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Simba SDK

Build a C++ ODBC Driver in 5 Days (MAC OS X)

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Introduction

The Build a C++ ODBC Driver in 5 Days guide demonstrates how to create a custom ODBC driver using SimbaEngine. Procedures in the guide explain how to modify and customize the Quickstart sample driver included with SimbaEngine.

At the end of five days, you will have a read-only driver that connects to your data store.

About SimbaEngine

ODBC is one of the most established and widely supported APIs for connecting to and working with databases. The ODBC specification provides a standard interface to which any ODBC-enabled application can connect. At the heart of ODBC technology is the driver, which connects an application to a data store.

SimbaEngine is a complete implementation of the ODBC specification. The libraries of SimbaEngine hide the complexity of error checking, session management, data conversions and other low-level implementation details, exposing a simple API called the Data Store Interface API (DSI API) that defines the operations needed to access a data store.

You use SimbaEngine to create an executable file that common reporting applications access when connecting to your data store in the process of executing an SQL statement. The executable file can be a Windows DLL; a Linux, Unix or Mac OS X shared object; a stand-alone server; or, some other form of executable. First, you create a DSI implementation (DSII) customized as needed to connect to your data source. Then, you create the executable by linking libraries from SimbaEngine with your custom DSI implementation. The project files or make files link in the appropriate SimbaODBC and SimbaEngine libraries to complete the driver. In the final executable, the components from SimbaEngine take responsibility for meeting the data access standards while your custom DSI implementation takes responsibility for accessing your data store and translating it to the DSI API.

Note: For a brief description of the ODBC standard, see http://www.simba.com/resources/data-access-standards-library#!odbc. For complete information on the ODBC 3.80 specification, see the ODBC Programmer's Reference at http://msdn.microsoft.com/en-us/library/ms714177(v=vs.85).aspx. For full documentation on SimbaEngine, see http://www.simba.com/products/simba-engine-sdk.

About the Quickstart Sample Driver

SimbaEngine includes sample drivers that you can use as a starting point for customizing your own driver. The Quickstart driver is a sample DSI implementation of an ODBC driver written in C++ that reads files in tabbed Unicode text format. The Simba SQLEngine component is required to perform the necessary SQL processing in the implementation because text files are not a SQL-aware data source.

Using the Quickstart sample driver to prototype a DSI implementation for your own data store helps you learn how SimbaEngine works. If you remove the shortcuts and simplifications implemented in the Quickstart driver, you can also use the driver as the

foundation for a commercial DSI implementation. Using the Quickstart sample driver is a fast and effective way to prepare a data access solution for your customers.

The UML diagram in "About the Quickstart Sample Driver" on the previous page shows a typical design pattern for a DSI implementation.

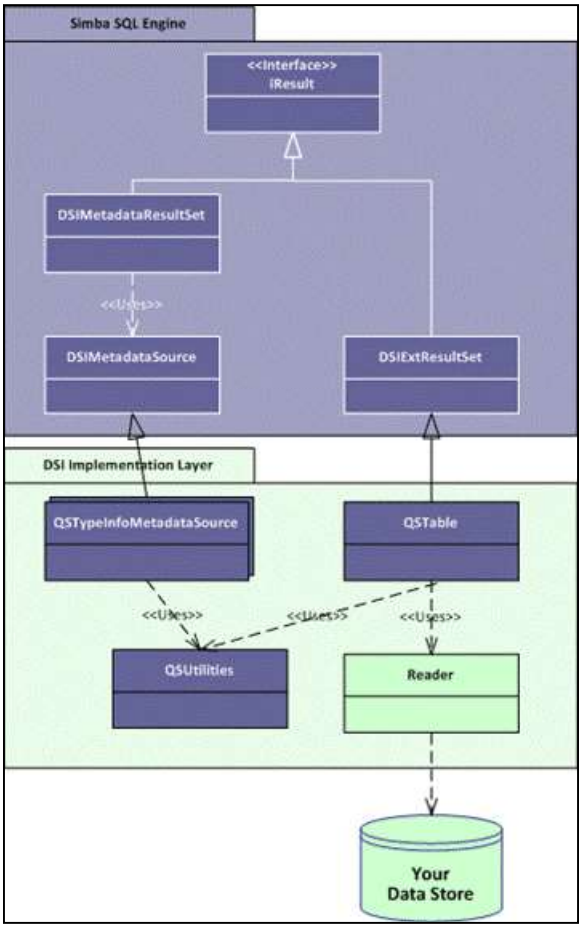

Figure 1: Design Pattern for a DSI Implementation

Notice the circular pattern of class relationships, headed by iResult and anchored by QSUtilities. The iResult class is responsible for retrieving column data and maintaining a cursor across result rows. The QSUtilities class contains platform-specific utility functions.

To implement data retrieval, your Reader class interacts directly with your data store to retrieve data, and then deliver the data to the QSTable class on demand. The Reader class should manage caching, buffering, paging and all the other techniques to speed data access.

As a starting point, to make your driver work properly with Microsoft Excel you can add metadata access by implementing the QSTypeInfoMetadataSource class and using the DSIExtMetadataHelper class. The DSIExtMetadataHelper class is responsible for iterating through tables and stored procedures so the engine can generate catalog function metadata.

Overview

To implement a working DSI with your data store, you need to:

1. Set up the development environment
2. Make a connection to the data store
3. Retrieve metadata
4. Work with columns
5. Retrieve data

In the Quickstart sample driver, you can identify areas of the code requiring modification by referring to pragma messages containing sequentially numbered TODO labels and a brief description.

Some areas of code you need to modify relate to retrieving data and metadata from your data store into the Simba SQLEngine. The Quickstart sample driver includes the classes and code to access the example data store. You need to modify the sample code to access your data store.

Some modifications you may make to Quickstart sample driver code relate to productization, including:

- Naming the driver
- Setting configuration properties for the driver
- Naming the XML error file and log files

Day One – Mac OS X Instructions

Today's task is to set up and test the development environment. By the end of the day, you will have compiled and tested your first ODBC driver.

The following instructions for setting up your environment assume that you are using Xcode 6.1. If you are using a different version, modify the paths accordingly. For example, if a path contains the xcode6_1 directory, modify the path to use the xcode5_1 directory instead.

Installing SimbaEngine

On the Mac OS X platform, SimbaEngine is provided as a single file consisting of the SimbaEngineSDK*.tar.gz file, a tar format archive that has been compressed using the gzip tool. The asterisk (*) in the file name represents a string of characters that represent the build number and platform. For example, the file name might look something like this: `SimbaEngineSDK_Release_Darwin-universal_clang_.0.1000.tar.gz`.

If you have a previous version of SimbaEngine installed, then uninstall the previous version prior to installing the new version.

To install SimbaEngine:

1. Open a command prompt.
2. Navigate to the directory where you want to install SimbaEngine.
    - In the *Build a C++ ODBC Driver in 5 Days* guide, the directory where you install SimbaEngine is referred to using the placeholder <installdir>. When working through procedures, ensure that you replace <installdir> using the appropriate file path.
    - We recommend that you install SimbaEngine to the `/Library` directory. Microsoft Excel 2016 will only load drivers from `/Library` and `/Applications`.
3. Copy the `SimbaEngineSDK*.tar.gz` file to the directory where you want to install SimbaEngine.
4. To uncompress the file, type:

```
gunzip SimbaEngineSDK*.tar.gz
```

5. To extract the tar file, type:

```
tar -xvf SimbaEngineSDK*.tar
```

Building the Quickstart Sample Driver

On the Mac OS X platform, the sample drivers include makefiles instead of Visual Studio solution files. The process to build each of the sample drivers is similar.

To build the SimbaEngine Quickstart sample driver:

1. Set the `SIMBAENGINE_DIR` environment variable by typing:

```
export SIMBAENGINE_DIR=<installdir>/SimbaEngineSDK/10.3/DataAccessComponents
```

In the command above, replace <installdir> with the directory where you installed the SimbaEngine files.

2. Set the `SIMBAENGINE_THIRDPARTY_DIR` environment variable by typing:

export SIMBAENGINE_THIRDPARTY_DIR=<installdir>/SimbaEngineSDK//
DataAccessComponents/ThirdParty

3. Change to the following directory:

<installdir>/SimbaEngineSDK//Examples/Source/Quickstart/Makefiles

4. To run the makefile for the debug target, building universal libraries containing both i386 and x86_64 architectures, type:

   make –f Quickstart.mak debug

   You can specify additional options. If you are using the Xcode5 package, you must specify COMPILER=Xcode5 in the make command or as an environment variable. For more information about the options and build configurations, refer to the *SimbaEngine Developer Guide*.

You can use the lipo command to extract 32- or 64-bit libraries from a universal library.

To extract i386 or x86_64 libraries from the universal library:

1. To display a list of the architectures found in the SimbaEngine Quickstart sample driver universal library created in the previous procedure, navigate to the directory `<installdir>/SimbaEngineSDK//Examples/Source/Quickstart/Bin/ Darwin_universal_clang`, and then type:

   lipo -info libQuickstart_debug.dylib

   The following information appears:

   Architectures in the fat file: libQuickstart_debug.dylib are: i386 x86_64

2. To extract i386 libraries from the universal library, type:

   lipo libQuickstart_debug.dylib -extract i386 -output

   libQuickstart_debug_i386.dylib

   OR

   To extract x86_64 libraries:

   lipo libQuickstart_debug.dylib -extract x86_64 -output

   libQuickstart_debug_x86_64.dylib

Configuring the Driver and Data Source

SimbaEngine supports using the iODBC Driver Manager on the Mac OS X platform. iODBC uses configuration files to define and configure ODBC data sources and drivers. The `odbc.ini` file defines ODBC data sources. The `odbcinst.ini` file defines ODBC drivers.

Locating ODBC Configuration Files

The value of the $ODBCINI environment variable specifies the location of the `odbc.ini` file, including the file name, for iODBC. The value of the $ODBCINSTINI environment variable specifies the location of the `odbcinst.ini` file, including the file name, for iODBC. If these environment variables are not set, then iODBC assumes that the configuration files exist in the user's home directory using the default file names (`.odbc.ini` and `.odbcinst.ini`).

Optionally, if you decide to put the configuration files somewhere other than the user's home directory, then set the environment variables using the command line. For example:

export ODBCINI=/usr/local/odbc/myodbc.ini
export ODBCINSTINI=/usr/local/odbc/myodbcinst.ini

For sample configuration files, see the following directory:

<installdir>/SimbaEngineSDK//Documentation/Setup

Configuring an ODBC Data Source

The `.odbc.ini` configuration file defines ODBC Data Sources.

To configure a data source:

1. To see if the .odbc.ini file already exists in your home directory, type the following command:

   ls –al ~ | grep .odbc.ini

   If the file exists, then details of the file appear. For example:

   -rw-rw-r-- 1 employee employee 1379 Oct 23 14:56 .odbc.ini

   If the file does not exist, then nothing is returned at the command prompt.

2. If the file does not exist, then copy the sample odbc.ini file to the user's home directory by typing:

cp <installdir>/SimbaEngineSDK//Documentation/Setup/odbc.ini ~/.odbc.ini

3. Using a text editor, open the `~/.odbc.ini` configuration file.

To open the file, you may need to configure your text editor to show hidden files.

4. Ensure that an entry appears in the [ODBC Data Sources] section to define the Data Source Name (DSN).

[ODBC Data Sources]
QuickstartDSII=QuickstartDSIIDriver

The [ODBC Data Sources] section specifies available data sources.

5. Ensure that a section having a name matching the data source name (DSN) exists in `~/.odbc.ini` to contain configuration options. Configuration options are specified as key-value pairs. For example:

   [QuickstartDSII]

   Description=Sample SimbaEngine Quickstart DSII

DBF=[INSTALLDIR]SimbaEngineSDK//Examples/Databases/Quickstart/

Driver=[INSTALLDIR]SimbaEngineSDK//Examples/Builds/Bin/ Darwin_universal_clang/libQuickstart.dylib

Locale=en-US

Defining an ODBC Driver

ODBC Drivers are defined in the `.odbcinst.ini` configuration file. The `.odbcinst.ini` file is optional because you can specify drivers directly in the `.odbc.ini` configuration file.

To define a driver:

1. To see if the `.odbcinst.ini` file exists in your home directory, type the following command:

   ls –al ~ | grep .odbcinst.ini

   If the file exists, then details of the file appear. For example:

   -rw-rw-r-- 1 employee employee 2272 Oct 23 15:30 .odbcinst.ini

   If the file does not exist, then nothing is returned at the command prompt.

2. If the file does not exist, then copy the sample `odbcinst.ini` file to the user's home directory by typing:

   cp <installdir>/SimbaEngineSDK//Documentation/Setup/odbcinst.ini ~/.odbcinst.ini

3. Using a text editor, open the `~/.odbcinst.ini` file.

4. Add a new entry to the [ODBC Drivers] section. Type driver name and the value "Installed". Here is a sample entry [ODBC Drivers] section:

   [ODBC Drivers]
   QuickstartDSIIDriver=Installed

   The [ODBC Drivers] section specifies available drivers. The driver name is used for the "Driver" value in the data source definition instead of the driver shared library name.

5. Add a new section with a name matching the new driver name. The section contains configuration options. Configuration options are specified as key-value pairs. For example:

   [QuickstartDSIIDriver]

   APILevel=1

   ConnectFunctions=YYY

   Description=Sample SimbaEngine Quickstart DSII

   Driver=[INSTALLDIR]SimbaEngineSDK//Examples/Builds/Bin/ Darwin_universal_clang/libQuickstart.dylib

DriverODBCVer=03.80

SQLLevel=1

Configuring the Simba Quickstart Sample Driver

Configuration options for drivers created using SimbaEngine appear in an `.INI` file. In order, SimbaEngine searches for the `.INI` file in the following locations:

1. The path, including the file name, specified using the SIMBAINI environment variable
2. The driver directory, as a non-hidden .INI file
3. In $HOME, as a hidden `.INI` file
4. In /etc/ as a non-hidden `.INI` file

Procedures in the *Build a C++ ODBC Driver in 5 Days* guide assume that the .INI file exists in the user's home directory.

To configure the Simba Quickstart ODBC Driver:

1. To see if the `.simba.quickstart.ini` file already exists in your home directory, type the following command:

   ls -al ~ | grep .simba.quickstart.ini

   If the file does not exist, then nothing is returned at the command prompt.

2. If the file does not exist, then copy the sample file to the user's home directory by typing:

cp <installdir>/SimbaEngineSDK//Documentation/Setup/ .simba.quickstart.ini ~/.simba.quickstart.ini.

3. Using a text editor, open the `~/.simba.quickstart.ini` file.
4. Set the value of `DriverManagerEncoding` to **UTF-32**.

For more information about your ODBC Driver Manager, consult your system administrator or refer to the documentation provided with the Driver Manager.

5. In the value for the ErrorMessagesPath property, replace [INSTALLDIR] with the path to your installation of SimbaEngine.

Set the `ODBCInstLib` property to the absolute path of the ODBCInst library for the iODBC Driver Manager. For example:

ODBCInstLib=<driver manager dir>/lib/libiodbcinst.dylib

6. Save the file.

For more information about how to configure data sources, please refer to the *SimbaEngine Developer Guide*.

Connecting to the Data Source

In order for the Quickstart sample driver to connect to the sample database successfully, the LD_LIBRARY_PATH environment variable must include references to the following libraries:

- International Components for Unicode (ICU)
- OpenSSL

To add the ICU and OpenSSL libraries:

Type the following at the command line:

export DYLD_LIBRARY_PATH=DYLD_LIBRARY_PATH:
[INSTALLDIR]/SimbaEngineSDK/
/DataAccessComponents/ThirdParty/icu/53.1/osx10_9/xcode6_
1/release3264/lib:
[INSTALLDIR]/SimbaEngineSDK//DataAccessComponents/ThirdParty/
openssl/1.0.1/osx10_9/xcode6_1/release3264/lib

Also, you must have the iODBC Driver Manager installed.

For more details on the iODBC Driver Manager and testing, please see the *SimbaEngine Developer Guide*.

The following procedure uses the iodbctest utility included with the iODBC Driver Manager to test connecting to the data source that the Quickstart sample driver uses.

Microsoft Excel 2016 only loads drivers from `/Library` and `/Applications`.

To test connecting the Quickstart sample driver to the sample data source:

1. At the command prompt, type:

   iodbctest

2. At the prompt says "Enter ODBC connect string", type `?` to show the list of DSNs and Drivers.

3. The list of DSNs should include a DSN named QuickstartDSII. To connect, type:

   DSN=QuickstartDSII

4. If you connect successfully, then a prompt that says "SQL>" appears. Type a SQL command to query your database. For example, type:

   SELECT * FROM PRODUCT

If there were no problems with the example drivers you built, you are now ready to set up a development project to start building your own ODBC driver.

Setting Up a Customizable Project

Now you are ready to set up a separate project for customization based on the Quickstart sample driver.

> **Important:** Creating a separate project to customize is helpful becaue you can compare your project to the Quickstart sample driver when debugging, for example.

To create a customizable project based on the Quickstart sample driver:

1. Copy the Quickstart directory to a new directory that will be the top-level directory for your new project and DSI implementation files. For example, at the command line type:

   cp –R <installdir>/SimbaEngineSDK//Examples/Source/Quickstart <installdir>/SimbaEngineSDK//Examples/Source/MyQuickstart

2. Browse to the /Makefiles subdirectory in the copy of the Quickstart project that you created in step "Setting Up a Customizable Project" on the previous page, and then rename the `Quickstart.mak` file. For example, type:

   mv Quickstart.mak MyQuickstart.mak

3. Then, rename the `.depend` file that is located in the `Makedepend` directory.

4. Browse to the /Source subdirectory in the copy of the Quickstart project that you created in step "Setting Up a Customizable Project" on the previous page. Open the file named `Makefile`, and then replace the "`Quickstart`" project name in the source code with the name of your new ODBC driver. Save and close the file.

5. Navigate to the following directory:

   <installdir>/SimbaEngineSDK//Examples/Source/MyQuickstart/Makefiles

6. Type make `-f MyQuickstart.mak debug` to run the makefile for the debug target.

Configuring Your Driver and Data Source

To configure your driver and data source:

1. Open the `.odbc.ini` configuration file in a text editor.
2. Make sure there is an entry in the [ODBC Data Sources] section that defines the data source name (DSN).

```
[ODBC Data Sources]
MyQuickstartDSII=MyQuickstartDSIIDriver
```

3. Make sure there is a section with a name that matches the data source name (DSN). For example:

   [MyQuickstartDSII]

   Description=Sample SimbaEngine Quickstart DSII

   DBF=[INSTALLDIR]SimbaEngineSDK//Examples/Databases/Quickstart/

   Driver=[INSTALLDIR]SimbaEngineSDK//Examples/Source/MyQuickstart/Bin/Darwin_universal_clang/libMyQuickstart_debug.dylib

Locale=en-US

4. Open the `.odbcinst.ini` configuration file in a text editor.
5. Add a new entry to the [ODBC Drivers] section. For example:

   [ODBC Drivers]
   MyQuickstartDSIIDriver=Installed

6. Add a new section with a name that matches the new driver name. For example:

   [MyQuickstartDSIIDriver]
   Driver=[INSTALLDIR]SimbaEngineSDK//Examples/Source/MyQuickstart/Bin/ Darwin_universal_clang/libMyQuickstart_debug.dylib

7. Copy the `.simba.quickstart.ini` file in your home directory so it has the name `.simba.myquickstart.ini`

Connecting to the Data Source Using Your Customizable Driver

One way to test your data source is using the iodbctest utility included with the iODBC Driver Manager.

To test your data source using iodbctest:

1. At the command prompt, type:

   iodbctest

2. At the prompt that says "Enter ODBC connect string", type `?` to show the list of DSNs and Drivers.
3. In the list, you should see your MyQuickstartDSII DSN. To connect to your data source, type:

   DSN=MyQuickstartDSII

4. If you connect successfully, then a prompt that says "SQL>" appears. Type a SQL command to query your database. For example, type:

   SELECT * FROM PRODUCT.

5. To exit iodbctest, at the prompt, type:

   quit

You can also use the LLDB debugger with the iodbctest utility.

To use LLDB to test your driver and hit a breakpoint:

1. Type `lldb iodbctest` to start the debugger.
2. Type `b Simba::DSI::DSIDriverFactory` to set a breakpoint at the `DSIDriverFactory` ()function in the `Main_Unix.cpp` file. `DSIDriverFactory`() runs as soon as the Driver Manager loads the ODBC driver. If you prefer to set a different breakpoint, then review the source code in the `<installdir>/SimbaEngineSDK//Examples/Source/MyQuickstart/Source directory` as needed.

When using the LLDB debugger with an application, your ODBC driver is not loaded until the application is running and you make a connection. This means that you can set breakpoints before the driver is loaded or after, depending on the breakpoint you want to hit. LLDB may display a message that the breakpoint cannot be resolved to any actual location because the driver is not loaded yet. Proceed to step "Connecting to the Data Source Using Your Customizable Driver" on the previous page.

3. To load and run the driver until the breakpoint is encountered, type:

   run DSN=MyQuickstartDSII;UID=<YourUserName>;PWD=<YourPassword>

Summary – Day One

So far, the following tasks are complete:

- Building and testing the Quickstart sample driver to ensure that SimbaEngine and development environment are installed and configured correctly.
- Creating, building and testing a copy of the Quickstart sample driver that you can customize to connect to a different data source.

Day Two

Today's goal is to customize your driver, enable logging and establish a connection to your data store. To accomplish this you will visit TODO items 1 to 6.

Remember that when you build the project, you will see the TODO messages in the Output window. To rebuild the whole solution, select **Build** > **Rebuild Solution**. If the Output window is not open, then select **Debug** > **Windows** > **Output**. Double click a TODO message to jump to the relevant section of code.

Construct a Connector Singleton

TODO #1: Construct a Connector Singleton

The `DSIDriverFactory()` implementation in `MainWindow.cpp` is the main entry point that is called from Simba's ODBC layer to create an instance of the DSI implementation. This method is called as soon as the Driver Manager calls `LoadLibrary()` on the ODBC connector.

To construct the connector singleton:

1. Launch Microsoft Visual Studio 2022.
2. Click **File** > **Open** > **Project/Solution**
3. Navigate to `[INSTALLDIR]\SimbaEngineSDK\10.0\Examples\Source\<YourProjectName>\Source` and then open the `<YourProjectName>_VS201x.vcproj` file.
4. Rebuild your solution and the double click the TODO #1 message section of code. The `Main_Windows.cpp` file opens.
5. Look at the `DSIDriverFactory()` implementation.
6. Specify the location that is used when reading driver settings from the registry. This change is related to rebranding. Replace "Simba" with your company name and change "Quickstart" to the name of your driver in the following line:
   `SimbaSettingReader::SetConfigurationBranding("Simba\\Quickstart");`

   This step, like those in day one, is important to distinguish your driver from our sample and other drivers.
7. Add the processing, if you are building a commercial connector.
8. Click **Save**.

On Linux and UNIX platforms, `DSIDriverFactory()` is implemented in `Main_Unix.cpp`.

Setting Driver Properties

TODO #2: Set the driver properties.

To set driver properties:

1. Double click the TODO #2 message to jump to the relevant section of code. The `QSDriver.cpp` file opens. Look at `SetDriverPropertyValues()` where you will set up the general properties for your driver.
2. Change the DSI_DRIVER_DRIVER_NAME setting. Set this to the name of your driver. (The same name you used to replace "QuickstartDSII" in Day One).
3. Depending on the character sets or Unicode encoding used on your data store, you may want to change the following settings:
   - DSI_DRIVER_STRING_DATA_ENCODING – The encoding of char data within the data store. The default value is ENC_UTF8.
   - DSI_DRIVER_WIDE_STRING_DATA_ENCODING – The encoding of wide character data within the data store. The default is ENC_UTF16_LE.

Setting Logging Details

Here you will customize how the driver logs errors and other information. The important loggers are the driver log for anything not specific to a single connection, and the connection log for anything unique to a single connection or statement within a connection. Following the TODOs below, you can use our provided logger implementation and just rename the output filename. Or you may entirely replace it later with your own implementation of our ILogger interface.

TODO #3: Set the driver-wide logging details.

TODO #4: Set the connection-wide logging details.

To set logging details:

1. Double click the TODO #3 message to jump to the relevant section of code.
2. Change the driver log's file name.
3. Double click the TODO #4 message to jump to the relevant section of code.
4. Change the connection log's file name.
5. Click **Save All.**

By default, the SimbaEngine Quickstart Driver maintains two kinds of log files: one for all driver-based calls and one for each connection created. Update these TODO's if you do not require such fine granularity in logging.

For more information about how to enable logging, refer to the *SimbaEngine Developer Guide*.

Checking Connection Settings

TODO #5: Check Connection Settings.

When the Simba ODBC layer is given a connection string from an ODBC-enabled application, the Simba ODBC layer parses the connection string into key-value pairs. Then, the entries in the connection string and the DSN are sent to the `QSConnection::UpdateConnectionSettings()` function for validation. Validating the correctness (eg. Passwords) is done later in the `Connect()` method.

To verify connection settings:

1. Double click the TODO #5 message to jump to the relevant section of code.
2. The `UpdateConnectionSettings()` function should validate that the key-value pairs in `in_connectionSettings` are sufficient to create a connection. Use the `VerifyRequiredSetting()` or `VerifyOptionalSetting()` utility functions to do this. If any of the values received are invalid, then you should throw an ErrorException seeded with `DIAG_INVALID_AUTH_SPEC`.

For example, the Quickstart driver verifies that the entries within `in_connectionSettings` are sufficient to create a connection by using the following code:

VerifyRequiredSetting(QS_DBF_KEY, in_connectionSettings, out_connectionSettings);

The Quickstart driver requires a single key in the DSN, "DBF" which represents the file location to be searched. This “QS_DBF_KEY” is the connection key to use when looking up the DBF path in the connection string.

If the entries within `in_connectionSettings` are not sufficient to create a connection, then you can ask for additional information from the ODBC-enabled application by specifying the additional, required settings to `out_connectionSettings`. If there are no further entries required, simply leave `out_connectionSettings` empty.

Establishing a Connection

TODO #6: Establish A Connection.

Once `QSConnection::UpdateConnectionSettings()` returns `out_connectionSettings` without any required settings. If there are only optional settings, a connection can still occur, then the Simba ODBC layer calls `QSConnection::Connect()` passing in all the connection settings received from the application.

To establish a connection:

Double click the TODO #6 message to jump to the relevant section of code.
Look at the code that authenticates the user against your data store using the

information provided within the `in_connectionSettings` parameter. The sample code uses the utility functions `GetRequiredSetting()` and `GetOptionalSetting()`. Alternatively, if authentication fails, you can choose to throw an `ErrorException` seeded with `DIAG_INVALID_AUTH_SPEC`. Use the obtained values (eg. hostname, username, password, etc.) to make a connection with your datasource by passing them to your relevant API or network protocol.

You have now authenticated the user against your data store.

Day Three

Today's goal is to return the data used to pass catalog information back to the ODBC-enabled application. Almost all ODBC-enabled applications require the following ODBC catalog functions:

- SQLGetTypeInfo
- SQLTables (CATALOG_ONLY)
- SQLTables (TABLE_TYPE_ONLY)
- SQLTables
- SQLColumns

Creating and Return Metadata Sources

TODO #7: Create and return your Metadata Sources.

`QSDataEngine::MakeNewMetadataTable()` is responsible for creating the sources to be used to return data to the ODBC-enabled application for the various ODBC catalog functions. Each ODBC catalog function is mapped to a unique `DSIMetadataTableId`, which is then mapped to an underlying `MetadataSource` that you will implement and return. Each `MetadataSource` instance is responsible for three things:

1. Creating a data structure that holds the data relevant for your data store: `Constructor`.
2. Navigating the structure on a row-by-row basis: `Move()`.
3. Retrieving data: `GetData()` (See Data Retrieval, Data Retrieval for a brief overview of data retrieval).

Handling DSI_TYPE_INFO_METADATA

SQLGetTypeInfo is used by applications to discover data types supported by your driver. The SDK supports all the types listed below but you may want to modify this metadata source if your tables don't support storing all of them or if some of the default metadata differs from our defaults.

The underlying ODBC catalog function `SQLGetTypeInfo` is handled as follows:

1. When called with `DSI_TYPE_INFO_METADATA`, `QSDataEngine::MakeNewMetadataTable()` will return an instance of `QSTypeInfoMetadataSource()`.
2. The SimbaEngine Quickstart Driver example exposes support for all data types, but due to its underlying file format, it is constrained to support only the following types:

SQL_BIGINT	SQL_BIT	SQL_CHAR
SQL_DECIMAL	SQL_DOUBLE	SQL_INTEGER
SQL_LONGVARCHAR	SQL_LONGWVARCHAR	SQL_NUMERIC
SQL_REAL	SQL_SMALLINT	SQL_TINYINT
SQL_TYPE_DATE	SQL_TYPE_TIME	SQL_TYPE_TIMESTAMP
SQL_VARCHAR	SQL_WCHAR	SQL_WVARCHAR

3. For your driver, you may need to change the types returned and the parameters for the types in `QSTypeInfoMetadataSource::PrepareType()`. You change the passed in SqlTypeInfo object to modify the parameters of the types that are supported.

Handling the other MetadataSources

The other required ODBC catalog functions (including SQLTables (CATALOG_ONLY), SQLTables (TABLE_TYPE_ONLY), SQLTables (SCHEMA_ONLY), SQLTables and SQLColumns) are used by applications to learn about your table structure (ie, their names and contents). These sources are handled as follows:

1. When called with any other `DSIMetadataTableId`, `QSDataEngine::MakeNewMetadataTable()` should return `NULL`. Returning `NULL` will signal SimbaEngine that it should use the metadata helper class returned via `QSDataEngine::CreateMetadataHelper()` along with some default `MetadataSources` to create the data source metadata. You can also choose to return a DSIMetadataSource if you don't want to use the metadata helper.

2. You will need to change:

   - `QSMetadataHelper::QSMetadataHelper()`
     The example constructor retrieves a list of the tables in the data source. You should modify this method to load the tables defined within your data store.

   - `QSMetadataHelper::GetNextTable()`
     In the SimbaEngine Quickstart Driver, this method returns the next table in the data source. You should modify this method to retrieve the next table from your data store.

   - The `DSIExtMetadataHelper` class works by retrieving the identifying information for each table and then opening the table via `QSDataEngine::OpenTable()`. Once you have implemented `QSTable`, the correct metadata will be returned for all of the tables and columns in your data source.

You can now retrieve type metadata from within your data store.

On Linux and UNIX platforms, this metadata is also available using the datatypes command in the iodbctest utility.

Day Four

Today's goal is to enable data retrieval from within the driver. We will discuss:

- Opening a table defined within your data store
- Retrieving the column information for the table
- Retrieving data

Enabling Data Retrieval

TODO #8: Open A Table.

`QSDataEngine::OpenTable()` is the entry point where Simba SQL Engine requests that tables involved in the query be opened.

`QSTable` is an implementation of `DSIExtSimpleResultSet`, an abstract class provided by Simba that provides for basic forward-only result set traversal. The main role of `QSTable` is to translate the stored data from your native data format into SQL Data types.

The Quickstart sample driver is implemented for Tabbed Unicode Files. The sample driver translates the text from UTF16-LE strings into the SQL Data types defined for each column within the configuration dialog.

In the Quickstart driver, `QSTable` uses a `TabbedUnicodeFileReader`, which provides an interface to navigate between lines within a Unicode text file. This class preprocesses each row in the file to determine the starting file offset of each column in the row. Its GetData method takes a `columnIndex` and uses it to calculate the exact position in the file where the column's data resides. The method repositions the file and retrieves the data as if from a byte-buffer. See *Appendix C*: Data Retrieval for a brief overview of data retrieval.

To enable data retrieval:

1. Modify the `QSDataEngine::OpenTable` method to check that the supplied catalog, schema and table names are valid and correspond to a table defined in your data store. If they are not, you should return null to indicate that the table does not exist. If the inputs are valid, then a new instance of `QSTable` is returned.
2. Make the following changes to `QSTable` for it to work with your data store:
   a. To return the catalog, schema and table names for your table:
      - `QSTable::QSTable()`: The constructor must be modified to take in the catalog, schema and table names and save them in member variables.
      - `QSTable::GetCatalogName()`: Returns `QS_CATALOG`;
      - `QSTable::GetSchemaName()`: Returns `simba_wstring()` (because it does not

support schemas);

- `QSTable::GetTableName()`: Returns `m_tableName`;

b. To return the columns defined for your table:

- `QSTable::InitializeColumns()`: Modify the method so that, for each column defined in the table, you define a `DSIResultSetColumn` in terms of SQL types. Here is an example of pseudo code for the new method:

- AutoPtr<DSIResultSetColumns> columns;

  Get all column information from your data store for the table

  For Each Defined Column

  {

  AutoPtr<DSIColumnMetadata> columnMetadata(

  new DSIColumnMetadata());

  columnMetadata->m_catalogName = m_catalogName;

  columnMetadata->m_schemaName = m_schemaName;

  columnMetadata->m_tableName = m_tableName;

  columnMetadata->m_name = //column name

  columnMetadata->m_label = //localized column name

  columnMetadata->m_unnamed = false;

  columnMetadata->m_charOrBinarySize = //the length in

  bytes

  columnMetadata->m_nullable = DSI_NULLABLE;

  // Change the first parameter of this method to the SQL

  // type that maps to your data store type.

  SqlTypeMetadata* sqlTypeMetadata =

  SqlTypeMetadataFactory::MakeNewSqlTypeMetadata(

  SQL_WVARCHAR, TDW_BUFFER_OWNED);

  columns->AddColumn(

  new DSIResultSetColumn(

  sqlTypeMetadata,

  columnMetadata.Detach()));

```
}


m_columns.Attach(columns.Detach());
```

c. Modify the following three methods. The methods are responsible for navigating a data structure containing information about one table in the data store and retrieving data from the table:

- `QSTable::MoveToBeforeFirstRow()`
- `QSTable::MoveToNextRow()`
- `QSTable::GetData()`

In your class:

- Implementing a streaming interface for the data in the table within your data store is best.
- Provide the ability to navigate forward from one table row to the next.
- Provide the ability to navigate across columns within the row.
- Provide the ability to read the data associated with the current row and column combination.

d. Modify `QSTable::DoCloseCursor()`. This is a callback method called from Simba SQL Engine to indicate that data retrieval has completed and that you may now do any tasks related to closing the connection to your data store.

You can now retrieve data and see the rest of the metadata from your data store. You should be able to:

- Run `SQLTables()` and `SQLColumns`() from within `ODBCTest32.exe` (Unicode) and see the correct metadata returned.
- Execute queries from any ODBC-enabled application such as Microsoft Excel, Microsoft Access, Microsoft SQL Server or Crystal Reports and see the results returned from your data store.

On Linux and UNIX platforms, lists of catalogs, schemas, tables and types are available using the qualifiers, owners, tables and types commands in the iodbctest utility.

Day Five

Today's goal is to start productizing your driver. Additionally, you can also start localizing your driver error messages. Refer to SimbaEngine Developer Guide for more details.

Configuring Error Messages

TODO #9: Register Messages xml file for handling by DSIMessageSource.

All the error messages used within your DSI implementation are stored in a file called `QSMessages.xml`

To configure error messages:

1. Rename the `QSMessages.xml` file to something appropriate to your data store.
2. Double click the TODO #9 message to jump to the relevant section of code.
3. Update the line associated with the TODO to match the new name of the file.
4. Open the `QSMessages.xml` file and change all instances of the following items:
   - The letters "`QS`" to a two letter abbreviation of your choice
   - The word "`Quickstart`" to a name relating to your driver
5. When you are done, you should revisit each exception thrown within your DSI implementation and change the parameters to match as well. This will rebrand your converted SimbaEngine Quickstart Driver for your organization.

TODO #10: Set the vendor name, which will be prepended to error messages.

The vendor name is prepended to all error messages that are visible to applications. The default vendor name is Simba.

To set the vendor name:

1. Double click the TODO #10 message to jump to the relevant section of code.
2. Set the vendor name as shown in the commented code.

Adding Finishing Touches

You have now completed all TODO's in the project. However, there are still a couple of final steps before you have a fully functioning driver.

To add finishing touches:

1. Rename all files and classes in the project to have the two-letter abbreviation you chose as part of TODO #9.

2. Create a driver configuration dialog. This dialog is presented to the user when they use the ODBC Data Source Administrator to create a new ODBC DSN or configure an existing one. The C++ SimbaEngine Quickstart Driver project contains an example ODBC configuration dialog that you can look at, as an example. You can find the source under the Setup folder within the SimbaEngine Quickstart Driver project.

3. To see the driver configuration dialog that you created, run the ODBC Data Source Administrator, open the Control Panel, select Administrative Tools, and then select Data Sources (ODBC). If your Control Panel is set to view by category, then Administrative Tools is located under System and Security.

> **Important:** If you are using 64-bit Windows with 32-bit applications, you must use the 32-bit ODBC Data Source Administrator. You cannot access the 32-bit ODBC Data Source Administrator from the start menu or control panel in 64-bit Windows. Only the 64-bit ODBC Data Source Administrator is accessible from the start menu or control panel. On 64-bit Windows, to launch the 32-bit ODBC Data Source Administrator you must run `C:\WINDOWS\SysWOW64\odbcad32.exe`. See ODBC Data Source Administrator on Windows 32-Bit vs. 64-Bit ODBC Data Source Administrator on Windows 32-Bit vs. 64-Bit on page 1 for details.

On Linux and UNIX platforms, creating a driver configuration dialog is possible. However, the Quickstart sample driver for Linux and UNIX platforms does not include a configuration dialog.

Conclusion

By modifying the Quickstart sample driver included with SimbaEngine, you have created your own read-only ODBC driver that connects to your data store.

Reference

This section contains more information that you may find useful when developing your sample ODBC driver.

Appendex A: ODBC Data Source Administrator on Windows 32-Bit vs. 64-Bit

On a 64-bit Windows system, you can execute 64-bit and 32-bit applications transparently. Currently, many applications are available in 32-bit versions only. Running 32-bit applications on 64-bit operating systems is common.

Note: Microsoft Excel is available in 32-bit and 64-bit versions.

In a single running process, all of the code must be either 64-bit or 32-bit. 64-bit applications can only load 64-bit ODBC drivers and 32-bit applications can only load 32-bit ODBC drivers.

On a 64-bit Windows system, the ODBC Data Source Administrator that you access through the Control Panel by default configures data sources for 64-bit applications. However, you must use the 32-bit version of the ODBC Data Source Administrator to configure data sources for 32-bit applications.

PROBLEM: You cannot access the 32-bit ODBC Data Source Administrator from the Start menu or Control Panel in 64-bit Windows.

SOLUTION: To create new 32-bit data sources or modify existing ones on 64-bit Windows you must run C:\WINDOWS\SysWOW64\odbcad32.exe. Create a shortcut to the 32-bit ODBC Data Source Administrator on your Desktop or Start menu if you configure 32-bit data sources frequently.

Appendex B: Bitness and the Windows Registry

A 64-bit application cannot use a 32-bit ODBC driver, and vice versa. In the Registry on computers running 64-bit Windows operating systems, system-wide information about 64-bit ODBC drivers is stored in the HKEY_LOCAL_MACHINE/SOFTWARE/ODBC subkey and system-wide information about 32-bit ODBC drivers is stored in the HKEY_LOCAL_ MACHINE/ SOFTWARE/WOW6432NODE/ODBC subkey.

For 32-bit applications running on a 64-bit computer, 32-bit data sources appear the same as if the application was running on a 32-bit computer.

On computers running 32-bit Windows operating systems, system-wide information about ODBC drivers is stored in the HKEY_LOCAL_MACHINE/SOFTWARE/ODBC subkey. 32-bit Windows operating systems cannot run 64-bit applications or drivers.

32- and 64-bit ODBC Data Source Administrators discussed in "Appendex A: ODBC Data Source Administrator on Windows 32-Bit vs. 64-Bit" above use information about drivers stored in the respective Windows Registry keys.

The ODBCINST.INI Subkey

To define a name and set the location of drivers, the ODBC Data Source Administrator matching the bitness of the operating system uses definitions in the subkey HKEY_LOCAL_MACHINE/SOFTWARE/ODBC/ODBCINST.INI and the 32-bit ODBC Data Source Administrator on 64-bit Windows uses Registry keys created in HKEY_LOCAL_MACHINE/SOFTWARE/WOW6432NODE/ODBC/ODBCINST.INI

The ODBCINST.INI subkey contains a subkey for each driver. The subkey for each driver includes the following string values:

- **Driver** provides the path to the driver DLL
- **Setup** provides the location of the driver setup DLL
- **Description** briefly describes the driver

The ODBCINST.INI subkey also contains a subkey named ODBC Drivers that contains string values to match the name of each driver subkey. Each string value is the text Installed

For more details on information in the Windows Registry contained in the ODBCINST.INI subkey, see the MSDN topic Registry Entries for ODBC Components at https://msdn.microsoft.com/en-us/library/ms714818%28v=vs.85%29.aspx.

The ODBC.INI Subkey

To connect a driver to a database, the ODBC Data Source Administrator matching the bitness of the operating system uses definitions in the subkey HKEY_LOCAL_MACHINE/SOFTWARE/ ODBC/ODBC.INI and the 32-bit ODBC Data Source Administrator on 64-bit Windows uses Registry keys created in HKEY_LOCAL_MACHINE/SOFTWARE/WOW6432NODE/ODBC/ ODBC.INI

The ODBC.INI subkey contains a subkey for each Data Source Name (DSN). The subkey for each DSN includes the following string values:

- **Driver** defines the name of the driver to use for connecting to the database, as set in the ODBCINST.INI subkey.

The Driver value can also set a file path to the driver DLL.

- **DBF** defines the path to the database to which the DSN creates a connection.
- **Description** briefly describes the DSN.

The ODBC.INI subkey also contains a subkey named ODBC Data Sources that contains string values to match the name of each DSN subkey. Each string value is the name of the driver that the DSN uses.

For more details on information in the Windows Registry contained in the ODBC.INI subkey, see the MSDN topic Registry Entries for Data Sources at https://msdn.microsoft.com/en-us/library/ms712603%28v=vs.85%29.aspx.

Appendix C: Data Retrieval

In the Data Store Interface (DSI), the following two methods actually perform the task of retrieving data from your data store:

- Each `MetadataSource` implementation of `GetMetadata()`
- `QSTable::GetData()`

Both methods will provide a way to uniquely identify a column within the current row. For `MetadataSource`, Simba SQL Engine will pass in a unique column tag (see `DSIOutputMetadataColumnTag`). For `QSTable`, Simba SQL Engine will pass in the column index.

In addition, both methods accept the following three parameters:

1. `in_data`

   The SQLData into which you must copy the value of your cell. This class is a wrapper around a buffer managed by the Simba SQL Engine. To access the buffer, you call its GetBuffer() method. The data you copy into the buffer must be formatted as a SQL Type (see http://msdn.microsoft.com/en-us/library/ms710150%28VS.85%29.aspx for a list of data types and definitions). Therefore, if your data is not stored as SQL Types, you will need to write code to convert from your native format.

   The type of this parameter is governed by the metadata for the column that is returned by the class. Thus, if you set the SQL Type of column 1 in `QSTable::InitializeColumns()` to `SQL_INTEGER`, then when `QSTable::GetData()` is called for column 1, you will be passed a `SQLData` that wraps an `int` datatype. For `MetadataSource`, the type is associated with the column tag (see `DSIOutputMetadataColumnTag.h`). For character or binary data you must call `SetLength()` before calling `GetBuffer()`. Not doing so may result in a heap-violation. See `QSTypeUtilities.h` for an example on how to handle character or binary data.

2. `in_offset`

   Character, wide character and binary data types can be retrieved in parts. This value specifies where, in the current column, the value should be copied from. The value is usually 0.

3. `in_maxSize`

   The maximum size (in bytes) that can be copied into the `in_data` parameter. For character or binary data, copying data that is greater than this size can result in a data truncation warning or a heap-violation.

SqlData types

SqlData objects represent the SQL types and encapsulate the data in a buffer. When you have a SqlData object and would like to know what data type it is representing, use `GetMetadata()->GetSqlType()` to see what the associated `SQL_* type` is.

For information how SQL types map to C++ types, see Appendix G in the *SimbaEngine Developer Guide*.

Fixed length types

The structures used to store the fixed-length data types represented by SqlData objects are:

SQL_BIT

SQL_DATE

SQL_DECIMAL

SQL_DOUBLE

SQL_FLOAT

SQL_INTERVAL_DAY

SQL_INTERVAL_DAY_TO_HOUR

SQL_INTERVAL_DAY_TO_MINUTE

SQL_INTERVAL_DAY_TO_SECOND

SQL_INTERVAL_HOUR

SQL_INTERVAL_HOUR_TO_MINUTE

SQL_INTERVAL_HOUR_TO_SECOND

SQL_INTERVAL_MINUTE

SQL_INTERVAL_MINUTE_TO_SECOND

SQL_INTERVAL_MONTH

SQL_INTERVAL_SECOND

SQL_INTERVAL_YEAR

SQL_INTERVAL_YEAR_TO_MONTH

SQL_NUMERIC

SQL_REAL

SQL_BIGINT

SQL_INTEGER

SQL_SMALLINT

SQL_TINYINT

SQL_TYPE_DATE

SQL_TYPE_TIME

SQL_TYPE_TIMESTAMP

More information on Date, Time and DateTime types

The associated SQL types for date, time, and datetime are `SQL_TYPE_DATE`, `SQL_TYPE_TIME`, and `SQL_TYPE_TIMESTAMP`. Please note that the `SQL_TIME`, `SQL_DATE`, and `SQL_TIMESTAMP` are ODBC 2.x types while the `SQL_TYPE_*` types are ODBC 3.x types, so you should be sure to use the `SQL_TYPE_*` types since you are developing an ODBC 3.x driver.

Simple Fixed-Length Data Example

For a SQL_INTEGER, the SQLData will contain a simba_int32 which you must copy your integer value into. The example below illustrates how this might be achieved.

```
switch (in_data->GetMetadata()->GetSqlType())
{
 case SQL_INTEGER:
 {
  simba_int32 value = 1234;
  *reinterpret_cast<simba_int32*>(in_data->GetBuffer()) = value;
 }
}
```

Variable Length Types

The following variable-length data types are stored in buffers and represented by SqlData objects:

SQL_BINARY

SQL_CHAR

SQL_LONGVARBINARY

SQL_LONGVARCHAR

SQL_VARBINARY

SQL_VARCHAR

SQL_WCHAR

SQL_WLONGVARCHAR

SQL_WVARCHAR

You may find that the `DSITypeUtilities::OutputWVarCharStringData` and `OutputVarCharStringData` are useful for setting character data.

Simple Variable-Length Data Example

The `SQL_CHAR` example below illustrates how the type utilities might be used while the `SQL_VARCHAR` example shows a simple example using memcpy. In practise, `SQL_CHAR`, `SQL_`

`VARCHAR` and `SQL_LONGVARCHAR` will not need separate cases to handle them and there will also be other considerations such as having to deal with offsets into the data.

```
switch (in_data->GetMetadata()->GetSqlType())
{
 case SQL_CHAR:
 {
  simba_string stdString("Hello");
  return DSITypeUtilities::OutputVarCharStringData(
     &stdString,
     in_data,
     in_offset,
     in_maxSize);
 }
 case SQL_VARCHAR:
 {
     simba_string stdString("Hello");
     simba_uint32 size = stdString.size();
     in_data->SetLength(size);
     memcpy(in_data->GetBuffer(), stdString, size);
return false;
 }
}
```

Data Conversion in Practice

In the SimbaEngine Quickstart example, when `GetData()` is called the values are read from the tabbed Unicode file (in `TabbedUnicodeFileReader::GetData`), converted to simba_wstrings (in `QSTable::ReadWholeColumnAsString`) and then converted to the requested SQL data type (in `QSTable::ConvertData`). This works well because the data source is a text file and a good cross-platform example.

For your data source, if you're already getting data of the correct type—integers, for example—then ideally you should skip the conversion to strings so you can achieve better performance. Be aware of which data types map to which SQL Types, as well as how to represent them in the expected format. Then you can set the buffer in an appropriate manner.

NULL Values

To represent a null value, directly set the SqlData object as null:

```
in_data->SetNull(true);
```

Appendix D: C++ Server Configuration

To establish a connection, the connection settings for the driver are normally retrieved directly from the ODBC DSN. However, when the driver is a server, the settings cannot be retrieved directly because the DSN refers to the client instead of a specific driver. In addition, there would also be security concerns, if a given client has control over server-specific settings. Therefore, to establish a connection when a driver is a server, the connection settings need to be augmented.

The information in this section only applies if you are using 32-Bit Windows. If you are using 64-bit Windows (with either 32-bit or 64-bit applications), the file paths must be configured appropriately. Please see Windows Registry 32-Bit vs. 64-Bit Windows Registry 32-Bit vs. 64-Bit on page 1 for details.

For the UltraLight sample driver, the registry entries under `HKEY_LOCAL_MACHINE/SOFTWARE/SIMBA/ULTRALIGHT/SERVER` are used to enable this server-specific behavior. The settings augment the connection settings that are passed in during a connection.

On Linux and UNIX platforms, the configuration entries are located in the `.simbaserver.ultralight.ini` file.

To set the UltraLight sample driver up as a server, build the UltraLight solution using a server configuration (i.e. Debug_Server or Release_Server). This will build the server executable.

The rest of the server settings are located under sub-nodes of `HKEY_LOCAL_MACHINE/SOFTWARE/SIMBA/ULTRALIGHT/SERVER`. For full list of possible server configuration parameters, please see the SimbaClientServer User Guide.

On Linux and UNIX platforms, to set the UltraLight sample driver up as a server you need to:

1. Build UltraLight using the debug (or release) server configuration:
   ```
   BUILDSERVER=exe make -f UltraLight.mak debug
   ```
2. Configure the server as required in the other sections of the `.simbaserver.ultralight.ini` file.

For further details on setting up a connection between a client and server, please see the *SimbaClientServer* User Guide. Once you have configured the client and server, you should be able to connect to your data source.

Appendix E: C++ Server Configuration

To establish a connection, the connection settings for the driver are normally retrieved directly from the ODBC DSN. However, when the driver is a server, the settings cannot be retrieved directly because the DSN refers to the client instead of a specific driver. In addition, there would also be security concerns, if a given client has control over server-specific settings. Therefore, to establish a connection when a driver is a server, the connection settings need to be augmented.

Important: Windows Registry keys listed below apply to 32-Bit Windows and 64-bit Windows when running 64-bit applications. If you are using 64-bit Windows with 32-bit applications, then adjust the paths as described in "Appendex B: Bitness and the Windows Registry " on page 28.

For the Quickstart sample driver, the registry entries under `HKEY_LOCAL_MACHINE/SOFTWARE/SIMBA/QUICKSTART/SERVER` are used to enable this server-specific behavior. The settings augment the connection settings that are passed in during a connection.

On Linux and UNIX platforms, the configuration entries are located in the .simbaserver.quickstart.ini file.

To set up the Quickstart sample driver as a server:

1. Build the Quickstart solution using a server configuration (i.e. Debug_Server or Release_Server). This will build the server executable.
2. In the Windows Registry, navigate to the key `HKEY_LOCAL_MACHINE/SOFTWARE/SIMBA/QUICKSTART/SERVER`, and then add the following string value: `DBF=[INSTALL_DIRECTORY]\Examples\Databases\Quickstart`.
3. Additonal server settings are located under sub-nodes of `HKEY_LOCAL_MACHINE/SOFTWARE/SIMBA/QUICKSTART/SERVER`. For full list of possible server configuration parameters, see the *SimbaClientServer* User Guide.

On Linux and UNIX platforms, to set the Quickstart sample driver up as a server you need to:

1. Build Quickstart using the debug (or release) server configuration:
   `BUILDSERVER=exe make -f Quickstart.mak debug`
2. Add the DBF value to the [Server] section of the .simbaserver.quickstart.ini file:
   `DBF=[INSTALL_DIRECTORY]/Examples/Databases/Text`
3. Configure the server as required in the other sections of the .simbaserver.quickstart.ini file.

For further details on setting up a connection between a client and server, please see the *SimbaClientServer* User Guide. After configuring the client and server, you should be able to connect to your data source.

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