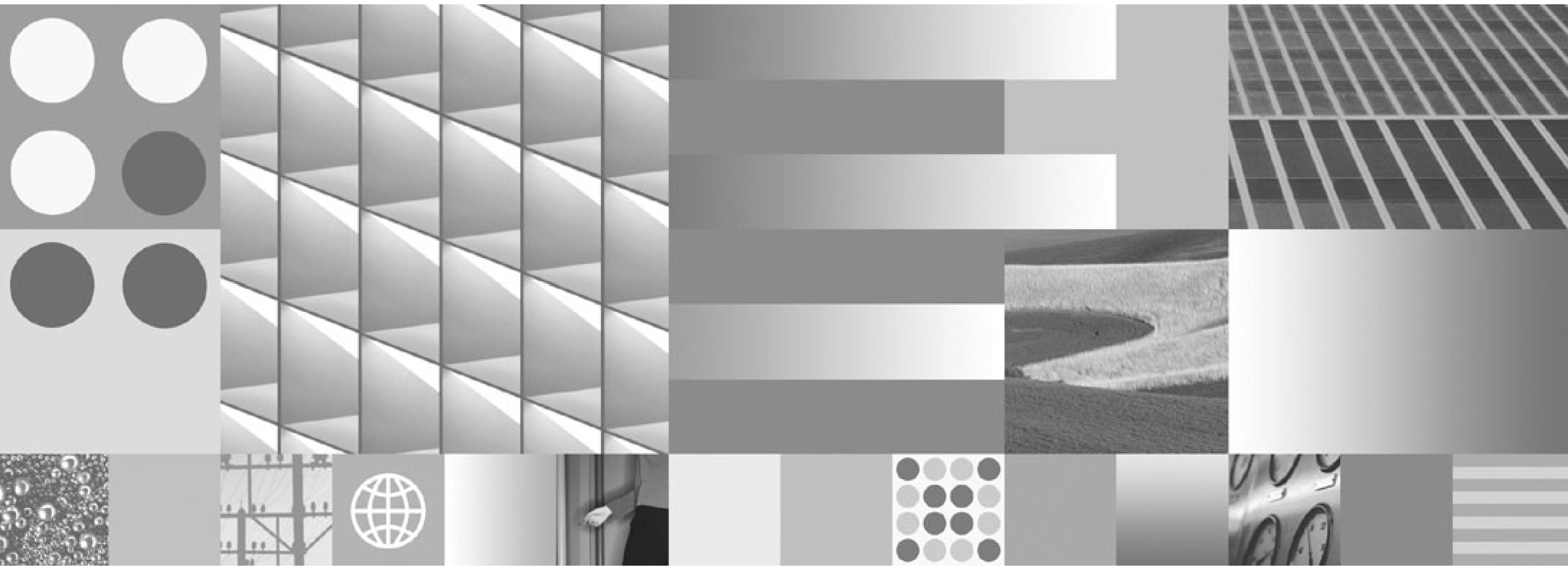
IBM InfoSphere Federation Server

Version 9.7



Configuration Guide for Federated Data Sources

SC19-1034-02

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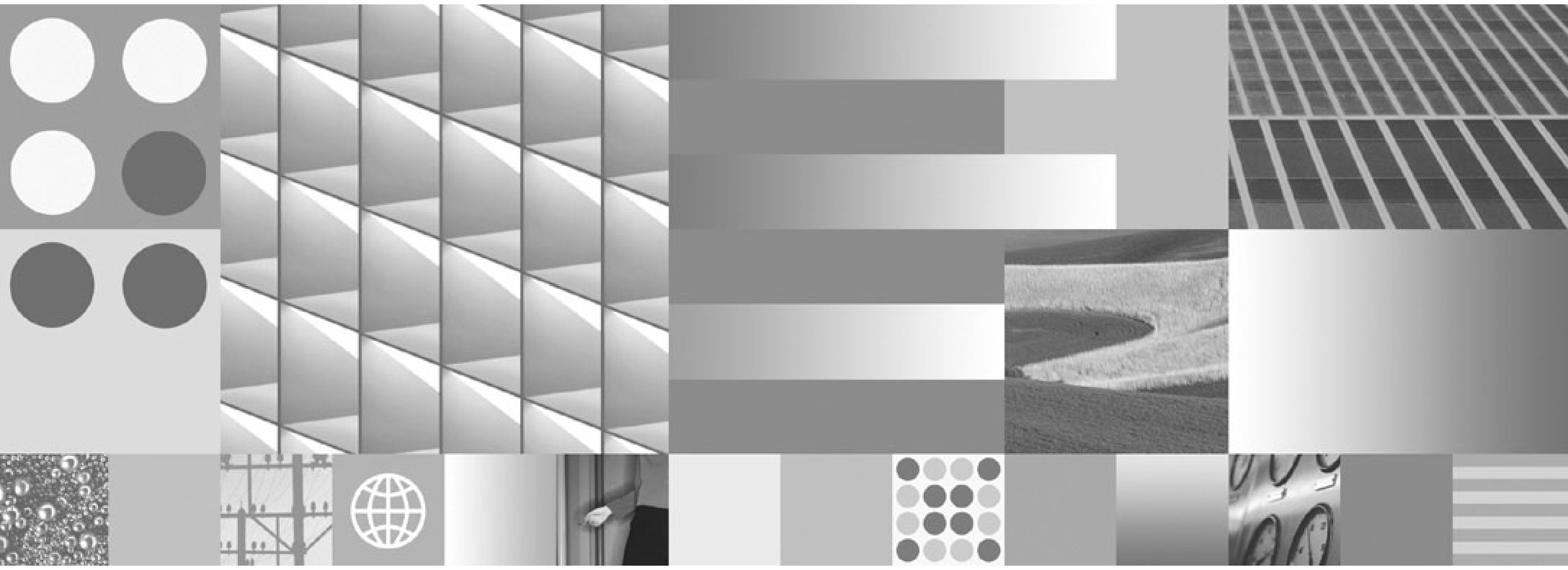


Configuration Guide for Federated Data Sources

SC19-1034-02

Note

Before using this information and the product that it supports, read the information in “Notices” on page 377.

Contents

Chapter 1. Configuring the federated server

Before you configure data sources, configure the federated server and verify that it is properly set up.

Procedure

To configure the federated server, complete these tasks:

Issuing commands in a federated system

If you are new to federation, review how to access the DB2® Control Center and how to start the DB2 command line. You use these interfaces to perform many tasks in a federated system.

The Control Center provides dialog boxes and wizards that guide you through the completion of a task, without requiring that you know the DB2 commands required to perform the task. If you are new to DB2 and federation, you might want to use the Control Center, which is intuitive and easy to use. To use the DB2 command line, you enter the DB2 commands that are required to accomplish a task. If you are already familiar with DB2, you might prefer using the command line. When both interfaces are available to accomplish a task, the documentation describes the specific steps to take and the commands to enter.

To access an interface, do the following:
- To start the DB2 command line, enter `db2` at the operating system prompt. Then you can enter commands, one after the other. When you finish using the DB2 command line, you enter `quit`.
- To use the DB2 Control Center, expand the **Federated Objects Folder** to display the list of objects that you can work with. Then select an object and use the panels and wizards to accomplish the task.

Verifying the setup of the federated server

When you install federation, the software attempts to configure the federated server for you. To avoid problems when you configure data sources, verify that the federated server is properly set up.

To verify the setup of the federated server, complete these tasks:

Enabling the federated server to access data sources

The FEDERATED parameter must be set to YES to enable the federated server to access to the data sources.

The installation program attempts to set the FEDERATED parameter, but it is best to confirm that it is properly set to YES. If the FEDERATED parameter is not properly set, all attempts to access data sources will fail with message SQL20076, reason code 1.

Procedure

To verify that the FEDERATED parameter is properly set and enable it if necessary:

1. From the DB2 command line, issue this command to display the parameters and their current settings:
```
GET DATABASE MANAGER CONFIGURATION
```
2. Check the value of the MAX_CONNECTIONS parameter to determine if the concentrator is on:
   - If MAX_CONNECTIONS is equal to MAX_COORDAGENTS, the concentrator is off.
   - If MAX_CONNECTIONS is greater than MAX_COORDAGENTS, the concentrator is on.

   The MAX_CONNECTIONS parameter cannot be active when the FEDERATED parameter is set to YES. If the concentrator is on, change the value of MAX_CONNECTIONS to be equal to MAX_COORDAGENTS.
3. Check the FEDERATED parameter setting. If the FEDERATED parameter is set to NO, change the setting to YES. Issue this command to change the setting:
```
UPDATE DATABASE MANAGER CONFIGURATION USING FEDERATED YES
```

Setting required environment variables for data source clients

Ensure that the required environment variables are set in the `db2dj.ini` file. This task is required for Informix®, Microsoft® SQL Server, Oracle, Sybase, and Teradata data sources, as well as for applications that use the JDBC and ODBC wrappers.

Before you begin

The system administrator performs this task.

If you install the client software before you install the federated server, the installation program automatically sets the required environment variables for the data sources that you select. If you install the client software after you install the federated server, upgrade to a new version of the client software, or migrate to new hardware, you must manually set the required environment variables.

This following table lists the required environment variables, by data source.

Table 1. Required environment variables, by data source

Data source	Required variable	Value
Informix	INFORMIXDIR INFORMIXSERVER	For INFORMIXDIR, the directory containing the Informix client software. For INFORMIXSERVER, the name of the default Informix server.

Table 1. Required environment variables, by data source (continued)

Data source	Required variable	Value
JDBC	Varies, depending on the installed JDBC driver. If you do not specify the JDBC driver package in the DRIVER_PACKAGE server parameter of the CREATE SERVER statement, you must specify the JDBC driver package in the ″CLASSPATH″ system environment variable. See the documentation of your JDBC driver for specific information on setting system environment variables.	File name and directory of the JDBC driver library.
Microsoft SQL Server	DJX_ODBC_LIBRARY_PATH	Directory containing the ODBC library.
ODBC	Varies, depending on the ODBC application.	Varies, depending on the ODBC application.
Oracle	ORACLE_HOME	Directory containing the Oracle client software.
Sybase	SYBASE, SYBASE_OCS	For SYBASE, the directory containing the Sybase client software. For SYBASE_OCS, the directory, version, and release of the client software.
Teradata	COPYLIB	Directory containing the Teradata client software.

Procedure

To set the environment variables manually:

1. Open the `db2dj.ini` file.

   The `db2dj.ini` file is added to the federated server during installation. By default, the file is in the location that the DB registry variable DB2_DJ_INI specifies. If the DB2_DJ_INI registry variable is not set, the file is in these locations:
   - On UNIX®, the file is in *`instancehome`*`/sqllib/cfg/db2dj.ini`, where *instancehome* is the home directory of the instance owner
   - On Microsoft Windows®, the file is in *`%DB2PATH%`*`\cfg\db2dj.ini`, where *%DB2PATH%* is the directory where the DB2 database system is installed. For example, `C:\Program Files\IBM\sqllib`.
2. Use the syntax *variable_name=variable_value* to set the value of the environment variable. If the *variable_value* is a file or directory name, you must specify the fully qualified path. For example, to set the INFORMIDIR variable to the directory informix in the home directory /home/user1, include this entry in the db2dj.ini file:

   ```
   INFORMIXDIR=/home/user1/informix
   ```
3. From the DB2 command line, issue these commands:

```
db2stop
db2start
```

You stop and then restart the database instance to ensure that the environment variables take effect.

4. If you are configuring a multi-partition system, copy the `db2dj.ini` file to each partition.

Restrictions for the db2dj.ini file

The `db2dj.ini` file contains the required and optional environment variables for a data source.

When you modify the `db2dj.ini` file, keep these restrictions in mind.

To specify each variable, use the format *variable_name=variable_value*

where

- *variable_name* is the name of the environment variable.
- *variable_value* is the value.

To specify a file name or directory name as the variable_value, specify the fully qualified name. The name cannot contain file name meta characters such as ~ (tilde) and environment variables, such as $HOME. For example, to set the INFORMIXDIR environment variable to the `informix` directory and the home directory that is named `/home/user1`, specify this value in the db2dj.ini file:

```
INFORMIXDIR=/home/user1/informix
```

Keep these limits in mind:

- The maximum length for the name of an environment variable is 255 bytes
- The maximum length for the value of an environment variable is 756 bytes
- The maximum length for a line in the `db2dj.ini` file is 1021 bytes; data beyond this length is ignored.

Verifying that library files are linked to data source client software

For best results, always verify that the library files are correctly linked to the data source client software before you use the CREATE WRAPPER command to register the wrapper. This task applies only when the federated server uses UNIX and the data source client is Informix, Microsoft SQL Server, Oracle, Sybase, or Teradata.

When you install federation, you can choose to configure wrappers automatically. If you install the data source client software on the federated server before you install federation on the server and choose to configure the wrapper automatically during the installation program, the wrapper library files are linked to the corresponding data source client software. If you install the data source client software after you install federation, for example to update to a new version of the client, you must manually link the wrapper library files to the data source client software.

These are the common causes of link failure:

- A required environment variable is not available during installation.
- The data source client is not installed on the federated server.
- The data source client that is installed on the federated server is not at a supported level.

Procedure

To verify that library files are correctly linked:

1. Open the message file for the data source. The message file is in the directory where the federated server is installed, in the lib32 or lib64 subdirectory. This table lists the data sources, message files, and library files.

Table 2. Data sources, message files, and library files

Data source	Message file	Library files
Informix	`djxlinkInformix.out`	AIX - `libdb2informix.a` HP-UX - `libdb2informix.so` Linux - `libdb2informix.so` Solaris - `libdb2informix.so`
Microsoft SQL Server	`djxlinkMssql.out`	AIX - `libdb2mssql3.a` HP-UX - `libdb2mssql3.so` Linux - `libdb2mssql3.so` Solaris - `libdb2mssql3.so`
Oracle	`djxlinkOracle.out`	AIX - `libdb2net8.a` HP-UX - `libdb2net8.so` Linux - `libdb2net8.so` Solaris - `libdb2net8.so`
Sybase	`djxlinkSybase.out`	AIX - `libdb2ctlib.a` HP-UX - `libdb2ctlib.so` Linux - `libdb2ctlib.so` Solaris - `libdb2ctlib.so`
Teradata	`djxlinkTeradata.out`	AIX - `libdb2teradata.a` HP-UX - `libdb2teradata.so` Linux - `libdb2teradata.so` Solaris - `libdb2teradata.so`

2. Evaluate the contents of the message file:
   - If linking succeeded, the library file displays in the directory where federation is installed, and the message file displays a success message.
   - If linking failed, the message file displays an error message. If neither the library file nor the message file display in the directory where federation is installed, you must manually link the library file to the data source client software.

Manually linking library files to data source client software

If the library files do not display in the directory path, you must run a script to link them to the data source client software.

Before you begin

- The data source client software must be installed and configured on the federated server.
- By default, the scripts issue all messages in English. To issue messages in another language, one federated database must be configured to use the code page for the non-English language.
- The required data source environment variables must be set.

Table 3. Data sources, scripts, and required environment variables

Data source	Script	Required environment variable
Informix	djxlinkInformix	INFORMIXDIR

Table 3. Data sources, scripts, and required environment variables (continued)

Data source	Script	Required environment variable
Microsoft SQL Server	djxlinkMssql	DJX_ODBC_LIBRARY_PATH
Oracle	djxlinkOracle	ORACLE_HOME
Sybase	djxlinkSybase	SYBASE, SYBASE_OCS
Teradata	djxlinkTeradata	COPLIB

Procedure

To link the library files to the data source client software:

1. Open a UNIX command prompt, and enter this command:
   ```
   cd /opt/IBM/db2/V9.5/bin
   ```
2. From the DB2 command line, enter these commands:
   ```
   db2 disconnect all
   db2stop
   ```
3. Run the script for each data source that you want to access. See the table above for the names of the scripts.
4. If you are installing a multi-partition environment, repeat Steps 1 - 3 on each database instance.
5. For each database instance, go to the directory *install_dir*/instance, where *install_dir* is the DB2 installation directory, and enter this command:
   ```
   ./db2iupdt instance_name
   ```
   This command updates the configuration of the instance and gives it access to the data sources.
6. For each database instance, display the file permissions on the library files. Verify that the database instance owner has the permission to read and run the files.

Managing the product license key and policy

Each computer on which IBM® InfoSphere™ Federation Server is installed must store a license file that specifies the product license key. The license policy controls and monitors the number of users who are allowed to connect to the federated server.

The license key is located in the license directory of the installation software. If the license key is not registered, you must manually register it.

1. Locate your license file in the `license` directory of the product installation software:

   `isfs.lic`
   : is the full product license file

   `isfs_t.lic`
   : is the try-and-buy product license file

   `isfs_d.lic`
   : is the developer edition license file
2. If license file is not in the directory, you must manually register a license key, see .
3. Specify the license policy to control and monitor the users who are allowed to connect to the federated server.

Creating a federated database

Before you configure the federated server to access data sources, you must create a federated database.

Before you begin

- You must have SYSADM or SYSCTRL authority to create a database.
- Federation must be installed on a server that will act as the federated server.

If the database instance uses a multiple-partition configuration, all of the partitions that are listed in the `db2nodes.cfg` file are affected when you create the database. The database partition from which you issue the CREATE DATABASE command becomes the catalog partition for the new database.

Procedure

To create the federated database:

1. Determine the code set and collating sequence that you want to specify when you create the federated database.
2. From the DB2 command line, issue the CREATE DATABASE command.

   For example, to create a database named federated that uses the code set ISO8859-15 in the territory of Brazil, issue this command:

   ```
   CREATE DATABASE federated
   USING CODESET ISO8859-15
   TERRITORY BR
   ```

Code sets, collating sequences, and national language support

When you create a federated database, you specify the code set, territory, and collating sequence. This information controls the language in which data is stored and the sequence in which character data is sorted.

A *code set* is a set of unique bit patterns that map to the characters of a specific natural language. IBM products use the term *code page* as a synonym for code set. A *territory* identifies a locale and specifies region-specific information for the specified code set. If you do not specify these options, the database uses the language and collating sequence of the DB2 client that you use to create the database.

Before you create the federated database, determine which code set and territory values to specify. After you create the database, you cannot change these values. To choose a code set for the federated database, evaluate the code set specified by the remote data source that the federated database will access. Choose a code set for the federated database that corresponds to the code set that the remote data sources use. If the federated database will access multiple data sources, evaluate the code sets specified by all of the remote data sources. If the data sources use different code sets or incompatible code sets, specify Unicode as the code set for the federated server.

For many data sources, the first time that a wrapper connects to a data source, the wrapper performs these tasks:

1. Determines the code page and territory of the federated database.

2. Maps the code set and territory to a data source client locale, if the data source supports one.
3. Sets an environment variable, calls a data source API to tell the data source what the client locale is, or prepares to perform code set conversion.

Code page conversion involves converting character data between the code page of the data source database and the code page of the federated database. Some data sources perform code page conversion. For some data sources that do not perform code page conversion, the wrapper performs the conversion. For example, if the federated database uses code page 819, territory US, the equivalent Oracle client locale is American_America.WE8ISO8859P1. The Oracle wrapper automatically sets the NLS_LANG environment variable to the Oracle client locale value. Then when data is sent from the Oracle database to the wrapper, the Oracle database converts the data from code set American_America.WE8ISO8859P1 to code page 819. When data is sent from the wrapper to the Oracle database, the Oracle server or client converts the data from code page 819 to the code set that the Oracle database uses.

The collating sequence is related to the language that the federated server supports and that the data source server supports. To specify the collating sequence for the federated database, include the COLLATE USING option on the CREATE DATABASE command. If the federated database and the data source use the same collating sequence, set the COLLATING_SEQUENCE server option to 'Y' when you issue the CREATE SERVER statement. The collating sequence that you specify for the federated database affects where queries that involve character sorting or character comparisons are performed. By default, the federated database uses a case-sensitive collating sequence. However, some data sources use a case-insensitive collating sequence as the default. A data source might also allow the collating sequence to be customized or might offer multiple options for setting the default code page. If the collating sequence of the federated database and the data source are different, a query might not return the results that you expect. For example, if the query involves character-sorting, the correct results are returned, but they are not in the order that you expect. If the query involves character comparisons, incorrect results might returned.

Where character-based operations are performed has an effect on query performance. When the collating sequences differ, the federated server performs character sorting and character comparisons locally to ensure that consistently sorted result sets are returned. For best results, set the federated database collating sequence to the same sequence that the data source uses. Then, where possible, the query optimizer pushes down character-based operations to the data source, so that the data source, not the federated database, performs the operations.

Setting up Unicode for federated systems

You can run relational and nonrelational wrappers, and user-defined functions on a database in the Unicode code page (UTF-8). A database in the Unicode code page provides a federated server environment that is platform independent.

Unicode support for federated systems

All relational and nonrelational wrappers and user-defined functions can run on a database in the Unicode code page (UTF-8).

The database in the Unicode code page provides federated server environments that are platform independent. The database can manipulate data that is stored in various code pages on different data sources.

In Figure 1 a company has branch offices in different countries. Each branch office stores customer data with its own databases in their own code page. The Microsoft SQL Server database stores data in code page A. The Oracle database stores data in code page B. Code page A and code page B are in different territories. To integrate the data from the different territories, the company can set the federated database's code page to Unicode. The company can then join the tables to see the total number of purchase orders, regardless of territory.

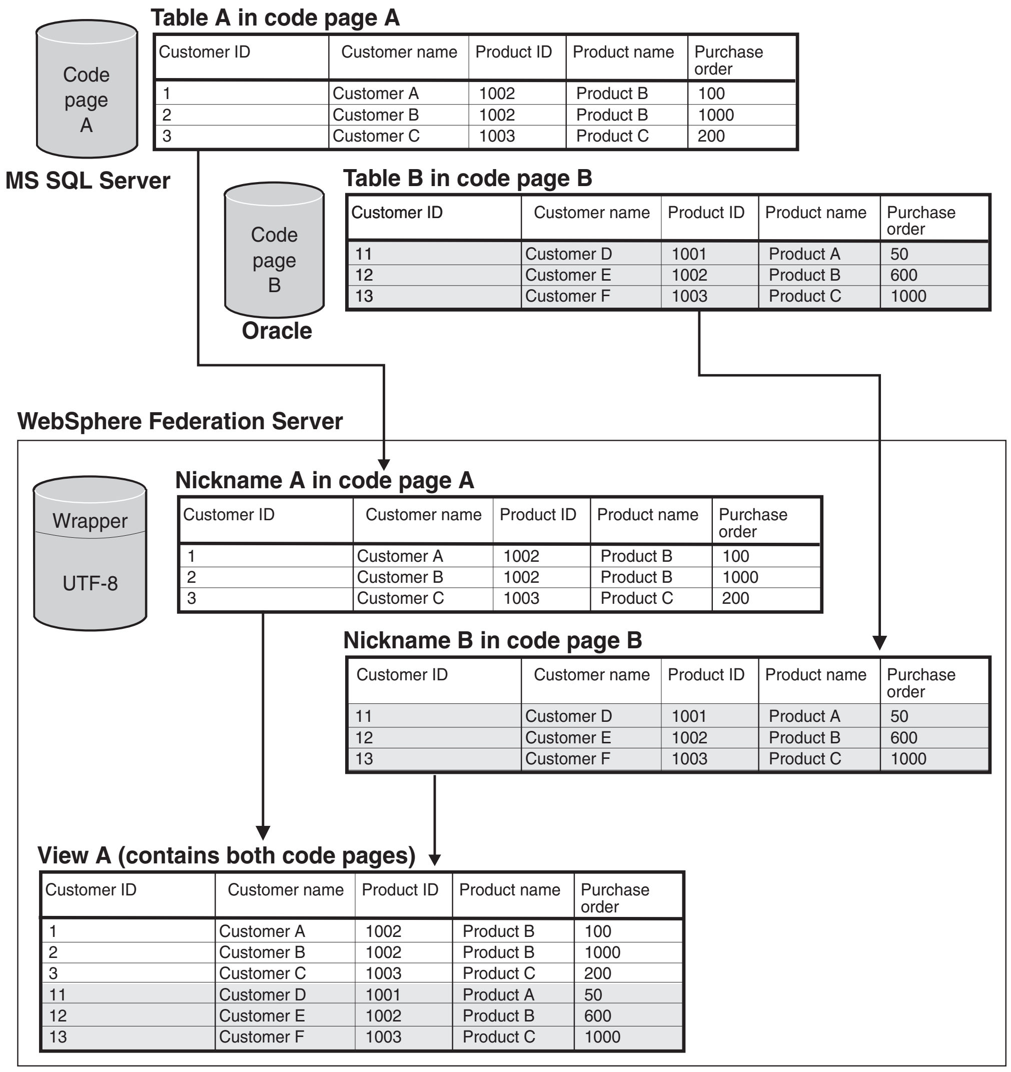


Table A in code page A

Customer ID	Customer name	Product ID	Product name	Purchase order
1	Customer A	1002	Product B	100
2	Customer B	1002	Product B	1000
3	Customer C	1003	Product C	200

Table B in code page B

Customer ID	Customer name	Product ID	Product name	Purchase order
11	Customer D	1001	Product A	50
12	Customer E	1002	Product B	600
13	Customer F	1003	Product C	1000

Nickname A in code page A

Customer ID	Customer name	Product ID	Product name	Purchase order
1	Customer A	1002	Product B	100
2	Customer B	1002	Product B	1000
3	Customer C	1003	Product C	200

Nickname B in code page B

Customer ID	Customer name	Product ID	Product name	Purchase order
11	Customer D	1001	Product A	50
12	Customer E	1002	Product B	600
13	Customer F	1003	Product C	1000

View A (contains both code pages)

Customer ID	Customer name	Product ID	Product name	Purchase order
1	Customer A	1002	Product B	100
2	Customer B	1002	Product B	1000
3	Customer C	1003	Product C	200
11	Customer D	1001	Product A	50
12	Customer E	1002	Product B	600
13	Customer F	1003	Product C	1000

Figure 1. Unicode example

Specifying the client code page for Unicode support of Microsoft SQL Server and ODBC data sources

To ensure correct code page conversion for Microsoft SQL Server and ODBC data sources, you must specify the client code page if the code page differs from the federated database code page.

Procedure

To specify the client code page, issue a CREATE SERVER statement with the CODEPAGE option set to the value of the client code page number. The client code page is the code page of the data source client.

Example: If the data source is Microsoft SQL Server and the federated server is on Windows and the default system locale of the operating system is set to Japanese (Shift-JIS), the CODEPAGE server option must be set to either 943 (Shift-JIS) or 1202 (UTF-16LE). To specify the 1202 code page for the Microsoft SQL server data source named FEDSERVERW, issue the following statement:

```
CREATE SERVER FEDSERVERW TYPE MSSQLSERVER VERSION 2000 WRAPPER MSSQLODBC3
      OPTIONS(NODE 'SAMPLE', DBNAME 'TESTDB', CODEPAGE '1202');
```

Example: If the data source is Microsoft SQL Server and the federated server is running on UNIX and the IANAAppCodePage setting of the DataDirect Connect client is 6 (Shift-JIS), the CODEPAGE server option must be set to either 943 (Shift-JIS) or 1208 (UTF-8). To specify the 1208 code page for the Microsoft SQL server data source named FEDSERVERU, issue the following statement:

```
CREATE SERVER FEDSERVERU TYPE MSSQLSERVER VERSION 2000 WRAPPER MSSQLODBC3
      OPTIONS(NODE 'SAMPLE', DBNAME 'TESTDB', CODEPAGE '1208');
```

Supported Unicode code pages for the MSSQL and ODBC wrapper CODEPAGE option

Valid code page values are those that DB2 Database for Linux®, UNIX, and Windows supports plus those shown in the following table.

Table 4. Supported Unicode code pages for the MSSQL and ODBC wrapper CODEPAGE option

CODEPAGE option value	Description
1200	Codepage1200 - UCS-2 (big-endian)
1202	Codepage1202 - UCS-2 (little-endian)
1208	Codepage1208 - UTF-8
1232	Codepage1232 - UTF-32 (big-endian)
1234	Codepage1234 - UTF-32 (little-endian)

Specifying the file code page for Unicode support of table-structured file data sources

To ensure correct code page conversion for table-structured file data sources data sources, you must specify the file code page if the code page differs from the federated database code page.

Restrictions

You can use the CODEPAGE option only in a Unicode federated database.

About this task

Valid values are those that DB2 Database for Linux, UNIX, and Windows supports. The default value is the code page of the federated database.

Procedure

To specify the code page of a table-structured file, issue the CREATE NICKNAME statement with the CODEPAGE option set to the code page number of the data in the table-structured file.

Example: The code page of the data in a file named DRUGDATA1.TXT is 943. To specify the code page of a table-structured file as 943, issue the following CREATE NICKNAME statement:

```
CREATE NICKNAME DRUGDATA1(Dcode Integer NOT NULL, Drug CHAR(20),
         Manufacutuer CHAR(20))
       FOR SERVER biochem_lab
       OPTIONS(FILE_PATH '/usr/pat/DRUGDATA1.TXT',CODEPAGE '943',
      COLUMN_DELIMITER '.',
       SORTED 'Y', KEY_COLUMN 'DCODE', VALIDATE_DATA_FILE 'Y');
```

Specifying the file code page for Unicode support of table-structured file data sources - example

The following example shows you how to specify the code page of a table-structured file.

The code page of the data in a file named DRUGDATA1.TXT is 943. To specify the code page of a table-structured file as 943, issue the following CREATE NICKNAME statement:

```
CREATE NICKNAME DRUGDATA1(Dcode Integer NOT NULL, Drug CHAR(20),
         Manufacutuer CHAR(20))
       FOR SERVER biochem_lab
       OPTIONS(FILE_PATH '/usr/pat/DRUGDATA1.TXT',CODEPAGE '943',
      COLUMN_DELIMITER '.',
       SORTED 'Y', KEY_COLUMN 'DCODE', VALIDATE_DATA_FILE 'Y');
```

Errors when remote and federated code point sizes are different

When the code point size differs between the federated database and the remote data source, you can get truncated data returned or insertion or update failures.

When you select data from the remote data source, that data is truncated if the character string conversion results in a larger number of bytes than the size of the nickname column. If the truncated data ends in a dangling character, blanks fill the remaining bytes. Also, you can insert or update data that is larger than the nickname column size if the converted data size is smaller than, or equal to, the remote column size.

If the federated database has a smaller code point size than the remote data source, insertion or update of data can fail. Insertions or updates fail if the character string conversion results in a larger number of bytes than the size of the remote data source column.

Adjust nickname column size or remote table column size to prevent data truncation or a truncation error.

Configuring the federated server to access data sources

After you install and set up the federated server and create a federated database, plan and then configure access to the data sources.

The process for configuring access to data sources is the same, regardless of the data source. What differs in the process are the particular settings that you apply as you complete each configuration task for each data source. The process described here is generic; for complete information on configuring a particular data source, see the detailed configuration information for the data source.

Review how to name and specify objects

During the configuration process, you use DB2 SQL statements to register objects. Before you perform any configuration tasks, be sure that you understand the federated naming rules and understand how the use of quotation marks in SQL statements affects the case-sensitivity of the objects that you specify.

Register the wrapper

After you use the federation installation program to install support for a data source, you must register the corresponding wrapper. A wrapper is a set of library files that the federated server uses to communicate with the data source and to retrieve data from it. For each type of data source that you want to access, you register one wrapper. For example, to access one table in DB2 for Linux, UNIX, and Windows, one table in DB2 for iSeries®, and one table in Teradata, you register two wrappers: the DRDA® wrapper for the DB2 data sources and the Teradata wrapper for Teradata data sources.

As part of your planning, decide whether or not to use the default wrapper name or assign a different name to the wrapper, and review the wrapper options that are available for each data source that you are configure. Each data source has one or more required wrapper options that you must set.

Register the server definitions

Before you can access specific data source objects, you register one or more server definitions. For a relational data source, a server definition represents a remote database, a database partition, or a node. For a nonrelational data source, a server definition often maps to other types of external data objects. Each data source has required and optional parameters that you must specify when you register the server definition.

As part of your planning, review the server options that are available for the specific data source that you are configuring. Each data source has one or more required server options that you must set.

Register user mappings

If a remote data source requires user authentication and if a user's remote user ID and remote password are different from the ones that the user uses to connect to the federated database, you define a user mapping. A user mapping is an association between a federation server authorization ID and a data source user ID and password. By default, user mappings are stored in the catalog on the federated server.

As part of your planning, decide if you want to store user mapping information in an external repository, such as on an LDAP server or in a file. To use an external repository, you must create a plug-in that provides the federated server with the interface to the repository.

Update data source statistics

For each relational data source that you plan to access, use a command that is equivalent to the DB2 RUNSTATS command to update the statistics at the remote data source. Then when you create nicknames, the most up-to-date statistical information is added to the system catalog in the federated database. Later when you run a query on the data source, the query optimizer uses this information to determine the most efficient way to perform the query.

After you create nicknames, statistics at the data source might change. When statistics for a relational data source change, use the SYSPROC.NNSTAT stored procedure to update the statistical information in the system catalog. When statistics for a nonrelational data source change, use the tool that is provided by the nonrelational data source, or manually update the statistics in the SYSTAT catalog views.

Register nicknames

You create a nickname for each relational data source object that you want to access. For some nonrelational data sources, you define a fixed list of input and output columns when you register the nickname. Each column that you specify is mapped to a particular field, column, or element in the data source object.

As part of your planning, review the nickname and column options that are available for the data source that you are configuring. Some data sources have required nickname and column options that you must set.

Perform additional configuration tasks

Depending on how you want to work with the data source, you might want to perform these additional configuration tasks.

Create index specifications
You can define an index specification for objects that do not have an index. For example, you create an index specification when a table acquires a new index or if the data source object, such as a view, does not have an index.

Define alternative data type mappings
In the federated system, there are default mappings between the data source data types and the federated database data types. For relational data sources, you can define alternative data type mappings. For example, you can change a type mapping for all data source objects located on a specific server or change a type mapping for a specific data source object, data source type, or data source object and type.

Define alternative function mappings
In the federated system, there are default function mappings between the built-in data source functions and the built-in federated database functions. For relational data sources, you can define alternative function mappings. For example, you can define an alternative function mapping when you want to use a new built-in function or a user-defined function that is available at the data source but for which the federated database lacks a mapped function.

Case sensitivity and the correct use of quotation marks

When you specify option values and objects in DB2 SQL statements, you need to know when quotation marks are required, which type to use, and how they affect cases sensitivity.

How you name objects when you first create them affects the case of the characters in the object name and determines how you specify object names and option values in commands. For example, if, when you create a nickname, you do not enclose the name in double quotation marks, the system catalog stores the nickname in uppercase characters, regardless of the case of the characters that you use to name the object. If you use double quotation marks when you create the nickname, the catalog stores the characters of the object name in exactly the case that you specify. Then, when you use the object name as an option value, you must specify exactly that case. For example, the FOREIGN_KEY column option that the Script, Web services, and XML wrappers support requires that you specify the nickname for the foreign key column as the option value. When you enter the option value, you must use the same case that the federated server catalog uses to store the nickname.

The following table describes the correct use of case and quotation marks when you specify option values and objects in DB2 SQL statements.

Table 5. Correct use of case and quotation marks

Identifier	Case and quotation mark use	Examples

Option value	Use the case that the option value requires, and enclose the option value in single quotation marks.	This statement creates a data source table named remote_schema.remote_table (all lowercase):
		`CREATE TABLE newton.my_nick`
		`(c1 int)`
		`OPTIONS`
		`(remote_server 'MY_SERVER'`
		`remote_schema 'remote_schema',`
		`remote_tabname 'remote_table');`
		
		This statement creates a data source table named REMOTE_SCHEMA.REMOTE_TABLE (all uppercase):
		`CREATE TABLE newton.my_nick`
		`(c1 int)`
		`OPTIONS`
		`(remote_server'MY_SERVER'`
		`remote_schema 'REMOTE_SCHEMA',`
		`remote_tabname 'REMOTE_TABLE');`

Object that contains only lowercase characters	Use all lowercase characters, and enclose in the identifier double quotation marks.	This statement creates a nickname on a data source table named infx_user.remote_table (all lowercase):
		`CREATE NICKNAME my_nick`
		`FOR`
		`infx_server.`
		`"infx_user"."remote_table";`
		
		Note: Some data sources such as Informix and Teradata use lowercase names by default.

Object that contains only uppercase characters, numbers, and underscore characters (_)	There are two choices:
	• Use all uppercase characters, and enclose the identifier in double quotation marks.
	• Use any case and do not enclose the identifier in double quotation marks.
		Each of these statements creates the nickname MY_NICK (all uppercase):
		`CREATE NICKNAME my_nick`
		`FOR infx_server.`
		`"infx_user"."remote_table";`
		`CREATE NICKNAME "MY_NICK"`
		`FOR infx_server.`
		`"infx_user"."remote_table";`

For data source authorization IDs and passwords, you can also use the server options FOLD_ID and FOLD_PW to convert the ID and password to the correct case.

From a UNIX operating system command prompt

If you enclose a case-sensitive value in quotation marks at the UNIX command prompt on the federated server, you must ensure that the quotation marks are parsed correctly:

SQL statements that contain double quotation marks, but that do not contain single quotation marks

If the SQL statement contains double quotation marks but does not contain single quotation marks, enclose the entire statement in single quotation marks.

For example, if you want to issue this SQL statement:

```
CREATE NICKNAME my_nickname FOR my_server."owner"."my_table"
```

You enter the following text at the UNIX command prompt:

```
db2 'CREATE NICKNAME my_nickname FOR my_server."owner"."my_table"'
```

SQL statements that contain single quotation marks, but that do not contain double quotation marks

If the SQL statement contains single quotation marks but does not contain double quotation marks, enclose the entire statement in double quotation marks.

For example, if you want to issue this SQL statement:

```
CREATE USER MAPPING FOR USER SERVER my_server
    OPTIONS(REMOTE_AUTHID 'my_id', REMOTE_PASSWORD 'my_password')
```

You enter the following text at the UNIX command prompt:

```
db2 "CREATE USER MAPPING FOR USER SERVER my_server
    OPTIONS(REMOTE_AUTHID 'my_id', REMOTE_PASSWORD 'my_password')"
```

SQL statements that contain both double and single quotation marks

If the SQL statement contains both single and double quotation marks:

- Enclose the entire statement in double quotation marks
- Precede each double quotation mark in the statement with a backward slash.

For example, to issue this SQL statement:

```
CREATE USER MAPPING FOR "local_id" SERVER my_server
    OPTIONS(REMOTE_AUTHID 'my_id', REMOTE_PASSWORD 'my_password')
```

You enter the following text at the UNIX command prompt:

```
db2 "CREATE USER MAPPING FOR \"local_id\" SERVER my_server
    OPTIONS(REMOTE_AUTHID 'my_id',  REMOTE_PASSWORD 'my_password')"
```

The above examples assume that you enter the SQL statements from the UNIX command prompt and pass the statement to the DB2 command, without using the -f option. To use the DB2 command with the -f option to enter the SQL statements from a file, enter the statements as shown in the first occurrence of each example.

From a Windows operating system command prompt

To preserve case-sensitive values when you enter commands from a Microsoft Windows command prompt on the federated server, precede each double quotation mark with a backward slash. For example, you want to create the nickname *nick1* for the Microsoft SQL Server table *weekly_salary*. The table resides in the *NORBASE* database. The local schema is *my_schema*.

At the Windows command prompt on the federated server, you type:

```
db2 CREATE NICKNAME nick1
    FOR NORBASE.\"my_schema\".\"weekly_salary\"
```

From the DB2 command line or from an application

When you specify a value from the DB2 command line or from an application, you can preserve case-sensitive values by enclosing the values in the proper quotation marks.

For example, you want to create a user mapping for the user ID *local_id*. The remote user ID *my_id* and the remote password is *my_password*. You want all three of these values to be preserved in lowercase. At the DB2 command prompt you type:

```
CREATE USER MAPPING FOR "local_id" SERVER my_server
    OPTIONS(REMOTE_AUTHID 'my_id', REMOTE_PASSWORD 'my_password')
```

Configuring multiple federated servers to access data sources

A federated system can consist of multiple federated servers. Instead of configuring each federated server separately, you can save time by using the control center to configure the federated servers.

Before you begin

- Federation must be installed on a server that will act as the federated server
- A federated database must exist on the federated server.

When you configure the first server, the **Action Output** window captures the DDL statements that are issued when you create the federated objects. You can reuse or modify these statements, and apply the statements to quickly configure additional federated servers.

The **Action Output** window remains active for the current session. If you close the **Action Output** window, the DDL statements for the current session continue to be stored in the **Action Output** window. However, if you close the DB2 Control Center all of the DLL statements from the current session are removed from the **Action Output** window.

Procedure

To configure multiple federated servers to access data sources:

1. Use the control center to configure the first federated server for the data sources that you want to access. This captures each DDL statement.
2. Display the **Action Output** page in the **Action Output** window. If you closed the **Action Output** window, right-click the **Federated Database Objects** folder and click **Show Actions** to open the **Action Output** window.
3. Delete any DDL statements that you do not want to use on the other federated servers. To delete a statement, right-click the statement and click **Remove**. For example, you might want to delete any statements that display Failed in the status column on the **Action Output** page.
4. Copy the statements that you want to use on the other federated servers to the **Command Editor** page.
   a. Select the statements that you want to copy. To select multiple statements, use the Ctrl key.
   b. Right-click on the selected statements and click **Copy to Command Editor**. The **Command Editor** page opens.

5. Change any DDL statements in the **Command Editor** page that you want to use on the other federated servers. For example, you might want to change any statement that specifies a local schema.

   You must change the user mappings to specify the proper passwords for the federated server. When the DDL for the CREATE USER MAPPING statements is captured in the **Action Output** window, the passwords are masked by asterisks. You must replace the asterisks with the proper passwords.
6. After you change the DDL statements that were generated in the **Action Output** window, run the DDL statements on the next federated server.

Chapter 2. Configuring data sources

You can configure the federated server to access relational and nonrelational data sources.

Configuring access to BioRS data sources

You can integrate the data that is in the BioRS databanks with information from other sources by using a federated system.

Procedure

To configure a federated server to access the BioRS data sources, you must provide the federated server with information about the data sources and objects that you want to access. After you configure the federated server, you can create queries and use the custom functions to access the BioRS data sources.

BioRS wrapper

BioRS is a query and retrieval system that you can use to retrieve information from multiple data sources. The BioRS wrapper uses the same APIs as the BioRS Web-based interface to run queries.

BioRS is a query and retrieval system that is developed by Biomax Informatics. You can use BioRS to retrieve information from multiple data sources, including flat files and relational databases. You usually download public data, such as SwissProt and GenBank, as flat files into your BioRS system. BioRS can integrate public data sources and proprietary data sources (for example, private databases that are maintained by your organization) into a common environment.

After a data source is integrated into the BioRS system, it is referred to as a *databank*. The elements that are contained in each databank entry are collectively referred to as a *schema*. Elements of a databank that are indexed can be used in the BIORS.CONTAINS, BIORS.CONTAINS_GE, and BIORS.CONTAINS_LE functions. The BioRS functions are specified in the WHERE clause of the SELECT statement. Elements that are not indexed can be referenced in the SELECT list and in other predicates in the WHERE clause. Elements that are not indexed are processed by the federated server.

You can establish relationships between entries in databanks, so that you can link databanks together in the BioRS system.

BioRS databanks can have a parent-child relationship (databanks can be nested). In such a relationship, the child databank contains a Reference data type element called PARENT. The PARENT element refers to the _ID_ element of the parent databank. Other than the presence of this predefined PARENT element, nested databanks contain the same data as unnested databanks.

BioRS provides a Web-based interface that enables users to run queries on the data in BioRS databanks. The BioRS wrapper uses the same application programming interfaces (APIs) as the BioRS Web-based interface to run queries.

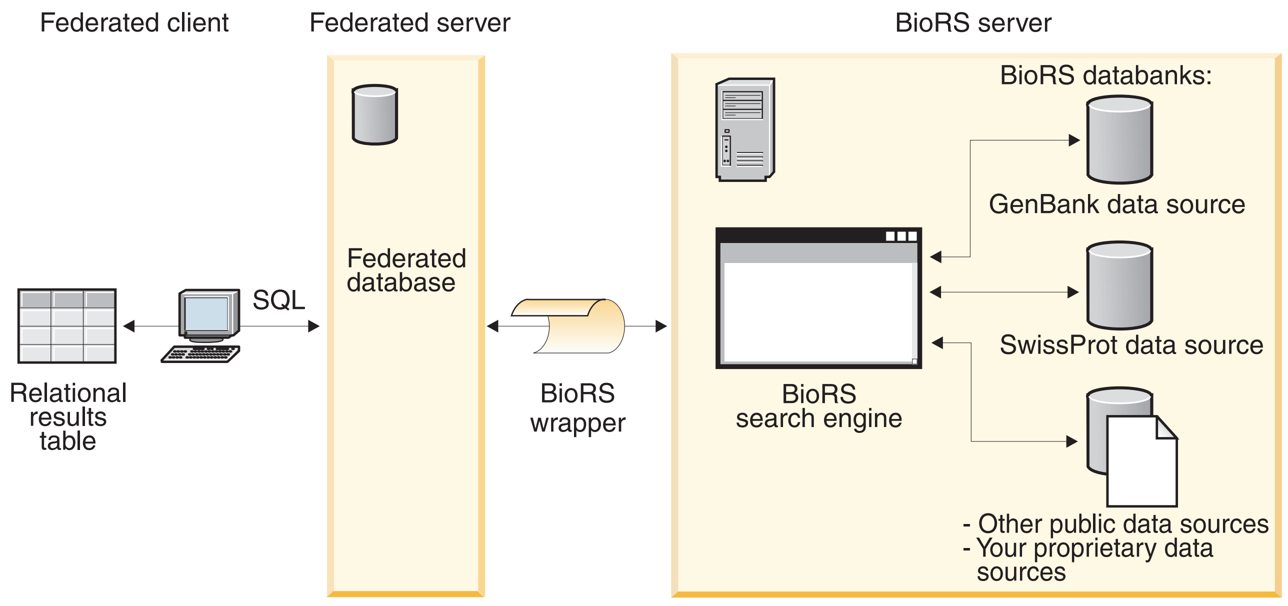


Figure 2. How the BioRS wrapper works

From the client, users or applications submit a query using SQL statements. Then, the query is sent to your federated system where the BioRS wrapper is installed. Depending on how the query is constructed, both the federated server and your BioRS server might be used to process the query. The BioRS server can be on a different computer from the federated system. Authentication information must be provided by the federated system to the BioRS server for each query. This information can be either a user ID and password combination, or an unauthenticated indication (usually a guest account).

For detailed information about the BioRS product, see the Biomax Web site at: http://www.biomax.com.

Adding BioRS data sources to a federated server

To configure a federated server to access BioRS data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin

- Federation must be installed on a server that will act as the federated server.
- A database must exist on the federated server.

About this task

You can configure a federated server to access data that is stored in BioRS data sources by using the Control Center or by issuing SQL statements on the command line. The Control Center includes a wizard to guide you through the steps that are necessary to configure the required federated objects.

Procedure

To add BioRS data sources to a federated server:

1. Register the custom functions for the BioRS wrapper.
2. Register the BioRS wrapper.

3. Register the BioRS server definitions.
4. Optional: Create the BioRS user mappings.
5. Register nicknames for BioRS databanks.

Registering the custom functions for the BioRS wrapper

You must register the BioRS custom functions before you register the BioRS wrapper. The BioRS custom functions are used with the BioRS wrapper to push down predicates to the BioRS query engine.

About this task

You must register all of the custom functions on each federated database instance where the BioRS wrapper is installed.

All of the custom functions for the BioRS wrapper must be registered with the schema name `biors`.

Procedure

To register the BioRS custom functions:

For each of the BioRS custom functions, issue the CREATE FUNCTION statement. You must specify two data types in each custom function. The first data type that you specify is the indexed column. The second data type that you specify is the search term. You must include the AS TEMPLATE, DETERMINISTIC, and NO EXTERNAL ACTION keywords in the CREATE FUNCTION statement.
The following example shows the syntax for the BIORS.CONTAINS function:

```
CREATE FUNCTION biors.contains (column_data_type, search_term_data_type)
    RETURNS INTEGER AS TEMPLATE
    DETERMINISTIC NO EXTERNAL ACTION;
```

Tip: Use the sample file `create_function_mappings.ddl` to register the BioRS custom functions. The sample file is located in the `sqllib/samples/lifesci/biors` directory on the federated server. The sample file contains the CREATE FUNCTION statements for each of the possible data type combinations. To register the custom functions, edit the `create_function_mappings.ddl` file to specify the data types for the index columns and search terms for each custom function. Then you must run the `create_function_mappings.ddl` file on each federated database instance where the BioRS wrapper is installed.

Custom functions for the BioRS wrapper:

Descriptions and examples of the custom functions that are used with the BioRS wrapper.

The federated environment uses two query engines. For the BioRS wrapper, these query engines are the federated database query engine and the BioRS query engine. You can specify that predicates get pushed down to the BioRS engine by using the BioRS custom functions.

The custom functions for the BioRS wrapper are:
- BIORS.CONTAINS
- BIORS.CONTAINS_LE
- BIORS.CONTAINS_GE
- BIORS.SEARCH_TERM

You use the CREATE FUNCTION statement to register the BioRS custom functions.

The following table lists the four BioRS custom functions with examples of the valid data types that you can specify when you register the functions.

Table 6. Custom functions for the BioRS wrapper

Function	Description
BIORS.CONTAINS (VARCHAR(), VARCHAR()) BIORS.CONTAINS (VARCHAR(), CHAR()) BIORS.CONTAINS (VARCHAR(), DATE) BIORS.CONTAINS (VARCHAR(), TIMESTAMP)	Searches an indexed column for values that are equal (according to the BioRS query semantics) to the value that you specify. The first argument must be a reference to the indexed column and the second argument is the search value that you specify.
BIORS.CONTAINS_LE (VARCHAR(), VARCHAR()) BIORS.CONTAINS_LE (VARCHAR(), SMALLINT) BIORS.CONTAINS_LE (VARCHAR(), BIGINT) BIORS.CONTAINS_LE (VARCHAR(), DECIMAL) BIORS.CONTAINS_LE (VARCHAR(), DOUBLE) BIORS.CONTAINS_LE (VARCHAR(), REAL)	Searches an indexed column for values that are less than or equal (according to the BioRS query semantics) to the value that you specify. The first argument must be a reference to the indexed column and the second argument is the search value that you specify.
BIORS.CONTAINS_GE (CHAR(), CHAR()) BIORS.CONTAINS_GE (CHAR(), DATE) BIORS.CONTAINS_GE (CHAR(), TIMESTAMP) BIORS.CONTAINS_GE (CHAR(), INTEGER) BIORS.CONTAINS_GE (CHAR(), SMALLINT) BIORS.CONTAINS_GE (CLOB(), DATE)	Searches an indexed column for values that are greater than or equal (according to the BioRS query semantics) to the value that you specify. The first argument must be a reference to the indexed column and the second argument is the search value that you specify.
BIORS.SEARCH_TERM (VARCHAR(), VARCHAR()) BIORS.SEARCH_TERM (VARCHAR(), CHAR()) BIORS.SEARCH_TERM (CHAR(), VARCHAR()) BIORS.SEARCH_TERM (CHAR(), CHAR())	Passes a BioRS query expression to the BioRS search engine.

Registering the BioRS wrapper

You must register a wrapper to access BioRS data sources. Federated servers use wrappers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

If you use a proxy server to access BioRS files, you must specify the proxy information as options when you register the wrapper. By default, wrapper options are used when you query any BioRS file. However, if you also specify proxy options when you register a server definition, the server options take precedence.

Procedure

To register the BioRS wrapper:

Choose the method that you want to use to register the BioRS wrapper:

Method	Procedure
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.

Method	Procedure

From the command line	Issue the CREATE WRAPPER statement.
	`CREATE WRAPPER` *`wrapper_name`*
	`LIBRARY` *`library_name`*`;`
	
	If you use a proxy server to access BioRS documents, the statement that you issue is:
	`CREATE WRAPPER` *`wrapper_name`*
	`LIBRARY` *`library_name`*
	`OPTIONS (PROXY_TYPE '`*`type`*`',`
	`PROXY_SERVER_NAME '`*`server_name`*`',`
	`PROXY_SERVER_PORT '`*`port_number`*`');`

You must specify the LIBRARY parameter in the CREATE WRAPPER statement. The name of the wrapper library file that you specify depends on the operating system of the federated server. See the list of BioRS wrapper library files for the correct library name to specify in the CREATE WRAPPER statement.

BioRS wrapper library files:

The BioRS wrapper library files are added to the federated server when you install the federated server.

When you install the federated server, three library files are added to the default directory path. For example, if the federated server is running on AIX®, the wrapper library files that are added to the directory path are `libdb2lsbiors.a`, `libdb2lsbiorsF.a`, and `libdb2lsbiorsU.a`. The default wrapper library file is `libdb2lsbiors.a`. The other wrapper library files are used with specific wrapper options.

You must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 7. BioRS wrapper library locations and file names

Operating system	Directory path	Wrapper library file name
AIX	/usr/opt/`<install_path>`/lib32/ /usr/opt/`<install_path>`/lib64/	libdb2lsbiors.a
Linux	/opt/IBM/db2/`<install_path>`/lib32 /opt/IBM/db2/`<install_path>`/lib64	libdb2lsbiors.so
Solaris	/opt/IBM/db2/`<install_path>`/lib32 /opt/IBM/db2/`<install_path>`/lib64	libdb2lsbiors.so
Windows	%DB2PATH%\bin	db2lsbiors.dll

`<install_path>` is the directory path where the federated server is installed on UNIX or Linux.

%DB2PATH% is the environment variable that is used to specify the directory path where the federated server is installed on Windows. The default Windows directory path is `C:\Program Files\IBM\SQLLIB`.

CREATE WRAPPER statement - Examples for the BioRS wrapper:

Use the CREATE WRAPPER statement to register the BioRS wrapper. The examples show the options that are required to access BioRS documents with and without a proxy server.

Registering a wrapper

If you are not using a proxy server to access BioRS documents, you issue this statement to register the wrapper:

```
CREATE WRAPPER biors_wrapper LIBRARY 'libdb2lsbiors.a';
```

biors_wrapper
: A name that you assign to the BioRS wrapper. Duplicate wrapper names are not allowed.

LIBRARY *'libdb2lsbiors.a'*
: The name of the wrapper library file for federated servers that use AIX operating systems.

Registering a wrapper for an HTTP proxy server

To register a wrapper and specify an HTTP proxy server, use the following statement:

```
CREATE WRAPPER biors_proxy LIBRARY 'libdb2lsbiors.a'
    OPTIONS (PROXY_TYPE 'HTTP',
        PROXY_SERVER_NAME 'proxy.mysite.com',
        PROXY_SERVER_PORT '81');
```

PROXY_TYPE *'HTTP'*
: Specifies the proxy type that is used to access the Internet when the federated server is behind a firewall. The valid values are 'NONE', 'HTTP', or 'SOCKS'.

PROXY_SERVER_NAME *'proxy.mysite.com'*
: Specifies the proxy server name or IP address. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

PROXY_SERVER_PORT *'81'*
: Specifies the proxy server port number. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

Registering a wrapper for a SOCKS proxy server

To register a wrapper and specify a SOCKS proxy server without authentication information, use the following statement:

```
CREATE WRAPPER biors_wrapper LIBRARY 'libdb2lsbiors.so'
    OPTIONS (PROXY_TYPE 'SOCKS',
        PROXY_SERVER_NAME 'proxy_socks',
        PROXY_SERVER_PORT '1081');
```

LIBRARY *'libdb2lsbiors.so'*
: The name of the wrapper library file for federated servers that use the Linux and Solaris operating systems.

PROXY_TYPE *'SOCKS'*
: Specifies the proxy type that is used to access the Internet when the federated server is behind a firewall. The valid values are 'NONE', 'HTTP', or 'SOCKS'.

PROXY_SERVER_NAME *'proxy_socks'*
: Specifies the proxy server name or IP address. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

PROXY_SERVER_PORT *'1081'*
: Specifies the proxy server port number. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

Registering the server definition for a BioRS data source

You must register each BioRS server that you want to access in the federated database.

If you use a proxy server to access BioRS files, you can specify the proxy information as options when you register the server definition. If you specify the proxy information in the server definition, the server options take precedence over the options that you specified when you registered the wrapper.

Procedure

To register a server definition for a BioRS data source:

Choose the method that you want to use to register the server definition:

Method	**Procedure**
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.

From the command line	Issue the CREATE SERVER statement.
	`CREATE SERVER server_definition_name`
	`VERSION version_number`
	`WRAPPER wrapper_name`
	`OPTIONS (NODE 'node_name');`
	
	If you use a proxy server to access BioRS files, you must specify several options when you register the BioRS wrapper or the server definition. To specify the proxy server information when you register the BioRS wrapper, you issue this statement:
	`CREATE SERVER server_definition_name`
	`VERSION version_number`
	`WRAPPER wrapper_name`
	`OPTIONS (PROXY_TYPE 'type',`
	`PROXY_SERVER_NAME 'server_name',`
	`PROXY_SERVER_PORT 'port_number');`

When you register the server definition, you specify server options in the CREATE SERVER statement. There are required server options and optional server options. The NODE server option is required.

After the server definition is registered, use the ALTER SERVER statement to add or drop server options.

CREATE SERVER statement - Examples for the BioRS wrapper:

Use the CREATE SERVER statement to register server definitions for the BioRS wrapper. The examples show the required parameters, the optional parameters, and the additional server options that you can specify.

Registering a server definition with the required parameters

The following example shows you how to register a server definition for a BioRS wrapper by issuing the CREATE SERVER statement:

```
CREATE SERVER biors_server VERSION '5.2' WRAPPER biors_wrapper
     OPTIONS(NODE 'biors_myco.com');
```

biors_server
: A name that you assign to the BioRS server. Duplicate server definition names are not allowed.

VERSION *'5.2'*
: The version of the BioRS server that you want to access. The supported BioRS versions are 5.0.14 and 5.2. If you are accessing a BioRS server that is version 5.2, you must specify *'5.2'* as the value for the VERSION parameter. You do not need to specify this option if you are using version 5.0.14. The default value of *'1.0'*, which equates to version 5.0.14, is used for this parameter if you do not specify the value.

WRAPPER *biors_wrapper*
: The wrapper name that you specified in the CREATE WRAPPER statement.

NODE *'biors_myco.com'*
: Specifies the host name of the system on which the BioRS query tool is available. The default value is *localhost*. This value is case sensitive.

  Although the name of the node is specified as an option in the CREATE SERVER statement, it is required for BioRS data sources.

Registering a server definition using optional parameters and server options

The following example shows additional parameters and server options that you can specify when you register a server definition for a BioRS wrapper:

```
CREATE SERVER biors_server TYPE BioRS VERSION '5.2'
     WRAPPER biors_wrapper
     OPTIONS (NODE 'biors_server2.com', PORT '5555', TIMEOUT 30 ,
     CASE_SENSITIVE 'N');
```

TYPE *BioRS*
: Specifies the type of data source server to which you are configuring access. For the BioRS wrapper, the server type must be `BioRS`. This parameter is optional.

PORT *'5555'*
: Specifies the number of the port to be used to connect to the BioRS server. The default value is '5014'.

TIMEOUT *30*
: Specifies the time, in minutes, that the BioRS wrapper waits for a response from the BioRS server. The default value is 10. This parameter is optional.

CASE_SENSITIVE *'N'*
: Specifies whether the BioRS server treats names in a case sensitive manner. Valid values are 'Y' or 'N'. The default value is 'Y'.

  In the BioRS product, a configuration parameter controls the case sensitivity of the data that is stored on the BioRS server machine. The CASE_SENSITIVE option is the federated server counterpart to that BioRS system configuration parameter. You must synchronize the BioRS server case sensitivity configuration settings in your BioRS system and in the federated server. If you do not keep the case sensitivity configuration settings synchronized between the BioRS server and the federated server, errors will occur when you attempt to access BioRS data through the federated server.

Important: You cannot change or delete the CASE_SENSITIVE option after you create a new BioRS definition. If you need to change the CASE_SENSITIVE option, you must drop and then create the server definition again. If you drop the BioRS server definition, you must also create all of the BioRS nicknames that referenced that server definition. The federated server automatically drops all nicknames that correspond to a dropped server.

Registering a server definition that includes a proxy server

```
CREATE SERVER biors_proxy_serv VERSION 5.2 WRAPPER biors_proxy
     OPTIONS (NODE 'biors.mysite.com',
     PORT '5555',
     PROXY_TYPE 'HTTP'
  PROXY_SERVER_NAME 'proxy.mysite.com
  PROXY_SERVER_PORT'81'
```

PROXY_TYPE *'HTTP'*
Specifies the proxy type that is used to access the Internet when behind a firewall. The valid values are 'NONE', 'HTTP', or 'SOCKS'.

PROXY_SERVER_NAME *'proxy.mysite.com'*
Specifies the proxy server name or IP address. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

PROXY_SERVER_PORT *'81'*
Specifies the proxy server port number. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

Registering a server definition that includes a proxy server with authentication information

To register a server definition and specify a SOCKS proxy server with authentication information, use the following statement:

```
CREATE SERVER biors_proxy_serv VERSION 5.2 WRAPPER biors_proxy
     OPTIONS (NODE 'biors.mysite.com',
         PORT '5555',
         PROXY_TYPE 'SOCKS'
         PROXY_SERVER_NAME 'proxy_socks',
         PROXY_SERVER_PORT '1081',
         PROXY_AUTHID 'argle'
         PROXY_PASSWORD 'bargle')
```

PROXY_AUTHID *'argle'*
Specifies the user ID on the proxy server. This server option is required when the value for the PROXY_TYPE server option is 'SOCKS'.

PROXY_PASSWORD *'bargle'*
Specifies the password on the proxy server that is associated with the user name *'argle'*. This server option is required when the value for the PROXY_TYPE server option is 'SOCKS'.

Creating the user mappings for a BioRS data source

When you attempt to access a BioRS server, the federated server establishes a connection to the BioRS server. Depending on the account access methods that are used in your BioRS system, you might not need to create user mappings.

A user mapping is an association between each federated server user ID and password and the corresponding data source user ID and password.

There are two methods for specifying user mappings with federated systems. You can use an external repository, such as LDAP, to store the user mappings or you can create the user mappings in the federated database catalog.

Before you begin

The account access methods that are used in your BioRS system will determine if you need to create user mappings:
- If your BioRS server is configured for guest access for all user accounts, you do not need to create user mappings. The federated server uses a guest account to access the BioRS server.
- If you have an external repository, such as LDAP, to store the user mappings, you do not need to create user mappings. You must specify the DB2_UM_PLUGIN option on the BioRS wrapper. You can specify this option when you register or alter the wrapper. The schema in the external repository must include guest access.
- If your BioRS server is configured to authenticate user accounts with IDs and passwords, you must create user mappings in the federated database for any user accounts that will use the BioRS wrapper to access BioRS data sources.
- If your BioRS server is configured to use a mixture of guest and authenticated user accounts, you must create user mappings for the authenticated user accounts that will use the BioRS wrapper to access BioRS data sources.

About this task

User mappings provide a way to authenticate the access of users or applications that query a BioRS data source with the BioRS wrapper. If a user mapping is not defined for a user or application, the federated server uses a guest account. If a databank that is being queried requires authentication, an error message might be returned.

To ensure that the correct user ID and password get passed to the BioRS server, create user mappings in your federated database for users who are authorized to search BioRS data sources. When you create a user mapping, the remote password is stored in an encrypted format in a federated database system catalog table.

Procedure

To map a local user ID to the BioRS server user ID and password:

Choose the method that you want to use to create the user mappings:

Method	Procedure
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.

Method	Procedure
Using the command line	Issue the CREATE USER MAPPING statement. For example: `CREATE USER MAPPING FOR local_userID SERVER server_definition_name OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password') PROXY_AUTHID 'proxy_server_userID', PROXY_PASSWORD 'proxy_server_password';`

If you specify authentication information for the proxy server when you register a server definition and a user mapping, the values that you specify in the CREATE USER MAPPING statement take precedence over the values that you specify in the CREATE SERVER statement.

For example, you have ten people in your organization and you specify authentication information when you register the server definition. You create user mappings for three of the ten people. When the three people access the federated system, the authentication information that you specified when you created the user mappings is used. For the remaining seven people, the authentication information that you specified when you registered the server definition is used.

CREATE USER MAPPING statement - Examples for the BioRS wrapper:

Use the CREATE USER MAPPING statement to map a federated server user ID to a BioRS server user ID and password.

You can create a user mapping by specifying a guest user account, an authenticated user account, the USER special register, or a proxy server.

Creating a user mapping for a guest user account

The GUEST user option specifies if the BioRS wrapper should use a guest account to access the BioRS server.

The following example shows how to specify that a guest user account is used to access the BioRS server:

```
CREATE USER MAPPING FOR charlie SERVER biors_server
      OPTIONS (GUEST 'Y');
```

charlie Specifies the local authorization ID that you are mapping to a remote user ID, which is defined at the BioRS server.

SERVER *biors_server*
Specifies the server definition name that you registered in the CREATE SERVER statement for the BioRS server.

GUEST *'Y'*

Specifies that the BioRS wrapper uses a guest user account to authenticate this user.

Creating a user mapping for an authenticated user account

The following example shows how to map a federated server user ID to a BioRS server user ID and password:

```
CREATE USER MAPPING FOR charlie SERVER biors_server
      OPTIONS (REMOTE_AUTHID 'charlene',
      REMOTE_PASSWORD 'all4one');
```

charlie Specifies the local authorization ID that you are mapping to a remote user ID and password, which are defined at the BioRS server.

SERVER *biors_server*
: Specifies the server definition name that you registered in the CREATE SERVER statement for the BioRS server.

REMOTE_AUTHID *'charlene'*
: Specifies the user ID at the BioRS server to which you are mapping *charlie*. This remote ID must be in a format that is expected by the BioRS server.

REMOTE_PASSWORD *'all4one'*
: Specifies the password that is associated with *'charlene'*.

Creating a user mapping by using a special register

You can use the federated database special register USER to map the authorization ID of the person who is issuing the CREATE USER MAPPING statement to the data source authorization ID that is specified in the REMOTE_AUTHID user option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER biors_server
       OPTIONS (REMOTE_AUTHID 'charlene', REMOTE_PASSWORD 'all4one');
```

Creating a user mapping for a proxy server

The following example shows how to map a federated server user ID to a BioRS server user ID and password:

To register a server definition and specify a SOCKS proxy server with authentication information, use the following statement:

```
CREATE USER MAPPING FOR charlie SERVER biors_proxy
      OPTIONS (REMOTE_AUTHID 'charlene',
      REMOTE_PASSWORD 'all4one'
      PROXY_AUTHID 'chuck'
      PROXY_PASSWORD 'them2us');
```

PROXY_AUTHID *'chuck'*
: Specifies the user ID on the proxy server. This user mapping option is required when the proxy server requires authentication.

PROXY_PASSWORD *'them2us'*
: Specifies the password on the proxy server that is associated with the user name *'chuck'*. This user mapping option is required when the proxy server requires authentication.

Registering nicknames for BioRS data sources

For each BioRS server definition that you register, you must register a nickname for each databank that you want to access. Use these nicknames, instead of the names of the databanks, when you query the BioRS servers.

Before you begin

- If a BioRS databank name does not conform to the syntax required by the CREATE NICKNAME statement, you must use the REMOTE_OBJECT nickname option when you register the nickname.
- If a BioRS element name does not conform to the syntax required by the CREATE NICKNAME statement, you must use the ELEMENT_NAME column option when you register the nickname.

Restrictions

Do not use the BioRS AllText element as the first column for a nickname. You can use the BioRS AllText element in any other column position (for example, as the second column or as the third column).

About this task

After a data source has been integrated into the BioRS system, it is referred to as a *databank* in BioRS. Databanks in BioRS equate to nicknames in a federated system.

The names that you give the nicknames can be up to 128 characters in length.

You can register a nickname by using the Control Center or from the command line. The Control Center includes a wizard to guide you through the steps that are necessary to register the nickname.

Procedure

To register a nickname for a BioRS databank:

Choose the method that you want to use to register the nickname:

Method	**Procedure**
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.

Using the command line	Issue the CREATE NICKNAME statement. For example:
	`CREATE NICKNAME nickname`
	`(`
	`column_name data_type`
	`   OPTIONS (nickname_column_options),`
	`column_name data_type`
	`   OPTIONS (nickname_column_options),`
	`column_name data_type`
	`   OPTIONS (nickname_column_options)`
	`)`
	`FOR SERVER server_definition_name`
	`OPTIONS (nickname_options);`

When you create a BioRS nickname, you define a list of nickname columns. The specified nickname columns must correspond to elements of a specific BioRS databank format. BioRS defines five possible data types for elements: Text, Number, Date, Author, and Reference. The BioRS data types can be mapped only to the CHAR, CLOB, or VARCHAR data types that are used by the federated database.

Repeat this step for each BioRS databank that you want to create a nickname for.

CREATE NICKNAME statement - examples for the BioRS wrapper:

Use the CREATE NICKNAME statement to register a nickname for a BioRS databank that you want to access.

Creating simple, but limited, nicknames for databanks

The simplest way to register a nickname for a BioRS databank is to give the nickname the same name as the BioRS databank.

For example:

```
CREATE NICKNAME SwissProt
    (ID VARCHAR(32) OPTIONS (ELEMENT_NAME '_ID_'),
     ALLTEXT VARCHAR(128),
     ENTRYDATE VARCHAR (64))
     FOR SERVER biors_server;
```

The name of the nickname is *SwissProt*, which is the same as the name of the corresponding BioRS databank.

Using this simple CREATE NICKNAME syntax limits you in two ways:

1. You are limited to one family of nicknames for each federated database schema. For example, you have two databanks that have a parent-child relationship. The databanks are SWISSPROT and SPFEAT. These databanks form a family. If you use the default syntax for the CREATE NICKNAME statement, you will have the (SWISSPROT nickname for the SWISSPROT databank and the SPFEAT nickname for the SPFEAT databank. To have more than one nickname for SWISSPROT in the schema, you must use the REMOTE_OBJECT nickname option when you register the nickname.
2. You are limited to databanks whose names can be used as nickname names. The databank name must conform to the syntax that is supported by the federated server. For example, if the databank name includes a period or space, you must use the REMOTE_OBJECT nickname option when you register the nickname.

Creating multiple nicknames for the same databank

The REMOTE_OBJECT nickname option specifies the name of the BioRS databank that is associated with the nickname. The name that you specify in the REMOTE_OBJECT nickname option determines the schema and the BioRS databank for the nickname. The REMOTE_OBJECT nickname option also specifies the relationship of the nickname to other nicknames.

The following example shows the same set of nickname characteristics as the previous example, but changes the nickname name. The example uses the REMOTE_OBJECT nickname option to specify the BioRS databank for which the nickname is being defined:

```
CREATE NICKNAME NewSP
    (ID VARCHAR(32) OPTIONS (ELEMENT_NAME '_ID_'),
     ALLTEXT VARCHAR(128),
     ENTRYDATE VARCHAR (64))
     FOR SERVER biors_server
     OPTIONS (REMOTE_OBJECT 'SwissProt');
```

Creating nicknames for databanks that do not conform to federated syntax

The following example shows how to create a nickname for a remote BioRS databank that does not conform to the syntax required by the federated server:

```
CREATE NICKNAME SwissFT
  (ID VARCHAR(32) OPTIONS (ELEMENT_NAME '_ID_'),
   ALLTEXT VARCHAR (128),
   ENTRYDATE VARCHAR (64),
   FtLength VARCHAR (16))
    FOR SERVER biors1
   OPTIONS (REMOTE_OBJECT 'SwissProt.Features');
```

SwissFT
A unique nickname that is used to identify the BioRS databank.

ID *VARCHAR(32)* **OPTIONS (ELEMENT_NAME** *'_ID_'***)**
The name and data type for a table column. The ELEMENT_NAME column option is specified for the ID column.

The ELEMENT_NAME column option specifies the BioRS element name. The case sensitivity of this name depends on the case sensitivity of the BioRS server and on the value of the CASE_SENSITIVE server option. You need to specify the BioRS element name only if it is different from the column name. Column option values must be enclosed in single quotation marks.

In general, use the ELEMENT_NAME column option under the following circumstances:

- When a BioRS element name contains characters, such as periods and spaces, that do not conform to valid federated syntax. For example, if your databank has an element named Pub.Date, you cannot use the element name as the column name. Characters such as periods and spaces are not supported. You must map the element name to a valid column name.
- When the syntax of a BioRS element name does not conform to standards that you or your organization have established for your federated system. For example, if your organization has established that the conventions for schemas, nicknames, and columns must include a prefix, a BioRS element name might not be able to be used as a column name.
- When the BioRS element name might not be obvious to federated users.

ALLTEXT *VARCHAR(128)*
The name and data type for a table column.

ENTRYDATE *VARCHAR(64)*
The name and data type for a table column.

FtLength *VARCHAR(16)*
The name and data type for a table column.

SERVER *biors1*
The name that you assigned to the BioRS server in the CREATE SERVER statement.

OPTIONS (REMOTE_OBJECT *'SwissProt.Features'***)**
Specifies the name of the BioRS databank that is associated with the nickname. This name determines the schema and the BioRS databank for the nickname. This name also specifies the relationship of the nickname to other nicknames.

The case sensitivity of this name depends on the case sensitivity of the BioRS server and on the value of the CASE_SENSITIVE server option.

Important: You cannot change or delete this name with the ALTER NICKNAME statement. If the name of the BioRS databank changes, you must delete and then create the nickname again.

You must specify the REMOTE_OBJECT nickname option when the name of a BioRS databank does not conform to valid federated syntax. In this example, the databank name ″SwissProt.Features″ does not conform for several reasons. The databank name contains a character, a period, that is not valid federated syntax and contains a mixture of uppercase and lowercase letters.

In general, use the REMOTE_OBJECT nickname option under the following circumstances:

- When a BioRS databank name contains characters, such as periods and spaces, that do not conform to valid federated syntax. You must map the databank name to a valid federated name.
- When the case sensitivity of a BioRS databank name does not conform to standards that you or your organization have established for your federated system. For example, if your organization has established that the conventions for schemas, nicknames, and columns must include a prefix, a BioRS databank name might not be able to be used a name.
- When the BioRS databank name might not be obvious to federated users.

Creating nicknames for a databank linked to another BioRS databank

The following example shows how to create a nickname for a table that uses a BioRS databank that is linked to another BioRS databank:

```
CREATE NICKNAME SwissFT2
  (ID VARCHAR(32) OPTIONS (ELEMENT_NAME '_ID_'),
  ALLTEXT VARCHAR (1200),
  FtKey VARCHAR (32),
  FtLength VARCHAR (64),
   FtDescription VARCHAR (128),
   Parent VARCHAR (32) OPTIONS (REFERENCED_OBJECT 'SwissProt'))
 FOR SERVER biors1
 OPTIONS (REMOTE_OBJECT 'SwissProt.Features');
```

The name of this nickname is SwissFT2. The table columns are ID, ALLTEXT, FtKey, FtLength, FtDescription, and Parent. The ELEMENT_NAME column option is specified for the ID column. The REMOTE_OBJECT option is used to specify the name of the BioRS databank to which the nickname corresponds.

Additionally, the Parent column uses the REFERENCED_OBJECT option. You must specify this option for columns that correspond to BioRS Reference data type elements. The REFERENCED_OBJECT option specifies the name of the BioRS databank to which the column refers. In this case, the Parent element refers to the BioRS SwissProt databank.

Custom functions and BioRS queries

The BioRS custom functions are used with the BioRS wrapper to push down predicates to the BioRS query engine.

The federated environment uses two query engines. For the BioRS wrapper, these query engines are the federated database and BioRS. You can specify that predicates get pushed down to the BioRS engine by using the four BioRS custom functions.

All of the custom functions for the BioRS wrapper must be registered with the schema name `BIORS`. You must include the `BIORS` schema whenever you use the functions.

The custom functions for the BIORS wrapper are:
- BIORS.CONTAINS
- BIORS.CONTAINS_LE
- BIORS.CONTAINS_GE
- BIORS.SEARCH_TERM

The BioRS CONTAINS functions

The custom functions BIORS.CONTAINS, BIORS.CONTAINS_LE and BIORS.CONTAINS_GE require a search term column argument and a query text argument. The following example shows a BIORS.CONTAINS statement:

```
BIORS.CONTAINS (search_term_column,query_term)
```

The value of the search term column argument must refer to an indexed BioRS column. The use of a non-indexed column produces the error message SQL30090N (″Operation invalid for application execution environment″).

The value of the query term argument is the value that is used to search the indexed element that is specified in the search term column argument.

The value of the query term argument can be only a literal, a host variable, or a column reference. You cannot use arithmetic or string concatenation. Also, the value of the query term argument cannot be NULL, even if the search term column that is used is defined as allowing null values.

The case of the query term argument does not matter.

Valid data types

The valid data types and formats of the query term argument depend on the BioRS data type of the search term column that is used. BioRS defines five possible data types: Text, Author, Date, Number, and Reference.

The BioRS data types and the function query terms that are valid for each data type are listed in the following table.

Table 8. BioRS data types and valid custom function query terms

Data type of search term column	Valid query term	Format
Text	VARCHAR() or CHAR()	BioRS text term, including wildcards.
Author	VARCHAR() or CHAR()	BioRS author reference in the form ″<last>, <init>″. ″<last>″ is the author’s last name. ″<init>″ is the author’s initials, without periods. White space between the comma and initials is accepted. Alternatively, <last> can be specified alone, without the comma or initials.

Table 8. BioRS data types and valid custom function query terms (continued)

Data type of search term column	Valid query term	Format
Date	VARCHAR(), CHAR(), DATE, or TIMESTAMP	If a character string, date format valid for the federated database, yyyy/mm/dd.
Number	VARCHAR() or CHAR(), INTEGER, SMALLINT, BIGINT REAL, DOUBLE, DECIMAL	Number formats valid for the federated database.
Reference	VARCHAR() or CHAR()	BioRS text term.

All other combinations of BioRS data type search term columns and query term arguments produce the error message SQL30090N (″Operation invalid for application execution environment″).

Using wildcard characters

The query term argument for Text, Author, and Reference data type search term columns must match a BioRS query language pattern. In BioRS, query term arguments can consist of alphanumeric strings and wildcards. The BIORS.CONTAINS function supports two wildcards: **?** (question mark) and ***** (asterisk).

The **?** wildcard matches a single character. For example, the predicate `BioRS.CONTAINS (description, 'bacteri?')=1` matches the term bacteria but not the term bacterial.

The * wildcard character matches zero or more characters. For example, the predicate `BioRS.CONTAINS (description, 'bacteri*')=1` matches the terms bacteri, bacteria, and bacterial.

For detailed information about BioRS query language patterns, see your BioRS documentation.

Specifying BioRS CONTAINS functions in queries

The BIORS.CONTAINS function can be specified for all BioRS column types.

The BIORS.CONTAINS_GE and BIORS.CONTAINS_LE custom functions can be specified only for columns whose underlying BioRS data type is Number or Date. The BIORS.CONTAINS_GE function selects rows where the column contains a value that is greater than or equal to the value that is represented by the query term argument. The BIORS.CONTAINS_LE function selects rows where the column contains a value that is less than or equal to the value that is represented by the query term argument.

The BIORS.CONTAINS, BIORS.CONTAINS_GE, and BIORS.CONTAINS_LE functions return an integer result. When any of the three CONTAINS functions are used in a predicate, the return value must be compared to the value 1 using the **=** or **<>** operators. For example:

```
SELECT * FROM s.MySP WHERE BIORS.CONTAINS (s.AllText, 'muscus') = 1;
```

The expression `NOT (BioRS.Contains (col,value) = 1)` is equivalent to the expression `BioRS.CONTAINS (col,value) <> 1`.

The BioRS SEARCH_TERM function

The BIORS.SEARCH_TERM custom function requires a search term column argument and a query term. The following example shows the syntax for the SEARCH_TERM custom function:

```
BIORS.SEARCH_TERM (search_term_column,query_term)
```

The value of the search term column argument must refer to the column that represents the _ID_ element.

The value of the query term argument is an expression that can reference multiple elements.

The value of the query term argument can be only a literal, a host variable, or a column reference. You cannot use arithmetic or string concatenation. Also, the value of the query term argument cannot be NULL, even if the search term column that is used is defined as allowing null values.

The case of the query term argument does not matter.

Specifying BioRS SEARCH_TERM function in queries

You can run queries that might not otherwise be possible by issuing the BIORS.SEARCH_TERM function. You can use this function to specify a search term using the BioRS format. The BIORS.SEARCH_TERM function requires two arguments. The first argument is a reference to the _ID_ column of the nickname to which the term is to be applied. The second argument is a character string that contains the term without a databank name.

The following example selects all of the columns for the entries in the MyEMBL databank where the SeqLength element contains a value greater than or equal to 100.

```
SELECT * FROM MyEMBL s WHERE
    BIORS.SEARCH_TERM (s.ID, '[SeqLength GREATER number:100;]') = 1;
```

The following example selects the MolWeight column from the Swiss nickname where the value of the MolWeight element is greater than or equal to 100368.

```
SELECT s.molweight FROM Swiss s WHERE
    BIORS.SEARCH_TERM (s.ID, '[MolWeight GREATER number:100368;]') = 1;
```

Equality operations in BioRS queries

You can use an equality operator (=) in literal expressions or in join queries, with certain limitations.

If you use the equality operator in a literal expression or in a join query, equality operator must reference the _ID_ element of a BioRS databank for the query to be pushed down to the BioRS server. Queries that include an equality operator but that do not reference the _ID_ element are not pushed down for processing by the BioRS server.

You can use the equality operator in a literal expression. For example:

```
ID = 'swissprot:100K_RAT'
```

You can use an equality predicate in a join between a BioRS databank and another local table or nonBioRS nicknames. For example:

```
SELECT n.ID, n.EntryDate, t.C1 FROM w46851_n1 n, w46851_t1 t WHERE t.ID = n.ID
```

A join between BioRS databanks must reference the _ID_ element of one databank and a reference type element for the other databank.

However, the use of an equality predicate can return results that differ from the expected results under these conditions:

Case-insensitive matching
The operation is not case sensitive. For example, ID='100k_rat' matches both of the following strings:

- '100k_rat'
- '100K_RAT'

Wildcard matching
The statement ID='100K_R*' matches both '100K_RAT' and '100K_RODENT.'

Databank prefixing
The operation returns a prefix that indicates the source databank. For example, ID='100K_RAT' in a join on the SwissProt databank might return a value of 'swissprot:100K_RAT.'

Note: Do not create applications that depend on any of the described behaviors.

The following example illustrates the behavior of the equality predicate in a join.

The local table, w46851_t1, contains the following values:

```
ID                             C1
------------------------------ -----------
swissprot:100K_RAT                       0
swissprot:RAT                            1
swissprot:100K_R                         2
swissprot:100K_R*                        3
swissprot:100k_rat                       4
100K_RAT                               100
RAT                                    101
100K_R                                 102
100K_R*                                103
100k_rat                               104
```

You can join the table w46851_t1 with a nickname w46851_n1 that is based on the SwissProt databank. The following statement shows the join query with an equality operation:

```
SELECT n.ID, n.EntryDate, t.C1 FROM w46851_n1 n, w46851_t1 t WHERE t.ID = n.ID
```

The following results are returned:

```
ID                             ENTRYDATE       C1
------------------------------ --------------- -----------
swissprot:100K_RAT             01-NOV-1997               0
swissprot:100K_RAT             01-NOV-1997               3
swissprot:100K_RAT             01-NOV-1997               4
swissprot:100K_RAT             01-NOV-1997             100
swissprot:100K_RAT             01-NOV-1997             103
swissprot:100K_RAT             01-NOV-1997             104

  6 record(s) selected.
```

However, the expected behavior is that only row 0 would be returned.

Equijoin predicates for the BioRS wrapper

You must specify predicates for the BioRS engine when you use the BioRS custom functions, with one exception. The exception is when you perform equijoin operations during a query.

A *join* operation involves retrieving data from two or more tables based on matching column values. An *equijoin* is a join operation in which the join condition has the form expression = expression. For BioRS queries, equijoin terms must contain the _ID_ element of one databank and a Reference type element of another databank.

Example for nickname definitions and an equijoin query

This example shows sample nickname definitions and an equijoin query that uses the sample nicknames.

You want to query two BioRS databanks, SwissProt and SwissProt.features. The SwissProt.features databank is a child of the SwissProt databank, and contains an element called Parent. The Parent element contains references to entries that are identified by the _ID_ element of SwissProt. You register two nickname definitions for the two databanks.

Nickname definition for the SwissProt databank

The SwissProt databank is the parent databank.

```
CREATE NICKNAME tc600sprot (
    ID              VARCHAR (32) OPTIONS (ELEMENT_NAME '_ID_'),
    AllText         VARCHAR (128),
    EntryDate       VARCHAR (128),
    Update          VARCHAR (128),
    Description     VARCHAR (1200),
    Crossreference  VARCHAR (32),
    Authors         VARCHAR (256),
    Journal         VARCHAR (256),
    JournalIssue    VARCHAR (64) OPTIONS (IS_INDEXED 'N'),
    PublicationYear VARCHAR (1024),
    Gene            VARCHAR (20) OPTIONS (IS_INDEXED 'Y'),
    Remarks         VARCHAR (1200),
    RemarkType      CHAR (20),
    CatalyticActivity VARCHAR (20),
    CoFactor        VARCHAR (64),
    Disease         VARCHAR (128),
    Function        VARCHAR (128),
    Pathway         VARCHAR (128),
    Similarity      VARCHAR (128),
    Complex         VARCHAR (64),
    FtKey           VARCHAR (32),
    FtDescription   VARCHAR (128),
    FtLength        VARCHAR (256),
    MolWeight       VARCHAR (64),
    ProteinLen      VARCHAR (32) OPTIONS (ELEMENT_NAME 'Protein_length'),
    Sequence        CLOB,
    AccNumber       VARCHAR (32),
    Taxonomy        VARCHAR (128),
    Organelle       VARCHAR (128),
    Organism        VARCHAR (128),
    Keywords        VARCHAR (1200),
    Localization    VARCHAR (128),
    FtKey_count     VARCHAR (32))
    FOR SERVER biors_server_600
        OPTIONS (REMOTE_OBJECT 'SwissProt');
```

Nickname definition for the SwissProt.features databank

The SwissProt.features databank is a child databank of the SwissProt databank. This nickname contains the **Parent** element.

```
CREATE NICKNAME tc600feat (
    ID            VARCHAR (32) OPTIONS (ELEMENT_NAME '_ID_'),
    AllText       VARCHAR (1200),
    FtKey         VARCHAR (32),
    FtLength      VARCHAR (64),
    FtDescription VARCHAR (128),
    Parent        VARCHAR (32) OPTIONS (REFERENCED_OBJECT 'SwissProt'))
    FOR SERVER biors_server_600
        OPTIONS (REMOTE_OBJECT 'SwissProt.features');
```

The query that references both nicknames in an equijoin

In this query, two predicates are applied to the tc600sprot nickname (SwissProt databank). These two predicates filter the rows that contain the term anopheles and have a publication year of 1997. One predicate is applied to the tc600feat nickname (SwissProt.features databank), which filters those rows whose FtKey element contains the term signal. The two nicknames are joined using the term *f.Parent = s.ID*.

```
SELECT s.ID, f.ID, f.FtKey FROM tc600sprot s, tc600feat f
   WHERE BIORS.CONTAINS (s.AllText, 'anopheles') = 1
   AND BIORS.CONTAINS (s.PublicationYear, 1997) = 1
  AND BIORS.CONTAINS (f.FtKey, 'signal') = 1
  AND f.Parent = s.ID;
```

The final result set contains only the rows that meet these criteria, and the entries in the SwissProt.features databank that reference a matching entry in the SwissProt databank.

The BioRS AllText element

Every databank in the BioRS system contains an element called AllText. The AllText element is an indexed element that BioRS automatically creates for all databanks.

By using the AllText element, you can search on all of the text in an entry, not just on specific indexed elements. For example, searching on the term `muscus` can return entries where the word `muscus` appears in the title, abstract, description, or organism.

To use the AllText element in a federated query, you must map the AllText element to a nickname column. You map the AllText element to a nickname column when you specify columns in the CREATE NICKNAME statement. A nickname column that is mapped to the AllText element returns a NULL value in SELECT statements. When you specify a column as an AllText element, the column must not be the first column declared in a CREATE NICKNAME statement.

After the AllText element is properly mapped to a nickname column, you can use that nickname column in a BIORS.CONTAINS custom function.

BioRS data source - Example queries

These examples include a comprehensive set of sample queries that you can use to access BioRS data sources and show you the statements that are necessary to create the nicknames that are used in the examples.

These examples show you how to:
- Structure your queries to optimize system performance
- Use the custom functions and wildcards in your queries
- Use queries to access specific BioRS data type columns
- Use relational predicates to form an equijoin between parent and child nicknames

The sample queries use the nicknames `swiss` and `swissft`.

CREATE NICKNAME statement for the `swiss` nickname

The parent nickname `swiss` was registered for the SwissProt databank by using the following CREATE NICKNAME statement:

```
CREATE NICKNAME swiss
  (
  ID                CHAR (30) OPTIONS (ELEMENT_NAME '_ID_'),
  EntryDate         VARCHAR (15),
  Update            CLOB (15),
  Description       CLOB (15),
  Crossreference    CLOB (15),
  Authors           CLOB (15),
  Journal           VARCHAR (15),
  JournalIssue      VARCHAR (15),
  PublicationYear   CLOB (15),
  PublicationTitle  CLOB (15),
  Gene              CLOB (15),
  Remarks           CLOB (15),
  RemarkType        VARCHAR (15),
  CatalyticActivity VARCHAR (15),
  CoFactor          VARCHAR (15),
  Disease           VARCHAR (15),
  Function          CLOB (15),
  Pathway           VARCHAR (15),
  Similarity        CLOB (15),
  Complex           VARCHAR (15),
  FtKey             VARCHAR (15),
  FtDescription     CLOB (15),
  FtLength          VARCHAR (15),
  MolWeight         CHAR (15),
  Protein_Length    VARCHAR (15),
  Sequence          CLOB (15),
  AccNumber         VARCHAR (15),
  Taxonomy          CLOB (15),
  Organelle         VARCHAR (15),
  Organism          VARCHAR (15),
  Keywords          VARCHAR (15),
  Localization      VARCHAR (15),
  FtKey_count       VARCHAR (15),
  AllText           CLOB (15)
  )
    FOR SERVER biors_server
      OPTIONS (REMOTE_OBJECT 'swissprot');
```

CREATE NICKNAME statement for the `swissft` nickname

The child nickname `swissft` was registered for the SwissProt.Features databank by using the following CREATE NICKNAME statement:

```
CREATE NICKNAME swissft
  (
  ID              VARCHAR (30) OPTIONS (ELEMENT_NAME '_ID_'),
  FtKey           VARCHAR (15),
  FtLength        VARCHAR (15),
  FtDescription   VARCHAR (15),
  Parent          VARCHAR (30) OPTIONS (REFERENCED_OBJECT 'swissprot'),
  AllText         CLOB (15)
  )
    FOR SERVER biors_server
      OPTIONS (REMOTE_OBJECT 'swissprot.features');
```

Query structures impact federated server performance

The queries and results in the following table show how you can structure your queries to optimize the workload between the federated system and the BioRS server.

Table 9. Samples of different queries that produce identical results

Query	Result

SELECT s.id FROM Swiss s WHERE BIORS.CONTAINS(s.id, ’100K_RAT’) = 1 FETCH FIRST 3 ROWS ONLY;	`ID`
	`---------------`
	`100K_RAT`
	
	`1 record(s) selected.`

SELECT s.id FROM Swiss s WHERE s.id LIKE ’%100K_RAT%’ FETCH FIRST 3 ROWS ONLY;	`ID`
	`---------------`
	`100K_RAT`
	
	`1 record(s) selected.`

Both of the queries in this table produce the same results. However, the first query runs much faster than the second query. The first query uses the BIORS.CONTAINS function to specify the input predicate. As a result, the BioRS server selects the data in the SwissProt databank, then passes the selected data to the federated server. In the second query, the LIKE input predicate is specified directly on the `swiss` nickname. As a result, the BioRS server transfers the entire SwissProt databank to the federated server. After the databank contents are transferred, the federated server then selects the data.

Query performance is typically much better when predicates are sent to the data source for processing.

Queries that use wildcards in the BIORS.CONTAINS custom function

The queries and results in the following table show the use of wildcard characters in the BIORS.CONTAINS custom function. All of the query results are identical, even though different wildcard characters are used.

Table 10. Sample queries that use wildcards in the BIORS.CONTAINS custom function

Query	Result

SELECT s.crossreference FROM Swiss s WHERE BIORS.CONTAINS(s.crossreference, ’MEDLINE’) = 1 FETCH FIRST 3 ROWS ONLY;	`CROSSREFERENCE`
	`---------------`
	`NCBI_TaxID=1011`
	`NCBI_TaxID=5875`
	`NCBI_TaxID=4081`
	
	`  3 record(s) selected.`

SELECT s.crossreference FROM Swiss s WHERE BIORS.CONTAINS(s.crossreference, ’?ED?IN?’) = 1 FETCH FIRST 3 ROWS ONLY;	`CROSSREFERENCE`
	`---------------`
	`NCBI_TaxID=1011`
	`NCBI_TaxID=5875`
	`NCBI_TaxID=4081`
	
	`  3 record(s) selected.`

SELECT s.crossreference FROM Swiss s WHERE BIORS.CONTAINS(s.crossreference, ’*D*N*’) = 1 FETCH FIRST 3 ROWS ONLY;	`CROSSREFERENCE`
	`---------------`
	`NCBI_TaxID=1011`
	`NCBI_TaxID=5875`
	`NCBI_TaxID=4081`
	
	`  3 record(s) selected`

Queries that access BioRS Author data type columns

The queries and results in the following table show how you can access information in BioRS Author data type elements with the BIORS.CONTAINS custom function. The syntax of all of the queries is nearly identical. The only difference is the presence or absence of the first initial in the query term, and the amount of space between the first name and the last initial.

Table 11. Sample queries that access BioRS Author data type columns

Query	Result

SELECT s.authors FROM Swiss s WHERE BIORS.CONTAINS(s.authors, ’Mueller’) = 1 FETCH FIRST 3 ROWS ONLY;	`AUTHORS`
	`---------------`
	`Mueller D. Rehb`
	`Mayer K.F.X. Sc`
	`Zemmour J. Litt`
	
	`  3 record(s) selected.`

SELECT s.authors FROM Swiss s WHERE BIORS.CONTAINS(s.authors, ’Mueller,D’) = 1 FETCH FIRST 3 ROWS ONLY;	`AUTHORS`
	`---------------`
	
	`  0 record(s) selected.`

SELECT s.authors FROM Swiss s WHERE BIORS.CONTAINS(s.authors, ’Mueller ,D’) = 1 FETCH FIRST 3 ROWS ONLY;	`AUTHORS`
	`---------------`
	
	`  0 record(s) selected.`

SELECT s.authors FROM Swiss s WHERE BIORS.CONTAINS(s.authors, ’Mueller, D’) = 1 FETCH FIRST 3 ROWS ONLY;	`AUTHORS`
	`---------------`
	`Mueller D. Rehb`
	`Zou P.J. Borovo`
	`Davies J.D. Mue`
	
	`  3 record(s) selected.`

Queries that access BioRS Date data type columns

The queries and results in the following table who how you can access information in BioRS Date type elements with the BIORS.CONTAINS custom function.

When a BioRS Date type field contains a sequence of dates, the results can contain extra information, as shown in the second example in the table. BioRS Numeric data type elements (Date and Number) can contain multiple values. Therefore, the results of the queries that are run on BioRS Date or Number elements can also contain multiple values. Multiple values are always separated by spaces.

Table 12. Sample queries that access BioRS Date data type columns

Query	Result

SELECT e.entrydate FROM embl e WHERE BIORS.CONTAINS(e.entrydate, date('11/01/1997')) = 1 FETCH FIRST 3 ROWS ONLY;	`ENTRYDATE`
	`---------------`
	`01-NOV-1997`
	`01-NOV-1997`
	`01-NOV-1997`
	
	`  3 record(s) selected.`

SELECT g.update FROM gen g WHERE BIORS.CONTAINS(g.update, date('11/01/1997')) = 1 FETCH FIRST 3 ROWS ONLY;	`UPDATE`
	`---------------`
	`01-NOV-1997 11-`
	`01-NOV-1997 12-`
	`01-NOV-1997 06-`
	
	`  3 record(s) selected.`

Queries that use the BIORS.CONTAINS_LE and BIORS.CONTAINS_GE custom functions

The queries and results in the following table show how you can use the BIORS.CONTAINS_LE and the BIORS.CONTAINS_GE custom functions.

Table 13. Sample queries that use the BIORS.CONTAINS_LE and BIORS.CONTAINS_GE custom functions

Query	Result

SELECT s.molweight FROM Swiss s WHERE BIORS.CONTAINS_LE(s.molweight, 100368) = 1 FETCH FIRST 3 ROWS ONLY;	`MOLWEIGHT`
	`---------------`
	`100368`
	`10576`
	`8523`
	
	`  3 record(s) selected.`

SELECT s.molweight FROM Swiss s WHERE BIORS.CONTAINS_GE(s.molweight, 100368) = 1 FETCH FIRST 3 ROWS ONLY;	`MOLWEIGHT`
	`---------------`
	`100368`
	`103625`
	`132801`
	
	`  3 record(s) selected.`

Table 13. Sample queries that use the BIORS.CONTAINS_LE and BIORS.CONTAINS_GE custom functions (continued)

Query	Result

SELECT s.journalissue FROM Swiss s WHERE BIORS.CONTAINS_GE(s.journalissue, 172) = 1 FETCH FIRST 3 ROWS ONLY;	`JOURNALISSUE`
	`---------------`
	`172 21`
	`242`
	`196`
	
	`  3 record(s) selected.`

Queries that use the BIORS.SEARCH_TERM custom function

The queries and results in the following table show how you can use the BIORS.SEARCH_TERM custom function to specify a search term using the BioRS format.

Table 14. Sample queries that use the BIORS.SEARCH_TERM custom function

Query	Result

SELECT s.publicationyear FROM Swiss s WHERE BIORS.SEARCH_TERM (s.id, ′[PublicationYear EQ number:1997;]′)=1 FETCH FIRST 10 ROWS ONLY;	`PUBLICATIONYEAR`
	`---------------`
	`1997`
	`1997 2000`
	`1988 1991 1997`
	`1994 1997`
	`1997 1998`
	`1994 1995 1997`
	`1997 1999`
	`1997`
	`1994 1994 1995`
	`1993 1992 1997`
	
	`  10 record(s) selected.`

SELECT s.molweight FROM Swiss s WHERE BIORS.SEARCH_TERM (s.id, ′[MolWeight EQ number:100368;]′) = 1 FETCH FIRST 10 ROWS ONLY;	`MOLWEIGHT`
	`---------------`
	`100368`
	`100368`
	
	`  2 record(s) selected.`

SELECT s.molweight FROM Swiss s WHERE BIORS.SEARCH_TERM (s.id, ′[MolWeight GREATER number:100368;]′) = 1 FETCH FIRST 10 ROWS ONLY;	`MOLWEIGHT`
	`---------------`
	`100368`
	`103625`
	`132801`
	`194328`
	`130277`
	`287022`
	`289130`
	`135502`
	`112715`
	`112599`
	
	`  10 record(s) selected.`

Using relational predicates to form an equijoin between two databanks that have a parent-child relationship

The following query shows how to use relational predicates to form an equijoin between two databanks that have a parent-child relationship:

```
SELECT s.id, f.id, f.parent FROM Swiss s, Swissft f
    WHERE (f.parent = s.id) FETCH FIRST 10 ROWS ONLY;
```

In the following query results, the `100K_RAT` record is a parent to nine child records (`100K_RAT.1` through `100K_RAT.9`).

```
ID                  ID                PARENT
------------------- ----------------- -----------------------------
100K_RAT            100K_RAT.1        swissprot:100K_RAT
100K_RAT            100K_RAT.2        swissprot:100K_RAT
100K_RAT            100K_RAT.3        swissprot:100K_RAT
100K_RAT            100K_RAT.4        swissprot:100K_RAT
100K_RAT            100K_RAT.5        swissprot:100K_RAT
100K_RAT            100K_RAT.6        swissprot:100K_RAT
100K_RAT            100K_RAT.7        swissprot:100K_RAT
100K_RAT            100K_RAT.8        swissprot:100K_RAT
100K_RAT            100K_RAT.9        swissprot:100K_RAT
104K_THEPA          104K_THEPA.1      swissprot:104K_THEPA

  10 record(s) selected.
```

Optimizing BioRS wrapper performance

You can improve query performance to BioRS data sources by optimizing the performance of the BioRS wrapper.

Guidelines for optimizing BioRS wrapper performance

The structure of your queries and statistical information about the BioRS databanks impact query performance.

Minimize the amount of data that is transferred between search engines.

The federated environment uses two search engines. For the BioRS wrapper, these search engines are the federated database and BioRS. Some configurations include more than one federated database engine. The federated database engine processes predicates (relational operators, such as =, BETWEEN, LIKE, and <>) specified on nickname columns. The BioRS engine processes predicates that are specified using four custom functions for the BioRS wrapper.

To minimize the amount of data that is transferred between the two search engines, structure your queries so that data processing gets pushed down to the BioRS system whenever possible.

If you need to perform join operations in a query, take advantage of any parent-child relationships that already exist in the BioRS databanks and perform equijoin operations whenever possible. Equijoin operations are processed in BioRS, which also minimizes the amount of data transferred between the federated database and BioRS search engines.

Important: Do not interrupt federated queries to BioRS, for example using Ctrl-D or Ctrl-Z in the command line processor, or stopping an application program. Interrupting a query leaves "dead" processes running on the BioRS server. These "dead" processes will rapidly degrade both the BioRS server and the federated server performance. If enough of these "dead" processes are running, unexpected errors can occur during federated query processing. For example, a valid query might return 0 rows, when rows are expected. In extreme situations, the BioRS server, the federated server, or both servers can stop or abnormally end.

Maintain BioRS statistical information in the federated environment.
In a federated system, the federated database relies on catalog statistics for nicknamed objects to optimize query processing. Maintaining current statistics about the BioRS data sources is essential to optimize the performance of the BioRS wrapper. If the statistical data or structural characteristics for a remote object on which a nickname is defined have changed, you must update the corresponding nickname column cardinality statistics in your federated system.

To optimize BioRS wrapper performance, perform these updates on the federated server at regular intervals.

BioRS statistical information

Current BioRS statistical information is essential for optimizing the performance of the BioRS wrapper.

In a federated system, the federated database relies on catalog statistics for objects with nicknames to optimize query processing. These statistics are retrieved from BioRS data sources when you register a nickname using the CREATE NICKNAME statement. The federated database verifies the presence of the object at the data source, and then attempts to gather existing data source statistical data. Information is read from the data source catalogs and put into the system catalog in the federated database.

For BioRS data sources, critical statistical information includes:
- The cardinality of a nickname. For BioRS data sources, nickname cardinality is equivalent to the number of entries in the corresponding BioRS databank.
- The cardinality of the column that corresponds to the BioRS _ID_ element. The cardinality of this column must match the cardinality of the nickname in which the column is referenced.
- The cardinality of all columns that the BioRS wrapper might need to use.

Tip: to optimize the performance of the BioRS wrapper, you should maintain current statistics about the BioRS data sources. If the statistical data or structural characteristics change for a remote object on which a nickname is defined, you must update the corresponding cardinality statistics in your federated system. The cardinality statistics are stored in the federated database system catalog in the SYSSTAT.TABLES view and in the SYSSTAT.COLUMNS view.

To maintain BioRS cardinality statistics in your federated system:
1. Determine the cardinality statistics for the nickname, if necessary.
2. Update the cardinality statistics for the nickname in the catalog views.
3. Update the cardinality statistics for the columns in the catalog views.

Determining BioRS databank cardinality statistics

You must determine BioRS databank cardinality statistics before you can update nickname statistics or update the cardinality of the column that corresponds to the BioRS _ID_ element.

Procedure

To determine cardinality statistics for a specific databank in BioRS:

Use either the BioRS `admin_find` utility program or the `www_find.cgi` utility program and specify the `-c` option, which is for cardinality . For more information about these two BioRS utility programs, see your BioRS documentation.

Updating BioRS nickname cardinality statistics

You must update the nickname cardinality statistics when the contents of a BioRS databank changes significantly.

Before you begin

You must determine the cardinality number of the BioRS databank that corresponds to the nickname whose statistics you want to update.

About this task

To update the BioRS nickname cardinality statistics in your federated system, you must modify the SYSSTAT.TABLES catalog view.

Maintaining correct cardinality statistics for nicknames enables the optimizer and the BioRS wrapper to choose the best performing data access plan.

Procedure

To update the BioRS nickname cardinality statistics:

Issue the UPDATE statement to modify the SYSSTAT.TABLES catalog view and specify the correct cardinality number. The syntax of the UPDATE statement is:

```
UPDATE SYSSTAT.TABLES SET CARD=cardinality_number
    WHERE TABSCHEMA=nickname_schema
    AND TABNAME=nickname_name;
```

For example, if the nickname is JONES.SWISS, you use the following UPDATE statement to update the statistics:

```
UPDATE SYSSTAT.TABLES SET CARD=15312191
    WHERE TABSCHEMA='JONES'
    AND TABNAME='SWISS';
```

SYSSTAT.TABLES
The system catalog view in the federated database where nickname statistics are stored.

SET CARD=15312191
The BioRS databank cardinality number that corresponds to the nickname that you are updating the statistics for.

TABSCHEMA= *'JONES'*
The name of the schema for the nickname that you want to update.

TABNAME=*'SWISS'*
The name of the nickname that you want to update.

Updating BioRS column cardinality statistics

To update BioRS column cardinality statistics in your federated system, you must modify the SYSSTAT.COLUMNS catalog view.

You can update BioRS column cardinality statistics before you create the BioRS nicknames or you can update BioRS column cardinality statistics when you want to improve query performance for BioRS data sources.

Restrictions

Do not use this procedure to update the cardinality statistics for columns that correspond to the BioRS _ID_ element.

You should ensure that the cardinality statistics for BioRS columns are current so that the optimizer and the BioRS wrapper can choose the best data access plan during query processing.

About this task

Procedure

To update BioRS column cardinality statistics:

Issue the UPDATE statement to modify the SYSSTAT.COLUMNS catalog view. The syntax of the UPDATE statement is:

```
UPDATE SYSSTAT.COLUMNS SET COLCARD=(SELECT COUNT(DISTINCT column_name)
    FROM nickname_schema.nickname_name)
    WHERE
    TABSCHEMA=nickname_schema
    AND TABNAME=nickname_name
    AND COLNAME=column_name;
```

SYSSTAT.COLUMNS
: The system catalog view in the federated database where column statistics are stored.

COLCARD=(SELECT COUNT(DISTINCT *column_name*
: The name of the column in the nickname that you are updating the statistics for.

TABSCHEMA= *nickname_schema*
: The name of the schema for the nickname that you want to update.

TABNAME=*nickname_name*
: The name of the nickname that you want to update.

COLNAME=*column_name*
: The name of the column whose cardinality statistics you want to update.

The query might take several minutes to run because all of the entries for the databank that is associated with the nickname must be retrieved.
If a column contains multiple values (for example, the PublicationYear element of the SwissProt database format), the calculation becomes too complex to use an SQL query. For such columns, you must manually calculate the cardinality value, and then update the SYSSTAT.COLUMNS catalog view. To calculate the cardinality value, divide the number of distinct values in the column by the average number of values per row. The calculated cardinality value cannot be greater than the cardinality of the table.
For example, if the nickname has the following three rows of values for the PublicationYear column, there are nine distinct values and the average number of values in a row is four.

- 1997 1992 1985
- 1997 1992 1982
- 1992 1991 1990 1976 1974 1971

The cardinality for this PublicationYear column is 9 divided by 4, or 3 (2.25 rounded to the next highest integer). You can update the SYSSTAT.COLUMNS catalog view using the following UPDATE statement:

```
UPDATE SYSSTAT.COLUMNS SET CARDCOL=3
    WHERE
    TABSCHEMA=nickname_schema
    AND TABNAME=nickname_name
    AND COLNAME=column_name;
```

Updating BioRS _ID_ column cardinality

To update BioRS column cardinality statistics for the column that maps to the BioRS _ID_ element, you must modify the SYSSTAT.COLUMNS catalog view.

Before you begin

You must determine the cardinality number of the BioRS databank that corresponds to the nickname in which the column is referenced. The cardinality number of the column that maps to the BioRS _ID_ element must match the cardinality of the nickname in which the column is referenced.

You should ensure that the cardinality statistics for the column that maps to the BioRS _ID_ element are current. The optimizer and the BioRS wrapper use these statistics to choose the best data access plan to process your queries.

About this task

To update the BioRS _ID_ column cardinality you must select entries in the SYSCAT.COLOPTIONS view that contain the ELEMENT_NAME option. This BioRS wrapper uses this option to map between nickname column names in the federated database and element names in the BioRS server.

Procedure

To update BioRS _ID_ column cardinality statistics:

Issue the UPDATE statement to modify the catalog view.
For example, :

```
UPDATE SYSSTAT.COLUMNS SET COLCARD=cardinality_number
    WHERE
    TABSCHEMA=nickname_schema
    AND TABNAME=nickname_name
    AND COLNAME=column_name
        IN (SELECT column_name FROM SYSCAT.COLOPTIONS
        WHERE
        TABSCHEMA=nickname_schema
        AND TABNAME=nickname_name
        AND OPTION='ELEMENT_NAME';
        AND SETTING='_ID_')
```

SYSSTAT.COLUMNS
The system catalog view in the federated database where column statistics are stored.

SET COLCARD=*cardinality_number*
The BioRS databank cardinality number that corresponds to the nickname of the column that you are updating the statistics for.

TABSCHEMA= *nickname_schema*
The name of the schema for the nickname that you want to update.

TABNAME=*nickname_name*
The name of the nickname that you want to update.

COLNAME=*column_name*
The name of the column whose cardinality statistics you want to update.

IN (SELECT *column_name* **FROM SYSCAT.COLOPTIONS**
This SELECT statement determines the name of the column that maps to the BioRS _ID_ element. SYSCAT.COLOPTIONS is the system catalog view in the federated database where column options are stored.

OPTION=*'ELEMENT_NAME'*
The value in the rows in the SYSCAT.COLOPTIONS view which indicates that a nickname column name is mapped to BioRS element name.

SETTING=*'_ID_'*
Specifies that the column for the ELEMENT_NAME option is '_ID_'.

Configuring access to DB2 data sources

To configure a federated server to access DB2 family data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin

- Verify the set up of the federated server.

Procedure

To configure the federated server to access DB2 data sources, complete these tasks:

1. Catalog a DB2 node entry.
2. Catalog the remote DB2 database.
3. Register the DB2 wrapper.
4. Register the server definitions for a DB2 data source.
5. Create the user mappings for a DB2 data source.
6. Test the connection to the DB2 data source server.
7. Register the nicknames for the DB2 tables and views.

Cataloging a DB2 node entry

You must catalog a node entry that specifies the protocol that the federated server uses to connect to the DB2 data source.

Procedure

To catalog a node entry:

Issue the CATALOG TCPIP NODE command.
For example:

```
CATALOG TCPIP NODE db2_node REMOTE system42 SERVER db2tcp42
```

where:

- *db2_node* is the name that you assign to the node
- *system42* is the host name of the system where the data source resides

- *db2tcp42* is the service name or primary port number of the server database manager instance

Cataloging the remote DB2 database

To identify which database the federated server connects to, you must catalog the remote DB2 database in the federated server system database directory.

Procedure

To catalog the remote database:

1. Use the Configuration Assistant to catalog the database, or issue the CATALOG DATABASE command.

   For example:

   ```
   CATALOG DATABASE DB2DB390 AS CLIENTS390 AT NODE DB2NODE AUTHENTICATION SERVER
   ```

   where:
   - *DB2DB390* is the name of the remote database to catalog
   - *CLIENTS390* is the alias for the remote database being cataloged. If you do not specify an alias, the database manager uses the name of the remote database as the alias.
   - *DB2NODE* is the name of the node that you previously cataloged
   - AUTHENTICATION SERVER specifies that authentication takes place on the DB2 data source node
2. If the name of the remote database has more than eight characters, issue the CATALOG DCS DATABASE command to create a DCS directory entry.

   For example:

   ```
   CATALOG DCS DATABASE SALES400 AS SALES_DB2DB400
   ```

   where:
   - *SALES400* is the alias of the remote database to catalog. The alias must match the name of an entry in the federated server system database directory that is associated with the remote node. The alias is the same name that you specify in the CATALOG DATABASE command.
   - *SALES_DB2DB400* is the name of target host database that you want to catalog

Registering the DB2 wrapper

You must register a wrapper to access DB2 family data sources. The federated server uses the wrapper to communicate with and retrieve data from the data sources. A wrapper is implemented as a set of library files.

Procedure

To register a wrapper:

Issue the CREATE WRAPPER statement and specify the name for the wrapper. The default wrapper name for the DB2 family data sources is DRDA.
For example:

```
CREATE WRAPPER DRDA
```

When you use the default name to register the wrapper, you do not need to specify the library name because the federated server automatically uses the default library name that is associated with the wrapper. If the wrapper name conflicts with an existing wrapper name in the federated database, you can replace the default wrapper name with a name that you choose. However, if you do so, you must include the LIBRARY parameter in the CREATE WRAPPER statement. For example, to register a wrapper with the name db2_wrapper on a federated server that uses the AIX operating system, issue this statement:

```
CREATE WRAPPER db2_wrapper LIBRARY 'libdb2drda.a'
```

The default library name is specific to the operating system of the federated server. For more information, see the list of DB2 wrapper library files.

DB2 wrapper library files

When you install the federated server, wrapper library files are added to the default directory path.

If you do not use the default wrapper name when you register a wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

This table lists the default directory paths and default wrapper library file names. In the table *install_path* in the directory path where the federation server is installed on UNIX or Linux, and *%DB2PATH%* is the environment variable that specifies the directory path where the federation server is installed on Microsoft Windows. The default Windows directory path is C:\Program Files\IBM\sqllib.

Table 15. DB2 directory paths and library file names by operating system

Operating system	Directory path	Library file name
AIX	/usr/opt/*install_path*/lib32/ /usr/opt/*install_path*/lib64/	libdb2drda.a
HP-UX	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2drda.so
Linux	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2drda.so
Solaris	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2drda.so
Windows	%DB2PATH%\bin	db2drda.dll

For each operating system, three library files installed: one default library file and two additional files that are used only with specific wrapper options.

Registering server definitions for DB2 data sources

The federated server requires authorization and password information to connect to each DB2 server. Because this authorization and password information is not stored in the global catalog, you must include it in the each server definition.

Procedure

To register a server definition, use one of these methods:

- Use the Federated Objects wizard in the DB2 Universal Database Control Center. To start the wizard, right-click the Federated Database Objects folder and click Create Federated Objects.
- Issue the CREATE SERVER statement.

When you register the server, you must include certain required server options. This example includes only the server options that are required to register a DB2 server:

```
CREATE SERVER server_definition_name TYPE server_type
VERSION version_number WRAPPER DRDA
      AUTHORIZATION "userid" PASSWORD "password"
      OPTIONS (DBNAME 'database_name')
```

DBNAME is a required server option. The value of DBNAME is the alias for the DB2 database that you want to access. You define the alias when you catalog the database.

Note: For the VERSION, if you used DB2 for z/OS® Version 8 to create the database in compatibility mode, you must specify Version 7.
When you register the server, you can specify additional server options in the CREATE SERVER statement. These options include general server options and server options that are specific to the data source. For more information, see the DB2 options reference information.

After you register the server, use the ALTER SERVER statement to add additional server options or drop existing server options

CREATE SERVER statement - Examples for the DB2 wrapper

Use the CREATE SERVER statement to register DB2 server definitions. This topic includes a complete example with the required options, and an example that shows the use of additional server options.

Complete example

The following example shows you how to register a server definition for a DRDA wrapper by using the CREATE SERVER statement:

```
CREATE SERVER DB2SERVER TYPE DB2/ZOS VERSION 7 WRAPPER DRDA
      AUTHORIZATION "spalten" PASSWORD "db2guru"
      OPTIONS (DBNAME 'CLNTS390')
```

DB2SERVER
: A name that you assign to the DB2 database server. Duplicate server definition names are not allowed. This is a required server option.

TYPE *DB2/ZOS*
: Specifies the type of data source server to which you are configuring access.

VERSION *7*
: The version of the DB2 database server that you want to access.

  Note: If you used DB2 for z/OS Version 8 to create the database in compatibility mode, you must specify Version 7.

WRAPPER *DRDA*
: The name that you specified in the CREATE WRAPPER statement.

AUTHORIZATION *"spalten"*
: The authorization ID at the data source. This ID must have BINDADD authority at the data source. This value is case sensitive.

PASSWORD *"db2guru"*
: The password that is associated with the authorization ID at the data source. This value is case sensitive.

DBNAME *'CLNTS390'*

The alias for the DB2 database that you want to access. You defined this alias when you cataloged the database using the CATALOG DATABASE command. This value is case sensitive.

Although the database name variable is specified as an option in the CREATE SERVER statement, it is required for DB2 data sources.

Server option example

When you register the server definition, you can specify additional server options in the CREATE SERVER statement. These options include general server options and DB2 data source-specific server options. For more information, see the options reference information.

The CPU_RATIO option indicates how much faster or slower the data source CPU runs than the federated CPU. If you set the CPU_RATIO option to '0.001', this indicates that the CPU at the remote data source has 1000 times more available capacity than the federated server CPU.

The SAME_DECFLT_ROUNDING specifies whether the rounding mode of both the Federated server and remote server are using the same DECFLOAT rounding mode setting. If you set the SAME_DECFLT_ROUNDING option to 'Y' it specifies that the DECFLOAT rounding mode settings are the same for both servers.

For example:

```
CREATE SERVER DB2SERVER TYPE DB2/CS VERSION 9.7 WRAPPER DRDA
      AUTHORIZATION "spalten" PASSWORD "db2guru"
      OPTIONS (DBNAME 'CLNTS390', CPU_RATIO '0.001', SAME_DECFLT_ROUNDING 'Y')
```

Creating user mappings for DB2 data sources

A user mapping defines an association between a user ID and password at the federated server and the corresponding user ID and password at the data source server.

Whether or not user mappings are required for DB2 data sources depends on the configuration of the federated environment. If the environment uses federated trusted contexts and proxy authentication, none or only a few user mappings may be required. For best results, plan and set up federated trusted contexts before you create user mappings.

Procedure

To map the local user ID to the DB2 server user ID and password:

Issue a CREATE USER MAPPING statement.
For example:

```
CREATE USER MAPPING FOR local_userID SERVER server_definition_name
      OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password')
```

The REMOTE_AUTHID is the connect authorization ID, not the bind authorization ID.

CREATE USER MAPPING statement - Examples for the DB2 wrapper

Use the CREATE USER MAPPING statement to map a federated server authorization ID to an DB2 server user ID and password.

Complete example

The following example shows how to map a federated server authorization ID to a remote DB2 user ID and password:

```
CREATE USER MAPPING FOR ALONZO SERVER DB2SERVER
      OPTIONS (REMOTE_AUTHID 'al', REMOTE_PASSWORD 'day2night')
```

ALONZO
: Maps the local authorization ID to the remote user ID and password.

SERVER *DB2SERVER*
: Specifies the name of the DB2 family data source server that you defined in the CREATE SERVER statement.

REMOTE_AUTHID *'al'*
: Specifies the connect user ID at the DB2 family data source server to which you are mapping *ALONZO*. The value is case-sensitive, unless you set the FOLD_ID server option to 'U' or 'L' in the CREATE SERVER statement.

REMOTE_PASSWORD *'day2night'*
: Specifies the password that is associated with *'al'*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

Special register example

The following is an example of the CREATE USER MAPPING statement which includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER DB2SERVER
      OPTIONS (REMOTE_AUTHID 'al', REMOTE_PASSWORD 'day2night')
```

You can use the DB2 special register USER to map the authorization ID of the person issuing the CREATE USER MAPPING statement to the data source user ID specified in the REMOTE_AUTHID user option.

Testing the connection to the DB2 data source server

Test the connection to the DB2 data source server to determine if the federated server is properly configured to access the DB2 data source server.

To test the connection to the DB2 server, open a pass-through session and issue an SQL SELECT statement on the DB2 system tables.

DB2 data source	Example

DB2 for z/OS	SET PASSTHRU *server_definition_name*
	SELECT count(*) FROM sysibm.systables
	SET PASSTHRU RESET

DB2 for Linux, UNIX and Windows	SET PASSTHRU *server_definition_name*
	SELECT count(*) FROM syscat.systables
	SET PASSTHRU RESET

DB2 for System i	SET PASSTHRU *server_definition_name*
	SELECT count(*) FROM qsys2.systables
	SET PASSTHRU RESET

If the SQL SELECT statement returns a count, access to the data source is properly configured.

Troubleshooting data source connection errors

A test connection to the data source server might return an error for several reasons. There are actions that you can take to determine why the error occurred.

Symptom

An error is returned when you attempt to connect to the data source.

Cause

There are several possible causes for a connection problem.

Resolving the problem

To troubleshoot data source connection errors, check the following items for problems:

- Verify that the data source is available.
- If applicable, ensure that the data source server is configured for incoming connections.
- Ensure that your user mapping settings for the REMOTE_AUTHID and REMOTE_PASSWORD options are valid for the connections to the data source. Alter the user mapping, or create another user mapping as necessary.
- If applicable, ensure that the data source client software on the federated server is installed and configured correctly to connect to the data source.
- For ODBC data sources, ensure that the ODBC driver on the federated server is installed and configured correctly to connect to the ODBC data source server. On federated servers that run Windows, use the ODBC Data Source Administrator tool to check the driver. On federated servers that run UNIX, consult the ODBC client vendor's documentation.
- Verify that the settings for the variables set on the federated server are correct for the data source. These variables include the system environment variables, the variables in the `db2dj.ini` file, and the DB2 Profile Registry (db2set) variables.
- Check your server definition. If necessary, drop the server definition and create it again.

Registering nicknames for DB2 tables and views

For each DB2 server definition, register a nickname for each table and view that you want to access. Then use the nicknames, not the names of the data source objects, when you query the DB2 database.

Before you begin

Before you register a nickname, use the DB2 RUNSTATS command to update the statistics at the DB2 data source. The federated server uses the data source statistics to optimize query processing.

Restrictions

You cannot create a nickname on a DB2 database alias.

Procedure

To register a nickname:

Issue the CREATE NICKNAME statement.
For example:

```
CREATE NICKNAME nickname FOR server_definition_name."remote_schema"."remote.table"
```

When you create the nickname, the federated server queries the data source catalog using the nickname. This query tests the connection to the data source. If the connection does not work, an error message displays.

CREATE NICKNAME statement - Examples for DB2 data sources

Use the CREATE NICKNAME statement and the required nickname options to register a nickname for an DB2 table or view that you want to access.

This example shows the use of the required options for the CREATE NICKNAME statement. You can also include additional nickname and column options.

```
CREATE NICKNAME DB2SALES FOR DB2SERVER.VINNIE.EUROPE
```

DB2SALES
A unique nickname that identifies the DB2 table or view. The nickname can include both a schema and the nickname. If you omit the schema, the authorization ID of the user who registers the nickname is used.

DB2SERVER.VINNIE.EUROPE
A three-part identifier for the remote object:

- *DB2SERVER* is the name that you assigned to the DB2 database server in the CREATE SERVER statement.
- *VINNIE* is the user ID of the owner of the table or view. This value is case sensitive.
- *EUROPE* is the name of the remote table or view that you want to access.

Configuring access to Excel data sources

You can integrate the data that is in Excel data sources with information from other sources by using a federated system.

Procedure

To configure a federated server to access Excel data sources, you must provide the federated server with information about the data sources and objects that you want to access. After you configure the federated server, you can create queries to access the Excel data sources.

Excel wrapper

An Excel workbook is a file that is created using the Microsoft Excel application and has a file extension of xls. The Excel wrapper is used to perform searches on the Excel files.

You use Excel files to store information that is best displayed in a table, with corresponding rows and columns. Excel workbooks consist of one or more spreadsheet pages, or *worksheets*. Worksheets are often used to perform calculations.

The following figure shows how the Excel wrapper connects your worksheets to the federated system.

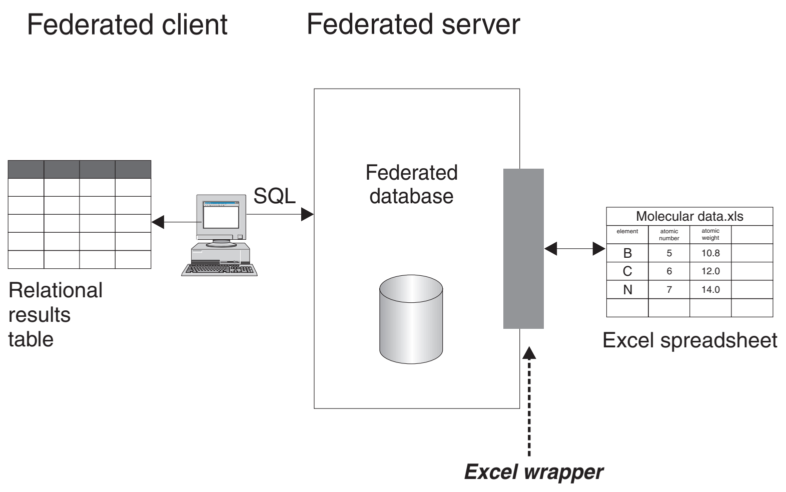


Figure 3. How the Excel wrapper works

The Excel wrapper uses the CREATE NICKNAME statement to map the columns in your Excel worksheets to columns in your federated system. The following table shows a sample of worksheet data that is stored in a file called `Compound_Master.xls`.

Table 16. Sample worksheet for Compound_Master.xls

	A	B	C	D
1	COMPOUND_NAME	WEIGHT	MOL_COUNT	WAS_TESTED
2	compound_A	1.23	367	tested
3	compound_G		210	
4	compound_F	0.000425536	174	tested
5	compound_Y	1.00256		tested
6	compound_Q		1024	
7	compound_B	33.5362		
8	compound_S	0.96723	67	tested
9	compound_O	1.2		tested

The information in an Excel worksheet is usually not available to you through standard SQL commands. When the Excel wrapper is installed and registered on your federated server, you can access this information as if it were a typical relational data source. For example, if you wanted to know all the compound data where the molecular count is greater than 100, you would run the following SQL query:

```
SELECT * FROM compound_master WHERE mol_count > 100
```

The results of the query are shown in the following table.

Table 17. Query results

COMPOUND_NAME	WEIGHT	MOL_COUNT	WAS_TESTED
compound_A	1.23	367	tested

Table 17. Query results (continued)

COMPOUND_NAME	WEIGHT	MOL_COUNT	WAS_TESTED
compound_G		210	
compound_F	0.000425536	174	tested
compound_Q		1024	

Methods of accessing Excel data

You can access data in Microsoft Excel worksheets by using either the Excel wrapper or the ODBC wrapper.

To query Excel data, both wrappers require a federated server that can open and read the worksheets in the Excel workbook. Therefore, the Excel workbook must be on the same computer as the federated server or on a network accessible drive.

If you use the Excel wrapper, the Excel application must be installed on the federated server.

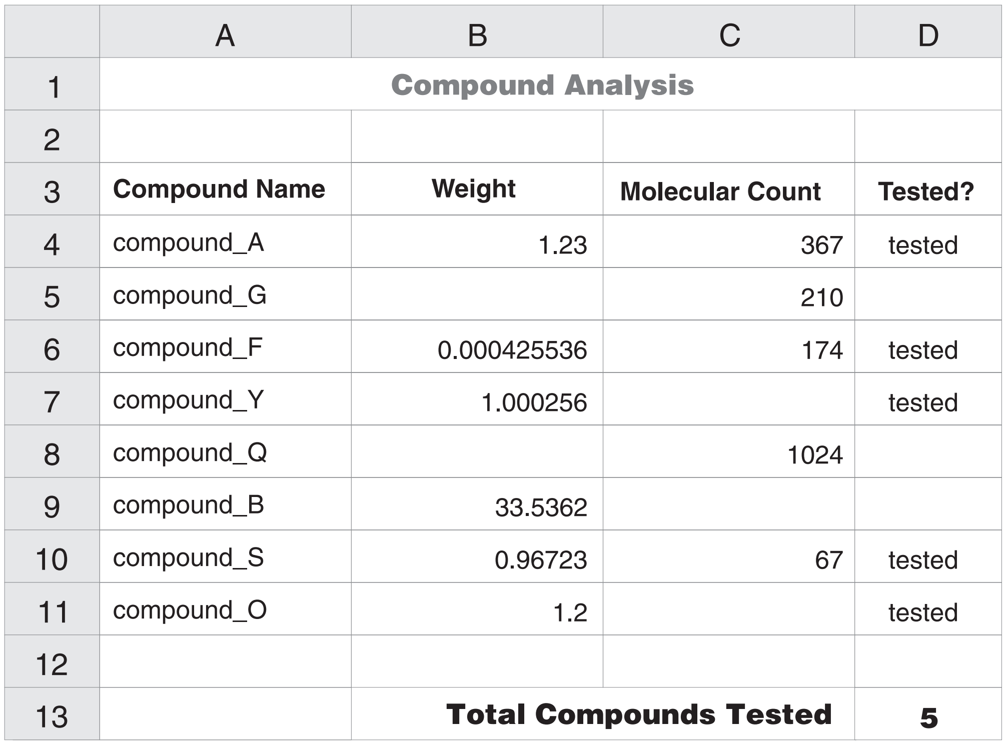
If you use the ODBC wrapper, the Excel ODBC driver must be on the federated server. This driver is installed automatically with Microsoft Windows®. The Excel application does not need to be installed on the federated server.

Each wrapper imposes some requirements on the location and layout of the data in the Excel workbooks. With the Excel wrapper, only the data in the first worksheet in the workbook can be accessed. With the ODBC wrapper, you can access data from any worksheet in the workbook.

The following examples show the worksheet layout requirements for these two wrappers.

Example of a worksheet that contains rows of labels and a formula

This example shows a worksheet that contains several rows of labels at the top of the worksheet, blank rows, and a formula in row 13. To access the data in the worksheet, you must identify the range of cells that you want to access.



	A	B	C	D
1	**Compound Analysis**			
2				
3	**Compound Name**	**Weight**	**Molecular Count**	**Tested?**
4	compound_A	1.23	367	tested
5	compound_G		210	
6	compound_F	0.000425536	174	tested
7	compound_Y	1.000256		tested
8	compound_Q		1024	
9	compound_B	33.5362		
10	compound_S	0.96723	67	tested
11	compound_O	1.2		tested
12				
13		**Total Compounds Tested**		**5**

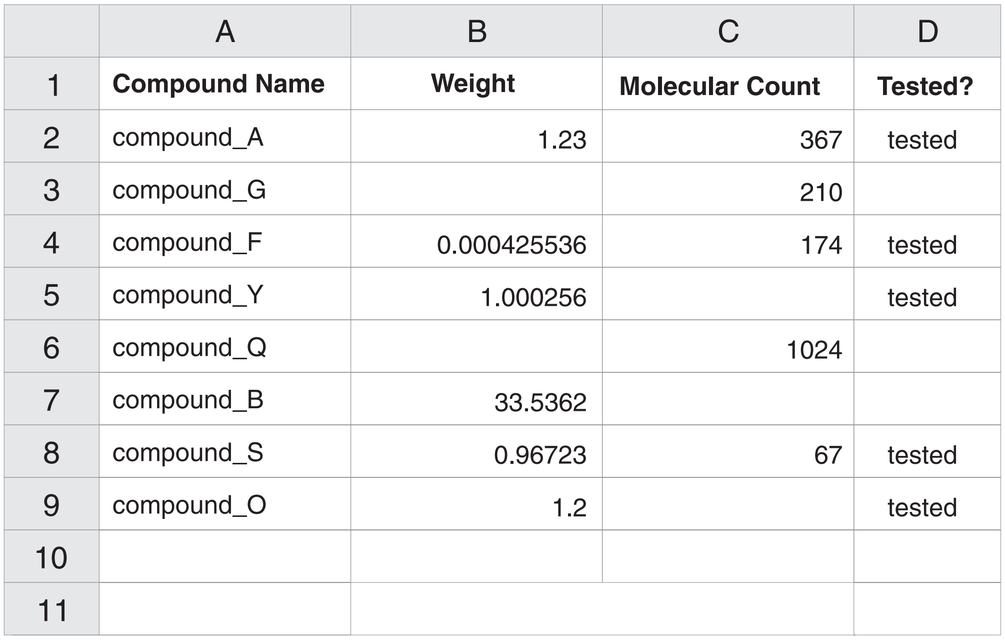
Figure 4. A worksheet that contains several rows of labels and a formula

If you use the Excel wrapper
You specify the range of cells in the CREATE NICKNAME statement by using the RANGE option. Include only the data in the range that you specify. Do not include any column labels in the range. Cells that contain formulas, such as SUM, return the result of the formula and not the formula. Unless you want the formula results returned, do not include the cells that contain formulas in the range. In this example, the range of cells that you include in the RANGE option is A4:D11.

If you use the ODBC wrapper
You must create a name for the range of cells to explicitly designate the location of the data within the worksheet. Excel refers to this range of cells as a *named range*. The Excel ODBC driver recognizes only one row of labels, the first row in the range. No blank rows are allowed between the labels and the data. The named range must include only one row of column labels. You specify the named range in the CREATE NICKNAME statement. You must include one row of column labels in the range that you name. If you do not include one row of column labels in the named range, the first row of data is treated as column labels. Cells that contain formulas, such as SUM, return the result of the formula and not the formula. Unless you want the formula results returned, do not include the cells that contain formulas in the range. In this example, the range of cells that you name is A3:D11.

Example of a worksheet that contains one row of labels

This example shows a worksheet that contains only one row of column labels at the top of the worksheet. The layout does not include extra rows with labels, blank rows, or cells with formulas.



	A	B	C	D
1	**Compound Name**	**Weight**	**Molecular Count**	**Tested?**
2	compound_A	1.23	367	tested
3	compound_G		210	
4	compound_F	0.000425536	174	tested
5	compound_Y	1.000256		tested
6	compound_Q		1024	
7	compound_B	33.5362		
8	compound_S	0.96723	67	tested
9	compound_O	1.2		tested
10				
11				

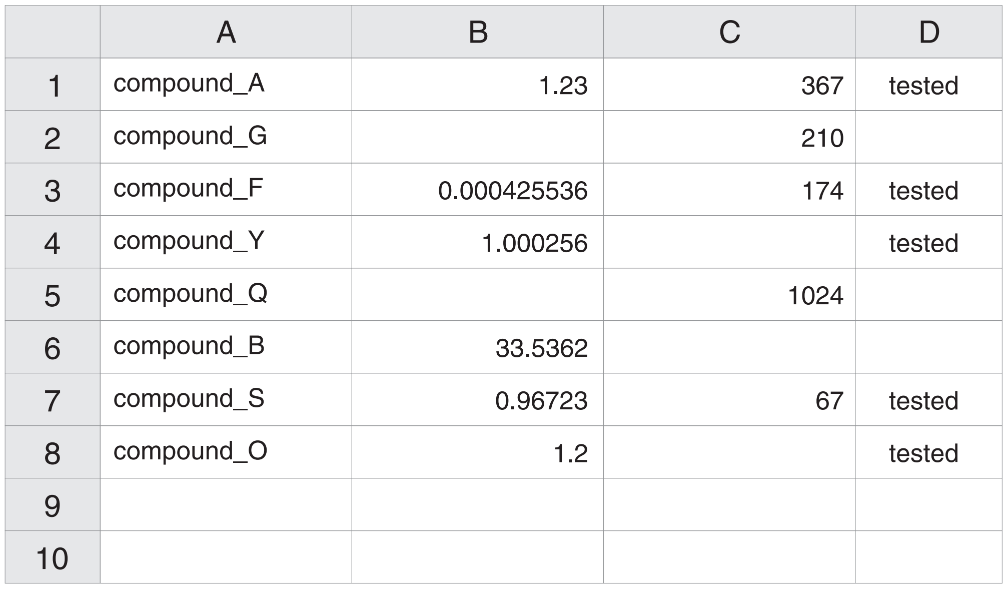
Figure 5. A worksheet that contains one row of column labels in row 1

If you use the Excel wrapper
: You must specify the range of cells in the CREATE NICKNAME statement by using the RANGE option. The range cannot include the column labels in row 1. The range of cells that you would specify is A2:D9.

If you use the ODBC wrapper
: You can access this data without creating a named range. You specify the worksheet name in the CREATE NICKNAME statement. The wrapper reads the first nonblank row as labels and uses the information as column names for the nickname. Subsequent rows are read as data.

Example of a worksheet that contains only data

This example shows a worksheet that contains only data. There are no rows of column labels, no blank rows, and no cells with formulas.



	A	B	C	D
1	compound_A	1.23	367	tested
2	compound_G		210	
3	compound_F	0.000425536	174	tested
4	compound_Y	1.000256		tested
5	compound_Q		1024	
6	compound_B	33.5362		
7	compound_S	0.96723	67	tested
8	compound_O	1.2		tested
9				
10				

Figure 6. A worksheet that contains only data

If you use the Excel wrapper
If the data is in the first worksheet in the workbook, the wrapper will access the data without using the RANGE option. If the data is in another worksheet in the workbook, you must specify the RANGE option in the CREATE NICKNAME statement.

If you use the ODBC wrapper
When you use the ODBC wrapper to access Excel data, the wrapper is limited by what the Excel ODBC driver supports. The Excel ODBC driver requires a specific format for the worksheet. The driver assumes that the first nonblank row contains the column labels. If the first nonblank row contains data, the data in that row is treated as the column labels for the remaining data. If the worksheet does not contain a row of column labels, the first row is used as the labels and not as data. In effect, you lose the first row of data. You can overcome this requirement by modifying your worksheet. Insert a new row before the data and add labels for each column of data, so that it looks like the example that contains one row of labels.

Adding Excel data sources to a federated server

To configure a federated server to access Excel data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin

- The data in Excel worksheets must be structured correctly so that the Excel wrapper can access the data.
- Federation must be installed on a server that will act as the federated server.
- A database must exist on the federated server.

Restrictions

- The Excel wrapper is available only for versions of the Microsoft Windows operating system that are supported by the federated server.

- The Excel application must be installed on the federated server.
- The Excel workbook must be on the same computer as the federated server or on a network accessible drive.
- The data in only the first worksheet in the Excel workbook can be accessed by the Excel wrapper.
- The federated database codepage set must match the Excel file character set, otherwise you could get unexpected results from your queries.
- Pass-through sessions are not allowed.

About this task

You can configure a federated server to access data that is stored in Excel data sources by using the Control Center or by issuing SQL statements on the command line. The Control Center includes a wizard to guide you through the steps that are necessary to configure the required federated objects.

Procedure

To add the Excel data sources to a federated server:
1. "Registering the Excel wrapper."
2. "Registering the server definition for an Excel data source" on page 65.
3. "Registering nicknames for Excel data sources" on page 66.

Registering the Excel wrapper

You must register a wrapper to access Excel data sources.

About this task

Wrappers are used by federated servers to communicate with and retrieve data from the data sources. Wrappers are implemented as a set of library files.

You can register a wrapper by using the Control Center or by using the command line. The Control Center includes a wizard to guide you through the steps that are necessary to register the wrapper.

Procedure

To register the Excel wrapper:

Choose the method that you want to use to register the Excel wrapper:

Method	**Procedure**
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.
Using the command line	Issue the CREATE WRAPPER statement. For example: `CREATE WRAPPER` *`excel_wrapper`* `LIBRARY '`*`db2lsxls.dll`*`';` You must specify the LIBRARY parameter in the CREATE WRAPPER statement.

Excel wrapper library files:

The Excel wrapper library files are added to the federated server when you install the federated server.

When you install the federated server, three library files are added to the default directory path. For example, if the federated server is running on Windows, the wrapper library files that are added to the directory path are `db2lsxls.dll`, `db2lsxlsF.dll`, and `db2lsxlsU.dll`. The default wrapper library file is `db2lsxls.dll`. The other wrapper library files are used with specific wrapper options.

When you register the Excel wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory path and default wrapper library file name are listed in the following table.

Table 18. Excel wrapper library location and file name

Operating system	Directory path	Wrapper library file name
Windows	%DB2PATH%\bin	db2lsxls.dll

%DB2PATH% is the environment variable that is used to specify the directory path where the federated server is installed on Windows. The default Windows directory path is `C:\Program Files\IBM\SQLLIB`.

Registering the server definition for an Excel data source

You must register a server definition because the hierarchy of the federated objects requires that the Excel workbook files, which are identified by nicknames, are associated with a specific server definition object.

About this task

You can register a server definition by using the Control Center or by using the command line. The Control Center includes a wizard to guide you through the steps that are necessary to register the server definition.

Procedure

To register a server definition for an Excel data source:

Choose the method that you want to use to register the server definition:

Method	Procedure
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.
Using the command line	Issue the CREATE SERVER statement. For example: `CREATE SERVER server_definition_name WRAPPER excel_wrapper;`

CREATE SERVER statement - Examples for the Excel wrapper:

Use the CREATE SERVER statement to register server definitions for the Excel wrapper.

The following example shows you how to register a server definition called `biochem_lab` for a workbook that contains biochemical data. The CREATE SERVER statement that you issue is:

```
CREATE SERVER biochem_lab WRAPPER excel_wrapper;
```

biochem_lab
A name that you assign to the Excel server definition. Duplicate server definition names are not allowed.

WRAPPER *Excel_wrapper*
The wrapper name that you specified in the CREATE WRAPPER statement.

Registering nicknames for Excel data sources

For each Excel server definition that you register, you must register a nickname for each Excel worksheet that you want to access. Use these nicknames, instead of the names of the worksheets, when you query the Excel data sources.

About this task

When you create a nickname for an Excel worksheet, the information in the worksheet data is mapped to a relational table.

Blank cells in the worksheet are interpreted as NULL.

Up to 10 consecutive blank rows can exist in the worksheet and will be included in the data set. More than 10 consecutive blank rows are interpreted as the end of the data set.

Blank columns can exist in the worksheet. However, these columns must be registered and described as valid fields even if they are not used.

Procedure

To register a nickname for an Excel worksheet:

Choose the method that you want to use to register the nickname. Nicknames can be up to 128 characters in length.

Method	Procedure
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**. Follow the steps in the wizard.

Method	Procedure
From command line	Issue the CREATE NICKNAME statement. For example: `CREATE NICKNAME nickname ( column_name data_type OPTIONS (nickname_column_ options), column_name data_type OPTIONS (nickname_column_ options), column_name data_type OPTIONS (nickname_column_ options) ) FOR SERVER server_definition_name OPTIONS (nickname_options);`

Repeat this step for each Excel worksheet that you want to create a nickname for.

CREATE NICKNAME statement - examples for the Excel wrapper:

Use the CREATE NICKNAME statement to register a nickname for an Excel worksheet that you want to access. These examples show the required parameters and optional nickname options.

```
CREATE NICKNAME Compounds
    (
    Compound_ID  INTEGER,
    CompoundName VARCHAR(50),
    MolWeight  FLOAT
    )
    FOR SERVER biochem_lab
    OPTIONS (FILE_PATH 'C:\My Documents\CompoundMaster.xls',
        RANGE 'B2:D25');
```

Compounds
A unique nickname that is used to identify the Excel worksheet.

Important: The nickname is a two-part name the consists of the schema and the name of the nickname. If you omit the schema when you register the nickname, the authorization ID of the user who registers the nickname is used for the nickname schema.

Compound_ID *INTEGER*
The name and data type for a worksheet column that contains the compound identifiers.

CompoundNAME *VARCHAR(50)*
The name and data type for a worksheet column that contains the compound names.

MolWeight *FLOAT*
The name and data type for a worksheet column that contains the molecular weight of the compounds.

FOR SERVER *biochem_lab*
The name that you assigned to the Excel server definition in the CREATE SERVER statement.

FILE_PATH *'C:\My Documents\CompoundMaster.xls'***)**
Specifies the fully qualified directory path and file name for the Excel workbook that contains the data you want to access. The data must be in the first worksheet in the workbook.

OPTIONS (RANGE *'B2:D25'***)**

Specifies the range of cells that you want to access in the workbook that you specified in the FILE_PATH nickname option.

Any syntax or semantic error in the range option value results in an SQL1882E message. Errors might include:

- The range is not a valid range. For example, if the top-left cell specified in the range is either below or to the right of the bottom-right cell.
- The number of columns designated by the range value does not correspond to the number of columns specified in the CREATE NICKNAME statement.
- A nonvalid character or other syntax error has been found.

Excel data sources - example queries

To access Excel data, you use the nickname and the defined nickname columns in your SQL statements in the same manner as you would use a regular table name and table columns.

These examples show you how to structure the queries to access Excel data using the nickname `compounds`.

Selecting a specific column of information

The following query displays all compound_IDs where the molecular weight is greater than 2000:

```
SELECT compound_ID FROM compounds
   WHERE molweight > 200;
```

Using an OR condition in your SELECT statements

The following query displays all records where the compound name or molecular weight is null:

```
SELECT * FROM compounds
   WHERE compoundname IS NULL OR molweight IS NULL;
```

Using LIKE and AND conditions in your SELECT statements

The following query displays all records where the compound name contains the string `ase` and the molecular weight is greater than or equal to 300:

```
SELECT * FROM compounds
   WHERE compoundname LIKE '%ase% AND molweight >= 300;
```

Excel data source - sample scenario

This scenario shows the SQL statements that are necessary to register the federated objects that are used to access an Excel worksheet. Included in this scenario are several queries that you can run using the nickname that you create.

Excel worksheet information

This scenario starts with a worksheet that contains information about various compounds. The name of the workbook that the worksheet is in is `Compound_Master.xls` and the workbook was created in Excel. The fully-qualified path name to the workbook is `C:\Data\Compound_Master.xls`.

The first worksheet in the workbook contains four columns and nine rows of data. The columns list the names of the compounds, the weight of the compounds, the molecular count of the compound, and if the compound has been tested.

The contents of the worksheet are shown in the following table.

Table 19. Sample worksheet Compound_Master.xls

Â	A	B	C	D
1	COMPOUND_NAME	WEIGHT	MOL_COUNT	WAS_TESTED
2	compound_A	1.23	367	tested
3	compound_G	Â	210	Â
4	compound_F	0.000425536	174	tested
5	compound_Y	1.00256	Â	tested
6	compound_Q	Â	1024	Â
7	compound_B	33.5362	Â	Â
8	compound_S	0.96723	67	tested
9	compound_O	1.2	Â	tested

Register the federated objects

To access the worksheet using the Excel wrapper you must register the objects on the federated server:

1. Register the Excel wrapper.

   For example:

   ```
   CREATE WRAPPER Excel LIBRARY 'db2lsxls.dll';
   ```
2. Register the server definition:

   For example:

   ```
   CREATE SERVER biochem_lab WRAPPER Excel;
   ```
3. Register a nickname that refers to the Excel worksheet:

   For example:

   ```
   CREATE NICKNAME Compound_Master
        (compound_name VARCHAR(40),
         weight        FLOAT,
         mol_count     INTEGER,
         was_tested    VARCHAR(20))
       FOR SERVER biochem_lab
       OPTIONS (FILE_PATH 'C:\Data\Compound_Master.xls');
   ```

The registration process is complete. The Excel worksheet is now part of the federated system, and can be used in SQL queries.

The following examples show the SQL queries and the results that arereturned from the *Compound_Master* nickname.

A query that returns all data that matches a specific WHERE clause condition

To return all of the data for the compounds that have a molecular count that is greater than 100, issue this query:

```
SELECT * FROM Compound_Master
    WHERE mol_count > 100;
```

A query that returns specific columns from the worksheet

To return the names and molecular counts for all of the compounds where the molecular count has not yet been determined, issue this query:

```
SELECT compound_name, mol_count FROM Compound_Master
    WHERE mol_count IS NULL;
```

All of the columns from rows 2, 3, 4, 6, and 8 are returned.

The *compound_name* and *mol_count* columns from rows 5, 7, and 10 are returned.

A query that counts the number of rows that match specific WHERE clause conditions

To return the number of compounds that have a weight that is greater than 1 and that have not been tested, issue this query:

```
SELECT count(*) FROM Compound_Master
    WHERE was_tested IS NULL AND weight > 1
```

The record count of 1 is returned. The compound in row 7 matches the query criteria.

A query that returns specific columns from the worksheet and includes a subselect statement

To return the names and molecular counts for all of the compound where the molecular count has been determined and the molecular count is less than the average molecular count, issue this query:

```
SELECT compound_name, mol_count FROM Compound_Master
    WHERE mol_count IS NOT NULL
    AND mol_count <
    (SELECT AVG(mol_count) FROM Compound_Master
         WHERE mol_count IS NOT NULL AND was_tested  IS NOT NULL);
```

The subquery returns 368 for the molecular count average. The main query uses the average to return the query results that are shown in the following table:

Table 20. Query results

COMPOUND_NAME	MOL_COUNT
compound_A	367
compound_G	210
compound_F	174
compound_S	67

File access control model for the Excel wrapper

To access an Excel file, the wrapper needs a user identity for security purposes. The Excel wrapper uses the user identity that is associated with the federated database service. The name of the federated database service depends on the name of the database instance. For example, if the database instance name is DB2, then the service name is `DB2 - DB2`. To determine the user identity that is associated with federated database service, use the Control Panel in Windows to display the services. Double-click the service name and display the Log On properties page.

Configuring access to Informix data sources

To configure a federated server to access Informix data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin

- The Informix Client SDK software must be installed and configured on the server that will act as the federated server.
- Check the setup of the federated server.
- Check the federated parameter to ensure that federation is enabled.
- On AIX federated servers, the AIX Base Application Development Math Library must be installed. You can determine if the Library is installed by issuing the AIX command lslpp -l bos.adt.libm.

You can configure a federated server to access data that is stored in Informix data sources by using the DB2 Control Center or by issuing SQL statements on the DB2 command line. The DB2 Control Center includes a wizard to guide you through the steps that are necessary to configure the required federated objects.

Procedure

To add Informix data sources to a federated server:
1. Set up and test the Informix client configuration file.
2. Set the Informix environment variables.
3. Register the wrapper.
4. Register the server definition.
5. Create the user mappings.
6. Test the connection to the server.
7. Register nicknames for Informix tables, views, and synonyms.

Setting up and testing the Informix client configuration file

The Informix client configuration file is used to connect to Informix databases, by using the client libraries that are installed on the federated server.

Before you begin

The Informix Client SDK software must be installed on the federated server.

The client configuration file specifies the location of each Informix database server and type of connection (protocol) for the database server.

The default location of the client configuration file depends on the operating system that is used by the federated server.
- On federated servers that run UNIX, the default location and name of the file is `$INFORMIXDIR/etc/sqlhosts`. The `sqlhosts` file is installed with the Informix client SDK.
- On federated servers that run Windows, the default location of the `sqlhosts` registry is the local computer.

The format of `sqlhosts` is described in the *Administrator's Guide for Informix Dynamic Server*.

Procedure

To set up and test the Informix client configuration file:

1. Configure the Informix Client SDK.
   - On federated servers that run UNIX, you can configure the Informix Client SDK by editing the `sqlhosts` file. You can also copy the `sqlhosts` file from another system that has Informix Connect or Informix Client SDK installed.
   - On federated servers that run Windows, you can configure the Informix Client SDK with the Informix Setnet32 utility. The Setnet32 utility sets up the `sqlhosts` registry.
2. Verify the location of the `sqlhosts` file or registry.
   - On federated servers that run UNIX, the `sqlhosts` file is located in the `$INFORMIXDIR/etc/` directory.
   - On federated servers that run Windows, the `sqlhosts` information is kept in the following key in the Windows registry:

   ```
   HKEY_LOCAL_MACHINE\SOFTWARE\INFORMIX\SQLHOSTS
   ```
3. If you want to place the `sqlhosts` file or registry in a path other than the default search path, set the INFORMIXSQLHOSTS environment variable to specify the file location. Use one of the following options to set the INFORMIXSQLHOSTS environment variable.
   - On federated servers that run UNIX, set the INFORMIXSQLHOSTS environment variable to the fully-qualified name of the `sqlhosts` file.
   - On federated servers that run Windows, use the Setnet32 utility to set the INFORMIXSQLHOSTS environment variable to the name of the Windows computer that stores the registry.
4. Test the connection to ensure that the client software is able to connect to the Informix server. If the Informix dbaccess utility is on the federated server, use this tool to test the connection. Otherwise, run the Informix demo program to test the client setup.

Setting the Informix environment variables

The Informix environment variables must be set in the `db2dj.ini` file on the federated server.

There are required and optional environment variables for Informix data sources. If you installed the Informix client software before you installed the Informix wrapper, the required Informix environment variables are set in the `db2dj.ini` file.

You must set the environment variables using the steps in this task if you did not install the Informix client software before you installed the Informix wrapper or if you want to set any of the optional environment variables.

To set the Informix environment variables:

1. Use one of the following methods to set the Informix environment variables that you want to use:

Method	Step
To set the environment variables using the DB2 Control Center	Use the Federated Objects wizard in the DB2 Control Center. To start the wizard, right-click the Federated Database Objects folder and click Create Federated Objects.

Method	Step
To set the environment variables automatically	Run the DB2 Setup program again and specify the **Custom** installation option. Follow the instructions in the wizard. **Important:** Running the installation program again will set only the required environment variables. The optional environment variables must be set manually.
To set the environment variables manually	Edit the `db2dj.ini` file. • On federated servers that run UNIX, the `db2dj.ini` file is located in the `sqllib/cfg` directory. • On federated servers that run Windows, the `db2dj.ini` file is located in the `%DB2PATH%\cfg` directory.

The `db2dj.ini` file contains configuration information about the Informix client software that is installed on your federated server. If the file does not exist, you can create a file with the name `db2dj.ini` by using any text editor. In the `db2dj.ini` file, you must specify the fully qualified path for the environment variables; otherwise you will encounter errors. The following environment variables show what an entry in the `db2dj.ini` file on UNIX might look like:

```
INFORMIXDIR=/informix/csdk
INFORMIXSERVER=inf10
```

2. Set the Informix code page conversion environment variables (as necessary).
3. To ensure that the environment variables are set on the federated server, recycle the federated database instance.

   Issue the following commands to recycle the federated database instance:

```
db2stop
db2start
```

Informix environment variables

There are required and optional environment variables for Informix data sources. These variables are set in the `db2dj.ini` file.

The valid environment variables for Informix are:
- INFORMIXDIR
- INFORMIXSERVER
- INFORMIXSQLHOSTS (optional)
- CLIENT_LOCALE (optional)
- DB_LOCALE (optional)
- DBNLS (optional)

The CLIENT_LOCALE, DB_LOCALE, and DBNLS environment variables are code page environment variables.

Variable descriptions

INFORMIXDIR

Specifies the directory path where the Informix Client SDK software is installed.

For example:
- On federated servers that run UNIX, set the path to:

```
INFORMIXDIR=/informix/csdk
```

- On federated servers the run Windows, set the path to:

```
INFORMIXDIR=C:\informix\csdk
```

INFORMIXSERVER
Identifies the name of the default Informix server. This setting must be a valid entry in the `sqlhosts` file (UNIX) or the SQLHOSTS registry key (Windows). To get a value for INFORMIXSERVER, read the `sqlhosts` file. Select one of the *dbservername* values. The *dbservername* is the first value in each entry in the `sqlhosts` file.

For example:

```
INFORMIXSERVER=inf10
```

Requirement: Although the Informix wrapper does not use the value of this environment variable, the Informix client requires that this environment variable be set. The wrapper uses the value of the NODE server option, which specifies the Informix database server that you want to access.

INFORMIXSQLHOSTS
If you are using the default path for the Informix `sqlhosts` file, you do not need to set this environment variable. However, if you are using some other path for the Informix `sqlhosts` file, then you need to set this environment variable. Set the INFORMIXSQLHOSTS variable to the full path name where the Informix `sqlhosts` file resides.

- On federated servers that run UNIX, the default path is `$INFORMIXDIR/etc/sqlhosts`.
- On federated servers that run Windows, if the SQLHOSTS registry key does not reside on the local computer, then the value for the INFORMIXSQLHOSTS environment variable is the name of the Windows computer that stores the registry.

A UNIX example of setting this environment variable to another path is:

```
INFORMIXSQLHOSTS=/informix/csdk/etc/my_sqlhosts
```

Informix code page conversion:

Each time that the Informix wrapper connects to an Informix data source, the wrapper determines which code page value to use for that connection. You can have the Informix wrapper set the code page value or you can designate a code page by setting the CLIENT_LOCALE environment variable.

The environment variables that specify Informix code page conversion are set in the `db2dj.ini` file on your federated server.

For Informix code page conversion, you can set the following optional environment variables:

- CLIENT_LOCALE
- DB_LOCALE
- DBNLS

The Informix code page environment variables are:

CLIENT_LOCALE

Specifies the Informix locale that you want to use. Use this variable when you do not want the Informix wrapper to automatically determine the variable setting.

For example:

```
CLIENT_LOCALE=Informix_client_locale_value
```

- If the CLIENT_LOCALE variable is set in the `db2dj.ini` file on the federated server, then the wrapper uses the code page value in the `db2dj.ini` file.
- If the CLIENT_LOCALE variable is not set on the federated server, the wrapper determines the territory and the code page of the federated database. The wrapper sets the CLIENT_LOCALE variable to the closest matching Informix locale. If there is no matching Informix locale, the wrapper sets the CLIENT_LOCALE variable to the en_us.8859-1 locale for UNIX systems and to the en_us.CP1252 locale for Windows systems.

You can see the list of valid Informix locales by issuing the glfiles command on the Informix server.

Refer to the *Informix Guide to GLS Functionality* for more information about code page conversions.

DB_LOCALE

Specifies that the Informix database uses a different code page than your client locale. Use this variable when you want Informix to perform conversions between the two code pages. Set the DB_LOCALE environment variable to the name of the Informix database locale.

For example:

```
DB_LOCALE=Informix_db_locale_value
```

DBNLS

Specifies that Informix verifies that the DB_LOCALE setting matches the actual locale of the Informix database. Set this environment variable to 1.

For example:

```
DBNLS=1
```

Force Informix to perform code page conversion

The Informix database uses a different code page than your client locale and you want Informix to perform conversions between the two code pages. You need to:

1. Set Informix environment variable DB_LOCALE to the name of the Informix database locale. You set this variable in the `db2dj.ini` file on the federated server.
2. To verify that the DB_LOCALE setting matches the actual locale of the Informix database, set the Informix environment variable DBNLS to 1. You set this variable in the `db2dj.ini` file on the federated server.

Informix data that uses the Chinese code page GB 18030

To access data that uses the Chinese code page GB 18030, use the UTF-8 code page on your federated database and add the following setting to your `db2dj.ini` file, so that Informix correctly translates the GB 18030 data to unicode.

```
DB_LOCALE=zh_cn.GB18030-2000
```

Registering the Informix wrapper

You must register a wrapper to access Informix data sources. Wrappers are used by federated servers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

Procedure

To register the Informix wrapper:

Issue the CREATE WRAPPER statement and specify the default name for the Informix wrapper.
For example:

```
CREATE WRAPPER INFORMIX;
```

Recommendation: Use the default wrapper name. The default wrapper name for Informix is INFORMIX. When you register the wrapper by using the default name, the federated server automatically uses the appropriate Informix wrapper library for the operating system that your federated server is running on.
If the default wrapper name conflicts with an existing wrapper name in the federated database, you can substitute the default wrapper name with a name that you choose. When you use a name that is different from the default name, you must include the LIBRARY parameter in the CREATE WRAPPER statement.
For example, to register a wrapper with the name informix_wrapper on a federated server that uses the AIX operating system, issue the following statement:

```
CREATE WRAPPER informix_wrapper LIBRARY 'libdb2informix.a';
```

The name of the wrapper library file that you specify depends on the operating system of the federated server. See the list of Informix wrapper library files for the correct library name to specify in the CREATE WRAPPER statement.

Informix wrapper library files

The Informix wrapper library files are added to the federated server when you install federation..

When you install federation, three library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files that are added to the directory path are `libdb2informix.a`, `libdb2informixF.a`, and `libdb2informixU.a`. The default wrapper library file is `libdb2informix.a`. The other wrapper library files are used internally by the default wrapper library.

If you decide not to use the default wrapper name when you register the wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 21. Informix wrapper library locations and file names

Operating system	Directory path	Library file name
AIX	`/usr/opt/install_path/lib32/` `/usr/opt/install_path/lib64/`	libdb2informix.a
HP-UX	`/opt/IBM/db2/install_path/lib32` `/opt/IBM/db2/install_path/lib64`	libdb2informix.so

Table 21. Informix wrapper library locations and file names (continued)

Operating system	Directory path	Library file name
Linux	`/opt/IBM/db2/install_path/lib32` `/opt/IBM/db2/install_path/lib64`	libdb2informix.so
Solaris	`/opt/IBM/db2/install_path/lib32` `/opt/IBM/db2/install_path/lib64`	libdb2informix.so
Windows	`%DB2PATH%\bin`	db2informix.dll

- *install_path* is the directory path where federation is installed on UNIX or Linux.
- %DB2PATH% is the environment variable that is used to specify the directory path where federation is installed on Windows. The default Windows directory path is `C:\Program Files\IBM\SQLLIB`.

Registering the server definitions for an Informix data source

You must register each Informix server that you want to access in the federated database.

Procedure

To register a server definition for an Informix data source:

1. Locate the node name in the Informix `sqlhosts` file or registry.

   Sample `sqlhosts` file:

   ```
   inf10an onsoctcp anaconda inmx10
   inf10bo onsoctcp boa ifmx10
   inf10py onsoctcp python ifmx10
   ```

   - The first value in each line is the *node_name*, such as `inf10an`.
   - The second value in each line is the *nettype*, or type of connection. In this example `onsoctcp` indicates this is a TCP/IP connection.
   - The third value in each line is the host name, such as anaconda, boa, and python.
   - The fourth value in each line is the service name, such as `inmx10`. The service name field depends on the *nettype* listed in the second value.

   For more information about the format of the `sqlhosts` file and the meaning of these fields, see the Informix manual *Administrators Guide for Informix Dynamic Server*.

2. Use one of the following methods to create the server definition.

   - Use the Federated Objects wizard in the DB2 Universal Database Control Center. To start the wizard, right-click the Federated Database Objects folder and click Create Federated Objects.
   - Issue the CREATE SERVER statement.

   For example:

   ```
   CREATE SERVER server_definition_name TYPE informix
       VERSION version_number WRAPPER INFORMIX
       OPTIONS (NODE 'node_name', DBNAME 'database_name');
   ```

   Although the *'node_name'* and *'database_name'* variables are specified as options in the CREATE SERVER statement, these options are required for Informix data sources.

   After the server definition is registered, use the ALTER SERVER statement to add or drop server options.

CREATE SERVER statement - Examples for the Informix wrapper

Use the CREATE SERVER statement to register server definitions for the Informix wrapper. This topic includes a complete example with the required parameters, and examples with additional server options.

Complete example

The following example shows you how to register a server definition for an Informix wrapper by issuing the CREATE SERVER statement:

```
CREATE SERVER asia TYPE informix VERSION 10 WRAPPER INFORMIX
      OPTIONS (NODE 'abc', DBNAME 'sales');
```

asia A name that you assign to the Informix database server. Duplicate server definition names are not allowed.

TYPE *informix*
: Specifies the type of data source server to which you are configuring access. For the Informix wrapper, the server type must be `informix`.

VERSION *10*
: The version of the Informix database server that you want to access.

WRAPPER *INFORMIX*
: The wrapper name that you specified in the CREATE WRAPPER statement.

NODE *'abc'*
: The name of the node where the Informix database server resides. Obtain the node name from the `sqlhosts` file. This value is case sensitive.

  Although the name of the node is specified as an option in the CREATE SERVER statement, it is required for Informix data sources.

DBNAME *'sales'*
: The name of the Informix database that you want to access. This value is case sensitive.

  Although the name of the database is specified as an option in the CREATE SERVER statement, it is required for Informix data sources.

Additional server options

When you create a server definition, you can specify additional server options in the CREATE SERVER statement. The server options can be general server options and Informix-specific server options.

FOLD_ID and FOLD_PW server options

When the federated server connects to a data source, the federated server tries to connect using all possible combinations of uppercase and lowercase for the user ID and password, as well as the current case. The federated server might make up to nine connect attempts before successfully connecting to the data source server. These attempts can slow down connect times and might result in the user ID being locked out. You can prevent lock outs by specifying values for the FOLD_ID and FOLD_PW server options. You can set the FOLD_ID and FOLD_PW server options to 'N' (do not fold the user ID or password).

If you set the FOLD_ID and FOLD_PW server options to 'N', you must specify the user ID and password in the correct case. The advantage to setting these server options to 'N' is that when an invalid user ID or password is specified, the wrapper will not keep trying the various uppercase and lowercase combinations. These two server options can reduce the chance of exceeding the maximum number of failed login attempts and the ID getting locked out.

The following example shows an Informix server definition with these server options:

```
CREATE SERVER asia TYPE informix VERSION 10 WRAPPER INFORMIX
       OPTIONS (NODE 'abc', DBNAME 'sales', FOLD_ID 'N', FOLD_PW 'N');
```

IUD_APP_SVPT_ENFORCE server option example

The IUD_APP_SVPT_ENFORCE option specifies whether the federated server should enforce detecting or building of application savepoint statements. Informix does not support application savepoint statements. When set to 'N', the federated server will not roll back transactions when an error is encountered. Your application must handle the error recovery.

The IUD_APP_SVPT_ENFORCE server option must be set to 'N' to enable replication to or from Informix data sources. The following example shows an Informix server definition with the IUD_APP_SVPT_ENFORCE server option.

```
CREATE SERVER asia TYPE informix VERSION 10 WRAPPER INFORMIX
       OPTIONS (NODE 'abc', DBNAME 'sales', IUD_APP_SVPT_ENFORCE 'N');
```

INFORMIX_DB_LOCALE and INFORMIX_CLIENT_LOCALE options

The INFORMIX_DB_LOCALE option sets the database locale environment variable (DB_LOCALE) that is used for the connection between the federated server and the data source server. If the INFORMIX_DB_LOCALE option is not specified, the Informix DB_LOCALE environment variable is set to the value that is specified in the `db2dj.ini` file. If the `db2dj.ini` file does not specify the DB_LOCALE environment variable, the Informix DB_LOCALE environment variable is not set A valid value is any valid Informix locale. This option is optional. The default setting is None.

The INFORMIX_CLIENT_LOCALE option sets the client locale environment variable (CLIENT_LOCALE) to be used for the connection between the federated server and the data source server. If the INFORMIX_CLIENT_LOCALE option is not specified, the Informix CLIENT_LOCALE environment variable is set to the value specified in the `db2dj.ini` file. If `db2dj.ini` does not specify CLIENT_LOCALE, then the Informix CLIENT_LOCALE environment variable is set to the Informix locale that most closely matches the code page and territory of the federated database. A valid value is any valid Informix locale. This option is optional. The default setting is None.

The following example shows an Informix server definition with the INFORMIX_DB_LOCALE and INFORMIX_CLIENT_LOCALE options.

```
CREATE SERVER asia TYPE informix VERSION 10 WRAPPER INFORMIX
       OPTIONS (NODE 'abc', DBNAME 'sales', INFORMIX_DB_LOCALE 'en_us.8859-1',
      INFORMIX_CLIENT_LOCALE 'en_us.CP1252');
```

Creating the user mappings for an Informix data source

When you attempt to access an Informix server, the federated server establishes a connection to the Informix server by using a user ID and password that are valid for that data source. You must define an association (a user mapping) between each federated server user ID and password and the corresponding data source user ID and password.

Create a user mapping for each user ID that will access the federated system to send distributed requests to the Informix data source.

Procedure

To map a local user ID to the Informix server user ID and password:

Issue a CREATE USER MAPPING statement.
For example:

```
CREATE USER MAPPING FOR local_userID SERVER server_definition_name
      OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password');
```

Although the REMOTE_AUTHID and REMOTE_PASSWORD variables are specified as options in the CREATE USER MAPPING statement, these options are required to access Informix data sources.

CREATE USER MAPPING statement - Examples for the Informix wrapper

Use the CREATE USER MAPPING statement to map a federated server user ID to an Informix server user ID and password. This topic includes a complete example with the required parameters, and an example that shows you how to use the DB2 special register USER with the CREATE USER MAPPING statement.

Complete example

The following example shows how to map a federated server user ID to an Informix server user ID and password:

```
CREATE USER MAPPING FOR VINCENT SERVER asia
      OPTIONS (REMOTE_AUTHID 'vinnie', REMOTE_PASSWORD 'close2call');
```

VINCENT
: Specifies the local user ID that you are mapping to a user ID that is defined at the Informix server.

SERVER *asia*
: Specifies the server definition name that you registered in the CREATE SERVER statement for the Informix server.

REMOTE_AUTHID *'vinnie'*
: Specifies the user ID at the Informix database server to which you are mapping *VINCENT*. The value is case-sensitive, unless you set the FOLD_ID server option to 'U' or 'L' in the CREATE SERVER statement.

  Although the remote user ID is specified as an option in the CREATE USER MAPPING statement, it is required for Informix data sources.

REMOTE_PASSWORD *'close2call'*
: Specifies the password that is associated with *'vinnie'*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

  Although the remote password is specified as an option in the CREATE USER MAPPING statement, it is required for Informix data sources.

Special register example

You can use the DB2 special register USER to map the authorization ID of the person who is issuing the CREATE USER MAPPING statement to the data source authorization ID that is specified in the REMOTE_AUTHID user option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER asia
       OPTIONS (REMOTE_AUTHID 'vinnie', REMOTE_PASSWORD 'close2call');
```

Testing the connection to the Informix server

Test the connection to the Informix data source server to determine if the federated server is properly configured to access Informix data sources.

You can test the connection to the Informix server by using the server definition and user mappings that you defined.

Procedure

To test the connection to the Informix server:

Open a pass-through session and issue a SELECT statement on the Informix system tables. If the SELECT statement returns a count, your server definition and your user mapping are set up properly.
For example:

```
SET PASSTHRU server_definition_name
SELECT count(*) FROM informix.systables
SET PASSTHRU RESET
```

If the SELECT statement returns an error, you should troubleshoot the connection errors.

Troubleshooting data source connection errors

A test connection to the data source server might return an error for several reasons. There are actions that you can take to determine why the error occurred.

Symptom

An error is returned when you attempt to connect to the data source.

Cause

There are several possible causes for a connection problem.

Resolving the problem

To troubleshoot data source connection errors, check the following items for problems:

- Verify that the data source is available.
- If applicable, ensure that the data source server is configured for incoming connections.
- Ensure that your user mapping settings for the REMOTE_AUTHID and REMOTE_PASSWORD options are valid for the connections to the data source. Alter the user mapping, or create another user mapping as necessary.
- If applicable, ensure that the data source client software on the federated server is installed and configured correctly to connect to the data source.
- For ODBC data sources, ensure that the ODBC driver on the federated server is installed and configured correctly to connect to the ODBC data source server. On

federated servers that run Windows, use the ODBC Data Source Administrator tool to check the driver. On federated servers that run UNIX, consult the ODBC client vendor's documentation.

- Verify that the settings for the variables set on the federated server are correct for the data source. These variables include the system environment variables, the variables in the `db2dj.ini` file, and the DB2 Profile Registry (db2set) variables.
- Check your server definition. If necessary, drop the server definition and create it again.

Performance tuning for the Informix wrapper

You can use the FOLD_ID and FOLD_PW server options to improve connectivity between the federated server and Informix data sources.

When the federated server connects to a data source, the server tries to connect using all possible combinations of uppercase and lowercase for the user ID and password. The server might make up to nine connect attempts before successfully connecting to the data source server. These attempts can slow down connect times and might result in the user ID getting locked out.

You can improve performance by specifying the values for the FOLD_ID and FOLD_PW server options.

- If all your Informix user IDs and passwords are in lowercase, setting the FOLD_ID and FOLD_PW server options with the value 'L' can improve your connect time.

  For example:

  ```
  ALTER SERVER TYPE INFORMIX
     OPTIONS (ADD FOLD_ID 'L');
  ALTER SERVER TYPE INFORMIX
     OPTIONS (ADD FOLD_PW 'L');
  ```

- The federated server attempts each combination of uppercase and lowercase values for the user ID and password. You can reduce the chance of the maximum number of failed login attempts being exceeded by setting these options to 'N' (do not fold the user ID and the password). If you establish these settings, then you need to always specify the user ID and password in the correct case. If an invalid user ID and password are specified, the wrapper will not keep trying the various combinations.

  For example:

  ```
  ALTER SERVER TYPE INFORMIX
     OPTIONS (ADD FOLD_ID 'N');
  ALTER SERVER TYPE INFORMIX
     OPTIONS (ADD FOLD_PW 'N');
  ```

Registering nicknames for Informix tables, views, and synonyms

For each Informix server definition that you register, you must register a nickname for each table, view, or synonym that you want to access. Use these nicknames, instead of the names of the data source objects, when you query the Informix servers.

Before you begin

Update the statistics at the Informix data source before you register a nickname. The federated database relies on the data source catalog statistics to optimize query processing. You can use the Informix UPDATE STATISTICS command, which is equivalent to the DB2 RUNSTATS command to update the data source statistics.

Procedure

To register a nickname for an Informix table, view, or synonym:

Issue the CREATE NICKNAME statement. Nicknames can be up to 128 bytes in length.
For example:

```
CREATE NICKNAME nickname FOR server_definition_name."remote_schema"."remote.table" ;
```

When you create the nickname, the federated server queries the data source catalog using the nickname. This query tests the connection to the data source table, view, or synonym. If the connection does not work, you will receive an error message.

Repeat this step for each Informix table, view, or synonym that you want to create a nickname for.

CREATE NICKNAME statement - Examples for the Informix wrapper

Use the CREATE NICKNAME statement to register a nickname for an Informix table, view, or synonym that you want to access. This topic includes a complete example with the required parameters.

Complete example

```
CREATE NICKNAME JPSALES FOR asia."vinnie"."japan" ;
```

JPSALES
A unique nickname that is used to identify the Informix table, view, or synonym.

Important: The nickname is a two-part name—the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname will be the authorization ID of the user who registers the nickname.

asia."vinnie"."japan"
A three-part identifier for the remote object:

- *asia* is the server definition name that you assigned to the Informix database server in the CREATE SERVER statement.
- *vinnie* is the name of the owner to which the table, view, or synonym belongs unless the database is ANSI-compliant. In an ANSI-compliant database, it is the schema name.
- *japan* is the name of the remote table, view, or synonym that you want to access.

The federated server folds the names of the Informix schemas and tables to uppercase unless you enclose the names in quotation marks.

Configuring access to JDBC data sources

To configure the federated server to access JDBC data sources, you must provide the federated server with information about the data sources and objects that you want to access.

The data sources that are accessed through the JDBC API are referred to in this text as JDBC data sources.

Before you begin

- The JDBC driver must be installed and configured on the computer that acts as the federated server.
- Check the setup of the federated server.
- Check the federated parameter to ensure that federation is enabled.
- Set the system environment variables, `db2dj.ini` file variables, and DB2 Profile Registry (db2set) variables. See the documentation provided by the JDBC data source for the JDBC client variables. The LIBPATH environment variable might be required.

Restrictions

- The JDBC wrapper is supported only in fenced mode.
- The JDBC wrapper does not support the following functions and statements:
  - LOCK TABLE statements on nicknames
  - Statement-level isolation
- JDBC data sources do not support positioned update and delete operations.
- The JDBC wrapper does not support INSERT, UPDATE, or DELETE statements against data sources that restrict the number of active statements for each connection. See the documentation for your data source to determine if the data source restricts the number of active statements for each connection.
- The JDBC wrapper does not support operations on tables that contain columns with data types that use driver-specific SQL data-type indicators. The type of operations that are not supported include the CREATE NICKNAME and SELECT statements in pass-through sessions. The JDBC wrapper supports only the SQL data type indicators that are defined by the JDBC specification 3.0 and above. See your JDBC driver documentation for the JDBC specifications.
- The JDBC wrapper does not support LOB in pass-through sessions.
- Restrictions on type mapping and data type conversion:
  - Unsupported data types: ARRAY, DATALINK, DISTINCT, JAVA_OBJECT, REF, STRUCT and OTHER
  - Data types with limited support:
    - Support for the XML data type is limited. The federated server processes aCLOB data type only if the related JDBC data type is either a CLOB or SQLXML (JDBC 4.0) data type. Otherwise, there is no support for the XML data type.
    - The DBCS and UNICODE data types are stored by the JDBC wrapper as UCS-2.
    - The DECFLOAT data type in DB2 databases and the NUMBER data type in Oracle databases have a larger scope; and their formats can be different to the corresponding JDBC wrapper data types. Mapping to a DECFLOAT or NUMBER data type might cause inaccurate results.

About this task

You can configure the federated server to access JDBC data sources by using the DB2 Control Center or by issuing SQL statements on the DB2 command line. The DB2 Control Center includes a wizard to guide you through the steps that are required to configure the required federated objects.

Procedure

To add JDBC data sources to a federated server:
1. Prepare the federated server to access data sources through JDBC.
2. Register the JDBC wrapper.
3. Register the server definitions for an JDBC data source.
4. Create a user mapping for an JDBC data source.
5. Test the connection to the JDBC data source server.
6. Register nicknames for JDBC data source tables and views.

Preparing the federated server to access data sources through JDBC

The federated server must be able to access JDBC data sources. To prepare the federated server, you must determine if you are required to set the CLASSPATH environment variable.

Before you begin

If you use a JDBC driver other then the DB2 default JDBC driver in the `db2jcc.jar` file, you might need to add the JDBC driver information to the CLASSPATH environment variable. Optionally, you can specify your JDBC driver packages with the DRIVER_PACKAGE parameter of the CREATE SERVER statement when you register your server definitions.

Procedure

To set the CLASSPATH environment variable:

Register the Java .jar file that contains your JDBC driver in the CLASSPATH environment variable.

Option	Description
For Linux and UNIX	Run the export command to register your JDBC driver. For example, if you specify the DB2 JDBC driver, run the following command: `export CLASSPATH=$CLASSPATH:`*`db2_instance_dir`*`/sqllib/java/db2jdcc.jar` where *db2_instance_dir* is the fully qualified file path of where your instance of the DB2 database system is installed.
For Windows	Set the CLASSPATH system environment variable to your JDBC driver: 1. Log on as an administrator. 2. Open the **Control Panel**, and navigate to **System** → **Environment Variables**. 3. Add the JDBC driver file name and directory to the CLASSPATH system variable. Use a semicolon to separate the new entry from all existing entries. See your JDBC driver documentation for specific information on registering system environment variables.

After you complete this task, you must register the wrapper.

Registering the JDBC wrapper

You must register a wrapper to access JDBC data sources. Federated servers use wrappers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

Procedure

To register the JDBC wrapper:

Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Run the CREATE WRAPPER statement and specify the default name for the JDBC wrapper.	For example: `CREATE WRAPPER JDBC;` When you register the wrapper by using the default name, JDBC, the federated server automatically uses the appropriate JDBC wrapper library for the operating system that your federated server runs on.
Run the CREATE WRAPPER statement and specify an alternative name for the JDBC wrapper.	If the default wrapper name conflicts with an existing wrapper name in the federated database, you can substitute the default wrapper name with a name that you choose. When you use a name that is different from the default name, you must include the LIBRARY parameter in the CREATE WRAPPER statement. For example, to register a wrapper with the name *jdbc_Wrapper* on a federated server that uses AIX, run the following statement: `CREATE WRAPPER jdbc_Wrapper LIBRARY 'libdb2rcjdbc.a';` The wrapper library file that you specify depends on the operating system of the federated server.

After you complete this task, you must register the server definitions.

JDBC wrapper library files

The JDBC wrapper library files are added to the federated server when you install the wrapper.

When you install the JDBC wrapper, library files are added to the default directory path. For example, if the federated server runs on AIX, the wrapper library files added to the directory path are `libdb2rcjdbc.a`, `libdb2rcjdbcF.a`, `libdb2rcjdbcU.a`, and `db2qgjdbc.jar`. The default wrapper library file is `libdb2rcjdbc.a`. The other wrapper library files are used internally by the JDBC wrapper.

If you do not use the default wrapper name when you register a wrapper, you must specify the **LIBRARY** parameter in the CREATE WRAPPER statement.

Use the following default directory paths and wrapper library file names to specify the **LIBRARY** parameter in the CREATE WRAPPER statement:

Table 22. JDBC client library directory paths and file names

Operating system	Directory path	Wrapper library file
AIX	`/usr/opt/install_path/lib32/` `/usr/opt/install_path/lib64/`	`libdb2rcjdbc.a`
Linux	`/opt/IBM/db2/install_path/lib32` `/opt/IBM/db2/install_path/lib64`	`libdb2rcjdbc.so`
Solaris	`/opt/IBM/db2/install_path/lib32` `/opt/IBM/db2/install_path/lib64`	`libdb2rcjdbc.so`
Windows	`%DB2PATH%\bin`	`db2rcjdbc.dll`

where *install_path* is the directory path where federation is installed on Linux or UNIX.

CREATE WRAPPER statement - Examples for the JDBC wrapper

Use the CREATE WRAPPER statement to register the JDBC wrapper.

To register a wrapper with the default name on a federated server, run the CREATE WRAPPER statement with the JDBC wrapper name, for example:

```
CREATE WRAPPER JDBC;
```

In the following examples, *jdbc_Wrapper* is the alternative name that you assign to the wrapper that you register in the federated database.

Linux and Solaris federated server

The following example shows you how to register a wrapper with an alternative name:

```
CREATE WRAPPER jdbc_Wrapper LIBRARY 'libdb2rcjdbc.so'';
```

AIX federated server

The following example shows you how to register a wrapper with an alternative name:

```
CREATE WRAPPER jdbc_Wrapper LIBRARY 'libdb2rcjdbc.a';
```

Windows federated server

The following example shows you how to register a wrapper with an alternative name:

```
CREATE WRAPPER jdbc_Wrapper LIBRARY 'db2rcjdbc.dll';
```

Registering server definitions for JDBC data sources

You must register each JDBC server that you want to access in the federated database.

Before you begin

If you use a JDBC driver other than the DB2 server default JDBC driver, you might need to set the CLASSPATH environment variable to specify your JDBC driver package files. Optionally, you can specify your JDBC driver packages in the CREATE SERVER statement with the DRIVER_PACKAGE server option.

Procedure

To register the JDBC server, you must specify the JDBC driver package name from the JDBC driver library and the JDBC connection string of the remote server.

To register a server definition for a JDBC data source:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Run the CREATE SERVER statement.	Run the CREATE SERVER statement for every JDBC server you want to register, for example:
	 `CREATE SERVER server_Definition_Name`
	 `  TYPE jdbc_Datasource_Type`
	 `  VERSION version_Number`
	 `  WRAPPER jdbc_Wrapper_Name`
	 `  OPTIONS (`
	 `      DRIVER_CLASS 'jdbc_Driver_Class_Path',`
	 `      URL 'jdbc_Url_Connect_String');`
	
	 Important: When you run the CREATE SERVER statement, it does not actually create a connection to data source until you run the CREATE NICKNAME statement. If you specify incorrect connection information in the OPTIONS parameter, you are not notified of the error until you run either the CREATE NICKNAME or pass-through statements.

After you complete this task, you must create a user mapping.

CREATE SERVER statement - Examples of the JDBC wrapper

Use the CREATE SERVER statement to register server definitions for the JDBC wrapper. This example provides the required parameters and an example with additional server parameters.

The following example shows how to register a server definition for a DB2 data source by issuing the CREATE SERVER statement:

```
CREATE SERVER jdbc_server1
   TYPE JDBC
   VERSION 3.0
   WRAPPER jdbc_wrapper1
   OPTIONS (
      DRIVER_PACKAGE '/home/My_LIB/JDBC_driver/derbyclient.jar',
      DRIVER_CLASS 'com.ibm.db2.jcc.DB2Driver',
      URL 'jdbc:db2://server.example.com:50471/testdb');
```

Parameter values

jdbc_server1
Specifies a name that you assign to the JDBC data source server. Duplicate server definition names are not allowed.

TYPE JDBC
Specifies the type of data source server that you want to access. This parameter is optional.

VERSION 3.0
Specifies the version of the JDBC data source that you want to access. This parameter is optional.

WRAPPER jdbc_wrapper1
: Specifies the wrapper name that you specified in the CREATE WRAPPER statement.

DRIVER_PACKAGE '/home/My_LIB/JDBC_driver/derbyclient.jar'
: Specifies the JDBC driver packages.

DRIVER_CLASS 'com.ibm.db2.jcc.DB2Driver'
: Specifies the JDBC driver library.

URL 'jdbc:db2://matthaus.cn.ibm.com:50471/testdb'
: Specifies the JDBC connection string of the remote server.

Server parameters

When you create the server definition, you can specify additional server options in the CREATE SERVER statement. The server options can include both general server options and JDBC-specific server parameters.

In general, the default settings for the server parameters have limited functionality. You can use the server parameters to optimize your configuration.

To access JDBC data sources, you must specify the DRIVER_CLASS and URL server parameters in the CREATE SERVER statement. The DRIVER_PACKAGE and JDBC_LOG server parameters are optional. The OPTIONS parameter syntax below specifies all of the JDBC-specific server parameters:

```
OPTIONS (
   DRIVER_PACKAGE '/path1/file1.jar: /path2/file2.jar',
   DRIVER_CLASS 'com.ibm.db2.jcc.DB2Driver',
   URL 'jdbc:db2://server.example.com:50471/testdb',
   JDBC_LOG 'Y');
```

Parameters

DRIVER_PACKAGE '/path1/file1.jar: /path2/file2.jar'
: Specifies the JDBC driver packages and sets your CLASSPATH environment variable.

DRIVER_CLASS 'com.ibm.db2.jcc.DB2Driver'
: Specifies the DB2 JDBC driver library.

URL 'jdbc:db2://server.example.com:50471/testdb'
: Specifies the JDBC connection string that consists of three parts that are all separated by a colon:

- The database protocol
- The database type name or connectivity driver name
- The database identity through an alias or sub-name

Examples

For DB2 databases
`jdbc:db2://server.example.com:50471/testdb`

where `jdbc` is the protocol, `db2` is the type of database, and `//server.example.com:50471/testdb` is the database alias that refers to a DB2 database catalog entry on the DB2 client.

For Oracle
`jdbc:oracle:thin:@//myhost:1521/orcl`

where `jdbc` is the protocol, `oracle` is the type of database, and `thin:@//myhost:1521/orcl` is the Oracle JDBC client information for accessing the Oracle server.

JDBC_LOG 'Y'
Specifies to create log files for error tracing. The default value of this server option is N.

Example

```
CREATE SERVER jdbc_server1
   TYPE JDBC
   VERSION 3.0
   WRAPPER jdbc_wrapper1
   OPTIONS (
      DRIVER_PACKAGE '/home2/JDBC_driver/derbyclient.jar',
      DRIVER_CLASS 'org.apache.derby.jdbc.ClientDriver',
      URL 'jdbc:derby://9.181.139.129:1527/testdb9;create=true;',
      JDBC_LOG 'Y');
```

Creating user mappings for JDBC data sources

You must define an association (a user mapping) between each federated server user ID and the corresponding data source user ID.

About this task

When you attempt to access a JDBC server, the federated server establishes a connection to the JDBC server by using a user ID and password for that data source.

Create a user mapping for each user ID that accesses the federated system to send distributed requests to the JDBC data source.

Procedure

To create user mappings for JDBC data sources:

Run the CREATE USER MAPPING statement to map a local user ID to the JDBC data source user ID and password:

```
CREATE USER MAPPING FOR local_userID
   SERVER server_definition_name
   OPTIONS (
      REMOTE_AUTHID 'remote_userID',
      REMOTE_PASSWORD 'remote_password');
```

The **REMOTE_AUTHID** and **REMOTE_PASSWORD** user mapping parameters are required.

After you complete this task, you can test the connection to the JDBC data source.

CREATE USER MAPPING statement - Examples for the JDBC wrapper

This example shows you how to use the DB2 special register USER with the CREATE USER MAPPING statement.

The following example shows how to map a federated authorization ID to a JDBC data source user ID and password:

```
CREATE USER MAPPING FOR arturo
   SERVER jdbc_server1
   OPTIONS (
      REMOTE_AUTHID 'art',
      REMOTE_PASSWORD 'red4blue');
```

Parameters

SERVER arturo
: Specifies the local authorization ID that you map to the remote user ID and password, which are defined at the JDBC data source.

OPTIONS jdbc_server1
: Specifies the server definition name that you defined in the CREATE SERVER statement for the JDBC data source.

REMOTE_AUTHID 'art'
: Specifies the remote user ID to which you map arturo. The value is case-sensitive, unless you set the FOLD_ID server parameter to 'U' or 'L' in the CREATE SERVER statement.

REMOTE_PASSWORD 'red4blue'
: Specifies the remote password that is associated with *'art'*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

DB2 special register USER

You can use the DB2 special register USER to map the authorization ID of the person who issues the CREATE USER MAPPING statement to the data source authorization ID that is specified in the REMOTE_AUTHID user option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER
   SERVER jdbc_server1
   OPTIONS (
      REMOTE_AUTHID 'art',
      REMOTE_PASSWORD 'red4blue');
```

Testing connections to JDBC data source servers

You can test the connection to the JDBC data source server by using the server definition and the user mappings that you defined.

Procedure

To test the connection to the JDBC data source server:

Open a pass-through session and issue a SELECT statement on the JDBC data source system tables. If the SELECT statement returns a count, your server definition and your user mapping are set up properly.

```
SET PASSTHRU server_definition_name
SELECT count(*) FROM schema_name.table_name
SET PASSTHRU RESET
```

If the SELECT statement returns an error, troubleshoot the connection errors.

After you complete this task, you must register nicknames for the JDBC data source tables and views.

Troubleshooting data source connection errors

A test connection to the data source server might return an error for several reasons. There are actions that you can take to determine why the error occurred.

Symptom

An error is returned when you attempt to connect to the data source.

Cause

There are several possible causes for a connection problem.

Resolving the problem

To troubleshoot data source connection errors, check the following items for problems:

- Verify that the data source is available.
- If applicable, ensure that the data source server is configured for incoming connections.
- Ensure that your user mapping settings for the REMOTE_AUTHID and REMOTE_PASSWORD options are valid for the connections to the data source. Alter the user mapping, or create another user mapping as necessary.
- If applicable, ensure that the data source client software on the federated server is installed and configured correctly to connect to the data source.
- For ODBC data sources, ensure that the ODBC driver on the federated server is installed and configured correctly to connect to the ODBC data source server. On federated servers that run Windows, use the ODBC Data Source Administrator tool to check the driver. On federated servers that run UNIX, consult the ODBC client vendor's documentation.
- Verify that the settings for the variables set on the federated server are correct for the data source. These variables include the system environment variables, the variables in the `db2dj.ini` file, and the DB2 Profile Registry (db2set) variables.
- Check your server definition. If necessary, drop the server definition and create it again.

Registering nicknames for JDBC data source tables and views

For each JDBC server definition that you register, you must register a nickname for each table or view that you want to access. Use these nicknames, instead of the names of the data source objects, when you query the JDBC data sources.

Before you begin

Update the statistics on the JDBC data source before you register a nickname. The federated database relies on the data source catalog statistics to optimize query processing. Use the data source command that is equivalent to the DB2 RUNSTATS command to update the data source statistics.

Procedure

To register a nickname for an JDBC data source table or view:

Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Run the CREATE NICKNAME statement.	For example: `CREATE NICKNAME nickname FOR server_definition_name."remote_schema"."remote.table";` Nicknames can be up to 128 characters in length.

When you create the nickname, the federated server queries the data source catalog. This query tests the connection to the data source table or view. If the connection does not work, you receive an error message.

Repeat this step for each JDBC table or view that you want to create a nickname for.

CREATE NICKNAME statement - Examples for the JDBC wrapper

The example shows how to register a nickname for a JDBC table or view by using the CREATE NICKNAME statement.

This statement specifies the server definition and the remote schema and table:

```
CREATE NICKNAME cust_europe FOR jdbc_server."vinnie"."italy"
```

cust_europe
A unique nickname that is used to identify the JDBC table or view. The nickname must be unique within the schema.

Important: The nickname is a two-part name; the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname is set to the authorization ID of the user who registers the nickname.

If your JDBC data source does not support schemas, omit the schema from the CREATE NICKNAME statement, for example:

```
CREATE NICKNAME cust_europe FOR jdbc_server."italy"
```

jdbc_server.″vinnie″.″italy″
A three-part identifier for the remote object:

jdbc_server
The server definition name that you assigned to the JDBC data source server in the CREATE SERVER statement.

vinnie The user ID of the owner to which the table or view belongs.

italy The name of the remote table or view that you want to access.

The federated server folds the names of the JDBC schemas and tables to uppercase, unless you enclose the names in double quotation marks.

Configuring access to Microsoft SQL Server data sources

To configure the federated server to access Microsoft SQL Server data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin

- The ODBC driver must be installed and configured on the federated server.
- Federation must be installed on a server that acts as the federated server.
- Check the setup of the federated server.
- Check the federated parameter to ensure that federation is enabled.

You can configure the federated server to access Microsoft SQL Server data sources by using the DB2 Control Center or by issuing SQL statements on the DB2 command line.

Procedure

To configure access to Microsoft SQL Server data sources:

1. Use one of the following methods to prepare the federated server and federated database depending on your operating system.
   - Prepare the federated server and federated database (Windows).
   - Prepare the federated server and federated database (UNIX)
2. Set the environment variables for the Microsoft SQL Server wrapper.
3. Register the wrapper.
4. Register the server definition.
5. Create the user mappings.
6. Test the connection to the Microsoft SQL Server remote server
7. Register nicknames for Microsoft SQL Server tables and views.

Preparing the federated server to access Microsoft SQL Server data sources (Windows)

On federated servers that run Windows, the federated server must be able to access Microsoft SQL Server data sources. To prepare the federated server, you must verify the settings in the ODBC System DSN and test the connection to Microsoft SQL Server data sources.

Procedure

To prepare the federated server to access Microsoft SQL Server data sources:

1. Verify that the ODBC System DSN is set to connect to the Microsoft SQL Server data source. In the Control Panel, locate the existing DSN entry for the Microsoft SQL Server remote server or create a DSN entry.

   The DSN entry for the Microsoft SQL Server remote server is the value that you will use for the NODE server option when you register the server definition in the federated database.
2. Use one of the following methods to test the connection to the Microsoft SQL Server data source:
   - Select **Configure** from the ODBC Data Source Administrator window.
   - Use the Microsoft SQL Server query tool.

After you complete this task, you can set the environment variables.

Preparing the federated server to access Microsoft SQL Server data sources (Linux, UNIX)

On federated servers that run Linux or UNIX, the federated server must be able to access Microsoft SQL Server data sources. To prepare the federated server, you must verify the settings in the odbc.ini file, create symbolic links, and test the connection to Microsoft SQL Server data sources.

Procedure

To prepare the federated server to access Microsoft SQL Server data sources:

1. Verify that the `odbc.ini` file is updated on the federated server. If the odbc.ini file does not exist on the federated server, you can create it in a text editor. Consult the documentation from the ODBC client vendor for information about the `odbc.ini` file.

   Remember: Place the `odbc.ini` file or a copy of this file in the home directory of the DB2 instance owner to ensure that it can be accessed if the instance owner is not the root user.
2. Verify that the path to the `odbc.ini` is in the ODBCINI environment variable.

   From an operating system command prompt, issue the following command:
   ```
   export ODBCINI=$HOME/.odbc.ini
   ```

3. Create the appropriate symbolic links:

Federated server operating system	**Step**

Linux	Create the following symbolic links:
	`ln -s $DJX_ODBC_LIBRARY_PATH/..`
	`/locale/usr/local/locale`
	
	`ln -s`
	`$DJX_ODBC_LIBRARY_PATH/libodbcinst.so/`
	`usr/lib/libodbcinst.so`
	
	If you are using the DataDirect Technologies Connect for the ODBC driver, verify the library name and create the symbolic link. The name of the library varies depending on the version of the driver and whether you are using a 32-bit or a 64-bit driver.
	
	For example, if you're using DataDirect Version 4.2, you would create the following link:
	`ln -s`
	`$DJX_ODBC_LIBRARY_PATH/libivicu19.so/`
	`usr/lib/libivicu19.so`
	
	If you're using DataDirect Version 5.0, you would create the following link:
	`ln -s`
	`$DJX_ODBC_LIBRARY_PATH/libivicu20.so/`
	`usr/lib/libivicu20.so`
	
	If you use DataDirect and do not include the symbolic link, CREATE WRAPPER MSSQLODBC3 might fail with the following error message:
	`SQL10013N The specified library`
	`name could not be loaded.`

Solaris	Create the following symbolic link:
	`ln -s $DJX_ODBC_LIBRARY_PATH/../`
	`locale $HOME/sqllib/locale`
	
	`$HOME` is the home directory of the DB2 instance owner.

4. Run the `/opt/odbc/odbc.sh` script. This script sets up several operating system specific environment variables.
5. Test the connection from the federated server to the Microsoft SQL server data source by using the DataDirect Connect ODBC demoodbc utility. The demoodbc utility is located in the `/demo` subdirectory of the DataDirect Connect ODBC libraries.

After you complete this task, you can set the environment variables.

Setting the Microsoft SQL Server environment variables

The Microsoft SQL Server environment variables must be set in the `db2dj.ini` file on the federated server.

Restrictions

Review the restrictions for the db2dj.ini file before you begin this task.

The `db2dj.ini` file contains configuration information about the Microsoft SQL Server ODBC driver that is installed on your federated server.

There are required and optional environment variables for Microsoft SQL Server data sources.

If you installed the Microsoft SQL Server client software before you installed the Microsoft SQL Server wrapper, the required Microsoft SQL Server environment variables are set in the `db2dj.ini` file.

You must set the environment variables by using the steps in this task if you did not install the Microsoft SQL Server client software before you installed the Microsoft SQL Server wrapper or if you want to set any of the optional environment variables.

Procedure

To set the Microsoft SQL Server environment variables:

1. Use one of the following methods:

Method	Step
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Automatically set the environment variables.	Run the IBM InfoSphere Federation Server installation wizard. Follow the instructions in the wizard. **Important:** Set the required environment variables by running the installation wizard. The optional environment variables must be set manually.

Manually set the environment variables.	Edit the `db2dj.ini` file.
	• On federated servers that run UNIX, this file is located in the `sqllib/cfg` directory.
	• On federated servers that run Windows, this file is located in the `%DB2PATH%\cfg` directory.
	
	If the file does not exist, you can create a file with the name `db2dj.ini` by using any text editor. In the `db2dj.ini` file, you must specify the fully qualified path in the value of the environment variables; otherwise you will encounter errors.
	
	For example:
	`DJX_ODBC_LIBRARY_PATH=/opt/odbc/lib`
	`ODBCINI=/opt/odbc/.odbc.ini`

2. To ensure that the environment variables are set on the federated server, recycle the DB2 instance with these commands:

```
db2stop
db2start
```

After you complete this task, you can register the wrapper.

Microsoft SQL Server environment variables

There are required and optional environment variables for Microsoft SQL Server data sources. These variables are set in the `db2dj.ini` file.

The following environment variables are valid for Microsoft SQL Server:

- DJX_ODBC_LIBRARY_PATH
- ODBCINI
- LD_LIBRARY_PATH (Solaris only)

Variable descriptions

DJX_ODBC_LIBRARY_PATH

Specifies the directory path to the ODBC library files. This variable must also be specified on federated servers that run Solaris.

For example:

```
DJX_ODBC_LIBRARY_PATH=ODBC_driver_directory/lib
```

ODBC_driver_directory is the directory path where the ODBC driver is installed.

ODBCINI

Specifies the directory path where your ODBC configuration file (`odbc.ini`) is located.

For example:

```
ODBCINI=/home/db2inst1/.odbc.ini
```

Do not set the ODBCINI environment variable as a system variable.

LD_LIBRARY_PATH (Solaris only)

On federated servers that run Solaris, specifies the directory path to the ODBC library files.

For example:

```
LD_LIBRARY_PATH=ODBC_driver_directory/lib
```

Registering the Microsoft SQL Server wrapper

You must register a wrapper to access Microsoft SQL Server data sources. Federated servers use wrappers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files

Procedure

To register the Microsoft SQL Server wrapper:

Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	Description

Issue the CREATE WRAPPER statement and specify the default name for the Microsoft SQL Server wrapper.	For example:
	`CREATE WRAPPER MSSQLODBC3;`
	
	Remember: When you register the wrapper by using the default name, MSSQLODBC3, the federated server automatically uses the appropriate Microsoft SQL Server wrapper library for the operating system that your federated server is running on.
	
	If the default wrapper name conflicts with an existing wrapper name in the federated database, you can substitute the default wrapper name with a name that you choose. When you use a name that is different from the default name, you must include the LIBRARY parameter in the CREATE WRAPPER statement.
	
	For example, to register a wrapper with the name sqlserver_wrapper on a federated server that uses AIX, issue the following statement:
	`CREATE WRAPPER sqlserver_wrapper`
	`  LIBRARY 'libdb2mssql3.a';`
	
	The wrapper library file that you specify depends on the operating system of the federated server.

After you complete this task, you can register the server definition.

Microsoft SQL Server wrapper library files

The Microsoft SQL Server wrapper library files are added to the federated server when you install the wrapper.

When you install the Microsoft SQL Server wrapper, three library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files that are added to the directory path are `libdb2mssql3.a`, `libdb2mssql3F.a`, and `libdb2mssql3U.a`. The default wrapper library file is `libdb2mssql3.a`. The other wrapper library files are used internally by the Microsoft SQL Server wrapper.

If you do not use the default wrapper name when you register a wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 23. Microsoft SQL Server client library locations and file names

Operating system	Directory path	Library file name
AIX	/usr/opt/*install_path*/lib32/ /usr/opt/*install_path*/lib64/	libdb2mssql3.a

Table 23. Microsoft SQL Server client library locations and file names (continued)

Operating system	Directory path	Library file name
Linux	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2mssql3.so
Solaris	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2mssql3.so
Windows	%DB2PATH%\bin	db2mssql3.dll

install_path is the directory path where the federated server is installed on UNIX or Linux.

Registering the server definitions for a Microsoft SQL Server data source

You must register each Microsoft SQL Server remote server that you want to access in the federated database.

Procedure

To register a server definition for a Microsoft SQL Server data source:

1. Locate the node name for the Microsoft SQL Server.
   - On federated servers that run Windows, the node name is the System DSN name that you specified for the Microsoft SQL Server remote server that you are accessing.
   - On federated servers that run UNIX, the node name is defined in the `.odbc.ini` file.

   At the top of the `.odbc.ini` file, there is a section labeled ODBC Data Sources, which lists the nodes. Each of the nodes has a section in the `.odbc.ini` file that describes the node.

   The following example is a `.odbc.ini` file on AIX. The node names are [rawilson] and [medusa].

   ```
   [ODBC Data Sources]
   rawilson=MS SQL Server 2000
   medusa=MS SQL Server 2000
   [rawilson]
   Driver=/opt/odbc/lib/ddmsss20.so
   Description=MS SQL Server Driver for AIX
     Address=9.112.30.39,1433
   [medusa]
   Driver=/opt/odbc/lib/ddmsss20.so
   Description=MS SQL Server Driver for AIX
   Address=9.112.98.123,1433
   [ODBC]
   InstallDir=/opt/odbc
   ```
2. Use one of the following methods to create the server definition.

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	Description

Issue the CREATE SERVER statement	For example:
	`CREATE SERVER server_definition_name`
	`TYPE MSSQLSERVER`
	`VERSION version_number`
	`WRAPPER wrapper_name`
	`OPTIONS (NODE 'node_name',`
	`DBNAME 'database_name');`
	
	Although the *'node_name'* and *'db_name'* variables are specified as options in the CREATE SERVER statement, these options are required for Microsoft SQL Server data sources.
	
	After the server definition is registered, use the ALTER SERVER statement to add or drop server options.

After you complete this task, you can create user mappings.

CREATE SERVER statement - Examples for the Microsoft SQL Server wrapper

Use the CREATE SERVER statement to register server definitions for the Microsoft SQL Server wrapper. This topic provides a complete example with the required parameters, and an example with additional server options.

The following example shows you how to register a server definition for a Microsoft SQL Server wrapper by issuing the CREATE SERVER statement:

```
CREATE SERVER sqlserver TYPE MSSQLSERVER VERSION 2000 WRAPPER wrapper_name
    OPTIONS (NODE 'sqlnode', DBNAME 'africa');
```

sqlserver
A name that you assign to the Microsoft SQL Server remote server. Duplicate server definition names are not allowed.

TYPE MSSQLSERVER
Specifies the type of data source to which you are configuring access. For the Microsoft SQL Server wrapper, the server type must be MSSQLSERVER.

VERSION *2000*
The version of Microsoft SQL Server database server that you want to access.

WRAPPER *wrapper_name*
The wrapper name that you specified in the CREATE WRAPPER statement.

NODE *'sqlnode'*
The name of the node where the Microsoft SQL Server remote server resides. On federated servers that run Windows, the System DSN name for the Microsoft SQL Server remote server that you are accessing. On federated servers that run UNIX, the node that is defined in the `.odbc.ini` file.

This value is case sensitive.

Although the name of the node is specified as an option in the CREATE SERVER statement, it is required for Microsoft SQL Server data sources.

DBNAME *'africa'*
: The name of the Microsoft SQL Server database that you want to access. This value is case sensitive.

  Although the name of the database is specified as an option in the CREATE SERVER statement, it is required for Microsoft SQL Server data sources.

Server options

When you create a server definition, you can specify additional server options in the CREATE SERVER statement. The server options can be general server options and Microsoft SQL Server-specific server options.

The COLLATING_SEQUENCE server option specifies whether the data source uses the same collating sequence as the federated server or a different collating sequence. On a Microsoft SQL Server database server that is running Windows NT® or Windows 2000, the default collating sequence is case insensitive (for example, 'STEWART' and 'StewART' are considered equal). To guarantee correct results from the federated server, set the COLLATING_SEQUENCE server option to 'I'. This setting indicates that the Microsoft SQL Server data source is case insensitive.

The federated server does not push down queries if the results that are returned from the data sources will be different from the results that are returned when processing the query at the federated server. When you set the COLLATING_SEQUENCE server option to 'I', the federated server does not push down queries that contain string data or expressions and that also contain any of the following clauses, predicates, or functions:

- GROUP BY clauses
- DISTINCT clauses
- Basic predicates, such as equal to (=)
- Aggregate functions, such as MIN or MAX

The following example shows how to specify the COLLATING_SEQUENCE server option:

```
CREATE SERVER sqlserver TYPE MSSQLSERVER VERSION 2000 WRAPPER mssqlodbc3
      OPTIONS (NODE 'sqlnode', DBNAME 'africa', COLLATING_SEQUENCE 'I');
```

Creating the user mappings for a Microsoft SQL Server data source

When you attempt to access an Microsoft SQL Server remote server, the federated server establishes a connection to the Microsoft SQL Server remote server by using a user ID and password that are valid for that data source.

Procedure

To map a local authorization ID to a remote Microsoft SQL Server user ID and password:

Issue a CREATE USER MAPPING statement.
For example:

```
CREATE USER MAPPING FOR local_userID SERVER server_definition_name
      OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password');
```

After you complete this task, you can test the connection to the Microsoft SQL Server tables and views.

CREATE USER MAPPING statement - Examples for the Microsoft SQL Server wrapper

Use the CREATE USER MAPPING statement to map a federated authorization ID to a remote Microsoft SQL Server user ID and password. This topic provides a complete example with the required parameters, and an example that shows you how to use the DB2 special register USER with the CREATE USER MAPPING statement.

The following example shows how to map a federated authorization ID to a Microsoft SQL Server remote server user ID and password:

```
CREATE USER MAPPING FOR elizabeth SERVER sqlserver
      OPTIONS (REMOTE_AUTHID 'liz', REMOTE_PASSWORD 'abc123')
```

elizabeth
: Specifies the authorization ID that you are mapping to a remote user ID and password, which are defined at the Microsoft SQL Server remote server.

SERVER *sqlserver*
: Specifies the server definition name that you registered in the CREATE SERVER statement for the Microsoft SQL Server remote server.

REMOTE_AUTHID *'liz'*
: Specifies the remote user ID to which you are mapping *elizabeth*. The value is case-sensitive, unless you set the FOLD_ID server option to 'U' or 'L' in the CREATE SERVER statement.

REMOTE_PASSWORD *'abc123'*
: Specifies the remote password that is associated with *'liz'*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

DB2 special register USER

You can use the DB2 special register USER to map the authorization ID of the person who is issuing the CREATE USER MAPPING statement to the remote user ID that is specified in the REMOTE_AUTHID option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER sqlserver
      OPTIONS (REMOTE_AUTHID 'liz', REMOTE_PASSWORD 'abc123');
```

Testing the connection to the Microsoft SQL Server remote server

Test the connection to the Microsoft SQL Server remote server to determine if the federated server is properly configured to access Microsoft SQL Server data sources.

You can test the connection to the Microsoft SQL Server remote server by using the server definition and user mappings that you defined.

Procedure

To test the connection to the Microsoft SQL Server remote server:

Open a pass-through session and issue a SELECT statement on the Microsoft SQL Server system tables. If the SELECT statement returns a count, your server definition and your user mapping are set up properly.
For example:

```
SET PASSTHRU server_definition_name
SELECT count(*) FROM dbo.sysobjects
SET PASSTHRU RESET
```

After you complete this task, you can register nicknames.

Troubleshooting data source connection errors

A test connection to the data source server might return an error for several reasons. There are actions that you can take to determine why the error occurred.

Symptom

An error is returned when you attempt to connect to the data source.

Cause

There are several possible causes for a connection problem.

Resolving the problem

To troubleshoot data source connection errors, check the following items for problems:

- Verify that the data source is available.
- If applicable, ensure that the data source server is configured for incoming connections.
- Ensure that your user mapping settings for the REMOTE_AUTHID and REMOTE_PASSWORD options are valid for the connections to the data source. Alter the user mapping, or create another user mapping as necessary.
- If applicable, ensure that the data source client software on the federated server is installed and configured correctly to connect to the data source.
- For ODBC data sources, ensure that the ODBC driver on the federated server is installed and configured correctly to connect to the ODBC data source server. On federated servers that run Windows, use the ODBC Data Source Administrator tool to check the driver. On federated servers that run UNIX, consult the ODBC client vendor's documentation.
- Verify that the settings for the variables set on the federated server are correct for the data source. These variables include the system environment variables, the variables in the `db2dj.ini` file, and the DB2 Profile Registry (db2set) variables.
- Check your server definition. If necessary, drop the server definition and create it again.

Registering nicknames for Microsoft SQL Server tables and views

For each Microsoft SQL Server remote server definition that you register, you must register a nickname for each table or view that you want to access. Use these nicknames, instead of the names of the data source objects, when you query the Microsoft SQL Server remote servers.

Before you begin

To ensure that the federated database has current and complete statistics, execute the Microsoft SQL Server sp_createstats stored procedure and the Microsoft SQL Server CREATE STATISTICS command from the Microsoft SQL Server database before creating the nickname.

The sp_createstats stored procedure gathers statistics on all of the default columns in a table in an Microsoft SQL Server data source, but does not gather statistics for columns that appear first within an index. To ensure that the federated database has complete statistics on the Microsoft SQL Server table, you also must use the Microsoft SQL Server CREATE STATISTICS command to gather statistics for each column that appears first in an index.

When you use the CREATE STATISTICS command from the Microsoft SQL Server database, you must give the statistic the same name for the column on which the statistics are being collected. By giving the statistic the same name as the column, you ensure that when you register the nickname with the CREATE NICKNAME statement, the federated database reads the statistics collected by the Microsoft SQL Server CREATE STATISTICS command.

Procedure

To register a nickname for a Microsoft SQL Server table or view:

Use one of the following methods:

Method	Description
Use the Control Center.	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**. Follow the steps in the wizard.

Issue the CREATE NICKNAME statement.	For example:
	`CREATE NICKNAME nickname`
	
	`FOR server_definition_name."remote_schema"."remote.table";`

When you create the nickname, the federated server queries the data source catalog using the nickname. This query tests the connection to the data source table, view, or synonym. If the connection does not work, you receive an error message.

Repeat this step for each Microsoft SQL Server table or view that you want to create a nickname for.

CREATE NICKNAME statement - Examples for the Microsoft SQL Server wrapper

Use the CREATE NICKNAME statement to register a nickname for a Microsoft SQL Server table or view that you want to access. This topic provides a complete example with the required parameters.

The following example shows how to register a nickname for a Micrsoft SQL Server table or view using the CREATE NICKNAME statement.

```
CREATE NICKNAME cust_africa FOR sqlserver."vinnie"."egypt"
```

cust_africa
: A unique nickname that is used to identify the Microsoft SQL Server table or view.

  Important: The nickname is a two-part name—the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname will be the authorization ID of the user who registers the nickname.

sqlserver."vinnie"."egypt"
: A three-part identifier for the remote object:
  - *sqlserver* is the server definition name that you assigned to the Microsoft SQL Server remote server in the CREATE SERVER statement.
  - *vinnie* is the user ID of the owner to which the table or view belongs.
  - *egypt* is the name of the remote table or view that you want to access.

  The federated server folds the names of the Microsoft SQL Server schemas and tables to uppercase unless you enclose the names in quotation marks.

Using ODBC tracing information to troubleshoot connections to Microsoft SQL Server data sources

If you experience problems connecting to the data source, you can obtain ODBC tracing information to analyze and resolve the problems.

Symptom

However, activating a trace does impact system performance. You should turn off tracing after you have resolved the connectivity problems.

If you are unable to connect to the data source with the Microsoft SQL Server wrapper, running a trace might help you diagnose the problem.

Cause

The cause of the problem might be an error in the wrapper configuration.

Diagnosing the problem

To diagnose the problem on a federated server running Windows:

1. In the Control Panel, open the **Administrative Tools** folder.
2. Click **Data Sources (ODBC)** to open the ODBC Data Source Administrator window.
3. Click the Tracing tab.
4. Click **Start Tracing Now** to start the trace utility.

On a federated server running UNIX:

1. Change the `odbc.ini` file.

   For example, if you use the DataDirect ODBC 3.x driver, find the example of the `odbc.ini` file in the client directory. The `odbc.ini` file contains a sample of the settings that are necessary to activate the trace files:

```
[ODBC]
Trace=1
TraceFile=/home/user1/trace_dir/filename.xxx
TraceDll==ODBC_driver_directory/odbctrac.so
InstallDir=/opt/odbc
```

To turn tracing on, set the first line to `Trace=1`. To turn tracing off, set the first line to `Trace=0`. The value of the TraceFile setting is the path and file name that the federated database instance has write access to.

Resolving the problem

Check the trace log file for problems.

On Windows, open the ODBC Data Source Administrator and click the Tracing tab. The path to the trace log file is shown in the Log File Path field.

On UNIX, open the `odbc.ini` file. The path to the trace log file is indicated by the TraceFile setting.

Configuring access to ODBC data sources

To configure the federated server to access ODBC data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin

- The ODBC driver must be installed and configured on the server that acts as the federated server.
- Federation must be installed on the server that acts as the federated server.
- Check the setup of the federated server.
- Check the federated parameter to ensure that federation is enabled.
- The proper setup of the system environment variables, `db2dj.ini` file variables, and DB2 Profile Registry (db2set) variables. Check the documentation provided by the ODBC data source for the variables that are required for your ODBC client. The LIBPATH environment variable might be required.

Restrictions

- The ODBC wrapper cannot be used to access any DB2 family data sources. Use the DRDA wrapper to access DB2 family data sources.
- The ODBC wrapper does not support the following functions and statements:
  - LOCK TABLE statements on nicknames
  - Features deprecated in ODBC 3.x
  - X/Open or SQL/CLI drivers
  - Stored procedure nicknames
  - Statement-level atomicity enforcement using remote savepoint statements
  - WITH HOLD cursors
- For data sources that do not support positioned update and delete operations, positioned UPDATE and DELETE statements and certain searched UPDATE and DELETE statements on a nickname will fail if a unique index on non-nullable columns does not exist on the nickname or its corresponding remote table. The error SQL30090 with the reason code 21 is returned when these statements fail.
- The ODBC wrapper does not support INSERT, UPDATE, or DELETE statements against data sources that restrict the number of active statements for each

connection. Consult the documentation for your data source to determine if the data source restricts the number of active statements for each connection. One of the ODBC data sources that this restriction applies to is IBM Red Brick™ Warehouse.

- The ODBC wrapper does not support operations on tables that contain columns with data types that use driver-specific SQL data type indicators. The type of operations that are not supported included the CREATE NICKNAME and SELECT statements in the pass-through mode. The ODBC wrapper supports only the SQL data type indicators that are defined by the ODBC standard in the *Microsoft ODBC Programmer's Reference*.

About this task

You can configure the federated server to access ODBC data sources by using the DB2 Control Center or by issuing SQL statements on the DB2 command line. The DB2 Control Center includes a wizard to guide you through the steps that are required to configure the required federated objects.

The data sources that are accessed through the ODBC API are referred to in this text as ODBC data sources.

Depending on your needs, you can access Excel data using the ODBC wrapper instead of using the Excel wrapper. To configure the ODBC wrapper to access Excel data, see Accessing Excel data using the ODBC wrapper.

Recommendation: For Microsoft SQL Server, you should use the Microsoft SQL Server wrapper for accessing Microsoft SQL Server data sources rather than using the ODBC wrapper. The Microsoft SQL Server wrapper provides better query performance and more functionality for Microsoft SQL Server. For information on configuring the Microsoft SQL Server wrapper, see Configuring access to Microsoft SQL Server data sources.

Procedure

To add ODBC data sources to a federated server:

1. Use one of the following methods to prepare the federated server and federated database depending on your operating system:
   - Prepare the federated server to access data sources through ODBC (Windows).
   - Prepare the federated server to access data sources through ODBC (Linux, UNIX).
2. Register the ODBC wrapper.
3. Register the server definitions for an ODBC data source.
4. Create a user mapping for an ODBC data source.
5. Test the connection to the ODBC data source server.
6. Register nicknames for ODBC data source tables and views.

Preparing the federated server to access data sources through ODBC (Windows)

On federated servers that run Windows, the federated server must be able to access ODBC data sources. To prepare the federated server, you must verify the settings in the ODBC System DSN.

Procedure

To prepare the federated server to access data sources through ODBC:

Verify that the ODBC 3.x driver has been installed and configured on the federated server.
The node name for the ODBC data source must be defined in the System DSN. See the ODBC driver documentation for the installation and configuration procedures. If you used the Microsoft ODBC Data Source Administrator window to configure the DSN, you can check this setting in the Control Panel. Ensure that ODBC data source is registered as a System DSN. Otherwise the federated server might not be able to find the DSN.

After you complete this task, you can register the wrapper.

Preparing the federated server to access data sources through ODBC (Linux, UNIX)

On federated servers that run Linux or UNIX, the federated server must be able to access ODBC data sources. To prepare the federated server, you must verify the settings in the `odbc.ini` file, create symbolic links, and test the connection to ODBC data sources.

Before you begin

For the Linux for System z operating system, you must set the **EnableDescribeParam** parameter to *1* in the `odbc.ini` configuration file of the DSN when you use the ODBC wrapper to connect to Sybase or Oracle data sources with the DataDirect Sybase Wire Protocol, Oracle Wire Protocol, or Oracle Client drivers:

```
EnableDescribeParam=1
```

If you do not set the **EnableDescribeParam** parameter to *1*, the 1822N error message is thrown for binding non-char and varchar host variables when the ODBC SERVER object is set to PUSHDOWN mode.

For additional information on connecting to a data source with a DataDirect driver, see http://media.datadirect.com/download/docs/odbc/allodbc/userguide/ase6.html.

Procedure

To prepare the federated server to access data sources through ODBC:

1. Verify that the `odbc.ini` file has been updated on the federated server. If the file does not exist, you can create it in a text editor. Consult the documentation from the ODBC client vendor for information about the `odbc.ini` file.
2. Configure the ODBC client.

   Consult the documentation from the ODBC client vendor for instructions on how to configure the ODBC client.
3. If the client is DataDirect ODBC or RedBrick, verify that the appropriate symbolic links are created. In the following symbolic links, *ODBC_CLIENT_DIR* is the directory where the ODBC client is installed.

Federated server operating system	Step
Linux	Create the following symbolic links: `ln -s $ODBC_CLIENT_DIR/../locale /usr/local/locale` `ln -s $ODBC_CLIENT_DIR/libodbcinst.so /usr/lib/libodbcinst.so` If you are using the DataDirect Technologies Connect for ODBC 4.2 driver, you must also create the following symbolic link: `ln -s $ODBC_CLIENT_DIR/libivicu19.so /usr/lib/libivicu19.so`
Solaris	Create the following symbolic link: `ln -s $ODBC_CLIENT_DIR/../locale $HOME/sqllib/locale` `$HOME` is the home directory of the DB2 instance owner.

4. If the client is DataDirect ODBC you can test the connection from the federated server to the data source by using the DataDirect Connect ODBC demoodbc tool.
   a. Run the `/opt/odbc/odbc.sh` script. This script sets up several operating system specific environment variables.
   b. Test the connection to the ODBC data source by using the DataDirect Connect ODBC demoodbc tool. The demoodbc tool is located in the `/demo` subdirectory of the Connect ODBC libraries.

After you complete this task, you can register the wrapper.

Registering the ODBC wrapper

You must register a wrapper to access ODBC data sources. Federated servers use wrappers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

Procedure

To register the ODBC wrapper:

Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	Description

Issue the CREATE WRAPPER statement and specify the default name for the ODBC wrapper.	For example:
	`CREATE WRAPPER ODBC;`
	
	Remember: When you register the wrapper by using the default name, ODBC, the federated server automatically uses the appropriate ODBC wrapper library for the operating system that your federated server is running on.
	
	You must specify the MODULE wrapper option on federated servers that run Linux or UNIX. The MODULE wrapper option specifies the full path of the library that contains the ODBC Driver Manager.
	
	For AIX and Solaris, if you are configuring access to IBM InfoSphere Classic Federation Server for z/OS data sources, you must specify the DB2_FENCED and DB2_SOURCE_CLIENT_MODE options as shown in the following example.
	`CREATE WRAPPER ODBC`
	` LIBRARY 'libdb2rcodbc.a'`
	` OPTIONS (DB2_FENCED 'Y',`
	`  DB2_SOURCE_CLIENT_MODE '32BIT',`
	` MODULE '/opt/IBM/DB2IIClassic82/cli/lib/cacsqlcli.so')`

Issue the CREATE WRAPPER statement and specify an alternative name for the ODBC wrapper.	If the default wrapper name conflicts with an existing wrapper name in the federated database, you can substitute the default wrapper name with a name that you choose. When you use a name that is different from the default name, you must include the LIBRARY parameter in the CREATE WRAPPER statement.
	
	For example, to register a wrapper with the name odbc_wrapper on a federated server that uses AIX, issue the following statement:
	`CREATE WRAPPER odbc_wrapper`
	`  LIBRARY 'libdb2rcodbc.a';`
	
	The wrapper library file that you specify depends on the operating system of the federated server.

After you complete this task, you can register the server definitions.

ODBC wrapper library files

The ODBC wrapper library files are added to the federated server when you install the wrapper.

When you install the ODBC wrapper, three library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files added to the directory path are `libdb2rcodbc.a`, `libdb2rcodbcF.a`, and `libdb2rcodbcU.a`. The default wrapper library file is `libdb2rcodbc.a`. The other wrapper library files are used internally by the ODBC wrapper.

If you do not use the default wrapper name when you register a wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 24. ODBC client library locations and file names

Operating system	Directory path	Wrapper library file
AIX	/usr/opt/*install_path*/lib32/ /usr/opt/*install_path*/lib64/	libdb2rcodbc.a
Linux	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2rcodbc.so
Solaris	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2rcodbc.so
Windows	%DB2PATH%\bin	db2rcodbc.dll

install_path is the directory path where federation is installed on UNIX or Linux.

CREATE WRAPPER statement - Examples for the ODBC wrapper

Use the CREATE WRAPPER statement to register the ODBC wrapper. This topic provides examples for Linux, UNIX and Windows.

In the following examples, *odbc_wrapper* is the name that you assign to the wrapper that you are registering in the federated database.

Linux and Solaris federated server

The following example shows you how to register a wrapper with the default name on a federated server that runs Linux or Solaris:

```
CREATE WRAPPER odbc OPTIONS (MODULE '/opt/lib/odbc.so');
```

You must specify the MODULE wrapper option on federated servers that run Linux or UNIX. The MODULE wrapper option specifies the full path of the library that contains the ODBC Driver Manager.

The following example shows you how to register a wrapper with an alternative name on a federated server the runs Linux or Solaris:

```
CREATE WRAPPER odbc_wrapper LIBRARY 'libdb2rcodbc.so'
     OPTIONS (MODULE '/opt/lib/odbc.so');
```

AIX federated server

The following example shows you how to register a wrapper with the default name on a federated server that runs AIX:

```
CREATE WRAPPER odbc
     OPTIONS (MODULE '/usr/lib/odbc.a');
```

You must specify the MODULE wrapper option on federated servers that run UNIX. The MODULE wrapper option specifies the full path of the library that contains the ODBC Driver Manager.

The following example shows you how to register a wrapper with an alternative name on a federated server that runs AIX:

```
CREATE WRAPPER odbc_wrapper LIBRARY 'libdb2rcodbc.a'
     OPTIONS (MODULE '/usr/lib/odbc.a');
```

IBM InfoSphere Classic Federation Server for z/OS (AIX)

The following example shows you how to register an ODBC wrapper by issuing the CREATE WRAPPER statement on an AIX operating system. On AIX and Solaris, the DB2_FENCED and DB2_SOURCE_CLIENT_MODE options must be specified as shown in the following example.

```
CREATE WRAPPER odbc
  OPTIONS (DB2_FENCED 'Y', DB2_SOURCE_CLIENT_MODE '32BIT',
  MODULE '/opt/IBM/DB2IIClassic82/cli/lib/cacsqlcli.so');
```

You must specify the MODULE wrapper option on federated servers that run UNIX. The MODULE wrapper option specifies the full path of the library that contains the ODBC Driver Manager.

The following example shows you how to register a wrapper for accessing IBM InfoSphere Classic Federation Server for z/OS data sources with an alternative name:

```
CREATE WRAPPER odbc_wrapper LIBRARY 'libdb2rcodbc.a'
  OPTIONS (DB2_FENCED 'Y', DB2_SOURCE_CLIENT_MODE '32BIT',
  MODULE '/opt/IBM/DB2IIClassic82/cli/lib/cacsqlcli.so');
```

Windows federated server

The following example shows you how to register a wrapper with the default name on a federated server that runs Windows:

```
CREATE WRAPPER odbc;
```

The following example shows you how to register a wrapper with an alternative name on a federated server that runs Windows:

```
CREATE WRAPPER odbc_wrapper LIBRARY 'db2rcodbc.dll';
```

Registering the server definitions for an ODBC data source

You must register each ODBC server that you want to access in the federated database.

Procedure

To register a server definition for an ODBC data source:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	Description

Issue the CREATE SERVER statement.	1. Issue the CREATE SERVER statement and specify the required server options:
	`CREATE SERVER server_definition_name TYPE data_source_type`
	`    VERSION version_number WRAPPER wrapper_name`
	`    OPTIONS (NODE 'node_name', CODEPAGE 'codepage_name', DBNAME 'database_name');`
	
	Although NODE, CODEPAGE, and DBNAME are server options in the CREATE SERVER statement, they are required for ODBC data sources:
	• The NODE server option must be set to the data source specified on the DATASOURCE keyword in the `cac.ini` file.
	Example
	If the `cac.ini` file specifies `DATASOURCE = CACSAMP tcp/150.45.37.49/5000`, then the NODE option should be set to *CACSAMP*.
	• The CODEPAGE server option must be set to the codepage number of the client codepage specified in the `cac.ini` file.
	Example
	If the `cac.ini` file specifies `CLIENT CODEPAGE = IBM-850`, then the CODEPAGE option should be set to `850`.
	• The DBNAME server option must be set to the name of the data source database that you want to access.
	Example
	If the ODBC data source name is venice, then the DBNAME option should be set to *venice*.
	2. After the server definition is created, use the ALTER SERVER statement to add or drop server options.

After you complete this task, you can create a user mapping.

CREATE SERVER statement - Examples of the ODBC wrapper

Use the CREATE SERVER statement to register server definitions for the ODBC wrapper. This topic provides a complete example with the required parameters, and an example with additional server options.

The following example shows you how to register a server definition for a MySQL data source by issuing the CREATE SERVER statement:

```
CREATE SERVER mysql_server TYPE mysql
       VERSION 4.0 WRAPPER wrapper_name
        OPTIONS (NODE 'odbc_node', DBNAME 'venice')
```

mysql_server
: A name that you assign to the ODBC data source server. Duplicate server definition names are not allowed.

TYPE *mysql*
: Specifies the type of data source server to which you are configuring access. This parameter is optional.

VERSION *4.0*
: The version of the ODBC data source that you want to access. This parameter is optional.

WRAPPER *wrapper_name*
: The wrapper name that you specified in the CREATE WRAPPER statement.

NODE *'odbc_node'*
The name of the node (the system DSN name) that was assigned to the ODBC data source when the DSN was defined. On federated servers that run Windows, this value must be the name of a system DSN in the ODBC Data Source Administrator window. On federated servers that run UNIX, the name of the node is the DSN defined in the ODBC configuration file. The ODBC configuration file is usually called odbc.ini.

Although the name of the node is specified as an option in the CREATE SERVER statement, it is required for ODBC data sources.

DBNAME *'venice'*
Optional. The name of the ODBC data source that you want to access.

Server options

When you create the server definition, you can specify additional server options in the CREATE SERVER statement. The server options can be general server options and ODBC-specific server options.

Some ODBC data sources (for example, MySQL) cannot process quotation marks around table names and column names in SQL statements. To access these data sources, you must include the following server options in the CREATE SERVER statement:

- DB2_TABLE_QUOTE_CHAR ' ` '
- DB2_ID_QUOTE_CHAR ' ` '
- DB2_AUTHID_QUOTE_CHAR ' ` '

The ` character is the delimiter for identifiers such as schema names, table names, and column names.

For example:

```
CREATE SERVER mysql_server TYPE mysql
       VERSION 4.0 WRAPPER wrapper_name
       OPTIONS (NODE 'mysql_node', DB2_TABLE_QUOTE_CHAR '`',
       DB2_ID_QUOTE_CHAR '`', DB2_AUTHID_QUOTE_CHAR '`')
```

Creating a user mapping for an ODBC data source

When you attempt to access an ODBC server, the federated server establishes a connection to the ODBC server by using a user ID and password that are valid for that data source. For data sources that require a user mapping, you must define an association (a user mapping) between each federated server user ID and password and the corresponding data source user ID and password.

About this task

Create a user mapping for each user ID that will access the federated system to send distributed requests to the ODBC data source.

Procedure

To map a local user ID to the ODBC data source user ID and password:

Issue a CREATE USER MAPPING statement.
For example:

```
CREATE USER MAPPING FOR local_userID SERVER server_definition_name
      OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password');
```

Although REMOTE_AUTHID and REMOTE_PASSWORD are user mapping options in the CREATE USER MAPPING statement, these options are required to access ODBC data sources:
The user mapping should map the DB2 auth ID to the user ID and password specified in the `cac.ini` file.

Example

If the `cac.ini` file specifies `USERID =` *`MY_USERID`* and `USERPASSWORD =` *`MY_PASSWORD`*, then the options of the CREATE USER MAPPING statement must be specified as follows:

```
REMOTE_AUTHID = MY_USERID
REMOTE_PASSWORD = MY_PASSWORD
```

After you complete this task, you can test the connection to the ODBC data source.

CREATE USER MAPPING statement - Examples for the ODBC wrapper

Use the CREATE USER MAPPING statement to map a federated server user ID to an ODBC data source user ID and password. This topic provides a complete example with the required parameters, and an example that shows you how to use the DB2 special register USER with the CREATE USER MAPPING statement.

The following example shows how to map a federated authorization ID to an ODBC data source user ID and password:

```
CREATE USER MAPPING FOR arturo SERVER mysql_server
      OPTIONS (REMOTE_AUTHID 'art', REMOTE_PASSWORD 'red4blue')
```

arturo
: Specifies the local authorization ID that you are mapping to the remote user ID and password, which are defined at the ODBC data source.

mysql_server
: Specifies the server definition name that you defined in the CREATE SERVER statement for the ODBC data source.

'art'
: Specifies the remote user ID to which you are mapping *arturo*. The value is case-sensitive, unless you set the FOLD_ID server option to 'U' or 'L' in the CREATE SERVER statement.

'red4blue'
: Specifies the remote password that is associated with *'art'*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

DB2 special register USER

You can use the DB2 special register USER to map the authorization ID of the person who is issuing the CREATE USER MAPPING statement to the data source authorization ID that is specified in the REMOTE_AUTHID user option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER mysql_server
      OPTIONS (REMOTE_AUTHID 'art', REMOTE_PASSWORD 'red4blue');
```

Testing the connection to the ODBC data source server

Test the connection to the ODBC data source server to determine if the federated server is properly configured to access ODBC data sources.

About this task

You can test the connection to the ODBC data source server by using the server definition and the user mappings that you defined.

Procedure

To test the connection to the ODBC data source server:

Open a pass-through session and issue a SELECT statement on the ODBC data source system tables. If the SELECT statement returns a count, your server definition and your user mapping are set up properly.

```
SET PASSTHRU server_definition_name
SELECT count(*) FROM schema_name.table_name
SET PASSTHRU RESET
```

If the SELECT statement returns an error, you should troubleshoot the connection errors

After you complete this task, you can register nicknames for the ODBC data source tables and views.

Troubleshooting data source connection errors

A test connection to the data source server might return an error for several reasons. There are actions that you can take to determine why the error occurred.

Symptom

An error is returned when you attempt to connect to the data source.

Cause

There are several possible causes for a connection problem.

Resolving the problem

To troubleshoot data source connection errors, check the following items for problems:

- Verify that the data source is available.
- If applicable, ensure that the data source server is configured for incoming connections.
- Ensure that your user mapping settings for the REMOTE_AUTHID and REMOTE_PASSWORD options are valid for the connections to the data source. Alter the user mapping, or create another user mapping as necessary.
- If applicable, ensure that the data source client software on the federated server is installed and configured correctly to connect to the data source.
- For ODBC data sources, ensure that the ODBC driver on the federated server is installed and configured correctly to connect to the ODBC data source server. On

federated servers that run Windows, use the ODBC Data Source Administrator tool to check the driver. On federated servers that run UNIX, consult the ODBC client vendor's documentation.

- Verify that the settings for the variables set on the federated server are correct for the data source. These variables include the system environment variables, the variables in the `db2dj.ini` file, and the DB2 Profile Registry (db2set) variables.
- Check your server definition. If necessary, drop the server definition and create it again.

Registering nicknames for ODBC data source tables and views

For each ODBC server definition that you register, you must register a nickname for each table or view that you want to access. Use these nicknames, instead of the names of the data source objects, when you query the ODBC data sources.

Before you begin

Update the statistics at the ODBC data source before you register a nickname. The federated database relies on the data source catalog statistics to optimize query processing. Use the data source command that is equivalent to the DB2 RUNSTATS command to update the data source statistics.

Procedure

To register a nickname for an ODBC data source table or view, use one of the following methods.

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Issue the CREATE NICKNAME statement. Nicknames can be up to 128 characters in length.	For example: `CREATE NICKNAME nickname FOR server_definition_name."remote_schema"."remote.table" ;`

When you create the nickname, the federated server queries the data source catalog using the nickname. This query tests the connection to the data source table or view. If the connection does not work, you receive an error message.

Repeat this step for each ODBC table or view that you want to create a nickname for.

CREATE NICKNAME statement - Examples for the ODBC wrapper

Use the CREATE NICKNAME statement to register a nickname for an ODBC table or view that you want to access. This topic provides a complete example with the required parameters.

The following example shows how to register a nickname for an ODBC table or view using the CREATE NICKNAME statement.

```
CREATE NICKNAME cust_europe FOR mysql_server."vinnie"."italy"
```

cust_europe
A unique nickname that is used to identify the ODBC table or view. The nickname must be unique within the schema.

Important: The nickname is a two-part name—the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname will be the authorization ID of the user who registers the nickname.

If your ODBC data source does not support schemas, omit the schema from the CREATE NICKNAME statement.

mysql_server."vinnie"."italy"
A three-part identifier for the remote object:

- *mysql_server* is the server definition name that you assigned to the ODBC data source server in the CREATE SERVER statement.
- *vinnie* is the user ID of the owner to which the table or view belongs.
- *italy* is the name of the remote table or view that you want to access.

The federated server folds the names of the ODBC schemas and tables to uppercase unless you enclose the names in quotation marks.

Optimizing ODBC wrapper performance with the ODBC tuning utility (db2fedsvrcfg)

You can optimize the performance of the ODBC wrapper with the ODBC tuning utility, db2fedsvrcfg. This utility runs a set of predefined queries against the data source and tests the results for accuracy. The utility creates a set of ALTER SERVER statements that you can run against the server to set the server options for optimal performance.

Before you begin

The following items must be configured on your federated server:

- Federation
- The ODBC wrapper
- The ODBC client software
- Variables for the system environment. The ODBCINI and LIBPATH variables might be required.

For information about installation, configuration, and ODBC requirements, see the documentation that is provided with each of these products.

Procedure

To optimize ODBC wrapper performance with the ODBC tuning utility:

1. If your ODBC server has not been defined, use the DB2 Control Center or DB2 Command Line Processor to connect to the federated server and create an ODBC wrapper and server.
2. Optional: If the test tables already exist on your ODBC data source, connect to your ODBC data source and drop them.
3. Run the ODBC tuning utility from the DB2 command line with the options that you want to use. The utility might take some time to complete.

4. Verify that the utility ran successfully. If the utility ran successfully, you see the following message in the command window or in the output file that you specified:

   ```
   ALTER SERVER "DS1" OPTIONS (ADD option1, 'value1')
   ALTER SERVER "DS1" OPTIONS (ADD option2, 'value2')
   ALTER SERVER "DS1" OPTIONS (ADD option3, 'value3')
   .....

   The db2fedsvrcfg command completed successfully.
   ```

   If the command ran unsuccessfully, you see an error message indicating the reason for the error. Correct the problem and run the command again.

   You must create the test tables manually under the following circumstances:

   - If you want to use table names that are different from the default
   - If the data source that you are accessing through ODBC is read-only
   - If the ODBC tuning utility is unable to create the test tables that are required by the utility
5. Connect to the federated server where the data source is defined.
6. Use the db2look utility to save your existing server settings before you run the file that is created by the ODBC tuning utility. See the documentation for the db2look utility for information about saving your existing server settings.
7. Optional: If your ODBC server is defined, you can connect to the federated server and drop the server options. The utility creates ALTER SERVER statements in the format described in step 4. If these server options have already been added, the ALTER SERVER statements will fail.
8. Use the following command to run the ALTER SERVER statements that were generated by the utility against the federated database. The ALTER SERVER statements that were created by the ODBC tuning utility are contained in the `db2fedsvrcfg.sql` file.

   ```
   db2 -tvf db2fedsvrcfg.sql
   ```
9. Verify that the results of the ALTER SERVER statements. If any of the statements failed, you can modify the statements in the `db2fedsvrcfg.sql` file and run the statements again until they succeed.
10. After you have completed tuning the server with the ODBC tuning utility, set the PUSHDOWN server option to 'Y' to complete the optimization process.

db2fedsvrcfg command syntax - ODBC tuning utility

Use the db2fedsvrcfg command to improve the performance of the ODBC wrapper.

Syntax

db2fedsvrcfg *-s serverName* [*-m odbcDriverManagerLibrary*] *-dsn odbcDSNname* [*-dbname dsDBname*] [*-u userid*] [*-p password*] [*-noprep*] [*-prefix tableNamePrefix*] [*-suffix tableNameSuffix*] [*-dscp codePage*] [*-v*] [*-o outputFile*] [*-h*]

Parameters

Use the command db2fedsvrcfg32 when you use 32-bit ODBC drivers on AIX or Solaris. Otherwise, use the command db2fedsvrcfg.

-dbname dsDBname
: The database name of the data source.

-dscp codePage
The code page identifier for the data source. If this option is not specified, the utility uses the code page of the user's environment. This parameter is optional.

-dsn odbcDSNname
The system data source name (DSN) for the data source.

-h Causes detailed help to be displayed. This parameter is optional.

-m odbcDriverManagerLibrary
The fully qualified file name of the ODBC driver manager library. The ODBC driver manager library file name is optional for Windows.

-noprep
Prevents the testing tables from being created at the data source before testing. This parameter is optional.

-o outputFile
The fully qualified file name for the ODBC tuning utility output file. The output file contains the ALTER SERVER statements that are used to tune the ODBC wrapper performance. This parameter is optional. If this parameter is not specified, the output is displayed in the command window.

-p password
The password for connecting to the data source. This parameter is optional.

-prefix tableNamePrefix
The prefix of the ODBC data source table names that the utility uses for the analysis. If a prefix is not specified, the default prefix, IITEST, is used. This parameter is optional.

-s serverName
The name of the federated server.

-suffix tableNameSuffix
The suffix of the ODBC data source table names that the utility uses for the analysis. If a suffix is not specified an empty string is used.

-u userid
The user name for connecting to the data source. This parameter is optional.

-v Specifies that the output of the utility is verbose. This parameter is optional.

Example

The following example shows the command that is run against datastore, the ODBC data source. In this example, the test tables are named ABC*n*XYZ, where *n* is a number from 1 to 7.

```
db2fedsvrcfg -s DS1 -m "/usr/lib/odbc.a"
   -dsn datastore -dbname db1 -u authid -p password -noprep
     -prefix ABC -suffix XYZ -o "/home/user1/db2fedsvrcfg.sql"
```

Test table definitions for the ODBC tuning utility (db2fedsvrcfg)

In some cases, you must create the test tables for the ODBC tuning utility manually. The test table definitions are described in this topic.

You must create the test tables for the ODBC tuning utility under the following circumstances:

- If you want to use table names that are different from the default
- If the data source that you are accessing through ODBC is read-only

- If the ODBC tuning utility is unable to create the test tables that are required by the utility

The following table definition applies to all seven of the test tables that are needed (IITEST1 through IITEST7). The default table name prefix is IITEST and the default suffix is an empty string. If you specify a different prefix and suffix, you must specify the -prefix and -suffix options when you run the ODBC tuning utility.

Table 25. ODBC tuning utility test table definition for the table IITEST1

Column name	SQL data type	SQL data type identifier	Length
IT1C1	integer	SQL_INTEGER	
IT1C2	integer	SQL_INTEGER	
IT1C3	char(1)	SQL_CHAR	1
IT1C4	char(3)	SQL_CHAR	3
IT1C5	char(10)	SQL_CHAR	10
IT1C6	varchar(10)	SQL_VARCHAR	10
IT1C7	char(100)	SQL_CHAR	100

Table 26. ODBC tuning utility test table definition for the table IITEST2

Column name	SQL data type	SQL data type identifier	Length
IT2C1	integer	SQL_INTEGER	
IT2C2	integer	SQL_INTEGER	
IT2C3	char(30)	SQL_CHAR	30

Table 27. ODBC tuning utility test table definition for the tables IITEST3 through IITEST7

Number of columns in each table	Column name	SQL data type	SQL data type identifier	Length
66	IT*x*C*n*	char(100)	SQL_CHAR	100

x	The number corresponding to the table that is being defined.
n	The column number.

For example, IT3C1 is the column name for the first column in table IITEST3.

Accessing Excel data using the ODBC wrapper

You can access Microsoft Excel workbooks with the ODBC wrapper by using the Excel ODBC driver.

Before you begin

- The Excel ODBC driver must be on the federated server.
- The federated server must be able to open and read the worksheets in the Excel workbook to retrieve the data. Therefore, the Excel workbooks must be on the same computer as the federated server or on a accessible mapped network drive.
- Format the columns according to the type of data the column is expected to have.
- The data inserted in the columns must comply with the format type that is specified for the column.

- If the first eight rows of the spreadsheet have no data make sure that they are empty. To ensure that a cell is empty, open the spreadsheet in Microsoft Excel and select **Edit** → **Clear All** .
- Ensure that the data inserted into the columns in the spreadsheet comply with the specified type.

Restrictions

- The ODBC wrapper cannot access a worksheet when the workbook is already opened by a user or an application in the read/write mode. However, if the ODBC wrapper opens the workbook before a user or an application opens the workbook, the user or application can open the workbook in read-only mode.
- The Excel ODBC driver expects that the first nonblank row contains the labels for the worksheet columns. You must insert a row of column labels in the worksheet if the worksheet does not have the labels.
- Because the Excel ODBC driver is only available for Windows operating systems, you can use the ODBC wrapper to access Excel data only on federated servers that run Windows.
- You can perform insert and update operations on Excel worksheets, but you cannot perform delete operations. The Excel ODBC driver does not support delete operations. To delete data from the worksheet, you must open the worksheet in Excel to make the changes.

About this task

The Excel application does not need to be installed on the federated server. The Excel ODBC driver is automatically installed with Windows.

With the ODBC wrapper and the Excel ODBC driver, you can access data from any of the worksheets within a workbook. The Excel ODBC driver interprets a workbook as a database and interprets each worksheet within the workbook as a table.

The Excel ODBC driver supports earlier versions of Excel workbooks even if the version of Excel application that produced the workbooks is no longer supported. For example, Microsoft no longer supports worksheets created in Excel Version 4.0, but the driver supports Excel worksheets that were created in that version.

Procedure

To access Excel worksheets with the ODBC wrapper:

1. Ensure that the Excel workbook that you want to access is on the federated server or on an accessible mapped network drive.
2. If your Excel data is shared through a transitional Windows network that uses workgroups, you must configure your access permissions on the Excel data source.
3. If necessary, change the layout of the data in the Excel worksheets to adhere to the Excel ODBC driver requirements. Repeat this step for each worksheet or named range that you want to access.
4. If necessary, create any named ranges that you want to access.
5. Create a system DSN for the workbook that you want to access. You can use the ODBC Data Source Administrator to configure the system DSN. The name that was specified when you created the system DSN is assigned as the value for the NODE option in the CREATE SERVER statement.

If your Excel data source is shared through a Windows network that uses workgroups, you must specify the database name of the system DSN with the following syntax:

```
\\computer_Name\filename_Subdirectory
```

where *computer_Name* is the computer name of the Excel data source and *filename_Subdirectory* is the sub-directory and file name of the Excel file.

Example

If the computer name of the Excel data source is XLSQLS and the network directory to the Excel file is `E:\share\test.xls`, then you specify the following DSN database name:

```
\\XLSQLS\share\test.xls
```

where the root directory of the network directory `E:` is replaced with `\\` and the computer name `XLSQLS`.

6. Issue the CREATE WRAPPER statement.
7. Specify the location of the workbook by registering a server object in the federated database system catalog. For the ODBC wrapper, you need a server object for each DSN. The DSN is associated with the workbook when the Excel ODBC driver is used. The NODE *compounds_workbook_dsn* is the system DSN that you created. The NODE option is required for the ODBC wrapper to access Excel worksheets.

   To specify the location of the workbook, issue the CREATE SERVER statement and use the DSN as the system DSN for the NODE option.

   For example:

   ```
   CREATE SERVER compounds_workbook WRAPPER odbc
        OPTIONS (NODE 'compounds_workbook_dsn', PASSWORD 'n')
   ```

   Repeat this step for each workbook that you plan to access.
8. Issue the CREATE NICKNAME statement to create a nickname for the worksheet that you want to access. The syntax is:

   ```
   CREATE NICKNAME nickname FOR server_name.remote_table
   ```
9. If you created a named range to access the data, specify the name of the range as the remote_table portion of the CREATE NICKNAME statement.

   For example, if the name of the range is *testing*, the CREATE NICKNAME statement is:

   ```
   CREATE NICKNAME compounds_nickname FOR compounds_workbook.testing
   ```

   To access the data in the entire worksheet instead of a range, you specify the name of the worksheet followed by the $ symbol.

   For example, if the name of the worksheet is *Sheet1*, the CREATE NICKNAME statement is:

   ```
   CREATE NICKNAME compounds_nick FOR compounds_workbook.Sheet1$
   ```

Configuring access permissions for Excel data in a workgroup when using the ODBC wrapper

You can configure your access permissions to access remote Excel data that is shared through a Windows network that uses workgroups.

About this task

All of the examples in this task are for Windows XP Professional, see the documentation of the operating system where your data source exists for specific information on how to set your user account permissions.

Procedure

To configure access permissions to your Excel data source:

1. Set the sharing and security model in the **Network access: Sharing and security model for local accounts** panel. You can select one of the following sharing and security models:

   Guest only – local users authenticate as Guest
   : You connect to the data source through only the Guest user account. You receive the level of access that you configure for the Guest user account and must use your DB2 user password.

   Classic – local users authenticate as themselves
   : You can use your DB2 user ID and password to connect to the data source or you can use the Guest user account. For the DB2 user ID, you receive the level of access to the data source according to the level of access of your DB2 user ID. For the Guest user account, you receive the level of access that you configure for the Guest user account and must use your DB2 user password.

   Example
   : To select the **Classic – local users authenticate as themselves** sharing and security model, you open the **Administrative Tools** and navigate to **Local Security Policy** → **Local policies** → **Security options** → **Network access: Sharing and security model for local accounts**.

2. Create the user account in the **Access this computer from the network Properties** panel:

Option	Description
For the Guest only – local users authenticate as Guest security model	Specify the Windows workgroup and create the Guest user account. You must specify the password using your DB2 password.
For the Classic – local users authenticate as themselves security model	• Specify the Windows workgroup and create the user account using your DB2 user ID and password. • If you want to use the Guest user account, specify the Windows workgroup and create the Guest user account. You must specify the password for the Guest user account using your DB2 password.

   Example
   : To create the Guest user account:

     a. Open the **Administrative Tools** and navigate to **Local Security Policy** → **Local policies** → **User Rights Assignment** → **Access the computer from network**
     b. Specify the Windows workgroup in the **From this location** field.
     c. Specify the DB2 user ID in the **Enter the object names to select** field.
     d. Click **Check Names**.
     e. In the **Enter Network Password** panel, specify the DB2 user ID and password.

3. Set the share permissions in the **Share Properties** panel by setting the **Change** and **Read** permissions to **Allow**.

Example

To set the share permissions of the `E:\share\test.xls` network directory:

- Right click the `E:\share` directory folder and then click **Sharing and Security**.
- On the **Sharing** tab, select **Share this folder** and click **Permissions**.
- Select the user and then select **Allow** for both the **Change** and **Read** permissions.

4. Set the NTFS permissions in the **Properties** panel by setting the **Read & Execute** and **Read** permissions to **Allow**.

   Example

   To set the NTFS permissions of the `E:\share\test.xls` file:

   - Right click the `test.xls` file and then click **Properties**.
   - On **Security** tab, select the user and then select **Allow** for both the **Read & Execute** and **Read** permissions.

Complete the procedure for accessing Excel data using the ODBC wrapper.

Configuring ODBC access to IBM InfoSphere Classic Federation Server for z/OS data sources

The ODBC wrapper has been optimized to access IBM InfoSphere Classic Federation Server for z/OS data sources. The ODBC wrapper detects the ODBC driver and automatically configures the performance options.

Before you begin

The following items must be configured on your federated server:

- Federated server
- IBM InfoSphere Classic Federation Server for z/OS client
- Federated database
- Variables in the system environment `db2dj.ini` file of the DB2 profile registry (db2set):
  - For Linux and UNIX systems, the CAC_CONFIG variable must specify the directory of the `cac.ini` file, for example:

    `CAC_CONFIG=`*`/home/db2inst1/cac.ini`*
  - The DB2LIBPATH environment variable might be required depending on the installation directories of the ODBC driver manager library and the ODBC driver library.
- For AIX and Solaris systems, the DB2_FENCED wrapper option must be set to *Y* and the DB2_SOURCE_CLIENT_MODE wrapper option must be set to *32BIT*.

For information about installation, configuration, and ODBC requirements, see the documentation that is provided with each of these products.

Restrictions

The ODBC wrapper does not support the following statement with IBM InfoSphere Classic Federation Server for z/OS data sources:

- CREATE TABLE

The following data types are not supported for use with IBM InfoSphere Classic Federation Server for z/OS data sources:

- BLOB
- CLOB
- DBCLOB
- CHAR FOR BIT DATA
- VARCHAR FOR BIT DATA

Procedure

To configure ODBC access to IBM InfoSphere Classic Federation Server for z/OS data sources:

1. Complete one of the following tasks depending on your operating system:
   - On Windows, ensure that the node name for the data source is defined as a system DSN. If you used Microsoft ODBC Data Source Administrator to define the DSN, you can use the **Control Panel** to verify that it is registered as a system DSN.
   - On UNIX, configure the ODBC driver.
2. You might need to add the data source client library directory to the DB2LIBPATH environment variable so that the client libraries load properly. Run the db2set command to set the DB2LIBPATH environment variable and specify the installation directory of the data source client library:
   ```
   db2set DB2LIBPATH="client_library_directory"
   ```
   Where *client_library_directory* is the directory of the data source client library.

   Example
   ```
   db2set DB2LIBPATH="/opt/IBM/DB2IIClassic82/cli/lib"
   ```
3. Register the ODBC wrapper.
4. Register the server definitions for an ODBC data source.
5. Create a user mapping for an ODBC data source.
6. Test the connection to the ODBC data source server.
7. Register nicknames for ODBC data source tables and views.

Registering the ODBC wrapper

You must register a wrapper to access ODBC data sources. Federated servers use wrappers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

Procedure

To register the ODBC wrapper:

Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	Description

Issue the CREATE WRAPPER statement and specify the default name for the ODBC wrapper.	For example:
	`CREATE WRAPPER ODBC;`
	
	Remember: When you register the wrapper by using the default name, ODBC, the federated server automatically uses the appropriate ODBC wrapper library for the operating system that your federated server is running on.
	
	You must specify the MODULE wrapper option on federated servers that run Linux or UNIX. The MODULE wrapper option specifies the full path of the library that contains the ODBC Driver Manager.
	
	For AIX and Solaris, if you are configuring access to IBM InfoSphere Classic Federation Server for z/OS data sources, you must specify the DB2_FENCED and DB2_SOURCE_CLIENT_MODE options as shown in the following example.
	`CREATE WRAPPER ODBC`
	` LIBRARY 'libdb2rcodbc.a'`
	` OPTIONS (DB2_FENCED 'Y',`
	`  DB2_SOURCE_CLIENT_MODE '32BIT',`
	` MODULE '/opt/IBM/DB2IIClassic82/cli/lib/cacsqlcli.so')`

Issue the CREATE WRAPPER statement and specify an alternative name for the ODBC wrapper.	If the default wrapper name conflicts with an existing wrapper name in the federated database, you can substitute the default wrapper name with a name that you choose. When you use a name that is different from the default name, you must include the LIBRARY parameter in the CREATE WRAPPER statement.
	
	For example, to register a wrapper with the name odbc_wrapper on a federated server that uses AIX, issue the following statement:
	`CREATE WRAPPER odbc_wrapper`
	`  LIBRARY 'libdb2rcodbc.a';`
	
	The wrapper library file that you specify depends on the operating system of the federated server.

After you complete this task, you can register the server definitions.

ODBC wrapper library files

The ODBC wrapper library files are added to the federated server when you install the wrapper.

When you install the ODBC wrapper, three library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files added to the directory path are `libdb2rcodbc.a`, `libdb2rcodbcF.a`, and `libdb2rcodbcU.a`. The default wrapper library file is `libdb2rcodbc.a`. The other wrapper library files are used internally by the ODBC wrapper.

If you do not use the default wrapper name when you register a wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 28. ODBC client library locations and file names

Operating system	Directory path	Wrapper library file
AIX	/usr/opt/*install_path*/lib32/ /usr/opt/*install_path*/lib64/	libdb2rcodbc.a
Linux	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2rcodbc.so
Solaris	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2rcodbc.so
Windows	%DB2PATH%\bin	db2rcodbc.dll

install_path is the directory path where federation is installed on UNIX or Linux.

CREATE WRAPPER statement - Examples for the ODBC wrapper

Use the CREATE WRAPPER statement to register the ODBC wrapper. This topic provides examples for Linux, UNIX and Windows.

In the following examples, *odbc_wrapper* is the name that you assign to the wrapper that you are registering in the federated database.

Linux and Solaris federated server

The following example shows you how to register a wrapper with the default name on a federated server that runs Linux or Solaris:

```
CREATE WRAPPER odbc OPTIONS (MODULE '/opt/lib/odbc.so');
```

You must specify the MODULE wrapper option on federated servers that run Linux or UNIX. The MODULE wrapper option specifies the full path of the library that contains the ODBC Driver Manager.

The following example shows you how to register a wrapper with an alternative name on a federated server the runs Linux or Solaris:

```
CREATE WRAPPER odbc_wrapper LIBRARY 'libdb2rcodbc.so'
     OPTIONS (MODULE '/opt/lib/odbc.so');
```

AIX federated server

The following example shows you how to register a wrapper with the default name on a federated server that runs AIX:

```
CREATE WRAPPER odbc
     OPTIONS (MODULE '/usr/lib/odbc.a');
```

You must specify the MODULE wrapper option on federated servers that run UNIX. The MODULE wrapper option specifies the full path of the library that contains the ODBC Driver Manager.

The following example shows you how to register a wrapper with an alternative name on a federated server that runs AIX:

```
CREATE WRAPPER odbc_wrapper LIBRARY 'libdb2rcodbc.a'
     OPTIONS (MODULE '/usr/lib/odbc.a');
```

IBM InfoSphere Classic Federation Server for z/OS (AIX)

The following example shows you how to register an ODBC wrapper by issuing the CREATE WRAPPER statement on an AIX operating system. On AIX and Solaris, the DB2_FENCED and DB2_SOURCE_CLIENT_MODE options must be specified as shown in the following example.

```
CREATE WRAPPER odbc
  OPTIONS (DB2_FENCED 'Y', DB2_SOURCE_CLIENT_MODE '32BIT',
  MODULE '/opt/IBM/DB2IIClassic82/cli/lib/cacsqlcli.so');
```

You must specify the MODULE wrapper option on federated servers that run UNIX. The MODULE wrapper option specifies the full path of the library that contains the ODBC Driver Manager.

The following example shows you how to register a wrapper for accessing IBM InfoSphere Classic Federation Server for z/OS data sources with an alternative name:

```
CREATE WRAPPER odbc_wrapper LIBRARY 'libdb2rcodbc.a'
  OPTIONS (DB2_FENCED 'Y', DB2_SOURCE_CLIENT_MODE '32BIT',
  MODULE '/opt/IBM/DB2IIClassic82/cli/lib/cacsqlcli.so');
```

Windows federated server

The following example shows you how to register a wrapper with the default name on a federated server that runs Windows:

```
CREATE WRAPPER odbc;
```

The following example shows you how to register a wrapper with an alternative name on a federated server that runs Windows:

```
CREATE WRAPPER odbc_wrapper LIBRARY 'db2rcodbc.dll';
```

Registering the server definitions for an ODBC data source

You must register each ODBC server that you want to access in the federated database.

Procedure

To register a server definition for an ODBC data source:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	Description

Issue the CREATE SERVER statement.	1. Issue the CREATE SERVER statement and specify the required server options:
	`CREATE SERVER server_definition_name TYPE data_source_type`
	`    VERSION version_number WRAPPER wrapper_name`
	`    OPTIONS (NODE 'node_name', CODEPAGE 'codepage_name', DBNAME 'database_name');`
	
	Although NODE, CODEPAGE, and DBNAME are server options in the CREATE SERVER statement, they are required for ODBC data sources:
	• The NODE server option must be set to the data source specified on the DATASOURCE keyword in the `cac.ini` file.
	Example
	If the `cac.ini` file specifies `DATASOURCE = CACSAMP tcp/150.45.37.49/5000`, then the NODE option should be set to *CACSAMP*.
	• The CODEPAGE server option must be set to the codepage number of the client codepage specified in the `cac.ini` file.
	Example
	If the `cac.ini` file specifies `CLIENT CODEPAGE = IBM-850`, then the CODEPAGE option should be set to `850`.
	• The DBNAME server option must be set to the name of the data source database that you want to access.
	Example
	If the ODBC data source name is venice, then the DBNAME option should be set to *venice*.
	2. After the server definition is created, use the ALTER SERVER statement to add or drop server options.

After you complete this task, you can create a user mapping.

CREATE SERVER statement - Examples of the ODBC wrapper

Use the CREATE SERVER statement to register server definitions for the ODBC wrapper. This topic provides a complete example with the required parameters, and an example with additional server options.

The following example shows you how to register a server definition for a MySQL data source by issuing the CREATE SERVER statement:

```
CREATE SERVER mysql_server TYPE mysql
       VERSION 4.0 WRAPPER wrapper_name
        OPTIONS (NODE 'odbc_node', DBNAME 'venice')
```

mysql_server
: A name that you assign to the ODBC data source server. Duplicate server definition names are not allowed.

TYPE *mysql*
: Specifies the type of data source server to which you are configuring access. This parameter is optional.

VERSION *4.0*
: The version of the ODBC data source that you want to access. This parameter is optional.

WRAPPER *wrapper_name*
: The wrapper name that you specified in the CREATE WRAPPER statement.

NODE *'odbc_node'*
The name of the node (the system DSN name) that was assigned to the ODBC data source when the DSN was defined. On federated servers that run Windows, this value must be the name of a system DSN in the ODBC Data Source Administrator window. On federated servers that run UNIX, the name of the node is the DSN defined in the ODBC configuration file. The ODBC configuration file is usually called odbc.ini.

Although the name of the node is specified as an option in the CREATE SERVER statement, it is required for ODBC data sources.

DBNAME *'venice'*
Optional. The name of the ODBC data source that you want to access.

Server options

When you create the server definition, you can specify additional server options in the CREATE SERVER statement. The server options can be general server options and ODBC-specific server options.

Some ODBC data sources (for example, MySQL) cannot process quotation marks around table names and column names in SQL statements. To access these data sources, you must include the following server options in the CREATE SERVER statement:
- DB2_TABLE_QUOTE_CHAR ' ` '
- DB2_ID_QUOTE_CHAR ' ` '
- DB2_AUTHID_QUOTE_CHAR ' ` '

The ` character is the delimiter for identifiers such as schema names, table names, and column names.

For example:
```
CREATE SERVER mysql_server TYPE mysql
       VERSION 4.0 WRAPPER wrapper_name
       OPTIONS (NODE 'mysql_node', DB2_TABLE_QUOTE_CHAR '`',
       DB2_ID_QUOTE_CHAR '`', DB2_AUTHID_QUOTE_CHAR '`')
```

Creating a user mapping for an ODBC data source

When you attempt to access an ODBC server, the federated server establishes a connection to the ODBC server by using a user ID and password that are valid for that data source. For data sources that require a user mapping, you must define an association (a user mapping) between each federated server user ID and password and the corresponding data source user ID and password.

About this task

Create a user mapping for each user ID that will access the federated system to send distributed requests to the ODBC data source.

Procedure

To map a local user ID to the ODBC data source user ID and password:

Issue a CREATE USER MAPPING statement.
For example:

```
CREATE USER MAPPING FOR local_userID SERVER server_definition_name
      OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password');
```

Although REMOTE_AUTHID and REMOTE_PASSWORD are user mapping options in the CREATE USER MAPPING statement, these options are required to access ODBC data sources:
The user mapping should map the DB2 auth ID to the user ID and password specified in the `cac.ini` file.

Example

If the `cac.ini` file specifies `USERID = MY_USERID` and `USERPASSWORD = MY_PASSWORD`, then the options of the CREATE USER MAPPING statement must be specified as follows:

```
REMOTE_AUTHID = MY_USERID
REMOTE_PASSWORD = MY_PASSWORD
```

After you complete this task, you can test the connection to the ODBC data source.

CREATE USER MAPPING statement - Examples for the ODBC wrapper

Use the CREATE USER MAPPING statement to map a federated server user ID to an ODBC data source user ID and password. This topic provides a complete example with the required parameters, and an example that shows you how to use the DB2 special register USER with the CREATE USER MAPPING statement.

The following example shows how to map a federated authorization ID to an ODBC data source user ID and password:

```
CREATE USER MAPPING FOR arturo SERVER mysql_server
      OPTIONS (REMOTE_AUTHID 'art', REMOTE_PASSWORD 'red4blue')
```

arturo
: Specifies the local authorization ID that you are mapping to the remote user ID and password, which are defined at the ODBC data source.

mysql_server
: Specifies the server definition name that you defined in the CREATE SERVER statement for the ODBC data source.

'art'
: Specifies the remote user ID to which you are mapping *arturo*. The value is case-sensitive, unless you set the FOLD_ID server option to 'U' or 'L' in the CREATE SERVER statement.

'red4blue'
: Specifies the remote password that is associated with *'art'*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

DB2 special register USER

You can use the DB2 special register USER to map the authorization ID of the person who is issuing the CREATE USER MAPPING statement to the data source authorization ID that is specified in the REMOTE_AUTHID user option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER mysql_server
      OPTIONS (REMOTE_AUTHID 'art', REMOTE_PASSWORD 'red4blue');
```

Testing the connection to the ODBC data source server

Test the connection to the ODBC data source server to determine if the federated server is properly configured to access ODBC data sources.

About this task

You can test the connection to the ODBC data source server by using the server definition and the user mappings that you defined.

Procedure

To test the connection to the ODBC data source server:

Open a pass-through session and issue a SELECT statement on the ODBC data source system tables. If the SELECT statement returns a count, your server definition and your user mapping are set up properly.

```
SET PASSTHRU server_definition_name
SELECT count(*) FROM schema_name.table_name
SET PASSTHRU RESET
```

If the SELECT statement returns an error, you should troubleshoot the connection errors

After you complete this task, you can register nicknames for the ODBC data source tables and views.

Troubleshooting data source connection errors

A test connection to the data source server might return an error for several reasons. There are actions that you can take to determine why the error occurred.

Symptom

An error is returned when you attempt to connect to the data source.

Cause

There are several possible causes for a connection problem.

Resolving the problem

To troubleshoot data source connection errors, check the following items for problems:

- Verify that the data source is available.
- If applicable, ensure that the data source server is configured for incoming connections.
- Ensure that your user mapping settings for the REMOTE_AUTHID and REMOTE_PASSWORD options are valid for the connections to the data source. Alter the user mapping, or create another user mapping as necessary.
- If applicable, ensure that the data source client software on the federated server is installed and configured correctly to connect to the data source.
- For ODBC data sources, ensure that the ODBC driver on the federated server is installed and configured correctly to connect to the ODBC data source server. On

federated servers that run Windows, use the ODBC Data Source Administrator tool to check the driver. On federated servers that run UNIX, consult the ODBC client vendor's documentation.

- Verify that the settings for the variables set on the federated server are correct for the data source. These variables include the system environment variables, the variables in the `db2dj.ini` file, and the DB2 Profile Registry (db2set) variables.
- Check your server definition. If necessary, drop the server definition and create it again.

Registering nicknames for ODBC data source tables and views

For each ODBC server definition that you register, you must register a nickname for each table or view that you want to access. Use these nicknames, instead of the names of the data source objects, when you query the ODBC data sources.

Before you begin

Update the statistics at the ODBC data source before you register a nickname. The federated database relies on the data source catalog statistics to optimize query processing. Use the data source command that is equivalent to the DB2 RUNSTATS command to update the data source statistics.

Procedure

To register a nickname for an ODBC data source table or view, use one of the following methods.

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Issue the CREATE NICKNAME statement. Nicknames can be up to 128 characters in length.	For example: `CREATE NICKNAME *nickname* FOR *server_definition_name."remote_schema"."remote.table"* ;`

When you create the nickname, the federated server queries the data source catalog using the nickname. This query tests the connection to the data source table or view. If the connection does not work, you receive an error message.

Repeat this step for each ODBC table or view that you want to create a nickname for.

CREATE NICKNAME statement - Examples for the ODBC wrapper

Use the CREATE NICKNAME statement to register a nickname for an ODBC table or view that you want to access. This topic provides a complete example with the required parameters.

The following example shows how to register a nickname for an ODBC table or view using the CREATE NICKNAME statement.

```
CREATE NICKNAME cust_europe FOR mysql_server."vinnie"."italy"
```

cust_europe
A unique nickname that is used to identify the ODBC table or view. The nickname must be unique within the schema.

Important: The nickname is a two-part name—the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname will be the authorization ID of the user who registers the nickname.

If your ODBC data source does not support schemas, omit the schema from the CREATE NICKNAME statement.

mysql_server."vinnie"."italy"
A three-part identifier for the remote object:

- *mysql_server* is the server definition name that you assigned to the ODBC data source server in the CREATE SERVER statement.
- *vinnie* is the user ID of the owner to which the table or view belongs.
- *italy* is the name of the remote table or view that you want to access.

The federated server folds the names of the ODBC schemas and tables to uppercase unless you enclose the names in quotation marks.

Optimizing ODBC wrapper performance with the ODBC tuning utility (db2fedsvrcfg)

You can optimize the performance of the ODBC wrapper with the ODBC tuning utility, db2fedsvrcfg. This utility runs a set of predefined queries against the data source and tests the results for accuracy. The utility creates a set of ALTER SERVER statements that you can run against the server to set the server options for optimal performance.

Before you begin

The following items must be configured on your federated server:

- Federation
- The ODBC wrapper
- The ODBC client software
- Variables for the system environment. The ODBCINI and LIBPATH variables might be required.

For information about installation, configuration, and ODBC requirements, see the documentation that is provided with each of these products.

Procedure

To optimize ODBC wrapper performance with the ODBC tuning utility:

1. If your ODBC server has not been defined, use the DB2 Control Center or DB2 Command Line Processor to connect to the federated server and create an ODBC wrapper and server.
2. Optional: If the test tables already exist on your ODBC data source, connect to your ODBC data source and drop them.
3. Run the ODBC tuning utility from the DB2 command line with the options that you want to use. The utility might take some time to complete.

4. Verify that the utility ran successfully. If the utility ran successfully, you see the following message in the command window or in the output file that you specified:

   ```
   ALTER SERVER "DS1" OPTIONS (ADD option1, 'value1')
   ALTER SERVER "DS1" OPTIONS (ADD option2, 'value2')
   ALTER SERVER "DS1" OPTIONS (ADD option3, 'value3')
   .....

   The db2fedsvrcfg command completed successfully.
   ```

   If the command ran unsuccessfully, you see an error message indicating the reason for the error. Correct the problem and run the command again.

   You must create the test tables manually under the following circumstances:
   - If you want to use table names that are different from the default
   - If the data source that you are accessing through ODBC is read-only
   - If the ODBC tuning utility is unable to create the test tables that are required by the utility
5. Connect to the federated server where the data source is defined.
6. Use the db2look utility to save your existing server settings before you run the file that is created by the ODBC tuning utility. See the documentation for the db2look utility for information about saving your existing server settings.
7. Optional: If your ODBC server is defined, you can connect to the federated server and drop the server options. The utility creates ALTER SERVER statements in the format described in step 4. If these server options have already been added, the ALTER SERVER statements will fail.
8. Use the following command to run the ALTER SERVER statements that were generated by the utility against the federated database. The ALTER SERVER statements that were created by the ODBC tuning utility are contained in the `db2fedsvrcfg.sql` file.

   ```
   db2 -tvf db2fedsvrcfg.sql
   ```
9. Verify that the results of the ALTER SERVER statements. If any of the statements failed, you can modify the statements in the `db2fedsvrcfg.sql` file and run the statements again until they succeed.
10. After you have completed tuning the server with the ODBC tuning utility, set the PUSHDOWN server option to ’Y’ to complete the optimization process.

db2fedsvrcfg command syntax - ODBC tuning utility

Use the db2fedsvrcfg command to improve the performance of the ODBC wrapper.

Syntax

db2fedsvrcfg *-s serverName* [*-m odbcDriverManagerLibrary*] *-dsn odbcDSNname* [*-dbname dsDBname*] [*-u userid*] [*-p password*] [*-noprep*] [*-prefix tableNamePrefix*] [*-suffix tableNameSuffix*] [*-dscp codePage*] [*-v*] [*-o outputFile*] [*-h*]

Parameters

Use the command db2fedsvrcfg32 when you use 32-bit ODBC drivers on AIX or Solaris. Otherwise, use the command db2fedsvrcfg.

-dbname dsDBname
: The database name of the data source.

-dscp codePage
: The code page identifier for the data source. If this option is not specified, the utility uses the code page of the user's environment. This parameter is optional.

-dsn odbcDSNname
: The system data source name (DSN) for the data source.

-h Causes detailed help to be displayed. This parameter is optional.

-m odbcDriverManagerLibrary
: The fully qualified file name of the ODBC driver manager library. The ODBC driver manager library file name is optional for Windows.

-noprep
: Prevents the testing tables from being created at the data source before testing. This parameter is optional.

-o outputFile
: The fully qualified file name for the ODBC tuning utility output file. The output file contains the ALTER SERVER statements that are used to tune the ODBC wrapper performance. This parameter is optional. If this parameter is not specified, the output is displayed in the command window.

-p password
: The password for connecting to the data source. This parameter is optional.

-prefix tableNamePrefix
: The prefix of the ODBC data source table names that the utility uses for the analysis. If a prefix is not specified, the default prefix, IITEST, is used. This parameter is optional.

-s serverName
: The name of the federated server.

-suffix tableNameSuffix
: The suffix of the ODBC data source table names that the utility uses for the analysis. If a suffix is not specified an empty string is used.

-u userid
: The user name for connecting to the data source. This parameter is optional.

-v Specifies that the output of the utility is verbose. This parameter is optional.

Example

The following example shows the command that is run against datastore, the ODBC data source. In this example, the test tables are named ABC*n*XYZ, where *n* is a number from 1 to 7.

```
db2fedsvrcfg -s DS1 -m "/usr/lib/odbc.a"
   -dsn datastore -dbname db1 -u authid -p password -noprep
     -prefix ABC -suffix XYZ -o "/home/user1/db2fedsvrcfg.sql"
```

Test table definitions for the ODBC tuning utility (db2fedsvrcfg)

In some cases, you must create the test tables for the ODBC tuning utility manually. The test table definitions are described in this topic.

You must create the test tables for the ODBC tuning utility under the following circumstances:

- If you want to use table names that are different from the default
- If the data source that you are accessing through ODBC is read-only

- If the ODBC tuning utility is unable to create the test tables that are required by the utility

The following table definition applies to all seven of the test tables that are needed (IITEST1 through IITEST7). The default table name prefix is IITEST and the default suffix is an empty string. If you specify a different prefix and suffix, you must specify the -prefix and -suffix options when you run the ODBC tuning utility.

Table 29. ODBC tuning utility test table definition for the table IITEST1

Column name	SQL data type	SQL data type identifier	Length
IT1C1	integer	SQL_INTEGER	
IT1C2	integer	SQL_INTEGER	
IT1C3	char(1)	SQL_CHAR	1
IT1C4	char(3)	SQL_CHAR	3
IT1C5	char(10)	SQL_CHAR	10
IT1C6	varchar(10)	SQL_VARCHAR	10
IT1C7	char(100)	SQL_CHAR	100

Table 30. ODBC tuning utility test table definition for the table IITEST2

Column name	SQL data type	SQL data type identifier	Length
IT2C1	integer	SQL_INTEGER	
IT2C2	integer	SQL_INTEGER	
IT2C3	char(30)	SQL_CHAR	30

Table 31. ODBC tuning utility test table definition for the tables IITEST3 through IITEST7

Number of columns in each table	Column name	SQL data type	SQL data type identifier	Length
66	IT*x*C*n*	char(100)	SQL_CHAR	100

x	The number corresponding to the table that is being defined.
n	The column number.

For example, IT3C1 is the column name for the first column in table IITEST3.

Configuring access to OLE DB data sources

To configure the federated server to access OLE DB data sources, you must provide the federated server with information about the OLE DB providers.

Before you begin

- Federation must be installed on a server that acts as the federated server.
- Check the setup of the federated server.
- Check the federated parameter to ensure that federation is enabled.

Microsoft OLE DB is a set of component object model (COM) interfaces that enable applications to access information that is typically not stored in databases. An OLE DB consumer is any piece of system or application code that consumes an OLE DB interface. An OLE DB provider is any software component that exposes an OLE DB interface.

You can configure a federated server to access data that is stored in OLE DB data sources by issuing SQL statements on the DB2 command line.

After you configure access to the OLE DB data source, use the CREATE FUNCTION statement to register a user-defined OLE DB external table function in the federated database.

Procedure

To configure access to OLE DB data sources to a federated server:
1. Register the wrapper.
2. Register the server definition.
3. Create the user mappings.

Registering the OLE DB wrapper

You must register a wrapper to access OLE DB data sources. Federated servers use wrappers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

About this task

The OLE DB wrapper enables you to access OLE DB providers that are compliant with Microsoft OLE DB version 2.0 (or later).

The OLE DB wrapper is used only to assist you in registering user-defined OLE DB external table functions in the federated database. Unlike other wrappers, the OLE DB wrapper does not use nicknames to access data that is stored in data sources.

Procedure

To register the OLE DB wrapper:

Use one of the following methods to register the OLE DB wrapper:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	Description

Issue the CREATE WRAPPER statement and specify the default name for the OLE DB wrapper.	For example:
	`CREATE WRAPPER OLEDB`
	
	Remember: When you register the wrapper by using the default name, OLEDB, the federated server automatically uses the appropriate OLE DB wrapper library for the operating system that your federated server is running on.
	
	If the default wrapper name conflicts with an existing wrapper name in the federated database, you can substitute the default wrapper name with a name that you choose. When you use a name that is different from the default name, you must include the LIBRARY parameter in the CREATE WRAPPER statement.
	
	For example, to register a wrapper with the name oledb_wrapper on a federated server that uses Windows, issue the following statement:
	`CREATE WRAPPER oledb_wrapper`
	`  LIBRARY 'db2oledb.dll'`
	
	The wrapper library file that you specify depends on the operating system of the federated server.

After you complete this task, you can register the server definition.

OLE DB wrapper library files

The OLE DB wrapper library files are added to the federated server when you install the wrapper.

When you install the OLE DB wrapper, the library file is added to the default directory path.

If you do not use the default wrapper name when you register the wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the library file name.

The default directory path and default wrapper library file name is listed in the following table.

Table 32. OLE DB client library locations and file names

Operating system	Directory path	Library file name
Windows	%DB2PATH%\bin	db2oledb.dll

Registering the server definitions for an OLE DB data source

You must register each OLE DB data source server that you want to access in the federated database.

About this task

You register a server definition for and OLE DB data source from the DB2 command line.

Procedure

To register a server definition for an OLE DB data source:

Issue the CREATE SERVER statement.
For example:

```
CREATE SERVER server_definition_name WRAPPER wrapper_name
      OPTIONS (CONNECTSTRING 'keyword=value;keyword=value');
```

Although the CONNECTSTRING variable is specified as an option in the CREATE SERVER statement, this option is required for OLE DB data sources.

After you complete this task, you can create a user mapping.

CREATE SERVER statement - Examples for the OLE DB wrapper

Use the CREATE SERVER statement to register server definitions for the OLE DB wrapper. This topic provides a complete example with the required parameters, and an example with additional server options.

The following example shows you how to register a server definition for an OLE DB wrapper by issuing the CREATE SERVER statement:

```
CREATE SERVER Nwind WRAPPER OLEDB
      OPTIONS (CONNECTSTRING 'Provider=Microsoft.Jet.OLEDB.4.0;
      Data Source=c:\msdasdk\bin\oledb\nwind.mdb');
```

Nwind A name that you assign to the OLE DB data source. Duplicate server definition names are not allowed.

WRAPPER *OLEDB*
The wrapper name that you specified in the CREATE WRAPPER statement.

CONNECTSTRING *'Provider=Microsoft.Jet.OLEDB.4.0; Data Source=c:\msdasdk\bin\oledb\nwind.mdb'*
Provides the initialization properties that are necessary to connect to an OLE DB provider.

The value for the CONNECTSTRING option contains a series of keyword and value pairs that are separated by semicolons. The equal sign (=) separates each keyword and its value. Keywords are the descriptions of the OLE DB initialization properties (property set DBPROPSET_DBINT) or provider-specific keywords.

For the complete syntax and semantics for the CONNECTSTRING option, see the *Microsoft OLE DB 2.0 Programmer's Reference and Data Access SDK*, Microsoft Press, 1998.

Server options

When you create the server definition, you can specify additional server options in the CREATE SERVER statement. The server options can be general server options and OLE DB-specific server options.

The COLLATING_SEQUENCE server option specifies whether the data source uses the same collating sequence as the federated server. The default setting for the COLLATING_SEQUENCE server option is 'N'. When the OLE DB data source uses the same collating sequence as the federated server, set the COLLATING_SEQUENCE server option is 'Y'.

The following example an OLE DB server definition that includes the COLLATING_SEQUENCE server option:

```
CREATE SERVER Nwind WRAPPER OLEDB
       OPTIONS (CONNECTSTRING 'Provider=Microsoft.Jet.OLEDB.4.0;
       Data Source=c:\msdasdk\bin\oledb\nwind.mdb',
     COLLATING_SEQUENCE 'Y')
```

Creating the user mappings for an OLE DB data source

When you attempt to access an OLE DB server, the federated server establishes a connection to the OLE DB server by using a user ID and password that are valid for that data source. You must define an association (a user mapping) between each federated authorization ID and password and the corresponding data source user ID and password.

Procedure

To map a local authorization ID to the remote OLE DB user ID and password:

Issue a CREATE USER MAPPING statement.
For example:

```
CREATE USER MAPPING FOR local_ userid SERVER server_definition_name
       OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password');
```

If the length of either the password on the OLE DB data source or the password on the federated server is less than eight characters, SQL statements that access the OLE DB data source will fail. The following error message appears:

```
SQL30082N Attempt to establish connection failed with security reason "15"
   ("PROCESSING FAILURE"). SQLSTATE=08001
```

To avoid this problem, either change the OLE DB data source password or change the password on the federated server to eight or more characters.

CREATE USER MAPPING statement - Examples for the OLE DB wrapper

Use the CREATE USER MAPPING statement to map a federated authorization ID to a remote OLE DB user ID and password. This topic includes a complete example with the required parameters, and an example that shows you how to use the DB2 special register USER with the CREATE USER MAPPING statement.

The following example shows how to map a federated authorization ID to a remote OLE data source user ID and password:

```
CREATE USER MAPPING FOR laura SERVER Nwind
       OPTIONS (REMOTE_AUTHID 'lulu', REMOTE_PASSWORD 'raiders')
```

laura Specifies the local authorization ID that you are mapping to a remote user ID and password, which are defined at the OLE DB data source.

SERVER *Nwind*
Specifies the server definition name that you registered in the CREATE SERVER statement for the OLE DB server.

REMOTE_AUTHID *'lulu'*
Specifies the user ID at the OLE DB database server to which you are mapping *lulu*. The value is case-sensitive, unless you set the FOLD_ID server option to 'U' or 'L' in the CREATE SERVER statement.

REMOTE_PASSWORD *'raiders'*
Specifies the password that is associated with *'lulu'*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

DB2 special register USER

You can use the DB2 special register USER to map the authorization ID of the person who is issuing the CREATE USER MAPPING statement to the data source authorization ID that is specified in the REMOTE_AUTHID user option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER Nwind
      OPTIONS (REMOTE_AUTHID 'lulu', REMOTE_PASSWORD 'raiders');
```

Configuring access to Oracle data sources

To configure a federated system to access Oracle data sources, you must provide the federated system with information about the data sources and objects that you want to access.

Before you begin

- The Oracle client software must be installed and configured on the server that acts as the federated server.
- Federation must be installed on a server that acts as the federated server.
- Check the setup of the federated server.
- Check the federated parameter to ensure that federation is enabled.

Procedure

To add Oracle data sources to a federated system:

1. Set the Oracle environment variables.
2. Set up and test the Oracle client configuration file.
3. Register the Oracle wrapper.
4. Register the server definitions for an Oracle data source.
5. Create the user mappings.
6. Test the connection to the Oracle server.
7. Register the nicknames.

Setting the Oracle environment variables

The Oracle environment variables must be set in the `db2dj.ini` file on the federated server.

Restrictions

Review the restrictions for the db2dj.ini file.

The `db2dj.ini` file contains configuration information about the Oracle client software that is installed on the federated server.

There are required and optional environment variables for Oracle data sources.

If you installed the Oracle client software before you installed the Oracle wrapper, the required Oracle environment variables are set in the `db2dj.ini` file.

If you did not install the Oracle client software before you installed the Oracle wrapper, or if you want to set any of the optional environment variables you must set the environment variables by using the steps in this task.

Procedure

To set the Oracle environment variables:

1. Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Automatically set the environment variables.	Run the IBM InfoSphere Federation Server installation wizard. Follow the instructions in the wizard. **Important:** Set the required environment variables by running the installation wizard. The optional environment variables must be set manually.
Manually set the environment variables.	Edit the `db2dj.ini` file: The `db2dj.ini` file is located in the directory that the DB2 registry variable DB2_DJ_INI specifies. When the DB2_DJ_INI variable is not set, the `db2dj.ini` file is in one of the following default paths depending on the operating system: • On Linux and UNIX: `*instancehome*/sqllib/cfg/db2dj.ini`. *instancehome* The home directory of the instance owner. • On Windows: `%DB2PATH%\cfg\db2dj.ini` **%DB2PATH%** The directory where the DB2 database system is installed, for example, `C:\Program Files\IBM\sqllib`. If the file does not exist, you can create a file with the name `db2dj.ini` by using any text editor. In the `db2dj.ini` file, you must specify the fully qualified path in the value of the environment variables; otherwise you will encounter errors.

2. On federated servers that run UNIX, add the Oracle environment variable to the `.profile` file of the DB2 instance. For example:

```
export ORACLE_HOME=oracle_home_directory
export PATH=$ORACLE_HOME/bin:$PATH
```

   Where *oracle_home_directory* is the directory where the Oracle client software is installed.

3. On federated servers that run Linux or UNIX, execute the DB2 instance `.profile` file by entering:

```
. $HOME/ .profile
```

4. To ensure that the environment variables are set on the federated server, recycle the DB2 instance with these commands:

```
db2stop
db2start
```

After you complete this task, you can set up and test the Oracle client.

Oracle environment variables

There are required and optional environment variables for Oracle data sources. These variables are set in the `db2dj.ini` file.

The following environment variables are valid for Oracle::

- ORACLE_HOME
- ORACLE_BASE (optional)
- ORA_NLS (optional)
- NLS_LANG (optional)
- TNS_ADMIN (optional)

Variable descriptions

ORACLE_HOME

Set the ORACLE_HOME environment variable to the directory path where the Oracle client software is installed. Specify the fully qualified path for the environment variable: ORACLE_HOME=*oracle_home_directory*. For example, if the Oracle home directory is `\usr\oracle\8.1.7`, the entry in the `db2dj.ini` file is `ORACLE_HOME=\usr\oracle\8.1.7`.

If an individual user of the federated instance sets the ORACLE_HOME environment variable locally, the federated instance does not use that setting. The federated instance uses only the value of ORACLE_HOME that is set in the `db2dj.ini` file.

ORACLE_BASE

ORACLE_BASE represents the root of the Oracle client directory tree. If you set the ORACLE_BASE environment variable when you installed the Oracle client software, set the ORACLE_BASE environment variable on the federated server.

For example:

```
ORACLE_BASE=oracle_root_directory
```

ORA_NLS

If multiple versions of Oracle are running on your system, you must ensure that:

- The appropriate ORA_NLS environment variable is set
- The corresponding NLS data files for the versions that you are using are available

The location-specific data is stored in a directory that is specified by the ORA_NLS environment variable. Each version of Oracle has a different ORA_NLS data directory.

Table 33. ORA_NLS environment variable by version

Oracle version	Environment variable
8.x, 9.x	ORA_NLS33
10.x	ORA_NLS10

For example, on federated servers that run UNIX that access Oracle 8.1 data sources, the ORA_NLS33 environment variable setting is:

```
ORA_NLS33=oracle_home_directory/ocommon/nls/admin/<data>
```

NLS_LANG

The NLS_LANG environment variable is a code page environment variable. Refer to the Oracle NLS documentation for information about setting this variable.

TNS_ADMIN

On federated servers that run Windows

The Oracle client looks for the `tnsnames.ora` file in the `%ORACLE_HOME%\NETWORK\ADMIN` directory, where `%ORACLE_HOME%` is defined in the `db2dj.ini` file. If the `tnsnames.ora` file is not in the `%ORACLE_HOME%\NETWORK\ADMIN` directory, you must set the TNS_ADMIN environment variable in the `db2dj.ini` file on the federated server. You set the environment variable in the `db2dj.ini` file to the path where the `tnsnames.ora` file is located.

On federated servers that run AIX or Linux

The Oracle client looks for the `tnsnames.ora` file in the `/etc` directory. If the `tnsnames.ora` file is not in the `/etc` directory, then the Oracle client looks for the `tnsnames.ora` file in the `$ORACLE_HOME/network/admin` directory, where `$ORACLE_HOME` is defined in `db2dj.ini` file. If the `tnsnames.ora` file is not in the `$ORACLE_HOME/network/admin` directory, you must set the TNS_ADMIN environment variable on the federated server. You set the environment variable in the `db2dj.ini` file to the path where the `tnsnames.ora` file is located.

For example, if the `tnsnames.ora` file is in the `/home/oracle` directory, you set the environment variable to:

```
TNS_ADMIN=/home/oracle
```

On federated servers that run Solaris

The Oracle client looks for the `tnsnames.ora` file in the `/var/opt/oracle` directory. If the `tnsnames.ora` file is not in the `/var/opt/oracle` directory, then the Oracle client looks for the `tnsnames.ora` file in the `$ORACLE_HOME/network/admin` directory, where `$ORACLE_HOME` is defined in `db2dj.ini` file. If the `tnsnames.ora` file is not in the `$ORACLE_HOME/network/admin` directory, you must set the TNS_ADMIN environment variable. You set the variable in the `db2dj.ini` file to the path where the `tnsnames.ora` file is located.

For example, if the `tnsnames.ora` file is in the `/home/oracle` directory, you set the environment variable to:

```
TNS_ADMIN=/home/oracle
```

Oracle code page conversion:

Each time that the Oracle wrapper connects to an Oracle data source, the wrapper determines which code page value to use for that connection. You can specify that the Oracle wrapper set the code page value or you can designate a code page by setting the NLS_LANG environment variable.

The environment variables that specify Oracle code page conversion are set in the `db2dj.ini` file on your federated server.

If the NLS_LANG environment variable is set in the `db2dj.ini` file on the federated server, the wrapper uses the code page value in the `db2dj.ini` file.

If the NLS_LANG environment variable is not set in the `db2dj.ini` file on the federated server, the wrapper determines the territory and the code page of the federated database. The wrapper sets the NLS_LANG environment variable to the closest matching Oracle locale. If there is no closely matching locale, the NLS_LANG environment variable is set to American_America.US7ASCII.

See the documentation that accompanies your Oracle software for a list of valid locales.

Example of Chinese code page GB 18030:

If you access an Oracle data source that contains data that is encoded with the Chinese code page GB 18030, and your federated database uses the UTF-8 code page, the Oracle wrapper sets the Oracle NLS_LANG environment variable to:

```
NLS_LANG=Simplified Chinese_China.UTF8
```

This setting is correct if you are using an Oracle 8 client, but if you are using the Oracle Version 9i (or later) client, you must set the NLS_LANG environment variable to override the default setting of the Oracle wrapper. Set the NLS_LANG environment variable to Simplified Chinese_China.AL32UTF8, so that the Oracle 9i client translates the GB 18030 data into Unicode correctly.

For example:

```
NLS_LANG=Simplified Chinese_China.AL32UTF8
```

Setting up and testing the Oracle client configuration file

The Oracle client configuration file is used to connect to Oracle databases, by using the client libraries that are installed on the federated system.

About this task

The client configuration file specifies the location of each Oracle database server and type of connection (protocol) for the database server.

The default name for the Oracle client configuration file is `tnsnames.ora`.

The default location of the client configuration file depends on the operating system that is used by the federated system:

- On Linux and UNIX systems, the default location of the file is `$ORACLE_HOME/network/admin`.
- On Windows systems, the default location of the file is `%ORACLE_HOME%\NETWORK\ADMIN`.

Procedure

To set up and test the Oracle client configuration file:

1. Create the `tnsnames.ora` using the Oracle NET8/NET Configuration utility that comes with the Oracle client software.

   Within the `tnsnames.ora` file, the SID (or SERVICE_NAME) is the name of the Oracle instance, and the HOST is the host name where the Oracle server is located.
2. If you want to place the `tnsnames.ora` file in a path other than the default search path, set the TNS_ADMIN environment variable to specify the file location:

a. Edit the `db2dj.ini` file in the `sqllib/cfg` directory, and set the TNS_ADMIN environment variable. For example:

```
TNS_ADMIN=x:/path/
```

b. Issue the following commands to recycle the DB2 instance and ensure that the environment variable is set in the program:

```
db2stop
db2start
```

3. Test the connection to ensure that the client software can connect to the Oracle server. Use the Oracle sqlplus utility to test the connection.

After you complete this task, you can register the Oracle wrapper.

Registering the Oracle wrapper

You must register a wrapper to access Oracle data sources. Federated servers use wrappers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

Procedure

To register an Oracle wrapper:

Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Issue the CREATE WRAPPER statement and specify the default name for the Oracle wrapper.	For example:
	`CREATE WRAPPER NET8 ;`
	
	Remember: When you register the wrapper by using the default name, NET8, the federated server automatically uses the appropriate Oracle wrapper library for the operating system that your federated server is running on.
	
	If you do not use the default wrapper name when you register a wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.
	
	For example, to register a wrapper with the name oracle_wrapper on the federated server that uses AIX, issue the following statement:
	`CREATE WRAPPER oracle_wrapper`
	`  LIBRARY 'libdb2net8.a'`
	
	The wrapper library file that you specify depends on the operating system of the federated server.

After you complete this task, you can register the server definitions.

Oracle wrapper library files

The Oracle wrapper library files are added to the federated server when you install the wrapper.

When you install the Oracle wrapper, three library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files that are added to the following directory path are libdb2net8.a, libdb2net8F.a, and libdb2net8U.a, The default wrapper library file is libdb2net8.a. The other wrapper library files are used internally by the Oracle wrapper.

The default directory paths and default wrapper library file names are listed in the following table.

Table 34. Oracle wrapper library locations and file names

Operating system	Directory path	Library file names
AIX	/usr/opt/*install_path*/lib32/ /usr/opt/*install_path*/lib64/	libdb2net8.a
Linux	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2net8.so
Solaris	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2net8.so
Windows	%DB2PATH%\bin	db2net8.dll

install_path is the directory path where the federated server is installed on UNIX or Linux.

Registering the server definitions for an Oracle data source

You must register each Oracle server that you want to access in the federated database.

Procedure

To register a server definition for an Oracle data source:

1. Locate the node name in the Oracle `tnsnames.ora` file.

   Sample `tnsnames` file:

   ```
   paris_node =
     (DESCRIPTION =
      (ADDRESS_LIST =
         (ADDRESS = (PROTOCOL = TCP)(HOST = somehost)(PORT = 1521)))
       (CONNECT_DATA = (SERVICE_NAME = ora9i.seel)))
   ```

   In this example, the node name to use in the CREATE SERVER statement is `paris_node`.
2. To create the server definition, use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	Description
Issue the CREATE SERVER statement	For example: `CREATE SERVER server_definition_name TYPE oracle VERSION version_number WRAPPER wrapper_name OPTIONS (NODE 'node_name') ;` Although the *node_name* variable is specified as an option in the CREATE SERVER statement, it is required for Oracle data sources. After the server definition is registered, use the ALTER SERVER statement to add or drop server options.

After you complete this task, you can create the user mappings.

CREATE SERVER statement - Examples for the Oracle wrapper

Use the CREATE SERVER statement to register server definitions for the Oracle wrapper. This topic provides a complete example with the required parameters, and an example with additional server options.

The following example shows you how to register a server definition for an Oracle wrapper by issuing the CREATE SERVER statement:

```
CREATE SERVER oraserver TYPE oracle VERSION 8.1.7 WRAPPER wrapper_name
      OPTIONS (NODE 'paris_node') ;
```

oraserver
: A name that you assign to the Oracle database server. Duplicate server definition names are not allowed.

TYPE *oracle*
: Specifies the type of data source server to which you are configuring access. For the Oracle wrapper, the server type must be `oracle`.

VERSION *8.1.7*
: The version of Oracle database server that you want to access.

WRAPPER *wrapper_name*
: The wrapper name that you specified in the CREATE WRAPPER statement.

NODE *'paris_node'*
: The name of the node where the Oracle database server resides. Obtain the node name from the `tnsnames.ora` file. This value is case sensitive.

  Although the name of the node is specified as an option in the CREATE SERVER statement, it is required for Oracle data sources.

Server options

When you create the server definition, you can specify additional server options in the CREATE SERVER statement. These server options can be general server options and Oracle-specific server options.

The federated server assumes that all of the Oracle VARCHAR columns contain trailing blanks. If you are certain that all of the VARCHAR columns in the Oracle database do not contain trailing blanks, you can set a server option to specify that the data source use a non-blank padded VARCHAR comparison semantic.

The following example shows an Oracle server definition with the VARCHAR_NO_TRAILING_BLANKS server option:

```
CREATE SERVER oraserver TYPE oracle VERSION 8.1.7 WRAPPER wrapper_name
      OPTIONS (NODE 'paris_node', VARCHAR_NO_TRAILING_BLANKS 'Y') ;
```

Use the VARCHAR_NO_TRAILING_BLANKS server option when none of the columns contains trailing blanks. If only some of the VARCHAR columns contain trailing blanks, you can set an option on those columns with the ALTER NICKNAME statement.

Creating the user mappings for an Oracle data source

To access an Oracle server, the federated server establishes a connection to the Oracle server by using a user ID and password that are valid for that data source.

Restrictions

The user ID at the Oracle data source must be created by using the Oracle create user command with the `identified by` clause, instead of the `identified externally` clause.

Procedure

To create the user mappings for an Oracle data source:

Issue a CREATE USER MAPPING statement. For example:

```
CREATE USER MAPPING FOR local_userID SERVER server_definition_name
      OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password') ;
```

After you complete this task, test the connection to the Oracle server.

CREATE USER MAPPING statement - Examples for the Oracle wrapper

Use the CREATE USER MAPPING statement to map a federated authorization ID to a remote Oracle user ID and password. This topic includes a complete example with the required parameters, and an example that shows you how to use the DB2 special register USER with the CREATE USER MAPPING statement.

The following example shows how to map a federated authorization ID to an Oracle user ID and password:

```
CREATE USER MAPPING FOR robert SERVER oraserver
      OPTIONS (REMOTE_AUTHID 'rob', REMOTE_PASSWORD 'then4now') ;
```

robert Specifies the authorization ID that you are mapping to a remote user ID and password, which are defined at the Oracle server.

SERVER *oraserver*
Specifies the server definition name that you registered in the CREATE SERVER statement for the Oracle server.

REMOTE_AUTHID *'rob'*
Specifies the remote user ID to which you are mapping *robert*. The value is case-sensitive, unless you set the FOLD_ID server option to 'U' or 'L' in the CREATE SERVER statement.

REMOTE_PASSWORD *'then4now'*
Specifies the remote password that is associated with *rob*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

DB2 special register USER

You can use the DB2 special register USER to map the authorization ID of the person who is issuing the CREATE USER MAPPING statement to the data source authorization ID that is specified in the REMOTE_AUTHID user option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER oraserver
      OPTIONS (REMOTE_AUTHID 'rob', REMOTE_PASSWORD 'then4now') ;
```

Testing the connection to the Oracle server

Test the connection to the Oracle server to determine if the federated server is properly configured to access Oracle data sources.

About this task

You can test the connection to the Oracle server by using the server definition and user mappings that you defined.

Procedure

To test the connection to the Oracle server:

Open a pass-through session and issue a SELECT statement on the Oracle system tables. If the SELECT statement returns a count, your server definition and your user mapping are set up properly.
For example:

```
SET PASSTHRU remote_server_name
SELECT count(*) FROM sys.all_tables
SET PASSTHRU RESET
```

If the SELECT statement returns an error, you should troubleshoot the connection errors.

After you complete this task, you can register the nicknames for the Oracle tables and views.

Troubleshooting connectivity problems with Oracle data sources

The most common problem that you might encounter when you configure the federated server to access Oracle data sources is connectivity.

Symptom

If you are not able to connect to an Oracle data source from a federated server, you might need to update the TCP/IP `hosts` file.

Cause

This problem can be caused by an out of date TCP/IP `hosts` file.

Resolving the problem

For each host in the DESCRIPTION section of the `tnsnames.ora` file, you might need to update the TCP/IP `hosts` file. Whether you update this file depends on how TCP/IP is configured on your network. Part of the network must translate the remote host name that is specified in the DESCRIPTION section in the `tnsnames.ora` file to an address.

If your network has a name server that recognizes the host name, you do not need to update the TCP/IP `hosts` file. If your network does not have a name server that recognizes the host name, you need to add an entry in the TCP/IP `hosts` file for the remote host.

The location of the TCP/IP `hosts` file depends on the operating system that is running on the federated server:

On federated servers that run Linux or UNIX
The `hosts` file is in the `/etc/hosts` directory.

On federated servers that run Windows
The `hosts` file is in the `x:\winnt\system32\drivers\etc\hosts` directory.

Troubleshooting data source connection errors

A test connection to the data source server might return an error for several reasons. There are actions that you can take to determine why the error occurred.

Symptom

An error is returned when you attempt to connect to the data source.

Cause

There are several possible causes for a connection problem.

Resolving the problem

To troubleshoot data source connection errors, check the following items for problems:

- Verify that the data source is available.
- If applicable, ensure that the data source server is configured for incoming connections.
- Ensure that your user mapping settings for the REMOTE_AUTHID and REMOTE_PASSWORD options are valid for the connections to the data source. Alter the user mapping, or create another user mapping as necessary.
- If applicable, ensure that the data source client software on the federated server is installed and configured correctly to connect to the data source.
- For ODBC data sources, ensure that the ODBC driver on the federated server is installed and configured correctly to connect to the ODBC data source server. On federated servers that run Windows, use the ODBC Data Source Administrator tool to check the driver. On federated servers that run UNIX, consult the ODBC client vendor's documentation.
- Verify that the settings for the variables set on the federated server are correct for the data source. These variables include the system environment variables, the variables in the `db2dj.ini` file, and the DB2 Profile Registry (db2set) variables.
- Check your server definition. If necessary, drop the server definition and create it again.

Registering nicknames for Oracle tables and views

For each Oracle server definition that you register, you must register a nickname for each table or view that you want to access. Use these nicknames, instead of the names of the data source objects, when you query the Oracle servers.

Before you begin

Update the statistics at the Oracle data source before you register a nickname. The federated database relies on the data source catalog statistics to optimize query processing. Use the data source command that is equivalent to the DB2 RUNSTATS command to update the data source statistics.

For data source objects that use Oracle Label Security, the nickname data cannot be cached. You can turn caching on or off using the ALTER NICKNAME statement.

Restriction: Creating a nickname on an Oracle synonym of a synonym is not supported and will throw the SQL0204 error message.

Procedure

To register a nickname for an Oracle table or view, use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Issue the CREATE NICKNAME statement.	For example: `CREATE NICKNAME nickname FOR server_definition_name."remote_schema"."remote.table" ;`

When you create the nickname, the federated server queries the data source catalog by using the nickname. This query tests the connection to the data source table or view. If the connection does not work, you receive an error message. Repeat this step for each Oracle table or view that you want to create a nickname for.

CREATE NICKNAME statement - Examples for the Oracle wrapper

Use the CREATE NICKNAME statement to register a nickname for an Oracle table or view that you want to access. This topic provides a complete example with the required parameters.

The following example shows you how to register a nickname for an Oracle table or view using the CREATE NICKNAME statement.

```
CREATE NICKNAME PARISINV FOR oraserver."vinnie"."inventory" ;
```

PARISINV
A unique nickname that is used to identify the Oracle table or view. The nickname consists of the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname will be the authorization ID of the user who registers the nickname.

oraserver."vinnie"."inventory"
A three-part identifier for the remote object:

- *oraserver* is the server definition name that you assigned to the Oracle database server in the CREATE SERVER statement.
- *vinnie* is the user ID of the owner to which the table or view belongs.
- *inventory* is the name of the remote table or view that you want to access.

The federated server changes the names of the Oracle schemas and tables to uppercase unless you enclose the names in quotation marks.

Configuring access to scripts as data sources

To configure a federated system to access scripts as data sources, you must register custom functions, a wrapper, a server definition, and nicknames for the scripts.

Before you begin

- Federation must be installed on a server that acts as the federated server.
- A federated database must exist on the federated server.

About this task

You can configure a federated server to access data through scripts by issuing SQL statements on the DB2 command line.

Procedure

To add scripts as data sources to a federated server:

1. Identify or write a script.
2. Register the custom function.
3. Configure the script daemon.
4. Start the script daemon.
5. Register the script wrapper.
6. Register the server definition for a data source that is accessed by a script.
7. Register nicknames for data sources.

Script wrapper overview

You can use scripts, such as Perl scripts, to access information in databases or to generate data. You can integrate that data with data from other federated data sources by using the script wrapper.

You might have existing scripts that return data from data sources such as life sciences data banks, or that generate data on their own. The script wrapper enables the use of scripts as if they are federated data sources. The script wrapper enables access to data that can then be integrated by using a federated system. The scripts must return results in XML.

Script wrapper nicknames can include input and output columns. These nicknames use function templates in predicates to pass input values to the script. Output data from the script is represented as XML in a hierarchical form, which can then map to nicknames by using primary and foreign keys.

The script wrapper is a read-only wrapper. The script wrapper cannot write data to a data source.

In the following diagram, data flows from a script through the script wrapper and script daemon to the federated database, where the data can be integrated with data from other sources and viewed with the federated client. Optionally, the federated system can access the script through a proxy server and firewall.

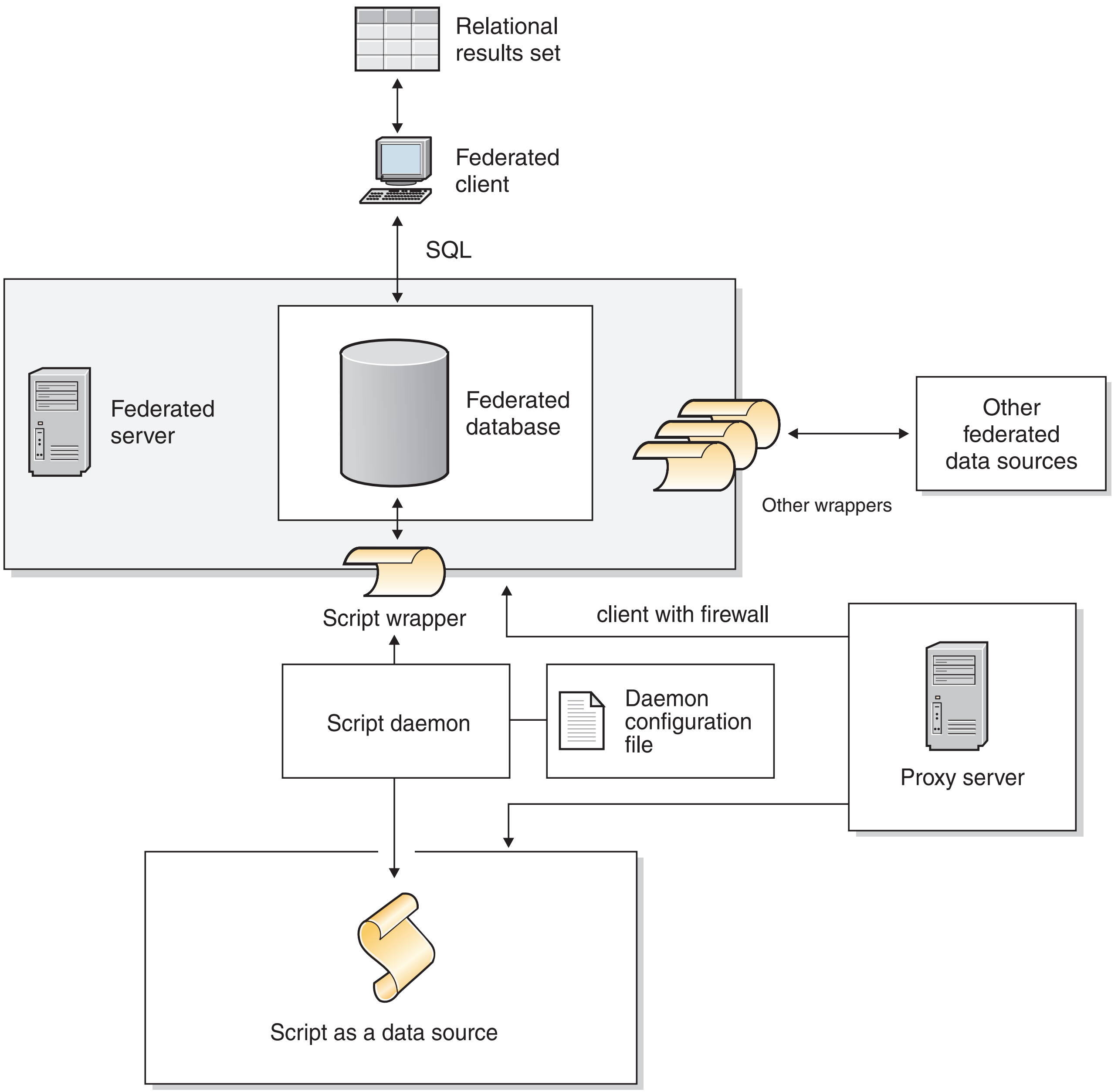


Figure 7. The script wrapper in a federated system

A script is invoked from the directory that contains the script daemon. If the script retrieves data from its own data file and cannot locate the data file, the script might include relative paths. Use absolute paths in scripts.

Adding scripts as data sources to a federated system

To configure a federated server to access scripts as data sources, you must configure the script daemon, a wrapper, a server definition, and nicknames for the scripts.

Registering the custom function for the script

You must register the script custom function WSSCRIPT.ARGS before you register the script wrapper.

About this task

You must register the custom function on each federated database instance where the script wrapper is installed.

The custom function for the script wrapper must be registered with the schema name WSSCRIPT.

You must include specific keywords when you register the custom function for the script wrapper. Include the AS TEMPLATE, DETERMINISTIC, and NO EXTERNAL ACTION keywords in the CREATE FUNCTION statement.

The federated environment uses two query engines. For the script wrapper, these query engines are the federated database query engine and the script wrapper query engine. You can specify that predicates get pushed down to the script wrapper engine by using the script wrapper custom functions in the WHERE clause of your SELECT statement.

The `create_function_mappings.ddl` file in the `sqllib/samples/lifesci/script` directory on the federated server specifies the data types for the custom function.

Procedure

To register the script custom function:

Run the `create_function_mappings.ddl` file on each federated database instance where the script wrapper is installed.

The following example shows the syntax for the WSSCRIPT.ARGS function:

```
CREATE FUNCTION WSSCRIPT.ARGS (input_column_data_type(), input_column_data_type())
    RETURNS INTEGER AS TEMPLATE
    DETERMINISTIC NO EXTERNAL ACTION;
```

Data types for the custom function for the script wrapper:

You must specify the data type of the input column twice in each custom function.

Register a separate WSSCRIPT custom function for each valid data type for the column_name argument. The WSSCRIPT custom function has the following data types:
- VARCHAR
- INTEGER
- CLOB
- DOUBLE
- DATE

Both parameters to the custom function must be of the same data type, which is the data type of the corresponding input column. When used in a query predicate, the first parameter is the name of the switch input column. The second column is the value to be passed to the script for this switch.

Configuring the script daemon

The script wrapper requires a script daemon that listens for script job requests from the script wrapper. The script daemon must be configured before you register the script wrapper.

Before you begin

The script daemon has the following prerequisites:

- Has write access to a directory in which the daemon can write temporary files.
- Runs on a server that you can access through TCP/IP from your federated system. This server can be the same server that operates as the federated server or a separate script server.
- Requires a configuration file that must be on the same server as the script daemon.
-
- Runs separately from the script wrapper and the federated database.

Procedure

To configure the script daemon:

1. Ensure that the executable files for the script daemon are on the correct server. You might need to copy the script daemon executable files to another server.

   During the installation of IBM InfoSphere Federation Server, the script daemon executable files are installed on the federated server. The name and location of the file is as follows:

   UNIX `db2script_daemon` is installed in the `$DB2PATH/bin` directory. `$DB2PATH` is the directory in which the federated server is installed.

   Windows
   `db2script_daemon.exe` is installed in the `%DB2PATH%\bin` directory. `%DB2PATH%` is the directory in which the federated server is installed, usually C:\SQLLIB\bin.

   If you use a separate script server, copy the script daemon executable and configuration files from the federated server to the script server. The script daemon executable files can run in any directory on the script server that does not contain spaces in the names in the directory path.
2. Ensure that the configuration file for the script daemon is on the correct server.

   During the installation of the federated system, a sample configuration file for the script daemon is installed on the federated server. The name of the sample configuration file is `SCRIPT_DAEMON.config`. The location of the file is as follows:

   UNIX The daemon configuration file is installed in the `$DB2PATH/bin` directory.

   Windows
   The daemon configuration file is installed in the `%DB2PATH%\bin` directory.

   By default, the daemon looks for the configuration file in the working directory from which the daemon is started. You can copy the configuration file to another location. If you use a script server, copy the daemon configuration file from the directory on the federated server to a directory on the script server. You can copy the daemon configuration file to any directory on the script server that the daemon can access.
3. Edit the sample configuration file for the script daemon.
   a. Rename the configuration file so that you can use the sample file again.

b. Ensure that the first line in the configuration file is an equal sign (=). If the equal sign is missing, the daemon does not start. An error message will indicate that the DAEMON_PORT was not specified.

c. Ensure that the last line in the configuration file ends with a new line.

   The sample configuration file that is provided with the federated system ends with a new line character. If the last line does not end with a new line character, you receive an error message when you try to run your first script query that uses the data source that is listed on the last line.

d. Ensure that there are no extra spaces after directory paths or at the end of the configuration file.

e. Specify the following options in the configuration file. For options that require paths, you can specify relative paths. Relative paths are relative to the directory from which the daemon process is started.

   DAEMON_PORT=*port_number*
   The network port on which the daemon listens for script job requests that are submitted by the wrapper. The default value is 4099.

   MAX_PENDING_REQUESTS=*number_of_requests*
   The maximum number of script job requests that can be blocking on the daemon at any one time. This number does not represent the number of script jobs that are running concurrently, only the number of job requests that can block at one time. Set this value to a number greater than five. The script daemon does not restrict the number of script jobs that can run concurrently.

   DAEMON_LOGFILE_DIR=*dir*
   The directory in which the daemon creates its log file. This file contains status and error information that is generated by the script daemon.

   SCRIPT_OUT_DIR_PATH=*path*
   The directory in which the daemon creates the temporary file to store the script output data. The daemon reads data from this file and passes the data back to the wrapper through the network connection. After the data is passed to the wrapper, the daemon cleans up the temporary file

   script specification entry=*entry*
   A list of entries that specifies the name and location of the scripts that can be invoked by the script wrapper. The entry has this format:

   ```
   script_name=fully-qualified_script_path
   ```

   The following examples apply to the designated operating system:

   UNIX For example, to specify a script that accesses an Oracle data source, add the following line to the daemon configuration file:

   ```
   oracle=/dsk/1/data/oracle
   ```

   Windows
   For example, to specify a script that accesses an Oracle data source, add the following line to the daemon configuration file:

   ```
   oracle=c:\data\oracle.a
   ```

The following example shows a SCRIPT_DAEMON.cfg file for four scripts:

```
=
DAEMON_PORT=4099
MAX_PENDING_REQUESTS=10
DAEMON_LOGFILE_DIR=./
SCRIPT_OUT_DIR_PATH=./
fee=/home/user_id/fee
fie=/home/user_id/fie
foe=/home/user_id/foe
fum=/home/user_id/fum
```

The sample configuration file for the script daemon provides an example of configuring the script daemon.

Starting the script daemon

Before you can access data sources with scripts, you must start the script daemon.

Before you begin

You must have write access to all the paths that are listed in the daemon configuration file for the DAEMON_LOGFILE_DIR and SCRIPT_OUT_DIR_PATH options.

About this task

The executable file for the script daemon starts a new process in which the script daemon runs.

Procedure

To start the script daemon:

1. Open the directory where the daemon executable file is located.
2. Issue the db2script_daemon command to run the executable files, including appropriate options.

The following example includes options:

```
db2script_daemon -a action -c config_file -d debug_level -u user_id -p password
```

db2script_daemon command - options and examples:

The db2script_daemon command starts the script daemon. You can start the script daemon with several options.

The db2script_daemon command can be used on either UNIX or Windows servers. Some of the options listed in the syntax can be used only on Windows servers.

The options that are specified with the start action affect only the current instance of the daemon and override the values that are specified with the install action.

Options - db2script_daemon command

The db2script_daemon command has the following options:

-a *action* **(Windows only)**
: Performs the specified activity. The valid actions are status, install, start, stop, and remove.

-c *config_file*
: Instructs the daemon service to use the specified configuration file. If you do not specify the configuration file, the daemon searches for the `SCRIPT_DAEMON.config` file in the directory where the daemon executable files are installed. You can use this option with the install and start actions.

-d *[***1 | 2 | 3***]*
: Sets the debugging level for the daemon service to the specified value. A value of 1 turns on logging, 2 traces all commands, and 3 turns on logging, traces all commands, and saves all temporary files to capture XML output. You can use this option with the install and start actions.

-u *user_id* **(Windows only)**
: Sets the daemon service to run under the specified user ID. You can use this option with the install action.

-p *password* **(Windows only)**
: Specifies the password for the specified user ID. The password is valid and required only when you specify the -u option. If the -p option is not specified when you set the -u option, the program prompts you for the password. You can use this option with the install action.

Examples - db2script_daemon command

The following examples show how to use the script daemon options.

Start the daemon

To start the daemon on UNIX, issue the following command:

```
db2script_daemon
```

This command assumes that the daemon configuration file is in the same directory as the executable file.

To install and start the daemon on Windows, issue the following commands:

```
db2script_daemon -a install
db2script_daemon -a start
```

Specify the daemon configuration file

If you changed the name of the daemon configuration file or if the configuration file is not in the same directory as the daemon executable file, you must use the -c option when you run the executable file. This option specifies the directory path and name for the daemon configuration file.

In this example, the daemon configuration information is in a file called `SCRIPT_D.config` in the subdirectory `cfg` on a UNIX server. Issue the following command:

```
db2script_daemon -c cfg/SCRIPT_D.config
```

Specify the debugging level

If you want to start the daemon with debugging turned on with a debugging level of 2, issue the following commands:

```
db2blast_daemon -a install -d 2
db2blast_daemon -a start
```

Check the status of the daemon (Windows)

To check the status of the daemon on a Windows server, issue the following command:

```
db2blast_daemon -a status
```

This command assumes that the daemon configuration file is in the same directory as the executable file.

Stop the daemon

To stop the daemon on UNIX, list the process ID of the daemon by issuing the following command:

```
ps -ef | grep db2script
```

Then use the process ID to stop the daemon by issuing the following command:

```
kill process_ID
```

This command assumes that the daemon configuration file is in the same directory as the executable file.

To stop the daemon on Windows, issue the following command:

```
db2script_daemon -a stop
```

Remove the daemon

You can remove the script daemon when you no longer want to use the script wrapper.

To remove the daemon, issue the following command:

```
db2script_daemon -a remove
```

Registering the script wrapper

You must register the script wrapper to access data sources with scripts. The script wrapper is implemented as a library file.

Procedure

To register the script wrapper:

Issue the CREATE WRAPPER statement, specifying a name for the script wrapper and the name of the wrapper library file.
For example, to register a wrapper with the name script_wrapper on a federated server that uses AIX, issue the following statement:

```
CREATE WRAPPER script_wrapper LIBRARY 'libdb2lsscript.a';
```

The name of the wrapper library file that you specify depends on the operating system of the federated server.
There are no script-wrapper specific options for the script wrapper CREATE WRAPPER statement. The wrapper runs unfenced by default.

Script wrapper library file:

To register the script wrapper, specify the script wrapper library file for the operating system of the federated server.

When you install federation, a script wrapper library file is added to the default directory path.

The default directory paths and default wrapper library file names are listed in the following table.

Table 35. Script wrapper library locations and file names

Operating system	Directory path	Wrapper library file name
AIX	/usr/opt/*install_path*/lib	libdb2lsscript.a
Linux	/opt/IBM/db2/*install_path*/lib	libdb2lsscript.so
Solaris	/opt/IBM/db2/*install_path*/lib	libdb2lsscript.so
Windows	%DB2PATH%\bin	db2lsscript.dll

- *install_path* is the directory path where federation is installed on UNIX or Linux.
- %DB2PATH% is the is the environment variable that is used to specify the directory path where federation is installed on Windows. The default Windows directory path is C:\Program Files\IBM\SQLLIB.

Registering the server definition for a script as a data source (DB2 command line)

You must register each server that you want to access in the federated database.

Procedure

To register a server definition for a script:

Issue the CREATE SERVER statement.
For example:

```
CREATE SERVER script_server WRAPPER script_wrapper
    OPTIONS (NODE 'myserver.example.com', DAEMON_PORT '4099');
```

The NODE and DAEMON_PORT server options are required for scripts as data sources.
After the server definition is registered, use the ALTER SERVER statement to add or drop server options.

CREATE SERVER statement - examples for the script wrapper:

The examples show the use of required options and additional server options.

Required options example

The following example shows you how to register a server definition for the script wrapper by issuing the CREATE SERVER statement:

```
CREATE SERVER server1_scriptn WRAPPER script_wrapper
    OPTIONS(NODE 'big_rs.company.com');
```

server1_scriptn
: A name that you assign to the script server. Duplicate server definition names are not allowed.

WRAPPER *script_wrapper*
: The wrapper name.

NODE *'big_rs.company.com'*
: Host name of the system on which the script daemon process is running. This value is case sensitive.

  Although the name of the node is specified as an option in the CREATE SERVER statement, it is required for the script wrapper.

Optional option example

The following example shows an additional server option that you can specify when you register a server definition for the script wrapper:

```
CREATE SERVER server1_scriptn  WRAPPER script_wrapper
   OPTIONS(NODE 'big_rs.company.com', DAEMON_PORT '4088');
```

DAEMON_PORT *'4088'*
: Specifies the number of the port that the daemon listens on for script job requests. The port number must be the same number that you specified in the DAEMON_PORT option of the daemon configuration file. The default port number is 4099.

Registering nicknames for scripts (DB2 command line)

You must register a separate nickname for each script. Use these nicknames when you query the data source that is accessed by a script.

About this task

The script wrapper associates XML data to nicknames. Parent and child nicknames correspond to the root and nested elements in an XML document. The parent and child nicknames are connected by primary and foreign keys that are specified in the CREATE NICKNAME statement. Each nickname is defined by XPath expressions that identify the XML data elements and specify how to extract column values from each element.

The data source is specified by the CREATE NICKNAME statement and associated with a script name with the DATASOURCE nickname option. You must create a column for each input argument to be passed to the script. Use input column options to control the syntax for switches on the command line. The value for each switch must be included in the query predicate by using the ARGS custom function at run time.

Simple scripts that do not require command-line arguments do not need input columns.

Procedure

To register a nickname for a script:

Issue the CREATE NICKNAME statement. Nicknames can be up to 128 characters long.
For example:

```
CREATE NICKNAME nickname
    (
     column_name data_type OPTIONS ('nickname_column_ options'),
     column_name data_type OPTIONS ('nickname_column_ options'),
     column_name data_type OPTIONS ('nickname_column_ options')
     )
     FOR SERVER server_definition_name
     OPTIONS (nickname_options);
```

Issue the statement for each script that you want to create a nickname for.

CREATE NICKNAME statement - examples for the script wrapper

The examples show you how to use the CREATE NICKNAME statement to register nicknames for the script wrapper.

The following example creates a parent nickname for the XML data that is returned from a script that is named fee:

```
CREATE NICKNAME customers
(
    argle  double  OPTIONS(SWITCH '-argle', POSITION 1, DEFAULT 1.0 ),
    argfile CLOB() OPTIONS(SWITCH '-file', INPUT_MODE 'FILE_INPUT', POSITION 2),
    argpos varchar()  OPTIONS(SWITCH ' ', POSITION 3),
    id       VARCHAR(5)    OPTIONS(XPATH './@id')
    name     VARCHAR(16)   OPTIONS(XPATH './name'),
    address  VARCHAR(30)   OPTIONS(XPATH './address/@street'),
    cid      VARCHAR(16) FOR BIT DATA NOT NULL OPTIONS(PRIMARY_KEY 'YES'))
    FOR SERVER script_server
    OPTIONS(DATASOURCE 'fee',
          XPATH '/doc/customer', STREAMING 'YES');
```

The following example creates a nickname that is called orders. The nickname orders is a child of the nickname that is called customers, which is created in the previous example:

```
CREATE NICKNAME orders
(
    amount INTEGER       OPTIONS(XPATH './amount'),
    date   VARCHAR(10)   OPTIONS(XPATH './date'),
    oid    VARCHAR(16)   OPTIONS(PRIMARY_KEY 'YES'),
    cid    VARCHAR(16) FOR BIT DATA NOT NULL OPTIONS(FOREIGN_KEY 'CUSTOMERS'))
    FOR SERVER script_server
    OPTIONS( XPATH './order');
```

Script wrapper nickname options

You can specify options when you create a nickname for a script. Only the root nickname can include input columns.

Nickname options

The following list describes the nickname options:

DATASOURCE
The name of the script that will be invoked. The script must be listed in the script daemon configuration file. This option is required for data sources in the parent nickname. This option applies only to the root nickname.

NAMESPACES
A comma-separated list of name=value pairs that the wrapper uses to resolve namespace prefixes in the nickname XPath expression.

TIMEOUT
The maximum time, in minutes, that the script wrapper waits for results from the script daemon. The default value is 60 minutes. This option applies only to the root nickname.

VALIDATE
Specifies whether the XML source document must be validated before the XML data is extracted. If this option is set to YES, the DB2 database system verifies that the structure of the source document conforms to an XML schema or to a document type definition (DTD). This option is accepted only for columns of the root nickname (the nickname that identifies the elements at the top level of the XML document). The default value is NO.

The XML source document is not validated if the script wrapper cannot locate the XML schema file or DTD file (.xsd or .dtd). The DB2 database system does not issue an error message if the validation does not occur. Ensure that the

XML schema file or DTD file is in the location that is specified in the XML source document. Do not set the VALIDATE parameter to YES if you set the STREAMING parameter to YES.

STREAMING
Specifies whether the XML source document is separated into logical fragments that correspond to the node that matches the XPath expression of the nickname. The script wrapper then processes the XML source data fragment by fragment, reducing total memory use. This option is accepted only for columns of the root nickname (the nickname that identifies the elements at the top level of the XML document). The default streaming value is NO. Do not set the STREAMING parameter to YES if you set the VALIDATE parameter to YES.

XPATH
An XPath expression that identifies the XML element that represents individual tuples in the data source. The wrapper evaluates the XPATH nickname option for a child nickname in the context of the path that is specified by the XPATH nickname option of the parent nickname. This XPath expression is used as a context for evaluating column values that are identified by the XPATH nickname column options.

Nickname column options

The nickname column options are described in the following:

DEFAULT
The default value for an input column. This option applies only to input columns.

The default value is used if no value is provided by the SQL query. This option is not required.

FOREIGN_KEY
Indicates that this nickname is a child nickname and specifies the corresponding parent nickname.

A nickname can have at most one FOREIGN_KEY column option. The value for this option is case-sensitive. The column that is designated by the FOREIGN_KEY option contains a key that is generated by the wrapper. The value of the column cannot be retrieved in a SELECT query, and the XPATH option must not be specified. The column can only be used to join parent nicknames and child nicknames. A CREATE NICKNAME statement with a FOREIGN_KEY option fails if the parent nickname has a different schema name. Unless the nickname that is referred to in a FOREIGN_KEY clause is explicitly defined to be lowercase or mixed case by enclosing it in quotation marks under the corresponding CREATE NICKNAME statement, then you must specify the nickname in uppercase when you refer to this nickname in the FOREIGN_KEY clause.

Foreign key columns must be designated as FOR BIT DATA and NOT NULL.

INPUT_MODE
Specifies the input mode for a column. Valid values are CONFIG or FILE_INPUT. The wrapper passes the specified value to the script daemon.

CONFIG
The value is treated as a configurable parameter.

FILE_INPUT
A file is created that stores the value and the file name is passed as the command line argument.

POSITION
An integer value for positional parameters. The position sequence order starts at 1. This option applies only to input columns.

If the positional value is set to an integer, then this input must be in this position in the command line. If this option is set, the switch is inserted into the appropriate location when the query is run. If POSITION is set to -1, the option is added as the last command line option. For example, if a column value must be at the end of the command line and there is no SWITCH option, setting the value of POSITION to -1 adds the value at the end of the command line. POSITION integer values cannot be duplicated in a nickname. This option is not required.

PRIMARY_KEY
Indicates that this nickname is a parent nickname. The column data type must be VARCHAR(16). A nickname can have at most one PRIMARY_KEY column option. The only valid value is Y.

The column that is designated as PRIMARY_KEY contains a key that is generated by the wrapper. The value of the column cannot be retrieved in a SELECT query, and the XPATH option must not be specified. The column can only be used to join parent nicknames and child nicknames. Primary key columns must be designated as FOR BIT DATA and NOT NULL.

SWITCH
A character string to specify a parameter for the script on the command line. This option applies only to input columns.

On the command line, the value of this option precedes the column value that is supplied by WSSCRIPT.ARGS or the default value, if any. If the value for the switch is an empty string and a default value exists for the column, the default value is added without any SWITCH information when the command line is generated. If no default value is provided and no value for the column is provided by the SQL query, then this input column is ignored when the command line is generated. This option is required for an input column.

SWITCH_ONLY
Enables the use of switches without a command line argument.

If the SWITCH_ONLY option is specified with a value of Y, then valid input values are Y or N. For an input value of Y, only the switch is added to the command line. For an input value of N, no value is added to the command line.

VALID_VALUES
A semicolon-separated set of valid values for a column.

XPATH
Specifies the XPath expression in the XML document that contains the data that corresponds to this column. The script wrapper evaluates the XPath expression after the CREATE NICKNAME statement applies this XPath expression from this XPATH nickname option. If you run a query on a column name that has an incorrectly configured XPATH tag reference such as incorrect case, your query returns null values in this column for all returned rows.

SQL queries with the script wrapper

SQL queries that are made through the script wrapper use the custom function to carry the parameter input values for the script.

Any SELECT statement that passes parameter values to a script through the script wrapper must contain at least one predicate with a custom function to take the parameter input values for the script.

Root nicknames

For example, the following statement creates a root nickname for a script named myscript:

```
CREATE NICKNAME customers (
 argle double OPTIONS(SWITCH '-argle', POSITION 1, DEFAULT 1.0),
 argfile CLOB() OPTIONS(SWITCH '-file', INPUT_MODE 'FILE_INPUT', POSITION 2),
 argpos varchar() OPTIONS(SWITCH' ', POSITION 3),
 id  varchar(10) OPTIONS(XPATH'./@id'),
 name varchar OPTIONS(XPATH '/name'))
 FOR SERVER script_server
   OPTIONS(DATASOURCE 'myscript', XPATH 'doc/customer',
       TIMEOUT '300', VALIDATE 'YES');
```

The custom function statements are as follows:

```
CREATE FUNCTION wsscript.args (varchar(), varchar())
 RETURNS INTEGER AS TEMPLATE
 DETERMINISTIC NO EXTERNAL ACTION;

CREATE FUNCTION wsscript.args (date(), date())
 RETURNS INTEGER AS TEMPLATE
 DETERMINISTIC NO EXTERNAL ACTION;

CREATE FUNCTION wsscript.args (integer(), integer())
 RETURNS INTEGER AS TEMPLATE
 DETERMINISTIC NO EXTERNAL ACTION;

CREATE FUNCTION wsscript.args (CLOB(), CLOB())
 RETURNS INTEGER AS TEMPLATE
 DETERMINISTIC NO EXTERNAL ACTION;

CREATE FUNCTION wsscript.args (double(), double)
 RETURNS INTEGER AS TEMPLATE
 DETERMINISTIC NO EXTERNAL ACTION;
```

The configuration file specifies the following configuration parameters:

```
SCRIPT_OUT_DIR_PATH=C:\temp
myscript=C:\perl\bin\perl myscript.pl -model
```

To run a query and send the contents of the table t1.bigdata to the daemon and to the local file C:\temp\f12345, issue the following query and wsscript.args command:

```
SELECT id, name FROM customers, t1
 WHERE wsscript.args (customers.argfile, t1.bigdata) = 1
```

The preceding query results in the following command line:

```
C:\perl\bin\perl myscript.pl -model -argle 1.0 -file C:\temp\f12345
```

To run a query that uses the default values for all parameters, run a query on the nickname with no predicates. To avoid problems with excessive output, include the STREAMING option in the nickname.

Child nicknames

The script wrapper maps the XML result set from the script into nicknames that have a parent-child relationship. To retrieve data from a child nickname, join the child nickname to its parent nickname up to the root. The SELECT statements that reference a child nickname must be joined with the parent nickname of the child nickname by using primary and foreign key columns.

The following query displays the customer names and amounts for each order of each customer:

```
SELECT c.name, o.amount FROM customers c, orders o
 WHERE c.cid=o.cid
 AND wsscript.args (customers.argfile, t1.bigdata) = 1
 AND wsscript.args (customers.argpos, VARCHAR('test1')) = 1
 AND wsscript.args (customers.argle, FLOAT('3.5')) = 1
```

Specify the join c.cid=o.cid statement to indicate the parent-child relationship between the customers nickname and the orders nickname. If you join a child nickname to itself, an error message is returned.

Optimizing script wrapper performance

The location of the script daemon can affect query performance.

To improve network communication performance, use a separate script server for the script daemon. Place the federated server and the script server on separate servers. Also, place the script daemon on the script server.

Configuring access to Sybase data sources

To configure a federated server to access Sybase data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin

- The Sybase Client SDK software must be installed on a server that will act as the federated server. When you install the Sybase client on Windows, you must specify the **Full** or **Custom** option. If you specify the custom option, you must the **XA Interface Library for ASE Distributed Transaction Manager** option.
- IBM InfoSphere Federation Servermust be installed on a server that acts as the federated server.
- Check the setup of the federated server.
- Check the federated parameter to ensure that federation is enabled.

You can configure a federated server to access data that is stored in Sybase data sources by using the DB2 Control Center or by issuing SQL statements on the DB2 command line. The DB2 Control Center includes a wizard to guide you through the steps that are necessary to configure the required federated objects.

Procedure

To configure access to Sybase data sources:

1. Set the Sybase environment variables.
2. Set up and test the Sybase client configuration file using one of the following methods depending on your operating system:
   - Set up and test the Sybase client configuration file (Linux, UNIX).
   - Set up and test the client configuration file (Windows).
3. Register the wrapper.

4. Register the server definition.
5. Create the user mappings.
6. Test the connection to the Sybase server.
7. Register nicknames for Sybase tables and views.

Sybase wrapper support for Adaptive Server Enterprise (ASE)

The Sybase wrapper supports the Sybase Adaptive Server Enterprise (ASE) 15.0, in addition to ASE 12.5 and ASE 12.0.

Supported clients for Sybase ASE 15.0

You can connect to the ASE 15.0 by using the Sybase wrapper with the Sybase client, version 12.5.1 or later.

If you use Software Developer Kit (SDK), version 12.5.1 as a Sybase client, IBM recommends that you to install the Electronic Software Distribution (ESD) #12 or later for the SDK on the federated server that is associated with the Sybase wrapper. If you use SDK, version 15.0 as a Sybase client, IBM recommends that you to install the ESD #3 or later. If you do not install the ESD, you might get an unexpected error while using the Sybase wrapper.

Updating Sybase libraries for the Sybase client, version 15.0

UNIX: If you use the Sybase client, version 15.0, you can run the Sybase lnsyblibs script to update Sybase library names to preserve consistency among supported versions of Sybase library files. The lnsyblibs script creates symbolic links from the new library names to the old library names, which allows the pre-version 15.0 applications to work with renamed libraries.

Windows: If you use the Sybase client, version 15.0 you can run the copylibs.bat file to copy the required *.dll files, which allows the pre-version 15.0 applications to work with renamed libraries.

lnsyblibs script error

The current lnsyblibs script contains an problem. When you run `'lnsyblibs create'`, the following error message occurs:

```
"libsyb*.s[o: No such file or directory"
```

As a workaround to this problem, you can delete the `|` (bar character) within [] (square brackets) at line 34 of the script. Sybase is aware of this problem. For more information, go to Sybase support.

Unsupported data types

You cannot create nicknames for data source objects that contain unsupported data types. The Sybase wrapper does not support the following data types that were introduced in ASE, version 12.5.1:

- DATE
- TIME

The Sybase wrapper does not support the following data types that were introduced in ASE, version 15.0:

- BIGINT
- LONGSYSNAME
- UNITEXT
- UNSIGNED BIGINT
- UNSIGNED INT

- UNSIGNED SMALLINT

Setting the Sybase environment variables

The Sybase environment variables must be set in the `db2dj.ini` file on the federated server.

Restrictions

Review the restrictions for the `db2dj.ini file`.

The `db2dj.ini` file contains configuration information about the Sybase Open Client software that is installed on your federated server.

There are required and optional environment variables for Sybase data sources.

If you installed the Sybase Open Client software before you installed the Sybase wrapper, the required Sybase environment variables are set in the `db2dj.ini` file.

You must set the environment variables by using the steps in this task if you did not install the Sybase Open Client software before you installed the Sybase wrapper or you want to set any of the optional environment variables.

Procedure

To set the Sybase environment variables:

1. Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Automatically set the environment variables.	Run the IBM InfoSphere Federation Server installation wizard. Follow the instructions in the wizard. **Important:** Set the required environment variables by running the installation wizard. The optional environment variables must be set manually.

Method	Description

Manually set the environment variables.	Edit the `db2dj.ini` file:
	
	The `db2dj.ini` file is located in the directory that the DB2 registry variable DB2_DJ_INI specifies. When the DB2_DJ_INI variable is not set, the `db2dj.ini` file is in one of the following default paths depending on the operating system:
	• On Linux and UNIX: `*instancehome*/sqllib/cfg/db2dj.ini`.
	instancehome
	The home directory of the instance owner.
	• On Windows: `%DB2PATH%\cfg\db2dj.ini`
	%DB2PATH%
	The directory where the DB2 database system is installed, for example, `C:\Program Files\IBM\sqllib`.
	
	If the file does not exist, you can create a file with the name `db2dj.ini` by using any text editor.
	
	In the `db2dj.ini` file, you must specify the fully qualified path in the value of the SYBASE environment variable; otherwise you will encounter errors. For example:
	`SYBASE=/opt/sybase`
	`SYBASE_OCS=OCS-12_5`

2. On Linux and UNIX, update the `.profile` file that is on the federated database instance. Specify information about the Sybase environment variables that you added to the `db2dj.ini` file. On Windows, the file is updated when you install the Sybase Open Client software.

   Issue the following commands to update the `.profile` file:
   ```
   export SYBASE=sybase_home_directory
   export SYBASE_OCS=OCS-version_release
   export PATH=$SYBASE/bin:$PATH
   ```
3. From the home directory, run the `.profile` file that is on federated database instance.

   Issue the following command to run the `.profile` file:
   ```
   . .profile
   ```
4. On some operating systems, such as Linux, you must add the path for the Sybase client library to the DB2LIBPATH db2set variable, for example:
   ```
   db2set DB2LIBPATH=/opt/sybase125/OCS-12_5/lib
   ```
5. To ensure that the environment variables are set on the federated server, recycle the federated database instance with these commands:
   ```
   db2stop
   db2start
   ```

After you complete this task, you must register the wrapper.

Sybase environment variables

There are required and optional environment variables for Sybase data sources. These variables are set in the `db2dj.ini` file.

The following environment variables are valid for Sybase:
- SYBASE
- SYBASE_OCS
- SYBASE_CHARSET (optional)

Variable descriptions

SYBASE

Specifies the directory path where the Sybase Open Client software is installed. Specify the fully qualified path for this environment variable.

For example, if Sybase Open Client Version 12.5 is installed in the directory path `D:\djxclient\sybase\V125`, specify the following SYBASE environment variable:

```
SYBASE=D:\djxclient\sybase\V125
```

If Sybase Open Client Version 12.0 is installed in the directory path `D:\djxclient\sybase\V12`, specify the following SYBASE environment variable:

```
SYBASE=D:\djxclient\sybase\V12
```

SYBASE_OCS

Specifies the directory, version and release of the Sybase Open Client software that is installed. Do not specify the fully qualified path when you specify this environment variable.

```
SYBASE_OCS=OCS-version_release
```

For example, if Sybase Open Client Version 12.0 is installed in the directory path `D:\djxclient\sybase\V12\OCS-12_0`, specify the following value for the SYBASE_OCS environment variable:

```
 SYBASE_OCS=OCS-12_0
```

If Sybase Open Client Version 12.5 is installed in the directory path `D:\djxclient\sybase\V125\OCS-12_5`, specify the following value for the SYBASE_OCS environment variable:

```
 SYBASE_OCS=OCS-12_5
```

SYBASE_CHARSET

Specifies the name of the character set that you want to use. Set the SYBASE_CHARSET environment variable to the codeset that you specify in the **CODESET** parameter of the federated server. A list of valid character set names exists in the `$SYBASE\charsets` directory.

The codesets are specified differently between the **CODESET** parameter and SYBASE_CHARSET environment variable. For example, if you set the **CODESET** parameter to the 8-bit Unicode Transformation Format, UTF-8, then specify UTF8 in the SYBASE_CHARSET environment variable:

```
SYBASE_CHARSET=utf8
```

If you do not set the SYBASE_CHARSET environment variable, the wrapper uses the Sybase character set that matches the one that is specified on the code page of the federated database. If there is no matching Sybase character set, the wrapper uses the iso_1 character set.

Setting up and testing the Sybase client configuration file (Windows)

The Sybase client configuration file is used to connect to Sybase databases by using the client libraries that are installed on the federated server.

Before you begin

The Sybase Client SDK software must be installed on the federated server.

About this task

The client configuration file specifies the location of each Sybase SQL Server and Adaptive Server Enterprise instance and the type of connection (protocol) for the database server.

You must set up a client configuration file on each instance in the federated server that will be used to connect to Sybase.

Procedure

To set up and test the Sybase client configuration file on federated servers that run Windows:

1. Set up the client configuration file by using the utility that comes with the Sybase Open Client software. See the Sybase documentation for more information about using this utility.

   The client configuration file is created in the `%SYBASE%\ini` directory. The name of the file is `sql.ini`.
2. Test the connection to ensure that the Sybase Open Client software is able to connect to the Sybase server.

   Use an appropriate Sybase query utility, such as isql, to test the connection.

   For example, if the Sybase Open Client software is installed in the directory path, `D:\djxclient\sybase\V125`, you can issue the following commands from a command prompt:

   ```
   cd D:\djxclient\sybase\V125\OCS-12_5\bin
   isql -Ssybnode -Umary
   ```

   Alternatively, you can issue the following command from a command prompt:

   ```
   %SYBASE%\%SYBASE_OCS%\bin\isql -Ssybnode -Umary
   ```

   Specifying the path to the interfaces file

   : If you would like to use an interfaces file other than the default file, use the IFILE server option to specify the path. The Sybase wrapper searches for the interfaces file in the following places, in the order specified:

   a. IFILE server option
   b. `%DB2PATH%\interfaces`
   c. `%SYBASE%\ini\sql.ini`

After you complete this task, you can set the environment variables.

Setting up and testing the Sybase client configuration file (UNIX)

The Sybase client configuration file is used to connect to Sybase databases, by using the client libraries that are installed on the federated server.

Before you begin

The Sybase Client SDK software must be installed on the federated server.

The client configuration file specifies the location of each Sybase SQL Server and Adaptive Server Enterprise instance and the type of connection (protocol) for the database server.

You must set up a client configuration file on each instance in the federated server that will be used to connect to Sybase.

Procedure

To set up and test the Sybase client configuration file on federated servers that run UNIX:

1. Set up the client configuration file by using the utility that comes with the Sybase Open Client software.

   The client configuration file is created in the `$SYBASE` directory. The default name of the file is `interfaces`. See the Sybase documentation for more information about using this utility.
2. Test the connection to ensure that the Sybase Open Client software is able to connect to the Sybase server.

   Use an appropriate Sybase query utility, such as isql, to test the connection.

   For example, if the Sybase Open Client software is installed in the directory path, `/opt/djxclient/sybase/V125`, you can issue the following command from a UNIX prompt:

   ```
   cd /opt/djxclient/sybase/V125/OCS-12_5
   isql -Ssybnode -Umary
   ```

   Alternatively, you can issue the following command from a UNIX prompt:

   ```
   $SYBASE/$SYBASE_OCS/bin/isql -Ssybnode -Umary
   ```

   Specifying the path to the interfaces file

   : If you would like to use an interfaces file other than the default file, use the IFILE server option to specify the path. The Sybase wrapper searches for the interfaces file in the following places, in the order specified:

   a. IFILE server option
   b. `sqllib/interfaces`
   c. `$SYBASE/interfaces`

After you complete this task, you can set the environment variables.

Registering the Sybase wrapper

You must register a wrapper to access Sybase data sources. Federated servers use wrappers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

Procedure

To register the Sybase wrapper:

Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	**Description**

Issue the CREATE WRAPPER statement and specify the default name for the Sybase wrapper.	For example:
	`CREATE WRAPPER CTLIB`
	
	Remember: When you register the wrapper by using the default name, CTLIB, the federated server automatically uses the appropriate Sybase wrapper library for the operating system that your federated server is running on.
	
	If the default wrapper name conflicts with an existing wrapper name in the federated database, you can substitute the default wrapper name with a name that you choose. When you use a name that is different from the default name, you must include the LIBRARY parameter in the CREATE WRAPPER statement.
	
	For example, to register a wrapper with the name sybase_wrapper on a federated server that uses AIX, issue the following statement:
	`CREATE WRAPPER sybase_wrapper`
	`  LIBRARY 'libdb2ctlib.a';`
	
	The wrapper library file that you specify depends on the operating system of the federated server.

After you complete this task, you can register the server definition.

Sybase wrapper library files

The Sybase wrapper library files are added to the federated server when you install the wrapper.

When you install the Sybase wrapper, three library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files that are added to the directory path are `libdb2ctlib.a`, `libdb2ctlibF.a`, and `libdb2ctlibU.a`. The other wrapper library files are used internally by the Sybase wrapper.

If you do not use the default wrapper name when you register the wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 36. Sybase wrapper library locations and file names

Operating system	Directory path	Library file name
AIX	/usr/opt/*install_path*/lib32/ /usr/opt/*install_path*/lib64/	libdb2ctlib.a
Linux	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2ctlib.so

Table 36. Sybase wrapper library locations and file names (continued)

Operating system	Directory path	Library file name
Solaris	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2ctlib.so
Windows	%DB2PATH%\bin	db2ctlib.dll

install_path is the directory path whereIBM InfoSphere Federation Server is installed on UNIX or Linux.

Registering the server definitions for a Sybase data source

You must register each Sybase server that you want to access in the federated database.

Procedure

To register a server definition for a Sybase data source:

1. Locate the node name in the Sybase `interfaces` file. The following examples show the entries for interfaces files for federated servers that run UNIX or Windows:

   UNIX:
   ```
   sybase125
   query tcp ether anaconda 4100
   ```
   Windows:
   ```
   [sybase125]
   query=TCP,anaconda,4100
   ```
   - The first line in each example is the node name, such as `sybase125`.
   - The second line lists the type of connection, the host name, and the port number. In this example `TCP` indicates that this is a TCP/IP connection, `anaconda` is the host name, and `4100` is the port number. .
2. To create the server definition, use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Issue the CREATE SERVER statement.	For example: `CREATE SERVER server_definition_name TYPE SYBASE VERSION Sybase_client_version_number WRAPPER wrapper_name OPTIONS (NODE 'node_name', DBNAME 'database_name');` Although the *'node_name'* and *'database_name'* variables are specified as options in the CREATE SERVER statement, these options are required for Sybase data sources. **Important:** If you did not rename the `sql.ini` file to `interfaces` when you set up the Sybase client configuration file, you must include the IFILE server option when you register the server definition. After the server definition is registered, use the ALTER SERVER statement to add or drop server options.

After you complete this task, you can create user mappings.

CREATE SERVER statement - Examples for the Sybase wrapper

Use the CREATE SERVER statement to register server definitions for the Sybase wrapper. This topic provides a complete example with the required parameters, and an example with additional server options.

The following example shows you how to register a server definition for a Sybase wrapper by issuing the CREATE SERVER statement:

```
CREATE SERVER SYBSERVER TYPE SYBASE VERSION 12.0 WRAPPER CTLIB
      OPTIONS (NODE 'sybnode', DBNAME 'sybdb');
```

SYBSERVER
: A name that you assign to the Sybase server. Duplicate server definition names are not allowed.

TYPE *SYBASE*
: Specifies the type of data source server to which you are configuring access. For the CTLIB wrapper, the server type must be *SYBASE*.

VERSION *12.0*
: The version of the Sybase database client software that is being used for the federated connection.

WRAPPER *CTLIB*
: The wrapper name that you specified in the CREATE WRAPPER statement.

NODE *'sybnode'*
: The name of the node where the Sybase server resides. Obtain the node name from the `interfaces` file. This value is case sensitive.

  Although the node name is specified as an option in the CREATE SERVER statement, it is required for Sybase data sources.

DBNAME *'sybdb'*
: The name of the Sybase database that you want to access. This value is case sensitive.

  Although the name of the database is specified as an option in the CREATE SERVER statement, it is required for Sybase data sources.

Server options

When you create a server definition, you can specify additional server options in the CREATE SERVER statement. The server options can be general server options and Sybase-specific server options.

IFILE server option

If you are not using the default interfaces file, you must create an `interfaces` file and include the IFILE server option in the CREATE SERVER statement. The default interfaces file is `$SYBASE/interfaces` for Linux and UNIX, and `%SYBASE%\ini\sql.ini` for Windows.

The value that you specify for the IFILE server option is the full path and name of the Sybase Open Client `sql.ini` file.

The following example shows how to use the IFILE server option when you register a server definition on a federated server that runs Windows:

```
CREATE SERVER SYBSERVER TYPE SYBASE VERSION 12.0 WRAPPER CTLIB
      OPTIONS (NODE 'sybnode', DBNAME 'sybdb',
      IFILE 'C:\Sybase\ini\sql.ini');
```

TIMEOUT server option

The TIMEOUT server option sets the number of seconds that the wrapper waits for a response from the Sybase server. Use the TIMEOUT option to avoid deadlocks on transactions.

The following example shows how to specify the TIMEOUT server option when you register a server definition:

```
CREATE SERVER SYBSERVER TYPE SYBASE VERSION 12.0 WRAPPER CTLIB
      OPTIONS (NODE 'sybnode', DBNAME 'sybdb',
        TIMEOUT '60');
```

The additional Sybase-specific server options are:
- LOGIN_TIMEOUT
- PACKET_SIZE

Creating the user mappings for a Sybase data source

When you attempt to access a Sybase server, the federated server establishes a connection to the Sybase server by using a user ID and password that are valid for that data source. You must define an association (a user mapping) between each federated server user ID and password and the corresponding data source user ID and password.

Create a user mapping for each user ID that will access the federated system to send distributed requests to the Sybase data source.

Procedure

Create user mappings for a Sybase data source:

Issue a CREATE USER MAPPING statement.
For example:

```
CREATE USER MAPPING FOR local_userID SERVER server_definition_name
      OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password');
```

After you complete this task, test the connection to the Sybase server.

CREATE USER MAPPING statement - Examples for the Sybase wrapper

Use the CREATE USER MAPPING statement to map a federated server user ID to a Sybase server user ID and password. This topic provides a complete example with the required parameters, and an example that shows you how to use the DB2 special register USER with the CREATE USER MAPPING statement.

The following example shows how to map a federated server user ID to a Sybase server user ID and password:

```
CREATE USER MAPPING FOR maria SERVER SYBSERVER
      OPTIONS (REMOTE_AUTHID 'mary', REMOTE_PASSWORD 'day2night');
```

maria Specifies the local user ID that you are mapping to a user ID that is defined at the Sybase server.

SERVER *SYBSERVER*
Specifies the server definition name that you registered in the CREATE SERVER statement for the Sybase server.

REMOTE_AUTHID *'mary'*
Specifies the user ID at the Sybase server to which you are mapping *maria*. The value is case-sensitive, unless you set the FOLD_ID server option to 'U' or 'L' in the CREATE SERVER statement.

Although the remote user ID is specified as an option in the CREATE SERVER statement, it is required for Sybase data sources.

REMOTE_PASSWORD *'day2night'*
Specifies the password that is associated with *'mary'*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

Although the remote password is specified as an option in the CREATE SERVER statement, it is required for Sybase data sources.

DB2 special register USER

You can use the DB2 special register USER to map the authorization ID of the person who is issuing the CREATE USER MAPPING statement to the data source authorization ID that is specified in the REMOTE_AUTHID user option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER SYBSERVER
      OPTIONS (REMOTE_AUTHID 'mary', REMOTE_PASSWORD 'day2night');
```

Testing the connection to the Sybase server

Test the connection to the Sybase data source server to determine if the federated server is properly configured to access Sybase data sources.

You can test the connection to the Sybase server by using the server definition and user mappings that you defined.

Procedure

To test the connection to the Sybase server:

Open a pass-through session and issue a SELECT statement on the Sybase system tables. If the SELECT statement returns a count, your server definition and your user mapping are set up properly.
For example:

```
SET PASSTHRU server_definition_name
SELECT count(*) FROM dbo.sysobjects
SET PASSTHRU RESET
```

If the SELECT statement returns an error, you should troubleshoot the connection errors.

After you complete this task, you can register nicknames for Sybase tables and views.

Troubleshooting data source connection errors

A test connection to the data source server might return an error for several reasons. There are actions that you can take to determine why the error occurred.

Symptom

An error is returned when you attempt to connect to the data source.

Cause

There are several possible causes for a connection problem.

Resolving the problem

To troubleshoot data source connection errors, check the following items for problems:

- Verify that the data source is available.
- If applicable, ensure that the data source server is configured for incoming connections.
- Ensure that your user mapping settings for the REMOTE_AUTHID and REMOTE_PASSWORD options are valid for the connections to the data source. Alter the user mapping, or create another user mapping as necessary.
- If applicable, ensure that the data source client software on the federated server is installed and configured correctly to connect to the data source.
- For ODBC data sources, ensure that the ODBC driver on the federated server is installed and configured correctly to connect to the ODBC data source server. On federated servers that run Windows, use the ODBC Data Source Administrator tool to check the driver. On federated servers that run UNIX, consult the ODBC client vendor's documentation.
- Verify that the settings for the variables set on the federated server are correct for the data source. These variables include the system environment variables, the variables in the `db2dj.ini` file, and the DB2 Profile Registry (db2set) variables.
- Check your server definition. If necessary, drop the server definition and create it again.

Registering nicknames for Sybase tables and views

For each Sybase server definition that you register, you must register a nickname for each table or view that you want to access. Use these nicknames, instead of the names of the data source objects, when you query the Sybase servers.

Before you begin

Update the statistics at the Sybase data source before you register a nickname. The federated database relies on the data source catalog statistics to optimize query processing. Use the data source command that is equivalent to the DB2 RUNSTATS command to update the data source statistics.

Procedure

To register a nickname for Sybase tables or views, use one of the following methods:

Methods	Descriptions
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Issue the CREATE NICKNAME statement. Nicknames can be up to 128 characters in length.	For example: `CREATE NICKNAME nickname` `FOR server_definition_name."remote_schema"."remote.table" ;`

When you create the nickname, the federated server queries the data source catalog by using the nickname. This query tests the connection to the data source table or view. If the connection does not work, you receive an error message.

Repeat this step for each Sybase table or view that you want to create a nickname for.

CREATE NICKNAME statement - Examples for the Sybase wrapper

Use the CREATE NICKNAME statement to register a nickname for a Sybase table or view that you want to access. This topic includes a complete example with the required parameters.

The following example shows you how to register a nickname for a Sybase table or view using the CREATE NICKNAME statement.

```
CREATE NICKNAME SYBSALES FOR SYBSERVER."vinnie"."europe";
```

SYBSALES
: A unique nickname that is used to identify the Sybase table or view.

  Important: The nickname is a two-part name—the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname will be the authorization ID of the user who is registering the nickname.

SYBSERVER."vinnie"."europe"
: A three-part identifier for the remote object:

  - *SYBSERVER* is the server definition name that you assigned to the Sybase database server in the CREATE SERVER statement.
  - *vinnie* is the user ID of the owner to which the table or view belongs.
  - *europe* is the name of the remote table or view that you want to access.

  The federated server folds the names of the Sybase schemas and tables to uppercase unless you enclose the names in quotation marks.

Troubleshooting the Sybase wrapper configuration

Problems loading the Sybase wrapper library

When you create the Sybase wrapper, you might encounter errors related to the installation of the Sybase Open Client software that prevents the Sybase wrapper library from being loaded.

Symptom

When you create the Sybase wrapper, the following SQL error is issued:

```
SQL10013N The specified library "db2ctlibF.dll"
could not be loaded.
```

Cause

The Sybase XA Interface Library for ASE Distributed Transaction Manager was not installed on the Windows system with the Sybase Open Client software.

Resolving the problem

Reinstall the Sybase Open Client software on Windows and select the **Full** or **Custom** installation option. If you select the **Custom** installation option, specify the **XA Interface Library for ASE Distributed Transaction Manager** option.

Missing SYBASE environment variable

If the `db2dj.ini` file is not in the correct directory or if it is missing, you will encounter an SQL error.

Symptom

The following SQL error is issued:

```
SQL1822N Unexpected error code "" received from data source
"server name". Associated text and tokens are "SYBASE variable not set"."
```

Cause

The `db2dj.ini` file was not found or the file does not contain the SYBASE environment variable. The `db2dj.ini` file is located in the directory that the DB2 registry variable DB2_DJ_INI specifies. When the DB2_DJ_INI variable is not set, the `db2dj.ini` file is in one of the following default paths depending on the operating system:

- On UNIX: *`instancehome`*`/sqllib/cfg/db2dj.ini`.

  instancehome
  : The home directory of the instance owner.

- On Windows: `%DB2PATH%\cfg\db2dj.ini`

  %DB2PATH%
  : The directory where the DB2 database system is installed, for example, `C:\Program Files\IBM\sqllib`.

Resolving the problem

Create a `db2dj.ini` file with the required Sybase environment variables and place it in the correct directory for your operating system. You can use a text editor to create the `db2dj.ini` file.

Missing Sybase node name

If the Sybase client configuration file is not properly configured, the federated system might be unable to locate the Sybase node name.

Symptom

The following SQL error is issued:

```
SQL1097N The node name was not found in the node directory.
```

Cause

The Sybase node name was not found.

Resolving the problem

To resolve the problem:
- If the IFILE server option was specified, verify that the node name is declared in the file that it specifies.
- If the interfaces file exists in `sqllib` directory, verify that the node name is declared in it.
- If the IFILE server option is not specified and the `interfaces` file does not exist in the `sqllib` directory, verify that the node name is declared in the `%SYBASE%\ini\sql.ini` file on Windows or the `$SYBASE/interfaces` file on UNIX.

Configuring access to table-structured file data sources

You can integrate the data that is in table-structured file with information from other sources by using a federated system.

Procedure

To configure a federated server to access table-structured file data sources, you must provide the federated server with information about the data sources and objects that you want to access. After you configure the federated server, you can create queries and use the custom functions to access the table-structured file data sources.

Table-structured files - overview

A table-structured file is a file that has a regular structure that consists of a series of records or rows of information. Each record contains the same number of fields. The data in the fields are separated by a delimiter, such as a comma.

The following example shows the contents of a file called DRUGDATA1.TXT. It contains three records, each with three fields, separated by commas:

```
234,DrugnameA,Manufacturer1
332,DrugnameB,Manufacturer2
333,DrugnameC,Manufacturer2
```

The first field is the unique ID number for the drug. The second field is the name of the drug. The third field is the name of the manufacturer who produces the drug.

The field delimiter can be more than one character in length. A single quotation mark cannot be used as a delimiter. The delimiter must be consistent throughout the file. A null value is represented by two delimiters next to each other or a delimiter followed by a line terminator, if the NULL field is the last one on the line. The column delimiter cannot exist as valid data for a column.

For example:

```
234,DrugnameA,Manufacturer1
332,DrugnameB,Manufacturer2
333,DrugnameC,Manufacturer2
356,,Manufacturer1
```

Attributes of table-structured files

The records, or rows, in table-structured files can be sorted or unsorted. The table-structured files wrapper can search files that are sorted more efficiently than files that are not sorted.

If the data in a table-structured file is sorted, the sort must be in ascending order on the key column. You should set the SORTED option to Y on the key column when you create define the columns for the nickname. Otherwise the wrapper processes the data in the table-structured file as unsorted data.

Sorted files

DRUGDATA1.TXT contains sorted records. The file is sorted by the first field, the unique ID number for the drug. This field is the primary key because it is unique for each drug. Sorted files must be sorted in ascending order.

```
234,DrugnameA,Manufacturer1
332,DrugnameB,Manufacturer2
333,DrugnameC,Manufacturer2
```

Unsorted files

DRUGDATA2.TXT contains unsorted records. There is no order to the way the records are listed in the file.

```
556,DrugnameB,Manufacturer2
234,DrugnameA,Manufacturer1
721,DrugnameC,Manufacturer2
```

Table-structured files wrapper

Data in a table-structured file can be joined with data in other table-structured files, relational data, or nonrelational and unstructured data.

Using a wrapper, the federated server can process SQL statements that query data in a table-structured file as if the data is contained in an ordinary relational table or view.

How the federated server works with table-structured files is illustrated in the following figure.

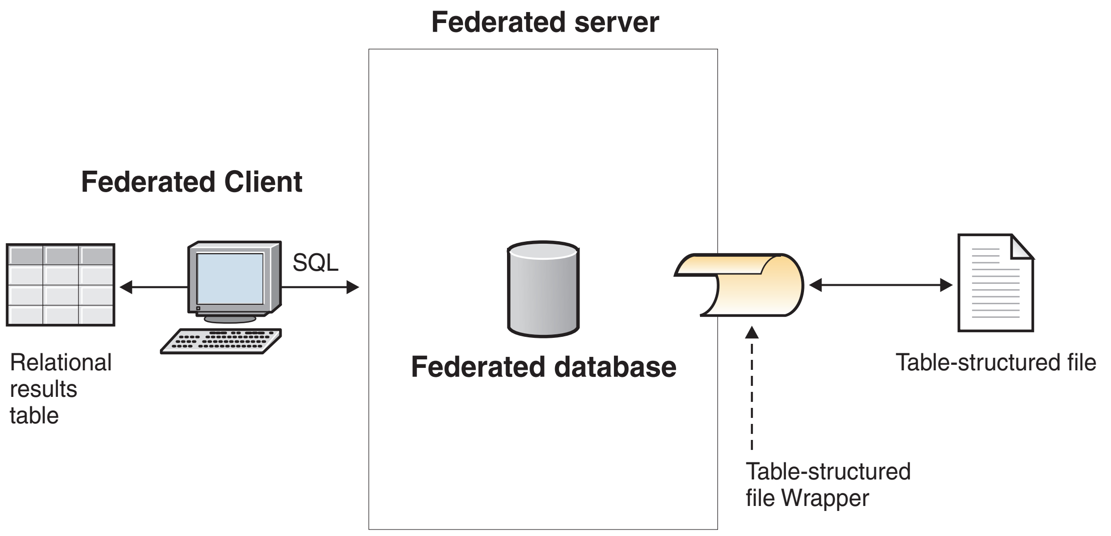


Figure 8. How the table–structured file wrapper works

For example, the table-structured file DRUGDATA2.TXT is located on a computer in your laboratory. The data in the file is:

```
556,DrugnameB,Manufacturer1
234,DrugnameA,Manufacturer2
721,DrugnameC,Manufacturer2
```

It is tedious to try to query and match this data with other tables from other data sources that you use.

After you register the DRUGDATA2.TXT file with the federated server, the table-structured file wrapper can access the data in the file as if the data is in a relational table.

For example, you can run the following query:

```
SELECT * FROM DRUGDATA2 ORDER BY DCODE
```

This query produces the following results:

DCODE	DRUG	MANUFACTURER
234	DrugnameA	Manufacturer2
556	DrugnameB	Manufacturer1
721	DrugnameC	Manufacturer2

You can join the data in the DRUGDATA2.TXT file with data from other relational and nonrelational data sources and analyze all of the data together.

Adding table-structured file data sources to a federated server

To configure a federated server to access table-structured file data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin

- Federation must be installed on a server that will act as the federated server.
- A database must exist on the federated server.

You can configure a federated server to access data that is stored in table-structured file data sources by using the Control Center or by issuing SQL statements on the command line. The Control Center includes a wizard to guide you through the steps that are necessary to configure the required federated objects.

Procedure

To add the table-structured file data sources to a federated server:

1. Register the table-structured file wrapper.
2. Register the table-structured file server definition.
3. Register nicknames for the table-structured files.

Registering the table-structured file wrapper

You must register a wrapper to access the table-structured files data sources. Wrappers are used by federated servers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

You can register a wrapper by using the Control Center or from the command line. The Control Center includes a wizard to guide you through the steps that are necessary to register the wrapper.

Procedure

To register the table-structured file wrapper:

Choose the method that you want to use to register the table-structured file wrapper:

Method	Procedure
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.

From the command line	Issue the CREATE WRAPPER statement.
	`CREATE WRAPPER` *`wrapper_name`*
	`LIBRARY` *`library_name`*`;`
	
	For example to register a wrapper with the name `flat_files_wrapper` on the federated server that uses the AIX operating system, issue the following statement:
	`CREATE WRAPPER` *`flat_files_wrapper`*
	`LIBRARY` *`'libdb2lsfile.a'`*`;`

You must specify the LIBRARY parameter in the CREATE WRAPPER statement. The name of the wrapper library file that you specify depends on the operating system of the federated server. See the list of table-structured file wrapper library files for the correct library name to specify in the CREATE WRAPPER statement.

Table-structured files wrapper library files:

The table-structured files wrapper library files are added to the federated server when you install IBM InfoSphere Federation Server.

When you install IBM InfoSphere Federation Server, three library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files that are added to the directory path are `libdb2lsfile.a`, `libdb2lsfileF.a`, and `libdb2lsfileU.a`. The default wrapper library file is `libdb2lsfile.a`. The other wrapper library files are used with specific wrapper options.

You must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 37. Table-structured files client library locations and file names

Operating system	Directory path	Wrapper library file names
AIX	/usr/opt/`<install_path>`/lib32/ /usr/opt/`<install_path>`/lib64/	libdb2lsfile.a
Linux	/opt/IBM/db2/`<install_path>`/lib32 /opt/IBM/db2/`<install_path>`/lib64	libdb2lsfile.so
Solaris	/opt/IBM/db2/`<install_path>`/lib32 /opt/IBM/db2/`<install_path>`/lib64	libdb2lsfile.so
Windows	%DB2PATH%\bin	db2lsfile.dll

`<install_path>` is the directory path where IBM InfoSphere Federation Server is installed on Linux or UNIX.

%DB2PATH% is the environment variable that is used to specify the directory path where IBM InfoSphere Federation Server is installed on Windows. The default Windows directory path is `C:\Program Files\IBM\SQLLIB`.

Registering the server definition for table-structured files

For table-structured files, you must register a server definition because the hierarchy of federated objects requires that the table-structured files, which are identified by nicknames, are associated with a specific server definition object.

You can register a server definition by using the Control Center or from the command line. The Control Center includes a wizard to guide you through the steps that are necessary to register the server definition.

Procedure

To register a server definition for a table-structured file data source:

Choose the method that you want to use to register the server definition:

Method	Procedure
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.

From the command line	Issue the CREATE SERVER statement. For example:
	`CREATE SERVER` *`server_definition_name`*
	`WRAPPER` *`wrapper_name`*`;`

CREATE SERVER statement - example for the table-structured file wrapper:

Use the CREATE SERVER statement to register the server definition for the table-structured file wrapper. This example shows the required parameters.

The following example shows you how to register a server definition called `biochem_lab` for a text file that contains biochemical data. The CREATE SERVER statement that you issue is:

```
CREATE SERVER biochem_lab WRAPPER flat_files_wrapper;
```

biochem_lab
: A name that you assign to the table-structured file server definition. Duplicate server definition names are not allowed.

WRAPPER *flat_files_wrapper*
: The wrapper name that you specified in the CREATE WRAPPER statement.

Registering nicknames for table-structured files

You must register a nickname for each table-structured file that you want to access. Use these nicknames, instead of the names of the files, when you query table-structured file data sources.

Restrictions

- If a nonnumeric field is too long for its column type, the excess data is truncated.
- If a decimal field in the file has more digits after the radix character than are allowed, the excess data is truncated. For example, if the number is 10.123456 and the data type specifies that 3 digits are allowed after the radix character, the number is truncated to 10.123. The radix character is determined by the RADIXCHAR item of the LC_NUMERIC National Language Support category. The scale parameter for the column data type specifies the number of digits allowed after the radix character.
- If you attempt to access table-structured file data sources that are on a shared drive from federated server that runs Windows 2003, your queries might fail. This is a limitation of Windows 2003. You can avoid this problem by specifying the absolute path in the FILE_PATH option in the CREATE NICKNAME statement.
- The maximum length for a line of data is 10 megabytes (10485760 bytes).
-

When you create a nickname for a table-structured file, the information in the data in the file is mapped to a relational table. You create nicknames for your table-structured file in one of two ways:

- Specifying the table-structured file when you create the nickname by using the FILE_PATH nickname option.
- Specifying the table-structured file when you query the data source, by using the DOCUMENT nickname column option. When this option is used, the nickname can be used to represent data from any table-structured file whose schema matches the nickname definition.

The names that you give the nicknames can be up to 128 characters in length.

You can register a nickname by using the Control Center or from the command line. The Control Center includes a wizard to guide you through the steps that are necessary to register the nickname.

Procedure

To register a nickname for a table-structured file:

Choose the method that you want to use to register the nickname:

Method	Procedure
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.
Using the command line	Issue the CREATE NICKNAME statement. For example: `CREATE NICKNAME nickname ( column_name data_type, column_name data_type, column_name data_type ) FOR SERVER server_definition_name OPTIONS (nickname_options);`

Repeat this step for each table-structured file that you want to create a nickname for.

CREATE NICKNAME statement - examples for table-structured file wrapper:

Use the CREATE NICKNAME statement to register a nickname for a table-structured file that you want to access.

You must specify either the FILE_PATH nickname option or the DOCUMENT nickname column option when you register a nickname for a table-structured file.

Creating a nickname with the FILE_PATH nickname option

The following example shows a CREATE NICKNAME statement for the table-structured file DRUGDATA1.TXT:

```
CREATE NICKNAME DRUGDATA1
    (
    Dcode INTEGER NOT NULL,
    Drug CHAR(20),
    Manufacturer CHAR(20)
    )
    FOR SERVER biochem_lab
    OPTIONS(FILE_PATH '/usr/pat/DRUGDATA1.TXT')
```

DRUGDATA1
: A unique nickname that is used to identify the table-structured file.

  The nickname is a two-part name—the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname is the authorization ID of the user who registers the nickname.

Dcode *INTEGER NOT NULL*
: The name and data type for a table-structured file column that contains a drug code.

Drug *CHAR(20)*
: The name and data type for a table-structured file column that contains the name of a drug.

Manufacturer *CHAR(20)*
: The name and data type for a table-structured file column that contains the name of the drug manufacturer.

FOR SERVER *biochem_lab*
: The name that you assigned to the table-structured file server definition in the CREATE SERVER statement.

FILE_PATH *'/usr/pat/DRUGDATA1.TXT'*
: Specifies the fully qualified directory path and file name for the table-structured file that contains the data you want to access. The path must be enclosed in single quotation marks.

Creating a nickname with the DOCUMENT nickname column option

When you create a nickname using the DOCUMENT nickname column option, you are specifying that the name of table-structured file will be supplied when you run a query that uses the nickname. You can specify the DOCUMENT nickname column option on only one column when you register the nickname. The column that is associated with the DOCUMENT option must be either a VARCHAR or CHAR data type. You must include the full path of the file when you run a query that uses the nickname.

The following example shows a CREATE NICKNAME statement that specifies the DOCUMENT nickname column option:

```
CREATE NICKNAME customers
   (
   doc  VARCHAR(100) OPTIONS(DOCUMENT 'FILE'),
   name VARCHAR(16),
   address VARCHAR(30),
   id VARCHAR(16))
   FOR SERVER biochem_lab
```

customers
: A unique name for the nickname.

: The nickname is a two-part name—the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname is the authorization ID of the user who registers the nickname.

doc *VARCHAR(100)* **OPTIONS(DOCUMENT 'FILE')**
: The name and data type for a column that is used to specify the name of the table-structured file that you want to access. You specify the file name when you run the query.

name *VARCHAR(16)*
: The name and data type for a table-structured file column that contains the name of the customer.

address *VARCHAR(30)*
: The name and data type for a table-structured file column that contains the address of the customer.

id *VARCHAR(16)*

FOR SERVER *biochem_lab*
: The name that you assigned to the table-structured file server definition in the CREATE SERVER statement.

FILE_PATH *'/usr/pat/DRUGDATA1.TXT'*
: Specifies the fully qualified directory path and file name for the table-structured file that contains the data you want to access. You must specify either the FILE_PATH or DOCUMENT nickname option in the CREATE NICKNAME statement. The path must be enclosed in single quotation marks.

Creating a nickname with the optional parameters

The following example shows a CREATE NICKNAME statement for the table-structured file DRUGDATA1.TXT:

```
CREATE NICKNAME DRUGDATA1
    (
    Dcode INTEGER NOT NULL,
    Drug CHAR(20),
    Manufacturer CHAR(20)
    )
    FOR SERVER biochem_lab
    OPTIONS(FILE_PATH '/usr/pat/DRUGDATA1.TXT',
        COLUMN_DELIMITER ',',
        SORTED 'Y',
        KEY_COLUMN 'DCODE',
        VALIDATE_DATA_FILE 'Y')
```

DRUGDATA1
: A unique nickname that is used to identify the table-structured file.

: The nickname is a two-part name—the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname is the authorization ID of the user who registers the nickname.

Dcode *INTEGER NOT NULL*
: The name and data type for a table-structured file column that contains a drug code.

Drug *CHAR(20)*
: The name and data type for a table-structured file column that contains the name of a drug.

Manufacturer *CHAR(20)*
: The name and data type for a table-structured file column that contains the name of the drug manufacturer.

FOR SERVER *biochem_lab*
: The name that you assigned to the table-structured file server definition in the CREATE SERVER statement.

FILE_PATH *'/usr/pat/DRUGDATA1.TXT'*
: Specifies the fully qualified directory path and file name for the table-structured file that contains the data you want to access. You must specify either the FILE_PATH or DOCUMENT nickname option in the CREATE NICKNAME statement. The path must be enclosed in single quotation marks.

COLUMN_DELIMITER *','*
: Specifies the delimiter that is used to separate the fields in a table-structured file. The delimiter value must be enclosed in single quotation marks. The column delimiter can be more than one character in

length. If you do not specify a column delimiter, the default delimiter is a comma. A single quote cannot be used as a delimiter. The column delimiter must be consistent throughout the file. A null value is represented by two delimiters next to each other or a delimiter followed by a line terminator, if the NULL field is the last one on the line. The column delimiter cannot exist as valid data for a column. For example, a column delimiter of a comma cannot be used if one of the columns contains data with embedded commas.

SORTED *'Y'*
Specifies that the data source file is sorted. Sorted data sources must be sorted in ascending order according to the collation sequence for the current locale, as defined by the settings in the LC_COLLATE National Language Support category. If you specify that the data source is sorted, set the VALIDATE_DATA_FILE option to 'Y'. The default value for the SORTED parameter is 'N'.

KEY_COLUMN *'DCODE'*
The name of the column in the file that forms the key on which the file is sorted. The key column value must be enclosed in single quotation marks. Specify this option only if you specify the SORTED nickname option. A column that is designated with the DOCUMENT nickname column option must not be specified as the key column. The value must be the name of a column that is defined in the CREATE NICKNAME statement. The key column must not contain null values. Only single column keys are supported. Multiple column keys are not allowed. The column must be sorted in ascending order. If the value is not specified for a sorted nickname, it defaults to the first column in the nicknamed file.

VALIDATE_DATA_FILE *'Y'*
Specifies if the wrapper verifies that the key column is sorted in ascending order and checks for null keys. The valid values for this option are Y or N. This option is not allowed if the DOCUMENT nickname column option is used for the file path.

Designating key columns when you register a nickname

You can designate a key column by specifying the NOT NULL constraint in the nickname statement:

```
CREATE NICKNAME tox (tox_id INTEGER NOT NULL, toxicity VARCHAR(100))
FOR SERVER tox_server1
  OPTIONS (FILE_PATH'/tox_data.txt', SORTED 'Y')

CREATE NICKNAME weights (mol_id INTEGER, wt VARCHAR(100) NOT NULL)
FOR SERVER wt_server
  OPTIONS (FILE_PATH'/wt_data.txt', SORTED 'Y', KEY_COLUMN 'WT')
```

NOT NULL
Specifies that the column cannot contain null, or blank, values.

The wrapper does not enforce the NOT NULL constraint, but the federated database does. If you create a nickname and attach a NOT NULL constraint on a column and then select a row containing a null value for the column, the federated database issues a SQL0407N error stating that you cannot assign a NULL value to a NOT NULL column.

The exception to this rule is for sorted nicknames. The key column for sorted nicknames cannot be NULL. If a NULL key column is found for a sorted nickname, the SQL1822N error is issued, stating that the key column is missing.

Case sensitive column names

The federated database changes the column names to uppercase unless the column is defined with double quotation marks. The following example will not work correctly because the value of the KEY_COLUMN option is enclosed in single quotation marks. In the example, the column name will be converted by the federated database to EMPNO. As a result, when you specify `empno` in a query, the column is not recognized by the federated database.

```
CREATE NICKNAME depart (
 empno char(6) NOT NULL)
 FOR SERVER DATASTORE
 OPTIONS(FILE_PATH'data.txt', SORTED 'Y', KEY_COLUMN 'empno');
```

Windows 2003 federated servers

If you attempt to access table-structured file data sources that are on a shared drive from a federated server that runs Windows 2003, your query might fail with the following error message:

```
SQL1822N  Unexpected error code "ERRNO = 2" received from data source
"SERVERNAME1". Associated text and tokens are "Unable to read file".
SQLSTATE=560BD
```

This is a limitation of Windows 2003. You can avoid this problem by specifying the absolute path in the FILE_PATH option in the CREATE NICKNAME statement.

The following example shows a CREATE NICKNAME statement with an abbreviated path specified in the FILE_PATH option:

```
CREATE NICKNAME nickname
   (
   COL1 CHAR (10) NOT NULL
   )
   FOR SERVER servername1
   OPTIONS (FILE_PATH 'X:\textfile1.txt');
```

where `X:\` is the drive that maps to the remote machine. Queries that use this nickname might fail because you specified the abbreviated path.

For federated server that runs Windows 2003, specify the absolute path in the FILE_PATH option in the CREATE NICKNAME statement.

For example:

```
CREATE NICKNAME nickname
   (
   COL1 CHAR (10) NOT NULL
   )
   FOR SERVER servername1
   OPTIONS (FILE_PATH '\\host.svl.ibm.com\D$\textfile1.txt') ;
```

File access control model for the table-structured file wrapper

The wrapper accesses table-structured files using the authorization information of the federated database instance owner. The wrapper can only access files that can be read by this user ID or group ID. The authorization ID that establishes the connection to the federated database is not used to access table-structured files.

On a federated server, any table-structured file for which a nickname has been created must be accessible with the same path name from each node. The file does not have to be on a federated database node as long as the file can be accessed from any node with a common path.

To access a table-structured file, the wrapper needs a user identity for security purposes. The table-structured file wrapper uses the user identity that is associated with the federated database service. The name of the federated database service depends on the name of the database instance. For example, if the database instance name is DB2, then the service name is `DB2 - DB2`. To determine the user identity that is associated with a federated database service, use the Control Panel in Windows to display the services. Double-click the service name and display the Log On properties page.

Table-structured files located on remote drives

The table-structured files that you want to access must be on a local or mapped drive.

Networks that have a Windows domain configured
The logon account for the federated database service must be an account from the domain that has access to the shared folder on the mapped drive where the table-structured files reside.

Networks that do not have a Windows domain configured
The federated database service logon account should have the same user name and password as a valid user on the computer that shares that folder. That user must be on the permissions list for the shared folder with at least read access

Guidelines for optimizing query performance for the table-structured file wrapper

You can improve the performance of table structured file queries by having files that are sorted and by creating statistics for your nicknames.

Use the following tips to improve query performance:
- Sort the data in your files. The federated server can search files that are sorted much more efficiently than files that are not sorted.
- For sorted files, specify a value or range for the key column when you submit a query.
- Statistics for nicknames of table-structured files must be updated manually by updating the SYSSTAT and SYSCAT views. Use the Nickname statistics update facility to update the statistics for the table-structured file nicknames.

Configuring access to Teradata data sources

To configure a federated server to access Teradata data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin
- Teradata client software must be installed and configured on the server that acts as the federated server.
- Federation must be installed on a server that acts as the federated server.
- Check the setup of the federated server.

- Check the federated parameter to ensure that federation is enabled.

About this task

You can configure a federated server to access data that is stored in Teradata data sources by using the DB2 Control Center or by issuing SQL statements on the DB2 command line. The DB2 Control Center includes a wizard to guide you through the steps that are necessary to configure the required federated objects.

Procedure

To configure access to Teradata data sources:
1. Test the connection to the Teradata server.
2. Verify that the Teradata library is enabled for run-time linking (AIX).
3. Set the environment variables for the Teradata wrapper.
4. Register the wrapper.
5. Register the server definition.
6. Create the user mappings.
7. Test the connection to the Teradata server.
8. Register nicknames for Teradata tables and views.

Testing the connection to the Teradata server

Test the connection to the Teradata server to verify that the Teradata client software is properly set up on the federated server.

Before you begin

The Basic Teradata Query (BTEQ) utility and the Teradata Data Connector Application Program Interface (PIOM) must be installed on the federated server. The BTEQ utility and the Teradata Data Connector Application Program Interface are installed on the federated server when you install the Teradata client software.

About this task

You use the BTEQ utility to submit an SQL query to verify that the federated server can connect to the Teradata server. See the Teradata documentation for more information about the BTEQ utility.

Procedure

To test the connection to the Teradata server:
1. Start a BTEQ utility session and log on to the Teradata server.
2. Issue an SQL command to verify that you can successfully connect to the Teradata server.

   For example:
   ```
   select count(*) from dbc.tables;
   ```
   If the connection is successful, you will see the output from the query.

   If the connection is unsuccessful, you will receive an error. Check the Teradata client software to verify that it is properly installed and configured on the federated server.
3. Log off from the Teradata server and end the BTEQ utility session.

After you complete this task, verify that the Teradata library is enabled for run-time linking.

Verifying that the Teradata library is enabled for run-time linking (AIX)

When you add a Teradata data source to your federated server on AIX, you must verify that run-time linking is enabled before you register wrappers or servers.

Procedure

To verify that the Teradata library is enabled for run-time linking:

1. Go to the directory in which the `libcliv2.so` file resides.

   The `libcliv2.so` file is installed with the Teradata client software. By default, it is installed in the `/usr/lib` directory.
2. From a command prompt, issue the following UNIX command to verify if run-time linking is enabled:
   ```
   dump -H libcliv2.so | grep libtli.a
   ```
3. Check the file names that are returned. If the `libtli.a` file name is returned, the Teradata library is enabled for run-time linking.

   If the `libtli.a` file name is not returned, open a command window and issue the following UNIX commands to enable run-time linking for the Teradata library:
   ```
   rtl_enable libcliv2.so -F libtli.a
   mv libcliv2.so libcliv2.so.old
   mv libcliv2.so.new libcliv2.so
   chmod a+r libcliv2.so
   ```

After you complete this task, you can set the environment variables.

Setting the Teradata environment variables

The Teradata environment variables must be set in the `db2dj.ini` file on the federated server.

Restrictions

Review the restrictions for the db2dj.ini file.

The `db2dj.ini` file contains configuration information about the Teradata client software that is installed on your federated server.

There are required and optional environment variables for Teradata data sources.

If you installed the Teradata client software before you installed the Teradata wrapper, the required Teradata environment variables are set in the `db2dj.ini` file.

You must set the environment variables by using the steps in this task if you did not install the Teradata client software before you installed the Teradata wrapper or if you want to set any of the optional environment variables.

Procedure

To set the Teradata environment variables:

1. Use one of the following methods:

Method	Step
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Automatically set the environment variables.	Run the IBM InfoSphere Federation Server installation wizard. Follow the instructions in the wizard. **Important:** Set the required environment variables by running the installation wizard. The optional environment variables must be set manually.
Manually set the environment variables.	Edit the `db2dj.ini` file: The `db2dj.ini` file is located in the directory that the DB2 registry variable DB2_DJ_INI specifies. When the DB2_DJ_INI variable is not set, the `db2dj.ini` file is in one of the following default paths depending on the operating system: • On UNIX: `*instancehome*/sqllib/cfg/db2dj.ini`. *instancehome* The home directory of the instance owner. • On Windows: `%DB2PATH%\cfg\db2dj.ini` **%DB2PATH%** The directory where the DB2 database system is installed, for example, `C:\Program Files\IBM\sqllib`. If the file does not exist, you can create a file with the name `db2dj.ini` by using any text editor. In the `db2dj.ini` file, you must specify the fully qualified path in the value of the environment variables; otherwise you will encounter errors. For example: `COPLIB=/usr/lib`

2. Set the Teradata code page conversion environment variables (as necessary).
3. To ensure that the environment variables are set on the federated server, recycle the federated database instance with these commands:

```
db2stop
db2start
```

After you complete this task, you can register the wrapper.

Teradata environment variables

There are required and optional environment variables for Teradata data sources. These variables are set in the `db2dj.ini` file.

The following environment variables are valid for Teradata:
- COPLIB
- COPERR
- TERADATA_CHARSET (optional)
- NETRACE (optional)
- COPANOMLOG (optional)

Variable descriptions

COPLIB

Specifies the directory path on the federated server for the `libcliv2.so` file. Specify the fully qualified path for the COPLIB variable.

For example:

```
COPLIB=/usr/lib
```

The `libcliv2.so` and `errmsg.cat` files typically reside in the same directory.

COPERR
Specifies the directory path on the federated server for the `errmsg.cat` file. Specify the fully qualified path for the COPERR variable.

For example:

```
COPERR=/usr/lib
```

TERADATA_CHARSET
Specifies the code page character set to use with Teradata data sources.

Each time that the federated server connects to a Teradata data source, the Teradata wrapper determines which code page character set to use for that connection. You can have the Teradata wrapper set the code page character set or you can designate a code page by setting the TERADATA_CHARSET environment variable.

If the TERADATA_CHARSET environment variable is set in the `db2dj.ini` file on the federated server, the wrapper uses the code page character set in the `db2dj.ini` file. The value in the TERADATA_CHARSET environment variable is not validated, but if the environment variable is not set to a valid value, the Teradata data source returns an error.

If the TERADATA_CHARSET environment variable is not set in the `db2dj.ini` file on the federated server, the wrapper detects the client character set based on the code page of the database.

On federated servers that run UNIX, the following values are valid for the TERADATA_CHARSET environment variable:

- HANGULKSC5601_2R4
- KanjiEUC_0U
- LATIN1_0A
- LATIN9_0A
- LATIN1252_0A
- SCHGB2312_1T0
- TCHBIG5_1R0
- UTF8
- ASCII

On federated servers that run Windows, the following values are valid for the TERADATA_CHARSET environment variable:

- HANGULKSC5601_2R4
- KanjiSJIS_0S
- LATIN1_0A
- LATIN1252_0A
- SCHGB2312_1T0
- TCHBIG5_1R0
- UTF8
- ASCII

NETRACE
Optional. Enables the tracing feature of the Teradata client software. This variable is needed only for debugging.

COPANOMLOG
Optional. Enables the logging feature of the Teradata client software. This variable is needed only for debugging.

Verifying the character set on the Teradata server

If the correct character set is not specified on the Teradata server, you can receive connection errors. Verify that the character set that you want to use is installed on the Teradata server.

Procedure

To verify that the character set that you want to use is installed on the Teradata server:

1. Log on to the Teradata server by using the BTEQ utility or any other valid logon utility.
2. Issue the following statement to display the dbc.chartranslations table: `select * from dbc.chartranslations;`
3. Check the value in the third column, InstallFlag, of the table that is returned. The value ′Y′ in the third column indicates that the character set is installed and in use on the Teradata server.

   Use the following table to determine if you have the correct character set installed:

Table 38. Character sets for Teradata

Double-byte character set	Single-byte character set	Teradata character set	Language	IBM DB2 code set
941	897	″KanjiSJIS_0S″	Japanese	IBM-943
1362	1126	″HANGULKSC5601_2R4″	Korean	1363
1385	1114	″SCHGB2312_1T0″	Simplified Chinese	GBk
380	1115	″SCHGB2312_1T0″	Simplified Chinese	IBM-1381
947	1114	″TCHBIG5_1R0″	Traditional Chinese	big5
1200	1208	″UTF8″	Unicode	UTF-8
0	819	″Latin1_0A″	English (Latin 1)	ISO8859-1
0	1252	″Latin1252_0A″	English (Win Latin)	ISO8859-1/15
0	819	″ASCII″	English (ASCII)	ISO8859-1

4. If you do not have the required character set installed, install the character set to use the Teradata wrapper.
   - ASCII is enabled on the Teradata server, but it is not cataloged in the dbc.chartranslations table. If all of the values that are returned for InstallFlag are ′N′, ASCII is the only valid character set on the Teradata server and the TERADATA_CHARSET environment variable must be set to ASCII in the `db2dj.ini` file.
   - If the character set that you want to use is listed in the dbc.chartranslations table, but the InstallFlag value is set to ′N′, issue the following statement to change the InstallFlag to ′Y′:

```
update dbc.chartranslations
     set installflag='Y' where CharSetName= 'character_set_name';
```

- If the character set that you want to use is not listed in the dbc.chartranslations table, contact Teradata customer support.

5. Restart the Teradata server to update the list of character sets. In a Teradata command window, enter: tpareset -f reason_for_restart

Troubleshooting character sets for Teradata data sources:

When you set the TERADATA_CHARSET environment variable for a Teradata data source, you might encounter errors if the correct character set is not specified.

Symptom

If the correct character set is not specified for the Teradata data source, you will encounter the following error:

```
SQL 1822N Unexpected error code "227"
received from data source "<string>". Associated text and
tokens are "MTDP: EM_CHARNAME(227): invalid character set
name specif". SQLSTATE=560BD
```

Cause

The character set that is specified in the TERADATA_CHARSET environment variable is incorrect.

Resolving the problem

Verify that the correct character set is installed and specified on the Teradata server and in the `db2dj.ini` file.

Registering the Teradata wrapper

You must register a wrapper to access Teradata data sources. Federated servers use wrappers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

Procedure

To register the Teradata wrapper:

Use one of the following methods:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Method	Description

Issue the CREATE WRAPPER statement and specify the default name for the Teradata wrapper.	For example:
	`CREATE WRAPPER TERADATA;`
	
	Remember: When you register the wrapper by using the default name, TERADATA, the federated server automatically uses the appropriate Teradata wrapper library for the operating system that your federated server is running on.
	
	If the default wrapper name conflicts with an existing wrapper name in the federated database, you can substitute the default wrapper name with a name that you choose. When you use a name that is different from the default name, you must include the LIBRARY parameter in the CREATE WRAPPER statement.
	
	For example, to register a wrapper with the name tera_wrapper on a federated server that uses AIX, issue the following statement:
	`CREATE WRAPPER tera_wrapper`
	`  LIBRARY 'libdb2teradata.a'`
	`  OPTIONS (DB2_FENCED 'Y');`
	
	The wrapper library file that you specify depends on the operating system of the federated server.
	
	Mandatory options for AIX and Solaris
	Note: The DB2_FENCED wrapper option in the CREATE WRAPPER statement are mandatory for AIX and Solaris because the Teradata wrapper supports only 32-bit clients.
	
	For example:
	`CREATE WRAPPER TERADATA`
	`  OPTIONS (DB2_FENCED 'Y')`

After you complete this task, you can register the server definition.

Teradata wrapper library files

The Teradata wrapper library files are added to the federated server when you install the wrapper.

When you install the Teradata wrapper, three library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files that are added to the directory path are `libdb2teradata.a`, `libdb2teradataF.a`, and `libdb2teradataU.a`. The default wrapper library file is `libdb2teradata.a`. The other wrapper library files are used internally by the Teradata wrapper.

If you do not use the default wrapper name when you register the wrapper, you must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 39. Teradata wrapper library locations and file names

Operating system	Directory path	Library file names
AIX	/usr/opt/*install_path*/lib32/ /usr/opt/*install_path*/lib64/	libdb2teradata.a
Solaris	/opt/IBM/db2/*install_path*/lib32 /opt/IBM/db2/*install_path*/lib64	libdb2teradata.so
Windows	%DB2PATH%\bin	db2teradata.dll

install_path is the directory path where the federated server is installed on UNIX.

Registering the server definitions for a Teradata data source

You must register each Teradata server that you want to access in the federated database.

Procedure

To register a server definition for an Teradata data source:

1. Locate the `hosts` file.
   - On federated servers that run AIX, the `hosts` file is located in the `/etc/hosts` directory.
   - On federated servers that run Windows, the `hosts` file is located in the `%WINDIR%\system32\drivers\etc\hosts` directory.
2. Search the `hosts` file for the alias of the remote server.

   This alias begins with an alphabetic string and ends with the suffix COP*n*. The value *n* is the number of the application processor that is associated with the Teradata communications processor.
3. Find the first non-numeric field on the line in the `hosts` that contains the alias.

   Sample `hosts` file:

```
127.0.0.1       localhost

9.22.5.77       nodexyz        nodexyzCOP1      # teradata server

9.66.111.133   rtplib05.data.xxx.com aap
9.66.111.161   rtpscm11.data.xxx.com aaprwrt
9.66.111.161   rtpscm11.data.xxx.com accessm
```

   In this example, `nodexyz` is the node name.
4. To create the server, use one of the following methods:

Methods	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.

Methods	Description

Issue the CREATE SERVER statement.	For example:
	`CREATE SERVER server_definition_name`
	`    TYPE TERADATA`
	`    VERSION version_number`
	`    WRAPPER wrapper_name`
	`    OPTIONS (NODE 'node_name');`
	
	Although the *'node_name'* variable is specified as an option in the CREATE SERVER statement, this option is required for Teradata data sources.

CREATE SERVER statement - Examples for the Teradata wrapper

Use the CREATE SERVER statement to register server definitions for the Teradata wrapper. This topic includes a complete example with the required parameters, and an example with additional server options.

The following example shows you how to register a server definition for a Teradata wrapper by issuing the CREATE SERVER statement:

```
CREATE SERVER tera_server TYPE TERADATA
     VERSION 2.5 WRAPPER my_wrapper
     OPTIONS (NODE 'tera_node');
```

tera_server
: A name that you assign to the Teradata database server. Duplicate server definition names are not allowed.

TYPE *TERADATA*
: Specifies the type of data source server to which you are configuring access. For the Teradata wrapper, the server type must be `TERADATA`.

VERSION *2.5*
: The version of the Teradata database server that you want to access.

WRAPPER *TERADATA*
: The wrapper name that you specified in the CREATE WRAPPER statement.

NODE *'tera_node'*
: The name of the node where the Teradata database server resides. Obtain the node name from the `hosts` file. This value is case sensitive.

  Although the name of the node is specified as an option in the CREATE SERVER statement, it is required for Teradata data sources.

Server options

When you create a server definition, you can specify additional server options in the CREATE SERVER statement. The server options can be general server options and Teradata-specific server options.

The CPU_RATIO and IO_RATIO server options provide the statistical information about the Teradata server to the query optimizer. To specify that the CPU resources of the federated server are twice as powerful as the CPU resources of the Teradata server, set the value of the CPU_RATIO server option to 2.0. To specify that the I/O devices of the federated server process data three times faster than the I/O devices of the Teradata server, set the IO_RATIO server option to 3.0.

The following example shows a Teradata server definition with these options:

```
CREATE SERVER tera_server TYPE TERADATA
     VERSION 2.5 WRAPPER my_wrapper
     OPTIONS (NODE 'tera_node', CPU_RATIO '2.0', IO_RATIO '3.0');
```

Creating the user mapping for a Teradata data source

When you attempt to access an Teradata server, the federated server establishes a connection to the Teradata server by using a user ID and password that are valid for that data source.

About this task

Create a user mapping for each user ID that will access the federated system to send distributed requests to the Teradata data source.

Procedure

To create the user mappings for a Teradata data source:

Issue a CREATE USER MAPPING statement.
For example:

```
CREATE USER MAPPING FOR local_userID SERVER server_definition_name
      OPTIONS (REMOTE_AUTHID 'remote_userID', REMOTE_PASSWORD 'remote_password')
```

Although the REMOTE_AUTHID and REMOTE_PASSWORD variables are specified as options in the CREATE USER MAPPING statement, these options are required to access Teradata data sources.

After you complete this task, test the connection from the federated server to the Teradata server.

CREATE USER MAPPING statement - Examples for the Teradata wrapper

Use the CREATE USER MAPPING statement to map a federated server authorization ID to a remote Teradata user ID and password. This topic includes a complete example with the required parameters, and an example that shows you how to use the DB2 special register USER with the CREATE USER MAPPING statement.

The following example shows how to map a local authorization ID to a remote Teradata user ID and password:

```
CREATE USER MAPPING FOR MICHAEL SERVER tera_server
      OPTIONS (REMOTE_AUTHID 'mike', REMOTE_PASSWORD 'passxyz123');
```

MICHAEL
: Specifies the local authorization ID that you are mapping to the remote user ID and password, which are defined at the Teradata server.

SERVER *tera_server*
: Specifies the server definition name that you registered in the CREATE SERVER statement for the Teradata server.

REMOTE_AUTHID *'mike'*
: Specifies the remote Teradata user ID to which you are mapping *MICHAEL*. The value is case-sensitive, unless you set the FOLD_ID server option to 'U' or 'L' in the CREATE SERVER statement.

  Although the remote user ID is specified as an option in the CREATE SERVER statement, it is required for Teradata data sources.

REMOTE_PASSWORD *'passxyz123'*
: Specifies the remote Teradata password that is associated with *'mike'*. The value is case-sensitive, unless you set the FOLD_PW server option to 'U' or 'L' in the CREATE SERVER statement.

  Although the remote password is specified as an option in the CREATE SERVER statement, it is required for Teradata data sources.

DB2 special register USER

You can use the DB2 special register USER to map the authorization ID of the person who is issuing the CREATE USER MAPPING statement to the data source authorization ID that is specified in the REMOTE_AUTHID user option.

The following example shows a CREATE USER MAPPING statement that includes the special register USER:

```
CREATE USER MAPPING FOR USER SERVER tera_server
      OPTIONS (REMOTE_AUTHID 'mike', REMOTE_PASSWORD 'passxyz123');
```

Testing the connection to the Teradata server

Test the connection to the Teradata data source server to determine if the federated server is properly configured to access Teradata data sources.

About this task

You can test the connection to the Teradata server by using the server definition and user mappings that you defined.

Procedure

To test the connection to the Teradata server:

Open a pass-through session and issue a SELECT statement on the Teradata system tables. If the SELECT statement returns a count, your server definition and your user mapping are set up properly.
For example:

```
SET PASSTHRU server_definition_name
SELECT count(*) FROM dbc.tables
SET PASSTHRU RESET
```

If the SELECT statement returns an error, you should troubleshoot the connection errors.

After you complete this task, you can register the nicknames for Teradata tables and views.

Troubleshooting data source connection errors

A test connection to the data source server might return an error for several reasons. There are actions that you can take to determine why the error occurred.

Symptom

An error is returned when you attempt to connect to the data source.

Cause

There are several possible causes for a connection problem.

Resolving the problem

To troubleshoot data source connection errors, check the following items for problems:
- Verify that the data source is available.
- If applicable, ensure that the data source server is configured for incoming connections.
- Ensure that your user mapping settings for the REMOTE_AUTHID and REMOTE_PASSWORD options are valid for the connections to the data source. Alter the user mapping, or create another user mapping as necessary.
- If applicable, ensure that the data source client software on the federated server is installed and configured correctly to connect to the data source.
- For ODBC data sources, ensure that the ODBC driver on the federated server is installed and configured correctly to connect to the ODBC data source server. On federated servers that run Windows, use the ODBC Data Source Administrator tool to check the driver. On federated servers that run UNIX, consult the ODBC client vendor's documentation.
- Verify that the settings for the variables set on the federated server are correct for the data source. These variables include the system environment variables, the variables in the `db2dj.ini` file, and the DB2 Profile Registry (db2set) variables.
- Check your server definition. If necessary, drop the server definition and create it again.

Registering nicknames for Teradata tables and views

For each Teradata server definition that you register, you must register a nickname for each table or view that you want to access. Use these nicknames, instead of the names of the data source objects, when you query the Teradata servers.

Before you begin

The federated database relies on the data source catalog statistics to optimize query processing. To ensure that the federated database has complete statistics on Teradata tables, use the COLLECT STATISTICS Teradata command before you register a nickname.

From the Teradata server, use the COLLECT STATISTICS Teradata command to collect statistics on one or more columns or indexes in a table.

When you register the nickname with the CREATE NICKNAME statement, the federated database reads the statistics from the Teradata system catalog and updates the local statistics for the nickname.

About this task

When you register a nickname on a Teradata view, the federated database recognizes all columns of the view as nullable, even if the columns in the Teradata view do not allow null values. There is no workaround for this limitation.

Procedure

To register a nickname for a Teradata table or view:

Method	Description
Use the Federated Objects wizard in the DB2 Control Center.	To start the wizard, right-click the Federated Database Objects folder and click **Create Federated Objects**.
Issue the CREATE NICKNAME statement. Nicknames can be up to 128 characters in length.	For example: `CREATE NICKNAME nickname FOR server_definition_name.remote_schema.remote_table;`

When you create the nickname, the federated server queries the data source catalog by using the nickname. This query tests the connection to the data source table or view. If the connection does not work, you receive an error message.

Repeat this step for each Teradata table or view that you want to create a nickname for.

Teradata nicknames on federated servers

When you query a Teradata data source from a federated server, you use a nickname in the query to identify the Teradata table and view that you want to access.

When you create a nickname for a Teradata table or view, the federated server connects to the Teradata server associated with the table or view. The federated server uses the nickname to verify the connection to the Teradata server. The federated database verifies the presence of the table or view at the data source and then attempts to gather statistical data about the Teradata table or view from the catalog on the Teradata server. The statistics that are gathered about the nicknamed object are stored in the global catalog on the federated server.

The federated server relies on the statistics that it collects for the nicknamed objects to optimize query processing. Because some or all of the Teradata catalog information might be used by the query optimizer, you should update the statistics at the Teradata server before you create a nickname. Update the statistics at the Teradata server by using a command or utility that is equivalent to the DB2 RUNSTATS command.

You cannot submit an INSERT, UPDATE, or DELETE statement to a nickname that references an updatable Teradata view unless the SQL statement can be completely pushed down to the Teradata data source.

CREATE NICKNAME statement - Examples for the Teradata wrapper

Use the CREATE NICKNAME statement to register a nickname for an Teradata table or view that you want to access. This topic includes a complete example with the required parameters.

This example shows how to create a nickname for a Teradata table or view on the Teradata server:

```
CREATE NICKNAME TERASALES FOR tera_server.vinnie.europe ;
```

TERASALES
A unique nickname that is used to identify the Teradata table or view.

Important: The nickname is a two-part name—the schema and the nickname. If you omit the schema when you register the nickname, the schema of the nickname will be the authorization ID of the user who registers the nickname. The authorization ID is for the federated server, not the remote Teradata data source.

tera_server.vinnie.europe
A three-part identifier for the remote object:

- *tera_server* is the server definition name that you assigned to the Teradata database server in the CREATE SERVER statement.
- *vinnie* is the user ID of the owner to which the table or view belongs. This value is case sensitive.
- *europe* is the name of the remote table or view that you want to access.

Troubleshooting the Teradata data source configuration

Enabling run-time linking for libcliv2.so (AIX)

If you run the `djxlinkTeradata.sh` file to link to the Teradata shared library called `libcliv2.so`, you might receive an error message when you issue a CREATE NICKNAME statement.

Symptom

An example of an error message that you might receive is:

```
DB21034E  The command was processed as an SQL statement because it was not a
valid Command Line Processor command.  During SQL processing it returned:
SQL30081N  A communication error has been detected.  Communication protocol
being used: "TCP/IP".  Communication API being used: "SOCKETS".  Location
where the error was detected: "9.112.26.28".  Communication function detecting
the error: "recv".  Protocol specific error code(s): "*", "*", "0".
SQLSTATE=08001
```

Cause

The `OsCall` function caused the federated server to stop.

Resolving the problem

If you receive an error message, check the `/sqllib/db2dump` directory for any trap files. Trap file names begin with the letter `t` and end with a suffix of `000`. For example:

```
 t123456.000
```

Check the trace information in the trap file for any `OsCall` function references that indicate that the `OsCall` function caused the federated server to stop.

The following example shows trace information with an `OsCall` function reference that you might find in a trap file:

```
*** Start stack traceback ***

0x239690E0 OsCall + 0x28C
0x23973FB0 mtdpassn + 0x8A4
0x239795A4 mtdp + 0x208
0x2395A928 MTDPIO + 0x28C
0x239609C4 CLICON + 0xD50
0x23962350 DBCHCL + 0xC4
```

If you find an OsCall function reference in one of the trap files, you must enable run-time linking for the libcliv2.so shared library.

Issue the following UNIX commands to enable run-time linking:

```
cd /usr/lib
rtl_enable libcliv2.so -F libtli.a
mv libcliv2.so libcliv2.so.old
mv libcliv2.so.new libcliv2.so
chmod a+r libcliv2.so
```

Troubleshooting character sets for Teradata data sources

When you set the TERADATA_CHARSET environment variable for a Teradata data source, you might encounter errors if the correct character set is not specified.

Symptom

If the correct character set is not specified for the Teradata data source, you will encounter the following error:

```
SQL 1822N Unexpected error code "227"
received from data source "<string>". Associated text and
tokens are "MTDP: EM_CHARNAME(227): invalid character set
name specif". SQLSTATE=560BD
```

Cause

The character set that is specified in the TERADATA_CHARSET environment variable is incorrect.

Resolving the problem

Verify that the correct character set is installed and specified on the Teradata server and in the db2dj.ini file.

Troubleshooting UPDATE or DELETE operation errors on nicknames

By default, rows are not uniquely identified on Teradata data source tables. You might receive an SQL error message when you try to update or delete a nickname that is associated with a Teradata table or view.

Symptom

The SQL30090N, RC=″21″ error is returned when you try to update or delete a nickname that is associated with a Teradata table or view.

Cause

This problem is caused because rows are not uniquely defined on the Teradata source table.

Resolving the problem

To resolve the problem:

1. Drop and recreate the nickname.
2. Create at least one unique index on the Teradata table that is being updated or deleted, and try the operation again.

Working with Teradata access logging

The Teradata product provides an access logging feature that generates log entries when Teradata checks the specific security privileges of various users on one or more databases. Although access logging provides considerable and meaningful security information, this feature significantly increases processor usage and can degrade system performance.

If you need to improve system performance, evaluate the checking privilege rules that you defined for access logging. Then, terminate any unnecessary rules by defining END LOGGING statements.

For the best performance, turn off all access logging. Drop the `Teradata DBC.AccLogRules` macro and then force a trusted parallel application (TPA) reset to stop access logging completely.

See the Teradata documentation for more information.

Configuring access to Web services data sources

To configure the federated system to access Web services data sources, you must provide the federated server with information about the data sources and objects that you want to access, such as a valid Web services description language (WSDL) document.

Before you begin

- Federation must be installed on a server that will act as the federated server.
- A database must exist on the federated server.

You can configure the federated server to access Web services data sources by using the DB2 Control Center or the DB2 command line. The DB2 Control Center includes a wizard to guide you through the steps that are required to configure the federated server.

Procedure

To configure access to Web services data sources:

1. Register the Web services wrapper.
2. Register the server definition for Web services data sources.
3. Register user mappings to enable security for HTTP authentication (optional)
4. Register nicknames for Web services data sources:
   - Register nicknames for Web services data sources by using the DB2 command line.
   - Register nicknames for Web services data sources by using the DB2 Control Center.
5. Create federated views for Web services nicknames.

Web services and the Web services wrapper

Web service providers are described by Web Services Description Language (WSDL) documents. You can use the Web services wrapper to access Web service providers.

The Figure 9 on page 213 diagram shows the architecture of Web services.

1. A Web service provider implements a service and publishes the WSDL information to a service broker, such as UDDI.
2. The service consumer can then use the service broker to find a Web service provider.
3. When the service consumer finds a Web service provider, the service consumer binds to the service provider so that the consumer can use the Web service.
4. The consumer invokes the service by exchanging SOAP (simple object access protocol) messages between the requester and provider.

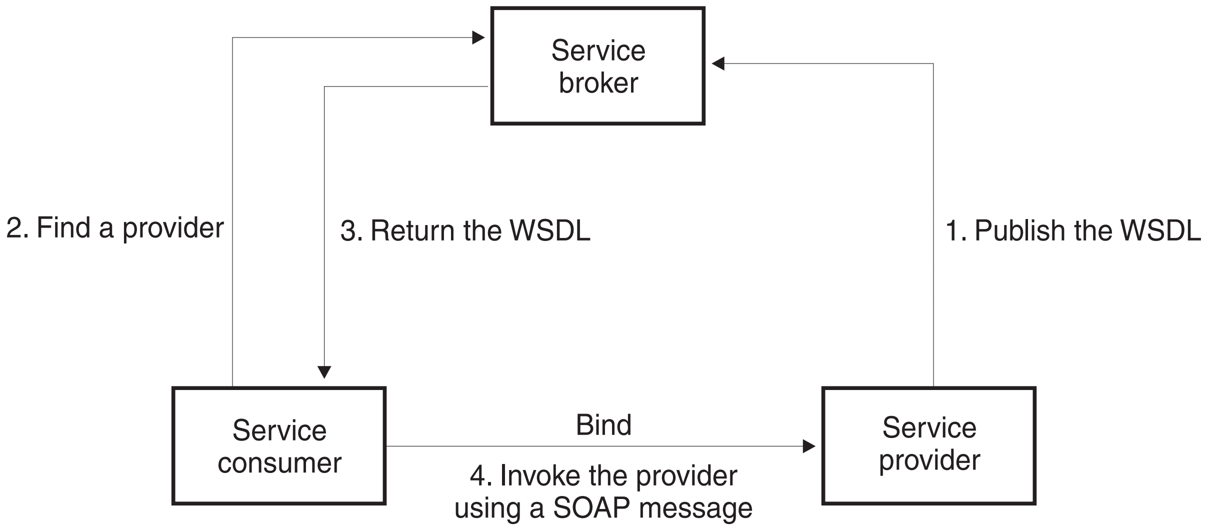


Figure 9. Web services: a service-oriented architecture

The SOAP specification defines the layout of an XML-based message. A SOAP message is contained in a SOAP envelope. The envelope consists of an optional SOAP header and a mandatory SOAP body. The SOAP header can contain information about the message, such as encryption information or authentication information. The SOAP body contains the message. The SOAP specification also defines a default encoding for programming language bindings, which is called the SOAP encoding.

The WSDL document and the Web service

The key to the Web service is the WSDL document. The WSDL document is an XML document that describes Web services in terms of the messages that it sends and receives. Messages are described by using a type system, which is typically the XML schema. A Web service operation associates a message exchange pattern with one or more messages. A message exchange pattern identifies the sequence and cardinality of messages that are sent or received, as well as who the messages are logically sent to or received from. An interface groups together operations without any commitment to the transport or wire format. A WSDL binding specifies transport and wire format details for one or more interfaces. An endpoint associates a network address with a binding. A service groups together endpoints that implement a common interface. The messages can contain document-oriented information or process-oriented information, which is also known as remote procedure calls (RPC). A WSDL document can contain one or more Web services.

The example in Figure 10 on page 215 shows the WSDL definition of a simple service that provides stock quotes. The Web service supports a single operation that is named GetLastTradePrice. The service can be accessed with the SOAP 1.1 protocol over HTTP. The request reads a ticker symbol as input, which is a string data type, and returns the price, which is a float data type. The string and float data types are predefined types in the XML schema standards. A Web service can also define data types and use those user-defined data types in messages. Predefined and user-defined XML data types map to columns of the nicknames. The complete example and the WSDL specification is at the W3C Web site.

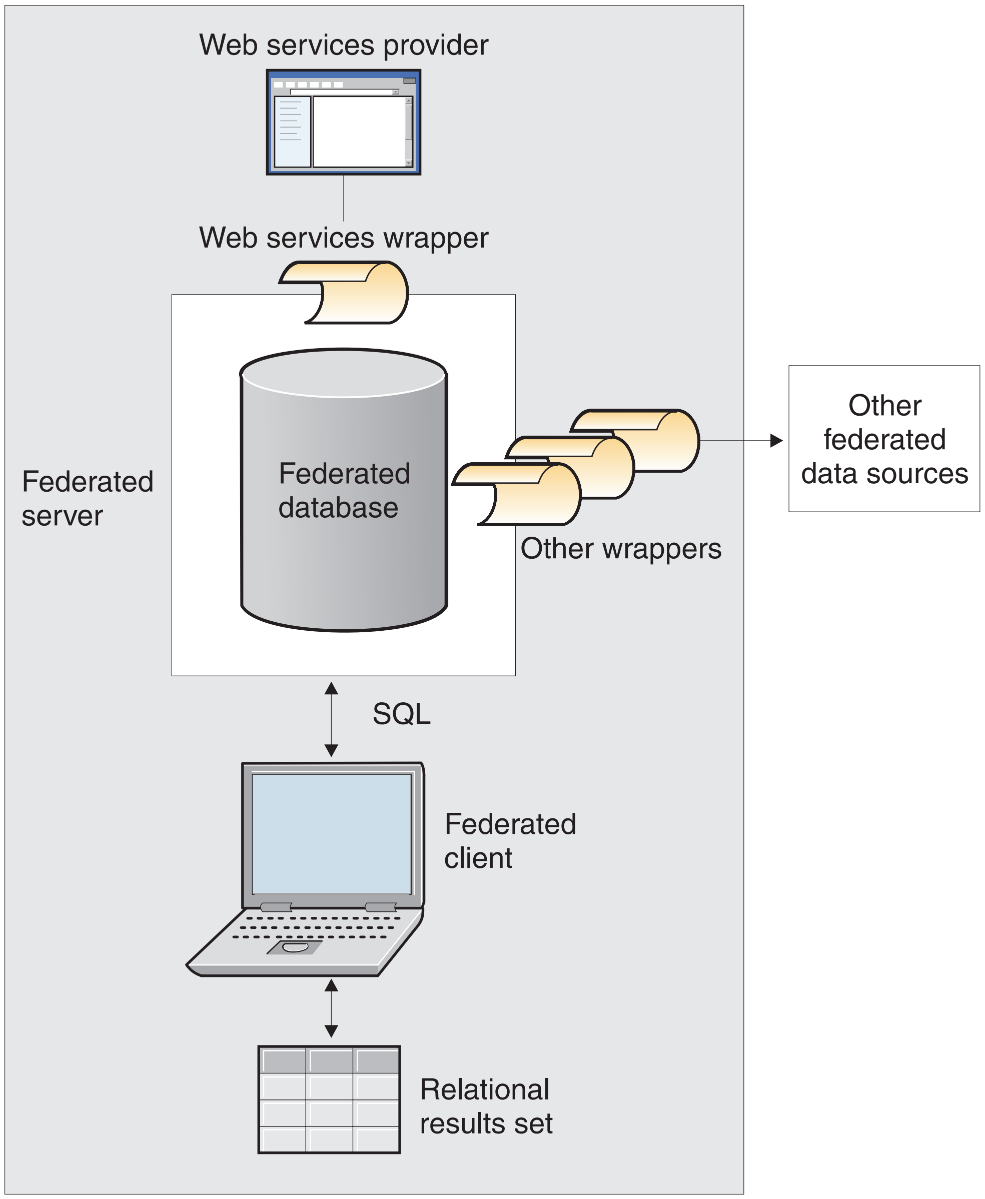
```
<?xml version="1.0"?>
<definitions name="StockQuote"
...


<types>
       <schema targetNamespace="http://example.com/stockquote.xsd"
              xmlns="http://www.w3.org/2000/10/XMLSchema">
           <element name="TradePriceRequest">
              <complexType>
                  <all>
                      <element name="tickerSymbol" type="string"/>
                  </all>
              </complexType>
           </element>
           <element name="TradePrice">
              <complexType>
                  <all>
                      <element name="price" type="float"/>
                  </all>
              </complexType>
           </element>
       </schema>
    </types>

<message name="GetLastTradePriceInput">
...
</message>

    <portType name="StockQuotePortType">
        <operation name="GetLastTradePrice">
           <input message="tns:GetLastTradePriceInput"/>
           <output message="tns:GetLastTradePriceOutput"/>
        </operation>
    </portType>


    <binding name="StockQuoteSoapBinding"
          type="tns:StockQuotePortType">
        <soap:binding style="document"
          transport="http://schemas.xmlsoap.org/soap/http"/>
        <operation name="GetLastTradePrice">
           <soap:operation soapAction="http://example.com/GetLastTradePrice"/>
           <input>
               <soap:body use="literal"/>
           </input>
           <output>
               <soap:body use="literal"/>
           </output>
        </operation>
    </binding>

   <service name="StockQuoteService">
        <documentation>My first service</documentation>
        <port name="StockQuotePort" binding="tns:StockQuoteBinding">
           <soap:address location="http://example.com/stockquote"/>
        </port>
    </service>
</definitions>
```

Figure 10. Example of a WSDL document

The WSDL document, Web services wrapper, and nicknames

The Web services wrapper uses the operations in a port type that have a SOAP binding with an HTTP transport. The input messages in the operation, and the associated types or elements become columns in the nickname. The output messages in the operation are extracted into the nickname hierarchy. You can create a separate hierarchy of nicknames for each operation in the WSDL document.

By using the Web services wrapper, you can use the federated systems functions to join data from Web services with data on other federated data sources.



The example Figure 11 on page 217 uses a WSDL document that contains a portType with an operation name of GETTEMP. With this Web service, you enter a zip code as input and receive a temperature for that zip code.

```
<?xml version="1.0"?>
<definitions name="TemperatureService" targetNamespace=http://www.xmethods.net/
   sd/TemperatureService.wsdl"
 xmlns:tns="http://www.xmethods.net/sd/TemperatureService.wsdl"
 xmlns:xsd="http://www.w3.org/2001/XMLSchema"
 xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
 xmlns="http://schemas.xmlsoap.org/wsdl/">
 <message name="getTempRequest">
   <part name="zipcode" type="xsd:string"/>
 </message>
<message name="getTempResponse">
   <part name="return" type="xsd:float"/>
</message>
<portType name="TemperaturePortType">
  <operation name="getTemp">
      <input message="tns:getTempRequest"/>
      <output message="tns:getTempResponse"/>
  </operation>
</portType>
<binding name="TemperatureBinding" type="tns:TemperaturePortType">
  <soap:binding style="rpc"
      transport="http://schemas.xmlsoap.org/soap/http" />
  <operation name="getTemp">
     <soap:operation soapAction="" />
    <input>
     <soap:body use="encoded" namespace="urn:xmethods-Temperature"
        encodingStyle="http://schemas.xmlsoap.org/soap/encoding/" />
    </input>
    <output>
      <soap:body use="encoded" namespace="urn:xmethods-Temperature"
         encodingStyle="http://schemas.xmlsoap.org/soap/encoding/" />
    </output>
  </operation>
</binding>
<service name="TemperatureService">
  <documentation>
      Returns current temperature in a given U.S. zipcode
  </documentation>
  <port name="TemperaturePort" binding="tns:TemperatureBinding">
     <soap:address
       location="http://services.xmethods.net:80/soap/servlet/rpcrouter" />
  </port>
</service>
</definitions>
```

Figure 11. GETTEMP Web service

The input value is described by the zipcode column of the nickname. The output value is described by the return column of the nickname. In the WSDL document, those columns are identified in the messages element. The messages element represents the logical definition of the data that is sent between the Web service provider and the Web service consumer. If more explanation of the information in the message element is needed, then the WSDL document can also contain a type element. The type element can refer to predefined types that are based on the XML schema specifications or types that are defined by a user.

The example Figure 12 on page 218 shows the nickname that the DB2® Control Center Discovery tool produces from the GETTEMP Web service WSDL document. The zipcode column is a required input column because of the nickname TEMPLATE syntax:

```
CREATE NICKNAME GETTEMP (
  ZIPCODE VARCHAR (48) OPTIONS(TEMPLATE '&column'),
   RETURN VARCHAR (48) OPTIONS(XPATH './return/text()')
   )
  FOR SERVER "EHPWSSERV"
   OPTIONS(URL 'http://services.xmethods.net:80/soap/servlet/rpcrouter',
           SOAPACTION ' ' ,
           TEMPLATE '<soapenv:Envelope>
                      <soapenv:Body>
                         <ns2:getTemp>
                           <zipcode>&zipcode[1,1]</zipcode>
                         </ns2:getTemp>
                      </soapenv:Body>
                    </soapenv:Envelope>',
           XPATH '/soapenv:Envelope/soapenv:Body/*' ,
           NAMESPACES ' ns1="http://www.xmethods.net/sd/TemperatureService.wsdl",
                        ns2="urn:xmethods-Temperature" ,
                          soapenv="http://schemas.xmlsoap.org/soap/envelope/"');
```

Figure 12. GETTEMP nickname

The nickname options in the Web services wrapper, URL and SOAPACTION, provide the ability to override the endpoint, or the address that you specified when you created the nickname. When you use the URLCOLUMN or SOAPACTIONCOLUMN enabled columns in a query, you can use dynamic addresses with the same nicknames. If you define the nickname options URL and SOAPACTION when you create a nickname and enable the URLCOLUMN and SOAPACTIONCOLUMN on the column option, then you are using the late binding functions of Web services wrappers. The value for the SOAPACTION nickname option becomes an attribute in the HTTP header. The value for the URL nickname option is the HTTP URL to which the request is sent.

The URL and SOAPACTION nickname options provide dynamic nickname associations. These dynamic addresses are useful if several companies implement a Web service portType. The Web services wrapper requires that the only differences between the WSDL documents are different URLs and SOAPACTIONS. You can use the late binding function to create and use the same nickname for different service endpoints that different companies might want to use. The URL and SOAPACTION values are derived from the WSDL document.

The following example shows how you can use the URLCOLUMN and SOAPACTIONCOLUMN column options:

```
CREATE NICKNAME GetPartQuote(
  partnumber INTEGER OPTIONS (TEMPLATE'&column'),
  price FLOAT OPTIONS (XPATH './price')),
  urlcol VARCHAR(100) OPTIONS (URLCOLUMN 'Y'),
  soapactioncol VARCHAR(100) OPTIONS (SOAPACTIONCOLUMN 'Y'),
 FOR SERVER myServer
  OPTIONS (
  ...
  SOAPACTION 'http://example.com/GetPartPrice' ,
  URL 'http://mycompany.com:9080/GetPartPrice'',
  ...
   )
```

Figure 13. GetPartQuote nickname

The following example uses the columns URLCOL and SOAPACTIONCOL that were defined with the URLCOLUMN column option enabled and the SOAPACTIONCOLUMN column option enabled:

```
SELECT * FROM supplier_endpoints p,
    GetPartQuote q
 WHERE partnumber=1234 AND
       p.url=q.urlcol AND
       p.soapaction=q.soapactioncol;
```

The SQL application can defer choosing which endpoints to use until the time that a query is run, instead of defining a specific endpoint at the time that the nickname is created.

The Web services wrapper can separate a large amount of WSDL document data into fragments to decrease the total memory that is used. Specify the **STREAMING** option in the DB2 Control Center in the Settings page of the Properties window, when you create a Web services nickname. The Web services wrapper processes the resulting stream of XML data and then extracts the information that is requested by a query fragment. The Web services wrapper parses one fragment at a time. Use the **STREAMING** option to parse large XML documents only.

Registering the Web services wrapper

You must register a wrapper to access Web services data sources. Wrappers are used by federated servers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

Before you begin

See the list of Web services wrapper library files for the correct name to specify in the CREATE WRAPPER statement.

The name of the wrapper library file that you specify depends on the operating system of the federated server.

Procedure

To register a wrapper:

Issue a CREATE WRAPPER statement with the name of the wrapper and the name of the wrapper library file. For example, to register a wrapper with the name websr_wrapper on a federated server that uses Windows, issue the following statement:

```
CREATE WRAPPER websr_wrapper LIBRARY 'db2ws.dll';
```

Web services wrapper library files

The Web services wrapper library files are added to the federated server when you install the federated server.

When you install IBM InfoSphere Federation Server, library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files added to the directory path are `libdb2ws.a`, `libdb2wsF.a`, and `libdb2wsU.a`. The default wrapper library file is `libdb2ws.a`. The other wrapper library files are used with specific wrapper options.

You must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 40. Library locations and file names for CREATE WRAPPER

Operating system	Directory path	Wrapper library file
AIX	/usr/opt/<install_path>/lib32/ /usr/opt/<install_path>/lib64/	libdb2ws.a
Linux	/opt/IBM/db2/<install_path>/lib32 /opt/IBM/db2/<install_path>/lib64	libsb2ws.so
Solaris	/opt/IBM/db2/<install_path>/lib32 /opt/IBM/db2/<install_path>/lib64	libdb2ws.so
Windows	%DB2PATH%\bin	db2ws.dll

- `<install_path>` is the directory path where the federated server is installed on Linux or UNIX.

  %DB2PATH% is the environment variable that is used to specify the directory path where the federated server is installed on Windows. The default Windows directory path is `C:\Program Files\IBM\SQLLIB`.

Registering the server definition for Web services data sources

You can register a server definition by using the DB2 Control Center or by using the DB2 command line. This task describes how to register a Web services server definition from the DB2 command line.

A server definition must be registered for each Web service that you want to access.

Procedure

To register a server definition to the federated system for the Web services wrapper, issue the CREATE SERVER statement.
For example, to register a Web services server definition named ws_server on Windows, issue the following statement:

```
CREATE SERVER ws_server WRAPPER websr_wrapper;
```

You can set optional timeout and proxy server parameters for the CREATE SERVER statement.

CREATE SERVER statement - Examples for Web services wrapper

Use the CREATE SERVER statement to register server definitions for the Web services wrapper with time out and proxy server settings.

Even if you are not using a proxy server to access Web services documents, you must still register a server definition. The hierarchy of federated objects requires that the Web services files are associated with a specific server definition object. The statement that you issue to register a server definition is:

```
CREATE SERVER my_server WRAPPER my_wrapper
   OPTIONS (TIMEOUT '60');
```

my_server
A name that you assign to the Web services server definition. Duplicate server definition names are not allowed.

WRAPPER my_wrapper
The wrapper name that you specified in the CREATE WRAPPER statement.

TIMEOUT ′60′
Specifies the time, in minutes, that the federated server should wait for a network transfer and the computation of a result.

Server definitions when a proxy server is used

You must use the proxy server options in the CREATE SERVER statement if all of the following conditions are true:
- You want to retrieve data by using a URI.
- The URI retrieves data from behind a firewall, through a proxy.
- The firewall or proxy is HTTP or SOCKS.

The options that you specify depend on the type of proxy server that you want to access.

Check with your network administrator for information about the type of proxy that you use, and the settings that you should specify in the proxy options.

Registering a server definition for an HTTP proxy server

To register a server definition and specify an HTTP proxy server, use the following statement:

```
CREATE SERVER ws_server_http
    WRAPPER ws_wrapper
    OPTIONS (PROXY_TYPE 'HTTP', PROXY_SERVER_NAME 'proxy_http',
        PROXY_SERVER_PORT '8080');
```

ws_server_http
A name that you assign to the Web services server definition. Duplicate server definition names are not allowed.

WRAPPER *ws_wrapper*
The wrapper name that you specified in the CREATE WRAPPER statement.

PROXY_TYPE *′HTTP′*
Specifies the proxy type that is used to access the Internet when behind a firewall.

PROXY_SERVER_NAME *′proxy_http′*
Specifies the proxy server name or IP address.

PROXY_SERVER_PORT *′8080′*
Specifies the proxy server port number.

Registering a server definition for a SOCKS proxy server with authentication information

To register a server definition and specify a SOCKS proxy server with authentication information, issue this statement:

```
CREATE SERVER ws_server_socks
    WRAPPER ws_wrapper
    OPTIONS (PROXY_TYPE 'SOCKS', PROXY_SERVER_NAME 'proxy_socks',
        PROXY_SERVER_PORT '1081', PROXY_AUTHID 'Sampson',
        PROXY_PASSWORD 'sailing4me');
```

PROXY_AUTHID *'Sampson'*
: Specifies the user name on the proxy server.

PROXY_PASSWORD *'sailing4me'*
: Specifies the password on the proxy server that is associated with the user name *Sampson*.

Enabling security through the Web services wrapper

The Web services wrapper supports HTTP authentication by using the CREATE USER MAPPING statement.

The Web services wrapper supports HTTPS as a transport protocol for SOAP messages. The WSDL document that is generated by the Web services provider contains https:// in the URL. Thus, the SOAP messages in the HTTP request or HTTP response are encrypted.

If the Web service uses HTTPS as a transport protocol, you can configure the wrapper to validate the SSL certificates that the server sends for identification by using the SSL_VERIFY_SERVER_CERTIFICATE wrapper or server option. The Web service wrapper can call Web services with self-signed certificates.

The user mapping is optional. If you do not specify a user mapping, you might see an error if the Web service provider expects authentication information. Some servers might use authentication to restrict access to a service. The need for authentication is not apparent from the information in the WSDL document.

Procedure

To map a federated server user ID to a Web services user ID and password:

Issue the CREATE USER MAPPING statement.

For example, with the following CREATE USER MAPPING statement, when the Web services nickname on the S1 server is accessed, the HTTP request is sent with SYSTEM as the user ID and MANAGER as the password.

```
CREATE USER MAPPING
  FOR RSPALTEN SERVER S1
  OPTIONS ( REMOTE_AUTHID 'SYSTEM', REMOTE_PASSWORD 'MANAGER'
   PROXY_AUTHID 'ID' PROXY_PASSWORD 'PWD'
   SSL_CLIENT_CERTIFICATE_LABEL 'LABEL');
```

Registering nicknames for Web services data sources

For each Web services server definition that you register, you must register a nickname for each data source that you want to access. You can register a nickname by using the command line or the DB2 Control Center.

To register nicknames for Web services data sources:

Select one of the following methods:

- "Registering nicknames for Web services data sources (DB2 command line)" on page 223

- "Registering nicknames for Web services data sources (DB2 Control Center)"

Registering nicknames for Web services data sources (DB2 command line)

For each Web services server definition that you register, you must register a nickname for each data source that you want to access. Use these nicknames instead of the names of the data sources when you query the Web services data sources.

Before you begin

You must have access to a valid WSDL document that describes the Web service with which you want to communicate.

Restrictions

- Only request-response operations are supported.
- A SOAP binding with an HTTP transport is the only binding that is supported.
- You must use either the TEMPLATE option or the XPATH option on each column, except for the special columns with the SOAPACTIONCOLUMN, URLCOLUMN, PRIMARY_KEY, or FOREIGN_KEY options.

You create one nickname hierarchy for each Web service operation that is defined in the Web services description language (WSDL) document. The parent nickname identifies the SOAP envelope; child nicknames identify the SOAP body elements and the optional SOAP header.

Procedure

To register nicknames for Web services data sources from the DB2 command line:

Issue a CREATE NICKNAME statement. For example, to register the nicknames on Windows for a Web service named GETTEMP, issue the following statement:

```
CREATE NICKNAME GETTEMP (
  ZIPCODE VARCHAR (48) OPTIONS(TEMPLATE '&column'),
   RETURN VARCHAR (48) OPTIONS(XPATH './return/text()')
   )
  FOR SERVER "EHPWSSERV"
   OPTIONS(URL 'http://services.xmethods.net:80/soap/servlet/rpcrouter',
           SOAPACTION ' ' ,
           TEMPLATE '<soapenv:Envelope>
                        <soapenv:Body>
                           <ns2:getTemp>
                             <zipcode>&zipcode[1,1]</zipcode>
                           </ns2:getTemp>
                        </soapenv:Body>
                      </soapenv:Envelope>',
           XPATH '/soapenv:Envelope/soapenv:Body/*' ,
           NAMESPACES ' ns1="http://www.xmethods.net/sd/TemperatureService.wsdl",
                        ns2="urn:xmethods-Temperature" ,
                          soapenv="http://schemas.xmlsoap.org/soap/envelope/"');
```

Registering nicknames for Web services data sources (DB2 Control Center)

For each Web services server definition that you register, you must register a nickname for each data source that you want to access. Use these nicknames instead of the names of the data sources when you query the Web services data sources.

Before you begin

You must have access to a valid WSDL document that describes the Web service with which you want to communicate.

Restrictions

- Only request-response operations are supported.
- A SOAP binding with an HTTP transport is the only binding that is supported.
- You must use either the TEMPLATE option or the XPATH option on each column, except for the special columns with the SOAPACTIONCOLUMN, URLCOLUMN, PRIMARY_KEY or FOREIGN_KEY options.

You create one nickname hierarchy for each Web service operation that is defined in the Web services description language (WSDL) document. The parent nickname identifies the SOAP envelope; child nicknames identify the SOAP body elements and the optional SOAP header.

In the DB2 Control Center, you can use the Discovery tool to create the nicknames. The input to the Discovery tool is a URL of the location of a WSDL document. The Discovery tool creates nicknames as a result of processing the WSDL document. The DB2 Control Center generates unique nicknames by grouping part names or element names with the column name from the WSDL document. The WSDL document can contain schema definitions that are embedded in the WSDL file or in an external XML schema file that is imported in the WSDL file. These schema definitions are imported by using a URL address.

When the DB2 Control Center generates a child nickname that is only used for input, the XPATH statement contains a period, such as in the following example:

```
XPATH '.'
```

Procedure

To register nicknames for Web services data sources from the DB2 Control Center:

1. Expand the **Federated Database Objects** folder.
2. Expand the wrapper folder for which you want to register nicknames.
3. Expand the **Server Definitions** folder.
4. Expand the server folder for which you want to register nicknames.
5. Right click the **Nicknames** folder and select **Create**.
6. In the Create Nicknames window, click **Discover** to define search criteria to help you select objects at the data source.
7. Specify the WSDL document that contains the definition of the Web service that you want federated system users to access. The WSDL document can be a local document or you can specify its location by using a URL.
8. Click **OK** to create the nickname according to the selected WSDL document.

The DB2 Control Center extracts the WSDL document into multiple create-nickname DDL statements, with the appropriate parent-child relationship definitions. The data definition language (DDL) statement that the DB2 Control Center generates maps all input elements to columns of the root nickname in the nickname hierarchy.

CREATE NICKNAME statement - examples for the Web services wrapper

When you create a nickname to access a Web service, you create an input column for each value in the input message of a Web service operation and an output column for each value in the output message of a Web service operation. You control the input and output column definitions with the nickname column option definitions.

The TEMPLATE column option specifies that a column is an input column. The XPATH column option specifies that a column is an output column. When the TEMPLATE nickname option contains a bracketed notation `([1,1])`, the column is a required input column.

The NAMESPACES nickname option is a comma-separated list of name-value pairs that a federated system uses to resolve the namespaces for elements in input and output XML documents. The namespaces are used in the message request so that the prefixes in the TEMPLATE nickname option are defined. The NAMESPACES nickname option resolves the prefixes in XPath expressions with the namespace URIs that are defined in the WSDL or XML schemas. The XPath expressions are applied on the XML document that is returned from the Web service.

Example 1: Required input columns

The following example shows a nickname for a Web service named getQuote. The Web service reads a stock ticker symbol and returns a trading price. The following DDL statement is created by the Discovery tool in the DB2 Control Center.

```
CREATE NICKNAME "stockquote.stockquoteport_getquote_nn" (
 symbol VARCHAR (48) OPTIONS(TEMPLATE '&column'),
 result VARCHAR (48) OPTIONS(XPATH './Result/text()'))
FOR SERVER "xmethods_server"  OPTIONS(
 URL 'http://66.28.98.121:9090/soap' ,
 SOAPACTION 'urn:xmethods-delayed-quotes#getQuote' ,
 TEMPLATE '<soapenv:Envelope>
                  <soapenv:Body>
                   <ns2:getQuote>
                     <symbol>&symbol[1,1]</symbol>
                   </ns2:getQuote>
                  </soapenv:Body>
                 </soapenv:Envelope>',
   XPATH '/soapenv:Envelope/soapenv:Body/*' ,
   NAMESPACES 'ns2="urn:xmethods-delayed-quotes" ,
              ns1="http://www.example.com/wsdl/
                  net.xmethods.services.stockquote.StockQuote/" ,
                  soapenv="http://schemas.xmlsoap.org/soap/envelope/" ');
```

The nickname TEMPLATE option specifies the column SYMBOL as a required input column, because the column contains the [1,1] designation. In the nickname TEMPLATE option, the complete SOAP envelope is specified for the Web service. The getQuote input value is contained in the SOAP envelope and body elements. The XPATH nickname option contains the information to find the trading price value through the SOAP envelope and body tags.

Use the stockquote.stockquoteport_getquote_nn nickname to access the Web service, such as in the following query:

```
SELECT * FROM "stockquote.stockquoteport_getquote_nn"
  WHERE symbol='IBM';
```

You must use the predicate, `symbol='IBM'`, in this statement because `symbol` is a required input column. The equality predicate is the only valid predicate on input columns. Each of the equality predicates sets a value in the input message. If the input column is optional, an equality predicate on that column is not necessary. If the input column is required, then you must issue the query with an equality predicate. You can use a literal value such as `IBM` in an equality expression or a value from a joined table or nickname.

Example 2: Repeating elements and child nicknames

The following example uses a Web service named getZooReport that produces a report for zoos. The input value is a zoo identifier. The output value is a report that is described by the following schema:

```
<wsdl:definitions name="Name"
    targetNamespace="http://myzoo.com"
...
<wsdl:types>
 <xsd:schema elementFormDefault="qualified" targetNamespace="http://myzoo.com"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema">
   <xsd:element name="Animal">
      <xsd:complexType>
         <xsd:sequence>
          <xsd:element ref="tns:Name"/>
          <xsd:element ref="tns:Species"/>
          <xsd:element ref="tns:Lot"/>
         </xsd:sequence>
      </xsd:complexType>
  </xsd:element>
  <xsd:element name="AnimalCareList">
     <xsd:complexType>
       <xsd:sequence>
         <xsd:element maxOccurs="unbounded" minOccurs="1" ref="tns:Animal"/>
       </xsd:sequence>
     </xsd:complexType>
  </xsd:element>
  <xsd:element name="Count" type="xsd:string"/>
  <xsd:element name="LastModified" type="xsd:string"/>
  <xsd:element name="Lot" type="xsd:string"/>
  <xsd:element name="Name" type="xsd:string"/>
  <xsd:element name="NumberOfCages" type="xsd:string"/>
  <xsd:element name="Species" type="xsd:string"/>
  <xsd:element name="Zoo">
     <xsd:complexType>
       <xsd:sequence>
         <xsd:element ref="tns:ZooName"/>
         <xsd:element ref="tns:Count"/>
         <xsd:element ref="tns:LastModified"/>
         <xsd:element maxOccurs="unbounded" minOccurs="0" ref="tns:Zookeeper"/>
       </xsd:sequence>
       <xsd:attribute name="id" type="xsd:string" use="optional"/>
      </xsd:complexType>
 </xsd:element>
 <xsd:element name="ZooName" type="xsd:string"/>
 <xsd:element name="Zookeeper">
     <xsd:complexType>
       <xsd:sequence>
         <xsd:element ref="tns:Name"/>
         <xsd:element ref="tns:NumberOfCages"/>
         <xsd:element ref="tns:AnimalCareList"/>
       </xsd:sequence>
      <xsd:attribute name="id" type="xsd:string" use="optional"/>
    </xsd:complexType>
</xsd:element>
</xsd:schema>
</wsdl:types>
...
```

Figure 14. getZooReport Web service

The following DDL statement is generated by the DB2 Control Center Discovery tool that is based on the WSDL that contains the schema:

```
CREATE NICKNAME zooport_getzooreport_nn (
 zooid VARCHAR (48) OPTIONS(TEMPLATE '&column'),
 zoo_id VARCHAR (48) OPTIONS(XPATH './ns1:Zoo/@ns1:id'),
 report_zooname VARCHAR (48) OPTIONS(XPATH './ns1:Zoo/ns1:ZooName/text()'),
 report_count VARCHAR (48) OPTIONS(XPATH './ns1:Zoo/ns1:Count/text()'),
 report_lastmodified VARCHAR (48)
       OPTIONS(XPATH './ns1:Zoo/ns1:LastModified/text()'),
 zooport_getzooreport_pkey VARCHAR (16) FOR BIT DATA NOT NULL
       OPTIONS(PRIMARY_KEY 'YES'))
FOR SERVER "zooserver"  OPTIONS(
 URL 'http://localhost:9080/MaelstromTest/services/ZooPort' ,
 SOAPACTION 'http://myzoo.com/getZooReport' ,
 TEMPLATE '<soapenv:Envelope>
              <soapenv:Body>
                <zooId>&zooId[1,1]</zooId>
              </soapenv:Body>
             </soapenv:Envelope>' ,
 XPATH '/soapenv:Envelope/soapenv:Body' ,
     NAMESPACES ' soapenv="http://schemas.xmlsoap.org/soap/envelope/" ,
                  ns1="http://myzoo.com " ');
```

Figure 15. Parent nickname - zooport_getzooreport_nn

```
CREATE NICKNAME zooport_getzooreport_report_nn (
 zooport_getzooreport_fkey VARCHAR (16)
        FOR BIT DATA NOT NULL
           OPTIONS(FOREIGN_KEY 'ZOOPORT_GETZOOREPORT_NN'),
   zookeeper_id VARCHAR (48) OPTIONS(XPATH './ns1:Zookeeper/@ns1:id'),
   report_name VARCHAR (48) OPTIONS(XPATH './ns1:Zookeeper/ns1:Name/text()'),
   report_numberofcages VARCHAR (48)
           OPTIONS(XPATH './ns1:Zookeeper/ns1:NumberOfCages/text()'),
   zooport_getzooreport_pkey VARCHAR (16)
           FOR BIT DATA NOT NULL OPTIONS(PRIMARY_KEY 'YES'))
  FOR SERVER "zooserver"  OPTIONS(
        XPATH './ns1:Zoo' ,
        NAMESPACES ' soapenv="http://schemas.xmlsoap.org/soap/envelope/" ,
               ns1="http://myzoo.com" ');
```

Figure 16. Child of nickname zooport_getzooreport_nn

```
CREATE NICKNAME zooport_getzooreport_report_report_nn (
        zooport_getzooreport_fkey VARCHAR (16) FOR BIT DATA NOT NULL
             OPTIONS(FOREIGN_KEY 'zooport_getzooreport_report_nn'),
        report_name VARCHAR (48)
             OPTIONS(XPATH './ns1:Animal/ns1:Name/text()'),
        report_species VARCHAR (48)
             OPTIONS(XPATH './ns1:Animal/ns1:Species/text()'),
        report_lot VARCHAR (48) OPTIONS(XPATH './ns1:Animal/ns1:Lot/text()'))
 FOR SERVER "zooserver"  OPTIONS(
        XPATH './ns1:Zookeeper/ns1:AnimalCareList' ,
        NAMESPACES ' soapenv="http://schemas.xmlsoap.org/soap/envelope/" ,
                  ns1="http://myzoo.com" ');
```

Figure 17. Child of zooport_getzooreport_report_nn

The schema includes some elements that are repeated, known as sequence elements. These repeated elements become child nicknames of the parent nickname, as shown in Figure 15, Figure 16, and Figure 17. For example, zooname, count, lastmodified, and zookeeper are all elements of zoo. The element zoo contains 0 or more zookeeper elements. The root nickname, zoo, contains the columns zooname, count, and lastmodified. A child nickname, zookeeper, is created by the DB2 Control Center Discovery tool to describe the repeating elements of zookeeper. The third element in the zookeeper column, animalcarelist, also contains 0 or more elements and so it becomes a child nickname, zooport_getzooreport_report_report_nn. The following figure shows the nickname hierarchy:

Root nickname: zooport_getzooreport_nn

Zoo (parent):

- ZooName
- Count
- LastModified
- ZooKeeper (there are 0 or more ZooKeeper elements)

  Child nickname: zooport_getzooreport_report_nn

  ZooKeeper elements

  – Name
  – NumberOfCages
  – AnimalCareList (there are 0 or more Animal elements)

    Child nickname: zooport_getzooreport_report_report_nn

    Animal

    - Name
    - Species
    - Lot

Figure 18. Parent -> Child -> nickname hierarchies

The following statement is a typical query that you might issue on the nicknames to access the zoo report Web service. When you issue this statement, you retrieve the information from the zoo report based on a specific identifier and on where the primary and foreign keys of the child nickname zoo reports match.

```
SELECT * FROM zooport_getzooreport_nn ,
        zooport_getzooreport_report_nn zk ,
        zooport_getzooreport_report__report__nn a
    WHERE zooid='1'AND zooport_getzooreport_pkey=zk.zooport_getzooreport_fkey
    and zk.zooport_getzooreport_pkey=a.zooport_getzooreport_fkey;
```

Example 3: Late binding

The following example shows how you can use the late binding option. You can use this option from the DB2 Control Center or from a DB2 command line. If you define the nickname options URL and SOAPACTION and if you enable the column options URLCOLUMN and SOAPACTIONCOLUMN when you create a nickname, you are using the late binding functions. The DB2 Control Center creates the column options, URLCOLUMN and SOAPACTIONCOLUMN, and sets the values of the columns to `yes`.

The following example is for a Web service that provides price quotes for parts that is implemented by all suppliers for a company. Here is the CREATE NICKNAME statement that includes the URLCOLUMN and SOAPACTIONCOLUMN definitions:

```
CREATE NICKNAME GetPartQuote(
  partnumber INTEGER OPTIONS (TEMPLATE'&column'),
  price FLOAT OPTIONS (XPATH './price')),
  urlcol VARCHAR(100) OPTIONS (URLCOLUMN 'Y'),
  soapactioncol VARCHAR(100) OPTIONS (SOAPACTIONCOLUMN 'Y'),
 FOR SERVER myServer
  OPTIONS (
  ...
  SOAPACTION 'http://example.com/GetPartPrice' ,
  URL 'http://mycompany.com:9080/GetPartPrice'',
  ...
   )
```

To get price quotes from all of the suppliers with a single query, the values that each supplier uses for the SOAPACTION and URL column options are needed. The query looks like this:

```
SELECT * FROM supplier_endpoints p,
    GetPartQuote q
 WHERE partnumber=1234 AND
       p.url=q.urlcol AND
       p.soapaction=q.soapactioncol;
```

Local table supplier_endpoints contains all of the URLs and SOAP addresses with which you can call the Web service. You can include an ORDER BY price clause to determine the least expensive supplier for this part.

Example 4: ESCAPE_INPUT column option

You can include XML fragments as input values in your query. When you register a nickname, include the column option ESCAPE_INPUT=N. This option maintains the special characters, such as angle brackets (< and >) in XML fragments in the input values.

When a schema contains repeating input values that requires you to send XML as part of the SOAP message, you can use the ESCAPE_INPUT column option to build the output message with the correct XML.

For example, the zoo Web service includes an operation to add a new zoo keeper and the animals that are associated with that zoo keeper. In the schema for this example, an AnimalCareList can have multiple animals.

```
CREATE NICKNAME add_zookeeper(
 zookeeper_id VARCHAR(48)  OPTIONS(TEMPLATE '...'),
 name VARCHAR(48) OPTIONS(TEMPLATE '...'),
 numberofcages VARCHAR(48) OPTIONS(TEMPLATE '...'),
 animals VARCHAR(3000) OPTIONS( TEMPLATE '...' , ESCAPE_INPUT 'N')
...
```

To add a new zoo keeper with two animals, issue a query such as the following example:

```
SELECT * FROM add_zookeeper
  WHERE zookeeper_ID='37' AND
        name='Amit Kapoor' AND
        numberofcages='3'  AND
        animals='<AnimalCareList xmlns="http://myzoo.com">
                  <Animal>
                    <Name>Larry</Name>
                    <Species>Gorilla</Species>
                    <Lot>7</Lot>
                  </Animal>
                  <Animal>
                    <Name>Bill</Name>
                    <Species>Chimpanzee</Species>
                    <Lot>8H</Lot>
                  </Animal>
                </AnimalCareList>';
```

The add_zookeeper nickname is a Web service operation that can change the state of the Web service, or update information. Although nonrelational wrappers cannot be updated, the SELECT statement in this example updates the zoo information to add a new zoo keeper.

You can also use the ESCAPE_INPUT column option for a schema with an element such as xsd:anyType. In this case, the type of the element is unknown. You can use the ESCAPE_INPUT column option on the input column for that element so that you can specify arbitrary XML fragments for your input.

SOAP header access

Use the Web Service wrapper to access Simple Object Access Protocol (SOAP) header values that are embedded in a SOAP message.

A SOAP message, either a request or response, consists of an envelope that contains the namespaces that are used by the rest of the SOAP message, an optional header, and a body. A SOAP header typically contains metadata about the SOAP message or other optional information. The SOAP message travels from a source to a destination by passing through a series of intermediary services that process the message or its side-effects. For example, a message may pass through a transaction service that provides the client with guaranteed invocation if the network fails, or a security service that is located at an enterprise portal may provide authentication information. These intermediaries often work on the metadata contained in the SOAP header.

SOAP headers often contain optional information or support evolving user interfaces. For example, a bank allows customers to use ATM cards to withdraw money from their checking accounts. However, some customers have more than one account. If a customer has multiple accounts, the bank must be able to identify the account from which the withdrawal is made.

Using this example, the following is the header element that specifies a bank account:

```
<xsd: element name="AccountID" type="xsd:int"/>
```

The following is a SOAP message that uses this header element. In this case, the customer selected to withdraw $1,000 from account 1 and incurred a transaction fee of 50 cents.

```
<SOAP-ENV:Envelope>
   <SOAP-ENV:Header>
     <tns:AccountID>1</tns:AccountID>
   </SOAP-ENV:Header>
   <SOAP-ENV:Body>
      <tns:Action>withdrawal</tns:Action>
      <tns:Amount>1000</tns:Amount>
      <tns:Fee>0.50</tns:Fee>
   </SOAP-ENV:Body>
<SOAP-ENV:Envelope>
```

SOAP headers have these requirements:

- soapenv:Header is an optional element under soapenv:Envelope.
- If it is used, the SOAP header must be the first element.

- All children under soapenv:Header must be namespace-qualified.
- A soapenv:Header can have these attributes: actor, mustUnderstand, and encoding style.

The nickname hierarchy for accessing SOAP headers requires that the root nickname point to the SOAP envelope. The header and the body elements are child nicknames of the root nickname. You can create the nicknames yourself or use the Control Center to generate the nicknames automatically. Then you can create queries that access the information that is stored in the SOAP header.

Example

These CREATE NICKNAME statements illustrate how to create root, body, and header nicknames.

```
CREATE NICKNAME STOCKSERVICE_GETLASTSELLPRICE_ROOT_NN
   (NN_PKEY VARCHAR(16)NOT NULL OPTIONS(PRIMARY_KEY 'YES'))
FOR SERVER "WSSERVER_HDR"
OPTIONS
   (URL 'http://wswrap.svl.ibm.com:9081/StockPrice/services/StockService' ,
   SOAPACTION ' ' , TEMPLATE
  '<soapenv:Envelope>&STOCKSERVICE_GETLASTSELLPRICE_HEADER_NN[1,1]
   &STOCKSERVICE_GETLASTSELLPRICE_BODY_NN[1,1]</soapenv:Envelope>', XPATH
  '/soapenv:Envelope',
   NAMESPACES 'soapenv="http://schemas.xmlsoap.org/soap/envelope/",
  ns1="http://soapheader.ibm.com"');

CREATE NICKNAME STOCKSERVICE_GETLASTSELLPRICE_HEADER_NN
   (NN_PKEY VARCHAR(16)NOT NULL OPTIONS(PRIMARY_KEY 'YES'),
   NN_FKEY VARCHAR (16) NOT NULL OPTIONS(FOREIGN_KEY
  'STOCKSERVICE_GETLASTSELLPRICE_ROOT_NN'),
   QUOTE_TIMESTAMP VARCHAR(30)OPTIONS(TEMPLATE '&column'))
FOR SERVER "WSSERVER_HDR"
OPTIONS
   (XPATH './soapenv:Header',TEMPLATE '<soapenv:Header>
   <ns1:quote_timestamp>&quote_timestamp[1,1]
   </ns1:quote_timestamp></soapenv:Header>',
   NAMESPACES 'ns1="http://soapheader.ibm.com",soapenv=
   "http://schemas.xmlsoap.org/soap/envelope/" ');

CREATE NICKNAME STOCKSERVICE_GETLASTSELLPRICE_BODY_NN
   (NN_PKEY VARCHAR(16)NOT NULL
   OPTIONS(PRIMARY_KEY 'YES'), NN_FKEY VARCHAR 16)NOT NULL
   OPTIONS(FOREIGN_KEY 'STOCKSERVICE_GETLASTSELLPRICE_ROOT_NN'),
   GETLASTSELLPRICE_TICKER VARCHAR (48)
   OPTIONS(TEMPLATE '&column'), GETLASTSELLPRICERETURN VARCHAR (48
   OPTIONS(XPATH
   './ns1:getLastSellPriceResponse/ns1:getLastSellPriceReturn/text()'))
FOR SERVER "WSSERVER_HDR"
   OPTIONS
   (TEMPLATE '<soapenv:Body><ns1:getLastSellPrice>
   <ns1:ticker>&getLastSellPrice_ticker[1,1]
   </ns1:ticker></ns1:getLastSellPrice></soapenv:Body>',
   XPATH './soapenv:Body',
   NAMESPACES ' soapenv="http://schemas.xmlsoap.org/soap/envelope/" ,
   ns1="http://soapheader.ibm.com" ');
```

The following query returns the price of IBM stock for a specific date and time:

```
SELECT * from
   STOCKSERVICE_GETLASTSELLPRICE_ROOT_NN as a,
   STOCKSERVICE_GETLASTSELLPRICE_HEADER_NN as b,
   STOCKSERVICE_GETLASTSELLPRICE_BODY_NN as c
where
```

```
a.nn_pkey = b.nn_fkey and
a.nn_pkey = c.nn_fkey and
b.QUOTE_TIMESTAMP='2007-05-09T18:30:20.000Z'and
c.GETLASTSELLPRICE_TICKER='IBM';
```

Nicknames and XPath expressions

The Web services wrapper uses nicknames that correspond to the tree structure of XML data. Each nickname is defined by XPath expressions that represent output values.

Nicknames correspond to the tree structure of your XML document data. Parent nicknames and child nicknames correspond to the root structure and nested elements of the data tree structure. These parent and child nicknames are connected by primary and foreign keys that are specified with the CREATE NICKNAME statement.

Each nickname is defined by XPath expressions that represent output values. The Web services wrapper uses XPath expressions to establish a correspondence between the data in an XML document and the rows in a relational table. These XPath expressions identify the values in the XML document and determine how these values correspond to the columns of each row. The wrapper only reads the XML data and does not update the document. The XPath option contains the information to find the SOAP messages through the SOAP envelope and SOAP body tags. The getQuote message is contained in the SOAP envelope and body elements.

The XPath expression for the NICKNAME option points to repeating tags that are in the output element. The XPath expression determines how many or which rows will be in the nickname. The column option XPath expression is relative to the NICKNAME XPath expression. The column option XPath identifies the values in a row. A NICKNAME option XPath in a child nickname is relative to a NICKNAME option XPath expression in a parent nickname.

When you create a nickname, you choose options in a Web services description language (WSDL) document that specify the association between the nickname and the XML document.

TEMPLATE option at the nickname and column levels

When a nickname is created, the Web services wrapper requires the nickname-level and the column-level template fragments, which is the TEMPLATE option on the CREATE NICKNAME statement.

The Web services wrapper builds XML documents that are required by the Web services environment. The wrapper uses this information during the query planning and the query execution phases.

The TEMPLATE option for the Web services wrapper:

The Web services wrapper needs the TEMPLATE option on the CREATE NICKNAME statement at the time that the nickname is created.

Web services wrapper

For the Web services wrapper, the required and optional attributes vary according to the definitions in the WSDL document and how a column is derived. A column can be derived from either an element or an attribute of an element.

- If the column is derived from an element, then the minOccurs value determines if a column is optional.
- If the value of minOccurs equals 0, then the column is optional.
- If the value of minOccurs equals 1, then the column is required.
- If the column is derived from an attribute of an element, then the value of use on the attribute determines if a column is optional.
- If an attribute contains the value use=optional, then the column is optional.
- If an attribute contains the value use=required, then the column is required.

The following example is an attribute in a schema definition that is associated with a column:

```
<xsd:complexType>
  <xsd:sequence>
    <xsd:element ref="tns:ZooName"/>
    <xsd:element ref="tns:Count"/>
    <xsd:element ref="tns:LastModified"/>
    <xsd:element maxOccurs="unbounded" minOccurs="0" ref="tns:Zookeeper"/>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:string" use="optional"/>
</xsd:complexType>
```

Creating federated views for Web services nicknames

Create federated views for Web services nicknames to ensure that queries that join pieces of a Web services nickname hierarchy run properly.

You can define federated views for the hierarchy of nicknames that describe a Web services document. A federated view ensures that the queries that join pieces of a Web services nickname hierarchy can run properly.

The Web services wrapper requires joins from any child nickname to include all nicknames back to the parent nickname. A SELECT statement on only a child nickname fails if the parent nickname is not included in the statement. The preferred method of including all required nicknames in a query is to define a federated view.

Procedure

To create federated views for Web services nicknames:

1. Define a view that includes all of the nicknames that are related to an operation in the Web service if you want to join those nicknames.
2. In the WHERE clause of the view, use join predicates for all columns that are related by the PRIMARY_KEY and FOREIGN_KEY column options.

In the following example, the primary key is on column `ooport_getzooreport_pk` in nickname `zooport_getzooreport_report_nn`. The foreign key is on column `ooport_getzooreport_fkey` in nickname `zooport_getzooreport_report_report_nn`.

```
CREATE VIEW zooreport
  (zooid, zooname, number_of_zookeeper,
   lastmodified,zookeeper_id, zookeeper_name,
   cages, animal_name, animal_species, animal_lot)
AS ( SELECT zooid, report_zooname,
      report_count, report_lastmodified,
      zookeeper_id, zk.report_name, report_numbercages,
      a.report_name, report_species,
      report_lot
     FROM zooport_getzooreport_nn ,
         zooport_getzooreport_report_nn as zk,
          zooport_getzooreport_report_report_nn as a
     WHERE zk.ooport_getzooreport_pkey=a.ooport_getzooreport_fkey
      AND zooport_getzooreport_pkey=zk.ooport_getzooreport_fkey);
```

You can get information from all of the nicknames with the following SELECT statement:

```
SELECT * FROM zooreport WHERE zooid='1';
```

Query restrictions for Web services wrappers

The use of query predicates and joins are restricted for Web services as shown in examples provided.

Equal predicates

The only valid predicates on input columns are equal predicates. For output columns, any predicate is valid.

The following example returns an error with a message that indicates that the predicate is not supported on that column. In this example, the column zipcode is an input column:

```
SELECT return FROM gettemp WHERE zipcode<'95141'
```

The following example shows a valid query using an equal predicate on the input columns. The customers nickname is joined with a local table that contains customer IDs. The query contains an additional predicate on the Sales column, which is an output-only column.

```
SELECT a.name, a.address
  FROM customers a, local_table b
  WHERE
    a.customer_id=b.custid AND
    a.Sales > 300000;
```

Predicates for required input columns

You must provide equality predicate values for all required input columns in your SQL queries for the nickname hierarchy that you reference. The wrapper returns an SQLCODE -901 for all queries that violate this restriction.

IN or OR predicates

For Web services wrappers, no IN or OR predicates are allowed for input columns.

The following examples show invalid queries. The customers nickname has one required input column, customer_id:

```
SELECT * FROM customers
  WHERE customer_id IN (12345, 67890, 11223);
SELECT * FROM customers
  WHERE customer_id IN (SELECT custid FROM local_table);  )
```

Joins on optional input columns

The following examples demonstrate a restriction on joining optional input columns and on using host variables. You cannot join optional input columns from a local table or nickname. If the WSDL generates an input nickname column as optional and you need to use that column in a join, then you must edit the DDL statement to change the column to a required input column.

In this example, a Web service wrapper nickname named order is created with shipping_method as an optional input column. The following statement is a valid query because it uses a literal in the predicate:

```
SELECT * FROM order
  WHERE part="hammer" AND shipping_method="FEDEX";
```

However, if you include a local table named orderparts, which defines parts and shipping methods, in the query, and the table contains a column named shipping_method that is optional, the statement is invalid:

```
SELECT * FROM
   order o, orderparts op
  WHERE
     o.part="hammer" AND
     o.shipping_method=op.shipping_method
```

If you use host variables in queries with predicates on optional input columns, the statement is also invalid:

```
SELECT * FROM
   order o
  WHERE
     o.part="hammer" AND
     o.shipping_method=:ashipping_method
```

To ensure valid results, joined input columns must be required columns for Web Services wrappers.

Outer joins

Outer joins between nicknames using the primary key from a parent nickname and the foreign key from child nickname columns are not supported.

When a parent element in an XML document contains no child elements, and if you use an inner join between the parent nickname and the child nickname, then no rows are returned for that element. For example, for a given customer, if there is no bankdetail information in the SAP system, then no rows are returned for the sap_bapi_customer_getdetail2_sap_customerbankdetail_NN nickname for the particular customer.

The following CREATE NICKNAME statements define the columns that are used in the example query:

```
CREATE NICKNAME sap_bapi_customer_getdetail2_NN(
 ...
 NAME VARCHAR(35)
     OPTIONS(XPATH './ns3:sap_customeraddress/
           ns1:sap_customeraddress/ns1:NAME/text()'),
 ...
 NN__PKEY VARCHAR(16)  OPTIONS(PRIMARY_KEY 'YES'),
 COMPANYCODE VARCHAR(4)  OPTIONS(XPATH './ns3:COMPANYCODE/text()',
       TEMPLATE '<ns3:COMPANYCODE>&column</ns3:COMPANYCODE>'),
 CUSTOMERNO VARCHAR(10)  OPTIONS(XPATH './ns3:CUSTOMERNO/text()',
       TEMPLATE '<ns3:CUSTOMERNO>&column</ns3:CUSTOMERNO>'),
 ...
  FOR SERVER sap_server
  OPTIONS(XPATH '//ns3:sap_bapi_customer_getdetail2',
  TEMPLATE '<ns3:sap_bapi_customer_getdetail2>
                 &sap_bapi_customer_getdetail2_sap_customerbankdetail_NN[0,1]
                 &COMPANYCODE[0,1]
                 &CUSTOMERNO[1,1]
            </ns3:sap_bapi_customer_getdetail2>',
  ...
```

Figure 19. Excerpt from getdetail2 nickname

```
CREATE NICKNAME sap_bapi_customer_getdetail2_sap_customerbankdetail_NN(
 CUSTOMER VARCHAR(10)  OPTIONS(XPATH './ns2:CUSTOMER/text()',
           TEMPLATE '<ns2:CUSTOMER>&column</ns2:CUSTOMER>'),
 BANK_KEY VARCHAR(15)  OPTIONS(XPATH './ns2:BANK_KEY/text()',
           TEMPLATE '<ns2:BANK_KEY>&column</ns2:BANK_KEY>'),
 BANK_ACCT VARCHAR(18)  OPTIONS(XPATH './ns2:BANK_ACCT/text()',
           TEMPLATE '<ns2:BANK_ACCT>&column</ns2:BANK_ACCT>'),
 CTRL_KEY VARCHAR(2)  OPTIONS(XPATH './ns2:CTRL_KEY/text()',
           TEMPLATE '<ns2:CTRL_KEY>&column</ns2:CTRL_KEY>'),
 BANK_REF VARCHAR(20)  OPTIONS(XPATH './ns2:BANK_REF/text()',
           TEMPLATE '<ns2:BANK_REF>&column</ns2:BANK_REF>'),
 NN__FKEY VARCHAR(16)  OPTIONS(FOREIGN_KEY 'SAP_BAPI_CUSTOMER_GETDETAIL2_NN'))
  FOR SERVER sap_server
  OPTIONS(XPATH './ns3:sap_customerbankdetail/ns2:sap_customerbankdetail',
  TEMPLATE '<ns3:sap_customerbankdetail>
              <ns2:sap_customerbankdetail>
                &CUSTOMER[0,1]
                &BANK_KEY[0,1]
                &BANK_ACCT[0,1]
                &CTRL_KEY[0,1]
                &BANK_REF[0,1]
              </ns2:sap_customerbankdetail>
            </ns3:sap_customerbankdetail>',
 ...
```

Figure 20. Excerpt from customer bank detail nickname

In the following example, the query returns no rows because there is an inner join condition between the two nicknames:

```
SELECT a.name, b.bank_key
  FROM sap_bapi_customer_getdetail2_NN a,
     sap_bapi_customer_getdetail2_sap_customerbankdetail_NN b
  WHERE a.customerno='1234567890'
  AND a.NN__PKEY=b.NN__FKEY;
```

If a Web services wrapper nickname definition contains required input columns, then a left outer join between this nickname and any other local table or other nicknames is not supported.

Web services data sources - example queries

Examples of SQL queries for the Web services wrapper are shown.

Example 1: Using materialized query tables

You use materialized query tables to locally cache the results of a query and to improve the performance of queries. You can use nicknames from Web services data sources to create materialized query tables. For some queries, the database can automatically determine whether the materialized query table can answer a query without accessing the base tables. The following procedure shows how to create and populate a materialized query table:

1. Create a local or base table:

   ```
   CREATE TABLE mystocks(ticker VARCHAR(10));
   ```

   You can use the local table to maintain all the values that you want to cache.
2. Insert all of the values that you want to cache into the table:

   ```
   INSERT INTO mystocks VALUES('IBM');
   INSERT INTO mystocks VALUES('MSFT');
   ...
   ```
3. Create a Web services nickname:

   ```
   CREATE NICKNAME stockquote_nn (
          ticker VARCHAR(40) OPTIONS (TEMPLATE   '&column'),
          price VARCHAR(16) OPTIONS (XPATH   './Result/text()')
          )
    FOR SERVER stock_server
    OPTIONS (TEMPLATE '<ticker>&column</ticker>'
              XPATH './Result/text()' );
   ```
4. Create a view that consists of the nickname and the local table:

   ```
   CREATE VIEW  stock_quote_view (ticker, price)
     AS (
       SELECT nn.ticker, nn.price
        FROM stockquote_nn nn, mystocks s
        WHERE nn.ticker=s.ticker
   );
   ```
5. Create a materialized query table:

   ```
   CREATE TABLE stockquote_MQT (ticker, ticker2, price)
          as (SELECT nn.ticker,s.ticker as ticker2, nn.price
     FROM stockquote_nn nn, mystocks s
     WHERE nn.ticker=s.ticker )
     DATA INITIALLY DEFERRED REFRESH DEFERRED;
   ```

   Include all of the VARCHAR columns in the join predicate (nn.ticker and s.ticker) in the materialized query table output list to maximize the opportunities that the materialized query table is used by the federated database.

   To defer the refresh of the materialized query table, specify the REFRESH DEFERRED keyword. Materialized query tables that are specified with the REFRESH DEFERRED keyword do not reflect changes to the underlying base table. Use the clause DATA INITIALLY DEFERRED so that your data is not inserted into the table as part of the CREATE TABLE statement.
6. Issue a REFRESH TABLE statement to populate the table. The data in the table reflects the result of the query as a snapshot at the time that you issue the

REFRESH TABLE statement. The following example populates the stockquote_MQT table and sets a value for the special register with the current refresh age.

```
REFRESH TABLE stockquote_MQT;

SET CURRENT REFRESH AGE any;
```

The queries that run on the data in the materialized query table are faster than the queries that run on the data in a base table. When you want to use the materialized query table, you refer to the view and not the nickname:

```
SELECT * FROM stock_quote_view
  WHERE  ticker='IBM';
```

If you issue a query to select a value that has not been cached, 0 rows are returned.

Example 2: Issuing joins using the primary and foreign keys

The PRIMARY_KEY and FOREIGN_KEY columns define relationships between the parent and child nicknames. Each parent nickname must have a primary key column option. You define the children of a parent nickname with the foreign key column option that references the primary key column of a parent nickname. A nickname can have multiple children, but a nickname can have only one parent.

Because these columns contain only binary data, the columns are defined with the FOR BIT DATA NOT NULL keywords. The DB2 Control Center generates this definition when you create the nickname. You can explicitly define the PRIMARY_KEY and FOREIGN_KEY columns as FOR BIT DATA NOT NULL when you create the nickname.

The following example shows how the Web services wrapper uses the PRIMARY_KEY and FOREIGN_KEY columns to associate parent and child nicknames.

```
CREATE NICKNAME zooport_getzooreport_nn (
   zooid VARCHAR (48) OPTIONS(TEMPLATE '&column'),
   zoo_id VARCHAR (48) OPTIONS(XPATH './ns1:Zoo/@id'),
   report_zoo_zooname VARCHAR (48)
       OPTIONS(XPATH './ns1:Zoo/ns1:ZooName/text()'),
   report_zoo_count VARCHAR (48)
       OPTIONS(XPATH './ns1:Zoo/ns1:Count/text()'),
   report_zoo_lastmodified VARCHAR (48)
       OPTIONS(XPATH './ns1:Zoo/ns1:LastModified/text()'),
   nn_pk VARCHAR (16) NOT NULL OPTIONS(PRIMARY_KEY 'YES'),
   url VARCHAR (256) OPTIONS(URLCOLUMN 'Y'),
   soapaction VARCHAR (256) OPTIONS(SOAPACTIONCOLUMN 'Y')
) FOR SERVER "mytestsrvr"
  OPTIONS(
    URL 'http://localhost:9080/MaelstromTest/services/ZooPort',
    SOAPACTION 'http://myzoo.com/getZooReport' ,
    TEMPLATE '<soapenv:Envelope>
               <soapenv:Body>
                 <zooId>&zooId[1,1]</zooId>
               </soapenv:Body>
              </soapenv:Envelope>',
    XPATH '/soapenv:Envelope/soapenv:Body' ,
    NAMESPACES ' soapenv="http://schemas.xmlsoap.org/soap/envelope/",
                ns1="http://myzoo.com" ');

CREATE NICKNAME zooport_getzooreport_report_zookeeper_nn (
  nn_fk VARCHAR (16) NOT NULL
      OPTIONS(FOREIGN_KEY 'ZOOPORT_GETZOOREPORT_NN'),
  zookeeper_id VARCHAR (48) OPTIONS(XPATH './@id'),
  report_zookeeper_name VARCHAR (48) OPTIONS(XPATH './ns1:Name/text()'),
  zookeeper_numbercages VARCHAR(48)
       OPTIONS(XPATH './ns1:NumberOfCages/text()'),
  nn_pk VARCHAR (16) NOT NULL OPTIONS(PRIMARY_KEY 'YES')
 )
FOR SERVER "MYTESTSRVR" OPTIONS(
  XPATH './ns1:Zoo/ns1:Zookeeper' ,
  NAMESPACES ' soapenv="http://schemas.xmlsoap.org/soap/envelope/",
       ns1="http://myzoo.com" ');
```

The foreign key, nn_fk, in nickname zooport_getzooreport_report_zookeeper_nn, refers to the parent nickname, zooport_getzooreport_nn in the foreign key option. The designated primary and foreign key nickname columns do not correspond to data in your WSDL document because these nickname columns contain keys that are generated by the wrapper. These keys identify a relationship between the parent and child nicknames that is unique only within a query. If the child nickname contains an input column, the parent nickname option template refers to that child nickname in the template structure with the nickname option.

The following SQL statement joins the parent and child nicknames:

```
SELECT *
FROM   zooport_getzooreport_nn a,
       zooport_getzooreport_report_zookeeper_nn z,

WHERE   a.nn_pk  = z.nn_fk
    AND a.zooid  = 100
    ;
```

The following description explains how the Web services wrapper uses the TEMPLATE and XPATH nickname and column options during query execution. It is not intended as an example of a specific implementation.

When you join the primary and foreign key columns, the Web services wrapper sends a message to the Web services provider, and a set of rows is returned from the Web services provider. The wrapper generates a message for the parent nickname by substituting the values of the input column (a.zooid = 100) from the query for the reference in the column option template (ZOOID VARCHAR (48) OPTIONS(TEMPLATE '&column')), and then all of the column references in the nickname template option (<zooId>&zooId[1,1]</zooId>). The nickname template option can include column references or child nickname references. The message is then sent to the Web service.

The wrapper generates the rows for a nickname by applying the nickname option XPATH on the document that the Web service returns. If the nickname option XPATH returns multiple XML fragments, then the nickname contains multiple rows. The column XPATH option is applied on the resulting XML fragments that represent the rows to get the column values. If a nickname has one or more indirect parents, all of the parent nickname XPATH expressions are applied in the order from the top of the hierarchy down before the nickname option XPATH and the column option XPATH are applied for this nickname.

Configuring access to XML data sources

You can integrate the data that is in XML data sources with information from other sources by using a federated system.

To configure a federated server to access XML data sources, you must provide the federated server with information about the data sources and objects that you want to access. After you configure the federated server, you can create queries to access the XML data sources.

XML wrapper

The Extensible Markup Language (XML) is a universal format for structured documents and data. XML uses tags for structuring the data in documents.

XML files use the `.xml` file extension. Like HTML, XML uses words that are enclosed in angle brackets (< >) as tags. The tags structure the data that is in the document.

The following document is a sample XML document.

```
<?xml version="1.0" encoding=UTF-8"?>
<doc>
   <customer id='123'>
      <name>...</name>
      <address>...</address>
       ...
      <order>
         <amount>...</amount>
            <date>...</date>
         <item quant='12'>
            <name>...</name>
         </item>
         <item quant='4'>...</item>
          ...
      </order>
      <order>...</order>
       ...
      <payment>
         <number>...</number>
         <date>...</date>
      </payment>
      <payment>>...</payment>
       ...
   </customer>
   <customer id='124'>...</customer>
</doc>
```

Figure 21. Sample XML document

How the XML wrapper works

The XML wrapper enables you to use SQL to query the following types of data:
- External XML documents that are stored in a single file
- Multiple XML files in a directory path
- Remote XML files that are referenced with a Uniform Reference Identifier (URI)
- XML documents stored in relational columns

The following figure shows how the XML wrapper works with your federated system.

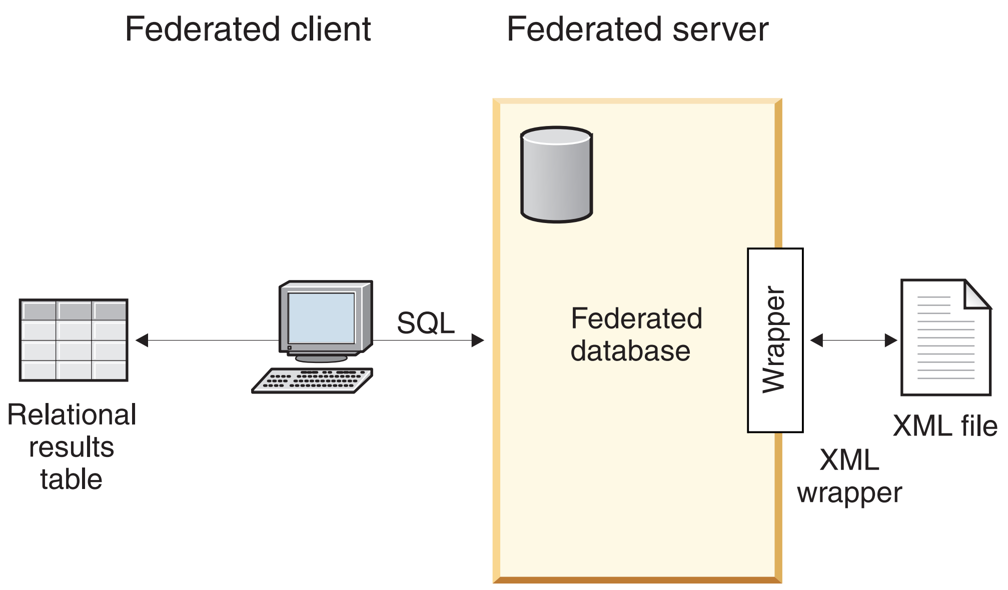


Figure 22. How the XML wrapper works

With the XML wrapper, you can map XML data from an external data source into a relational schema that is composed of a set of nicknames. The structure of an XML document is logically equivalent to a relational schema in which the nested and repeating elements are modeled as separate tables with foreign keys.

The nicknames that correspond to an XML document are organized into a tree structure in which the child nicknames map to elements that are nested within the element that corresponds to the parent nickname.

A root nickname is a nickname at the top-level of a nickname hierarchy. A nonroot nickname is a nickname that has a parent nickname in a nickname hierarchy. You can have root nicknames that are not the top level element in an XML document.

When nested elements are repeated or have distinct identities with complex structures, you can provide separate nicknames for each nested element.

Child and parent nicknames are connected by primary and foreign keys that are generated by the wrapper.

XPath expressions are used to map an XML document into a relational schema that is composed of a set of nicknames. XPath is an addressing mechanism for identifying the parts of an XML file (for example, the groups of nodes and attributes within an XML document tree). The basic XPath syntax is similar to file system addressing.

Each nickname is defined by an XPath expression that identifies the XML elements representing individual tuples, and a set of XPath expressions that specifies how to extract the column values from each element.

An example of XML document mapping

The following example illustrates how:

- The sample XML document is mapped into a set of nicknames
- Parent and child relationships are established by using primary and foreign keys

- XPath expressions are used to define individual tuples and columns within each element of the document
- A query can run on the XML document after the document is registered to your federated system

The sample XML document contains a set of customer elements. Each element encloses several order and payment elements.

The order elements enclose several item elements.

The relationship among the elements is shown in the following figure.

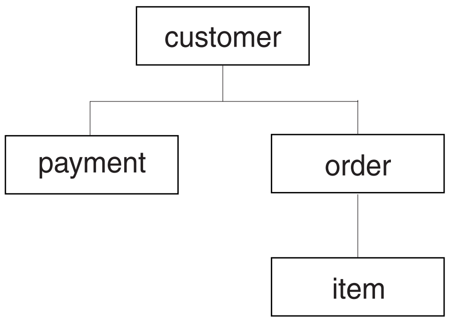


Figure 23. Tree structure of the sample XML document

From this structure, you can use the CREATE NICKNAME statement to map the XML document into a relational schema that includes four nicknames:
- customers
- orders
- payments
- items

You define relationships between the nicknames by specifying each nickname as a parent nickname or a child nickname by using special nickname column options that specify primary and foreign keyss. Each parent nickname must have a special column that is designated with a primary key column option. You define the children of a parent nickname with the foreign key column option that references the primary key column of a parent nickname. The designated primary and foreign nickname columns do not correspond to data in your XML document because these nickname columns will contain keys that are generated by the wrapper. A nickname can have multiple children, but a nickname can have only one parent. The root nickname has no parent.

For the sample XML document, the customers nickname has a defined primary key, and the orders, payments, and items nicknames have defined foreign keys that point to the parent nickname. The foreign keys of the orders and payments nicknames point to the customers nickname, and the foreign key of the items nickname points to the orders nickname.

To identify the XML elements that represent individual tuples, you create one XPath expression. In this example, all the customer elements are referenced by using the `'/doc/customer'` XPath expression, and all the order elements are referenced by using the `'./order'` XPath expression. The period in the `'./order'` XPath expression indicates that the tuples of each order element are nested within the tuples of the corresponding customer element.

You create a set of XPath expressions to specify how to extract the column values from each element. In this example, the `id` attribute of the customer elements, now a column defined in the nickname, is referenced by using the `'./@id'` XPath expression. The name element of the customer elements is referenced by using the `'./name'` XPath expression.The address element of the customer elements is referenced by using the `'./address/@street'` XPath expression.

After you map the XML document into a set of nicknames by using the CREATE NICKNAME statement, you define each nickname as a parent or child by using primary and foreign keys. You specify XPath expressions on these primary and foreign keys that define individual tuples and columns within each element of the document. You can then run SQL queries on the XML document.

Adding XML to a federated system

To configure a federated server to access XML data sources, you must provide the federated server with information about the data sources and objects that you want to access.

Before you begin

- Federation must be installed on a server that will act as the federated server.
- A database must exist on the federated server.

About this task

You can configure a federated server to access data that is stored in XML data sources by using the Control Center or by issuing SQL statements on the command line. The Control Center includes a wizard to guide you through the steps that are necessary to configure the required federated objects.

Procedure

To add XML data sources to a federated server:

1. Register the XML wrapper.
2. Register the XML server definition.
3. Register nicknames for the XML data sources.
4. Create federated views for non-root nicknames.

Registering the XML wrapper

You must register a wrapper to access XML data sources.

About this task

Wrappers are used by federated servers to communicate with and retrieve data from data sources. Wrappers are implemented as a set of library files.

You can register a wrapper by using the Control Center or from the command line. The Control Center includes a wizard to guide you through the steps that are necessary to register the wrapper.

If you use a proxy server and a keystore to access XML files, you can specify the proxy server information as options when you register the wrapper or server definition. If you specify the proxy server information when you register the server definition, those settings override the proxy server settings that you specify when you register the wrapper.

Procedure

To register the XML wrapper:

Choose the method that you want to use to register the XML wrapper:

Method	Procedure
Using the Control Center	Start the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**.

From the command line	Issue the CREATE WRAPPER statement.
	`CREATE WRAPPER wrapper_name`
	`LIBRARY library_name;`
	
	If you use a proxy server or a keystore to access XML files, you must specify several options when you register either the XML wrapper or the server definition. To specify the proxy server information when you register the XML wrapper, the statement that you issue is:
	`CREATE WRAPPER wrapper_name`
	`LIBRARY library_name`
	`OPTIONS (PROXY_TYPE 'type',`
	`PROXY_SERVER_NAME 'server_name',`
	`PROXY_SERVER_PORT 'port_number');`

You must specify the LIBRARY parameter in the CREATE WRAPPER statement. The name of the wrapper library file that you specify depends on the operating system of the federated server. See the list of XML wrapper library files for the correct library name to specify in the CREATE WRAPPER statement.
If you use a proxy server or a keystore to access XML files, you must specify several options when you register either the XML wrapper or the server definition.

XML wrapper library files:

The XML wrapper library files are added to the federated server when you install the federated server.

When you install IBM InfoSphere Federation Server, three library files are added to the default directory path. For example, if the federated server is running on AIX, the wrapper library files that are added to the directory path are `libdb2lsxml.a`, `libdb2lsxmlF.a`, and `libdb2lsxmlU.a`. The default wrapper library file is `libdb2lsxml.a`. The other wrapper library files are used with specific wrapper options.

You must include the LIBRARY parameter in the CREATE WRAPPER statement and specify the default wrapper library file name.

The default directory paths and default wrapper library file names are listed in the following table.

Table 41. XML wrapper library locations and file names

Operating system	Directory path	Wrapper library file name

AIX	`/usr/opt/<install_path>/lib32/`
	`/usr/opt/<install_path>/lib64/`
		libdb2lsxml.a

Table 41. XML wrapper library locations and file names (continued)

Operating system	Directory path	Wrapper library file name
Linux	/opt/IBM/db2/<install_path>/lib32 /opt/IBM/db2/<install_path>/lib64	libdb2lsxml.so
Solaris	/opt/IBM/db2/<install_path>/lib32 /opt/IBM/db2/<install_path>/lib64	libdb2lsxml.so
Windows	%DB2PATH%\bin	db2lsxml.dll

`<install_path>` is the directory path where the federated server is installed on Linux or UNIX.

%DB2PATH% is the environment variable that is used to specify the directory path where the federated server is installed on Windows. The default Windows directory path is `C:\Program Files\IBM\SQLLIB`.

CREATE WRAPPER statement - Examples for the XML wrapper:

Use the CREATE WRAPPER statement to register the XML wrapper. The examples show the parameters that are required to access XML documents with and without a proxy server.

Registering a wrapper

If you are not using a proxy server to access XML documents, the statement that you issue to register the wrapper is:

```
CREATE WRAPPER xml_wrapper LIBRARY 'libdb2lsxml.a';
```

xml_wrapper
: A name that you assign to the XML wrapper. Duplicate wrapper names are not allowed.

LIBRARY *'libdb2lsxml.a'*
: The name of the wrapper library file for federated servers that use AIX operating systems.

Registering a wrapper for an HTTP proxy server

To register a wrapper and specify an HTTP proxy server, use the following statement:

```
CREATE WRAPPER xml_wrapper LIBRARY 'libdb2lsxml.a'
    OPTIONS (PROXY_TYPE 'HTTP', PROXY_SERVER_NAME 'proxy_http',
        PROXY_SERVER_PORT '8080');
```

PROXY_TYPE *'HTTP'*
: Specifies the proxy type that is used to access the Internet when behind a firewall. The valid values are 'NONE', 'HTTP', or 'SOCKS'.

PROXY_SERVER_NAME *'proxy_http'*
: Specifies the proxy server name or IP address. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

PROXY_SERVER_PORT *'8080'*
: Specifies the proxy server port number. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

Registering a wrapper for a SOCKS proxy server

To register a wrapper and specify a SOCKS proxy server without authentication information, use the following statement:

```
CREATE WRAPPER xml_wrapper LIBRARY 'libdb2lsxml.so'
    OPTIONS (PROXY_TYPE 'SOCKS', PROXY_SERVER_NAME 'proxy_socks',
        PROXY_SERVER_PORT '1081');
```

LIBRARY *'libdb2lsxml.so'*
: Specifies the name of the wrapper library file for federated servers that use Linux and Solaris operating systems.

PROXY_TYPE *'SOCKS'*
: Specifies the proxy type that is used to access the Internet when behind a firewall. The valid values are 'NONE', 'HTTP', or 'SOCKS'.

PROXY_SERVER_NAME *'proxy_socks'*
: Specifies the proxy server name or IP address. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

PROXY_SERVER_PORT *'1081'*
: Specifies the proxy server port number. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

Registering the server definition for an XML data source

You must register a server definition to retrieve XML documents. The server definition that you register depends on if you use a proxy server to access the XML documents.

About this task

To retrieve XML documents that are behind a firewall by using a proxy and a Uniform Resource Identifier (URI), you must include the proxy server options in the CREATE SERVER statement.

If you are not using a proxy server, you must still register a server definition because the hierarchy of federated objects requires that the XML files are associated with a specific server definition object.

You can register a server definition by using the Control Center or from the command line. The Control Center includes a wizard to guide you through the steps to register the server definition.

Procedure

To register a server definition for an XML data source:

Choose the method that you want to use to register the server definition:

Method	Procedure
Using the Control Center	Use the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**. Follow the steps in the wizard.

Method	Procedure

From the command line	Issue the CREATE SERVER statement.
	
	If you do not use a proxy server to access XML documents, the statement that you issue is:
	`CREATE SERVER server_definition_name`
	`WRAPPER wrapper_name;`
	
	If you use a proxy server to access XML documents, the statement that you issue is:
	`CREATE SERVER server_definition_name`
	`WRAPPER wrapper_name`
	`OPTIONS (PROXY_TYPE 'type',`
	`PROXY_SERVER_NAME 'server_name',`
	`PROXY_SERVER_PORT 'port_number');`

If you use a proxy server to access XML documents, the protocol that you use might require that you specify an authorization ID and a password for the proxy server. You specify the authentication information as options when you register the server definition.

CREATE SERVER statement - Examples for the XML wrapper:

Use the CREATE SERVER statement to register server definitions for the XML wrapper. The examples show the parameters that are required to access XML documents with and without a proxy server.

Registering a server definition

Even if you are not using a proxy server to access XML documents, you must still register a server definition. The hierarchy of federated objects requires that the XML files are associated with a specific server definition object. The statement that you issue to register a server definition is:

```
CREATE SERVER xml_server WRAPPER xml_wrapper;
```

xml_server
: A name that you assign to the XML server definition. Duplicate server definition names are not allowed.

WRAPPER *xml_wrapper*
: The wrapper name that you specified in the CREATE WRAPPER statement.

Server definitions when a proxy server is used

You must use the proxy server options in the CREATE SERVER statement if all of the following conditions are true:

- You want to retrieve data using a URI
- The URI used will retrieve data from behind a firewall, through a proxy
- The firewall or proxy used is HTTP or SOCKS

The options that you specify depend on the type of proxy server that you want to access.

Check with your network administrator for information about the type of proxy that you use, and the settings that you should specify in the proxy options.

Registering a server definition for an HTTP proxy server

To register a server definition and specify an HTTP proxy server, use the following statement:

```
CREATE SERVER xml_server_http
    WRAPPER xml_wrapper
    OPTIONS (PROXY_TYPE 'HTTP', PROXY_SERVER_NAME 'proxy_http',
        PROXY_SERVER_PORT '8080');
```

xml_server_http
: A name that you assign to the XML server definition. Duplicate server definition names are not allowed.

WRAPPER *xml_wrapper*
: The wrapper name that you specified in the CREATE WRAPPER statement.

PROXY_TYPE *'HTTP'*
: Specifies the proxy type that is used to access the Internet when behind a firewall. The valid values are 'NONE', 'HTTP', or 'SOCKS'.

PROXY_SERVER_NAME *'proxy_http'*
: Specifies the proxy server name or IP address. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

PROXY_SERVER_PORT *'8080'*
: Specifies the proxy server port number. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

Registering a server definition for a SOCKS proxy server

To register a server definition and specify a SOCKS proxy server when authentication information is not required, use the following statement:

```
CREATE SERVER xml_server_socks
    WRAPPER xml_wrapper
    OPTIONS (PROXY_TYPE 'SOCKS', PROXY_SERVER_NAME 'proxy_socks',
        PROXY_SERVER_PORT '1081');
```

xml_server_socks
: A name that you assign to the XML server definition. Duplicate server definition names are not allowed.

WRAPPER *xml_wrapper*
: The wrapper name that you specified in the CREATE WRAPPER statement.

PROXY_TYPE *'SOCKS'*
: Specifies the proxy type that is used to access the Internet when behind a firewall. The valid values are 'NONE', 'HTTP', or 'SOCKS'.

PROXY_SERVER_NAME *'proxy_socks'*
: Specifies the proxy server name or IP address. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

PROXY_SERVER_PORT *'1081'*
: Specifies the proxy server port number. This option is required if the value for the PROXY_TYPE server option is 'HTTP' or 'SOCKS'.

Registering a server definition for a SOCKS proxy server with authentication information

To register a server definition and specify a SOCKS proxy server with authentication information, use the following statement:

```
CREATE SERVER xml_server_socks
    WRAPPER xml_wrapper
    OPTIONS (PROXY_TYPE 'SOCKS', PROXY_SERVER_NAME 'proxy_socks',
        PROXY_SERVER_PORT '1081', PROXY_AUTHID 'Martin',
        PROXY_PASSWORD 'not4me');
```

PROXY_AUTHID *'Martin'*
: Specifies the user name on the proxy server. This server option is required when the value for the PROXY_TYPE server option is 'SOCKS'.

PROXY_PASSWORD *'not4me'*
: Specifies the password on the proxy server that is associated with the user name *'Martin'*. This server option is required when the value for the PROXY_TYPE server option is 'SOCKS'.

Specifying a time limit on proxy server responses

In addition to the required server options for proxy servers, you can also specify the SOCKET_TIMEOUT server option when you register a server definition. The SOCKET_TIMEOUT server option specifies the maximum amount of time, in minutes, that the federated server will wait for the results from the proxy server. If you do not specify the SOCKET_TIMEOUT server option, there is no time limit. The federated server will wait indefinitely for the results from the proxy server.

To register a server definition and specify how long the federated server waits for a response from the proxy server, use the following statement:

```
CREATE SERVER xml_server_http
    WRAPPER xml_wrapper
    OPTIONS (PROXY_TYPE 'HTTP', PROXY_SERVER_NAME 'proxy_http',
        PROXY_SERVER_PORT '8080', SOCKET_TIMEOUT '12');
```

SOCKET_TIMEOUT *12*
: Specifies that the federated server will wait 12 minutes for a response from the proxy server.

Access XML files using a proxy server

If your network uses a proxy server, you must specify information about the proxy server when you register the wrapper or server definition for XML data sources.

The options that you specify depend on the type of proxy server that you want to access, and whether you are using Secure Socket Layer (SSL) or Transport Layer Security (TLS) protocols.

You can specify the proxy and SSL options when you register a wrapper or a server definition:

- If you specify these options when you register the wrapper, the nicknames that are associated with that wrapper will use the options that are set for the wrapper.
- If you specify these options when you register a server definition, the nicknames that are associated with that server definition will use the options that are set for the server definition.

- If you specify different values for these options when you register the wrapper and the server definition, the values that are set for the server definition take precedence over the values that are set for the wrapper.

The XML wrapper has a validation feature that might have limitations when it is used with the proxy server. The conditions in which you will see this limitation are:

- You are using the proxy feature, at the server level, and you have set the various proxy options
- The XML instance document contains a reference to an external XML schema that is located outside the firewall

If you have one of these conditions, try to change the location of your XML schema to a location inside the firewall. If you change the XML schema location, you must update the XML instance document with the new location of the XML schema.

Proxy server options

The following table lists the options that must you specify for each type of proxy server:

Table 42. Options that are required with proxy servers

Type of proxy server	Required wrapper or server options
HTTP or SOCKS without authentication	PROXY_TYPE PROXY_SERVER_NAME PROXY_SERVER_PORT
HTTP or SOCKS with authentication	PROXY_TYPE PROXY_SERVER_NAME PROXY_SERVER_PORT PROXY_AUTHID PROXY_PASSWORD

SSL server options

The following table lists the options that you must specify when you use the SSL protocols:

Table 43. Options that are required with SSL protocols

Federated object	Required options
Wrapper	SSL_KEYSTORE_FILE SSL_KEYSTORE_PASSWORD SSL_VERIFY_SERVER_CERTIFICATE
Server definition	SSL_KEYSTORE_FILE SSL_KEYSTORE_PASSWORD SSL_VERIFY_SERVER_CERTIFICATE SSL_CLIENT_CERTIFICATE_LABEL

Nicknames for XML data sources

You must register a nickname for each XML document that you want to access. Use these nicknames, instead of the document names, when you query XML data sources.

You can register nicknames for XML data sources by using the Control Center or the command line. The Control Center simplifies the process for creating the XML nicknames. Before you register the nicknames, you should understand:

Data associations between nicknames and XML documents:

Nicknames correspond to the tree structure of your XML document data. Parent nicknames and child nicknames correspond to the root structure and nested elements of the data tree structure. These parent and child nicknames are connected by primary and foreign keys that are specified with the CREATE NICKNAME statement.

Each nickname is defined by XPath expressions that perform the following functions:
- Identifies the XML elements that represent individual tuples
- Specifies how to extract the column values from each element

The XML wrapper uses XPath expressions to establish a correspondence between the data in the XML document and the rows in a relational table. These XPath expressions identify the values within the XML document and determine how these values correspond to the columns of each row. The XML wrapper reads the XML document data only. The XML wrapper does not update this data.

When you create a nickname, you choose options that specify the association between the nickname and the XML document. Nicknames are associated with your XML documents either in a fixed manner or with source names that you specify.

With a fixed association, the nickname represents data from specific XML documents. These XML documents include:

One local file
You specify one XML file as your XML document.

Multiple local files in a directory path
You specify a directory path in which multiple XML files reside. The XML files in this directory path provide the XML document data to the nickname. All of the XML files must have the same configuration. If any XML file in the directory has a configuration that is different from the configuration of the nickname, the XML wrapper returns null values when it processes that XML data file. The directory must be either local to the federated server or accessible from a shared file system.

When scanning the directory, the XML wrapper retains and parses only those files with a `.xml` extension. The XML wrapper ignores all other files, including files with a `.txt` extension, files with a `.xsd` extension, and files without extensions.

Use the FILE_PATH option in the CREATE NICKNAME statement to specify fixed data from a file. Use the DIRECTORY_PATH option to specify fixed data from a directory.

When the source data is specified while the query is running, you can use the nickname to represent data from any XML document source whose schema matches the nickname definition. These XML documents include:

Uniform Reference Identifiers
A remote XML file that a URI refers to supplies the XML document data to the nickname. Specify this document source by using the DOCUMENT 'URI' nickname column option.

Relational columns
Columns from a relational table, view, or nickname are used as input to your XML document. Specify this document source by using the DOCUMENT 'COLUMN' nickname column option.

File A single file that contains XML data is supplied as input while the query runs. Specify this document source by using the DOCUMENT 'FILE' nickname column option.

Directory
Multiple XML files under a specified directory path supply the data while the query runs. Specify this document source by using the DOCUMENT 'DIRECTORY' nickname column option.

You specify the DOCUMENT column option to indicate that the source data is supplied at query time. Specify either URI, COLUMN, FILE, or DIRECTORY with the DOCUMENT column to indicate the type of XML document source.

You cannot specify a FILE_PATH option or a DIRECTORY_PATH option with a DOCUMENT column option.

Use the STREAMING option to separate the XML document data into fragments. You can use the STREAMING option with data that is in a fixed format or data that is from source names that you specify when you run a query. The XML wrapper processes the resulting stream of XML data and extracts the information that is requested by a query fragment. The XML wrapper parses one fragment at a time. Because fragments are parsed one at a time, total memory use decreases. The processing time required to run the entire query increases depending on the memory capacity of your server. Therefore, use the STREAMING option to only parse large XML documents that are 50 megabytes or more.

You can also choose nickname option values that help you optimize queries that retrieve large amounts of XML data or data that contains multiple nested elements. These options include:
- INSTANCE_PARSE_TIME
- XPATH_EVAL_TIME
- NEXT_TIME

You can set values for these options to test and optimize the XML query. These option values control the processing time that is needed to locate elements and to parse the data in the rows of the XML document.

The cost model facility for the XML wrapper:

The XML wrapper provides a cost model facility to optimize queries on nicknames that correspond to your XML source documents.

When you create a nickname by using the CREATE NICKNAME statement, you can specify the following nickname options to support the cost model facility:
- INSTANCE_PARSE_TIME
- XPATH_EVAL_TIME

You can use the default values for these nickname options. Or you can set the values for these nickname options to optimize queries on the root and nonroot nicknames that you create.

The INSTANCE_PARSE_TIME nickname option is the amount of time, in milliseconds, that is required to read and parse one row-producing root element of the root nickname. The parsing time includes all contained row-producing nonroot elements. For example if the root nickname is customers, the nonroot elements are all of the elements that correspond to the orders, payments, and items of each customer. The XML wrapper builds a structure in memory to represent these row-producing root and nonroot elements.

The XPATH_EVAL_TIME nickname option is the amount of time, in milliseconds, that is required to evaluate the XPath expressions that locate the data corresponding to a row of the nickname. The XPath expressions that are evaluated include the XPath expressions that locate the actual rows and the XPath expressions that locate column values within these rows.

Namespaces for XML data sources:

Use the NAMESPACES nickname column option to identify the elements or attributes that are part of a namespace.

You can specify the NAMESPACES nickname option when you register nicknames. The value of the NAMESPACES nickname column option is a comma-separated list of name and value pairs. The XML wrapper uses the name and value pairs to resolve the namespace prefixes that are in the nickname XPath expressions. The prefixes that are used in the XPath expressions are processed by the XPath processor.

In the following example, the XML document includes the name, code, and description information for three products. The XML document declares two namespaces, `http://www.one.com` and `http://www.two.com`, and has one default namespace `http://www.default.com`. The `product` element is associated with the `ns1` namespace. The `product` element contains the `name` and `code` attributes and the `desc` element. The `name` attribute is not associated with a namespace. The `code` attribute is associated with the `ns2` namespace. The `desc` element is associated with the `default` namespace.

```
<?xml version="1.0" encoding="UTF-8"?>
<doc xmlns:ns1="http://www.one.com" xmlns:ns2="http://www.two.com"
    xmlns="http://www.default.com">
<ns1:product name="Computer" ns2:code="ABC123"
    <desc>"The Computer product description"</desc>
<ns1:product name="Keyboard" ns2:code="EFG456"
    <desc>"The Keyboard product description"</desc>
<ns1:product name="Mouse" ns2:code="HIJ789"
    <desc>"The Mouse product description"</desc>
</ns1:product>
</doc>
```

The following table shows the namespace that is associated with each element and attribute in the XML document.

Table 44. The elements, attributes, and namespaces in the XML document

Element or attribute	Namespace in XML document	Notes
`product`: An element in the XML document.	ns1=″http://www.one.com″	None
`name`: An attribute of the `product` element in the XML document.	None	The `name` attribute is not associated with a namespace.
`code`: An attribute of the `product` element in the XML document.	ns2=″http://www.two.com″	None
`desc`: An element within the `product` element in the XML document.	″http://www.default.com″	The `desc` element uses the `default` namespace, which does not contain a prefix.

When you register the nickname for the XML document, you define three columns to correspond to the elements and attributes in the XML document. You specify the namespace information in the NAMESPACES nickname option. For example:

```
CREATE NICKNAME products
   (name VARCHAR(16) OPTIONS (XPATH '@name'),
    code VARCHAR(16) OPTIONS (XPATH '@pre2:code')
    description VARCHAR (256) OPTIONS (XPATH './default:desc'))
    FOR SERVER xml_server
    OPTIONS (FILE_PATH '/home/mbreining/sql/xml/namespaces.xml',
        XPATH '//pre1:name',
        NAMESPACES 'pre1="http://www.one.com", pre2="http://www.two.com",
           default="http=//www.default.com"');
```

The following table shows how the XML document namespaces correspond to the values that you specify in the CREATE NICKNAME statement.

Table 45. XML document namespaces and corresponding values from the CREATE NICKNAME statement.

Namespace in XML document	Column name in the CREATE NICKNAME statement	Value in the XPATH column option	Value in the NAMESPACES nickname option
The namespace is `ns1="http://www.one.com"`.	None	None	The value is `pre1="http://www.one.com"`. The value is a prefix that you define (pre1) and the unique identifier for the namespace (″http://www.one.com″).
None. The attribute is not associated with a namespace.	Name	The value is `@name`. The value is an attribute that is in the XML document (name).	None
The namespace is `ns2="http://www.two.com"`	Code	The value is `@pre2:code`. The value is a prefix that you define (pre2) and an attribute that is in the XML document (code).	The value is `pre2="http://www.two.com"`. The value is a prefix that you define (pre2) and the unique identifier for the namespace (″http://www.two.com″).

Table 45. XML document namespaces and corresponding values from the CREATE NICKNAME statement. (continued)

Namespace in XML document	Column name in the CREATE NICKNAME statement	Value in the XPATH column option	Value in the NAMESPACES nickname option
The namespace is `"http://www.default.com"` The default namespace does not contain a prefix.	Description	The value is `./default:desc`. The value is a prefix that you define (default) and an element that is in the XML document (desc).	The value is `default="http=//www.default.com"`. The value is a prefix that you define (default) and the unique identifier for the namespace ("http://www.default.com").

The NAMESPACES nickname option uses packed descriptors to support strings that are greater than 256 characters.

For more information about XML namespaces, see the explanation for namespaces on the W3C Web site.

Registering nicknames for XML data sources:

For each XML server definition that you register, you must register a nickname for each XML document that you want to access. Use these nicknames, instead of the XML document names, when you query the XML data sources.

Restrictions

If you attempt to access XML data sources that are on a shared drive from a federated server that runs Windows 2003, your queries might fail. This is a limitation of Windows 2003. You can avoid this problem by specifying the absolute path in the FILE_PATH option in the CREATE NICKNAME statement.

You must create nicknames that correspond to the tree structure of your XML data source. Parent nicknames correspond to the root structure of the tree. Child nicknames correspond to the elements that are nested within the element for the parent nickname.

You can register nicknames by using the Control Center or from the command line. The Control Center includes a wizard to guide you through the steps to register the server definition.

Procedure

To register nicknames for XML data sources:

Choose the method that you want to use to register the server definition:

Method	Procedure
Using the Control Center	Use the Federated Objects wizard. Right-click the **Federated Database Objects** folder and click **Create Federated Objects**. Follow the steps in the wizard.

Method	Procedure
From the command line	Issue the CREATE NICKNAME statement. Nicknames can be up to 128 characters in length.

CREATE NICKNAME statement - examples for XML wrapper:

Use the CREATE NICKNAME statement to register nicknames for XML documents. There is a complete example, which shows how to create parent and child nicknames, and examples for specific column options.

Recommendation: Do not use the self or descendant operator // when you specify XPATH columns and nickname options in your queries. The self or descendant operator is an XPath operator. Using self or descendant operator can decrease federated server performance.

Complete example

The following example shows how to create nicknames for XML data sources by using the sample XML file shown in the following sample XML file.

```
<?xml version="1.0" encoding="UTF-8"?>
<doc>
   <customer id='123'>
      <name>...</name>
      <address>...</address>
       ...
      <order>
         <amount>...</amount>
         <date>...</date>
         <item quant='12'>
            <name>...</name>
         </item>
         <item quant='4'>...</item>
          ...
      </order>
      <order>...</order>
       ...
      <payment>
         <number>...</number>
         <date>...</date>
      </payment>
      <payment>...</payment>
       ...
   </customer>
   <customer id='124'>...</customer>
</doc>
```

Figure 24. Sample XML file

The parent nickname

The first step is to create the parent nickname, `customers`. To create the nickname, issue the following statement:

```
CREATE NICKNAME customers(
   id         VARCHAR(5)    OPTIONS(XPATH './@id')
   name       VARCHAR(16)   OPTIONS(XPATH './name'),
   address   VARCHAR(30)   OPTIONS(XPATH './address/@street'),
   cid       VARCHAR(16) FOR BIT DATA NOT NULL OPTIONS(PRIMARY_KEY 'YES'))
   FOR SERVER xml_server
   OPTIONS(DIRECTORY_PATH '/home/db2user',
         XPATH '/doc/customer', STREAMING 'YES');
```

This statement creates the `customers` nickname over multiple XML files under the specified directory path, `/home/db2user`.

The STREAMING nickname option indicates that the XML source data is separated and processed by node, in this example by customer record. When the STREAMING nickname option is used, the wrapper does not storing the entire XML document into memory. Instead, the XML wrapper divides the document into multiple sections which are parsed individually and sequentially. The STREAMING nickname option should be used only with large XML documents. The performance of your queries is impacted when you use this option.

The child nicknames

The next step is to create the child nicknames for the `orders`, `payments`, and `items` elements.

Issue the following statement to create the `orders` child nickname:

```
CREATE NICKNAME orders(
   amount INTEGER       OPTIONS(XPATH './amount'),
   date   VARCHAR(10)   OPTIONS(XPATH './date'),
   oid    VARCHAR(16)   OPTIONS(PRIMARY_KEY 'YES'),
   cid    VARCHAR(16) FOR BIT DATA NOT NULL OPTIONS(FOREIGN_KEY 'CUSTOMERS'))
   FOR SERVER xml_server
   OPTIONS( XPATH './order');
```

Issue the following statement to create the `payments` child nickname:

```
CREATE NICKNAME payments(
   number INTEGER       OPTIONS(XPATH './number'),
   date   VARCHAR(10)   OPTIONS(XPATH './date'),
   cid    VARCHAR(16) FOR BIT DATA NOT NULL OPTIONS(FOREIGN_KEY 'CUSTOMERS'))
   FOR SERVER xml_server
   OPTIONS( XPATH './payment');
```

Issue the following statement to create the `items` child nickname:

```
CREATE NICKNAME items(
   name      VARCHAR(20)   OPTIONS(XPATH './name'),
   quantity  INTEGER       OPTIONS(XPATH './@quant'),
   oid       VARCHAR(16) FOR BIT DATA NOT NULL OPTIONS(FOREIGN_KEY 'ORDERS'))
   FOR SERVER xml_server
   OPTIONS( XPATH './item');
```

Nickname column option examples

The following examples show you how to include the DOCUMENT nickname column options when you create nicknames. The examples also show you how those options are used in queries.

DOCUMENT *'FILE'* **example**

The following examples show you how to include the DOCUMENT nickname column options when you create nicknames. The examples also show you how to use those options in queries.

The following CREATE NICKNAME example shows the use of the DOCUMENT 'FILE' nickname column option:

```
CREATE NICKNAME customers(
   doc      VARCHAR(100)   OPTIONS(DOCUMENT 'FILE'),
   name     VARCHAR(16)    OPTIONS(XPATH './name'),
   address  VARCHAR(30)    OPTIONS(XPATH './address/@street'),
   cid      VARCHAR(16) FOR BIT DATA NOT NULL OPTIONS(PRIMARY_KEY 'YES'))
   FOR SERVER xml_server
   OPTIONS(XPATH '/doc/customer');
```

You can then run the following query on the `customers` nickname, specifying the location of the XML document in the WHERE clause:

```
SELECT * FROM customers WHERE doc = '/home/db2user/Customers.xml';
```

DOCUMENT *'DIRECTORY'* **example**

The following CREATE NICKNAME example shows the use of the DOCUMENT 'DIRECTORY' nickname column option:

```
CREATE NICKNAME customers(
   doc      VARCHAR(100)   OPTIONS(DOCUMENT 'DIRECTORY'),
   name     VARCHAR(16)    OPTIONS(XPATH './name'),
   address  VARCHAR(30)    OPTIONS(XPATH './address/@street'),
   cid      VARCHAR(16) FOR BIT DATA NOT NULL OPTIONS(PRIMARY_KEY 'YES'))
   FOR SERVER xml_server
   OPTIONS(XPATH '/doc/customer');
```

You can then run the following query on the `customers` nickname:

```
SELECT name FROM customers WHERE doc = '/home/data/xml';
```

This query retrieves the XML documents that are located under the directory path `/home/data/xml`, which is specified in the WHERE clause.

DOCUMENT *'URI'* **example**

The following CREATE NICKNAME example shows the use of the DOCUMENT 'URI' nickname column option:

```
CREATE NICKNAME customers(
   doc      VARCHAR(100)   OPTIONS(DOCUMENT 'URI'),
   name     VARCHAR(16)    OPTIONS(XPATH './name'),
   address  VARCHAR(30)    OPTIONS(XPATH './address/@street'),
   cid      VARCHAR(16) FOR BIT DATA NOT NULL OPTIONS(PRIMARY_KEY 'YES'))
   FOR SERVER xml_server
   OPTIONS(XPATH '/doc/customer');
```

You can then run the following query on the `customers` nickname to retrieve the XML data from the remote location:

```
SELECT * FROM customers WHERE doc = 'http://www.lg-mv.org/foo.xml';
```

DOCUMENT *'COLUMN'* **example**

The following CREATE NICKNAME example shows the use of the DOCUMENT 'COLUMN' nickname column option:

```
CREATE NICKNAME emp(
   doc      VARCHAR(500)  OPTIONS(DOCUMENT 'COLUMN')
   fname    VARCHAR(16)   OPTIONS(XPATH '@first'),
   lname    VARCHAR(16)   OPTIONS(XPATH '@last'))
   FOR SERVER xml_server
   OPTIONS(XPATH '/doc/name');
```

You can then run one of the following queries on the emp nickname to retrieve the XML data:

```
SELECT * FROM emp WHERE doc = '<?xml version="1.0" encoding="UTF-8"?>
        <doc>
        <title>  employees </title>
        <name first="David"  last="Marston"/>
        <name first="Donald" last="Leslie"/>
        <name first="Emily"  last="Farmer"/>
        <name first="Myriam" last="Midy"/>
        <name first="Lee"    last="Tran"/>
        <name first="Lili"   last="Farmer"/>
        <name first="Sanjay" last="Kumar"/>
        </doc>';
```

or

```
SELECT * FROM emp WHERE doc = (SELECT * FROM xml_tab);
```

The `xml_tab` table contains one column that is populated with the XML data.

Queries for XML data sources

Before you create queries to access XML data sources, there are actions that you can take to optimize the query performance.

Federated views

You can use federated views to ensure that the queries that join the pieces of an XML nickname hierarchy run correctly.

Avoid the self or descendant operator

Do not use the self or descendant operator // when you specify XPATH columns and nickname options when you create the XML nicknames. The self or descendant operator is an XPath operator, and using the self or descendant operator can decrease federated server performance.

Windows 2003 federated servers

If you attempt to access XML data sources that are on a shared drive from a federated server that runs Windows 2003, your query might fail with the following error message:

```
SQL1822N  Unexpected error code "ERRNO = 2" received from data source
"XML_SERVER". Associated text and tokens are "Unable to read file".
SQLSTATE=560BD
```

This is a limitation of Windows 2003. You can avoid this problem by specifying the absolute path in the FILE_PATH option in the CREATE NICKNAME statement.

The following example shows a CREATE NICKNAME statement with an abbreviated path specified in the FILE_PATH option:

```
CREATE NICKNAME customers
(
  id      VARCHAR(5)  OPTIONS(XPATH './@id'),
  name    VARCHAR(16) OPTIONS(XPATH './name'),
  address VARCHAR(30) OPTIONS(XPATH './address/@street'),
  cid     VARCHAR(16) FOR BIT DATA NOT NULL
     OPTIONS(PRIMARY_KEY 'YES'))
     FOR SERVER xml_server
        OPTIONS(DIRECTORY_PATH '\home\db2user',
           XPATH '/doc/customer', STREAMING 'YES');
```

Queries that use this nickname might fail because you specified the abbreviated path.

For federated servers that run Windows 2003, specify the absolute path in the FILE_PATH option in the CREATE NICKNAME statement.

For example:

```
CREATE NICKNAME customers
(
  id      VARCHAR(5)  OPTIONS(XPATH './@id'),
  name    VARCHAR(16) OPTIONS(XPATH './name'),
  address VARCHAR(30) OPTIONS(XPATH './address/@street'),
  cid     VARCHAR(16) FOR BIT DATA NOT NULL
     OPTIONS(PRIMARY_KEY 'YES'))
     FOR SERVER xml_server
        OPTIONS(DIRECTORY_PATH '\\host.svl.ibm.com\D$\home\db2user',
           XPATH '/doc/customer', STREAMING 'YES');
```

Creating federated views for the XML wrapper nicknames

You can create federated views over the hierarchy of nicknames that describe an XML document. Defining federated views ensures that the queries that join the pieces of an XML nickname hierarchy run properly.

About this task

A *federated view* is a view in the federated database that references a nickname, instead of a data source table.

In the XML nickname hierarchy the root nickname and queries that join columns, other than the special PRIMARY_KEY and FOREIGN_KEY columns, are not impacted by using federated views.

When you create federated views for XML nicknames, you should include all of the required predicates and a full path to the root directory.

Procedure

To create federated views for XML nicknames:

Use the CREATE VIEW statement to define a view for each nonroot nickname. The view should be a join of all the nicknames on the path to the root nickname.

1. In the WHERE clause of the view, define the PRIMARY_KEY and FOREIGN_KEY columns as the join predicates.
2. In the SELECT list, include all the columns of the nonroot nickname except the column that is designated with the FOREIGN_KEY nickname column option. In the SELECT list, include the column of the parent nickname designated with the PRIMARY_KEY option.

CREATE VIEW statement - examples for the XML wrapper

Use the CREATE VIEW statement to create federated views for nonroot nicknames. This example includes a sample XML file, the statements that you use to create the views, and shows how you can use the views in a query.

You can create federated views over the hierarchy of nicknames that describe an XML document to ensure that the queries that join pieces of an XML nickname hierarchy run correctly. When you specify a federated view in a query, data is retrieved from the remote data source.

The following examples show you how to create federated views for nonroot nicknames to describe XML source documents.

Sample XML file

The following examples are based this sample XML file.

```
<?xml version="1.0" encoding="UTF-8"?>
<doc>
   <customer id='123'>
      <name>...</name>
      <address>...</address>
       ...
      <order>
         <amount>...</amount>
            <date>...</date>
         <item quant='12'>
            <name>...</name>
         </item>
         <item quant='4'>...</item>
          ...
      </order>
      <order>...</order>
       ...
      <payment>
         <number>...</number>
         <date>...</date>
      </payment>
      <payment>...</payment>
       ...
   </customer>
   <customer id='124'>...</customer>
</doc>
```

Figure 25. Sample XML file

CREATE VIEW statements for the nonroot nicknames

The following example shows how to create a federated view for the nonroot nickname `order`:

```
CREATE VIEW order_view AS
   SELECT o.amount, o.date, o.oid, c.cid
   FROM customers c, orders o
   WHERE c.cid = o.cid;
```

The following example shows how to create a federated view for the nonroot nickname `payment`:

```
CREATE VIEW payment_view AS
   SELECT p.number, p.date, c.cid
   FROM customers c, payments p
   WHERE c.cid = p.cid;
```

The following example shows how to create a federated view for the nonroot nickname `item`:

```
CREATE VIEW item_view AS
   SELECT i.quantity, i.name, o.oid
   FROM customers c, orders o, items i
   WHERE c.cid = o.cid AND o.oid = i.oid;
```

A query that uses the federated views

Queries that are submitted to the federated views are processed correctly because the join path to the root directory is specified in the WHERE clause.

For example, the following query uses the customer identification number and the date that an order was placed to return the amount that was ordered and the amount of the payment due. Instead of using the nicknames in the query, the views are specified in the FROM clause.

```
SELECT o.amount, p.amount
FROM order_view o, payment_view p
WHERE p.date = o.date AND
   p.cid = o.cid;
```

Query optimization tips for the XML cost model facility

The cost model facility for the XML wrapper helps optimize queries on the nicknames that you create.

The cost model facility uses the following nickname options of the CREATE NICKNAME statement:
- INSTANCE_PARSE_TIME
- XPATH_EVAL_TIME

You can specify values for these nickname options when you issue a CREATE NICKNAME statement to register a nickname for an XML data source.

The cost model facility uses these parameter values to determine the amount of time required to parse the data in each row of an XML source document. The parameter values are also used to evaluate the XPath expression for the nickname.

You can use the default values for these nickname options. However, if you want to optimize queries on large or complex XML source structures for the nicknames that you create, use the following example as a guide.

An example of optimizing a large query

Your XML document has a relational schema with four nicknames:
- customers
- orders
- payments
- items

The root nickname is customers.

Run queries on each nickname. Run each query on a sample of the XML data that is typical for your environment.

For example:

```
SELECT * from customers;
SELECT * from orders;
SELECT * from payments;
SELECT * from items;
```

Make a note of the amount of time (in milliseconds) that is required to run each query by using the db2batch command, or an equivalent command or utility. You can use the db2batch command to obtain an output file that contains the time required to run queries. Make a note of the number of tuples that are returned.

For each nickname, use the following formulas to determine the optimal values for the INSTANCE_PARSE_TIME and XPATH_EVAL_TIME nickname options:

```
INSTANCE_PARSE_TIME =
 (75%  X  run time of SELECT * query) ÷ number of tuples returned
```

```
XPATH_EVAL_TIME     =
 (25%  X  run time of SELECT * query) ÷ number of tuples returned
```

For the root nickname (in this example, `customers`), use the calculated values for the INSTANCE_PARSE_TIME and XPATH_EVAL_TIME nickname options.

For nonroot nicknames, (in this example, `orders`, `payments`, and `items`), use only the calculated value for the XPATH_EVAL_TIME parameter. The INSTANCE_PARSE_TIME parameter value is not applicable for nonroot nicknames.

You can use these formulas as a guide for tuning your queries. The optimal values for these nickname options also depend on the complexity of your XML source documents and on the speed of the processor that you are using.

XML data source - example queries

Examples of queries using XML nicknames.

These examples use the customers, orders, and items nicknames.

A query that returns a specific value from the XML documents

When the following SELECT statement is run, the wrapper returns the names of all of the customers:

```
SELECT name FROM customers;
```

A query that returns all of the records for a specific customer

When the following SELECT statement is run, the wrapper returns all of the records in which the customer name is Chang:

```
SELECT * FROM customers
    WHERE name='Chang';
```

A query that returns specific values based on a join condition between a parent and child nickname

When the following SELECT statement is run, the wrapper returns the customer names and amounts for each order placed by each customer. You must specify the join, c.cid=o.cid, to indicate the parent-child relationship between the customers nickname and the orders nickname.

```
SELECT c.name, o.amount FROM customers c, orders o
    WHERE c.cid=o.cid;
```

A query that shows how to specify join conditions between a parent and several child nicknames

When the following SELECT statement is run, the wrapper returns the customer addresses, order amounts, and item names for each order and item of each customer. You must specify the two joins to maintain the parent-child relationships.

```
SELECT c.address, o.amount, i.name FROM customers c, orders o, items i
    WHERE c.cid=o.cid AND o.oid=i.oid;
```

Queries that show how specify an XML document in a query

The following examples show you how to write queries by using a nickname that specifies a DOCUMENT nickname column option rather than a FILE_PATH nickname option.

The CREATE NICKNAME statement that is used to create the customers nickname is:

```
CREATE NICKNAME customers
(
   doc      VARCHAR(100)   OPTIONS(DOCUMENT 'FILE'),
   name     VARCHAR(16)    OPTIONS(XPATH './name'),
   address  VARCHAR(30)    OPTIONS(XPATH './address/@street'),
   cid      VARCHAR(16)    OPTIONS(PRIMARY_KEY 'YES'))
   FOR SERVER xml_server
   OPTIONS(XPATH '/doc/customer');
```

The following query selects all of the data from the XML file `Customers.xml` with a path of `/home/db2user/Customers.xml`:

```
SELECT * FROM customers
   WHERE doc='/home/db2user/Customers.xml';
```

The following query selects the names of customers and the dates of their orders from the `Customers.xml` file for each order with an amount over 1000. The path `/home/db2user/Customers.xml` specifies the location of the `Customers.xml` file.

```
SELECT c.name, o.date FROM customers c, orders o
   WHERE c.doc='/home/db2user/Customers.xml' AND o.amount > 1000;
```

Chapter 3. Data source support for federated features

Refer to this table when you want to know whether or not a data source supports a specific federated feature.

Before you can use some of these features, you may need to set specific wrapper or server options or perform other tasks to enable the functionality. For more information, see the specific topics on each feature.

Table 46. Features and supported data sources

Feature	**Data sources**
Application savepoints with WRITE operations against nicknames	DB2 for Linux, UNIX, and Windows
Asynchrony optimization	All data sources
Cache tables	DB2 family Informix Microsoft SQL Server Oracle Sybase
Data import into nicknames	DB2 family Informix Microsoft SQL Server Oracle Sybase Teradata
Error tolerance in nested table expressions	DB2 family Informix JDBC Microsoft SQL Server ODBC Oracle Sybase Teradata
External user mapping repository	All data sources
Federated health indicators	DB2 family Excel Informix JDBC Microsoft SQL Server ODBC Oracle Sybase Table-structured files Teradata XML (root nicknames only)
Federated procedures	DB2 family, in trusted mode Oracle, in trusted mode Microsoft SQL Server, in trusted mode Sybase, in fenced mode, with the federated server installed on UNIX Sybase, in fenced mode or trusted mode, with the federated server installed on Linux or Microsoft Windows

Table 46. Features and supported data sources (continued)

Feature	Data sources
Federated trusted contexts	DB2 for Linux, UNIX, and Windows Version 9.5 DB2 for z/OS Version 9 Oracle
HTTP proxy	Web services XML
Connection-level isolation	DB2 family Informix JDBC Microsoft SQL Server ODBC Oracle Sybase
Label-based access control	DB2 for Linux, UNIX, and Windows Version 9.1 and 9.5 Oracle
LOB read and write operations	DB2 for z/OS DB2 for Linux, UNIX, and Windows DB2 for System i® Oracle
LOB read-only operations	BioRS Informix JDBC Microsoft SQL Server ODBC Script Sybase Teradata Web services XML
Materialized query tables	All data sources, with specific restrictions
Nickname statistics update facility	BioRS DB2 family Excel Informix JDBC Microsoft SQL Server ODBC Oracle Sybase Table-structured files Teradata XML (root nicknames only)
Pass-through sessions	DRDA Informix Oracle Microsoft SQL Server Sybase Teradata
Remote XML data type	DB2 for Linux, UNIX, and Windows XML wrapper

Table 46. Features and supported data sources (continued)

Feature	Data sources
SOCKS proxy	BioRS Script Web services XML
Secure Socket Layer (SSL)	Web services XML
Statement-level isolation	DB2 family Microsoft SQL Server
Two-phase commit transactions	DB2 for Linux, UNIX, and Windows, in trusted mode DB2 for System i, in trusted mode DB2 for z/OS, in trusted mode Informix, in trusted mode Microsoft SQL Server, in trusted mode, with the federated server installed on Microsoft Windows Oracle, in trusted mode Sybase, in trusted mode, with the federated server installed on Microsoft Windows Sybase, in fenced mode, with the federated server installed on UNIX
Unicode support	All data sources

Chapter 4. Data source options reference

Each data source supports specific wrapper, server, user mapping, nickname, and column options.

BioRS options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, nickname, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify in the CREATE WRAPPER and CREATE SERVER statements.

Table 47. Wrapper options for BioRS

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java™, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
PROXY_SERVER_NAME	Specifies the name or IP address of the proxy server. This option is required if the value of PROXY_TYPE is HTTP or SOCKS. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.
PROXY_SERVER_PORT	Specifies the port or service name for the proxy service on the proxy server. This option is required if the value of PROXY_TYPE is HTTP or SOCKS. Valid values are a decimal port number from 1 to 32760 or a service name.

Table 47. Wrapper options for BioRS (continued)

Name	Description
PROXY_TYPE	Specifies the proxy type to use to access the Internet when the federated server is behind a firewall. Valid values are NONE, HTTP, and SOCKS. The default value is NONE. If you set this option to HTTP or SOCKS, you must also specify the PROXY_SERVER_NAME and PROXY_SERVER_PORT.

Server options

Table 48. Server options for BioRS

Name	Description
CASE_SENSITIVE	Specifies whether the BioRS server treats names in a case-sensitive manner. Valid values are Y and N. The default is Y; names are treated in a case-sensitive manner. In the BioRS product, a configuration parameter controls the case sensitivity of the data that is stored on the BioRS server. The CASE_SENSITIVE option and the configuration parameter must specify the same case sensitivity. If you need to change the value of the CASE_SENSITIVE option after you create the server definition, you must drop the server definition and create the definition and all nicknames again.
DB2_MAX_ASYNC_REQUESTS_ PER_QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, `"UserMappingRepositoryLDAP"`. For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language for the user mapping plug-in. Valid values are Java and C. The default is Java.
NODE	Required. Specifies the DNS host name or IP address of the system on which the BioRS query tool is available. Valid IP addresses are in IPv4 (dot-separated) format or IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured. The default value is `localhost`.

Table 48. Server options for BioRS (continued)

Name	Description
PORT	Specifies the port for connections to the BioRS server. Valid values are a numeric port or a TCP/IP service name. The default is 5014.
PROXY_AUTHID	Specifies the user name for proxy server authentication.
PROXY_PASSWORD	Specifies the password for proxy server authentication.
PROXY_SERVER_NAME	Specifies the name or IP address of the proxy server. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.
PROXY_SERVER_PORT	Specifies the port or service name for the proxy service on the proxy server. Valid values are a decimal port number from 1 to 32760 or a service name.
PROXY_TYPE	Specifies the proxy type to use to access the Internet when the federated server is behind a firewall. Valid values are NONE, HTTP, and SOCKS. The default value is NONE.
TIMEOUT	Specifies the maximum time, in minutes, that the federated server waits for a response from the remote server. The default is 10.

User mapping options

Table 49. User mapping options for BioRS

Option	Description
GUEST	Specifies that the GUEST BioRS authentication ID is used to perform operations. Valid values are Y and N. The default is N; the GUEST BioRS ID is not used. This option is not valid if you specify the REMOTE_AUTHID and REMOTE_PASSWORD options.
PROXY_AUTHID	Specifies the user name for proxy server authentication.
PROXY_PASSWORD	Specifies the password for proxy server authentication. The password is encrypted when it is stored in the federated database catalog.
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.

Nickname options

Table 50. Nickname options for BioRS

Option	Description
REMOTE_OBJECT	Specifies the name of the BioRS databank that is associated with the nickname. This name determines the schema and the BioRS databank for the nickname. The name also specifies the relationship of the nickname to other nicknames. The case sensitivity of this option depends on the case sensitivity of the BioRS server and on the value of the CASE_SENSITIVE server option. You cannot use the ALTER NICKNAME statement to change or delete this name. If the name of the BioRS databank changes, you must delete the nickname and then create it again.
TIMEOUT	Specifies the maximum time, in minutes, to wait for a response from the data source server. The default is 10.

Column options

Table 51. Column options for BioRS

Option	Description
ELEMENT_NAME	Specifies the BioRS element name. The case sensitivity of this name depends on the case sensitivity of the BioRS server and on the value of the CASE_SENSITIVE server option. You must specify the BioRS element name only if it is different from the column name.
IS_INDEXED	Specifies whether the corresponding column is indexed and, therefore, can be referenced in a predicate. Valid values are Y and N. The default is N; the column is not indexed.
REFERENCED_OBJECT	Specifies the name of the BioRS databank that is referenced by the current column. The case sensitivity of this name depends on the case sensitivity of the BioRS server and on the value of the CASE_SENSITIVE server option. This option is valid only for columns that have the BioRS data type of Reference.

DB2 database options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, nickname, and column options.

Wrapper options

The following tables list the options that apply to DB2 data sources and identify the required options that you must specify.

Table 52. Wrapper options for DB2 data sources

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, `"UserMappingRepositoryLDAP"`. For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.

Server options

Table 53. Server options for DB2 data sources

Name	Description
COLLATING_SEQUENCE	Specifies whether the data source uses the same default collating sequence as the federated database. Valid values are Y, N, and I. I specifies a case-insensitive. The default is Y. The collating sequence specified for the federated server must match the collating sequence on the remote data source.
COMM_RATE	Specifies the communication rate, in megabytes per second, between the federated server and the data source server. Valid values are whole numbers the are greater than 0 and less than 2147483648. The default is 2.
CPU_RATIO	Specifies how much faster or slower the data source CPU is when compared to federated server CPU. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same CPU speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server CPU speed is 50% slower than the data source CPU. A setting of 2 indicates that the federated CPU is twice as fast as the data source CPU.
DATE_COMPAT	Specifies whether the date_compat parameter is applied to the database. Valid values are Y and N. The default is N. This server option is only valid for DB2 Database for Linux, UNIX, and Windows, Version 9.7 or later.

Table 53. Server options for DB2 data sources (continued)

Name	Description
DBNAME	Required. Specifies the specific database to use for the initial remote DB2 database connection. This specific database is the database alias for the remote DB2 database that is cataloged on the federated server by using the CATALOG DATABASE command or the DB2 Configuration Assistant.
DB2_MAXIMAL_PUSHDOWN	Specifies the primary criteria that the query optimizer uses to choose an access plan. Valid values are Y and N. The default is N; the query optimizer chooses the plan that has the lowest estimated cost. Y specifies that the query optimizer choose the access plan that pushes down the most query operations to the data source.
DB2_MAX_ASYNC_REQUESTS_ PER_QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
DB2_TWO_PHASE_COMMIT	Specifies whether the federated server connects to the data source in two-phase commit protocol or one-phase commit protocol. Valid values are Y and N. The default is N; the federated server uses the one-phase commit protocol to connect. Y specifies that the federated server uses two-phase commit protocol to connect.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
FED_PROXY_USER	Specifies the authorization ID to use to establish all outbound trusted connections when the inbound connection is non-trusted. The user whose ID is specified in this option must have a user mapping that specifies both the REMOTE_AUTHID and a REMOTE_PASSWORD options. **Restriction:** This server option is only valid for DB2 Database for Linux, UNIX, and Windows Version 9.5 and later and DB2 for z/OS Version 9 and later.

Table 53. Server options for DB2 data sources (continued)

Name	Description
FOLD_ID	Specifies the case for the user ID that is sent to the data source. There is no default value; the federated server sends the user ID in uppercase; then if the uppercase user ID fails, the server sends the user ID in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
FOLD_PW	Specifies the case for the password that is sent to the data source. There is no default value; the federated server sends the password in uppercase; then if the uppercase password fails, the server sends the password in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
IO_RATIO	Specifies how much faster or slower the data source I/O system runs when compared to the federated server I/O system. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same I/O speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server speed is 50% slower than the data source speed. A setting of 2 indicates that the federated speed is twice as fast as the data source speed.
NO_EMPTY_STRING	Specifies whether the remote data source server can contain empty strings. Valid values are Y and N. The default value varies depending on your remote data source. For remote Oracle data sources, the default is Y; all empty string values are converted to NULL values. For all other remote data sources, the default is N; the data source can contain empty strings. You can improve your systems performance by setting this option to Y in system configurations where the federated server is in VARCHAR2 compatible mode but the remote data source is not VARCHAR2 compatible.

Table 53. Server options for DB2 data sources (continued)

Name	**Description**
NUMBER_COMPAT	Specifies whether the data source server supports the NUMBER data type. Valid values are Y and N. The default is N; the data source server does not support the NUMBER data type. In systems where the federated server does not support the NUMBER data type but the data source server does, you must set the NUMBER_COMPAT option to Y because the data source server can return DECFLOAT results that are outside of the range of the DECIMAL data type and cause the SQLSTATE 560BD error. **Restriction:** This server option is only valid for DB2 Database for Linux, UNIX, and Windows Version 9.7 and later.
OLD_NAME_GEN	Specifies how to convert the column names and index names that are in the data source into nickname column names and local index names for the federated server. Valid values are Y and N. The default is N; the generated names closely match the names in the data source. Y specifies that the generated names are the same as the names that were created in IBM WebSphere® Federation Server Version 9 and earlier. Thus, the names might not closely match the data source names.
PUSHDOWN	Specifies whether the federated server allows the data source to evaluate operations. Valid values are Y and N. The default is Y; the data source evaluates operations. N specifies that the federated server send SQL statements that include only SELECT with column names. Predicates, such as WHERE=; column and scalar functions, such as MAX and MIN; sorts, such as ORDER BY OR GROUP BY; and joins are not included in any SQL that the federated server sends to the data source.

Table 53. Server options for DB2 data sources (continued)

Name	Description
SAME_DECFLT_ROUNDING	Specifies whether the rounding mode of both the federated server and data source server are using the same DECFLOAT rounding mode settings. Valid values are Y and N. The default is N; the federated server and remote server have different DECFLOAT rounding mode settings. **Important:** If you set this option to Y when the rounding modes are different between the federated server and data source server, you might receive incorrect DECFLOAT rounding results. To configure an existing federated server and data source server that use the same DECFLOAT rounding mode setting, use the ALTER SERVER statement. **Restriction:** This server option is only valid for DB2 Database for Linux, UNIX, and Windows Version 9.5 and later.
VARCHAR2_COMPAT	Specifies whether the remote data source is VARCHAR2 compatible. The valid values Y and N. The default value varies depending on the remote data source. For remote Oracle data sources, the default is Y; the data source is VARCHAR2 compatible. For all other remote data sources, the default is N; the data source is not set to VARCHAR2 compatible mode. You must set this server option to Y if your DB2 Database for Linux, UNIX, and Windows, ODBC, or JDBC data source is configured in VARCHAR2 compatible mode.

User mapping options

Table 54. User mapping options for DB2 data sources

Option	Description
FED_PROXY_USER	Specifies the authorization ID to use to establish all outbound trusted connections when the inbound connection is non-trusted. The user whose ID is specified in this option must have a user mapping that specifies both a REMOTE_AUTHID and a REMOTE_PASSWORD. If you specify the FED_PROXY_USER user mapping option, you must also specify the FED_PROXY_USER server option. **Restriction:** This server option is only valid for DB2 Database for Linux, UNIX, and Windows Version 9.5 and later and DB2 for z/OS Version 9 and later.

Table 54. User mapping options for DB2 data sources (continued)

Option	Description
ACCOUNTING_STRING	Required if accounting information must be passed. Specifies a DRDA accounting string. Valid values include any string that has 255 characters or fewer.
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.
USE_TRUSTED_CONTEXT	Specifies whether the user mapping is trusted. Valid values are Y and N. The default is N; the user mapping is not trusted and can be used only in non-trusted federated outbound connections. Y specifies that the user mapping is trusted and can be used in both trusted and non-trusted outbound federated connections. **Restriction:** This server option is only valid for DB2 Database for Linux, UNIX, and Windows Version 9.5 and later and DB2 for z/OS Version 9 and later.

Column options

Table 55. Column options for DB2 data sources

Option	Description
NUMERIC_STRING	Specifies how to treat numeric strings. The default is N. If the data source string column contains only numeric strings and no other characters, including blanks, set the NUMERIC_STRING option to Y. When NUMERIC_STRING is set to Y for a column, the query optimizer recognizes that the column contains no blanks that could interfere with the sorting of the data in the column. Use this option when the collating sequence of a data source is different from the collating sequence that the federated server uses. Columns that use this option are not excluded from remote evaluation because of a different collating sequence.
NO_EMPTY_STRING	Specifies whether the remote data source server can contain empty strings. Valid values are Y and N. The default value varies depending on your remote data source. For remote Oracle data sources, the default is Y; all empty string values are converted to NULL values. For all other remote data sources, the default is N; the data source can contain empty strings.

Table 55. Column options for DB2 data sources (continued)

Option	Description
XML_ROOT	Specifies the XML root element to add to the values of an XML column that references an XML sequence. This option ensures that the values of the XML column is a well-formed XML document.

Excel options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, and nickname options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 56. Wrapper options for Excel

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode.

Server options

Table 57. Server options for Excel

Name	Description
DB2_MAX_ASYNC_REQUESTS_PER_ QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.

Nickname options

Table 58. Nickname options for Excel

Option	Description
FILE_PATH	Required. Specifies the fully qualified directory path and file name of the Excel spreadsheet that you want to access.
RANGE	Specifies the range of cells to use, for example, A1:C100. The value before the colon specifies the top left cell of the range. The value after the colon specifies the bottom right cell of the range.

Informix options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 59. Wrapper options for Informix

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.

Server options

Table 60. Server options for Informix

Name	Description
COLLATING_SEQUENCE	Specifies whether the data source uses the same default collating sequence as the federated database. Valid values are Y, N, and I. I specifies a case-insensitive. The default is Y. The collating sequence specified for the federated server must match the collating sequence on the remote data source.
COMM_RATE	Specifies the communication rate, in megabytes per second, between the federated server and the data source server. Valid values are whole numbers the are greater than 0 and less than 2147483648. The default is 2.

Table 60. Server options for Informix (continued)

Name	Description
CPU_RATIO	Specifies how much faster or slower the data source CPU is when compared to federated server CPU. Valid values are greater than 0 and less than 1x10^{23}. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same CPU speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server CPU speed is 50% slower than the data source CPU. A setting of 2 indicates that the federated CPU is twice as fast as the data source CPU.
DBNAME	Required. Specifies the name of the Informix database that you want to access.
DB2_MAXIMAL_PUSHDOWN	Specifies the primary criteria that the query optimizer uses to choose an access plan. Valid values are Y and N. The default is N; the query optimizer chooses the plan that has the lowest estimated cost. Y specifies that the query optimizer choose the access plan that pushes down the most query operations to the data source. If more than one access plan meets this criteria, plan that has the lowest cost is chosen.
DB2_MAX_ASYNC_REQUESTS_ PER_QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
DB2_TWO_PHASE_COMMIT	Specifies whether the federated server connects to the data source in two-phase commit protocol or one-phase commit protocol. Valid values are Y and N. The default is N; the federated server uses the one-phase commit protocol to connect. Y specifies that the federated server uses two-phase commit protocol to connect.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.

Table 60. Server options for Informix (continued)

Name	Description
FOLD_ID	Specifies the case for the user ID that is sent to the data source. There is no default value; the federated server sends the user ID in uppercase; then if the uppercase user ID fails, the server sends the user ID in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
FOLD_PW	Specifies the case for the password that is sent to the data source. There is no default value; the federated server sends the password in uppercase; then if the uppercase password fails, the server sends the password in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
INFORMIX_CLIENT_LOCALE	Specifies the CLIENT_LOCALE to use for the connection between the federated server and the data source server. The value is any valid Informix locale. If you do not specify this option, the CLIENT_LOCALE environment variable is set to the value that is specified in the `db2dj.ini` file. If the `db2dj.ini` does not specify the CLIENT_LOCALE environment variable, the INFORMIX_CLIENT_LOCALE is set to the Informix locale that most closely matches the code page and territory of the federated database.
INFORMIX_DB_LOCALE	Specifies the Informix DB_LOCALE to use for the connection between the federated server and the data source server. If the INFORMIX_DB_LOCALE option is not specified, the Informix DB_LOCALE environment variable is set to the value specified in the `db2dj.ini` file. If the `db2dj.ini` file does not specify a value, the Informix DB_LOCALE environment variable is not set.

Table 60. Server options for Informix (continued)

Name	Description

INFORMIX_LOCK_MODE	Specifies the lock mode to set for an Informix data source. The Informix wrapper issues the SET LOCK MODE command immediately after connecting to an Informix data source. Valid values are W, N, and a number. The default is W; the wrapper waits an unlimited amount of time for the lock to be released. N specifies not to wait; an error is returned immediately. Use a number to specify the maximum amount of time, in seconds, to wait. If a deadlock or timeout occurs, use the ALTER SERVER statement to change the value of the INFORMIX_LOCK_MODE option. For example:
	`ALTER SERVER TYPE informix`
	`VERSION 9`
	`WRAPPER informix`
	`OPTIONS`
	`(ADD informix_lock_mode '60')`

IO_RATIO	Specifies how much faster or slower the data source I/O system runs when compared to the federated server I/O system. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same I/O speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server speed is 50% slower than the data source speed. A setting of 2 indicates that the federated speed is twice as fast as the data source speed.
IUD_APP_SVPT_ENFORCE	Specifies whether the federated server enforces the use of application savepoint statements. Valid values are Y and N. The default is Y; if the data source does not enforce application savepoint statements and an error occurs during an insert, update, or delete operation, the federated server rolls back the transaction and SQL error code SQL1476N is returned. It is recommended that you use the default setting.
NODE	Required. Specifies the name by which the data source is defined as an instance to its relational database management system.

Table 60. Server options for Informix (continued)

Name	Description
OLD_NAME_GEN	Specifies how to convert the column names and index names that are in the data source into nickname column names and local index names for the federated server. Valid values are Y and N. The default is N; the generated names closely match the names in the data source. Y specifies that the generated names are the same as the names that were created in IBM WebSphere Federation Server Version 9 and earlier. Thus, the names might not closely match the data source names.
PUSHDOWN	Specifies whether the federated server allows the data source to evaluate operations. Valid values are Y and N. The default is Y; the data source evaluates operations. N specifies that the federated server send SQL statements that include only SELECT with column names. Predicates, such as WHERE=; column and scalar functions, such as MAX and MIN; sorts, such as ORDER BY OR GROUP BY; and joins are not included in any SQL that the federated server sends to the data source.

User mapping options

Table 61. User mapping options for Informix

Name	Description
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.

Column options

Table 62. Column options for Informix

Name	Description
NUMERIC_STRING	Specifies how to treat numeric strings. The default is N. If the data source string column contains only numeric strings and no other characters, including blanks, set the NUMERIC_STRING option to Y. When NUMERIC_STRING is set to Y for a column, the query optimizer recognizes that the column contains no blanks that could interfere with the sorting of the data in the column. Use this option when the collating sequence of a data source is different from the collating sequence that the federated server uses. Columns that use this option are not excluded from remote evaluation because of a different collating sequence.

JDBC options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 63. Wrapper options for JDBC

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. The only valid value is Y because the DB2 server only supports loading the JVM in fenced mode. The default is Y; the wrapper runs in fenced mode.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.

Server options

Table 64. Server options for JDBC

Name	Description
COLLATING_SEQUENCE	Specifies whether the data source uses the same default collating sequence as the federated database. Valid values are Y, N, and I. I specifies a case-insensitive. The default is Y. The collating sequence specified for the federated server must match the collating sequence on the remote data source.
COMM_RATE	Specifies the communication rate, in megabytes per second, between the federated server and the data source server. Valid values are whole numbers the are greater than 0 and less than 2147483648. The default is 2.
CPU_RATIO	Specifies how much faster or slower the data source CPU is when compared to federated server CPU. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same CPU speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server CPU speed is 50% slower than the data source CPU. A setting of 2 indicates that the federated CPU is twice as fast as the data source CPU.
DATEFORMAT	Specifies the date format that the data source uses. Use ’DD’, ’MM’, and ’YY’ or ’YYYY’ to specify the date format. You can specify a delimiter such as a space, a hyphen, or a comma. For example, the format ’YYYY-MM-DD’ specifies a date such as 1958-10-01. The value can contain null values.
DB2_MAXIMAL_PUSHDOWN	Specifies the primary criteria that the query optimizer uses to choose an access plan. Valid values are Y and N. The default is N; the query optimizer chooses the plan that has the lowest estimated cost. Y specifies that the query optimizer choose the access plan that pushes down the most query operations to the data source.
DB2_MAX_ASYNC_REQUESTS_PER_ QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 0. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.

Table 64. Server options for JDBC (continued)

Name	Description
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.

DRIVER_CLASS	Specifies the JDBC driver library. You can register the server against multiple JDBC data sources if the JDBC driver conforms to the JDBC specification version 3.0 and later. See your JDBC driver documentation for the JDBC specifications and information on how to set the DRIVER_CLASS server option.
	
	Example
	In this example, the `com.ibm.db2.jcc.DB2Driver` JDBC driver library is specified:
	
	`DRIVER_CLASS`
	` 'com.ibm.db2.jcc.DB2Driver'`
	
	Important: If you specify this option, you must also specify the URL server option.

DRIVER_PACKAGE	Specifies the JDBC driver packages. Use a path separator to specify multiple driver class packages. Use a semicolon in the Windows operating systems and a colon in Linux and Unix operating systems.
	
	Example
	In this example, you specify multiple driver packages with a colon on Linux operating systems:
	
	`DRIVER_PACKAGE`
	` '/path1/file1.jar: /path2/file2.jar'`

FOLD_ID	Specifies the case for the user ID that is sent to the data source. There is no default value; the federated server sends the user ID in uppercase; then if the uppercase user ID fails, the server sends the user ID in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.

Table 64. Server options for JDBC (continued)

Name	Description
FOLD_PW	Specifies the case for the password that is sent to the data source. There is no default value; the federated server sends the password in uppercase; then if the uppercase password fails, the server sends the password in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
IO_RATIO	Specifies how much faster or slower the data source I/O system runs when compared to the federated server I/O system. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same I/O speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server speed is 50% slower than the data source speed. A setting of 2 indicates that the federated speed is twice as fast as the data source speed.
JDBC_LOG	Specifies whether the JDBC wrapper creates log files for error tracing. Valid values are Y and N. The default is N; log file are not created. If this server option is set to Y, the JDBC wrapper writes JDBC log files to the `jdbc_wrapper`*`prod_id`*`.log` file, where *prod_id* is the product ID. The log file is stored in the directory specified by the DB2 database manager configuration parameter DIAGPATH. The default directory on UNIX systems is `inst_home/sqllib/db2dump`. **Recommendation:** Setting this server option to YES will impact the performance of your system and you should not enable logging in production systems.
OLD_NAME_GEN	Specifies how to convert the column names and index names that are in the data source into nickname column names and local index names for the federated server. Valid values are Y and N. The default is N; the generated names closely match the names in the data source. Y specifies that the generated names are the same as the names that were created in IBM WebSphere Federation Server Version 9 and earlier. Thus, the names might not closely match the data source names.

Table 64. Server options for JDBC (continued)

Name	Description
PUSHDOWN	Specifies whether the federated server allows the data source to evaluate operations. Valid values are Y and N. The default is Y; the data source evaluates operations. N specifies that the federated server send SQL statements that include only SELECT with column names. Predicates, such as WHERE=; column and scalar functions, such as MAX and MIN; sorts, such as ORDER BY OR GROUP BY; and joins are not included in any SQL that the federated server sends to the data source.
TIMEFORMAT	Specifies the time format that the data source uses. Use 'hh12', 'hh24', 'mm', 'ss', 'AM', and 'A.M.' to specify the time format. For example, the format `'hh24:mm:22'` specifies a time such as 16:00:00. The format `'hh12:mm:ss AM'` specifies a time such as 8:00:00 AM. The value can contain null values.
TIMESTAMPFORMAT	Specifies the timestamp format that the data source uses. Valid values are in the format that the DATEFORMAT option and the TIMEFORMAT option use. Specify 'n' for a tenth of a second, 'nn' for a hundredth of a second, 'nnn' for milliseconds, and so on, up to 'nnnnnn' for microseconds. For example, the format `'YYY-MM-DD-hh24:mm:ss.nnnnnn'` specifies a timestamp such as 1994-01-01-24:00:00.000000. The value can contain null values.

Table 64. Server options for JDBC (continued)

Name	**Description**
URL	Specifies the JDBC connection string of the remote server. The JDBC connection string consists of three parts that are all separated by a colon: • Database protocol • Database type name or connectivity driver name • Database identity through an alias or sub-name **Example** In this example, the JDBC connection string is `jdbc:db2://cn.ibm.com:50471/testdb`: `URL 'jdbc:db2://cn.ibm.com:50471/testdb'` You can register the server against multiple JDBC data sources if the JDBC driver conforms to the JDBC specification version 3.0 and above. See your JDBC driver documentation for the JDBC specifications and information on how to set the URL server option. **Important:** If you specify this option, you must also specify the DRIVER_CLASS server option.
VARCHAR_NO_TRAILING_BLANKS	Specifies whether the data source contains VARCHAR columns that contain at least one trailing blank character. The default is N; VARCHAR columns contain at least one trailing blank character.

User mapping options

Table 65. User mapping options for JDBC

Name	**Description**
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.

Column options

Table 66. Column options for JDBC

Name	Description
NUMERIC_STRING	Specifies whether the column contains strings of numeric characters that include blanks. Valid values are Y and N. The default is N; the column does not contain numeric strings that include blanks. If the column contains only numeric strings followed by trailing blanks, do not specify Y. When NUMERIC_STRING is set to Y for a column, the query optimizer recognizes that the column contains no blanks that could interfere with the sorting of the data in the column. Use this option when the collating sequence of a data source is different from the collating sequence that the federated server uses. Columns that use this option are not excluded from remote evaluation because of a different collating sequence.
VARCHAR_NO_TRAILING_BLANKS	Specifies whether there is at least one trailing blank in the VARCHAR column.

Microsoft SQL Server options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 67. Wrapper options for Microsoft SQL Server

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "UserMappingRepositoryLDAP". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.

Server options

Table 68. Server options for Microsoft SQL Server

Name	Description
CODEPAGE	Specifies the code page that corresponds to the coded character set of the data source client configuration. On UNIX and Microsoft Windows systems that use a non-Unicode federated database, the default is the code page of the federated database. On UNIX systems that use a Unicode federated database, the default is 1208. On Windows systems that use a Unicode federated database, the default is 1202.
COLLATING_SEQUENCE	Specifies whether the data source uses the same default collating sequence as the federated database. Valid values are Y, N, and I. I specifies a case-insensitive. The default is Y. The collating sequence specified for the federated server must match the collating sequence on the remote data source.
COMM_RATE	Specifies how much faster or slower the data source CPU is when compared to federated server CPU. Valid values are greater than 0 and less than 1x10^{23}. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same CPU speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server CPU speed is 50% slower than the data source CPU. A setting of 2 indicates that the federated CPU is twice as fast as the data source CPU.
CPU_RATIO	Specifies how much faster or slower the CPU of the data source runs when compared to the speed of the federated server's CPU. Valid values are greater than 0 and less than 1x10^{23}. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4.
DBNAME	Required. Specifies the alias for the database that you want to access. The value is case-sensitive.
DB2_MAXIMAL_PUSHDOWN	Specifies the primary criteria that the query optimizer uses to choose an access plan. Valid values are Y and N. The default is N; the query optimizer chooses the plan that has the lowest estimated cost. Y specifies that the query optimizer choose the access plan that pushes down the most query operations to the data source. If more than one access plan meets this criteria, plan that has the lowest cost is chosen.

Table 68. Server options for Microsoft SQL Server (continued)

Name	Description
DB2_MAX_ASYNC_REQUESTS_PER_QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
DB2_TWO_PHASE_COMMIT	Specifies whether the federated server connects to the data source in two-phase commit protocol or one-phase commit protocol. Valid values are Y and N. The default is N; the federated server uses the one-phase commit protocol to connect. Y specifies that the federated server uses two-phase commit protocol to connect. **Important:** If you set this option to Y, you must also specify the XA_OPEN_STRING_OPTION.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
FOLD_ID	Specifies the case for the user ID that is sent to the data source. There is no default value; the federated server sends the user ID in uppercase; then if the uppercase user ID fails, the server sends the user ID in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
FOLD_PW	Specifies the case for the password that is sent to the data source. There is no default value; the federated server sends the password in uppercase; then if the uppercase password fails, the server sends the password in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.

Table 68. Server options for Microsoft SQL Server (continued)

Name	**Description**
IO_RATIO	Specifies how much faster or slower the data source I/O system runs when compared to the federated server I/O system. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same I/O speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server speed is 50% slower than the data source speed. A setting of 2 indicates that the federated speed is twice as fast as the data source speed.
NODE	Required. If the federated server uses Microsoft Windows, the value for NODE is the system DSN name that you specify for the Microsoft SQL Server. If the federated server uses UNIX or Linux, the value for NODE is defined in the `odbc.ini` file. The value is case-sensitive.
OLD_NAME_GEN	Specifies how to convert the column names and index names that are in the data source into nickname column names and local index names for the federated server. Valid values are Y and N. The default is N; the generated names closely match the names in the data source. Y specifies that the generated names are the same as the names that were created in IBM WebSphere Federation Server Version 9 and earlier. Thus, the names might not closely match the data source names.
PASSWORD	Specifies whether or not passwords are sent to a data source. The default is Y.
PUSHDOWN	Specifies whether the federated server allows the data source to evaluate operations. Valid values are Y and N. The default is Y; the data source evaluates operations. N specifies that the federated server send SQL statements that include only SELECT with column names. Predicates, such as WHERE=; column and scalar functions, such as MAX and MIN; sorts, such as ORDER BY OR GROUP BY; and joins are not included in any SQL that the federated server sends to the data source.
XA_OPEN_STRING_OPTIONS	Required when DB2_TWO_PHASE_COMMIT is set to Y. Specifies the resource manager ID of the Microsoft SQL Server Registry.

User mapping options

Table 69. User mapping options for Microsoft SQL Server

Name	Description
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.

Column options

Table 70. Column options for Microsoft SQL Server

Name	Description
NUMERIC_STRING	Specifies how to treat numeric strings. The default is N. If the data source string column contains only numeric strings and no other characters, including blanks, set the NUMERIC_STRING option to Y. When NUMERIC_STRING is set to Y for a column, the query optimizer recognizes that the column contains no blanks that could interfere with the sorting of the data in the column. Use this option when the collating sequence of a data source is different from the collating sequence that the federated server uses. Columns that use this option are not excluded from remote evaluation because of a different collating sequence.

ODBC options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 71. Wrapper options for ODBC

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode. **Important:** If you set this option to Y for a UNIX system, you must also set the DB2_SOURCE_CLIENT_MODE wrapper option.

Table 71. Wrapper options for ODBC (continued)

Name	Description
DB2_SOURCE_CLIENT_MODE	Specifies that the client for the data source is 32-bit and that the database instance on the federated server is 64-bit. The only valid value is 32-bit. This option is valid only for UNIX. **Important:** If you set this option, you must also set the DB2_FENCED wrapper option to Y.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, `"UserMappingRepositoryLDAP"`. For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
MODULE	Required for federated servers that run on a UNIX system. Specifies the full path of the library that contains the ODBC Driver Manager implementation or the SQL/CLI implementation. There is no default for UNIX. On a Microsoft Windows system, the default is `odbc32.dll`.

Server options

Table 72. Server options for ODBC

Name	Description
CODEPAGE	Specifies the code page that corresponds to the coded character set of the client configuration for the data source. On UNIX and Windows systems that use a non-Unicode federated database, the default is the code page that the federated database uses. On UNIX systems that use a Unicode federated database, the default is 1208. On Windows systems that use a Unicode federated database, the default is 1202.
COLLATING_SEQUENCE	Specifies whether the data source uses the same default collating sequence as the federated database. Valid values are Y, N, and I. I specifies a case-insensitive. The default is Y. The collating sequence specified for the federated server must match the collating sequence on the remote data source.

Table 72. Server options for ODBC (continued)

Name	Description
COMM_RATE	Specifies the communication rate, in megabytes per second, between the federated server and the data source server. Valid values are whole numbers the are greater than 0 and less than 2147483648. The default is 2.
CPU_RATIO	Specifies how much faster or slower the data source CPU is when compared to federated server CPU. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same CPU speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server CPU speed is 50% slower than the data source CPU. A setting of 2 indicates that the federated CPU is twice as fast as the data source CPU.
DATEFORMAT	Specifies the date format that the data source uses. Use ’DD’, ’MM’, and ’YY’ or ’YYYY’ to specify the date format. You can specify a delimiter such as a space, a hyphen, or a comma. For example, the format `’YYYY-MM-DD’` specifies a date such as 1958-10-01. The value can contain null values.
DBNAME	Specifies the name of the data source database that you want to access.
DB2_MAXIMAL_PUSHDOWN	Specifies the primary criteria that the query optimizer uses to choose an access plan. Valid values are Y and N. The default is N; the query optimizer chooses the plan that has the lowest estimated cost. Y specifies that the query optimizer choose the access plan that pushes down the most query operations to the data source.
DB2_MAX_ASYNC_REQUESTS_PER_ QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 0. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, `"UserMappingRepositoryLDAP"`. For a plug-in written in C, specifies any valid C library name.

Table 72. Server options for ODBC (continued)

Name	Description
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
FOLD_ID	Specifies the case for the user ID that is sent to the data source. There is no default value; the federated server sends the user ID in uppercase; then if the uppercase user ID fails, the server sends the user ID in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
FOLD_PW	Specifies the case for the password that is sent to the data source. There is no default value; the federated server sends the password in uppercase; then if the uppercase password fails, the server sends the password in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
IO_RATIO	Specifies how much faster or slower the data source I/O system runs when compared to the federated server I/O system. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same I/O speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server speed is 50% slower than the data source speed. A setting of 2 indicates that the federated speed is twice as fast as the data source speed.
NODE	Required. Specifies the name of the node or the system DSN name that is assigned to the ODBC data source when the DSN is defined. The value is case-sensitive.
OLD_NAME_GEN	Specifies how to convert the column names and index names that are in the data source into nickname column names and local index names for the federated server. Valid values are Y and N. The default is N; the generated names closely match the names in the data source. Y specifies that the generated names are the same as the names that were created in IBM WebSphere Federation Server Version 9 and earlier. Thus, the names might not closely match the data source names.

Table 72. Server options for ODBC (continued)

Name	Description
PUSHDOWN	Specifies whether the federated server allows the data source to evaluate operations. Valid values are Y and N. The default is Y; the data source evaluates operations. N specifies that the federated server send SQL statements that include only SELECT with column names. Predicates, such as WHERE=; column and scalar functions, such as MAX and MIN; sorts, such as ORDER BY OR GROUP BY; and joins are not included in any SQL that the federated server sends to the data source.
TIMEFORMAT	Specifies the time format that the data source uses. Use 'hh12', 'hh24', 'mm', 'ss', 'AM', and 'A.M.' to specify the time format. For example, the format `'hh24:mm:22'` specifies a time such as 16:00:00. The format `'hh12:mm:ss AM'` specifies a time such as 8:00:00 AM. The value can contain null values.
TIMESTAMPFORMAT	Specifies the timestamp format that the data source uses. Valid values are in the format that the DATEFORMAT option and the TIMEFORMAT option use. Specify 'n' for a tenth of a second, 'nn' for a hundredth of a second, 'nnn' for milliseconds, and so on, up to 'nnnnnn' for microseconds. For example, the format `'YYY-MM-DD-hh24:mm:ss.nnnnnn'` specifies a timestamp such as 1994-01-01-24:00:00.000000. The value can contain null values.
VARCHAR_NO_TRAILING_BLANKS	Specifies whether the data source contains VARCHAR columns that contain at least one trailing blank character. The default is N; VARCHAR columns contain at least one trailing blank character.

User mapping options

Table 73. User mapping options for ODBC

Name	Description
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.

Column options

Table 74. Column options for ODBC

Name	Description
NUMERIC_STRING	Specifies whether the column contains strings of numeric characters that include blanks. Valid values are Y and N. The default is N; the column does not contain numeric strings that include blanks. If the column contains only numeric strings followed by trailing blanks, do not specify Y. When NUMERIC_STRING is set to Y for a column, the query optimizer recognizes that the column contains no blanks that could interfere with the sorting of the data in the column. Use this option when the collating sequence of a data source is different from the collating sequence that the federated server uses. Columns that use this option are not excluded from remote evaluation because of a different collating sequence.
VARCHAR_NO_TRAILING_BLANKS	Specifies whether there is at least one trailing blank in the VARCHAR column.

Oracle options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 75. Wrapper options for Oracle

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, `"UserMappingRepositoryLDAP"`. For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.

Server options

Table 76. Server options for Oracle

Name	Description
COLLATING_SEQUENCE	Specifies whether the data source uses the same default collating sequence as the federated database. Valid values are Y, N, and I. I specifies a case-insensitive. The default is Y. The collating sequence specified for the federated server must match the collating sequence on the remote data source.
COMM_RATE	Specifies the communication rate, in megabytes per second, between the federated server and the data source server. Valid values are whole numbers the are greater than 0 and less than 2147483648. The default is 2.
CPU_RATIO	Specifies how much faster or slower the data source CPU is when compared to federated server CPU. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same CPU speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server CPU speed is 50% slower than the data source CPU. A setting of 2 indicates that the federated CPU is twice as fast as the data source CPU.
DB2_MAXIMAL_PUSHDOWN	Specifies the primary criteria that the query optimizer uses to choose an access plan. Valid values are Y and N. The default is N; the query optimizer chooses the plan that has the lowest estimated cost. Y specifies that the query optimizer choose the access plan that pushes down the most query operations to the data source.
DB2_MAX_ASYNC_REQUESTS_PER_ QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
DB2_TWO_PHASE_COMMIT	Specifies whether the federated server connects to the data source in two-phase commit protocol or one-phase commit protocol. Valid values are Y and N. The default is N; the federated server uses the one-phase commit protocol to connect. Y specifies that the federated server uses two-phase commit protocol to connect.

Table 76. Server options for Oracle (continued)

Name	Description
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "UserMappingRepositoryLDAP". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
FED_PROXY_USER	Specifies the authorization ID to use to establish all outbound trusted connections when the inbound connection is non-trusted. **Important:** The user whose ID is specified in this option must have a user mapping that specifies both a REMOTE_AUTHID and a REMOTE_PASSWORD.
FOLD_ID	Specifies the case for the user ID that is sent to the data source. There is no default value; the federated server sends the user ID in uppercase; then if the uppercase user ID fails, the server sends the user ID in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
FOLD_PW	Specifies the case for the password that is sent to the data source. There is no default value; the federated server sends the password in uppercase; then if the uppercase password fails, the server sends the password in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
IO_RATIO	Specifies how much faster or slower the data source I/O system runs when compared to the federated server I/O system. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same I/O speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server speed is 50% slower than the data source speed. A setting of 2 indicates that the federated speed is twice as fast as the data source speed.
NODE	Required. Specifies the name of the node where the Oracle database server resides. Obtain the name of the node from the `tnsnames.ora` file.

Table 76. Server options for Oracle (continued)

Name	Description
OLD_NAME_GEN	Specifies how to convert the column names and index names that are in the data source into nickname column names and local index names for the federated server. Valid values are Y and N. The default is N; the generated names closely match the names in the data source. Y specifies that the generated names are the same as the names that were created in IBM WebSphere Federation Server Version 9 and earlier. Thus, the names might not closely match the data source names.
PLAN_HINTS	Specifies whether or not plan hints are to be enabled. Plan hints are statement fragments that provide additional information that the data source optimizer uses to improve query performance. The data source optimizer uses the plan hints to decide whether or not to use an index and which index or which table join sequence to use. Valid values are Y and N. The default is N; plan hints are not to be enabled. Y specifies that plan hints are to be enabled at the data source if it supports plan hints.
PUSHDOWN	Specifies whether the federated server allows the data source to evaluate operations. Valid values are Y and N. The default is Y; the federated server allows the data source to evaluate operations. N specifies that the federated server retrieves columns from the remote data source.
VARCHAR_NO_TRAILING_BLANKS	Specifies for a particular server if VARCHAR columns contain any trailing blanks. To apply the option to a single column, use the VARCHAR_NO_TRAILING_BLANKS column option.
XA_OPEN_STRING_OPTIONS	Specifies additional information to append to the string. For example, the information might be the directory for trace files.

User mapping options

Table 77. User mapping options for Oracle

Name	Description
FED_PROXY_USER	Specifies the authorization ID to use to establish all outbound trusted connections when the inbound connection is not trusted. **Important:** The user whose ID is specified in this option must have a user mapping that specifies both a REMOTE_AUTHID and a REMOTE_PASSWORD. If you specify the FED_PROXY_USER user mapping option, you must also specify the FED_PROXY_USER server option.

Table 77. User mapping options for Oracle (continued)

Name	Description
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.
USE_TRUSTED_CONTEXT	Specifies whether the user mapping is trusted. Valid values are Y and N. The default is N; the user mapping is not trusted and can be used only in non-trusted outbound connections. Y specifies that the user mapping is trusted and can be used in both trusted and non-trusted outbound connections.

Column options

Table 78. Column options for Oracle

Name	Description
NUMERIC_STRING	Specifies whether the column contains strings of numeric characters that include blanks. Valid values are Y and N. The default is N; the column does not contain numeric strings that include blanks. If the column contains only numeric strings followed by trailing blanks, do not specify Y. When NUMERIC_STRING is set to Y for a column, the query optimizer recognizes that the column contains no blanks that could interfere with the sorting of the data in the column. Use this option when the collating sequence of a data source is different from the collating sequence that the federated server uses. Columns that use this option are not excluded from remote evaluation because of a different collating sequence.
VARCHAR_NO_TRAILING_BLANKS	Specifies if the column contains any trailing blanks.

Script options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, nickname, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 79. Wrapper options for scripts

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode.
PROXY_TYPE	Specifies the proxy type to use to access the Internet when the federated server is behind a firewall. Valid values are NONE and SOCKS. The default value is NONE.
PROXY_SERVER_NAME	Specifies the name or IP address of the proxy server. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.
PROXY_SERVER_PORT	Specifies the name or IP address of the proxy server. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.

Server options

Table 80. Server options for scripts

Name	Description
DAEMON_PORT	Specifies the port number on which the Script daemon listens for Script job requests. The default is 4099. The port number must be the same as the DAEMON_PORT option in the daemon configuration file. If a service name is configured for the Script daemon, use a TCP/IP service name.
DB2_MAX_ASYNC_REQUESTS_PER_ QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
NODE	Required. Specifies the DNS host name or IP address of the system on which the Script daemon runs. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.
PROXY_AUTHID	Specifies the user name for proxy server authentication.
PROXY_PASSWORD	Specifies the password for proxy server authentication.

Table 80. Server options for scripts (continued)

Name	Description
PROXY_SERVER_NAME	Specifies the name or IP address of the proxy server. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.
PROXY_SERVER_PORT	Specifies the port or service name for the proxy service on the proxy server. Valid values are a decimal port number from 1 to 32760 or a service name.
PROXY_TYPE	Specifies the proxy type to use to access the Internet when the federated server is behind a firewall. Valid values are NONE and SOCKS. The default value is NONE.

User mapping options

Table 81. User mapping options for scripts

Name	Description
PROXY_AUTHID	Specifies the user name for proxy server authentication.
PROXY_PASSWORD	Specifies the password for proxy server authentication. The password is encrypted when it is stored in the federated database catalog.

Nickname options

Table 82. Nickname options for scripts

Name	Description
DATASOURCE	Required for the root nickname. Specifies the name of the script to invoke. The script that you specify as the value of this option must also be specified in the Script daemon configuration file. **Important:** This option valid only for the root nickname.

NAMESPACES	Specifies the namespaces that are associated with the namespace prefixes that are used in the XPATH and TEMPLATE options for each column. Use this syntax:
	`NAMESPACES'`*`prefix1=`*
	`"`*`actual_namespace1`*`",`
	`prefix2="actual_namespace2"'`
	
	Use a comma to separate multiple namespaces. For example:
	`NAMESPACES='http://www.myweb.com/cust",`
	`i='http://www.myweb.com/cust/id",`
	`n='http://www.myweb.com/cust/name"'`

Table 82. Nickname options for scripts (continued)

Name	Description
STREAMING	Specifies whether the source document should be separated into logical fragments for processing. The fragments correspond to the node that matches the XPath expression of the nickname. The wrapper then parses and processes source data fragment-by-fragment. This type of parsing minimizes memory use. Valid values are Y and N. The default is N; the documents are not parsed. This option is valid only on the root nickname. Do not set both the STREAMING and VALIDATE options to Y.
TIMEOUT	Specifies the maximum time, in minutes, to wait for results from the daemon. The default is 60. This option is valid only for the root nickname.
VALIDATE	Specifies whether the source document is validated to ensure that it conforms to an XML schema or document type definition (DTD) before data is extracted from it. The default is N; validation does not occur. Before you set the value to Y, the schema file or DTD file is in the location that the source document specifies. This option is valid only for the root nickname. Do not set both the STREAMING and VALIDATE options to Y.
XPATH	Specifies the XPath expression that identifies the XML elements that represent individual tuples. The XPATH nickname option for a child nickname is evaluated in the context of the path that is specified by the XPATH nickname option of its parent. This XPath expression is used as a context for evaluating column values that are identified by the presence of the XPATH column option.

Column options

Table 83. Column options for scripts

Name	Description
DEFAULT	Specifies a default value for a script input column. If the SQL query does not provide a value, this default value is used.

Table 83. Column options for scripts (continued)

Name	Description
FOREIGN_KEY	Indicates that this nickname is a child nickname and specifies the name of the corresponding parent nickname. A nickname can have at most one FOREIGN_KEY column option. The value for the option is case-sensitive. Do not specify the XPATH option for this column. The column can be used only to join a parent nickname and a child nickname. A CREATE NICKNAME statement that includes a FOREIGN_KEY option fails if the parent nickname has a different schema name. Unless the nickname that is referred to in a FOREIGN_KEY clause was explicitly defined as lowercase or mixed case in the CREATE NICKNAME statement, you must specify the nickname in uppercase when you refer to this nickname in the FOREIGN_KEY clause. When this option is set on a column, no other option can be set on the column.
INPUT_MODE	Specifies the input mode for the column. Valid values are CONFIG and FILE_INPUT. CONFIG treats the value as the input mode for a column. FILE_INPUT specifies a file that stores the value. The wrapper passes the specified value to the Script daemon.
POSITION	Specifies an integer value for positional parameters. If the positional value is set to an integer, then this input must be in this position in the command line. If this option is set, the switch is inserted into the appropriate location when the query runs. If POSITION is set to -1, the option is added as the last command line option. A POSITION integer value cannot be used twice in the same nickname. This option applies only to input columns.
PRIMARY_KEY	Required for a parent nickname that has one or more child nicknames. Specifies that this nickname is a parent nickname. The column data type must be VARCHAR(16). A nickname can have only one PRIMARY_KEY column option. Yes is the only valid value. Do not specify the XPATH option for this column. The column can be used only to join parent nicknames and child nicknames. When this option is set on a column, no other option can be set on the column.

Table 83. Column options for scripts (continued)

Name	Description
SWITCH	Specifies a flag for the script on the command line. The value of this option preceded the column value that is supplied by WSSCRIPT.ARGS or by the default value, if any. If you do not specify a value for this option and a default value exists for the column, the default value is added without any switch information. This option is required for input columns.
SWITCH_ONLY	Enables the use of switches without a command line argument. Valid values are Y and N. Set this option to Y and the valid input values are Y and N. For an input value of Y, only the switch is added to the command line. For an input value of N, no value is added to the command line.
VALID_VALUES	Specifies a set of valid values for a column. Use a semicolon to separate multiple values.
XPATH	Specifies the Xpath expression in the XML document that contains the data that corresponds to this column. The wrapper evaluates this XPath expression after the CREATE NICKNAME statement applies the XPath expression from the XPATH nickname option.

Sybase options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 84. Wrapper options for Sybase

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. On Microsoft Windows, valid values are Y and N. The default is N; the wrapper runs in trusted mode. On UNIX, the default and the only valid value is Y; the wrapper must run in fenced mode.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.

Table 84. Wrapper options for Sybase (continued)

Name	Description
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.

Server options

Table 85. Server options for Sybase

Name	Description
COLLATING_SEQUENCE	Specifies whether the data source uses the same default collating sequence as the federated database. Valid values are Y, N, and I. I specifies a case-insensitive. The default is Y. The collating sequence specified for the federated server must match the collating sequence on the remote data source.
COMM_RATE	Specifies the communication rate, in megabytes per second, between the federated server and the data source server. Valid values are whole numbers the are greater than 0 and less than 2147483648. The default is 2.
CPU_RATIO	Specifies how much faster or slower the data source CPU is when compared to federated server CPU. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same CPU speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server CPU speed is 50% slower than the data source CPU. A setting of 2 indicates that the federated CPU is twice as fast as the data source CPU.
CONV_EMPTY_STRING	Specifies whether the federated server converts an empty string into a space during replication tasks. Valid values are Y and N. The default is N; the federated server does not convert empty strings. Set this option to Y when the data source has a non-nullable character column that stores an empty string.
DBNAME	Required. Specifies the name of the database that you want to access. Obtain the name of the database from the Sybase server.

Table 85. Server options for Sybase (continued)

Name	Description
DB2_MAXIMAL_PUSHDOWN	Specifies the primary criteria that the query optimizer uses to choose an access plan. Valid values are Y and N. The default is N; the query optimizer chooses the plan that has the lowest estimated cost. Y specifies that the query optimizer choose the access plan that pushes down the most query operations to the data source.
DB2_MAX_ASYNC_REQUESTS_PER_ QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
DB2_TWO_PHASE_COMMIT	Specifies whether the federated server connects to the data source in two-phase commit protocol or one-phase commit protocol. Valid values are Y and N. The default is N; the federated server uses the one-phase commit protocol to connect. Y specifies that the federated server uses two-phase commit protocol to connect.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
FOLD_ID	Specifies the case for the user ID that is sent to the data source. There is no default value; the federated server sends the user ID in uppercase; then if the uppercase user ID fails, the server sends the user ID in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.
FOLD_PW	Specifies the case for the password that is sent to the data source. There is no default value; the federated server sends the password in uppercase; then if the uppercase password fails, the server sends the password in lowercase. Valid values are U (uppercase), L (lowercase), and N (null). Avoid using the null setting, which might result in poor performance.

Table 85. Server options for Sybase (continued)

Name	Description
IFILE	Specifies the path and name of the Sybase interface file to use instead of the default interface file. The Sybase wrapper searches for the interface file in the following places, in the order specified: On Microsoft Windows, in the IFILE server option, then in the %DB2PATH%\interfaces directory, and finally in the %SYBASE%\ini\sql.ini directory. On UNIX, in the IFILE server option, then in the sqllib/interfaces directory, and finally in the $SYBASE/interfaces directory.
IO_RATIO	Specifies how much faster or slower the data source I/O system runs when compared to the federated server I/O system. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same I/O speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server speed is 50% slower than the data source speed. A setting of 2 indicates that the federated speed is twice as fast as the data source speed.
LOGIN_TIMEOUT	Specifies the amount of time, in seconds, that the federated server waits before abandoning a login request. The default is 0; the federated server waits an unlimited amount of time.
NODE	Required. Specifies the name of the node where the Sybase server resides. The node name is in the Sybase interfaces file.
OLD_NAME_GEN	Specifies how to convert the column names and index names that are in the data source into nickname column names and local index names for the federated server. Valid values are Y and N. The default is N; the generated names closely match the names in the data source. Y specifies that the generated names are the same as the names that were created in IBM WebSphere Federation Server Version 9 and earlier. Thus, the names might not closely match the data source names.
PACKET_SIZE	Specifies the packet size, in bytes, that the client library uses to send tabular data stream (TDS) packets. If the Sybase wrapper needs to send or receive large amounts of text and image data, increase the PACKET_SIZE.

Table 85. Server options for Sybase (continued)

Name	Description
PLAN_HINTS	Specifies whether or not plan hints are to be enabled. Plan hints are statement fragments that provide additional information that the data source optimizer uses to improve query performance. The data source optimizer uses the plan hints to decide whether or not to use an index and which index or which table join sequence to use. Valid values are Y and N. The default is N; plan hints are not to be enabled. Y specifies that plan hints are to be enabled at the data source if it supports plan hints.
PUSHDOWN	Specifies whether the federated server allows the data source to evaluate operations. Valid values are Y and N. The default is Y; the data source evaluates operations. N specifies that the federated server send SQL statements that include only SELECT with column names. Predicates, such as WHERE=; column and scalar functions, such as MAX and MIN; sorts, such as ORDER BY OR GROUP BY; and joins are not included in any SQL that the federated server sends to the data source.
TIMEOUT	Specifies the maximum time, in seconds, that the federated server waits for the remote server to respond to a command. The default is 0, which specifies an unlimited amount of time.
XA_OPEN_STRING_OPTIONS	Specifies open strings for the Sybase DTM XA interface. These strings are in addition to the LRM name, user name, and password.

User mapping options

Table 86. User mapping options for Sybase

Option	Description
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.

Column options

Table 87. Column options for Sybase

Option	Description
NUMERIC_STRING	Specifies how to treat numeric strings. The default is N. If the data source string column contains only numeric strings and no other characters, including blanks, set the NUMERIC_STRING option to Y. When NUMERIC_STRING is set to Y for a column, the query optimizer recognizes that the column contains no blanks that could interfere with the sorting of the data in the column. Use this option when the collating sequence of a data source is different from the collating sequence that the federated server uses. Columns that use this option are not excluded from remote evaluation because of a different collating sequence.

Teradata options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 88. Wrapper options for Teradata

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. On Microsoft Windows, valid values are Y and N. The default is N; the wrapper runs in trusted mode. On UNIX, the default value is Y; the wrapper must run in fenced mode.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.

Server options

Table 89. Server options for Teradata

Name	**Description**
COLLATING_SEQUENCE	Specifies whether the data source uses the same default collating sequence as the federated database. Valid values are Y, N, and I. I specifies a case-insensitive. The default is Y. The collating sequence specified for the federated server must match the collating sequence on the remote data source.
COMM_RATE	Specifies the communication rate, in megabytes per second, between the federated server and the data source server. Valid values are whole numbers the are greater than 0 and less than 2147483648. The default is 2.
CPU_RATIO	Specifies how much faster or slower the data source CPU is when compared to federated server CPU. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same CPU speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server CPU speed is 50% slower than the data source CPU. A setting of 2 indicates that the federated CPU is twice as fast as the data source CPU.
DB2_MAXIMAL_PUSHDOWN	Specifies the primary criteria that the query optimizer uses to choose an access plan. Valid values are Y and N. The default is N; the query optimizer chooses the plan that has the lowest estimated cost. Y specifies that the query optimizer choose the access plan that pushes down the most query operations to the data source.
DB2_MAX_ASYNC_REQUESTS_PER_ QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, "`UserMappingRepositoryLDAP`". For a plug-in written in C, specifies any valid C library name.

Table 89. Server options for Teradata (continued)

Name	Description
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
IO_RATIO	Specifies how much faster or slower the data source I/O system runs when compared to the federated server I/O system. Valid values are greater than 0 and less than $1x10^{23}$. The default is 1.0. Values can be expressed in any valid double notation, for example, 123E10, 123, or 1.21E4. A setting of 1 indicates that the federated server and the data source server have the same I/O speed; a 1:1 ratio. A setting of 0.5 indicates that the federated server speed is 50% slower than the data source speed. A setting of 2 indicates that the federated speed is twice as fast as the data source speed.
NODE	Required. Specifies the alias name or IP address of the Teradata server.
OLD_NAME_GEN	Specifies how to convert the column names and index names that are in the data source into nickname column names and local index names for the federated server. Valid values are Y and N. The default is N; the generated names closely match the names in the data source. Y specifies that the generated names are the same as the names that were created in IBM WebSphere Federation Server Version 9 and earlier. Thus, the names might not closely match the data source names.
PUSHDOWN	Specifies whether the federated server allows the data source to evaluate operations. Valid values are Y and N. The default is Y; the data source evaluates operations. N specifies that the federated server send SQL statements that include only SELECT with column names. Predicates, such as WHERE=; column and scalar functions, such as MAX and MIN; sorts, such as ORDER BY OR GROUP BY; and joins are not included in any SQL that the federated server sends to the data source.

User mapping options

Table 90. User mapping options for Teradata

Name	Description
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.

Table 90. User mapping options for Teradata (continued)

Name	Description
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.

Column options

Table 91. Column options for Teradata

Name	Description
NUMERIC_STRING	Specifies how to treat numeric strings. The default is N. If the data source string column contains only numeric strings and no other characters, including blanks, set the NUMERIC_STRING option to Y. When NUMERIC_STRING is set to Y for a column, the query optimizer recognizes that the column contains no blanks that could interfere with the sorting of the data in the column. Use this option when the collating sequence of a data source is different from the collating sequence that the federated server uses. Columns that use this option are not excluded from remote evaluation because of a different collating sequence.

Table-structured file options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, nickname, and column options.

The following tables list the options that apply to this data source and identify the required options that you must specify.

Wrapper options

Table 92. Wrapper options for table-structured files

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode.

Server options

Table 93. Server options for table-structured files

Name	Description
DB2_MAX_ASYNC_REQUESTS_PER_ QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.

Nickname options

Table 94. Nickname options for table-structured files

Name	Description
COLUMN_DELIMITER	Specifies a single character to use as the delimiter that separates columns in the table-structured file. The default is a comma (,). A single quotation mark cannot be used as a delimiter. The column delimiter must be consistent throughout the file. A null value is represented by two delimiters next to each other or by a delimiter followed by a line terminator, if the NULL field is the last one on the line. The column delimiter cannot exist as valid data for a column.
CODEPAGE	Specifies the code page of the file at the data source. This option is valid only for federated databases that use Unicode. The source data is converted from the specified code page to Unicode.
FILE_PATH	Specifies the fully qualified path to the table-structured file. Enclose the file name in single quotation marks. The data file must be a standard file or a symbolic link, rather than a pipe or another non-standard file type. **Important:** If you specify the FILE_PATH option, do not specify a DOCUMENT column.
KEY_COLUMN	Specifies the name of the column on which the file is sorted. A column that has the DOCUMENT column option cannot be the key column. Only single-column keys are supported. The value must be the name of a column that is defined in the CREATE NICKNAME statement. The column must be sorted in ascending order. The key column must be designated as non-nullable by adding the NOT NULL option to its definition in the nickname statement. This value is case-sensitive.

Table 94. Nickname options for table-structured files (continued)

Name	Description
SORTED	Specifies whether the file at the data source is or is not sorted in ascending order. Valid values are Y and N. The default is N; the file at the data source is not sorted in ascending order. Sorted data sources must be sorted in ascending order according to the collation sequence for the current locale, as defined by the settings in the LC_COLLATE National Language Support category. If you specify that the data source is sorted, set the VALIDATE_DATA_FILE option to Y.
VALIDATE_DATA_FILE	For sorted files, this option specifies whether the wrapper verifies that the key column is sorted in ascending order and checks for null keys. This validation occurs only once when the nickname is first created. The default is N; sort order is not verified. This option is valid only when the SORTED option is set to Y and the DOCUMENT option is not specified.

Column options

Table 95. Column options for table-structured files

Option	Description
DOCUMENT	Allows you to specify the file path when the query runs, instead of when you create the nickname. The only valid value is FILE. Only one column of each nickname can be specified with the DOCUMENT option. The column that is associated with the DOCUMENT option must be a data type of VARCHAR or CHAR. Using the DOCUMENT nickname column option instead of the FILE_PATH nickname option implies that the file that corresponds to this nickname will be supplied when the query runs. If the DOCUMENT option has the FILE value, the value that is supplied when the query runs is the full path of the file whose schema matches the nickname definition for this nickname.

Web services options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, nickname, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 96. Wrapper options for Web services

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. The default is N; the wrapper runs in trusted mode.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, `"UserMappingRepositoryLDAP"`. For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
PROXY_TYPE	Specifies the proxy type to use to access the Internet when the federated server is behind a firewall. Valid values are NONE, HTTP, and SOCKS. The default value is NONE.
PROXY_SERVER_NAME	Specifies the name or IP address of the proxy server. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.
PROXY_SERVER_PORT	Specifies the port or service name for the proxy service on the proxy server. Valid values are a decimal port number from 1 to 32760 or a service name.
SSL_KEYSTORE_FILE	Specifies the certificate storage file for communications that use SSL or TSL. A valid value is a fully qualified path name that is accessible by the federated database agent or by a fenced-mode process. The default is *`install path`*`/cfg/WSWrapperKeystore.kdb`.
SSL_KEYSTORE_PASSWORD	Specifies the password to use to access the file in the SSL_KEYSTORE_FILE option. Valid values are a password, which is encrypted when it is stored in the federated database catalog, and `file:`*`file_name`*, where *file_name* is the fully qualified path to a stash file.
SSL_VERIFY_SERVER_CERTIFICATE	Specifies whether the server certificate is verified during SSL authentication. Valid values are Y and N. The default is N; the certificate is not verified.

Server options

Table 97. Server options for Web services

Name	Description
DB2_MAX_ASYNC_REQUESTS_PER_ QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
DB2_UM_PLUGIN	Specifies the implementation of the user mapping plug-in. For a plug-in written in Java, specifies a case-sensitive string for the class name that corresponds to the user mapping repository class. For example, `"UserMappingRepositoryLDAP"`. For a plug-in written in C, specifies any valid C library name.
DB2_UM_PLUGIN_LANG	Specifies the language of the user mapping plug-in. Valid values are Java and C. The default is Java.
PROXY_AUTHID	Specifies the user name for proxy server authentication.
PROXY_PASSWORD	Specifies the password for proxy server authentication.
PROXY_SERVER_NAME	Specifies the name or IP address of the proxy server. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.
PROXY_SERVER_PORT	Specifies the port or service name for the proxy service on the proxy server. Valid values are a decimal port number from 1 to 32760 or a service name.
PROXY_TYPE	Specifies the proxy type to use to access the Internet when the federated server is behind a firewall. Valid values are NONE, HTTP, and SOCKS. The default value is NONE.
SSL_CLIENT_CERTIFICATE_LABEL	Specifies the client certificate to send during SSL authentication. If you do not specify a value, the current authorization ID for the federated database is used to locate the certificate.
SSL_KEYSTORE_FILE	Specifies the certificate storage file for communications that use SSL or TSL. A valid value is a fully qualified path name that is accessible by the federated database agent or by a fenced-mode process. The default is *install path*`/cfg/WSWrapperKeystore.kdb`.

Table 97. Server options for Web services (continued)

Name	Description
SSL_KEYSTORE_PASSWORD	Specifies the password to use to access the file in the SSL_KEYSTORE_FILE option. Valid values are a password, which is encrypted when it is stored in the federated database catalog, and `file:`*`file_name`*, where *file_name* is the fully qualified path to a stash file.
SSL_VERIFY_SERVER_CERTIFICATE	Specifies whether to verify the server certificate during SSL authentication. Valid values are Y and N. The default is N; the certificate is not verified.

User mapping options

Table 98. User mapping options for Web services

Name	Description
PROXY_AUTHID	Specifies the user name for proxy server authentication.
PROXY_PASSWORD	Specifies the password for proxy server authentication. The password is encrypted when it is stored in the federated database catalog.
REMOTE_AUTHID	Specifies the remote user ID to which the local user ID is mapped. If you do not specify this option, the ID that is used to connect to the federated database is used.
REMOTE_PASSWORD	Specifies the remote password for the remote user ID. If you do not specify this option, the password that is used to connect to the federated database is used.
SSL_CLIENT_CERTIFICATE_LABEL	Specifies the client certificate to send during SSL authentication. If you do not specify a value, the current federated database authorization ID is used to locate the certificate.

Nickname options

Table 99. Nickname options for Web services

Name	Description
NAMESPACES	Specifies the namespaces that are associated with the namespace prefixes that are used in the XPATH and TEMPLATE options for each column. Use this syntax: `NAMESPACES'`*`prefix1`*`= "`*`actual_namespace1`*`", prefix2="actual_namespace2"'` Use a comma to separate multiple namespaces. For example: `NAMESPACES='http://www.myweb.com/cust", i='http://www.myweb.com/cust/id", n='http://www.myweb.com/cust/name"'`
SOAPACTION	Required for the root nickname. Specifies the URI SOAPACTION attribute from the Web Services Description Language (WSDL) format. The URL can contain a colon-separated IPv6 address if it is enclosed in square brackets. For example:`http://[1080:0:0:0:8:800:200C:417A]` **Note:** This option is not valid for nonroot nicknames.
STREAMING	Specifies whether the source document should be separated into logical fragments for processing. The fragments correspond to the node that matches the XPath expression of the nickname. The wrapper then parses and processes source data fragment-by-fragment. This type of parsing minimizes memory use. Valid values are Y and N. The default is N; the documents are not parsed. This option is valid only on the root nickname.
TEMPLATE	Specifies the nickname template fragment to use to construct a SOAP request. The fragment must conform to the specified template syntax. This option is valid only for the root nickname.
URL	Required for the root nickname. Specifies the URL for the Web service endpoint. Supported protocols are HTTP and HTTPS. The URL can contain a colon-separated IPv6 address if it is enclosed in square brackets. For example:`http://[1080:0:0:0:8:800:200C:417A]`
XML_CODESET	Specifies the encoding to use to send and receive XML data. This option overrides the internal encoding.

Table 99. Nickname options for Web services (continued)

Name	Description
XPATH	Required. Specifies the Xpath expression that identifies the SOAP response elements that represent individual tuples. The Xpath expression is used as a context for evaluating column values that the XPATH nickname column options identify.

Column options

Table 100. Column options for Web services

Name	Description
ESCAPE_INPUT	Specifies whether XML special characters are replaced in XML input values or not. Use this option to include XML fragments as input, for example, to include XML fragments that have repeating elements. Valid values are Y and N. N is the default; XML input values are retained. The column data type must be VARCHAR or CHAR. If ESCAPE_INPUT is set to Y, you must also specify the TEMPLATE column option.
FOREIGN_KEY	Indicates that this nickname is a child nickname and specifies the name of the corresponding parent nickname. A nickname can have at most one FOREIGN_KEY column option. The value for the option is case-sensitive. Do not specify the XPATH option for this column. The column can be used only to join a parent nicknames and a child nickname. A CREATE NICKNAME statement that includes a FOREIGN_KEY option fails if the parent nickname has a different schema name. Unless the nickname that is referred to in a FOREIGN_KEY clause was explicitly defined as lowercase or mixed case in the CREATE NICKNAME statement, you must specify the nickname in uppercase when you refer to this nickname in the FOREIGN_KEY clause. **Note:** • When this option is set on a column, no other option can be set on the column. • If you set this column option, you cannot later use the ALTER NICKNAME statement to drop the option. Instead, you must drop the nickname and then create the nickname again without this column option.

Table 100. Column options for Web services (continued)

Name	**Description**
PRIMARY_KEY	Required for a parent nickname that has one or more child nicknames. Specifies that this nickname is a parent nickname. The column data type must be VARCHAR(16). A nickname can have only one PRIMARY_KEY column option. Yes is the only valid value. Do not specify the XPATH option for this column. The column can be used only to join parent nicknames and child nicknames. **Note:** • When this option is set on a column, no other option can be set on the column. • If you set this column option, you cannot later use the ALTER NICKNAME statement to drop the option. Instead, you must drop the nickname and then create the nickname again without this column option.
SOAPACTIONCOLUMN	Specifies the column that dynamically specifies the SOAP action for the Web Services endpoint when you run a query. This option is valid only for the root nickname. If the host name is an IPv6 (colon-separated) address, enclose the host name in square brackets. For example: ’`http://[1080:0:0:0:8:800:200C:417A]:99/soap`’ When this option is set on a column, no other option can be set on the column.
TEMPLATE	Specifies the column template fragment to use to construct the XML input document. The fragment must conform to the specified template syntax. **Note:** If you set this column option, you cannot later use the ALTER NICKNAME statement to drop the option. Instead, you must drop the nickname and then create the nickname again without this column option.
URLCOLUMN	Specifies the column that dynamically specifies the SOAP action for the Web Services endpoint when you run a query. This option is valid only for the root nickname. If the host name is an IPv6 (colon-separated) address, enclose the host name in square brackets. For example: ’`http://[1080:0:0:0:8:800:200C:417A]:99/soap`’ When this option is set on a column, no other option can be set on the column.

Table 100. Column options for Web services (continued)

Name	Description
XPATH	Specifies the Xpath expression in the XML document that contains the data that corresponds to this column. The wrapper evaluates this XPath expression after the CREATE NICKNAME statement applies the XPath expression from the XPATH nickname option. **Note:** If you set this column option, you cannot later use the ALTER NICKNAME statement to drop the option. Instead, you must drop the nickname and then create the nickname again without this column option.

XML options reference

To configure how the federated server and its users interact with a data source, set and modify wrapper, server, user mapping, nickname, and column options.

Wrapper options

The following tables list the options that apply to this data source and identify the required options that you must specify.

Table 101. Wrapper options for XML

Name	Description
DB2_FENCED	Required. Specifies whether the wrapper runs in fenced mode or in trusted mode. Valid values are Y and N. N is the default; the wrapper runs in trusted mode.
PROXY_TYPE	Specifies the proxy type to use to access the Internet when the federated server is behind a firewall. Valid values are NONE, HTTP, and SOCKS. The default value is NONE.
PROXY_SERVER_NAME	Specifies the name or IP address of the proxy server. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.
PROXY_SERVER_PORT	Specifies the port or service name for the proxy service on the proxy server. Valid values are a decimal port number from 1 to 32760 or a service name.
SSL_KEYSTORE_FILE	Specifies the certificate storage file for communications that use SSL or TSL. A valid value is a fully qualified path name that is accessible by the federated database agent or by a fenced-mode process.

Table 101. Wrapper options for XML (continued)

Name	Description
SSL_KEYSTORE_PASSWORD	Specifies the password to use to access the file in the SSL_KEYSTORE_FILE option. Valid values are a password, which is encrypted when it is stored in the federated database catalog, and `file:`*`file_name`*, where *file_name* is the fully qualified path to a stash file.
SSL_VERIFY_SERVER_CERTIFICATE	Specifies whether the server certificate is verified during SSL authentication. Valid values are Y and N. The default is N; the certificate is not verified.

Server options

Table 102. Server options for XML

Name	Description
DB2_MAX_ASYNC_REQUESTS_PER_QUERY	Specifies the maximum number of concurrent asynchronous requests from a query. Valid values are from -1 to 64000. The default is 1. -1 specifies that the federated query optimizer determines the number of requests. 0 specifies that the data source cannot accommodate additional asynchronous requests.
PROXY_AUTHID	Specifies the user name for proxy server authentication.
PROXY_PASSWORD	Specifies the password for proxy server authentication.
PROXY_SERVER_NAME	Specifies the name or IP address of the proxy server. Valid IP addresses are in IPv4 (dot-separated) format or in IPv6 (colon-separated) format. Use IPv6 format only if IPv6 is configured.
PROXY_SERVER_PORT	Specifies the port or service name for the proxy service on the proxy server. Valid values are a decimal port number from 1 to 32760 or a service name.
PROXY_TYPE	Specifies the proxy type to use to access the Internet when the federated server is behind a firewall. Valid values are NONE, HTTP, and SOCKS. The default value is NONE.
SOCKET_TIMEOUT	Specifies the maximum time, in minutes, that the federated server waits for results from the proxy server. A valid value is any number that is greater than or equal to 0. The default is 0; the server waits an unlimited amount of time.
SSL_CLIENT_CERTIFICATE_LABEL	Specifies the client certificate to send during SSL authentication. If you do not specify a value, the current authorization ID for the federated database is used to locate the certificate.

Table 102. Server options for XML (continued)

Name	Description
SSL_KEYSTORE_FILE	Specifies the certificate storage file for communications that use SSL or TSL. A valid value is a fully qualified path name that is accessible by the federated database agent or by a fenced-mode process.
SSL_KEYSTORE_PASSWORD	Specifies the password to use to access the file in the SSL_KEYSTORE_FILE option. Valid values are a password, which is encrypted when it is stored in the federated database catalog, and `file:`*`file_name`*, where *file_name* is the fully qualified path to a stash file.
SSL_VERIFY_SERVER_CERTIFICATE	Specifies whether to verify the server certificate during SSL authentication. The default is N; the certificate is not verified.

User mapping options

Table 103. User mapping options for XML

Name	Description
PROXY_AUTHID	Specifies the user name for proxy server authentication.
PROXY_PASSWORD	Specifies the password for proxy server authentication.
SSL_CLIENT_CERTIFICATE_LABEL	Specifies the client certificate to send during SSL authentication. If you do not specify a value, the current authorization ID for the federated database is used to locate the certificate.

Nickname options

Table 104. Nickname options for XML

Name	Description
DIRECTORY_PATH	Specifies the path name of a directory that contains one or more XML files. Use this option to create a single nickname over multiple XML source files. The XML wrapper uses only the files with an .xml extension that are located in the directory that you specify. The XML wrapper ignores all other files in this directory. If you specify this nickname option, do not specify a DOCUMENT column. This option is valid only for the root nickname.
FILE_PATH	Specified the file path of the XML document. If you specify FILE_PATH, do not specify a DOCUMENT column. This option is valid only for the root nickname.

Table 104. Nickname options for XML (continued)

Name	Description
INSTANCE_PARSE_TIME	Specifies the time, in milliseconds, that is required to parse one row of the XML source document. The valid value can be an integer or decimal value. The default is 7. This option is valid only for columns of the root nickname. To optimize queries of large or complex XML source structures, modify the INSTANCE_PARSE_TIME, XPATH_EVAL_TIME, and NEXT_TIME options.
NAMESPACES	Specifies the namespaces that are associated with the namespace prefixes that are used in the XPATH and TEMPLATE options for each column. Use this syntax: `NAMESPACES'prefix1= "actual_namespace1", prefix2="actual_namespace2"'` Use a comma to separate multiple namespaces. For example: `NAMESPACES='http://www.myweb.com/cust", i='http://www.myweb.com/cust/id", n='http://www.myweb.com/cust/name"'`
NEXT_TIME	Specified the time, in milliseconds, that is required to locate subsequent source elements from the Xpath expression. The default is 1. This option is valid for root nicknames and nonroot nicknames. To optimize queries of large or complex XML source structures, modify the INSTANCE_PARSE_TIME, XPATH_EVAL_TIME, and NEXT_TIME options.
STREAMING	Specifies whether the source document should be separated into logical fragments for processing. The fragments correspond to the node that matches the XPath expression of the nickname. The wrapper then parses and processes source data fragment-by-fragment. This type of parsing minimizes memory use. Valid values are Y and N. The default is N; the documents are not parsed. This option is valid only on the root nickname.
VALIDATE	Specifies whether the source document is validated to ensure that it conforms to an XML schema or document type definition (DTD) before data is extracted from it. The default is N; validation does not occur. Before you set the value to Y, the schema file or DTD file is in the location that the source document specifies. This option is valid only for the root nickname. Do not set both the STREAMING and VALIDATE options to Y.

Table 104. Nickname options for XML (continued)

Name	Description
XPATH	Required. Specifies the Xpath expression that identifies the elements that represent the individual tuples. The Xpath expression is used as a context for evaluating column values that are identified by the XPATH column option.
XPATH_EVAL_TIME	Specifies the time required, in milliseconds, to evaluate the Xpath expression of the nickname and to locate the first element. The value can be an integer or decimal value. The default is 1. This option is valid for root nicknames and nonroot nicknames. To optimize queries of large or complex XML source structures, modify the INSTANCE_PARSE_TIME, XPATH_EVAL_TIME, and NEXT_TIME options.

Column options

Table 105. Column options for XML

Name	Description
DOCUMENT	Specifies that this column is a DOCUMENT column. The value of the DOCUMENT column indicates the type of XML source data that is supplied to the nickname when the query runs. This option is valid only for columns of the root nickname (the nickname that identifies the elements at the top level of the XML document). Only one column for each nickname can be specified with the DOCUMENT option. If you use a DOCUMENT column option instead of a FILE_PATH or DIRECTORY_PATH nickname option, the document that corresponds to this nickname is supplied when the query runs. Valid values are FILE, DIRECTORY, URI, and COLUMN. The default is FILE. The column must be of VARCHAR data type.

Table 105. Column options for XML (continued)

Name	Description
FOREIGN_KEY	Indicates that this nickname is a child nickname and specifies the name of the corresponding parent nickname. A nickname can have at most one FOREIGN_KEY column option. The value for the option is case-sensitive. Do not specify the XPATH option for this column. The column can be used only to join a parent nicknames and a child nickname. A CREATE NICKNAME statement that includes a FOREIGN_KEY option fails if the parent nickname has a different schema name. Unless the nickname that is referred to in a FOREIGN_KEY clause was explicitly defined as lowercase or mixed case in the CREATE NICKNAME statement, you must specify the nickname in uppercase when you refer to this nickname in the FOREIGN_KEY clause. **Note:** • When this option is set on a column, no other option can be set on the column. • If you set this column option, you cannot later use the ALTER NICKNAME statement to drop the option. Instead, you must drop the nickname and then create the nickname again without this column option.
PRIMARY_KEY	Required for a parent nickname that has one or more child nicknames. Specifies that this nickname is a parent nickname. The column data type must be VARCHAR(16). A nickname can have only one PRIMARY_KEY column option. Yes is the only valid value. Do not specify the XPATH option for this column. The column can be used only to join parent nicknames and child nicknames. **Note:** • When this option is set on a column, no other option can be set on the column. • If you set this column option, you cannot later use the ALTER NICKNAME statement to drop the option. Instead, you must drop the nickname and then create the nickname again without this column option.

Table 105. Column options for XML (continued)

Name	Description
XPATH	Specifies the Xpath expression in the XML document that contains the data that corresponds to this column. The wrapper evaluates this XPath expression after the CREATE NICKNAME statement applies the XPath expression from the XPATH nickname option. **Note:** If you set this column option, you cannot later use the ALTER NICKNAME statement to drop the option. Instead, you must drop the nickname and then create the nickname again without this column option.

Chapter 5. Views in the global catalog table containing federated information

Most of the catalog views in a federated database are the same as the catalog views in any other DB2 for Linux, UNIX, and Windows database.

There are several unique views that contain information pertinent to a federated system, such as the SYSCAT.WRAPPERS view.

The SYSCAT views are read-only. You cannot issue an update or insert operation on a view in the SYSCAT schema. Using the SYSSTAT views is the recommended way to update the system catalog. Change applications that reference the SYSCAT view to reference the updatable SYSSTAT view instead.

The following table lists the SYSCAT views which contain federated information. These are read-only views.

Table 106. Catalog views typically used with a federated system

Catalog views	Description
SYSCAT.CHECKS	Contains check constraint information that you defined.
SYSCAT.COLCHECKS	Contains columns referenced by a check constraint.
SYSCAT.COLUMNS	Contains column information about the data source objects (tables and views) that you created nicknames for.
SYSCAT.COLOPTIONS	Contains information about column option values that you set for a nickname.
SYSCAT.CONSTDEP	Contains the dependency of an informational constraint that you defined.
SYSCAT.DATATYPES	Contains data type information about local built-in and user-defined DB2 data types.
SYSCAT.DBAUTH	Contains the database authorities held by individual users and groups.
SYSCAT.FUNCMAPOPTIONS	Contains information about option values that you have set for a function mapping.
SYSCAT.FUNCMAPPINGS	Contains the function mappings between the federated database and the data source objects.
SYSCAT.INDEXCOLUSE	Contains columns that participate in an index.
SYSCAT.INDEXES	Contains index specifications for data source objects.
SYSCAT.INDEXOPTIONS	Contains information about index options.
SYSCAT.KEYCOLUSE	Contains columns that participate in a key defined by a unique key, primary key, or foreign key constraint.
SYSCAT.NICKNAMES	Contains information about nicknames that you created.

Table 106. Catalog views typically used with a federated system (continued)

Catalog views	Description
SYSCAT.REFERENCES	Contains information about referential constraints that you defined.
SYSCAT.ROUTINES	Contains local DB2 user-defined functions, or function templates. Function templates are used to map to a data source function.
SYSCAT.REVTYPEMAPPINGS	This view is not used. All data type mappings are recorded in the SYSCAT.TYPEMAPPINGS view.
SYSCAT.ROUTINEOPTIONS	Contains information about federated routine option values.
SYSCAT.ROUTINEPARMOPTIONS	Contains information about federated routine parameter option values.
SYSCAT.ROUTINEPARMS	Contains a parameter or the result of a routine defined in SYSCAT.ROUTINES.
SYSCAT.ROUTINESFEDERATED	Contains information about federated routines that you defined.
SYSCAT.SERVERS	Contains server definitions that you create for data source servers.
SYSCAT.TABCONST	Each row represents a table and nickname constraints of type CHECK, UNIQUE, PRIMARY KEY, or FOREIGN KEY.
SYSCAT.TABLES	Contains information about each local DB2 table, federated view, and nickname that you create.
SYSCAT.TYPEMAPPINGS	Contains forward data type mappings and reverse data type mappings. The mapping is to local DB2 data types from data source data types. These mappings are used when you create a nickname on a data source object.
SYSCAT.USEROPTIONS	Contains user authorization information that you set when you create user mappings between the federated database and the data source servers.
SYSCAT.VIEWS	Contains information about local federated views that you create.
SYSCAT.WRAPOPTIONS	Contains information about option values that you have set for a wrapper.
SYSCAT.WRAPPERS	Contains the name of the wrapper and library file for each data source that you create a wrapper for.

The following table lists the SYSSTAT views which contain federated information. These are read-write views that contain statistics you can update.

Table 107. Federated updatable global catalog views

Catalog views	Description
SYSSTAT.COLUMNS	Contains statistical information about each column in the data source objects (tables and views) that you have created nicknames for. Statistics are not recorded for inherited columns of typed tables.
SYSSTAT.INDEXES	Contains statistical information about each index specification for data source objects.
SYSSTAT.ROUTINES	Contains statistical information about each user-defined function. Does not include built-in functions. Statistics are not recorded for inherited columns of typed tables.
SYSSTAT.TABLES	Contains information about each base table. View, synonym, and alias information is not included in this view. For typed tables, only the root table of a table hierarchy is included in the view. Statistics are not recorded for inherited columns of typed tables.

Chapter 6. Function mapping options for federated systems

The federated server provides default mappings between DB2 functions and data source functions. For most data sources, the default function mappings are in the wrappers. To use a data source function that the federated server does not recognize or to change the default mapping, you create a function mapping.

When you create a function mapping, you specify the name of the data source function and must enable the mapped function. Then when you use the mapped function, the query optimizer compares the cost of running the function at the data source with the cost of running the function at the federated server.

Table 108. Options for function mappings

Name	Description
DISABLE	Enable or disable a default function mapping. Valid values are Y and N. The default is N.
REMOTE_NAME	The name of the data source function. The default is the local name.

Chapter 7. Valid server types in SQL statements

Server types indicate the kind of data source that the server definition represents.

Server types vary by vendor, purpose, and operating system. Supported values depend on the data source.

For most data sources, you must specify a valid server type in the CREATE SERVER statement.

Table 109. Data sources and server types

Data source	Server type
BioRS	A server type is not required in the CREATE SERVER statement.
Excel	A server type is not required in the CREATE SERVER statement.
IBM DB2® Universal Database™ for Linux, UNIX, and Windows	DB2/UDB
IBM DB2 Universal Database for System i and AS/400®	DB2/ISERIES
IBM DB2 Universal Database for z/OS	DB2/ZOS
IBM DB2 for VM	DB2/VM
Informix	INFORMIX
JDBC	JDBC (Required for JDBC data sources that are supported by JDBC drivers 3.0 and later.)
Microsoft SQL Server	MSSQLSERVER (Required for data sources supported by the DataDirect Connect ODBC 4.2 (or later) driver or the Microsoft SQL Server ODBC 3.0 (or later) driver.)
ODBC	ODBC (Required for ODBC data sources that are supported by the ODBC 3.x driver.)
OLE DB	A server type is not required in the CREATE SERVER statement.
Oracle	ORACLE (Required for Oracle data sources supported by Oracle NET8 client software.)
Sybase (CTLIB)	SYBASE
Table-structured files	A server type is not required in the CREATE SERVER statement.
Teradata	TERADATA
Web services	A server type is not required in the CREATE SERVER statement.
XML	A server type is not required in the CREATE SERVER statement.

Chapter 8. Data type mappings

Data types mappings for relational data sources include forward type mappings, reverse type mappings, and type mappings that are specific to Unicode. Each of the nonrelational data sources support specific data types.

Default forward data type mappings

The two kinds of mappings between data source data types and federated database data types are forward type mappings and reverse type mappings. In a forward type mapping, the mapping is from a remote type to a comparable local type.

You can override a default type mapping, or create a new type mapping with the CREATE TYPE MAPPING statement.

These mappings are valid with all the supported versions, unless otherwise noted.

For all default forward data types mapping from a data source to the federated database, the federated schema is SYSIBM.

The following tables show the default forward mappings between federated database data types and data source data types.

Default forward data type mappings for DB2 Database for Linux, UNIX, and Windows data sources

The following table lists the default forward data type mappings for DB2 Database for Linux, UNIX, and Windows data sources.

Table 110. DB2 Database for Linux, UNIX, and Windows default forward data type mappings (Not all columns shown)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
BIGINT	-	-	-	-	-	-	BIGINT	-	0	-
BLOB	-	-	-	-	-	-	BLOB	-	-	-
CHAR	-	-	-	-	-	-	CHAR	-	0	N
CHAR	-	-	-	-	Y	-	CHAR	-	0	Y
CLOB	-	-	-	-	-	-	CLOB	-	-	-
DATE	-	-	-	-	-	-	DATE	-	0	-
DATE	-	-	-	-	-	-	TIMESTAMP[1]	-	0	-
DBCLOB	-	-	-	-	-	-	DBCLOB	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
DECFLOAT [2]	-	-	-	-	-	-	DECFLOAT	-	0	-
DOUBLE	-	-	-	-	-	-	DOUBLE	-	-	-
FLOAT	-	-	-	-	-	-	DOUBLE	-	-	-
GRAPHIC	-	-	-	-	-	-	GRAPHIC	-	0	N
INTEGER	-	-	-	-	-	-	INTEGER	-	0	-
LONGVAR	-	-	-	-	N	-	CLOB	-	-	-
LONGVAR	-	-	-	-	Y	-	BLOB	-	-	-

Table 110. DB2 Database for Linux, UNIX, and Windows default forward data type mappings (Not all columns shown) (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
LONGVARG	-	-	-	-	-	-	DBCLOB	-	-	-
REAL	-	-	-	-	-	-	REAL	-	-	-
SMALLINT	-	-	-	-	-	-	SMALLINT	-	0	-
TIME	-	-	-	-	-	-	TIME	-	0	-
TIMESTAMP(*p*)	-	-	*p*	*p*	-	-	TIMESTAMP(*p*)	-	*p*	-
VARCHAR	-	-	-	-	-	-	VARCHAR	-	0	N
VARCHAR	-	-	-	-	Y	-	VARCHAR	-	0	Y
VARGRAPH	-	-	-	-	-	-	VARGRAPHIC	-	0	N
VARGRAPHIC	-	-	-	-	-	-	VARGRAPHIC	-	0	N

Note:

1. The federated type is TIMESTAMP(0) if the date_compat configuration parameter is set to ON.
2. The SAME_DECFLT_ROUNDING server option is set to N by default and operations will not be pushed down to the remote data source unless SAME_DECFLT_ROUNDING is set to Y. For information on the SAME_DECFLT_ROUNDING server option, see DB2 database options reference.

Default forward data type mappings for DB2 for System i data sources

The following table lists the default forward data type mappings for DB2 for System i data sources.

Table 111. DB2 for System i default forward data type mappings (Not all columns shown)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
BLOB	-	-	-	-	-	-	BLOB	-	-	-
CHAR	1	254	-	-	-	-	CHAR	-	0	N
CHAR	255	32672	-	-	-	-	VARCHAR	-	0	N
CHAR	1	254	-	-	Y	-	CHAR	-	0	Y
CHAR	255	32672	-	-	Y	-	VARCHAR	-	0	Y
CLOB	-	-	-	-	-	-	CLOB	-	-	-
DATE	-	-	-	-	-	-	DATE	-	0	-
DBCLOB	-	-	-	-	-	-	DBCLOB	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
FLOAT	4	-	-	-	-	-	REAL	-	-	-
FLOAT	8	-	-	-	-	-	DOUBLE	-	-	-
GRAPHIC	1	127	-	-	-	-	GRAPHIC	-	0	N
GRAPHIC	128	16336	-	-	-	-	VARGRAPHIC	-	0	N
INTEGER	-	-	-	-	-	-	INTEGER	-	0	-
NUMERIC	-	-	-	-	-	-	DECIMAL	-	-	-
SMALLINT	-	-	-	-	-	-	SMALLINT	-	0	-
TIME	-	-	-	-	-	-	TIME	-	0	-
TIMESTAMP	-	-	-	-	-	-	TIMESTAMP(6)	-	6	-
VARCHAR	1	32672	-	-	-	-	VARCHAR	-	0	N
VARCHAR	1	32672	-	-	Y	-	VARCHAR	-	0	Y

Table 111. DB2 for System i default forward data type mappings (Not all columns shown) (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
VARG	1	16336	-	-	-	-	VARGRAPHIC	-	0	N
VARGRAPHIC	1	16336	-	-	-	-	VARGRAPHIC	-	0	N

Default forward data type mappings for DB2 for VM and VSE data sources

The following table lists the default forward data type mappings for DB2 for VM and VSE data sources.

Table 112. DB2 Server for VM and VSE default forward data type mappings (Not all columns shown)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
BLOB	-	-	-	-	-	-	BLOB	-	-	-
CHAR	1	254	-	-	-	-	CHAR	-	0	N
CHAR	1	254	-	-	Y	-	CHAR	-	0	Y
CLOB	-	-	-	-	-	-	CLOB	-	-	-
DATE	-	-	-	-	-	-	DATE	-	0	-
DBAHW	-	-	-	-	-	-	SMALLINT	-	0	-
DBAINT	-	-	-	-	-	-	INTEGER	-	0	-
DBCLOB	-	-	-	-	-	-	DBCLOB	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
FLOAT	4	-	-	-	-	-	REAL	-	-	-
FLOAT	8	-	-	-	-	-	DOUBLE	-	-	-
GRAPHIC	1	127	-	-	-	-	GRAPHIC	-	0	N
INTEGER	-	-	-	-	-	-	INTEGER	-	-	-
SMALLINT	-	-	-	-	-	-	SMALLINT	-	-	-
TIME	-	-	-	-	-	-	TIME	-	0	-
TIMESTAMP	-	-	-	-	-	-	TIMESTAMP(6)	-	6	-
VARCHAR	1	32672	-	-	-	-	VARCHAR	-	0	N
VARCHAR	1	32672	-	-	Y	-	VARCHAR	-	0	Y
VARGRAPHIC	1	16336	-	-	-	-	VARGRAPHIC	-	0	N
VARGRAPH	1	16336	-	-	-	-	VARGRAPHIC	-	0	N

Default forward data type mappings for DB2 for z/OS data sources

The following table lists the default forward data type mappings for DB2 for z/OS data sources.

Table 113. DB2 for z/OS default forward data type mappings (Not all columns shown)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
BLOB	-	-	-	-	-	-	BLOB	-	-	-
CHAR	1	254	-	-	-	-	CHAR	-	0	N
CHAR	255	32672	-	-	-	-	VARCHAR	-	0	N

Table 113. DB2 for z/OS default forward data type mappings (Not all columns shown) (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
CHAR	1	254	-	-	Y	-	CHAR	-	0	Y
CHAR	255	32672	-	-	Y	-	VARCHAR	-	0	Y
CLOB	-	-	-	-	-	-	CLOB	-	-	-
DATE	-	-	-	-	-	-	DATE	-	0	-
DBCLOB	-	-	-	-	-	-	DBCLOB	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
FLOAT	4	-	-	-	-	-	REAL	-	-	-
FLOAT	8	-	-	-	-	-	DOUBLE	-	-	-
GRAPHIC	1	127	-	-	-	-	GRAPHIC	-	0	N
INTEGER	-	-	-	-	-	-	INTEGER	-	0	-
ROWID	-	-	-	-	Y	-	VARCHAR	40	-	Y
SMALLINT	-	-	-	-	-	-	SMALLINT	-	0	-
TIME	-	-	-	-	-	-	TIME	-	0	-
TIMESTAMP	-	-	-	-	-	-	TIMESTAMP(6)	-	6	-
VARCHAR	1	32672	-	-	-	-	VARCHAR	-	0	N
VARCHAR	1	32672	-	-	Y	-	VARCHAR	-	0	Y
VARG	1	16336	-	-	-	-	VARGRAPHIC	-	0	N
VARGRAPHIC	1	16336	-	-	-	-	VARGRAPHIC	-	0	N

Default forward data type mappings for Informix data sources

The following table lists the default forward data type mappings for Informix data sources.

Table 114. Informix default forward data type mappings (Not all columns shown)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
BLOB	-	-	-	-	-	-	BLOB	2147483647	-	-
BOOLEAN	-	-	-	-	-	-	CHARACTER	1	-	-
BYTE	-	-	-	-	-	-	BLOB	2147483647	-	-
CHAR	1	254	-	-	-	-	CHARACTER	-	-	-
CHAR	255	32672	-	-	-	-	VARCHAR	-	-	-
CLOB	-	-	-	-	-	-	CLOB	2147483647	-	-
DATE	-	-	-	-	-	-	DATE	4	-	-
DATE	-	-	-	-	-	-	TIMESTAMP[1]	-	0	-
DATETIME[2]	0	4	0	4	-	-	DATE	4	-	-
DATETIME	6	10	6	10	-	-	TIME	3	-	-
DATETIME	0	4	6	15	-	-	TIMESTAMP(6)	10	6	-
DATETIME	6	10	11	15	-	-	TIMESTAMP(6)	10	6	-
DECIMAL	1	31	0	31	-	-	DECIMAL	-	-	-
DECIMAL	32	130	-	-	-	-	DOUBLE	8	-	-
DECIMAL	1	32	255	255	-	-	DOUBLE	-	-	-
FLOAT	-	-	-	-	-	-	DOUBLE	8	-	-
INTEGER	-	-	-	-	-	-	INTEGER	4	-	-

Table 114. Informix default forward data type mappings (Not all columns shown) (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
INTERVAL	-	-	-	-	-	-	VARCHAR	25	-	-
INT8	-	-	-	-	-	-	BIGINT	19	0	-
LVARCHAR	1	32672	-	-	-	-	VARCHAR	-	-	-
MONEY	1	31	0	31	-	-	DECIMAL	-	-	-
MONEY	32	32	-	-	-	-	DOUBLE	8	-	-
NCHAR	1	254	-	-	-	-	CHARACTER	-	-	-
NCHAR	255	32672	-	-	-	-	VARCHAR	-	-	-
NVARCHAR	1	32672	-	-	-	-	VARCHAR	-	-	-
REAL	-	-	-	-	-	-	REAL	4	-	-
SERIAL	-	-	-	-	-	-	INTEGER	4	-	-
SERIAL8	-	-	-	-	-	-	BIGINT	-	-	-
SMALLFLOAT	-	-	-	-	-	-	REAL	4	-	-
SMALLINT	-	-	-	-	-	-	SMALLINT	2	-	-
TEXT	-	-	-	-	-	-	CLOB	2147483647	-	-
VARCHAR	1	32672	-	-	-	-	VARCHAR	-	-	-

Notes:

1. The federated type is TIMESTAMP(0) if the date_compat configuration parameter is set to ON.
2. For the Informix DATETIME data type, the DB2 UNIX and Windows federated server uses the Informix high-level qualifier as the REMOTE_LENGTH and the Informix low-level qualifier as the REMOTE_SCALE.

The Informix qualifiers are the ″TU_″ constants defined in the Informix Client SDK `datatime.h` file. The constants are:

0 = YEAR	8 = MINUTE	13 = FRACTION(3)
2 = MONTH	10 = SECOND	14 = FRACTION(4)
4 = DAY	11 = FRACTION(1)	15 = FRACTION(5)
6 = HOUR	12 = FRACTION(2)	

Default forward data type mappings for JDBC data sources

The following table lists the default forward data type mappings for JDBC data sources.

Table 115. JDBC default forward data type mappings

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
BIGINT	-	-	-	-	-	-	BIGINT	8	-	-
BINARY	-	254	-	-	-	-	CHAR	-	-	Y
BINARY	255	32672	-	-	-	-	VARCHAR	-	-	Y
BINARY	32673	2147483647	-	-	-	-	BLOB	2147483647	-	-
BIT	-	-	-	-	-	-	SMALLINT	2	-	-
BLOB	-	-	-	-	-	-	BLOB	2147483647	-	-
BOOLEAN-	-	-	-	-	-	-	SMALLINT	2	-	-
CHAR	-	254	-	-	-	-	CHAR	-	-	-
CHAR	255	32672	-	-	-	-	VARCHAR	-	-	-
CHAR	32673	2147483647	-	-	-	-	CLOB	2147483647	-	-
CLOB	-	-	-	-	-	-	CLOB	2147483647	-	-

Table 115. JDBC default forward data type mappings (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
DATE	-	-	-	-	-	-	DATE	-	-	-
DATE	-	-	-	-	-	-	TIMESTAMP[1]	-	-	-
DECIMAL	1	31	0	31	-	-	DECIMAL	-	-	-
DECIMAL	32	38	0	38	-	-	DOUBLE	8	-	-
DOUBLE	-	-	-	-	-	-	DOUBLE	8	-	-
FLOAT	-	-	-	-	-	-	FLOAT	4	-	-
INTEGER	-	-	-	-	-	-	INTEGER	4	-	-
LONGVARCHAR	-	32672	-	-	-	-	VARCHAR	-	-	-
LONGVARCHAR	32673	2147483647	-	-	-	-	CLOB	2147483647	-	-
LONGVARBINARY	-	32672	-	-	-	-	VARCHAR	-	-	Y
LONGVARBINARY	32673	2147483647	-	-	-	-	BLOB	2147483647	-	-
LONGNVARCHAR	-	16336	-	-	-	-	VARGRAPHIC	-	-	-
LONGNVARCHAR[2]	16337	1073741823	-	-	-	-	DBCLOB	-	-	-
NCHAR[2]	-	127	-	-	-	-	GRAPHIC	-	-	-
NCHAR[2]	128	16336	-	-	-	-	VARGRAPHIC	-	-	-
NCHAR[2]	16337	1073741823	-	-	-	-	DBCLOB	-	-	-
NCLOB[2]	-	-	-	-	-	-	DBCLOB	-	-	-
NUMERIC	1	31	0	31	-	-	DECIMAL	-	-	-
NUMERIC	32	38	0	38	-	-	DOUBLE	8	-	-
NVARCHAR[2]	-	16336	-	-	-	-	VARGRAPHIC	-	-	-
NVARCHAR[2]	16337	1073741823	-	-	-	-	DBCLOB	-	-	-
REAL							REAL	4		
SMALLINT	-	-	-	-	-	-	SMALLINT	2	-	-
TIME	-	-	-	-	-	-	TIME	3	-	-
TIMESTAMP	-	-	-	-	-	-	TIMESTAMP(6)	10	6	-
TIMESTAMP(*p*)	-	-	-	-	-	-	TIMESTAMP(6)	10	6	-
TINYINT	-	-	-	-	-	-	SMALLINT	2	-	-
VARBINARY	-	32672	-	-	-	-	VARCHAR	-	-	Y
VARBINARY	32673	2147483647	-	-	-	-	BLOB	2147483647	-	-
VARCHAR	-	32672	-	-	-	-	VARCHAR	-	-	-
VARCHAR	32673	2147483647	-	-	-	-	CLOB	2147483647	-	-

Note:

1. The federated type is TIMESTAMP(0) if the date_compat configuration parameter is set to ON.
2. Data types that are only supported by the JDBC 4.0 driver: NCHAR, NVARCHAR, LONGVARCHAR, and NCLOB.

The following data types are unsupported by the JDBC wrapper: DATALINK, OTHER, JAVA_OBJECT, DISTINCT, STRUCT, ARRAY, and REF.

Default forward data type mappings for Microsoft SQL Server data sources

The following table lists the default forward data type mappings for Microsoft SQL Server data sources.

Table 116. Microsoft SQL Server default forward data type mappings

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
bigint [1]	-	-	-	-	-	-	BIGINT	-	-	-
binary	1	254	-	-	-	-	CHARACTER	-	-	Y
binary	255	8000	-	-	-	-	VARCHAR	-	-	Y
bit	-	-	-	-	-	-	SMALLINT	2	-	-
char	1	254	-	-	-	-	CHAR	-	-	N
char	255	8000	-	-	-	-	VARCHAR	-	-	N
datetime	-	-	-	-	-	-	TIMESTAMP(6)	10	6	-
decimal	1	31	0	31	-	-	DECIMAL	-	-	-
decimal	32	38	0	38	-	-	DOUBLE	-	-	-
float	-	8	-	-	-	-	DOUBLE	8	-	-
float	-	4	-	-	-	-	REAL	4	-	-
image	-	-	-	-	-	-	BLOB	2147483647	-	Y
int	-	-	-	-	-	-	INTEGER	4	-	-
money	-	-	-	-	-	-	DECIMAL	19	4	-
nchar	1	127	-	-	-	-	CHAR	-	-	N
nchar	128	4000	-	-	-	-	VARCHAR	-	-	N
numeric	1	31	0	31	-	-	DECIMAL	-	-	-
numeric	32	38	0	38	-	-	DOUBLE	8	-	-
ntext	-	-	-	-	-	-	CLOB	2147483647	-	Y
nvarchar	1	4000	-	-	-	-	VARCHAR	-	-	N
real	-	-	-	-	-	-	REAL	4	-	-
smallint	-	-	-	-	-	-	SMALLINT	2	-	-
smalldatetime	-	-	-	-	-	-	TIMESTAMP(6)	10	6	-
smallmoney	-	-	-	-	-	-	DECIMAL	10	4	-
SQL_BIGINT	-	-	-	-	-	-	BIGINT	-	-	-
SQL_BINARY	1	254	-	-	-	-	CHARACTER	-	-	Y
SQL_BINARY	255	8000	-	-	-	-	VARCHAR	-	-	Y
SQL_BIT	-	-	-	-	-	-	SMALLINT	2	-	-
SQL_CHAR	1	254	-	-	-	-	CHAR	-	-	N
SQL_CHAR	255	8000	-	-	-	-	VARCHAR	-	-	N
SQL_DATE	-	-	-	-	-	-	DATE	4	-	-
SQL_DECIMAL	1	31	0	31	-	-	DECIMAL	-	-	-
SQL_DECIMAL	32	38	0	38	-	-	DOUBLE	8	-	-
SQL_DOUBLE	-	-	-	-	-	-	DOUBLE	8	-	-
SQL_FLOAT	-	-	-	-	-	-	DOUBLE	8	-	-
SQL_GUID	-	-	-	-	-	-	VARCHAR	-	-	Y
SQL_INTEGER	-	-	-	-	-	-	INTEGER	4	-	-
SQL_ LONGVARCHAR	-	-	-	-	-	-	CLOB	2147483647	-	N
SQL_ LONGVARBINARY	-	-	-	-	-	-	BLOB	-	-	Y
SQL_NUMERIC	1	31	0	31	-	-	DECIMAL	-	-	-
SQL_NUMERIC	32	38	0	38	-	-	DOUBLE	8	-	-
SQL_REAL	-	-	-	-	-	-	REAL	8	-	-
SQL_SMALLINT	-	-	-	-	-	-	SMALLINT	2	-	-

Table 116. Microsoft SQL Server default forward data type mappings (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
SQL_TIME	-	-	-	-	-	-	TIME	3	-	-
SQL_TIMESTAMP	-	-	-	-	-	-	TIMESTAMP	10	6	-
SQL_TINYINT	-	-	-	-	-	-	SMALLINT	2	-	-
SQL_VARBINARY	1	8000	-	-	-	-	VARCHAR	-	-	Y
SQL_VARCHAR	1	8000	-	-	-	-	VARCHAR	-	-	N
SQL_WCHAR	1	254	-	-	-	-	CHARACTER	-	-	N
SQL_WCHAR	255	8800	-	-	-	-	VARCHAR	-	-	N
SQL_WLONGVARCHAR	-	1073741823	-	-	-	-	CLOB	2147483647	-	N
SQL_WVARCHAR	1	16336	-	-	-	-	VARCHAR	-	-	N
text	-	-	-	-	-	-	CLOB	-	-	N
timestamp	-	-	-	-	-	-	VARCHAR	8		Y
tinyint	-	-	-	-	-	-	SMALLINT	2	-	-
uniqueidentifier	1	4000	-	-	Y	-	VARCHAR	16	-	Y
varbinary	1	8000	-	-	-	-	VARCHAR	-	-	Y
varchar	1	8000	-	-	-	-	VARCHAR	-	-	N

Note:

1. This type mapping is valid only with Microsoft SQL Server Version 2000.

Default forward data type mappings for ODBC data sources

The following table lists the default forward data type mappings for ODBC data sources.

Table 117. ODBC default forward data type mappings (Not all columns shown)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
SQL_BIGINT	-	-	-	-	-	-	BIGINT	8	-	-
SQL_BINARY	1	254	-	-	-	-	CHARACTER	-	-	Y
SQL_BINARY	255	32672	-	-	-	-	VARCHAR	-	-	Y
SQL_BIT	-	-	-	-	-	-	SMALLINT	2	-	-
SQL_CHAR	1	254	-	-	-	-	CHAR	-	-	N
SQL_CHAR	255	32672	-	-	-	-	VARCHAR	-	-	N
SQL_DATE	-	-	-	-	-	-	DATE	-	-	-
SQL_DATE	-	-	-	-	-	-	TIMESTAMP[1]	-	-	-
SQL_DECIMAL	1	31	0	31	-	-	DECIMAL	-	-	-
SQL_DECIMAL	32	38	0	38	-	-	DOUBLE	8	-	-
SQL_DOUBLE	-	-	-	-	-	-	DOUBLE	8	-	-
SQL_FLOAT	-	8	-	-	-	-	FLOAT	8	-	-
SQL_FLOAT	-	4	-	-	-	-	FLOAT	4	-	-
SQL_INTEGER	-	-	-	-	-	-	INTEGER	4	-	-
SQL_ LONGVARCHAR	-	-	-	-	-	-	CLOB	2147483647	-	N
SQL_ LONGVARBINARY	-	-	-	-	-	-	BLOB	2147483647	-	Y

Table 117. ODBC default forward data type mappings (Not all columns shown) (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
SQL_NUMERIC	1	31	0	31	-	-	DECIMAL	-	-	-
SQL_NUMERIC	32	32	0	31	-	-	DOUBLE	8	-	-
SQL_REAL	-	-	-	-	-	-	REAL	4	-	-
SQL_SMALLINT	-	-	-	-	-	-	SMALLINT	2	-	-
SQL_TIMESTAMP	-	-	-	-	-	-	TIMESTAMP(6)	10	6	-
SQL_TIMESTAMP(*p*)	-	-	-	-	-	-	TIMESTAMP(6)	10	6	-
SQL_TYPE_DATE	-	-	-	-	-	-	DATE	4	-	-
SQL_TYPE_TIME	-	-	-	-	-	-	TIME	3	-	-
SQL_TYPE_ TIMESTAMP	-	-	-	-	-	-	TIMESTAMP	10	-	-
SQL_TINYINT	-	-	-	-	-	-	SMALLINT	2	-	-
SQL_VARBINARY	1	32672	-	-	-	-	VARCHAR	-	-	Y
SQL_VARCHAR	1	32672	-	-	-	-	VARCHAR	-	-	N
SQL_WCHAR	1	127	-	-	-	-	CHAR	-	-	N
SQL_WCHAR	128	16336	-	-	-	-	VARCHAR	-	-	N
SQL_WVARCHAR	1	16336	-	-	-	-	VARCHAR	-	-	N
SQL_ WLONGVARCHAR	-	1073741823	-	-	-	-	CLOB	2147483647	-	N

Note:

1. The federated type is TIMESTAMP(0) if the date_compat configuration parameter is set to ON.

Default forward data type mappings for Oracle NET8 data sources

The following table lists the default forward data type mappings for Oracle NET8 data sources.

Table 118. Oracle NET8 default forward data type mappings

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
BLOB	0	0	0	0	-	\0	BLOB	2147483647	0	Y
CHAR	1	254	0	0	-	\0	CHAR	0	0	N
CHAR	255	2000	0	0	-	\0	VARCHAR	0	0	N
CLOB	0	0	0	0	-	\0	CLOB	2147483647	0	N
DATE	0	0	0	0	-	\0	TIMESTAMP(6)	0	0	N
FLOAT	1	126	0	0	-	\0	DOUBLE	0	0	N
LONG	0	0	0	0	-	\0	CLOB	2147483647	0	N
LONG RAW	0	0	0	0	-	\0	BLOB	2147483647	0	Y
NUMBER	10	18	0	0	-	\0	BIGINT	0	0	N
NUMBER	1	38	-84	127	-	\0	DOUBLE	0	0	N
NUMBER	1	31	0	31	-	>=	DECIMAL	0	0	N
NUMBER	1	4	0	0	-	\0	SMALLINT	0	0	N
NUMBER	5	9	0	0	-	\0	INTEGER	0	0	N
NUMBER	-	10	0	0	-	\0	DECIMAL	0	0	N
RAW	1	2000	0	0	-	\0	VARCHAR	0	0	Y

Table 118. Oracle NET8 default forward data type mappings (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
ROWID	0	0	0	NULL	-	\0	CHAR	18	0	N
TIMESTAMP(*p*) [1]	-	-	-	-	-	\0	TIMESTAMP(6)	10	6	N
VARCHAR2	1	4000	0	0	-	\0	VARCHAR	0	0	N

Note:

1.

- TIMESTAMP*(p)* represents a timestamp with a variable scale from 0-9. The scale of the Oracle timestamp is mapped to TIMESTAMP(6) by default. You can change this default type mapping and map the Oracle TIMESTAMP to a federated TIMESTAMP of the same scale by using a user-defined type mapping.
- This type mapping is valid only for Oracle 9i (or later) client and server configurations.

Default forward data type mappings for Sybase data sources

The following table lists the default forward data type mappings for Sybase data sources.

Table 119. Sybase CTLIB default forward data type mappings

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
binary	1	254	-	-	-	-	CHAR	-	-	Y
binary	255	32672	-	-	-	-	VARCHAR	-	-	Y
bit	-	-	-	-	-	-	SMALLINT	-	-	-
char	1	254	-	-	-	-	CHAR	-	-	N
char	255	32672	-	-	-	-	VARCHAR	-	-	N
char null (see varchar)										
date	-	-	-	-	-	-	DATE	-	-	-
date	-	-	-	-	-	-	TIMESTAMP[1]	-	-	-
datetime	-	-	-	-	-	-	TIMESTAMP(6)	-	-	-
datetimn	-	-	-	-	-	-	TIMESTAMP	-	-	-
decimal	1	31	0	31	-	-	DECIMAL	-	-	-
decimal	32	38	0	38	-	-	DOUBLE	-	-	-
decimaln	1	31	0	31	-	-	DECIMAL	-	-	-
decimaln	32	38	0	38	-	-	DOUBLE	-	-	-
float	-	4	-	-	-	-	REAL	-	-	-
float	-	8	-	-	-	-	DOUBLE	-	-	-
floatn	-	4	-	-	-	-	REAL	-	-	-
floatn	-	8	-	-	-	-	DOUBLE	-	-	-
image	-	-	-	-	-	-	BLOB	-	-	-
int	-	-	-	-	-	-	INTEGER	-	-	-
intn	-	-	-	-	-	-	INTEGER	-	-	-
money	-	-	-	-	-	-	DECIMAL	19	4	-
moneyn	-	-	-	-	-	-	DECIMAL	19	4	-
nchar	1	254	-	-	-	-	CHAR	-	-	N
nchar	255	32672	-	-	-	-	VARCHAR	-	-	N
nchar null (see nvarchar)										

Table 119. Sybase CTLIB default forward data type mappings (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
numeric	1	31	0	31	-	-	DECIMAL	-	-	-
numeric	32	38	0	38	-	-	DOUBLE	-	-	-
numericn	1	31	0	31	-	-	DECIMAL	-	-	-
numericn	32	38	0	38	-	-	DOUBLE	-	-	-
nvarchar	1	32672	-	-	-	-	VARCHAR	-	-	N
real	-	-	-	-	-	-	REAL	-	-	-
smalldatetime	-	-	-	-	-	-	TIMESTAMP(6)	-	-	-
smallint	-	-	-	-	-	-	SMALLINT	-	-	-
smallmoney	-	-	-	-	-	-	DECIMAL	10	4	-
sysname	-	-	-	-	-	-	VARCHAR	30	-	N
text	-	-	-	-	-	-	CLOB	-	-	-
time	-	-	-	-	-	-	TIME	-	-	-
timestamp	-	-	-	-	-	-	VARCHAR	8	-	Y
tinyint	-	-	-	-	-	-	SMALLINT	-	-	-
unichar[2]	1	254	-	-	-	-	CHAR	-	-	N
unichar[2]	255	32672	-	-	-	-	VARCHAR	-	-	N
unichar null (see univarchar)										
univarchar[2]	1	32672	-	-	-	-	VARCHAR	-	-	N
varbinary	1	32672	-	-	-	-	VARCHAR	-	-	Y
varchar	1	32672	-	-	-	-	VARCHAR	-	-	N

Note:

1. The federated type is TIMESTAMP(0) if the date_compat configuration parameter is set to ON.
2. Valid for non-Unicode federated databases.

Default forward data type mappings for Teradata data sources

The following table lists the default forward data type mappings for Teradata data sources.

Table 120. Teradata default forward data type mappings (Not all columns shown)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
BLOB	1	2097088000	-	-	-	-	BLOB	-	-	-
BYTE	1	254	-	-	-	-	CHAR	-	-	Y
BYTE	255	32672	-	-	-	-	VARCHAR	-	-	Y
BYTE	32673	64000	-	-	-	-	BLOB	-	-	-
BYTEINT	-	-	-	-	-	-	SMALLINT	-	-	-
CHAR	1	254	-	-	-	-	CHARACTER	-	-	-
CHAR	255	32672	-	-	-	-	VARCHAR	-	-	-
CHAR	32673	64000	-	-	-	-	CLOB	-	-	-
CLOB	1	2097088000 (Latin)	-	-	-	-	CLOB	-	-	-
CLOB	1	1048544000 (Unicode)	-	-	-	-	CLOB	-	-	-

Table 120. Teradata default forward data type mappings (Not all columns shown) (continued)

Remote Typename	Remote Lower Len	Remote Upper Len	Remote Lower Scale	Remote Upper Scale	Remote Bit Data	Remote Data Operators	Federated Typename	Federated Length	Federated Scale	Federated Bit Data
DATE	-	-	-	-	-	-	DATE	-	-	-
DATE	-	-	-	-	-	-	TIMESTAMP[1]	-	-	-
DECIMAL	1	18	0	18	-	-	DECIMAL	-	-	-
DOUBLE PRECISION	-	-	-	-	-	-	DOUBLE	-	-	-
FLOAT	-	-	-	-	-	-	DOUBLE	-	-	-
GRAPHIC	1	127	-	-	-	-	GRAPHIC	-	-	-
GRAPHIC	128	16336	-	-	-	-	VARGRAPHIC	-	-	-
GRAPHIC	16337	32000	-	-	-	-	DBCLOB	-	-	-
INTEGER	-	-	-	-	-	-	INTEGER	-	-	-
INTERVAL	-	-	-	-	-	-	CHAR	-	-	-
NUMERIC	1	18	0	18	-	-	DECIMAL	-	-	-
REAL	-	-	-	-	-	-	DOUBLE	-	-	-
SMALLINT	-	-	-	-	-	-	SMALLINT	-	-	-
TIME	0	21	0	21	-	-	TIME	-	-	-
TIMESTAMP(*p*)	-	-	*p*	*p*	-	-	TIMESTAMP(6)	10	6	-
VARBYTE	1	32762	-	-	-	-	VARCHAR	-	-	Y
VARBYTE	32763	64000	-	-	-	-	BLOB	-	-	-
VARCHAR	1	32672	-	-	-	-	VARCHAR	-	-	-
VARCHAR	32673	64000	-	-	-	-	CLOB	-	-	-
VARGRAPHIC	1	16336	-	-	-	-	VARGRAPHIC	-	-	-
VARGRAPHIC	16337	32000	-	-	-	-	DBCLOB	-	-	-

Note:

1. The federated type is TIMESTAMP(0) if the date_compat configuration parameter is set to ON.

Sample forward data type mappings

You can use the sample forward type mappings to take advantage of support for the TIMESTAMP data type with a precision.

For Informix data sources, these type mappings are used for nickname column types, federated procedures parameters, passthru, and federated procedure result sets.

For data sources other than Informix, these type mappings affect only the mappings for nickname column types and federated procedure parameters. The mappings do not affect passthru and federated procedure result sets.

Forward data type mappings - Informix example

When creating federated objects, you can use the sample forward type mapping provided for Informix.

You need to create these mappings before you create a federated object.

```
CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(0)
   TO SERVER TYPE informix REMOTE TYPE datetime(0,10);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(1)
   TO SERVER TYPE informix REMOTE TYPE datetime(0,11);
```

```
CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(2)
   TO SERVER TYPE informix REMOTE TYPE datetime(0,12);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(3)
   TO SERVER TYPE informix REMOTE TYPE datetime(0,13);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(4)
   TO SERVER TYPE informix REMOTE TYPE datetime(0,14);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(5)
   TO SERVER TYPE informix REMOTE TYPE datetime(0,15);
```

Forward data type mappings - Microsoft SQL Server example

When creating federated objects, you can use the sample forward type mapping provided for Microsoft SQL Server.

You need to create these mappings before you create a nickname or federated procedure.

```
CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(3)
   TO SERVER TYPE mssqlserver REMOTE TYPE "datetime";

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(0)
   TO SERVER TYPE mssqlserver REMOTE TYPE "smalldatetime";
```

Forward data type mappings - Oracle example

When creating federated objects, you can use the sample forward type mapping provided for Oracle.

You need to create these mappings before you create a nickname or federated procedure.

```
CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(0)
   TO SERVER TYPE oracle REMOTE TYPE timestamp(0);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(1)
   TO SERVER TYPE oracle REMOTE TYPE timestamp(1);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(2)
   TO SERVER TYPE oracle REMOTE TYPE timestamp(2);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(3)
   TO SERVER TYPE oracle REMOTE TYPE timestamp(3);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(4)
   TO SERVER TYPE oracle REMOTE TYPE timestamp(4);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(5)
   TO SERVER TYPE oracle REMOTE TYPE timestamp(5);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(7)
   TO SERVER TYPE oracle REMOTE TYPE timestamp(7);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(8)
   TO SERVER TYPE oracle REMOTE TYPE timestamp(8);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(9)
   TO SERVER TYPE oracle REMOTE TYPE timestamp(9);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(0)
   TO SERVER TYPE oracle REMOTE TYPE date;
```

Forward data type mappings - Sybase example

When creating federated objects, you can use the sample forward type mapping provided for Sybase.

You need to create these mappings before you create a nickname or federated procedure.

```
CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(3)
   TO SERVER TYPE sybase REMOTE TYPE datetime);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(0)
   TO SERVER TYPE sybase REMOTE TYPE smalldatetime);
```

Forward data type mappings - Teradata example

When creating federated objects, you can use the sample forward type mapping provided for Teradata.

You need to create these mappings before you create a nickname or federated procedure.

```
CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(0)
   TO SERVER TYPE teradata REMOTE TYPE timestamp(0);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(1)
   TO SERVER TYPE teradata REMOTE TYPE timestamp(1);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(2)
   TO SERVER TYPE teradata REMOTE TYPE timestamp(2);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(3)
   TO SERVER TYPE teradata REMOTE TYPE timestamp(3);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(4)
   TO SERVER TYPE teradata REMOTE TYPE timestamp(4);

CREATE TYPE MAPPING FROM LOCAL TYPE timestamp(5)
   TO SERVER TYPE teradata REMOTE TYPE timestamp(5);
```

Default reverse data type mappings

For most data sources, the default type mappings are in the wrappers.

The two kinds of mappings between data source data types and federated database data types are forward type mappings and reverse type mappings. In a forward type mapping, the mapping is from a remote type to a comparable local type. The other type of mapping is a reverse type mapping, which is used with transparent DDL to create or modify remote tables.

The default type mappings for DB2 family data sources are in the DRDA wrapper. The default type mappings for Informix are in the INFORMIX wrapper, and so forth.

When you define a remote table or view to the federated database, the definition includes a reverse type mapping. The mapping is from a local federated database data type for each column, and the corresponding remote data type. For example, there is a default reverse type mapping in which the local type REAL points to the Informix type SMALLFLOAT.

Federated databases do not support mappings for LONG VARCHAR, LONG VARGRAPHIC, and user-defined types.

When you use the CREATE TABLE statement to create a remote table, you specify the local data types you want to include in the remote table. These default reverse type mappings will assign corresponding remote types to these columns. For example, suppose that you use the CREATE TABLE statement to define an Informix table with a column C2. You specify BIGINT as the data type for C2 in the statement. The default reverse type mapping of BIGINT depends on which version of Informix you are creating the table on. The mapping for C2 in the Informix table will be to DECIMAL in Informix Version 8 and to INT8 in Informix Version 9.

You can override a default reverse type mapping, or create a new reverse type mapping with the CREATE TYPE MAPPING statement.

The following tables show the default reverse mappings between federated database local data types and remote data source data types.

These mappings are valid with all the supported versions, unless otherwise noted.

Default reverse data type mappings for DB2 Database for Linux, UNIX, and Windows data sources

The following table lists the default reverse data type mappings for DB2 Database for Linux, UNIX, and Windows data sources.

Table 121. DB2 Database for Linux, UNIX, and Windows default reverse data type mappings (Not all columns shown)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Federated Bit Data
BIGINT	-	8	-	-	-	-	BIGINT	-	-	-
BLOB	-	-	-	-	-	-	BLOB	-	-	-
CHARACTER	-	-	-	-	-	-	CHAR	-	-	N
CHARACTER	-	-	-	-	Y	-	CHAR	-	-	Y
CLOB	-	-	-	-	-	-	CLOB	-	-	-
DATE[1]	-	4	-	-	-	-	DATE	-	-	-
DBCLOB	-	-	-	-	-	-	DBCLOB	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
DECFLOAT [2]	-	8	-	-	-	-	DECFLOAT	-	0	-
DECFLOAT [2]	-	16	-	-	-	-	DECFLOAT	-	0	-
DOUBLE	-	8	-	-	-	-	DOUBLE	-	-	-
FLOAT	-	8	-	-	-	-	DOUBLE	-	-	-
GRAPHIC	-	-	-	-	-	-	GRAPHIC	-	-	N
INTEGER	-	4	-	-	-	-	INTEGER	-	-	-
REAL	-	-	-	-	-	-	REAL	-	-	-
SMALLINT	-	2	-	-	-	-	SMALLINT	-	-	-
TIME	-	3	-	-	-	-	TIME	-	-	-
TIMESTAMP(*p*)	-	-	*p*	*p*	-	-	TIMESTAMP(*p*)	-	*p*[3]	-
VARCHAR	-	-	-	-	-	-	VARCHAR	-	-	N
VARCHAR	-	-	-	-	Y	-	VARCHAR	-	-	Y
VARGRAPH	-	-	-	-	-	-	VARGRAPHIC	-	-	N
VARGRAPHIC	-	-	-	-	-	-	VARGRAPHIC	-	-	-

Table 121. DB2 Database for Linux, UNIX, and Windows default reverse data type mappings (Not all columns shown) (continued)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Federated Bit Data

Note:

1. When the date_compat parameter is set to OFF, the federated DATE maps to TIMESTAMP(0).
2. The SAME_DECFLT_ROUNDING server option is set to N by default and operations will not be pushed down to the remote data source unless SAME_DECFLT_ROUNDING is set to Y. For information on the SAME_DECFLT_ROUNDING server option, see DB2 database options reference.
3. For Version 9.5 or earlier, the remote scale for TIMESTAMP is 6.

Default reverse data type mappings for DB2 for System i data sources

The following table lists the default reverse data type mappings for DB2 for System i data sources.

Table 122. DB2 for System i default reverse data type mappings (Not all columns shown)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operations	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BLOB	-	-	-	-	-	-	BLOB	-	-	-
CHARACTER	-	-	-	-	-	-	CHARACTER	-	-	N
CHARACTER	-	-	-	-	Y	-	CHARACTER	-	-	Y
CLOB	-	-	-	-	-	-	CLOB	-	-	-
DATE	-	4	-	-	-	-	DATE	-	-	-
DBCLOB	-	-	-	-	-	-	DBCLOB	-	-	-
DECIMAL	-	-	-	-	-	-	NUMERIC	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
DOUBLE	-	8	-	-	-	-	FLOAT	-	-	-
GRAPHIC	-	-	-	-	-	-	GRAPHIC	-	-	N
INTEGER	-	4	-	-	-	-	INTEGER	-	-	-
REAL	-	4	-	-	-	-	FLOAT	-	-	-
SMALLINT	-	2	-	-	-	-	SMALLINT	-	-	-
TIME	-	3	-	-	-	-	TIME	-	-	-
TIMESTAMP(*p*)	-	-	*p*	*p*	-	-	TIMESTAMP	-	-	-
VARCHAR	-	-	-	-	-	-	VARCHAR	-	-	N
VARCHAR	-	-	-	-	Y	-	VARCHAR	-	-	Y
VARGRAPHIC	-	-	-	-	-	-	VARG	-	-	N

Default reverse data type mappings for DB2 for VM and VSE data sources

The following table lists the default reverse data type mappings for DB2 for VM and VSE data sources.

Table 123. DB2 for VM and VSE default reverse data type mappings (Not all columns shown)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BLOB	-	-	-	-	-	-	BLOB	-	-	-

Table 123. DB2 for VM and VSE default reverse data type mappings (Not all columns shown) (continued)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
CHARACTER	-	-	-	-	-	-	CHAR	-	-	-
CHARACTER	-	-	-	-	Y	-	CHAR	-	-	Y
CLOB	-	-	-	-	-	-	CLOB	-	-	-
DATE	-	4	-	-	-	-	DATE	-	-	-
DBCLOB	-	-	-	-	-	-	DBCLOB	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
DOUBLE	-	8	-	-	-	-	FLOAT	-	-	-
GRAPHIC	-	-	-	-	-	-	GRAPHIC	-	-	N
INTEGER	-	4	-	-	-	-	INTEGER	-	-	-
REAL	-	4	-	-	-	-	REAL	-	-	-
SMALLINT	-	2	-	-	-	-	SMALLINT	-	-	-
TIME	-	3	-	-	-	-	TIME	-	-	-
TIMESTAMP(*p*)	-	-	*p*	*p*	-	-	TIMESTAMP	-	-	-
VARCHAR	-	-	-	-	-	-	VARCHAR	-	-	-
VARCHAR	-	-	-	-	Y	-	VARCHAR	-	-	Y
VARGRAPH	-	-	-	-	-	-	VARGRAPH	-	-	N

Default reverse data type mappings for DB2 for z/OS data sources

The following table lists the default reverse data type mappings for DB2 for z/OS data sources.

Table 124. DB2 for z/OS default reverse data type mappings (Not all columns shown)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BLOB	-	-	-	-	-	-	BLOB	-	-	-
CHARACTER	-	-	-	-	-	-	CHAR	-	-	N
CHARACTER	-	-	-	-	Y	-	CHAR	-	-	Y
CLOB	-	-	-	-	-	-	CLOB	-	-	-
DATE	-	4	-	-	-	-	DATE	-	-	-
DBCLOB	-	-	-	-	-	-	DBCLOB	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
DOUBLE	-	8	-	-	-	-	DOUBLE	-	-	–
FLOAT	-	8	-	-	-	-	DOUBLE	-	-	-
GRAPHIC	-	-	-	-	-	-	GRAPHIC	-	-	N
INTEGER	-	4	-	-	-	-	INTEGER	-	-	-
REAL	-	4	-	-	-	-	REAL	-	-	-
SMALLINT	-	2	-	-	-	-	SMALLINT	-	-	-
TIME	-	3	-	-	-	-	TIME	-	-	-
TIMESTAMP(*p*)	-	-	*p*	*p*	-	-	TIMESTAMP	-	-	-
VARCHAR	-	-	-	-	-	-	VARCHAR	-	-	N
VARCHAR	-	-	-	-	Y	-	VARCHAR	-	-	Y
VARGRAPHIC	-	-	-	-	-	-	VARGRAPHIC	-	-	N

Default reverse data type mappings for Informix data sources

The following table lists the default reverse data type mappings for Informix data sources.

Table 125. Informix default reverse data type mappings

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BIGINT [1]	-	-	-	-	-	-	DECIMAL	19	-	-
BIGINT [2]	-	-	-	-	-	-	INT8	-	-	-
BLOB	1	2147483647	-	-	-	-	BYTE	-	-	-
CHARACTER	-	-	-	-	N	-	CHAR	-	-	-
CHARACTER	-	-	-	-	Y	-	BYTE	-	-	-
CLOB	1	2147483647	-	-	-	-	TEXT	-	-	-
DATE	-	4	-	-	-	-	DATE	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
DOUBLE	-	8	-	-	-	-	FLOAT	-	-	-
INTEGER	-	4	-	-	-	-	INTEGER	-	-	-
REAL	-	4	-	-	-	-	SMALLFLOAT	-	-	-
SMALLINT	-	2	-	-	-	-	SMALLINT	-	-	-
TIME	-	3	-	-	-	-	DATETIME	6	10	-
TIMESTAMP	-	10	-	-	-	-	DATETIME	0	15	-
VARCHAR	1	254	-	-	N	-	VARCHAR	-	-	-
VARCHAR [1]	255	32672	-	-	N	-	TEXT	-	-	-
VARCHAR	-	-	-	-	Y	-	BYTE	-	-	-
VARCHAR [2]	255	2048	-	-	N	-	LVARCHAR	-	-	-
VARCHAR [2]	2049	32672	-	-	N	-	TEXT	-	-	-

Note:

1. This type mapping is valid only with Informix server Version 8 (or lower).
2. This type mapping is valid only with Informix server Version 9 (or higher).

For the Informix DATETIME data type, the federated server uses the Informix high-level qualifier as the REMOTE_LENGTH and the Informix low-level qualifier as the REMOTE_SCALE.

The Informix qualifiers are the "TU_" constants defined in the Informix Client SDK `datatime.h` file. The constants are:

0 = YEAR	8 = MINUTE	13 = FRACTION(3)
2 = MONTH	10 = SECOND	14 = FRACTION(4)
4 = DAY	11 = FRACTION(1)	15 = FRACTION(5)
6 = HOUR	12 = FRACTION(2)	

Default reverse data type mappings for JDBC data sources

The following table lists the default reverse data type mappings for JDBC data sources that conform to the type mappings of the DB2 JDBC driver.

Table 126. JDBC default reverse data type mappings

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BIGINT	-	-	-	-	-	-	BIGINT	-	-	-
BLOB	-	-	-	-	-	-	BLOB	-	-	-

Table 126. JDBC default reverse data type mappings (continued)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
CHAR	-	-	-	-	Y	-	BINARY	-	-	-
CHAR	-	-	-	-	-	-	CHAR	-	-	-
CLOB	-	-	-	-	-	-	CLOB	-	-	-
DATE	-	4	-	-	-	-	DATE	-	-	-
DBCLOB	-	-	-	-	-	-	NCLOB	-	-	-
DECIMAL	-	-	-	-	-	-	DECIMAL	-	-	-
DOUBLE	-	8	-	-	-	-	DOUBLE	-	-	-
GRAPHIC	-	-	-	-	-	-	NCHAR	-	-	-
INTEGER	-	-	-	-	-	-	INTEGER	-	-	-
REAL	-	4	-	-	-	-	REAL	-	-	-
SMALLINT	-	-	-	-	-	-	SMALLINT	-	-	-
TIME	-	3	-	-	-	-	TIME	-	-	-
TIMESTAMP	-	-	-	-	-	-	TIMESTAMP	-	-	-
TIMESTAMP(*p*)	-	-	*p*	*p*	-	-	TIMESTAMP(*p*)	-	min(9,*p*)	-
VARCHAR	-	-	-	-	Y	-	VARBINARY	-	-	-
VARCHAR	-	-	-	-	N	-	VARCHAR	-	-	-
VARGRAPHIC	-	-	-	-	-	-	NVARCHAR	-	-	-

Default reverse data type mappings for Microsoft SQL Server data sources

The following table lists the default reverse data type mappings for Microsoft SQL Server data sources.

Table 127. Microsoft SQL Server default reverse data type mappings (Not all columns shown)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BIGINT [1]	-	-	-	-	-	-	bigint	-	-	-
BLOB	-	-	-	-	-	-	image	-	-	-
CHARACTER	-	-	-	-	Y	-	binary	-	-	-
CHARACTER	-	-	-	-	N	-	char	-	-	-
CLOB	-	-	-	-	-	-	text	-	-	-
DATE	-	4	-	-	-	-	datetime	-	-	-
DECIMAL	-	-	-	-	-	-	decimal	-	-	-
DOUBLE	-	8	-	-	-	-	float	-	-	-
INTEGER	-	-	-	-	-	-	int	-	-	-
SMALLINT	-	-	-	-	-	-	smallint	-	-	-
REAL	-	4	-	-	-	-	real	-	-	-
TIME	-	3	-	-	-	-	datetime	-	-	-
TIMESTAMP	-	10	-	-	-	-	datetime	-	-	-
VARCHAR	1	8000	-	-	N	-	varchar	-	-	-
VARCHAR	8001	32672	-	-	N	-	text	-	-	-
VARCHAR	1	8000	-	-	Y	-	varbinary	-	-	-
VARCHAR	8001	32672	-	-	Y	-	image	-	-	-

Table 127. Microsoft SQL Server default reverse data type mappings (Not all columns shown) (continued)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data

Note:

1. This type mapping is valid only with Microsoft SQL Server Version 2000.

Default reverse data type mappings for ODBC data sources

The following table lists the default reverse data type mappings for ODBC data sources.

Table 128. ODBC default reverse data type mappings (Not all columns shown)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BIGINT	-	-	-	-	-	-	SQL_BIGINT	-	-	-
BLOB	-	-	-	-	-	-	SQL_LONGVARBINARY	-	-	-
CHAR	-	-	-	-	Y	-	SQL_BINARY	-	-	-
CHAR	-	-	-	-	N	-	SQL_CHAR	-	-	-
CLOB	-	-	-	-	-	-	SQL_LONGVARCHAR	-	-	-
DATE	-	4	-	-	-	-	SQL_TYPE_DATE	-	-	-
DBCLOB	-	-	-	-	-	-	SQL_WLONGVARCHAR	-	-	-
DECIMAL	-	-	-	-	-	-	SQL_DECIMAL	-	-	-
DOUBLE	-	8	-	-	-	-	SQL_DOUBLE	-	-	-
FLOAT	-	-	-	-	-	-	SQL_FLOAT	-	-	-
GRAPHIC	-	-	-	-	-	-	SQL_WCHAR	-	-	-
INTEGER	-	-	-	-	-	-	SQL_INTEGER	-	-	-
REAL	-	4	-	-	-	-	SQL_REAL	-	-	-
SMALLINT	-	-	-	-	-	-	SQL_SMALLINT	-	-	-
TIME	-	3	-	-	-	-	SQL_TYPE_TIME	-	-	-
TIMESTAMP	-	10	-	-	-	-	SQL_TYPE_TIMESTAMP(*p*)	-	-	-
VARCHAR	-	-	-	-	Y	-	SQL_VARBINARY	-	-	-
VARCHAR	-	-	-	-	N	-	SQL_VARCHAR	-	-	-
VARGRAPHIC	-	-	-	-	Y	-	SQL_WVARCHAR	-	-	-

Default reverse data type mappings for Oracle NET8 data sources

The following table lists the default reverse data type mappings for Oracle NET8 data sources.

Table 129. Oracle NET8 default reverse data type mappings

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BIGINT	0	8	0	0	N	\0	NUMBER	19	0	N
BLOB	0	2147483647	0	0	Y	\0	BLOB	0	0	Y
CHARACTER	1	254	0	0	N	\0	CHAR	0	0	N
CHARACTER	1	254	0	0	Y	\0	RAW	0	0	Y
CLOB	0	2147483647	0	0	N	\0	CLOB	0	0	N

Table 129. Oracle NET8 default reverse data type mappings (continued)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
DATE[1]	0	4	0	0	N	\0	DATE	0	0	N
DECIMAL	0	0	0	0	N	\0	NUMBER	0	0	N
DECFLOAT	0	8	0	0	N	\0	NUMBER	0	0	N
DECFLOAT	0	16	0	0	N	\0	NUMBER	0	0	N
DOUBLE	0	8	0	0	N	\0	FLOAT	126	0	N
FLOAT	0	8	0	0	N	\0	FLOAT	126	0	N
INTEGER	0	4	0	0	N	\0	NUMBER	10	0	N
REAL	0	4	0	0	N	\0	FLOAT	63	0	N
SMALLINT	0	2	0	0	N	\0	NUMBER	5	0	N
TIME	0	3	0	0	N	\0	DATE	0	0	N
TIMESTAMP [2]	0	10	0	0	N	\0	DATE	0	0	N
TIMESTAMP*(p)* [3]	-	-	-	-	N	\0	TIMESTAMP*(p)*	-	-	N
VARCHAR	1	4000	0	0	N	\0	VARCHAR2	0	0	N
VARCHAR	1	2000	0	0	Y	\0	RAW	0	0	Y

Note:

1. When the date_compat parameter is set to OFF, the federated DATE maps to the Oracle date. When the date_compat parameter is set to ON, the federated DATE (equivalent to TIMESTAMP(0)), maps to Oracle TIMESTAMP(0).
2. This type mapping is valid only with Oracle Version 8.
3.
   - TIMESTAMP*(p)* represents a timestamp with a variable scale from 0-9 for Oracle and 0-12 for federation. When the scale is 0-9, the remote Oracle TIMESTAMP has the same scale as the federated TIMESTAMP. If the scale of the federated TIMESTAMP is greater than 9, the corresponding scale of the Oracle TIMESTAMP is 9 which is the largest Oracle scale.
   - This type mapping is valid only with Oracle Version 9, 10, and 11.

Default reverse data type mappings for Sybase data sources

The following table lists the default reverse data type mappings for Sybase data sources.

Table 130. Sybase CTLIB default reverse data type mappings

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BIGINT	-	-	-	-	-	-	decimal	19	0	-
BLOB	-	-	-	-	-	-	image	-	-	-
CHARACTER	-	-	-	-	N	-	char	-	-	-
CHARACTER	-	-	-	-	Y	-	binary	-	-	-
CLOB	-	-	-	-	-	-	text	-	-	-
DATE	-	-	-	-	-	-	datetime	-	-	-
DECIMAL	-	-	-	-	-	-	decimal	-	-	-
DOUBLE	-	-	-	-	-	-	float	-	-	-
INTEGER	-	-	-	-	-	-	integer	-	-	-
REAL	-	-	-	-	-	-	real	-	-	-
SMALLINT	-	-	-	-	-	-	smallint	-	-	-
TIME	-	-	-	-	-	-	datetime	-	-	-
TIMESTAMP	-	-	-	-	-	-	datetime	-	-	-
VARCHAR[1]	1	255	-	-	N	-	varchar	-	-	-

Table 130. Sybase CTLIB default reverse data type mappings (continued)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
VARCHAR[1]	256	32672	-	-	N	-	text	-	-	-
VARCHAR [2]	1	16384	-	-	N	-	varchar	-	-	-
VARCHAR [2]	16385	32672	-	-	N	-	text	-	-	-
VARCHAR[1]	1	255	-	-	Y	-	varbinary	-	-	-
VARCHAR[1]	256	32672	-	-	Y	-	image	-	-	-
VARCHAR [2]	1	16384	-	-	Y	-	varbinary	-	-	-
VARCHAR [2]	16385	32672	-	-	Y	-	image	-	-	-

Note:

1. This type mapping is valid only for CTLIB with Sybase server version 12.0 (or earlier).
2. This type mapping is valid only for CTLIB with Sybase server version 12.5 (or later).

Default reverse data type mappings for Teradata data sources

The following table lists the default reverse data type mappings for Teradata data sources.

Table 131. Teradata default reverse data type mappings (Not all columns shown)

Federated Typename	Federated Lower Len	Federated Upper Len	Federated Lower Scale	Federated Upper Scale	Federated Bit Data	Federated Data Operators	Remote Typename	Remote Length	Remote Scale	Remote Bit Data
BLOB	1	2097088000	-	-	-	-	BLOB	-	-	-
CHARACTER	-	-	-	-	-	-	CHARACTER	-	-	-
CHARACTER	-	-	-	-	Y	-	BYTE	-	-	-
CLOB	1	2097088000	-	-		-	CLOB	-	-	-
DATE	-	-	-	-	-	-	DATE	-	-	-
DBCLOB [1]	1	64000	-	-	-	-	VARGRAPHIC	-	-	-
DECIMAL	1	18	0	18	-	-	DECIMAL	-	-	-
DECIMAL	19	31	0	31	-	-	FLOAT	8	-	-
DOUBLE	-	-	-	-	-	-	FLOAT	-	-	-
GRAPHIC	-	-	-	-	-	-	GRAPHIC	-	-	-
INTEGER	-	-	-	-	-	-	INTEGER	-	-	-
REAL	-	-	-	-	-	-	FLOAT	8	-	-
SMALLINT	-	-	-	-	-	-	SMALLINT	-	-	-
TIME	-	-	-	-	-	-	TIME	15	-	-
TIMESTAMP	10	10	6	6	-	-	TIMESTAMP	26	6	-
VARCHAR	-	-	-	-	-	-	VARCHAR	-	-	-
VARCHAR	-	-	-	-	Y	-	VARBYTE	-	-	-
VARGRAPHIC	-	-	-	-	-	-	VARGRAPHIC	-	-	-

Note:

1. The Teradata VARGRAPHIC data type can contain only the specified length (1 to 32000) of a DBCLOB data type.

Unicode default data type mappings

Specific data sources support forward data type mappings and reverse data type mappings for Unicode databases.

Unicode default forward data type mappings for JDBC data sources

The following table lists the default forward data type mapping for JDBC data sources when the federated database is a Unicode database.

Table 132. Unicode default forward data type mappings for JDBC data sources

UTF-8	JDBC	
Data type	**Data type**	**Length**
CHAR	CHAR	1 to 254 bytes
VARCHAR	VARCHAR	1 to 32672 bytes
CLOB	CLOB	-
GRAPHIC	NCHAR	1 to 127 characters
VARGRAPHIC	NVARCHAR	1 to 16336 characters
DBCLOB	NCLOB	-

Unicode default reverse data type mappings for JDBC data sources

The following table lists the default reverse data type mapping for JDBC data sources when the federated database is a Unicode database.

Table 133. Unicode default reverse data type mappings for JDBC data sources

UTF-8		JDBC
Data type	**Length**	**Data type**
CHAR	1 to 254 bytes	CHAR
VARCHAR	1 to 32672 bytes	VARCHAR
CLOB	1 to 2147483647 bytes	CLOB
GRAPHIC	1 to 127 characters	NCHAR
VARGRAPHIC	1 to 16336 characters	NVARCHAR
DBCLOB	1 to 1073741823 characters	NCLOB

Unicode default forward data type mappings for Microsoft SQL Server data sources

The following table lists the default forward data type mapping for Microsoft SQL Server data sources when the federated database is a Unicode database.

Table 134. Unicode default forward data type mappings for Microsoft SQL Server data sources

UTF-8	Microsoft SQL Server	
Data type	**Data type**	**Length**
CHAR	CHAR	1 to 254 bytes
VARCHAR	CHAR	255 to 8000 bytes
	VARCHAR	1 to 8000 bytes
CLOB	TEXT	-
GRAPHIC	NCHAR	1 to 127 characters

Table 134. Unicode default forward data type mappings for Microsoft SQL Server data sources (continued)

UTF-8	**Microsoft SQL Server**	
Data type	**Data type**	**Length**
VARGRAPHIC	NCHAR	128 to 16336 characters
	NVARCHAR	1 to 16336 characters
DBCLOB	NTEXT	-

Unicode default reverse data type mappings for Microsoft SQL Server data sources

The following table lists the default reverse data type mapping for Microsoft SQL Server data sources when the federated database is a Unicode database.

Table 135. Unicode default reverse data type mappings for Microsoft SQL Server data sources

UTF-8		**Microsoft SQL Server**
Data type	**Length**	**Data type**
CHAR	1 to 254 bytes	CHAR
VARCHAR	1 to 32672 bytes	VARCHAR
CLOB	1 to 2 147 483 647 bytes	TEXT
GRAPHIC	1 to 127 characters	NCHAR
VARGRAPHIC	1 to 16336 characters	NVARCHAR
DBCLOB	1 to 1 073 741 823 characters	NTEXT

Unicode default forward data type mappings for NET8 data sources

The following table lists the default forward data type mapping for NET8 data sources when the federated database is a Unicode database.

Table 136. Unicode default forward data type mappings for NET8 data sources

UTF-8	**Oracle**	
Data type	**Data type**	**Length**
CHAR	CHAR	1 to 254 bytes
VARCHAR	CHAR	255 to 2000 bytes
	VARCHAR2	1 to 4000 bytes
DBCLOB	NCLOB	
GRAPHIC	NCHAR	1 to 127 characters
VARGRAPHIC	NCHAR	128 to 1000 characters
	NVARCHAR2	1 to 2000 characters

Unicode default reverse data type mappings for NET8 data sources

The following table lists the default reverse data type mapping for NET8 data sources when the federated database is a Unicode database.

Table 137. Unicode default reverse data type mappings for NET8 data sources

UTF-8		**Oracle**
Data type	**Length**	**Data type**
CHAR	1 to 254 bytes	CHAR
VARCHAR	1 to 4000 bytes	VARCHAR2
CLOB	1 to 2 147 483 647 bytes	CLOB
GRAPHIC	1 to 127 characters	NCHAR
VARGRAPHIC	1 to 2000 characters	NVARCHAR2
DBCLOB	1 to 1 073 741 823 characters	NCLOB

Unicode default forward data type mappings for ODBC data sources

The following table lists the default forward data type mapping for ODBC data sources when the federated database is a Unicode database.

Table 138. Unicode default forward data type mappings for ODBC data sources

UTF-8	**ODBC**	
Data type	**Data type**	**Length**
CHAR	SQL_CHAR	1 to 254 bytes
VARCHAR	SQL_CHAR	255 to 32672 bytes
	SQL_VARCHAR	1 to 32672 bytes
CLOB	SQL_LONGVARCHAR	-
GRAPHIC	SQL_WCHAR	1 to 127 characters
VARGRAPHIC	SQL_WCHAR	128 to 16336 characters
	SQL_WVARCHAR	1 to 16336 characters
DBCLOB	SQL_WLONGVARCHAR	-

Unicode default reverse data type mappings for ODBC data sources

The following table lists the default reverse data type mapping for ODBC data sources when the federated database is a Unicode database.

Table 139. Unicode default reverse data type mappings for ODBC data sources

UTF-8		**ODBC**
Data type	**Length**	**Data type**
CHAR	1 to 254 bytes	SQL_CHAR
VARCHAR	1 to 32672 bytes	SQL_VARCHAR
CLOB	1 to 2 147 483 647 bytes	SQL_LONGVARCHAR
GRAPHIC	1 to 127 characters	SQL_WCHAR
VARGRAPHIC	1 to 16336 characters	SQL_WVARCHAR
DBCLOB	1 to 1 073 741 823 characters	SQL_WLONGVARCHAR

Unicode default forward data type mappings for Sybase data sources

The following table lists the default forward data type mapping for Sybase CTLIB data sources when the federated database is a Unicode database.

Table 140. Unicode default forward data type mappings for Sybase CTLIB data sources

UTF-8	**Sybase**	
Data type	**Data type**	**Length**
CHAR	char	1 to 254 bytes
	nchar	1 to 127 characters
VARCHAR	char	255 to 32672 bytes
	varchar	1 to 32672 bytes
	nchar	128 to 16336 characters
	nvarchar	1 to 16336 characters
CLOB	text	
GRAPHIC	unichar	1 to 127 characters
VARGRAPHIC	unichar	128 to 16336 characters
	univarchar	1 to 16336 characters

Unicode default reverse data type mappings for Sybase data sources

The following table lists the default reverse data type mapping for Sybase CTLIB data sources when the federated database is a Unicode database.

Table 141. Unicode default reverse data type mappings for Sybase CTLIB data sources

UTF-8		**Sybase**
Data type	**Length**	**Data type**
CHAR	1 to 254 bytes	char
VARCHAR	1 to 32672 bytes	varchar
CLOB	1 to 2 147 483 647 bytes	text
GRAPHIC	1 to 127 characters	unichar
VARGRAPHIC	1 to 16336 characters	univarchar

Data types supported for nonrelational data sources

For most of the nonrelational data sources, you must specify the column information, including data type, when you create the nicknames to access the data source.

Some of the nonrelational wrappers create all of the columns required to access a data source. These are called *fixed columns*. Other wrappers let you specify some or all of the data types for the columns in the CREATE NICKNAME statement.

The following sections list the wrappers that you can specify the data types for, and the data types that the wrapper supports.

Data types supported by the BioRS wrapper

The following table lists the DB2 data types that the BioRS wrapper supports.

Table 142. BioRS data types that map to DB2 data types

BioRS data types	DB2 data type
AUTHOR	CHARACTER, CLOB, VARCHAR
DATE	CHARACTER, CLOB, VARCHAR
NUMBER	CHARACTER, CLOB, VARCHAR
REFERENCE	CHARACTER, CLOB, VARCHAR
TEXT	CHARACTER, CLOB, VARCHAR

The maximum length allowed for the CLOB data type is 5 megabytes.

Data types supported by the Excel wrapper

The following table lists the DB2 data types that the Excel wrapper supports.

Table 143. Excel data types that map to DB2 data types

Excel data types	DB2 data type
character	CHARACTER
date	DATE
number	DOUBLE
number	FLOAT
integer	INTEGER
character	VARCHAR

Data types supported by the Script wrapper

The following table lists the DB2 data types that the Script wrapper supports.

Table 144. Script data types that map to DB2 data types

XML data types	DB2 data type
character	BLOB
character	CHARACTER
character	CHARACTER FOR BIT DATA
character	CLOB (maximum length is 5 megabytes)
date	DATE
number	DECIMAL
number	DOUBLE
number	FLOAT
integer	INTEGER
number	REAL
integer	SMALLINT
character	VARCHAR
character	VARCHAR FOR BIT DATA

Data types supported by the table-structured file wrapper

The following table lists the DB2 data types that the table-structured file wrapper supports.

Table 145. Table-structured file data types that map to DB2 data types

Table-structured file data types	DB2 data type
character	CHARACTER
character	CLOB (maximum length is 5 megabytes)
number	DECIMAL
number	DOUBLE
number	FLOAT
integer	INTEGER
number	REAL
integer	SMALLINT
character	VARCHAR

Data types supported by the Web services wrapper

The following table lists the DB2 data types that the Web services wrapper supports. The Web services wrapper uses XML data types.

Table 146. XML data types that map to DB2 data types for the Web services wrapper

XML data types	DB2 data type
character	BLOB
character	CHARACTER
character	CHARACTER FOR BIT DATA
character	CLOB (maximum length is 5 megabytes)
date	DATE
number	DECIMAL
number	DOUBLE
number	FLOAT
integer	INTEGER
number	REAL
integer	SMALLINT
character	VARCHAR
character	VARCHAR FOR BIT DATA

Data types supported by the XML wrapper

The following table lists the DB2 data types that the XML wrapper supports.

Table 147. XML data types that map to DB2 data types for the XML wrapper

XML data types	DB2 data type
character	BLOB
character	CHARACTER

Table 147. XML data types that map to DB2 data types for the XML wrapper (continued)

XML data types	DB2 data type
character	CHARACTER FOR BIT DATA
character	CLOB (maximum length is 5 megabytes)
date	DATE
number	DECIMAL
number	DOUBLE
number	FLOAT
integer	INTEGER
number	REAL
integer	SMALLINT
character	VARCHAR
character	VARCHAR FOR BIT DATA
XML document	XML

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