
Enable Column Projection	Displays the column details of the complex files sources.
Schema Format	<p>Displays the schema format that you selected while creating the complex file data object. You can change the schema format. You can also parameterize the schema format.</p> <p>You can select one of the following options:</p> <ul style="list-style-type: none"> <li>- Flat</li> <li>- Avro</li> <li>- JSON</li> <li>- ORC</li> <li>- Parquet</li> <li>- Intelligent Structure Model</li> </ul> <p>When you read an empty JSON file, the Data Integration Service does not generate headers in the target data.</p> <p>You can change the complex file format without losing the column metadata even after you configure the schema properties for another complex file format.</p> <p><b>Note:</b> You can switch from one schema format to another only once. If you change the schema format more than once, you might lose the original datatypes.</p>
Schema	<p>Displays the schema associated with the complex file. You can select a different schema. You can parameterize the schema or the schema path.</p> <p>To parameterize the schema path, obtain the path from the server. To parameterize schema or schema path for flat files, provide the schema in the same format in which the flat file is imported in the Developer Client.</p> <p>When you use Refresh Schema for the source or target in a mapping and also, parameterize the schema, the parameterized schema takes precedence over the refresh schema.</p> <p><b>Note:</b> If you disable the column projection, the schema associated with the complex file is removed. If you want to associate schema again with the complex file, enable the column projection and select schema.</p>
Schema Properties	Applicable only to flat files.
Column Mapping	<p>Displays the mapping between input and output ports.</p> <p><b>Note:</b> If you disable the column projection, the mapping between input and output ports is removed. If you want to map the input and output ports, enable the column projection and click <b>Select Schema</b> to associate a schema to the complex file.</p>

## Flat File Schema Properties

You can configure format properties for a flat file that is delimited.

The following table describes the file format and column format properties that you configure for a flat file:

Property	Description
Maximum row to preview	Number of rows to show in data preview. Default is 0.
Delimiters	Character used to separate columns of data. Default is comma. If you enter a delimiter that is the same as the escape character or the text qualifier, you might receive unexpected results. You cannot specify a multibyte character as a delimiter.

Property	Description
Text Qualifier	Quote character that defines the boundaries of text strings. Default is double quotes. If you select a quote character, the Developer tool ignores delimiters within pairs of quotes.
Qualifier Mode	Qualifier behavior for the source object. You can select one of the following options: <ul style="list-style-type: none"> <li>- <b>Minimal</b>. Default mode. Applies qualifier to data that have a delimiter value or a special character present in the data. Otherwise, the Data Integration Service does not apply the qualifier.</li> <li>- <b>All</b>. Applies qualifier to all data.</li> </ul>
Row Delimiter	Character used to separate the rows of data. You must select the default value, <code>\012 LF (\n)</code> .
Header Line Number	Line number that you want to use as the header. You can also read a data from a file that does not have a header. To read data from a file with no header, specify the value of the Header Line Number field as 0.
First Data Row	Line number from where you want the Data Integration Service to read data.
Escape Character	Character immediately preceding a column delimiter character embedded in an unquoted string, or immediately preceding the quote character in a quoted string. When you specify an escape character, the Data Integration Service reads the delimiter character as a regular character. Default is backslash ( <code>\</code> ).
Retain Escape Character in Data	Not applicable.

**Note:** If you update the flat file format properties during the data object import and want to see the updated format properties in Data Preview, you must parse the flat file again by selecting the **Schema** property.

### Parameterize Column Format Properties

You can parameterize the column format properties for flat files in a parameter file. The following table describes property strings that you can use in a parameter file:

Property	Value
maxRowsToPreview	A positive integer value. Default is 0.
delimiter	Specify the octal code for the character. Preface the octal code with a backslash ( <code>\</code> ). Specify the following values for the given delimiters: <ul style="list-style-type: none"> <li>- <code>\011 TAB</code> for Tab</li> <li>- <code>;</code> for semicolon</li> <li>- <code>,</code> for comma</li> <li>- <code>\040 SP</code> for space</li> </ul> Default is comma. You cannot specify a multibyte character as a delimiter.
textQualifier	Specify the following string values: <ul style="list-style-type: none"> <li>- <code>SINGLE_QUOTES</code> for <code>'</code></li> <li>- <code>DOUBLE_QUOTES</code> for <code>"</code></li> <li>- <code>NO_QUOTES</code></li> </ul> Default is double quotes.

Property	Value
importColumnFromFirstLine	True or false. Default is true.
rowDelimiter	Default value, \012 LF (\n).
escapeCharacter	A string value. Default is \.

### A Sample JSON Parameter File

```
{ "maxRowsToPreview": 10, "delimiter": ";", "textQualifier": "SINGLE_QUOTES",
  "importColumnFromFirstLine":true, "escapeCharacter" : "-" }
```

## Microsoft Azure Data Lake Storage Gen1 Data Object Write Operation Properties

The Data Integration Service writes data to a Microsoft Azure Data Lake Storage Gen1 object based on the data object write operation. The Developer tool displays the data object write operation properties for the Microsoft Azure Data Lake Storage Gen1 data object in the Data Object Operation section.

You can view the data object write operation from the Input and Target properties.

### Input properties

Represent data that the Data Integration Service reads from a Microsoft Azure Data Lake Storage Gen1 directory server. Select the input properties to edit the port properties and specify the advanced properties of the data object write operation.

### Target properties

Represent data that the Data Integration Service writes to Microsoft Azure Data Lake Storage Gen1. Select the target properties to view data, such as the name and description of the Microsoft Azure Data Lake Storage Gen1 object.

## Input Properties of the Data Object Write Operation

Input properties represent data that the Data Integration Service writes to a Microsoft Azure Data Lake Storage Gen1 directory server. Select the input properties to edit the port properties of the data object write operation. You can also specify advanced data object write operation properties to write data to Microsoft Azure Data Lake Storage Gen1 objects.

The input properties of the data object write operation include general properties that apply to the data object write operation. Input properties also include port, source, and advanced properties that apply to the data object write operation.

You can view and change the input properties of the data object write operation from the **General**, **Ports**, **Targets**, **run-time**, and **Advanced** tabs.

## Ports Properties - Input Write

The input ports properties list the data types, precision, and scale of the data object write operation.

The following table describes the input ports properties that you must configure in the data object write operation:

Property	Description
Name	The name of the port.
Type	The data type of the port.
Precision	The maximum number of significant digits for numeric data types, or maximum number of characters for string data types. For numeric data types, precision includes scale.
Detail	The detail of the data type.
Scale	The maximum number of digits after the decimal point for numeric values.
Description	The description of the port.

## Run-time Properties

The run-time properties display the name of the connection used for write transformation.

The following table describes the run-time properties that you configure for a Microsoft Azure Data Lake Storage Gen1 write operation:

Property	Description
Connection	Name of the Microsoft Azure Data Lake Storage Gen1 connection.

## Advanced Properties - Target

You can use the advanced properties to specify data object write operation properties to write data to a Microsoft Azure Data Lake Storage Gen1 server.

The following table describes the advanced properties that you configure for a Microsoft Azure Data Lake Storage Gen1 write operation:

Property	Description
Tracing Level	By default, the tracing level for every transformation is Normal. Change the tracing level to a Verbose setting when you need to troubleshoot a transformation that is not behaving as expected. Set the tracing level to Terse when you want the minimum amount of detail to appear in the log.
Maintain row order	Not applicable
Directory Path Override	Overrides the default directory path.
File Name Override	Overrides the file name.

Property	Description
Compress Newly Created File	Enables compression. Applicable to the .csv files in the native environment.
If file exists	If the target exists, overwrites or appends the data to the existing file. You can also configure the mapping to fail if the target already exists. Append is applicable to .csv files in the native environment.

## Schema Properties

The Developer tool displays schema properties for flat files and complex file targets in the **Data Object Operations Details** window.

The following table describes the schema properties that you configure for flat files and complex file targets:

Property	Description
Column Name	Displays the name of the column.
Column Type	Displays the format of the column.
Enable Column Projection	Displays the column details of the complex files sources.
Schema Format	<p>Displays the schema format that you selected while creating the complex file data object. You can change the schema format. You can also parameterize the schema format.</p> <p>You can select one of the following options:</p> <ul style="list-style-type: none"> <li>- Flat</li> <li>- Avro</li> <li>- JSON</li> <li>- ORC</li> <li>- Parquet</li> </ul> <p>You can change the complex file format without losing the column metadata even after you configure the column projection properties for another complex file format.</p> <p><b>Note:</b> You can switch from one schema format to another only once. If you change the schema format more than once, you might lose the original datatypes.</p>
Schema	<p>Displays the schema associated with the complex file. You can select a different schema. You can parameterize the schema or the schema path.</p> <p>To parameterize the schema path, obtain the path from the server.</p> <p>When you use Refresh Schema for the source or target in a mapping and also, parameterize the schema, the parameterized schema takes precedence over the refresh schema.</p> <p><b>Note:</b> If you disable the column projection, the schema associated with the complex file is removed. If you want to associate schema again with the complex file, enable the column projection and select schema.</p>
Schema Properties	Applicable only to flat files.
Column Mapping	<p>Displays the mapping between input and output ports.</p> <p><b>Note:</b> If you disable the column projection, the mapping between input and output ports is removed. If you want to map the input and output ports, enable the column projection and click <b>Select Schema</b> to associate a schema to the complex file.</p>

## Flat File Schema Properties

You can configure format properties for a flat file that is delimited.

The following table describes the file format and column format properties that you configure for a flat file:

Property	Description
Maximum row to preview	Number of rows to show in data preview. Default is 0.
Delimiters	Character used to separate columns of data. Default is comma. If you enter a delimiter that is the same as the escape character or the text qualifier, you might receive unexpected results. You cannot specify a multibyte character as a delimiter.
Text Qualifier	Quote character that defines the boundaries of text strings. Default is double quotes. If you select a quote character, the Developer tool ignores delimiters within pairs of quotes.
Qualifier Mode	Qualifier behavior for the target object. You can select one of the following options: <ul style="list-style-type: none"><li>- <b>Minimal</b>. Applies the qualifier to data that contains either a delimiter value or a special character. Otherwise, the Data Integration Service does not apply the qualifier.</li><li>- <b>All</b>. Applies qualifier to all data.</li></ul> Default is minimal.
Row Delimiter	Character used to separate the rows of data. The default value is <code>\012 LF (\n)</code> .
Target Header	Indicates whether you want to write data with or without a header.
Escape Character	Character immediately preceding a column delimiter character embedded in an unquoted string, or immediately preceding the quote character in a quoted string. When you specify an escape character, the Data Integration Service reads the delimiter character as a regular character. Default is backslash (\).
Retain Escape Character in Data	Not applicable.

**Note:** If you update the flat file format properties during the data object import and want to see the updated format properties in Data Preview, you must parse the flat file again by selecting the **Schema** property.

## Parameterize Column Format Properties

You can parameterize the column format properties for flat files in a parameter file. The following table describes property strings that you can use in a parameter file:

Property	Value
maxRowsToPreview	A positive integer value. Default is 0.
delimiter	Specify the octal code for the character. Preface the octal code with a backslash (\). Specify the following values for the given delimiters: <ul style="list-style-type: none"><li>- \011 TAB for Tab</li><li>- ; for semicolon</li><li>- , for comma</li><li>- \040 SP for space</li></ul> Default is comma. You cannot specify a multibyte character as a delimiter
textQualifier	Specify the following string values: <ul style="list-style-type: none"><li>- SINGLE_QUOTES for '</li><li>- DOUBLE_QUOTES for "</li><li>- NO_QUOTES</li></ul> Default is double quotes.
rowDelimiter	Default value, \012 LF (\n).
escapeCharacter	A string value. Default is \.

## A Sample JSON Parameter File

```
{ "maxRowsToPreview": 10, "delimiter": ";", "textQualifier": "SINGLE_QUOTES",  
  "escapeCharacter" : "-" }
```

## Rules and guidelines for writing to a flat file target

Consider the following rules when you run a mapping to write data to a flat file in the native environment or on the Spark engine:

- For a mapping that runs on the Spark engine, the first row of the header in the flat file contains an additional # symbol. For example, the header `ID_Char` appears as `#ID_Char`.
- For a mapping that runs in the native environment, the header in the flat file does not contain an additional # symbol. For example, the header `ID_Char` appears as `ID_Char`.
- For a mapping that runs on the Spark engine, the double quotes text qualifier is honored. For example, the column name `abcd` with the double quotes text qualifier appears as `"abcd"`.
- For a mapping that runs in the native environment, the double quotes text qualifier is not honored. For example, the column name `abcd` with the double quotes text qualifier appears as `abcd`.



# Importing a Microsoft Azure Data Lake Storage Gen1 Data Object

Import a Microsoft Azure Data Lake Storage Gen1 data object to add to a mapping.

1. Select a project or folder in the **Object Explorer** view.
2. Click **File > New > Data Object**.
3. Select **Microsoft Azure Data Lake Storage Gen1 Data Object** and click **Next**.  
The **Microsoft Azure Data Lake Storage Gen1 Data Object** dialog box appears.
4. Enter a name for the data object.
5. In the **Resource Format** list, select any of the following formats:
  - Intelligent Structure Model: to read any format that an intelligent structure parses.
  - Binary: to read and write any resource format.
  - Flat: to read and write delimited resources.
  - Avro: to read and write Avro resources.
  - Json: to read and write JSON resources.
  - Parquet: to read and write Parquet resources.

**Note:** Intelligent structure model and JSON formats are supported only on the Spark engine. For a data object with an intelligent structure model, create a read operation. You cannot use a write transformation for a data object with an intelligent structure model in a mapping. Avro and Parquet are supported in the native and Hadoop environments.

6. Click **Browse** next to the **Location** option and select the target project or folder.
7. Click **Browse** next to the **Connection** option and select the Microsoft Azure Data Lake Storage Gen1 connection from which you want to import the Microsoft Azure Data Lake Storage Gen1 resource metadata.
8. To add a resource, click **Add** next to the **Selected Resources** option.  
The **Add Resource** dialog box appears.
9. From the Package Explorer, select a naming context from which you want to import the schema.
10. You can Perform one of the following tasks to import an Microsoft Azure Data Lake Storage Gen1 table, and then click **OK**:
  - Navigate to the Microsoft Azure Data Lake Storage Gen1 table that you want to import.
  - Search for the Microsoft Azure Data Lake Storage Gen1 table, enter the name of the Microsoft Azure Data Lake Storage Gen1 table entity that you want to add and click **OK**.
11. Click **Finish**.  
The data object appears under Data Objects in the project or folder in the **Object Explorer** view.

# Creating a Microsoft Azure Data Lake Storage Gen1 Object Read or Write Operation

You can add a Microsoft Azure Data Lake Storage Gen1 data object read or write operation to a mapping or mapplet as a source. You can create the data object read or write operation for one or more Microsoft Azure Data Lake Storage Gen1 data objects.

Before you create a Microsoft Azure Data Lake Storage Gen1 data object read or write operation, you must create at least one Microsoft Azure Data Lake Storage Gen1 data object.

1. Select the data object in the Object Explorer view.
2. Right-click and select **New > Data Object Operation**.  
The **Data Object Operation** dialog box appears.
3. Enter a name for the data object read or write operation.
4. Select **Read** or **Write** as the type of data object operation.
5. Click **Add**.  
The **Select Resources** dialog box appears.
6. Select the Microsoft Azure Data Lake Storage Gen1 object for which you want to create the data object read or write operation and click **OK**.
7. Click **Finish**.

The Developer tool creates the data object read or write operation for the selected data object.

# Creating a Microsoft Azure Data Lake Storage Gen1 Target

You can create a Microsoft Azure Data Lake Storage Gen1 target using the **Create Target** option.

1. Select a project or folder in the **Object Explorer** view.
2. Select a source or a transformation in the mapping.
3. Right-click the Source transformation and select **Create Target**.  
The **Create Target** dialog box appears.
4. Select **Others** and then select **adlsv2** data object from the list in the **Data Object Type** section.
5. Click **OK**.  
The **New adlsv2 Data Object** dialog box appears.
6. Enter a name for the data object.
7. In the **Resource Format** list, select any of the following formats to create the target type:
  - Avro
  - Flat
  - JSON
  - Parquet
8. Click **Finish**.

The new target appears under the **Physical Data Objects** category in the project or folder in the **Object Explorer** view.

## Rules and Guidelines for Microsoft Azure Data Lake Storage Gen1 Target Data Object

Use the following rules and guidelines when you create a new Microsoft Azure Data Lake Storage Gen1 target:

- You must specify a connection for the newly created Microsoft Azure Data Lake Storage Gen1 target in the **Connection** field to run a mapping.
- When you write an Avro, JSON, or Parquet file using the **Create Target** option, you cannot provide a Null data type.
- When you select a flat resource format that contains different data types and select the **Create Target** option to create a Microsoft Azure Data Lake Storage Gen1 target, the Data Integration Service creates string ports for all the data types with a precision of 256 characters.
- When you select a flat resource format to create a Microsoft Azure Data Lake Storage Gen1 target, the Data Integration Service maps all the data types in the source file to the String data type in the target file. You must manually map the data types in the source and target files.
- For a newly created Microsoft Azure Data Lake Storage Gen1 target, the Data Integration Service considers the value of the folder path that you specify in the **Directory** connection property and file name from the **Native Name** property in the Microsoft Azure Data Lake Storage Gen1 data object details. Provide a directory path and file name in the Microsoft Azure Data Lake Storage Gen1 data object read and write advanced properties to overwrite the values.
- When you use a flat resource format to create a target, the Data Integration Service considers the following values for the formatting options:

Formatting Options	Values
Delimiters	Comma (,)
Text Qualifier	No quotes
Import Column Names From First Line	Generates header
Row Delimiter	Backslash with a character n (\n)
Escape Character	Empty

If you want to configure the formatting options, you must manually edit the projected columns.

## CHAPTER 5

# Microsoft Azure Data Lake Storage Gen1 Mappings

This chapter includes the following topics:

- [Microsoft Azure Data Lake Storage Gen1 Mapping Overview, 28](#)
- [Mapping Validation and Run-time Environments, 29](#)
- [Microsoft Azure Data Lake Storage Gen1 Mapping Example, 29](#)
- [Microsoft Azure Data Lake Storage Gen1 Dynamic Mapping Overview, 30](#)
- [Microsoft Azure Data Lake Storage Gen1 Dynamic Mapping Example, 32](#)

## Microsoft Azure Data Lake Storage Gen1 Mapping Overview

After you create the Microsoft Azure Data Lake Storage Gen1 data object with a Microsoft Azure Data Lake Storage Gen1 connection, you can develop a mapping. You can define the following types of objects in the mapping:

- A Read transformation of the Microsoft Azure Data Lake Storage Gen1 data object to read data from Microsoft Azure Data Lake Storage Gen1.
- A Write transformation of the Microsoft Azure Data Lake Storage Gen1 data object to write data to Microsoft Azure Data Lake Storage Gen1.

Validate and run the mapping. You can deploy the mapping and run it or add the mapping to a Mapping task in a workflow. You cannot define a Lookup transformation of the Microsoft Azure Data Lake Storage Gen1 data object.

**Note:** If you use multiple connections in a mapping, verify that all connections point to the same Microsoft Azure Data Lake Storage Gen1. If you run a mapping on the HDInsight cluster that uses Microsoft Azure Data Lake Storage Gen1 file system, the Microsoft Azure Data Lake Storage Gen1 connector must point to the same Microsoft Azure Data Lake Storage Gen1.

When you read data from Microsoft Azure Data Lake Storage Gen1 and terminate the mapping, the Integration Service continues to download the entire data set and then, deletes the data set. This might take a long time based on the size of the data set.

# Mapping Validation and Run-time Environments

You can validate and run mappings in the native environment or in a non-native environment, such as Hadoop or Databricks.

When you validate a mapping, you can validate it against one or all of the engines. The Developer tool returns validation messages for each engine.

When you run a mapping, you can choose to run the mapping in the native environment or in a non-native environment, such as Hadoop or Databricks. Configure the run-time environment in the Developer tool to optimize mapping performance and process data that is greater than 10 terabytes. When you run mappings in the native environment, the Data Integration Service processes and runs the mapping. When you run mappings in a non-native environment, the Data Integration Service pushes the processing to a compute cluster, such as Hadoop or Databricks.

You can run standalone mappings, mappings that are a part of a workflow in a non-native environment. When you select the Hadoop environment, the Data Integration Service pushes the mapping logic to the Spark engine.

When you select the Databricks environment, the Integration Service pushes the mapping logic to the Databricks Spark engine, the Apache Spark engine packaged for Databricks.

## Microsoft Azure Data Lake Storage Gen1 Mapping Example

You work as a data analyst for a large financial enterprise. The enterprise performs risk management, fraud detection, and other analysis with Microsoft Azure Data Lake Analytics. You need to write the data to Microsoft Azure Data Lake Storage Gen1 to perform the analytics. Create a mapping to read data from a flat file source and write data to Microsoft Azure Data Lake Storage Gen1. After the data is available in the Microsoft Azure Data Lake Storage Gen1, you can perform the data analytics.

You can use the following objects in a Microsoft Azure Data Lake Storage Gen1 mapping:

### **Flat file input**

The input file is a flat file that contains the customer names and other details about customers.

Create a flat file data object. Configure the flat file connection and specify the flat file that contains the customer data as a resource for the data object. Drag the data object into a mapping as a read data object.

### **Transformations**

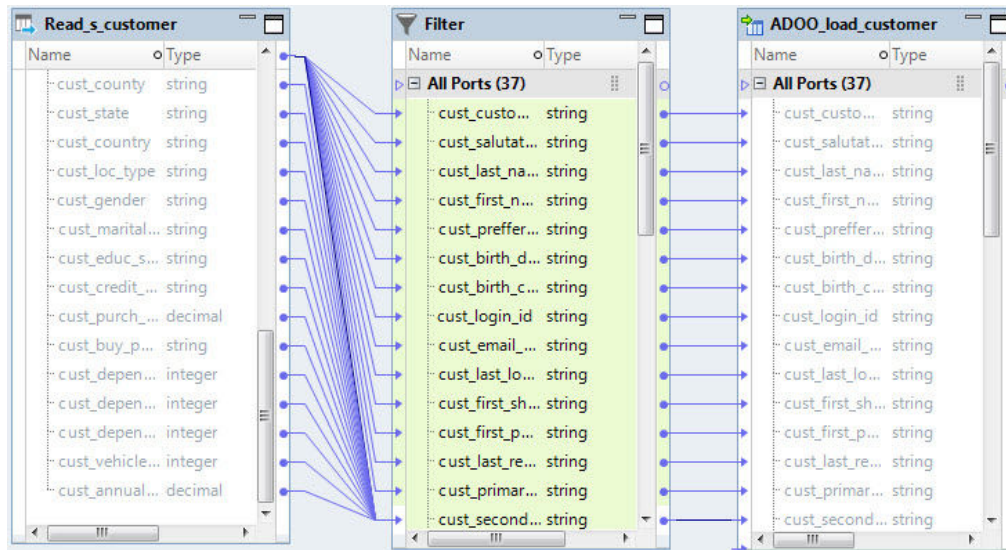
Add Filter transformation to get customer data in a particular region.

The Filter transformation filters the source data based on the value you specify for the region ID column. The Data Integration Service returns the rows that meet the filter condition.

### **Microsoft Azure Data Lake Store output**

Create a Microsoft Azure Data Lake Storage Gen1 data object write operation. Configure the Microsoft Azure Data Lake Store connection and specify the Microsoft Azure Data Lake Storage Gen1 object as a target for the data object. Drag the data object into a mapping as a target data object.

The following image shows the Microsoft Azure Data Lake Storage Gen1 mapping example:



When you run the mapping, the customer records are read from the flat file and written to the Microsoft Azure Data Lake Storage Gen1 table.

## Microsoft Azure Data Lake Storage Gen1 Dynamic Mapping Overview

You can use Microsoft Azure Data Lake Storage Gen1 data objects as dynamic sources and targets in a mapping.

Use the Microsoft Azure Data Lake Storage Gen1 dynamic mapping to accommodate changes to source, target, and transformation logics at run time. You can use a Microsoft Azure Data Lake Storage Gen1 dynamic mapping to manage frequent schema or metadata changes or to reuse the mapping logic for data sources with different schemas. Configure rules, parameters, and general transformation properties to create the dynamic mapping.

If the data source for a source or target changes, you can configure a mapping to dynamically get metadata changes at runtime. If a source changes, you can configure the Read transformation to accommodate changes. If a target changes, you can configure the Write transformation accommodate target changes.

You do not need to manually synchronize the data object and update each transformation before you run the mapping again. The Data Integration Service dynamically determine transformation ports, transformation logic in the ports, and the port links within the mapping.

There are the two options available to enable a mapping to run dynamically. You can select one of the following options to enable the dynamic mapping:

- In the **Data Object** tab of the data object read or write operation, select the **At runtime, get data object columns from data source** option when you create a mapping.  
When you enable the dynamic mapping using this option, you can refresh the source and target schemas at the runtime.
- In the **Ports** tab of the data object write operation, select the value of the **Columns defined by** property as **Mapping Flow** when you configure the data object write operation properties.

**Note:** Dynamic mapping is applicable when you run the mapping in the native environment, on the Spark engine, or on the Databricks Spark engine. When you create a dynamic mapping to read multiple files from a directory and override the directory, verify that the override directory contains a source file with the same name as the imported object. Else, the mapping fails.

For information about dynamic mappings, see the *Informatica Developer Mapping Guide*.

## Refresh Schema

You can refresh the source or target schema at the runtime when you enable a mapping to run dynamically. You can refresh the imported metadata before you run the dynamic mapping.

You can enable a mapping to run dynamically using the **At runtime, get data object columns from data source** option in the **Data Object** tab of the Read and Write transformations when you create a mapping.

When you add or override the metadata dynamically, you can include all the existing source and target objects in a single mapping and run the mapping. You do not have to change the source schema to update the data objects and mappings manually to incorporate all the new changes in the mapping.

You can use the mapping template rules to tune the behavior of the execution of such pipeline mapping.

When the Source or Target transformation contains updated ports such as changes in the port names, data types, precision, or scale, the Data Integration Service fetches the updated ports and runs the mapping dynamically. You must ensure that at least one of the column name in the source or target file is the same as before refreshing the schema to run the dynamic mapping successfully.

Even though the original order of the source or target ports in the file changes, the Data Integration Service displays the original order of the ports in the file when you refresh the schemas at runtime.

If there are more columns in the source file as compared to the target file, the Data Integration Service does not map the extra column to the target file and loads null data for all the unmapped columns in the target file.

If the Source transformation contains updated columns that do not match the Target transformation, the Data Integration Service does not link the new ports by default when you refresh the source or target schema. You must create a run-time link between the transformations to link ports at run time based on a parameter or link policy in the **Run-time Linking** tab and update the target schema manually. For information about run-time linking, see the *Informatica Developer Mapping Guide*.

**Note:** When you refresh a schema of a flat file, the Data Integration Service writes all data types as String data types.

## Mapping Flow

You can add all the Source transformation or transformation ports to the target dynamically when enable a mapping to run dynamically using the **Mapping Flow** option. You can then use the dynamic ports in the Write transformation.

When you select the **Mapping Flow** option, the Data Integration Service allows the Target transformation to override ports of the Write transformation with all the updated incoming ports from the pipeline mapping and loads the target file with the ports at runtime.

The Data Integration Service creates the target files dynamically based on the metadata of the incoming ports from the pipeline mapping.

To enable a dynamic mapping using the **Mapping Flow** option, select the value of the **Columns defined by** property as **Mapping Flow** in the **Ports** tab in the Write transformation.

# Microsoft Azure Data Lake Storage Gen1 Dynamic Mapping Example

Your organization has a large amount of data that keeps changing. Your organization needs to incorporate all the updated data in a short span of time. Create a dynamic mapping, where you can refresh the source schema dynamically to fetch the updated data. Add all the dynamic ports to the target to override the metadata of the existing ports.

1. Import the Microsoft Azure Data Lake Storage Gen1 read and write data objects.
2. Select a project or folder in the **Object Explorer** view.
3. Click **File > New > Mapping**.  
The **Mapping** dialog box appears.
4. Enter the name of the mapping in the **Name** field.
5. Click **Finish**.
6. Drag the data object into a mapping.  
The **Adlsv2 Data Object Access** dialog box appears.
7. Select the **Read** option and click **OK**.
8. In the **Data Object** tab, select the **At runtime, get data object columns from data source** check box.
9. Drag the data object into a mapping.  
The **Adlsv2 Data Object Access** dialog box appears.
10. Select the **Write** option and click **OK**.
11. In the **Ports** tab, select the value of the **Columns defined by** as **Mapping Flow**.
12. Select all the source incoming ports and add the ports to the target.
13. Save and run the mapping.



## APPENDIX A

# Microsoft Azure Data Lake Storage Gen1 Datatype Reference

This appendix includes the following topics:

- [Datatype Reference Overview, 33](#)
- [Microsoft Azure Data Lake Storage Gen1 and Transformation Data Types, 34](#)
- [Flat File and Transformation Data Types, 34](#)
- [Avro Data Types and Transformation Data Types, 35](#)
- [JSON Data Types and Transformation Data Types, 37](#)
- [Parquet Data Types and Transformation Data Types, 37](#)
- [Rules and Guidelines for Data Types, 39](#)

## Datatype Reference Overview

Informatica Developer uses the following data types in Microsoft Azure Data Lake Storage Gen1 mappings:

- Microsoft Azure Data Lake Storage Gen1 native data types. Microsoft Azure Data Lake Storage Gen1 data types appear in the physical data object column properties.
- Transformation data types. Set of data types that appear in the transformations. They are internal data types based on ANSI SQL-92 generic data types, which the Data Integration Service uses to move data across platforms. Transformation data types appear in all transformations in a mapping.

When PowerExchange for Microsoft Azure Data Lake Storage Gen1 reads source data, it converts the native data types to the comparable transformation data types before transforming the data. When PowerExchange for Microsoft Azure Data Lake Storage Gen1 writes to a target, it converts the transformation data types to the comparable native data types.

# Microsoft Azure Data Lake Storage Gen1 and Transformation Data Types

The following table lists the Microsoft Azure Data Lake Storage Gen1 data types that the Data Integration Service supports and the corresponding transformation data types:

Microsoft Azure Data Lake Storage Gen1 Native Data Type	Transformation Data Type	Range
String	string	1 to 104,857,600 characters
Number	Decimal	Precision 1 to 28 digits, scale 0 to 28
Binary	Binary	1 to 104,857,600 bytes The binary data type is applicable when you run a mapping in the native environment.

## Flat File and Transformation Data Types

Flat file data types map to transformation data types that the Data Integration Service uses to move data across platforms.

The following table compares flat file data types to transformation data types:

Flat File Data type	Transformation Data type	Range
Bigint	Bigint	Precision of 19 digits, scale of 0
Number	Decimal	For transformations that support precision up to 38 digits, the precision is 1 to 38 digits, and the scale is 0 to 38. For transformations that support precision up to 28 digits, the precision is 1 to 28 digits, and the scale is 0 to 28. If you specify the precision greater than the maximum number of digits, the Data Integration Service converts decimal values to double in high precision mode. If the precision is greater than 15, the Data Integration Service converts decimal values to double in low-precision mode.
String	String	1 to 104,857,600 characters
Nstring	String	1 to 104,857,600 characters

# Avro Data Types and Transformation Data Types

Avro data types map to transformation data types that the Data Integration Service uses to move data across platforms.

The following table compares the Avro data types that the Data Integration Service supports and the corresponding transformation data types:

Avro Data Type	Transformation Data Type	Range
Array	Array	Unlimited number of characters.
Boolean	Integer	TRUE (1) or FALSE (0).
Bytes	Binary	Precision 4000.
Date	Date/Time	January 1, 0001 to December 31, 9999.
Decimal	Decimal	Decimal value with declared precision and scale. Scale must be less than or equal to precision. For transformations that support precision up to 38 digits, the precision is 1 to 38 digits, and the scale is 0 to 38. For transformations that support precision up to 28 digits, the precision is 1 to 28 digits, and the scale is 0 to 28. If you specify the precision greater than the maximum number of digits, the Data Integration Service converts decimal values to double in high precision mode.
Double	Double	Precision 15.
Fixed	Binary	1 to 104,857,600 bytes.
Float	Double	Precision 15.
Int	Integer	-2,147,483,648 to 2,147,483,647 Precision 10 and scale 0.
Long	Bigint	-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807. Precision 19 and scale 0.
Map	Map	Unlimited number of characters.
Record	Struct	Unlimited number of characters.
String	String	1 to 104,857,600 characters.
Time	Date/Time	Time of the day. Precision to microsecond.

Avro Data Type	Transformation Data Type	Range
Timestamp	Date/Time	January 1, 0001 00:00:00 to December 31, 9999 23:59:59.997. Precision to microsecond.
Union	Corresponding data type in a union of ["primitive_type complex_type", "null"] or ["null", "primitive_type complex_type"].	Dependent on primitive or complex data type.

### Avro Union Data Type

A union indicates that a field might have more than one data type. For example, a union might indicate that a field can be a string or a null. A union is represented as a JSON array containing the data types.

The Developer tool only interprets a union of ["primitive\_type|complex\_type", "null"] or ["null", "primitive\_type|complex\_type"]. The Avro data type converts to the corresponding transformation data type.

### Avro Timestamp Data Type Support

The following table lists the Timestamp data type support for Avro file formats:

Timestamp Data type	Native	Spark
Timestamp_micros	Yes	Yes
Timestamp_millis	Yes	No
Time_millis	Yes	No
Time_micros	Yes	No

### Unsupported Avro Data Types

The Developer tool does not support the following Avro data types:

- Enum
- Null
- Timestamp\_tz

# JSON Data Types and Transformation Data Types

JSON data types map to transformation data types that the Data Integration Service uses to move data across platforms.

The following table compares the JSON data types that the Data Integration Service supports and the corresponding transformation data types:

JSON	Transformation	Range
Array	Array	Unlimited number of characters.
Double	Double	Precision of 15 digits.
Integer	Integer	-2,147,483,648 to 2,147,483,647. Precision of 10, scale of 0.
Object	Struct	Unlimited number of characters.
String	String	1 to 104,857,600 characters.

## Unsupported JSON Data Types

The Developer tool does not support the following JSON data types:

- Date
- Decimal
- Timestamp
- Enum
- Union

# Parquet Data Types and Transformation Data Types

Parquet data types map to transformation data types that the Data Integration Service uses to move data across platforms.

The following table compares the Parquet data types that the Data Integration Service supports and the corresponding transformation data types:

Parquet	Transformation	Range
Binary	Binary	1 to 104,857,600 bytes
Binary (UTF8)	String	1 to 104,857,600 characters
Boolean	Integer	-2,147,483,648 to 2,147,483,647 Precision of 10, scale of 0
Date	Date/Time	January 1, 0001 to December 31, 9999.

Parquet	Transformation	Range
Decimal	Decimal	<p>Decimal value with declared precision and scale. Scale must be less than or equal to precision.</p> <p>For transformations that support precision up to 38 digits, the precision is 1 to 38 digits, and the scale is 0 to 38.</p> <p>For transformations that support precision up to 28 digits, the precision is 1 to 28 digits, and the scale is 0 to 28.</p> <p>If you specify the precision greater than the maximum number of digits, the Data Integration Service converts decimal values to double in high precision mode.</p>
Double	Double	Precision of 15 digits.
Float	Double	Precision of 15 digits.
Int32	Integer	-2,147,483,648 to 2,147,483,647 Precision of 10, scale of 0
Int64	Bigint	-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807 Precision of 19, scale of 0
Map	Map	Unlimited number of characters.
Struct	Struct	Unlimited number of characters.
Time	Date/Time	Time of the day. Precision to microsecond.
Timestamp	Date/Time	January 1, 0001 00:00:00 to December 31, 9999 23:59:59.997. Precision to microsecond.
group (LIST)	Array	Unlimited number of characters.

The Parquet schema that you specify to read or write a Parquet file must be in smaller case. Parquet does not support case-sensitive schema.

### Parquet Timestamp Data Type Support

The following table lists the Timestamp data type support for Parquet file formats:

Timestamp Data type	Native	Spark
Timestamp_micros	Yes	No
Timestamp_millis	Yes	No
Time_millis	Yes	No

Timestamp Data type	Native	Spark
Time_micros	Yes	No
int96	Yes	Yes

## Unsupported Parquet Data Types

The Developer tool does not support the following Parquet data types:

- Timestamp\_nanos
- Time\_nanos
- Timestamp\_tz

# Rules and Guidelines for Data Types

Consider the following rules and guidelines for data types:

- Avro data types support:
  - Date, Decimal, and Timestamp data types are applicable when you run a mapping in the native environment or on the Spark engine in Cloudera CDH 6.3 distribution.
  - Time data type is applicable when you run a mapping in the native environment in Cloudera CDH 6.3 distribution.
- JSON data types support:
  - For PowerExchange for Microsoft Azure Data Lake Storage Gen2, you can read and write complex file objects in JSON format in mappings that run in the native environment, Spark engine, and Databricks Spark engine.
  - For other file-based adapters, you can read and write complex file objects in JSON format in mappings that run on the Spark engine only.
- Parquet data types support:
  - Before you create and run a new mapping on the Databricks engine to read a parquet file with hierarchical data types, you must set the `-DINFA_HADOOP_DIST_DIR=hadoop\Databricks_7.2` option in the `developerCore.ini` file.
  - When you set the `-DINFA_HADOOP_DIST_DIR=hadoop<Distro>` option in the `developerCore.ini` file and import a Parquet file, the format of the imported metadata differs based on the distribution. For Cloudera CDP 7.1, the metadata is imported as string and for other supported distributions, the metadata is imported as UTF8.
  - Date, Time, and Timestamp data types till microseconds are applicable when you run a mapping in the native environment, Blaze, and Spark engine in the Hortonworks HDP 3.1, Azure HDInsight HDI 4.0, and Cloudera CDP 7.1 distributions.
  - Date, Time\_Millis, and Timestamp\_Millis data types are applicable when you run a mapping in the native environment or Spark engine in MapR 6.1.
  - Decimal data types are applicable when you run a mapping in the native environment and Spark engine in Cloudera CDH 6.3, Hortonworks HDP 3.1, Amazon EMR 5.20, MapR 6.1, and Azure HDInsight HDI 4.0 distributions.

- Date, Time, Timestamp, and Decimal data types are applicable when you run a mapping on the Databricks Spark engine.
- When you run a mapping and use Date data type that does not have a time value, the Data Integration Service adds the time value, based on the time zone, to the date in the target.  
For example, Date data type used in the source:

1980-01-09

Value generated in the target:

1980-01-09 00:00:00

- When you run a mapping in the native environment and use Time data type in the source, the Data Integration Service writes incorrect date value to the target.  
For example, Time data type used in the source:

1980-01-09 06:56:01.365235000

Incorrect Date value is generated in the target:

1899-12-31 06:56:01.365235000

- When you run a mapping in the native environment and use Date data type in the source, the Data Integration Service writes incorrect time value to the target.  
For example, Date data type used in the source:

1980-01-09 00:00:00

Incorrect Time value generated in the target:

1980-01-09 05:30:00

- To run a mapping that reads and writes Date, Time, Timestamp, and Decimal data types, update the `-DINFA_HADOOP_DIST_DIR` option to the `developerCore.ini` file. The `developerCore.ini` file is located in the following directory:  
`<Client installation directory>\clients\DeveloperClient\`  
 Add the following path to the `developerCore.ini` file:  
`-DINFA_HADOOP_DIST_DIR=hadoop\<Hadoop distribution>_<version>`  
 For example: `-DINFA_HADOOP_DIST_DIR=hadoop\CDH_6.3`
- To use precision up to 38 digits for Decimal data type in the native environment, set the `EnableSDKDecimal38` custom property to `true` for the Data Integration Service. The `EnableSDKDecimal38` custom property is applicable to all file-based PowerExchange adapters except PowerExchange for HDFS.



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