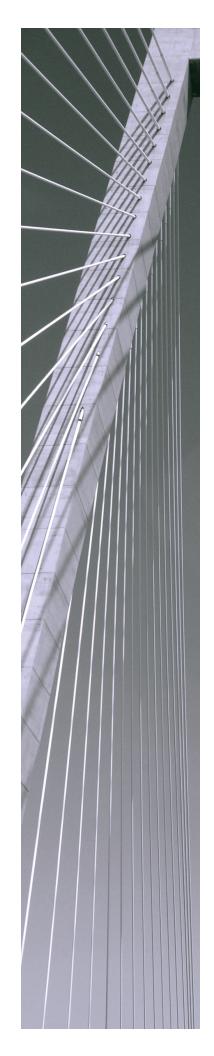


Install Guide

DataStax

Version 2.5.7 June 1, 2018



#### DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector **Copyright © 2018 Simba Technologies Inc. All Rights Reserved.**

Information in this document is subject to change without notice. Companies, names and data used in examples herein are fictitious unless otherwise noted. No part of this publication, or the software it describes, may be reproduced, transmitted, transcribed, stored in a retrieval system, decompiled, disassembled, reverse-engineered, or translated into any language in any form by any means for any purpose without the express written permission of Simba Technologies Inc.

### Trademarks

Simba, the Simba logo, SimbaEngine, and Simba Technologies are registered trademarks of Simba Technologies Inc. in Canada, United States and/or other countries. All other trademarks and/or servicemarks are the property of their respective owners.

### **Contact Us**

Simba Technologies Inc. 938 West 8th Avenue Vancouver, BC Canada V5Z 1E5

Tel: +1 (604) 633-0008

Fax: +1 (604) 633-0004

www.simba.com

For information about contacting DataStax, go to http://www.datastax.com/company#contact

## About This Guide

## Purpose

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector Install Guide explains how to install and configure the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector. The guide also provides details related to features of the driver.

## Audience

The guide is intended for end users of the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, as well as administrators and developers integrating the driver.

## **Knowledge Prerequisites**

To use the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, the following knowledge is helpful:

- Familiarity with the platform on which you are using the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector
- Ability to use the data source to which the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector is connecting
- An understanding of the role of ODBC technologies and driver managers in connecting to a data source
- Experience creating and configuring ODBC connections
- Exposure to SQL

## **Document Conventions**

Italics are used when referring to book and document titles.

**Bold** is used in procedures for graphical user interface elements that a user clicks and text that a user types.

Monospace font indicates commands, source code, or contents of text files.

## 🖉 Note:

A text box with a pencil icon indicates a short note appended to a paragraph.

## ! Important:

A text box with an exclamation mark indicates an important comment related to the preceding paragraph.

## Table of Contents

About the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector	7
Windows Driver	8
Windows System Requirements	. 8
Installing the Driver on Windows	. 8
Creating a Data Source Name on Windows	. 9
Configuring Authentication on Windows	.11
Configuring Advanced Options on Windows	. 11
Configuring SSL Verification on Windows	.13
Configuring Logging Options on Windows	.15
Verifying the Driver Version Number on Windows	. 17
Linux Driver	. 18
Linux System Requirements	
Installing the Driver Using the RPM File	
Configuring the ODBC Driver Manager on Linux	
Configuring ODBC Connections on Linux	
Verifying the Driver Version Number on Linux	31
Using a Connection String	32
DSN Connection String Example	. 32
DSN-less Connection String Examples	. 32
Features	.34
CQL Connector	.34
Data Types	34
User-Defined Types	.36
Virtual Tables	. 37
Write-Back	.39
Query Modes	40
Catalog and Schema Support	. 40
Security and Authentication	. 40
Driver Configuration Options	42
Configuration Options Appearing in the User Interface	.42
Configuration Options Having Only Key Names	.57

DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector	Install Guide
Contact Us	66
Third-Party Trademarks	67
Third-Party Licenses	68

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector enables Business Intelligence (BI), analytics, and reporting on data that is stored in Apache Cassandra databases. The driver complies with the ODBC 3.80 data standard and adds important functionality such as Unicode, as well as 32- and 64-bit support for high-performance computing environments on all platforms.

ODBC is one of the most established and widely supported APIs for connecting to and working with databases. At the heart of the technology is the ODBC driver, which connects an application to the database. For more information about ODBC, see *Data Access Standards* on the Simba Technologies

website: https://www.simba.com/resources/data-access-standards-glossary. For complete information about the ODBC specification, see the ODBC API Reference from the Microsoft documentation: https://docs.microsoft.com/en-us/sql/odbc/reference/syntax/odbc-api-reference.

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector is available for Microsoft® Windows® and Linux platforms.

The *Install Guide* is suitable for users who are looking to access data residing within Cassandra from their desktop environment. Application developers might also find the information helpful. Refer to your application for details on connecting via ODBC.

## Windows Driver

## Windows System Requirements

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector supports Apache Cassandra versions 2.0.0 through 3.x.

Install the driver on client machines where the application is installed. Each machine that you install the driver on must meet the following minimum system requirements:

- One of the following operating systems:
  - Windows 10, 8.1, or 7 SP1
  - Windows Server 2016, 2012, or 2008 R2 SP1
- 150 MB of available disk space
- Visual C++ Redistributable for Visual Studio 2013 installed (with the same bitness as the driver that you are installing).
   You can download the installation packages at https://www.microsoft.com/enca/download/details.aspx?id=40784.

To install the driver, you must have administrator privileges on the machine.

## Installing the Driver on Windows

On 64-bit Windows operating systems, you can execute both 32- and 64-bit applications. However, 64-bit applications must use 64-bit drivers, and 32-bit applications must use 32-bit drivers. Make sure that you use the version of the driver that matches the bitness of the client application:

- DataStax Cassandra 2.5 32-bit.msi for 32-bit applications
- DataStax Cassandra 2.5 64-bit.msi for 64-bit applications

You can install both versions of the driver on the same machine.

# To install the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector on Windows:

- 1. Depending on the bitness of your client application, double-click to run DataStax Cassandra 2.5 32-bit.msi or DataStax Cassandra 2.5 64-bit.msi.
- 2. Click Next.
- 3. Select the check box to accept the terms of the License Agreement if you agree, and then click **Next**.

- 4. To change the installation location, click **Change**, then browse to the desired folder, and then click **OK**. To accept the installation location, click **Next**.
- 5. Click Install.
- 6. When the installation completes, click **Finish**.

## **Creating a Data Source Name on Windows**

Typically, after installing the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, you need to create a Data Source Name (DSN).

Alternatively, for information about DSN-less connections, see Using a Connection String on page 32.

### To create a Data Source Name on Windows:

- 1. Open the ODBC Administrator:
  - If you are using Windows 7 or earlier, click Start <a>> All Programs</a>
     > DataStax Cassandra ODBC Driver 2.5 > ODBC Administrator.
  - Or, if you are using Windows 8 or later, on the Start screen, type **ODBC** administrator, and then click the **ODBC Administrator** search result.

### Note:

Make sure to select the ODBC Data Source Administrator that has the same bitness as the client application that you are using to connect to Cassandra.

- 2. In the ODBC Data Source Administrator, click the **Drivers** tab, and then scroll down as needed to confirm that the DataStax Cassandra ODBC Driver appears in the alphabetical list of ODBC drivers that are installed on your system.
- 3. Choose one:
  - To create a DSN that only the user currently logged into Windows can use, click the **User DSN** tab.
  - Or, to create a DSN that all users who log into Windows can use, click the System DSN tab.

## Note:

It is recommended that you create a System DSN instead of a User DSN. Some applications load the data using a different user account, and might not be able to detect User DSNs that are created under another user account.

4. Click Add.

- 5. In the Create New Data Source dialog box, select **DataStax Cassandra ODBC Driver** and then click **Finish**. The DataStax Cassandra ODBC Driver DSN Setup dialog box opens.
- 6. In the **Data Source Name** field, type a name for your DSN.
- 7. Optionally, in the **Description** field, type relevant details about the DSN.
- 8. Choose one:
  - In the **Host** field, type the name or IP address of the host where your Cassandra instance is running.
  - Or, in the **Host** field, type a comma-separated list of host names or IP addresses of Cassandra servers to which the driver connects.

## Note:

The driver attempts to connect to all the servers concurrently, and then keep the first connection that is successfully established. The driver does not maintain a connection with any of the other servers in the list.

9. In the **Port** field, type the number of the TCP port that the server uses to listen for client connections.

### Note:

The default port used by Cassandra is 9042.

- 10. If user login is required to access the Cassandra instance, then configure authentication. For more information, see Configuring Authentication on Windows on page 11.
- 11. In the **Default Keyspace** field, type the name of the Cassandra keyspace to use by default.
- 12. To configure advanced driver options, click **Advanced Options**. For more information, see Configuring Advanced Options on Windows on page 11.
- 13. To configure logging behavior for the driver, click **Logging Options**. For more information, see Configuring Logging Options on Windows on page 15.
- 14. To test the connection, click **Test**. Review the results as needed, and then click **OK**.

## Note:

If the connection fails, then confirm that the settings in the DataStax Cassandra ODBC Driver DSN Setup dialog box are correct. Contact your Cassandra server administrator as needed.

15. To save your settings and close the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector DSN Setup dialog box,

16. To close the ODBC Data Source Administrator, click **OK**.

## **Configuring Authentication on Windows**

Some Cassandra databases require authentication. You can configure the driver to pass your user name and password to the Cassandra server to authenticate the connection.

### To configure authentication on Windows:

- 1. To access authentication options, open the ODBC Data Source Administrator where you created the DSN, select the DSN, and then click **Configure**.
- 2. In the Mechanism drop-down list, select User Name and Password.
- 3. In the **Username** field, type an appropriate user name for accessing the Cassandra database.
- 4. In the **Password** field, type the password corresponding to the user name you typed above.
- 5. Encrypt your credentials by selecting one of the following:
  - If the credentials are used only by the current Windows user, select **Current User Only**.
  - Or, if the credentials are used by all users on the current Windows machine, select **All Users Of This Machine**.
- 6. To save your settings and close the dialog box, click **OK**.

## **Configuring Advanced Options on Windows**

You can configure advanced options to modify the behavior of the driver.

#### To configure advanced options on Windows:

- 1. To access advanced options, open the ODBC Data Source Administrator where you created the DSN, then select the DSN, then click **Configure**, and then click **Advanced Options**.
- 2. In the **Query Mode** list, select an option to specify how the driver executes queries:
  - To execute all queries in SQL, select SQL.
  - To execute all queries in CQL, select CQL.
  - To execute queries in SQL by default and then execute failed queries in CQL, select **SQL with CQL fallback**.
- 3. In the **Tunable Consistency** list, select an option to specify a Cassandra replica or the number of Cassandra replicas that must process a query in order for the

query to be considered successful. For detailed information about each option, see the topic *Configuring data consistency* in the Apache Cassandra 2.0 documentation:

http://www.datastax.com/documentation/cassandra/2.0/cassandra/dml/dml\_config\_consistency\_c.html.

- 4. In the Load Balancing Policy list, select the load balancing policy to use:
  - To cycle through all nodes in the cluster on a per-query basis, select **Round Robin**.
  - To first try all nodes in a primary "local" data center before trying any nodes from other data centers, select **DC Aware**.
- 5. In the **Binary Column Length** field, type the default column length to report for BLOB columns.
- 6. In the **String Column Length** field, type the default column length to report for ASCII, TEXT, and VARCHAR columns.
- 7. In the **Virtual Table Name Separator** field, type a separator for naming a virtual table built from a collection.

## Note:

For more information about virtual tables, see Virtual Tables on page 37.

- 8. To use a Blacklist or Whitelist when connecting to hosts in the Cassandra cluster, enter the host IP addresses in the **Blacklist Hosts** or **Whitelist Hosts** field.
  - Each IP addresses should be entered in quotation marks, separated by a comma. For example: "1.2.3.4", "5.6.7.8".
- 9. To use a Blacklist or Whitelist of datacenter hosts, enter the host names or addresses in the **Blacklist Datacenter Hosts** or **Whitelist Datacenter Hosts** field.
  - Each name or addresses should be entered in quotation marks, separated by a comma. For example: "datacenter1", "datacenter2".
- 10. To use a token-aware policy to improve load balancing and latency, select the **Enable Token Aware** check box.
- 11. To use a latency-awareness algorithm to distribute more of the workload onto faster machines, select the **Enable Latency Aware** check box.
- 12. Select how the driver handles null value INSERT statements:
  - To configure the driver to insert all NULL values as specified in INSERT statements, select the **Enable null values insertion** check box.
  - To configure the driver to ignore NULL values inserted into a column that contains only NULL values, clear the Enable null values insertion check box.

## Note:

For more information about this option, see Enable Null Value Insert on page 46.

- 13. Select how the driver handles capitalization in schema, table, and column names:
  - To differentiate between capital and lower-case letters in schema, table, and column names, select the **Enable Case Sensitive** check box.
  - To ignore the capitalization of schema, table, and column names, clear the **Enable Case Sensitive** check box.

## Note:

For more information about case sensitivity in Cassandra, see Enable Case Sensitive on page 45.

- 14. To map text and varchar data types in Cassandra to use SQL\_WVARCHAR, select the Use SQL\_WVARCHAR for string data type check box.
- 15. Select how the driver handles large result sets:
  - To configure the driver to split large result sets into pages, select the **Enable paging** check box and then type the maximum number of rows to display on each page in the **Rows per page** field.
  - To configure the driver to fetch all results into memory regardless of the result set size, clear the **Enable paging** check box.

### Important:

Disabling paging and then fetching a large result set can cause issues such as out of memory errors and database timeouts.

- 16. To configure client-server verification over SSL, use the options in the SSL area. For more information, see Configuring SSL Verification on Windows on page 13.
- 17. To save your settings and close the Advanced Options dialog box, click **OK**.
- 18. To close the DataStax Cassandra ODBC Driver DSN Setup dialog box, click OK.

## **Configuring SSL Verification on Windows**

If you are connecting to a Cassandra server that has Secure Sockets Layer (SSL) enabled, then you can configure the driver to connect to an SSL-enabled socket. When connecting to a server over SSL, the driver supports identity verification between the client and the server.

## Configuring an SSL Connection without Identity Verification

You can configure a connection that uses SSL but does not verify the identity of the client or the server.

### To configure an SSL connection without verification on Windows:

- 1. To access the SSL options for a DSN, open the ODBC Data Source Administrator where you created the DSN, then select the DSN, then click **Configure**, and then click **Advanced Options**.
- 2. In the SSL area, select **One-way Server Verification** or **Two-way Server and Client Verification**.
- 3. Clear the Enable Server Hostname Verification check box.
- 4. To save your settings and close the dialog box, click **OK**.

## Configuring One-way SSL Verification

You can configure one-way SSL verification so that the client verifies the identity of the Cassandra server.

### To configure one-way SSL verification on Windows:

- 1. To access the SSL options for a DSN, open the ODBC Data Source Administrator where you created the DSN, then select the DSN, then click **Configure**, and then click **Advanced Options**.
- 2. In the SSL area, select **One-way Server Verification**.
- 3. Ensure that the Enable Server Hostname Verification check box is selected.
- 4. In the **Trusted CA Certificates** field, specify the full path of the PEM file containing the certificate for verifying the server.
- 5. To save your settings and close the dialog box, click **OK**.

## Configuring Two-way SSL Verification

You can configure two-way SSL verification so that the client and the Cassandra server verify each other.

#### To configure two-way SSL verification on Windows:

- 1. To access the SSL options for a DSN, open the ODBC Data Source Administrator where you created the DSN, then select the DSN, then click **Configure**, and then click **Advanced Options**.
- 2. In the SSL area, select Two-way Server and Client Verification.
- 3. Ensure that the **Enable Server Hostname Verification** check box is selected.
- 4. In the **Trusted CA Certificates** field, specify the full path of the PEM file containing the certificate for verifying the server.

- 5. In the **Client-side Certificate** field, specify the full path of the PEM file containing the certificate for verifying the client.
- 6. In the **Client-side Private Key** field, specify the full path of the file containing the private key used to verify the client.
- If the private key file is protected with a password, type the password in the Key File Password field. To save the password in the DSN, select the Remember Password check box.

### Important:

Passwords are saved in plain text in the DSN; they are not encrypted or censored.

8. To save your settings and close the dialog box, click **OK**.

## **Configuring Logging Options on Windows**

To help troubleshoot issues, you can enable logging. In addition to functionality provided in the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, the ODBC Data Source Administrator provides tracing functionality.

### Important:

Only enable logging or tracing long enough to capture an issue. Logging or tracing decreases performance and can consume a large quantity of disk space.

The settings for logging apply to every connection that uses the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, so make sure to disable the feature after you are done using it.

#### To enable driver logging on Windows:

- 1. To access logging options, open the ODBC Data Source Administrator where you created the DSN, then select the DSN, then click **Configure**, and then click **Logging Options**.
- 2. From the **Log Level** drop-down list, select the logging level corresponding to the amount of information that you want to include in log files:

Logging Level	Description
OFF	Disables all logging.

Logging Level	Description
FATAL	Logs severe error events that lead the driver to abort.
ERROR	Logs error events that might allow the driver to continue running.
WARNING	Logs events that might result in an error if action is not taken.
INFO	Logs general information that describes the progress of the driver.
DEBUG	Logs detailed information that is useful for debugging the driver.
TRACE	Logs all driver activity.

- 3. In the **Log Path** field, specify the full path to the folder where you want to save log files.
- 4. If requested by Technical Support, type the name of the component for which to log messages in the **Log Namespace** field. Otherwise, do not type a value in the field.
- 5. In the Max Number Files field, type the maximum number of log files to keep.

#### Note:

After the maximum number of log files is reached, each time an additional file is created, the driver deletes the oldest log file.

6. In the **Max File Size** field, type the maximum size of each log file in megabytes (MB).

### Note:

After the maximum file size is reached, the driver creates a new file and continues logging.

- 7. Click OK.
- 8. Restart your ODBC application to make sure that the new settings take effect.

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector produces two log files at the location you specify in the Log Path field, where *[DriverName]* is the name of the driver:

- A DataStax [DriverName]\_driver.log file that logs driver activity that is not specific to a connection.
- A DataStax [DriverName]\_connection\_[Number].log for each connection made to the database, where [Number] is a number that identifies each log file. This file logs driver activity that is specific to the connection.

If you enable the UseLogPrefix connection property, the driver prefixes the log file name with the user name associated with the connection and the process ID of the application through which the connection is made. For more information, see UseLogPrefix on page 64.

### To disable driver logging on Windows:

- 1. Open the ODBC Data Source Administrator where you created the DSN, then select the DSN, then click **Configure**, and then click **Logging Options**.
- 2. From the Log Level drop-down list, select LOG\_OFF.
- 3. Click OK.
- 4. Restart your ODBC application to make sure that the new settings take effect.

## Verifying the Driver Version Number on Windows

If you need to verify the version of the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector that is installed on your Windows machine, you can find the version number in the ODBC Data Source Administrator.

#### To verify the driver version number on Windows:

- 1. Open the ODBC Administrator:
  - If you are using Windows 7 or earlier, click Start 
     > DataStax Cassandra ODBC Driver 2.5 > ODBC Administrator.
  - Or, if you are using Windows 8 or later, on the Start screen, type **ODBC** administrator, and then click the **ODBC Administrator** search result.

### Note:

Make sure to select the ODBC Data Source Administrator that has the same bitness as the client application that you are using to connect to Cassandra.

2. Click the **Drivers** tab and then find the DataStax Cassandra ODBC Driver in the list of ODBC drivers that are installed on your system. The version number is displayed in the **Version** column.

## Linux Driver

## **Linux System Requirements**

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector supports Apache Cassandra versions 2.0.0 through 3.x.

Install the driver on client machines where the application is installed. Each machine that you install the driver on must meet the following minimum system requirements:

- One of the following distributions:
  - Red Hat® Enterprise Linux® (RHEL) 6 or 7
  - CentOS 6 or 7
  - SUSE Linux Enterprise Server (SLES) 11 or 12
  - Debian 7, 8, or 9
  - Ubuntu 14.04 or 16.04
- 50 MB of available disk space
- One of the following ODBC driver managers installed:
  - iODBC 3.52.7 or later
  - unixODBC 2.2.12 or later

To install the driver, you must have root access on the machine.

## Installing the Driver Using the RPM File

On 64-bit editions of Linux, you can execute both 32- and 64-bit applications. However, 64-bit applications must use 64-bit drivers, and 32-bit applications must use 32-bit drivers. Make sure to install and use the version of the driver that matches the bitness of the client application:

- DataStaxCassandraODBC-32bit-[Version].rpm for the 32-bit driver
- DataStaxCassandraODBC-[Version].rpm for the 64-bit driver

[Version] is the version number of the driver.

You can install both the 32-bit and 64-bit versions of the driver on the same machine.

To install the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector using the RPM File:

- 1. Log in as the root user.
- 2. Navigate to the folder containing the RPM package for the driver.
- 3. Depending on the Linux distribution that you are using, run one of the following commands from the command line, where [RPMFileName] is the file name of the RPM package:
  - If you are using Red Hat Enterprise Linux or CentOS, run the following command:

```
yum --nogpgcheck localinstall [RPMFileName]
```

• Or, if you are using SUSE Linux Enterprise Server, run the following command:

zypper install [RPMFileName]

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector files are installed in the /opt/datastax/cassandraodbc directory.

Next, configure the environment variables on your machine to make sure that the ODBC driver manager can work with the driver. For more information, see Configuring the ODBC Driver Manager on Linux on page 19.

## Configuring the ODBC Driver Manager on Linux

To make sure that the ODBC driver manager on your Linux machine is configured to work with the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, do the following:

- Make sure that your machine uses the correct ODBC driver manager by setting the library path environment variable. For more information, see Specifying ODBC Driver Managers on Linux on page 20.
- If the driver configuration files are not stored in the default locations, then make sure that the ODBC driver manager locates and uses those files by setting environment variables. For more information, see Specifying the Locations of the Driver Configuration Files on page 20.

After configuring the ODBC driver manager, you can configure a connection and access your data store through the driver. For more information, see Configuring ODBC Connections on Linux on page 21.

## Specifying ODBC Driver Managers on Linux

You need to make sure that your Linux machine uses the correct ODBC driver manager to load the driver. To do this, set the LD\_LIBRARY\_PATH environment variable to include the paths to the ODBC driver manager libraries.

For example, if the libraries are installed in /usr/local/lib, then run the following command to set LD\_LIBRARY\_PATH:

```
export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/local/lib
```

The example above demonstrates how to set the environment variable for the current user session. For information about setting environment variables permanently, refer to the shell documentation for the platform that you are using.

## Specifying the Locations of the Driver Configuration Files

By default, ODBC driver managers are configured to use hidden versions of the odbc.ini and odbcinst.ini configuration files (named .odbc.ini and .odbcinst.ini) located in the home directory, as well as the datastax.cassandraodbc.ini file in the lib subfolder of the driver installation directory. If you store these configuration files elsewhere, then you must set the environment variables described below so that the driver manager can locate the files.

If you are using iODBC, do the following:

- Set ODBCINI to the full path and file name of the odbc.ini file.
- Set ODBCINSTINI to the full path and file name of the odbcinst.ini file.
- Set DATASTAXCASSANDRAODBC to the full path and file name of the datastax.cassandraodbc.ini file.

If you are using unixODBC, do the following:

- Set ODBCINI to the full path and file name of the odbc.ini file.
- Set ODBCSYSINI to the full path of the directory that contains the odbcinst.ini file.
- Set DATASTAXCASSANDRAODBC to the full path and file name of the datastax.cassandraodbc.ini file.

For example, if your odbc.ini and odbcinst.ini files are located in /usr/local/odbc and your datastax.cassandraodbc.ini file is located in /etc, then set the environment variables as follows:

For iODBC:

export ODBCINI=/usr/local/odbc.ini

```
export ODBCINSTINI=/usr/local/odbc/odbcinst.ini
export DATASTAXCASSANDRAODBC=/etc/datastax.cassandraodbc.ini
```

### For unixODBC:

```
export ODBCINI=/usr/local/odbc.ini
export ODBCSYSINI=/usr/local/odbc
export DATASTAXCASSANDRAODBC=/etc/datastax.cassandraodbc.ini
```

To locate the datastax.cassandraodbc.ini file, the driver uses the following search order:

- 1. If the DATASTAXCASSANDRAODBC environment variable is defined, then the driver searches for the file specified by the environment variable.
- 2. The driver searches the directory that contains the driver library files for a file named datastax.cassandraodbc.ini.
- 3. The driver searches the current working directory of the application for a file named datastax.cassandraodbc.ini.
- 4. The driver searches the home directory for a hidden file named .datastax.cassandraodbc.ini (prefixed with a period).
- 5. The driver searches the /etc directory for a file named datastax.cassandraodbc.ini.

## **Configuring ODBC Connections on Linux**

The following sections describe how to configure ODBC connections when using the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector on non-Windows platforms:

- Creating a Data Source Name on Linux on page 21
- Configuring a DSN-less Connection on Linux on page 24
- Configuring Authentication on Linux on page 26
- Configuring SSL Verification on Linux on page 26
- Configuring Logging Options on Linux on page 27
- Testing the Connection on Linux on page 29

## Creating a Data Source Name on Linux

When connecting to your data store using a DSN, you only need to configure the odbc.ini file. Set the properties in the odbc.ini file to create a DSN that specifies the connection information for your data store. For information about configuring a DSN-less connection instead, see Configuring a DSN-less Connection on Linux on page 24.

If your machine is already configured to use an existing <code>odbc.ini</code> file, then update that file by adding the settings described below. Otherwise, copy the <code>odbc.ini</code> file from the <code>Setup</code> subfolder in the driver installation directory to the home directory, and then update the file as described below.

### To create a Data Source Name on a non-Windows machine:

1. In a text editor, open the odbc.ini configuration file.

## Note:

If you are using a hidden copy of the odbc.ini file, then you need to remove the period (.) from the start of the file name before the file becomes editable.

2. In the [ODBC Data Sources] section, add a new entry by typing a name for the DSN, an equal sign (=), and then the name of the driver.

For example, for the 32-bit driver:

```
[ODBC Data Sources]
Sample DSN=DataStax Cassandra ODBC Driver 32-bit
```

- 3. Create a section that has the same name as your DSN, and then specify configuration options as key-value pairs in the section:
  - a. Set the Driver property to the full path of the driver library file that matches the bitness of the application.

For example, for the 32-bit driver:

```
Driver=/opt/datastax/cassandraodbc/lib/32/libdatasta
xcqlodbc 32.so
```

- b. Do one of the following:
  - If you are connecting to a single Cassandra server, set the Host property to the IP address or host name of the server, and then set the Port property to the number of the TCP port that the server uses to listen for client connections.

For example:

```
Host=192.168.222.160
Port=9042
```

• Or, if you are connecting to a multiple servers, set the Host property to a comma-separated list of the servers in the cluster, specifying the host names or IP addresses and port numbers.

For example:

Host=192.168.222.160:9042, 192.168.222.165:9042, 192.168.222.231:9042

- c. If authentication is required to access the server, then do the following:
  - i. Set the AuthMech property to 1.
  - ii. Set the UID property to an appropriate user name for accessing the Cassandra server.
  - iii. Set the PWD property to the password corresponding to the user name you provided above.

For example:

AuthMech=1 UID=datastax PWD=datastax123

- d. If you want to connect to the server through SSL, then enable SSL and specify the certificate information. For more information, see Configuring SSL Verification on Linux on page 26.
- e. Optionally, set additional key-value pairs as needed to specify other optional connection settings. For detailed information about all the configuration options supported by the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, see Driver Configuration Options on page 42.
- 4. Save the odbc.ini configuration file.

## Note:

If you are storing this file in its default location in the home directory, then prefix the file name with a period (.) so that the file becomes hidden. If you are storing this file in another location, then save it as a non-hidden file (without the prefix), and make sure that the ODBCINI environment variable specifies the location. For more information, see Specifying the Locations of the Driver Configuration Files on page 20.

For example, the following is an odbc.ini configuration file for a 32-bit driver containing a DSN that connects to a single Cassandra server with authentication:

```
[ODBC Data Sources]
Sample DSN=DataStaxCassandra ODBC Driver 32-bit
[Sample DSN]
Driver=/opt/datastax/cassandraodbc/lib/32/libdatastaxcqlodbc
32.so
```

```
Host=192.168.222.160
Port=9042
AuthMech=1
UID=datastax
PWD=datastax123
```

You can now use the DSN in an application to connect to the data store.

## Configuring a DSN-less Connection on Linux

To connect to your data store through a DSN-less connection, you need to define the driver in the odbcinst.ini file and then provide a DSN-less connection string in your application.

If your machine is already configured to use an existing odbcinst.ini file, then update that file by adding the settings described below. Otherwise, copy the odbcinst.ini file from the Setup subfolder in the driver installation directory to the home directory, and then update the file as described below.

### To define a driver on a non-Windows machine:

1. In a text editor, open the odbcinst.ini configuration file.

## Note:

If you are using a hidden copy of the odbcinst.ini file, then you need to remove the period (.) from the start of the file name before the file becomes editable.

2. In the [ODBC Drivers] section, add a new entry by typing a name for the driver, an equal sign (=), and then Installed.

For example, for the 32-bit driver:

```
[ODBC Drivers]
DataStax ODBC driver for Apache Cassandra and DataStax
Enterprise with CQL connector 32-bit=Installed
```

- 3. Create a section that has the same name as the driver (as specified in the previous step), and then specify the following configuration options as key-value pairs in the section:
  - a. Set the Driver property to the full path of the driver library file that matches the bitness of the application.

For example, for the 32-bit driver:

```
Driver=/opt/datastax/cassandraodbc/lib/32/libdatasta
xcqlodbc 32.so
```

b. Optionally, set the Description property to a description of the driver.

#### For example:

Description=DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector

4. Save the odbcinst.ini configuration file.

### Note:

If you are storing this file in its default location in the home directory, then prefix the file name with a period (.) so that the file becomes hidden. If you are storing this file in another location, then save it as a non-hidden file (without the prefix), and make sure that the ODBCSYSINI environment variable specifies the location. For more information, see Specifying the Locations of the Driver Configuration Files on page 20.

For example, the following is an odbcinst.ini configuration file for both the 32- and 64-bit drivers on Linux:

```
[ODBC Drivers]
```

```
DataStax ODBC driver for Apache Cassandra and DataStax
Enterprise with CQL connector 32-bit=Installed
DataStax ODBC driver for Apache Cassandra and DataStax
Enterprise with CQL connector 64-bit=Installed
[DataStax ODBC driver for Apache Cassandra and DataStax
Enterprise with CQL connector 32-bit]
Description=DataStax ODBC driver for Apache Cassandra and
DataStax Enterprise with CQL connector (32-bit)
Driver=/opt/datastax/cassandraodbc/lib/32/libdatastaxcqlodbc
 32.so
[DataStax ODBC driver for Apache Cassandra and DataStax
Enterprise with CQL connector 64-bit]
Description=DataStax ODBC driver for Apache Cassandra and
DataStax Enterprise with CQL connector (64-bit)
Driver=/opt/datastax/cassandraodbc/lib/64/libdatastaxcqlodbc
 64.so
```

You can now connect to your data store by providing your application with a connection string where the Driver property is set to the driver name specified in the odbcinst.ini file, and all the other necessary connection properties are also set.

DataStax ODBC driver for Apache CassandraInstaand DataStax Enterprise with CQL connectorFor more information, see "DSN-less Connection String Examples" in Using aConnection String on page 32.

For instructions about configuring SSL connections, see Configuring SSL Verification on Linux on page 26.

For detailed information about all the connection properties that the driver supports, see Driver Configuration Options on page 42.

## **Configuring Authentication on Linux**

Some Cassandra databases require authentication. You can configure the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector to authenticate your connection to the database by providing your Cassandra user name and password.

You can set the connection properties described below in a connection string or in a DSN (in the odbc.ini file). Settings in the connection string take precedence over settings in the DSN.

### To configure authentication:

- 1. Set the AuthMech property to 1.
- 2. Set the UID property to an appropriate user name for accessing the Cassandra server.
- 3. Set the PWD property to password corresponding to the user name you provided above.

## Configuring SSL Verification on Linux

You can configure the driver to connect to Cassandra over SSL and enable identity verification between the client and the server.

You can set the connection properties described below in a connection string or in a DSN (in the odbc.ini file). Settings in the connection string take precedence over settings in the DSN.

### Configuring a Connection without SSL

You can configure a connection that does not use SSL.

#### To configure a connection without SSL on Linux:

> Set the SSLMode property to 0.

#### Configuring One-way SSL Verification

You can enable the client to verify the Cassandra server.

## To configure one-way SSL verification on Linux:

- 1. Set the SSLMode property to 1.
- 2. Set the UseSslIdentityCheck property to 1.
- 3. Set the SSLTrustedCertsPath property to the full path of the .pem file containing the certificate for verifying the server.

## Configuring Two-way SSL Verification

You can enable the client and the Cassandra server to verify each other.

### To configure two-way SSL verification on Linux:

- 1. Set the SSLMode property to 2.
- 2. Set the UseSslIdentityCheck property to 1.
- 3. Set the SSLTrustedCertsPath property to the full path of the .pem file containing the certificate for verifying the server.
- 4. Set the SSLUserCertsPath property to the full path of the .pem file containing the certificate for verifying the client.
- 5. Set the SSLUserKeyPath property to the full path of the file containing the private key used to verify the client.
- 6. If the private key file is protected with a password, set the SSLUserKeyPWD property to specify the password.

### Important:

Passwords are saved in plain text in the DSN; they are not encrypted or censored.

### Configuring an SSL Connection that does not Verify Certificates

You can configure a connection that uses SSL but does not verify the client or the server.

#### To configure an SSL connection without verification on Linux:

- 1. Set the SSLMode property to 1 or 2.
- 2. Set the UseSslIdentityCheck property to 0.

## **Configuring Logging Options on Linux**

To help troubleshoot issues, you can enable logging in the driver.

### Important:

Only enable logging long enough to capture an issue. Logging decreases performance and can consume a large quantity of disk space.

Logging is configured through driver-wide settings in the

 ${\tt datastax.cassandraodbc.ini}$  file, which apply to all connections that use the driver.

## To enable logging on Linux:

- 1. Open the datastax.cassandraodbc.ini configuration file in a text editor.
- 2. To specify the level of information to include in log files, set the LogLevel property to one of the following numbers:

LogLevel Value	Description
0	Disables all logging.
1	Logs severe error events that lead the driver to abort.
2	Logs error events that might allow the driver to continue running.
3	Logs events that might result in an error if action is not taken.
4	Logs general information that describes the progress of the driver.
5	Logs detailed information that is useful for debugging the driver.
6	Logs all driver activity.

- 3. Set the  ${\tt LogPath}$  key to the full path to the folder where you want to save log files.
- 4. Set the LogFileCount key to the maximum number of log files to keep.

#### Note:

After the maximum number of log files is reached, each time an additional file is created, the driver deletes the oldest log file.

5. Set the LogFileSize key to the maximum size of each log file in megabytes (MB).

## Note:

After the maximum file size is reached, the driver creates a new file and continues logging.

- 6. Optionally, to prefix the log file name with the user name and process ID associated with the connection, set the UseLogPrefix property to 1.
- 7. Save the datastax.cassandraodbc.ini configuration file.
- 8. Restart your ODBC application to make sure that the new settings take effect.

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector produces two log files at the location you specify using the LogPath key, where [DriverName] is the name of the driver:

- A [DriverName]\_driver.log file that logs driver activity that is not specific to a connection.
- A [DriverName]\_connection\_[Number].log for each connection made to the database, where [Number] is a number that identifies each log file. This file logs driver activity that is specific to the connection.

If you set the UseLogPrefix property to 1, then each file name is prefixed with [UserName]\_[ProcessID]\_, where [UserName] is the user name associated with the connection and [ProcessID] is the process ID of the application through which the connection is made. For more information, see UseLogPrefix on page 64.

## To disable logging on Linux:

- 1. Open the datastax.cassandraodbc.ini configuration file in a text editor.
- 2. Set the LogLevel key to 0.
- 3. Save the datastax.cassandraodbc.ini configuration file.
- 4. Restart your ODBC application to make sure that the new settings take effect.

## Testing the Connection on Linux

To test the connection, you can use an ODBC-enabled client application. For a basic connection test, you can also use the test utilities that are packaged with your driver manager installation. For example, the iODBC driver manager includes simple utilities called iodbctest and iodbctestw. Similarly, the unixODBC driver manager includes simple utilities called isql and iusql.

### DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector Using the iODBC Driver Manager

You can use the iodbctest and iodbctestw utilities to establish a test connection with your driver. Use iodbctest to test how your driver works with an ANSI application, or use iodbctestw to test how your driver works with a Unicode application.

## Note:

There are 32-bit and 64-bit installations of the iODBC driver manager available. If you have only one or the other installed, then the appropriate version of iodbctest (or iodbctestw) is available. However, if you have both 32- and 64-bit versions installed, then you need to make sure that you are running the version from the correct installation directory.

For more information about using the iODBC driver manager, see http://www.iodbc.org.

#### To test your connection using the iODBC driver manager:

- 1. Run iodbctest or iodbctestw.
- 2. Optionally, if you do not remember the DSN, then type a question mark (?) to see a list of available DSNs.
- 3. Type the connection string for connecting to your data store, and then press ENTER. For more information, see Using a Connection String on page 32.

If the connection is successful, then the SQL> prompt appears.

## Using the unixODBC Driver Manager

You can use the isql and iusql utilities to establish a test connection with your driver and your DSN. isql and iusql can only be used to test connections that use a DSN. Use isql to test how your driver works with an ANSI application, or use iusql to test how your driver works with a Unicode application.

## Note:

There are 32-bit and 64-bit installations of the unixODBC driver manager available. If you have only one or the other installed, then the appropriate version of isql (or iusql) is available. However, if you have both 32- and 64-bit versions installed, then you need to make sure that you are running the version from the correct installation directory.

For more information about using the unixODBC driver manager, see http://www.unixodbc.org.

### To test your connection using the unixODBC driver manager:

- > Run isql or iusql by using the corresponding syntax:
  - isql [DataSourceName]
  - iusql [DataSourceName]

[DataSourceName] is the DSN that you are using for the connection.

If the connection is successful, then the SQL> prompt appears.

### Note:

For information about the available options, run isql or iusql without providing a DSN.

## Verifying the Driver Version Number on Linux

If you need to verify the version of the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector that is installed on your Linux machine, you can query the version number through the command-line interface if the driver was installed using an RPM file.

#### To verify the driver version number on Linux:

- Depending on your package manager, at the command prompt, run one of the following commands:
  - yum list | grep DataStaxCassandraODBC
  - rpm -qa | grep DataStaxCassandraODBC

The command returns information about the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector that is installed on your machine, including the version number.

## Using a Connection String

For some applications, you might need to use a connection string to connect to your data source. For detailed information about how to use a connection string in an ODBC application, refer to the documentation for the application that you are using.

The connection strings in the following sections are examples showing the minimum set of connection attributes that you must specify to successfully connect to the data source. Depending on the configuration of the data source and the type of connection you are working with, you might need to specify additional connection attributes. For detailed information about all the attributes that you can use in the connection string, see Driver Configuration Options on page 42.

## **DSN Connection String Example**

The following is an example of a connection string for a connection that uses a DSN:

DSN=[DataSourceName]

[DataSourceName] is the DSN that you are using for the connection.

You can set additional configuration options by appending key-value pairs to the connection string. Configuration options that are passed in using a connection string take precedence over configuration options that are set in the DSN.

## **DSN-less Connection String Examples**

Some applications provide support for connecting to a data source using a driver without a DSN. To connect to a data source without using a DSN, use a connection string instead.

The placeholders in the examples are defined as follows, in alphabetical order:

- [PortNumber] is the number of the TCP port that the Cassandra server uses to listen for client connections.
- [Server] is the IP address or host name of the Cassandra server to which you are connecting. You can specify a comma-separated list of servers.
- [YourPassword] is the password corresponding to your user name.
- [YourUserName] is the user name that you use to access the Cassandra server.

## Connecting to a Cassandra Server Without Authentication

The following is the format of a DSN-less connection string for a Cassandra server that does not require authentication:

```
Driver=DataStax Cassandra ODBC Driver;Host=[Server];
Port=[PortNumber];
```

For example:

```
Driver=DataStax Cassandra ODBC Driver;Host=192.168.222.160;
Port=9042;
```

## Connecting to a Cassandra Server Requiring Authentication

The following is the format of a DSN-less connection string for a Cassandra server that requires authentication:

```
Driver=DataStax Cassandra ODBC Driver;Host=[Server];
Port=[PortNumber];AuthMech=1;UID=[YourUserName];
PWD=[YourPassword];
```

For example:

```
Driver=DataStax Cassandra ODBC Driver;Host=192.168.222.160;
Port=9042;AuthMech=1;UID=datastax;PWD=datastax123;
```

## Features

For more information on the features of the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, see the following:

- CQL Connector on page 34
- Data Types on page 34
- User-Defined Types on page 36
- Virtual Tables on page 37
- Write-Back on page 39
- Query Modes on page 40
- Catalog and Schema Support on page 40
- Security and Authentication on page 40

## **CQL Connector**

The CQL Connector feature of the driver allows applications to execute standard SQL queries against Cassandra. It converts SQL-92 queries to CQL operations and processes the results. When the driver is configured to work in SQL with CQL Fallback mode, it uses the SQL Connector to handle SQL queries by loading and processing the data in memory. This feature enables the driver to support SQL operations that cannot be executed natively through CQL queries, such as column filtering and table joins.

## **Data Types**

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector can convert between Cassandra data types and SQL data types.

The table below lists the supported ODBC 3.x data type mappings. A few data types are mapped to a different type when using ODBC 2.x. Those data type mappings are listed in the next table.

To support complex data types such as sets, lists, and maps, the driver renormalizes the data into virtual tables. For more information, see Virtual Tables on page 37.

Cassandra Type	SQL Type
ASCII	SQL_VARCHAR

Cassandra Type	SQL Type
BIGINT	SQL_INT
BLOB	SQL_LONGVARBINARY
BOOLEAN	SQL_BIT
COUNTER	SQL_BIGINT
DATE	SQL_DATE (2.x) and SQL_TYPE_DATE (3.x)
DECIMAL	SQL_DECIMAL
DOUBLE	SQL_DOUBLE
FLOAT	SQL_REAL
INET	SQL_VARCHAR
INT	SQL_INTEGER
SMALLINT	SQL_SMALLINT
TEXT	SQL_WVARCHAR
TIME	SQL_TIME (2.x) or SQL_TYPE_TIME (3.x)
TIMESTAMP	SQL_TYPE_TIMESTAMP
See the note below.	
TIMEUUID	GUID
TINYINT	SQL_TINYINT
UUID	GUID
VARCHAR	SQL_VARCHAR
VARINT	SQL_NUMERIC

## Note:

Cassandra internally represents a Timestamp value as a 64-bit signed integer value representing the number of milliseconds since epoch January 1 1970 at 00:00:00 GMT. The range of Timestamp values supported by the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector is from "1601-01-01 00:00:00.000" to "9999-12-31 23:59:59.999".

Cassandra Type	SQL Type
TIMESTAMP	SQL_TIMESTAMP
See the note above.	
TIMEUUID	SQL_VARCHAR
UUID	SQL_VARCHAR

## **User-Defined Types**

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector provides support for Cassandra user-defined types in certain situations. Specifically, user-defined types are supported as base data or as part of a collection.

The column names for user-defined types are constructed in the following format:

```
[Column_name]_[Subtype_name]
```

Where:

- [Column name] is the name of the column that contains the user-defined type
- [Subtype\_name] is the name of the subtype in the user-defined type

For example, a user-defined type that contains a user's full name is created as follows:

```
CREATE TYPE fullname
(first_name text, last_name text)
```

The driver creates a table that contains two columns, id:text and name:fullname. The driver then reads the data from this table as follows:

```
"id", "name_first_name", "name_last_name"
"a", "Chris", "Kwan"
```

# Virtual Tables

One advantage of the Apache Cassandra design is the ability to store data that is denormalized into fewer tables. By taking advantage of nested data structures such as sets, lists, and maps, transactions can be simplified. However, the ODBC interface does not natively support accessing this type of data. By renormalizing the data contained within collections (sets, lists, and maps) into virtual tables, the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector allows users to directly interact with the data but leave the storage of the data in its denormalized form in Cassandra.

If a table contains any collection columns, when the table is queried for the first time, the driver creates the following virtual tables:

- A "base" table, which contains the same data as the real table except for the collection columns.
- A virtual table for each collection column, which expands the nested data.

Virtual tables refer to the data in the real table, enabling the driver to access the denormalized data. By querying the virtual tables, you can access the contents of Cassandra collections via ODBC. When you write or modify data in a virtual table, the data in the real table in the Cassandra database is updated.

The base table and virtual tables appear as additional tables in the list of tables that exist in the database. The base table uses the same name as the real table that it represents. The virtual tables that represent collections are named using the name of the real table, a separator (**vt** by default), and the name of the column.

For example, consider the table below. ExampleTable is a Cassandra database table that contains an integer primary key column named pk\_int, a list column, a map column, and a set column (named StringSet).

pk_int	List	Мар	StringSet
1	["1", "2" , "3"]	{ "S1" : "a", "S2" : "b" }	{ "A", "B", "C" }
3	["100", "101", "102", "105"]	{ "S1" : "t" }	{ "A", "E" }

The driver would generate multiple virtual tables to represent this single table. The first virtual table is the base table, shown below.

pk_int		
1		
3		

The base table contains the same data as the original database table except for the collections, which are omitted from this table and expanded in other virtual tables.

The following tables show the virtual tables that renormalize the data from the List, Map, and StringSet columns.

pk_int	List#index	List#value
1	0	1
1	1	2
1	2	3
3	0	100
3	1	101
3	2	102
3	3	105

pk_int	Map#key	Map#value
1	S1	А
1	S2	b
3	S1	t

pk_int	StringSet#value
1	A

pk_int	StringSet#value
1	В
1	С
3	A
3	E

The foreign key columns in the virtual tables reference the primary key columns in the real table, and indicate which real table row the virtual table row corresponds to. The columns with names that end with #index or #key indicate the position of the data within the original list or map. The columns with names that end with #value contain the expanded data from the collection.

The data in the virtual tables can be selected, inserted, and updated as if they were normal tables, and the driver will handle the storage details within Cassandra. You can also explicitly append data to the end of a list by inserting a row of data with the index column set to -1.

For example, to append 106 to the List column in ExampleTable, where pk\_int = 3, use the following query:

```
INSERT INTO "ExampleTable_vt_List" (pk_int, "List#index",
"List#value") VALUES (3, -1, '106')
```

# Write-Back

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector supports Data Manipulation Languages (DML) statements such as INSERT, UPDATE, and DELETE.

Because Cassandra supports the UPSERT operation instead of INSERT and UPDATE, when you execute an INSERT or UPDATE statement using the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, the resulting behavior is an UPSERT operation. When you use the driver to write data to a Cassandra database, the INSERT and UPDATE operations both set the column value regardless of whether the data already exists.

You can use the TRUNCATE TABLE statement to delete rows from non-virtual tables. However, to delete rows from virtual tables, you must use the DELETE FROM statement instead.

# **Query Modes**

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector can be configured to process queries as SQL statements or as CQL statements.

The default query mode used by the driver is SQL with CQL Fallback. In this query mode, the driver treats all incoming queries as SQL. If an error occurs while handling the query as SQL, then the driver will pass the original query to Cassandra to execute as CQL. However, because Cassandra is not aware of virtual tables, incoming queries that reference virtual tables will fail when they are passed through to the server to be executed as CQL.

Alternatively, you can configure the driver to work in SQL mode or CQL mode. When working in SQL mode, the driver treats all incoming queries as SQL, so any queries that are not written in standard SQL-92 syntax will fail. When working in CQL mode, the driver treats all incoming queries as CQL, so any queries written in a non-CQL syntax will fail.

# **Catalog and Schema Support**

The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector supports both catalogs and schemas to make it easy for the driver to work with various ODBC applications. Since Cassandra only organizes column families into keyspaces, the driver provides a synthetic catalog named CASSANDRA under which all of the keyspaces are organized. The driver also maps the ODBC schema to the Cassandra keyspace.

# **Security and Authentication**

To protect data from unauthorized access, some Cassandra data stores require connections to be authenticated with user credentials or the SSL protocol. The DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector provides full support for these authentication protocols.

#### Note:

In this documentation, "SSL" refers to both TLS (Transport Layer Security) and SSL (Secure Sockets Layer). The driver supports TLS 1.1 and 1.2. The SSL version used for the connection is the highest version that is supported by both the driver and the server.

The driver provides a mechanism that enables you to authenticate your connection using your Cassandra user name and password. For detailed configuration instructions, see Configuring Authentication on Windows on page 11 or Configuring Authentication on Linux on page 26.

Additionally, the driver supports the following types of SSL connections:

- No identity verification
- One-way authentication
- Two-way authentication

It is recommended that you enable SSL whenever you connect to a server that is configured to support it. SSL encryption protects data and credentials when they are transferred over the network, and provides stronger security than authentication alone. For detailed configuration instructions, see Configuring SSL Verification on Windows on page 13 or Configuring SSL Verification on Linux on page 26.

# Driver Configuration Options

Driver Configuration Options lists the configuration options available in the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector alphabetically by field or button label. Options having only key names, that is, not appearing in the user interface of the driver, are listed alphabetically by key name.

When creating or configuring a connection from a Windows machine, the fields and buttons described below are available in the following dialog boxes:

- DataStax Cassandra ODBC Driver DSN Setup
- Advanced Options
- Logging Options

When using a connection string or configuring a connection from a non-Windows machine, use the key names provided below.

# **Configuration Options Appearing in the User Interface**

The following configuration options are accessible via the Windows user interface for the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, or via the key name when using a connection string or configuring a connection from a Linux or macOS computer:

- Binary Column Length on page 43
- Blacklist Datacenter Hosts on page 43
- Blacklist Hosts on page 43
- Client-side Certificate on page 44
- Client-side Private Key on page
   44
- Default Keyspace on page 44
- Enable Case Sensitive on page 45
- Enable Latency Aware on page 45
- Enable Null Value Insert on page 46
- Enable Paging on page 46

- Log Path on page 50
- Max File Size on page 51
- Max Number Files on page 51
- Mechanism on page 52
- Password on page 52
- Port on page 52
- Query Mode on page 53
- Rows Per Page on page 53
- SSL on page 53
- String Column Length on page 54
- Trusted CA Certificates on page
  54
- Tunable Consistency on page 55
- No on page 55

- Enable Token Aware on page 47
- Enable Server Hostname Verification on page 47
- Host on page 48
- Key File Password on page 48
- Load Balancing Policy on page 49
- Log Level on page 49

# Binary Column Length

• User Name on page 56

- Virtual Table Name Separator on page 56
- Whitelist Datacenter Hosts on page 56
- Whitelist Hosts on page 57

Key Name	Default Value	Required
BinaryColumnLength	4000	No

#### Description

The default column length to report for BLOB columns.

#### Blacklist Datacenter Hosts

Key Name	Default Value	Required
BlacklistDatacenterFilteringHosts	None	No

#### Description

The address or name of data center hosts in the Cassandra cluster you do not wish to connect to. Each name or addresses should be entered in quotation marks, separated by a comma.

For example: "datacenter1", "datacenter2".

#### **Blacklist Hosts**

Key Name	Default Value	Required
BlacklistFilteringHosts	None	No

The IP addresses of data store hosts in the Cassandra cluster you do not wish to connect to. Each IP addresses should be entered in quotation marks, separated by a comma.

For example: "1.2.3.4", "5.6.7.8".

# **Client-side Certificate**

Key Name	Default Value	Required
SSLUserCertsPath	None	Yes, if two-way SSL verification is enabled.

# Description

The full path to the .pem file containing the certificate for verifying the client.

# Client-side Private Key

Key Name	Default Value	Required
SSLUserKeyPath	None	Yes, if two-way SSL verification is enabled.

# Description

The full path to the file containing the private key used to verify the client.

# **Default Keyspace**

Key Name	Default Value	Required
DefaultKeyspace	None	No

# Description

The default keyspace (schema) to connect to in Cassandra.

Key Name	Default Value	Required
EnableCaseSensitive	Selected (1)	No

#### Description

This option specifies whether the driver differentiates between capital and lower-case letters in schema, table, and column names.

- Enabled (1): The driver differentiates between capital and lower-case letters in schema, table, and column names. It is recommended that you enclose the names of all schemas, tables, and columns in double quotation marks (") if this option is enabled.
- Disabled (10): The driver ignores the capitalization of schema, table, and column names.

#### Important:

- If the naming conventions for your Cassandra server are case-sensitive, you must leave this option enabled.
- If you are using the driver in a BI tool such as Tableau or Lumira, it is recommended that you leave this option enabled.
- If this option is disabled, then queries that use case-sensitive schema, table, and column names are not supported.

# Enable Latency Aware

Key Name	Default Value	Required
EnableLatencyAware	Clear (0)	No

#### Description

This option specifies whether the driver uses a latency-awareness algorithm to distribute the load away from slower-performing nodes.

- Enabled (1): The driver uses the latency-awareness algorithm.
- Disabled (0): The driver does use the latency-awareness algorithm.

Key Name	Default Value	Required
EnableNullInsert	Clear (0)	No

#### Description

This option specifies how the driver inserts NULL values.

- Enabled (1): The driver inserts all NULL values as specified in INSERT statements.
- Disabled (0): If an INSERT statement only specifies NULL values for a column or does not specify any values for a column, then the driver omits that column when executing the INSERT statement.

Consider the following before modifying this property:

- It is recommended that you leave the property disabled so that the driver does not insert NULL values into empty cells and create tombstones, which may decrease server performance and cause errors to occur. However, this setting may decrease driver performance when executing INSERT statements that affect a large number of rows.
- It is recommended that you enable this property by setting it to 1 only when executing INSERT statements that do not contain unnecessary NULL values, because inserting NULL values into empty columns creates tombstones.

For more information about tombstones, see "About deletes" in the Apache Cassandra 2.0 documentation: http://docs.datastax.com/en/cassandra/2.0/cassandra/dml/dml\_about\_deletes\_c.html.

# **Enable Paging**

Key Name	Default Value	Required
EnablePaging	Selected (1)	No

#### Description

This option specifies whether to split large result sets into pages.

- Enabled (1): The driver splits large result sets into pages.
- Disabled (0): The driver fetches all results into memory regardless of the result set size.

See also the driver configuration option Rows Per Page on page 53.

# Enable Server Hostname Verification

Key Name	Default Value	Required
UseSslIdentityCheck	Selected (1)	No

#### Description

This option specifies whether the driver requires the host name of the server to match the host name in the SSL certificate.

- Enabled (1): During SSL verification the driver requires the host name of the server to match the host name in the certificate.
- Disabled (0): During SSL verification the driver allows the host name of the server to not match the host name in the certificate.

# Enable Token Aware

Key Name	Default Value	Required
EnableTokenAware	Selected (1)	No

#### Description

This option specifies whether to use a token-aware policy to improve load balancing and latency.

- Enabled (1): The driver uses the token-aware policy.
- Disabled (1): The token-aware policy is not used.

# **Encrypt Password**

Key Name	Default Value	Required
N/A	All Users Of This Machine	No

This option specifies how the driver encrypts the credentials that are saved in the DSN:

- Current User Only: The credentials are encrypted, and can only be used by the current Windows user.
- All Users Of This Machine: The credentials are encrypted, but can be used by any user on the current Windows machine.

#### Important:

This option is available only when you configure a DSN using the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector DSN Setup dialog box in the Windows driver. When you connect to the data store using a connection string, the driver does not encrypt your credentials.

#### Host

Key Name	Default Value	Required
Host	None	Yes

#### Description

The IP address or host name of the Cassandra server.

You can specify a comma-separated list of IP addresses or host names. The driver attempts to connect to each of the servers in succession, and establishes the first available connection.

#### Key File Password

Key Name	Default Value	Required
SSLUserKeyPWD	None	No

#### Description

The password for the private key file that is specified in the Client-side Private Key field or the SSLUserKeyPath key.

For more information, see Client-side Private Key on page 44.

Key Name	Default Value	Required
LoadBalancingPolicy	DC Aware (0)	No

# Description

This option specifies the load balancing policy to be used.

- Round Robin (1): The driver uses the Round Robin policy to cycle through all nodes in the cluster on a per-query basis.
- DC Aware (0): The driver uses the DC Aware policy. For each query, all nodes in a primary "local" data center are tried first, before any nodes from other data centers.

#### Note:

As of driver version 2.5.6, the COLoadBalancingPolicy key has been deprecated and replaced by the LoadBalancingPolicy key. The driver still accepts COLoadBalancingPolicy in the connection string, but this key may not be supported in future releases. It is recommended that you use the LoadBalancingPolicy key instead.

# Log Level

Key Name	Default Value	Required
LogLevel	<b>OFF (</b> 0 <b>)</b>	No

# Description

Use this property to enable or disable logging in the driver and to specify the amount of detail included in log files.

#### Important:

- Only enable logging long enough to capture an issue. Logging decreases performance and can consume a large quantity of disk space.
- The settings for logging apply to every connection that uses the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector, so make sure to disable the feature after you are done using it.
- This option is not supported in connection strings. To configure logging for the Windows driver, you must use the Logging Options dialog box. To configure logging for a non-Windows driver, you must use the datastax.cassandraodbc.ini file.

Set the property to one of the following values:

- OFF (0): Disable all logging.
- FATAL (1): Logs severe error events that lead the driver to abort.
- ERROR (2): Logs error events that might allow the driver to continue running.
- WARNING (3): Logs events that might result in an error if action is not taken.
- INFO (4): Logs general information that describes the progress of the driver.
- DEBUG (5): Logs detailed information that is useful for debugging the driver.
- TRACE (6): Logs all driver activity.

When logging is enabled, the driver produces two log files at the location you specify in the Log Path (LogPath) property, where *[DriverName]* is the name of the driver:

- A [DriverName]\_driver.log file that logs driver activity that is not specific to a connection.
- A [DriverName]\_connection\_[Number].log for each connection made to the database, where [Number] is a number that identifies each log file. This file logs driver activity that is specific to the connection.

If you enable the UseLogPrefix connection property, the driver prefixes the log file name with the user name associated with the connection and the process ID of the application through which the connection is made. For more information, see UseLogPrefix on page 64.

# Log Path

Key Name	Default Value	Required
LogPath	None	Yes, if logging is enabled.

The full path to the folder where the driver saves log files when logging is enabled.

#### Important:

This option is not supported in connection strings. To configure logging for the Windows driver, you must use the Logging Options dialog box. To configure logging for a non-Windows driver, you must use the datastax.cassandraodbc.ini file.

# Max File Size

Key Name	Default Value	Required
LogFileSize	20	No

#### Description

The maximum size of each log file in megabytes (MB). After the maximum file size is reached, the driver creates a new file and continues logging.

#### Important:

This option is not supported in connection strings. To configure logging for the Windows driver, you must use the Logging Options dialog box. To configure logging for a non-Windows driver, you must use the datastax.cassandraodbc.ini file.

#### **Max Number Files**

Key Name	Default Value	Required
LogFileCount	50	No

#### Description

The maximum number of log files to keep. After the maximum number of log files is reached, each time an additional file is created, the driver deletes the oldest log file.

#### Important:

This option is not supported in connection strings. To configure logging for the Windows driver, you must use the Logging Options dialog box. To configure logging for a non-Windows driver, you must use the datastax.cassandraodbc.ini file.

# Mechanism

Key Name	Default Value	Required
AuthMech	No Authentication (0)	No

#### Description

The authentication mechanism to use.

Select one of the following settings, or set the key to the corresponding number:

- No Authentication (0)
- User Name And Password (1)

# Password

Key Name	Default Value	Required
PWD	None	Yes, if the authentication mechanism is User Name And Password (1).

# Description

The password corresponding to the user name that you provided in the User Name field (the UID key).

#### Port

Key Name	Default Value	Required
Port	9042	Yes

The TCP port that the Cassandra server uses to listen for client connections.

# Query Mode

Key Name	Default Value	Required
QueryMode	SQL with CQL Fallback (2)	No

#### Description

This option specifies the query mode to use when sending queries to Cassandra.

- SQL (0):The driver uses SQL\_QUERY\_MODE and executes all queries in SQL.
- CQL (1): The driver uses CQL\_QUERY\_MODE and executes all queries in CQL.
- SQL with CQL Fallback (2): The driver uses SQL\_WITH\_CQL\_FALLBACK\_ QUERY\_MODE and executes all queries in SQL by default. If a query fails, then the driver executes the query in CQL.

# **Rows Per Page**

Key Name	Default Value	Required
RowsPerPage	10000	No

# Description

When the Enable Paging option is enabled, use this option to specify the maximum number of rows to display on each page.

See also the driver configuration option Enable Paging on page 46.

# SSL

Key Name	Default Value	Required
SSLMode	No SSL (0)	No

This option specifies how the driver uses SSL to connect to the Cassandra server.

- No SSL (0): The driver does not use SSL.
- One-way Server Verification (1): If the Enable Server Hostname Verification option is enabled, the client verifies the Cassandra server using SSL. Otherwise, the driver connects to the Cassandra server using SSL but the client and the server do not verify each other.
- Two-way Server and Client Verification (2): If the Enable Server Hostname Verification option is enabled, the client and the Cassandra server verify each other using SSL. Otherwise, the driver connects to the Cassandra server using SSL but the client and the server do not verify each other.

For more information, see Enable Server Hostname Verification on page 47.

# String Column Length

Key Name	Default Value	Required
StringColumnLength	4000	No

#### Description

The default column length to report for ASCII, TEXT, and VARCHAR columns.

# **Trusted CA Certificates**

Key Name	Default Value	Required
SSLTrustedCertsPath	The path to the cacerts.pem file in the \lib folder in the driver's installation directory. The exact file path varies depending on the version of the driver that is installed.	No

# Description

The full path to the . pem file containing the certificate for verifying the server.

Key Name	Default Value	Required
TunableConsistency	<b>ONE (</b> 1)	No

#### Description

The specific Cassandra replica or the number of Cassandra replicas that must process a query in order for the query to be considered successful.

Select one of the following settings, or set the key to the number corresponding to the desired setting:

- ANY (0)
- ONE (1)
- TWO (2)
- THREE (3)
- **QUORUM**(4)
- ALL (5)
- LOCAL\_QUORUM (6)
- EACH\_QUORUM(7)
- LOCAL\_ONE (10)

These settings correspond to the consistency levels available in Cassandra. For detailed information about each consistency level, see *Configuring data consistency* in the Apache Cassandra 2.0 documentation:

http://www.datastax.com/documentation/cassandra/2.0/cassandra/dml/dml\_config\_ consistency\_c.html.

# Use SQL\_WVARCHAR For String Data Types

Key Name	Default Value	Required
UseSqlWVarchar	Clear (0)	No

# Description

This option specifies how text and varchar types are mapped to SQL.

- Enabled (1): The Cassandra text and varchar types are mapped to SQL\_WVARCHAR.
- Disabled (0): The Cassandra text and varchar types are mapped to SQL\_ VARCHAR.

# User Name

Key Name	Default Value	Required
UID	None	Yes, if the authentication mechanism is User Name And Password (1).

#### Description

The user name that you use to access the Cassandra server.

# Virtual Table Name Separator

Key Name	Default Value	Required
VTTableNameSeparator	_vt_	No

# Description

The separator for naming a virtual table built from a collection.

The name of a virtual table consists of the name of the original table, then the separator, and then the name of the collection.

#### For example:

OriginalTable vt CollectionName

# Whitelist Datacenter Hosts

Key Name	Default Value	Required
WhitelistDatacenterFilteringHosts	None	No

The addresses or names of the datacenter hosts in the Cassandra cluster you wish to connect to. Each name or addresses should be entered in quotation marks, separated by a comma.

For example: "datacenter1", "datacenter2".

# Whitelist Hosts

Key Name	Default Value	Required
WhitelistFilteringHosts	None	No

#### Description

The IP addresses of data store hosts in the Cassandra cluster you wish to connect to. Each IP addresses should be entered in quotation marks, separated by a comma.

For example: "1.2.3.4", "5.6.7.8".

# **Configuration Options Having Only Key Names**

The following configuration options do not appear in the Windows user interface for the DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector. They are accessible only when you use a connection string or configure a connection on macOS or Linux.

- Cached Rows Limit on page 58
- Concurrent Requests on page 58
- Core Connections Per Host on page 58
- Default Column Scale on page 59
- Disable Decimal Padding on page 59
- Driver on page 60
- Enable Asynchronous Writes on page 60
- Enable Joins on page 60
- Insert Query Threads on page 61
- IO Threads on page 61
- Iterations Per Insert Thread on page 61
- Maximum Concurrent Connections on page 61
- Maximum Concurrent Requests on page 62

- Maximum Connections Per Host on page 62
- Maximum Requests Per Flush on page 62
- Pending Requests High Water Mark on page 63
- Pending Requests Low Water Mark on page 63
- Queue Size Event on page 63
- Queue Size IO on page 64
- Write Bytes High Water Mark on page 65
- Write Bytes Low Water Mark on page 65

The UseLogPrefix property must be configured as a Windows Registry key value, or as a driver-wide property in the datastax.cassandraodbc.ini file for macOS or Linux.

• UseLogPrefix on page 64

# Cached Rows Limit

Key Name	Default Value	Required
CachedRowsLimit	5000	No

#### Description

The maximum number of rows that the driver caches before forcing a flush.

# **Concurrent Requests**

Key Name	Default Value	Required
NumConcurrentRequests	100	No

#### Description

The number of concurrent requests per insertion thread.

# **Core Connections Per Host**

Key Name	Default Value	Required
CoreConnectionsPerHost	1	No

The number of connections that the driver makes to each server in each IO thread.

# Default Column Scale

Key Name	Default Value	Required
DefaultColumnScale	10	No

#### Description

The default scale used for decimal columns.

# **Disable Decimal Padding**

Key Name	Default Value	Required
DisableDecimalPadding	Clear (0)	No

#### Description

This option specifies whether to disable decimal padding.

- Enabled (1): The driver disables decimal padding, and fits the decimal scale to the input parameter's scale, on a per-row basis.
  - Trailing zeroes are discarded. For example, 1.500 is inserted as 1.5.
  - Values with a scale that is greater than the default column scale are truncated. For example, if the default column scale is 3 and the value is 1.5557, the value is inserted as 1.555.
- Disabled (0): The driver uses decimal padding.

To set the default decimal column scale, see Default Column Scale on page 59.

# Key NameDefault ValueRequiredDriverwhen installed on<br/>Windows, or the absolute<br/>path of the driver shared<br/>object file when installed<br/>on a non-Windows<br/>machine.Yes

#### Description

On Windows, the name of the installed driver.

On other platforms, the name of the installed driver as specified in odbcinst.ini, or the absolute path of the driver shared object file.

# Enable Asynchronous Writes

Key Name	Default Value	Required
EnableAsynchronousWrites	Selected (1)	No

#### Description

This option specifies whether to enable asynchronous database write.

- Enabled (1): The driver allows asynchronous database writes.
- Disabled (0): The driver does not allow asynchronous writes.

# **Enable Joins**

Key Name	Default Value	Required
EnableJoins	Clear (0)	No

#### Description

This option specifies whether SQL joins are allowed.

- Enabled (1): The driver allows joins, and executes SQL queries that contain them.
- Disabled (0): The driver does not allow joins. If a SQL query that contains a join is submitted, the driver returns an error.

# **Insert Query Threads**

Key Name	Default Value	Required
NumInsertQueryThreads	2	No

#### Description

The number of insert query threads.

# **Iterations Per Insert Thread**

Key Name	Default Value	Required
NumIterationsPerInsertThread	50	No

#### Description

The number of iterations for each insert query thread.

# **IO** Threads

Key Name	Default Value	Required
NumThreadsIO	1	No

#### Description

The number of IO threads, that is, the number of threads that handle query requests.

# Maximum Concurrent Connections

Key Name	Default Value	Required
MaxConcurrentCreation	1	No

The maximum number of connections that can exist concurrently.

A new connection is created when the existing connections are unable to keep up with request throughput.

# Maximum Concurrent Requests

Key Name	Default Value	Required
MaxConcurrentRequestsThreshold	100	No

# Description

The maximum number of concurrent requests that can exist on a connection before the driver creates a new connection.

#### Note:

If the number of connections has reached the Maximum Connections Per Host value, a new connection is not created.

# Maximum Connections Per Host

Key Name	Default Value	Required
MaxConnectionsPerHost	2	No

#### Description

The maximum number of connections that the driver makes to each server in each IO thread.

A new connection is created when the existing connections are unable to keep up with request throughput.

# Maximum Requests Per Flush

Key Name	Default Value	Required
MaxRequestsPerFlush	128	No

The maximum number of requests processed by an IO worker per flush.

# Pending Requests High Water Mark

Key Name	Default Value	Required
PendingRequestsHighWaterMark	256	No

# Description

The high water mark for the number of requests that can be queued for a connection in a connection pool.

If the number of queued requests exceeds this value, the driver disables writes to a host on an IO worker until the number of queued requests drops below the low water mark.

# Pending Requests Low Water Mark

Key Name	Default Value	Required
PendingRequestsLowWaterMark	128	No

# Description

The low water mark for the number of requests queued for a connection in a connection pool.

If the number of queued requests exceeds the high water mark value (see Pending Requests High Water Mark on page 63), the driver disables writes to a host on an IO worker until the number of queued requests drops below this value.

# Queue Size Event

Key Name	Default Value	Required
QueueSizeEvent	8192	No

The size of the fixed-size queue that stores events.

#### Queue Size IO

Key Name	Default Value	Required
QueueSizeIO	8192	No

#### Description

The size of the fixed-size queue that stores pending requests.

# UseLogPrefix

Key Name	Default Value	Required
UseLogPrefix	0	No

#### Description

This option specifies whether the driver includes a prefix in the names of log files so that the files can be distinguished by user and application.

#### Important:

To configure this option for the Windows driver, you create a value for it in one of the following registry keys:

- For a 32-bit driver installed on a 64-bit machine: HKEY\_LOCAL\_ MACHINE\SOFTWARE\Wow6432Node\DataStax\DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector\Driver
- Otherwise: HKEY\_LOCAL\_MACHINE\SOFTWARE\DataStax\DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector\Driver

Use UseLogPrefix as the value name, and either 0 or 1 as the value data.

To configure this option for a non-Windows driver, you must use the datastax.cassandraodbc.ini file.

Set the property to one of the following values:

• 1: The driver prefixes log file names with the user name and process ID associated with the connection that is being logged.

For example, if you are connecting as a user named "jdoe" and using the driver in an application with process ID 7836, the generated log files would be named jdoe\_7836\_[DriverName]\_driver.log and jdoe\_7836\_ [DriverName]\_connection\_[Number].log, where [Number] is a number that identifies each connection-specific log file.

• 0: The driver does not include the prefix in log file names.

# Write Bytes High Water Mark

Key Name	Default Value	Required
WriteBytesHighWaterMark	65536	No

# Description

The high water mark for the number of bytes that can be outstanding on a connection.

If the number of bytes outstanding on a connection exceeds this value, the driver disables writes to a host on an IO worker until the number of outstanding bytes drops below the low water mark.

# Write Bytes Low Water Mark

Key Name	Default Value	Required
WriteBytesLowWaterMark	32768	No

# Description

The low water mark for the number of bytes that can be outstanding on a connection.

If the number of bytes outstanding on a connection exceeds the high water mark (see Write Bytes High Water Mark on page 65), the driver disables writes to a host on an IO worker until the number of outstanding bytes drops below this value.

# Contact Us

If you have difficulty using the driver, please contact our Support staff.

For information about contacting Support, go to http://www.datastax.com/what-we-offer/products-services/support

# Third-Party Trademarks

Linux is the registered trademark of Linus Torvalds in Canada, United States and/or other countries.

Microsoft, MSDN, Windows, Windows Server, Windows Vista, and the Windows start button are trademarks or registered trademarks of Microsoft Corporation or its subsidiaries in Canada, United States and/or other countries.

Red Hat, Red Hat Enterprise Linux, and CentOS are trademarks or registered trademarks of Red Hat, Inc. or its subsidiaries in Canada, United States and/or other countries.

SUSE is a trademark or registered trademark of SUSE LLC or its subsidiaries in Canada, United States and/or other countries.

Apache Cassandra, Apache, and Cassandra are trademarks of The Apache Software Foundation or its subsidiaries in Canada, the United States and/or other countries.

All other trademarks are trademarks of their respective owners.

# Third-Party Licenses

The licenses for the third-party libraries that are included in this product are listed below.

#### Boost Software License - Version 1.0 - August 17th, 2003

Permission is hereby granted, free of charge, to any person or organization obtaining a copy of the software and accompanying documentation covered by this license (the "Software") to use, reproduce, display, distribute, execute, and transmit the Software, and to prepare derivative works of the Software, and to permit third-parties to whom the Software is furnished to do so, all subject to the following:

The copyright notices in the Software and this entire statement, including the above license grant, this restriction and the following disclaimer, must be included in all copies of the Software, in whole or in part, and all derivative works of the Software, unless such copies or derivative works are solely in the form of machine-executable object code generated by a source language processor.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. IN NO EVENT SHALL THE COPYRIGHT HOLDERS OR ANYONE DISTRIBUTING THE SOFTWARE BE LIABLE FOR ANY DAMAGES OR OTHER LIABILITY, WHETHER IN CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

#### dtoa License

The author of this software is David M. Gay.

Copyright (c) 1991, 2000, 2001 by Lucent Technologies.

Permission to use, copy, modify, and distribute this software for any purpose without fee is hereby granted, provided that this entire notice is included in all copies of any software which is or includes a copy or modification of this software and in all copies of the supporting documentation for such software.

THIS SOFTWARE IS BEING PROVIDED "AS IS", WITHOUT ANY EXPRESS OR IMPLIED WARRANTY. IN PARTICULAR, NEITHER THE AUTHOR NOR LUCENT MAKES ANY REPRESENTATION OR WARRANTY OF ANY KIND CONCERNING THE MERCHANTABILITY OF THIS SOFTWARE OR ITS FITNESS FOR ANY PARTICULAR PURPOSE.

Copyright (c) 1998, 1999, 2000 Thai Open Source Software Center Ltd

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NOINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

#### ICU License - ICU 1.8.1 and later

COPYRIGHT AND PERMISSION NOTICE

Copyright (c) 1995-2014 International Business Machines Corporation and others

All rights reserved.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, provided that the above copyright notice(s) and this permission notice appear in all copies of the Software and that both the above copyright notice(s) and this permission notice(s) and this permission notice appear in supporting documentation.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR HOLDERS INCLUDED IN THIS NOTICE BE LIABLE FOR ANY CLAIM, OR ANY SPECIAL INDIRECT OR CONSEQUENTIAL DAMAGES, OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER

DataStax ODBC driver for Apache Cassandra and DataStax Enterprise with CQL connector TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

Except as contained in this notice, the name of a copyright holder shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization of the copyright holder.

All trademarks and registered trademarks mentioned herein are the property of their respective owners.

#### libuv License

libuv is part of the Node project: http://nodejs.org/

libuv may be distributed alone under Node's license:

Copyright Joyent, Inc. and other Node contributors. All rights reserved. Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

This license applies to all parts of libuv that are not externally maintained libraries.

The externally maintained libraries used by libuv are:

- tree.h (from FreeBSD), copyright Niels Provos. Two clause BSD license.

- ngx queue.h (from Nginx), copyright Igor Sysoev. Two clause BSD license.

- inet pton and inet ntop implementations, contained in src/inet.c, are copyright the Internet Systems Consortium, Inc., and licensed under the ISC license.

- stdint-msvc2008.h (from msinttypes), copyright Alexander Chemeris. Three clause BSD license.

#### **OpenSSL License**

Copyright (c) 1998-2016 The OpenSSL Project. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- 3. All advertising materials mentioning features or use of this software must display the following acknowledgment:

"This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (http://www.openssl.org/)"

- 4. The names "OpenSSL Toolkit" and "OpenSSL Project" must not be used to endorse or promote products derived from this software without prior written permission. For written permission, please contact openssl-core@openssl.org.
- 5. Products derived from this software may not be called "OpenSSL" nor may "OpenSSL" appear in their names without prior written permission of the OpenSSL Project.
- 6. Redistributions of any form whatsoever must retain the following acknowledgment:

"This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/)"

THIS SOFTWARE IS PROVIDED BY THE OpenSSL PROJECT "AS IS" AND ANY EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE OpenSSL PROJECT OR ITS CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE. DataStax ODBC driver for Apache Cassandra In: and DataStax Enterprise with CQL connector This product includes cryptographic software written by Eric Young (eay@cryptsoft.com). This product includes software written by Tim Hudson (tjh@cryptsoft.com).

#### **Original SSLeay License**

Copyright (C) 1995-1998 Eric Young (eay@cryptsoft.com)

All rights reserved.

This package is an SSL implementation written by Eric Young (eay@cryptsoft.com). The implementation was written so as to conform with Netscapes SSL.

This library is free for commercial and non-commercial use as long as the following conditions are aheared to. The following conditions apply to all code found in this distribution, be it the RC4, RSA, Ihash, DES, etc., code; not just the SSL code. The SSL documentation included with this distribution is covered by the same copyright terms except that the holder is Tim Hudson (tjh@cryptsoft.com).

Copyright remains Eric Young's, and as such any Copyright notices in the code are not to be removed. If this package is used in a product, Eric Young should be given attribution as the author of the parts of the library used. This can be in the form of a textual message at program startup or in documentation (online or textual) provided with the package.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1. Redistributions of source code must retain the copyright notice, this list of conditions and the following disclaimer.
- 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- 3. All advertising materials mentioning features or use of this software must display the following acknowledgement:

"This product includes cryptographic software written by Eric Young (eay@cryptsoft.com)"

The word 'cryptographic' can be left out if the rouines from the library being used are not cryptographic related :-).

4. If you include any Windows specific code (or a derivative thereof) from the apps directory (application code) you must include an acknowledgement:

"This product includes software written by Tim Hudson (tjh@cryptsoft.com)"

THIS SOFTWARE IS PROVIDED BY ERIC YOUNG ``AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED

and DataStax Enterprise with CQL connector WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

The licence and distribution terms for any publically available version or derivative of this code cannot be changed. i.e. this code cannot simply be copied and put under another distribution licence [including the GNU Public Licence.]

#### **Stringencoders License**

Copyright 2005, 2006, 2007

Nick Galbreath -- nickg [at] modp [dot] com

DataStax ODBC driver for Apache Cassandra

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

Neither the name of the modp.com nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, DataStax ODBC driver for Apache Cassandra Install and DataStax Enterprise with CQL connector STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

This is the standard "new" BSD license:

http://www.opensource.org/licenses/bsd-license.php

#### Apache License, Version 2.0

The following notice is included in compliance with the Apache License, Version 2.0 and is applicable to all software licensed under the Apache License, Version 2.0.

Apache License

Version 2.0, January 2004

#### http://www.apache.org/licenses/

#### TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION

1. Definitions.

"License" shall mean the terms and conditions for use, reproduction, and distribution as defined by Sections 1 through 9 of this document.

"Licensor" shall mean the copyright owner or entity authorized by the copyright owner that is granting the License.

"Legal Entity" shall mean the union of the acting entity and all other entities that control, are controlled by, or are under common control with that entity. For the purposes of this definition, "control" means (i) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (ii) ownership of fifty percent (50%) or more of the outstanding shares, or (iii) beneficial ownership of such entity.

"You" (or "Your") shall mean an individual or Legal Entity exercising permissions granted by this License.

"Source" form shall mean the preferred form for making modifications, including but not limited to software source code, documentation source, and configuration files.

"Object" form shall mean any form resulting from mechanical transformation or translation of a Source form, including but not limited to compiled object code, generated documentation, and conversions to other media types.

"Work" shall mean the work of authorship, whether in Source or Object form, made available under the License, as indicated by a copyright notice that is

included in or attached to the work (an example is provided in the Appendix below).

"Derivative Works" shall mean any work, whether in Source or Object form, that is based on (or derived from) the Work and for which the editorial revisions, annotations, elaborations, or other modifications represent, as a whole, an original work of authorship. For the purposes of this License, Derivative Works shall not include works that remain separable from, or merely link (or bind by name) to the interfaces of, the Work and Derivative Works thereof.

"Contribution" shall mean any work of authorship, including the original version of the Work and any modifications or additions to that Work or Derivative Works thereof, that is intentionally submitted to Licensor for inclusion in the Work by the copyright owner or by an individual or Legal Entity authorized to submit on behalf of the copyright owner. For the purposes of this definition, "submitted" means any form of electronic, verbal, or written communication sent to the Licensor or its representatives, including but not limited to communication on electronic mailing lists, source code control systems, and issue tracking systems that are managed by, or on behalf of, the Licensor for the purpose of discussing and improving the Work, but excluding communication that is conspicuously marked or otherwise designated in writing by the copyright owner as "Not a Contribution."

"Contributor" shall mean Licensor and any individual or Legal Entity on behalf of whom a Contribution has been received by Licensor and subsequently incorporated within the Work.

- 2. Grant of Copyright License. Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, nocharge, royalty-free, irrevocable copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, sublicense, and distribute the Work and such Derivative Works in Source or Object form.
- 3. Grant of Patent License. Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable (except as stated in this section) patent license to make, have made, use, offer to sell, sell, import, and otherwise transfer the Work, where such license applies only to those patent claims licensable by such Contributor that are necessarily infringed by their Contribution(s) alone or by combination of their Contribution(s) with the Work to which such Contribution(s) was submitted. If You institute patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Work or a Contribution incorporated within the Work constitutes direct or contributory patent infringement, then any patent licenses granted to You under this License for that Work shall terminate as of the date such litigation is filed.

- 4. Redistribution. You may reproduce and distribute copies of the Work or Derivative Works thereof in any medium, with or without modifications, and in Source or Object form, provided that You meet the following conditions:
  - (a) You must give any other recipients of the Work or Derivative Works a copy of this License; and
  - (b) You must cause any modified files to carry prominent notices stating that You changed the files; and
  - (c) You must retain, in the Source form of any Derivative Works that You distribute, all copyright, patent, trademark, and attribution notices from the Source form of the Work, excluding those notices that do not pertain to any part of the Derivative Works; and
  - (d) If the Work includes a "NOTICE" text file as part of its distribution, then any Derivative Works that You distribute must include a readable copy of the attribution notices contained within such NOTICE file, excluding those notices that do not pertain to any part of the Derivative Works, in at least one of the following places: within a NOTICE text file distributed as part of the Derivative Works; within the Source form or documentation, if provided along with the Derivative Works; or, within a display generated by the Derivative Works, if and wherever such third-party notices normally appear. The contents of the NOTICE file are for informational purposes only and do not modify the License. You may add Your own attribution notices within Derivative Works that You distribute, alongside or as an addendum to the NOTICE text from the Work, provided that such additional attribution notices cannot be construed as modifying the License.

You may add Your own copyright statement to Your modifications and may provide additional or different license terms and conditions for use, reproduction, or distribution of Your modifications, or for any such Derivative Works as a whole, provided Your use, reproduction, and distribution of the Work otherwise complies with the conditions stated in this License.

- 5. Submission of Contributions. Unless You explicitly state otherwise, any Contribution intentionally submitted for inclusion in the Work by You to the Licensor shall be under the terms and conditions of this License, without any additional terms or conditions. Notwithstanding the above, nothing herein shall supersede or modify the terms of any separate license agreement you may have executed with Licensor regarding such Contributions.
- 6. Trademarks. This License does not grant permission to use the trade names, trademarks, service marks, or product names of the Licensor, except as required

DataStax ODBC driver for Apache Cassandra

and DataStax Enterprise with CQL connector

for reasonable and customary use in describing the origin of the Work and reproducing the content of the NOTICE file.

- 7. Disclaimer of Warranty. Unless required by applicable law or agreed to in writing, Licensor provides the Work (and each Contributor provides its Contributions) on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. You are solely responsible for determining the appropriateness of using or redistributing the Work and assume any risks associated with Your exercise of permissions under this License.
- 8. Limitation of Liability. In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall any Contributor be liable to You for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising as a result of this License or out of the use or inability to use the Work (including but not limited to damages for loss of goodwill, work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if such Contributor has been advised of the possibility of such damages.
- 9. Accepting Warranty or Additional Liability. While redistributing the Work or Derivative Works thereof, You may choose to offer, and charge a fee for, acceptance of support, warranty, indemnity, or other liability obligations and/or rights consistent with this License. However, in accepting such obligations, You may act only on Your own behalf and on Your sole responsibility, not on behalf of any other Contributor, and only if You agree to indemnify, defend, and hold each Contributor harmless for any liability incurred by, or claims asserted against, such Contributor by reason of your accepting any such warranty or additional liability.

END OF TERMS AND CONDITIONS

APPENDIX: How to apply the Apache License to your work.

To apply the Apache License to your work, attach the following boilerplate notice, with the fields enclosed by brackets "[]" replaced with your own identifying information. (Don't include the brackets!) The text should be enclosed in the appropriate comment syntax for the file format. We also recommend that a file or class name and description of purpose be included on the same "printed page" as the copyright notice for easier identification within third-party archives.

Copyright [yyyy] [name of copyright owner]

Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at

http://www.apache.org/licenses/LICENSE-2.0

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

This product includes software that is licensed under the Apache License, Version 2.0 (listed below):

#### DataStax C/C++ Driver for Apache Cassandra License

Copyright © 2014-2015 DataStax

Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at

#### http://www.apache.org/licenses/LICENSE-2.0

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.