**Oracle® Financial Services Crime and Compliance Studio Application**

Installation Guide

Release 8.0.7.0.0

**E91246-01**

February 2019

ORACLE®

Installation Guide, Release 8.0.7.0.0

E91246-01

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# Document Control

This section provides the revision details of the document.

| Version Number | Revision Date | Changes Done |
| --- | --- | --- |
| 8.0.7.0.0 | Created: February 2019 | Created first version of Oracle Financial Services Crime and Compliance Studio Installation Guide for 8.0.7.0.0 Release. |

This document includes the necessary instructions to install the OFS Crime and Compliance Studio application and perform the required post installation configurations.

# Preface

This section provides supporting information for the OFS Crime and Compliance Studio application Installation Guide and includes the following topics:

- Summary
- Audience
- Related Documents
- Conventions
- Abbreviations

## Summary

Before you begin the installation, ensure that you have access to the Oracle Support Portal with valid login credentials to quickly notify us of any issues at any stage. You can obtain the login credentials by contacting Oracle Support.

## Audience

The Installation Guide is intended for System Engineers who are responsible for installing and configuring the OFS Crime and Compliance Studio Application's components.

### Prerequisites for the Audience

The document assumes that you have experience in installing Enterprise components and basic knowledge about the following are recommended:

- Scala, PGQL, and PGX
- UNIX commands
- Database concepts
- Web Application Server
- Big Data

## Related Documents

This section identifies additional documents related to OFS Crime and Compliance Studio application. You can access the following documents from Oracle Help Center (OHC) Documentation Library:

- *Oracle Financial Services Crime and Compliance Studio Administration Guide*

- *Oracle Financial Services Crime and Compliance Studio User Guide*
- *Oracle Financial Services Crime and Compliance Studio ReadMe*

## Conventions

The following table lists the text conventions used in this document:

*Table 0–1   Conventions Used in this Guide*

| Convention | Meaning |
| --- | --- |
| **boldface** | Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary. |
| *italic* | Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values. |
| `monospace` | Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter. |

## Abbreviations

The following table lists the abbreviations used in this document:

*Table 0–2   Abbreviations and Their Meaning*

| Abbreviation | Meaning |
| --- | --- |
| OFS | Oracle Financial Services |
| HTTPS | Hypertext Transfer Protocol Secure |
| JDBC | Java Database Connectivity |
| LDAP | Lightweight Directory Access Protocol |
| LHS | Left Hand Side |
| MOS | My Oracle Support |
| OS | Operating System |
| SFTP | Secure File Transfer Protocol |
| URL | Uniform Resource Locator |
| WAR | Web application ARchive |
| JAR | Java ARchive |
| PGX | Parallel Graph AnalytiX |
| PGQL | Property Graph Query Language |
| XML | Extensible Markup Language |

# 1

## Understanding Crime and Compliance Studio Application Installation

This chapter provides necessary information required to understand the installation of the Oracle Financial Service (OFS) Crime and Compliance Studio application.

This chapter includes the following topics:

- Installation Overview
- Hardware and Software Requirements

## Installation Overview

You can download this installer to install a new instance of the OFS Crime and Compliance Studio application. Figure 1–1 shows the order of procedures required to install a new instance of the Studio application.

*Figure 1–1*   **Installation Overview**
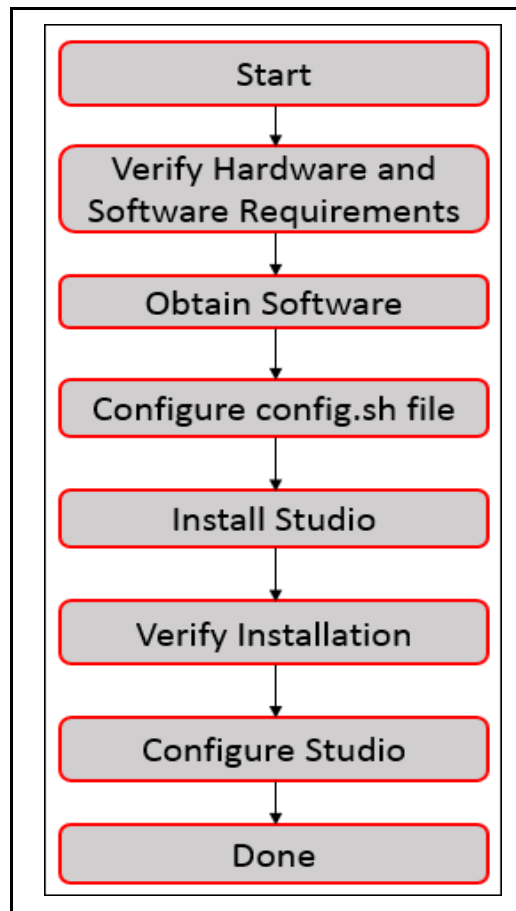


Table 1–1 provides additional information to specific documentation for each task in the flowchart.

*Table 1–1*   *Studio Application Installation Tasks and Descriptions*

| Tasks | Details and Documentation |
| --- | --- |
| Verify Hardware and Software requirements. | To verify that your system contains the necessary hardware and software requirements for installing and hosting the Studio application, see Hardware and Software Requirements. |
| Obtain the Software | To access and download the Crime and Compliance Studio application, see Obtaining the Software. |
| Configure config.sh File | To configure the file, see Configuring config.sh. |
| Install Studio Application | To install the Crime and Compliance Studio application, see Installing the Studio Application. |
| Verify Installation | To verify installation of Crime and Compliance Studio application, see Verifying Installation. |
| Configure Studio Application | To configure Crime and Compliance Studio application, See Post Installation Configurations. |

# Hardware and Software Requirements

This section describes the various Operating Systems, Database, Web Server, and Web Application Server versions, and other variant details on which this release of the Studio application is qualified. For information on the requirements, see Oracle Help Center (OHC) Documentation Library.

## Configurations Supported for Java 8

*Table 1–2    Configurations Supported for Java 8*

| BIG DATA | |
|---|---|
| Cloudera Distribution Hadoop 5.12 | <ul><li>CDH Version 5.12</li><li>Hadoop-2.5.0+cdh5.3.3+844</li><li>Hive-0.13.1+cdh5.3.3+350</li><li>Sqoop1 V 1.4.4+cdh5.3.3+67</li></ul> |
| Cloudera Hive Connectors | Hive JDBC Connectors V 2.5.15 |
| Oracle R Advanced Analytics for Hadoop | Oracle R Advanced Analytics for Hadoop (ORAAH)  2.4.0 |
| Hadoop Security  Protocol | <ul><li>Kerberos R release 1.6.1</li><li>Sentry-1.4.0</li></ul> |

# 2

# Preparing for Installation

This chapter provides necessary information to review before installing the OFS Crime and Compliance Studio application.

This chapter includes the following sections:

- Installer and Installation Prerequisites
- Obtaining the Software
- Performing Common Pre-Installation Tasks

## Installer and Installation Prerequisites

Table 2–1 provides the list of prerequisites required before beginning the installation of the Studio application. The Installer or Environment Check Utility notifies you if any requirements are not met.

*Table 2–1    Prerequisite Information*

| Category | Sub-Category | Expected Value |
|----------|--------------|----------------|
| Environment Settings | PGX Settings | Set the following paths in the Environment variables:<br>• `PGX_HOME`: Indicates the path on the server where PGX client has been installed. For more information, see Configuring PGX.<br>• `SPARK_HOME`: Indicates the path where `SPARK_HOME` has been installed by the client. |
|  | Java Settings | • `PATH` in `.profile` to be set to include the Java Runtime Environment absolute path. The path should include java 8.<br>**Note:**<br>• Ensure the absolute path to `JRE/bin` is set at the beginning of `PATH` variable.<br>• For example, `PATH=/usr/java/jre1.8/bin:$ORACLE_HOME/bin:$PATH`<br>• Ensure no SYMBOLIC links to JAVA installation is being set in the `PATH` variable |
|  | Oracle Database Settings | **Oracle Processing Server**<br>• `ORACLE_HOME` to be set in `.profile` file pointing to appropriate Oracle DB Client installation.<br>• `PATH` in `.profile` to be set to include appropriate `$ORACLE_HOME/bin` path |

*Table 2–1 (Cont.) Prerequisite Information*

| Category | Sub-Category | Expected Value |
|---|---|---|
| | MySQL Database Schema Settings | Install a MYSQL Database on server and create a schema. This schema will be used by Data Studio to store the metadata.<br><br>Enter the URL of the newly created schema in the `MYSQL_JDBC_URL` parameter in `config.sh` file. |
| | Installation Directory | A directory where the installation files will be installed.<br><br>User permission is set to 755 on the installation directory. |
| | Download Directory | A directory where the product installer file will be downloaded/ copied.<br><br>Ensure user permission is set to 755 on the Download directory. |
| | OS Locale | • `Linux: en_US.utf8`<br><br>To check the locale installed, execute the following command:<br><br>`locale -a | grep -i 'en_US.utf'` |
| | Studio Schema | Create a new schema with the grant permissions given in the next row. This newly created schema is referred to as Studio Schema. |
| | Oracle Database Schema Settings | Grant the following permissions to the newly created Oracle Database Schema:<br><br>• GRANT create session TO <Studio Schema User>;<br>• GRANT create table TO <Studio Schema User>;<br>• GRANT create view TO <Studio Schema User>;<br>• GRANT create any trigger TO <Studio Schema User>;<br>• GRANT create any procedure TO <Studio Schema User>;<br>• GRANT create sequence TO <Studio Schema User>;<br>• GRANT ALL privileges TO <Studio Schema User>;<br>• Grant execute on dbms_rls to <Studio Schema User>;<br>• Grant execute on sys.dbms_session to <Studio Schema User>;<br>• ALTER USER <Studio Schema User> QUOTA 100M ON users;<br>• Grant create sequence to <Studio Schema User>;<br>• Grant create SYNONYM to <Studio Schema User>;<br>• Grant create any context to <BD Schema User>;<br>• Grant execute on dbms_rls to <BD Schema User>; |
| | Wallet Settings | For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet" |

*Table 2–1    (Cont.)  Prerequisite Information*

| Category | Sub-Category | Expected Value |
|---|---|---|
| | Interpreter Settings | Perform the following pre-requisite settings only for the interpreters that you need:<br><br>• fcc-jdbc<br><br>• fcc-ore. For more information, see Appendix E, "Installing RServe Manually".<br><br>• pgx<br><br>• fcc-pyspark<br><ul><li>You must install the py4j package in spark cluster.</li><li>You must install the Livy server (0.3.0).</li></ul>• fcc-python.<br><ul><li>You must install the py4j package.</li></ul>• fcc-spark-scala<br><ul><li>You must install the Livy server (0.3.0).</li></ul>• fcc-spark-sql<br><ul><li>You must install the Livy sever(0.3.0).</li></ul> |

## Obtaining the Software

This release of the Studio application can be downloaded from My Oracle Support. You must have a valid Oracle account to download the software and then search for the Bug ID **29295027** under the *Patches & Updates* tab.

## Performing Common Pre-Installation Tasks

The common pre-installation activities that you must carry out before installing the Studio application are:

• Identifying the Installation, Download and Metadata Repository Directories

• Downloading Crime and Compliance Studio Application Installer

• Extracting the Software

## Identifying the Installation, Download and Metadata Repository Directories

To install the Crime and Compliance Studio Application Pack, create the following directory which is typically the user home directory:

• **Studio Download Directory (Optional)**: Create a download directory and copy the Crime and Compliance Studio Application Installer File (archive). This is the directory where the downloaded installer/patches can be copied.

## Downloading Crime and Compliance Studio Application Installer

To download and copy the Studio Application Installer, follow these steps:

1. Login to the My Oracle Support with a valid Oracle account and search for the Bug ID **29295027** under the *Patches & Updates* tab.

2. Download the installer archive `OFS_FCCM_STUDIO_8.0.7.0.0_LINUX.zip` file to the download directory (in Binary Mode) on the setup identified for Studio installation.

## Extracting the Software

> **Note**:
>
> You must be logged in to the UNIX operating system as a non-root user.

1. Download the unzip utility (OS specific) `unzip_<os>.Z` and copy it in Binary mode to the directory where you want to install the application. If you already have the unzip utility to extract the contents of the downloaded archive, skip to Step 4.

2. Uncompress the unzip installer file with the following command:

   ```
   uncompress unzip_<os>.Z
   ```

   > **Note:**
   >
   > In the error message, "uncompress: not found [No such file or directory]" is displayed, contact your UNIX administrator.

3. Assign EXECUTE permission to the file with the following command:

   ```
   chmod 751 unzip_<OS>
   ```

   For example, `chmod 751 unzip_sparc`

4. Extract the contents of the `OFS_FCCM_STUDIO_8.0.7.0.0_LINUX.zip` installer archive file in the download directory with the following command:

   ```
   unzip -a OFS_FCCM_STUDIO_8.0.7.0.0_LINUX.zip
   ```

   > **Note**
   >
   > Do not rename the Application installer folder name on extraction from the archive.

5. Navigate to the download directory where the installer archive is extracted and assign execute permission to the installer directory with the following command:

   ```
   chmod 0755 OFS_FCCM_STUDIO -R
   ```

# 3

# Installing the Crime and Compliance Studio Application

This chapter provides the instructions to install the OFS Crime and Compliance Studio application.

This chapter includes the following topics:

- Installing the Studio Application
- Verifying Installation

## Installing the Studio Application

This section provides instructions to install the OFS Services Crime and Compliance Studio application.

This topic includes the following sections:

- Configuring config.sh
- Running the Installer

## Configuring config.sh

To configure the `config.sh` file, follow below steps:

1. Log in to the system as non-root user.

2. Navigate to the `OFS_FCCM_STUDIO/bin/config.sh` file.

3. Configure the `config.sh` file as mentioned in Table 3–1.

   You must manually set the InteractionVariable parameter values as mentioned in the Table 3–1. If a value is not applicable, enter NA and ensure that the value is not entered as NULL.

*Table 3–1    config.sh Parameters*

| InteractionVariable Name | Significance | Used for Hive DataBase | Used for Oracle Database |
|---|---|---|---|
| FCC_STUDIO_ INSTALLATION_PATH | Indicates the path where Studio is extracted. | Yes | Yes |

*Table 3–1   (Cont.) config.sh Parameters*

| InteractionVariable Name | Significance | Used for Hive DataBase | Used for Oracle Database |
|---|---|---|---|
| OFSAA_SERVICE_URL | Indicates the URL of the OFSAA instance. Do not enter '/' at the end of the URL.<br>**Note:**<br>• For OFSAAAI, the value must be in the following format:<br>`https://<HOSTName>:<PortNo>/<ContextName>/rest-api` | Yes | Yes |
| PGX_SERVER_URL | Indicates the URL of the PGX server.<br>Example: `http://<HOSTName>:<PortNo>/`<br>The value for the PortNo must be 7007. | Yes | Yes |
| LIVY_HOST_URL | Indicates the URL of the Livy application.<br>The format for the URL is as follows:<br>`http://<HOSTName>:<PortNo>` | Yes | No |
| AUTH_SERVICE_URL | Indicates the AUTH service URL which will get activated once the `fcc-studio.sh` file runs.<br>The format for the authservice URL is as follows:<br>`http://<HOSTName>:7041/authservice` | Yes | Yes |
| BATCH_SERVICE_URL | Indicates the batch service URL which will get activated once the `fcc-studio.sh` file runs.<br>The format for the batch service URL is as follows:<br>`http://<HOSTName>:7043/batchservice` | Yes | Yes |
| META_SERVICE_URL | Indicates the metaservice URL which will get activated once the `fcc-studio.sh` file runs.<br>The format for the metaservice URL is as follows:<br>`http://<HOSTName>:7045/metaservice` | Yes | Yes |
| SESSION_SERVICE_URL | Indicates the session service URL which will get activated once the `fcc-studio.sh` file runs.<br>The format for the session service URL is as follows:<br>`http://<HOSTName>:7047/sessionservice` | Yes | Yes |
| FCC_STUDIO_URL | Indicates the Studio URL.<br>The format for the FCC Studio URL is as follows:<br>http://<HOSTName>:7008 | Yes | Yes |
| RSERVE_USERNAME | Indicates the RServe username. | Yes<br>If the ORE interpreter is to be used. | Yes<br>If the ORE interpreter is to be used. |

*Table 3–1   (Cont.)  config.sh Parameters*

| InteractionVariable Name | Significance | Used for Hive DataBase | Used for Oracle Database |
|---|---|---|---|
| RSERVE_PASSWORD | Indicates the RServe password. | Yes<br><br>If the ORE interpreter is to be used. | Yes<br><br>If the ORE interpreter is to be used. |
| HTTP_PROXY | Indicates the HTTP proxy. | Yes<br><br>If the ORE interpreter is to be used. | Yes<br><br>If the ORE interpreter is to be used. |
| HTTPS_PROXY | Indicates the HTTPS proxy. | Yes<br><br>If the ORE interpreter is to be used. | Yes<br><br>If the ORE interpreter is to be used. |
| REPO_CRAN_URL | Indicates the URL from where the R packages are obtained.<br>The format for the REPO_CRAN_URL is as follows:<br>https://cran.r-project.org/ | Yes<br><br>If the ORE interpreter is to be used. | Yes<br><br>If the ORE interpreter is to be used. |
| USERS_LIB_PATH | Indicates the path where R packages will be installed. | Yes<br><br>If the ORE interpreter is to be used. | Yes<br><br>If the ORE interpreter is to be used. |
| RSERVE_CONF_PATH | Indicates the path where `Rserve.conf` file is present. | Yes<br><br>If the ORE interpreter is to be used. | Yes<br><br>If the ORE interpreter is to be used. |
| STUDIO_DB_ HOSTNAME | Indicates the hostname of the database where Studio schema is created. | Yes | Yes |
| STUDIO_DB_PORT | Indicates the port number where Studio schema is created. | Yes | Yes |
| STUDIO_DB_ SERVICE_NAME | Indicates the service name of the database where Studio schema is created. | Yes | Yes |
| STUDIO_DB_SID | Indicates the SID of the database where Studio schema is created. | Yes | Yes |
| STUDIO_DB_ USERNAME | Indicates the username of the Studio Schema (newly created Oracle Schema). | Yes | Yes |
| STUDIO_DB_ PASSWORD | Indicates the password for the newly created schema. | Yes | Yes |
| STUDIO_ALIAS_ NAME | Indicates the Studio alias name. For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet," | Yes | Yes |
| STUDIO_WALLET_ LOCATION | Indicates the Studio wallet location. For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet," | Yes | Yes |

*Table 3–1    (Cont.)  config.sh Parameters*

| InteractionVariable Name | Significance | Used for Hive DataBase | Used for Oracle Database |
|---|---|---|---|
| STUDIO_TNS_ ADMIN_PATH | Indicates the path of the tnsnames.ora file where an entry for the STUDIO_ALIAS_NAME is present. For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet," | Yes | Yes |
| BD_CONFIG_ HOSTNAME | Indicates the hostname of the database where BD config schema is installed. | Yes | Yes |
| BD_CONFIG_PORT | Indicates the port of the database where BD config schema is installed. | Yes | Yes |
| BD_CONFIG_ SERVICE_NAME | Indicates the service name of the database where BD config schema is installed. installed. | Yes | Yes |
| BD_CONFIG_SID | Indicates the SID of the database where BD config schema is installed. | Yes | Yes |
| BD_CONFIG_ USERNAME | Indicates the username for the BD config schema. | Yes | Yes |
| BD_CONFIG_ PASSWORD | Indicates the password for the BD config schema. | Yes | Yes |
| BD_CONFIG_ALIAS_ NAME | Indicates the BD config alias name. For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet," | Yes | Yes |
| BD_CONFIG_ WALLET_LOCATION | Indicates the BD config wallet location. For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet," | Yes | Yes |
| BD_CONFIG_TNS_ ADMIN_PATH | Indicates the path of the tnsnames.ora file where an entry for the BD_CONFIG_ALIAS_NAME is present. For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet," | Yes | Yes |
| BD_ATOMIC_ HOSTNAME | Indicates the BD atomic schema host name. | Yes | Yes |
| BD_ATOMIC_PORT | Indicates the BD atomic schema port number. | Yes | Yes |
| BD_ATOMIC_ SERVICE_NAME | Indicates the BD atomic schema service name. | Yes | Yes |
| BD_ATOMIC_SID | Indicates the BD atomic schema SID. | Yes | Yes |
| BD_ATOMIC_ USERNAME | Indicates the username of the BD atomic schema. | Yes | Yes |
| BD_ATOMIC_ PASSWORD | Indicates the password of the BD atomic schema. | Yes | Yes |
| BD_ATOMIC_ALIAS_ NAME | Indicates the BD atomic alias name. For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet," | Yes | Yes |
| BD_ATOMIC_ WALLET_LOCATION | Indicates the BD atomic wallet location. For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet," | Yes | Yes |
| BD_ATOMIC_TNS_ ADMIN_PATH | Indicates the path of the tnsnames.ora file where an entry for the BD_ATOMIC_ALIAS_NAME is present. For more information, see Appendix D, "Setting Up Password Stores with Oracle Wallet," | Yes | Yes |
| FSINFODOM | Indicates the name of the OFSAA or BD Infodom. | Yes | Yes |

*Table 3–1   (Cont.)  config.sh Parameters*

| InteractionVariable Name | Significance | Used for Hive DataBase | Used for Oracle Database |
|---|---|---|---|
| FSSEGMENT | Indicates the name of the OFSAA or BD segment. | Yes | Yes |
| DATAMOVEMENT_LINK_NAME | If the newly created schema is in a different database host, then you must create a DB link and provide the same link in this parameter. Alternatively, you can provide the source schema name. | Yes | Yes |
| DATAMOVEMENT_LINK_TYPE | If DB link is used, enter DBLINK in this field. If DB link is not used, enter SCHEMA in this field. | Yes | Yes |
| PGX_INSTALATION_PATH | Indicates the installation path of the PGX server.<br><br>Example: `<FCC_STUDIO_INSTALLATION_PATH>/pgx/server/pgx-3.1.2` | Yes | Yes |
| PGX_PGB_PATH | Indicates the path where you want to obtain the output graph PGB file.<br><br>Example for Hive Installation:<br><br>`hdfs:/user/ofsaa`<br><br>Example for Oracle DB Installation:<br><br>`/scratch/ofsaa` | Yes | Yes |
| MYSQLDB_JDBC_URL | Enter details for the MYSQL database created schema. This schema will be used by Data Studio to store the metadata.<br><br>Example: jdbc:mysql://<hostname>:<port>/<MySQL Schema Name> | Yes | Yes |
| MYSQLDB_USER | Indicates the username of MYSQL schema. | Yes | Yes |
| MYSQLDB_PASSWORD | Indicates the password of MYQSQL schema. | Yes | Yes |
| HADOOP_CREDENTIAL_PROVIDER_PATH | Indicates the path where Hadoop credential is stored like | Yes | No |
| HADOOP_PASSWORD_ALIAS | Indicates the Hadoop alias given while creating the hadoop credentials like | Yes | No |
| Hive_Host_Name | Indicates the Hive host name. | Yes | No |
| Hive_Port_number | Indicates the Hive port number. | Yes | No |
| HIVE_PRINCIPAL | Indicates the Hive Principal. | Yes | No |
| HIVE_SCHEMA | Indicates to create schema in HIVE. | Yes | No |
| JAAS_CONF_FILE_PATH | Created for future use. | No | No |
| Krb_Host_FQDN_Name | Indicates the Krb host FQDN name. | Yes | No |
| Krb_Realm_Name | Indicates the Krb realm name. | Yes | No |
| Krb_Service_Name | Indicates the Krb service name. | Yes | No |
| KRB5_CONF_FILE_PATH | Created for future use. | No | No |
| security_krb5_kdc_server | Created for future use. | No | No |

*Table 3–1    (Cont.)  config.sh Parameters*

| InteractionVariable Name | Significance | Used for Hive DataBase | Used for Oracle Database |
|---|---|---|---|
| security_krb5_realm | Created for future use. | No | No |
| kerberos_keytab_file | Created for future use. | No | No |
| server_kerberos_ keytab_file | Created for future use. | No | No |
| server_kerberos_ principal | Created for future use. | No | No |
| SQOOP_ HOSTMACHINE_ USER_NAME | Indicates the user name of Host machine where sqoop will run. | Yes | No |
| SQOOP_PARAMFILE_ PATH | 1.  Create a file with the name `Sqoop.properties` and make the following entry to the same:<br><br>`oracle.jdbc.mapDateToTimestamp=false`<br><br>2.  Enter the location of the `Sqoop.properties file` in the `SQOOP_PARAMFILE_PATH` parameter. | Yes | No |
| SQOOP_PARTITION_ COL | Indicates the column in which the HIVE table is partitioned.<br><br>The value must be `SNAPSHOT_DT` | Yes | No |
| SQOOP_TRG_ HOSTNAME | Indicates the host name of the SQOOP web server.<br><br>Example: `<HOSTName>` | Yes | No |
| SQOOP_WORKDIR_ HDFS | Indicates the SQOOP working directory in HDFS. | Yes | No |

## Running the Installer

To run the installer, follow these steps:

1.  Navigate to the `OFS_FCC_STUDIO/bin/` directory.

2.  Execute the following command in the console:

    `./install.sh`

    > **Note:** Execution of install.sh does not generate log file.

3.  Execute the following command in the console:

    `./fcc_studio.sh`

    The Studio application is installed. The Data Studio and all the interpreters are started.

## Verifying Installation

To verify the installation, verify the following log files:

See the log files located in the `<FCC_STUDIO_INSTALLATION_PATH>/fcc_studio/logs` directory. If all servers are up and running, indicates that the installation is complete.

> **Note:** Any errors encountered in the process is displayed with an appropriate error code. Do not proceed with further installation and contact Oracle Support with relevant log files.

If the installation of the Studio application is unsuccessful, you must reinstall the application by performing certain cleanup tasks. For more information, see Reinstalling Studio Application.

# 4

# Reinstalling Studio Application

If the installation of the Studio application is unsuccessful, you must reinstall the application by performing certain cleanup tasks.

Perform the following to reinstall Studio application:

1. Navigate to the `<FCC_STUDIO_INSTALLATION_PATH>/OFS_FCCM_STUDIO/bin` folder.

2. Create a backup for the existing `config.sh` file.

3. Delete the `OFS_FCCM_STUDIO` folder.

4. Unzip the `OFS_FCCM_STUDIO-8.0.7.0.0.zip` file and extract the software. For more information, see Extracting the Software.

5. Perform database cleanup by performing the following:

    • Cleanup for Studio Schema

    • Cleanup for BD Atomic Schema

    • Cleanup for BD Config Schema

    • Cleanup for MySQL Database

6. Install the Studio application. For more information, see Installing the Crime and Compliance Studio Application.

## Cleanup for Studio Schema

Perform the following to cleanup the Studio schema:

1. Drop the existing Studio schema and create a new studio schema.

2. Grant the following permissions to the newly created Oracle database schema:

    • GRANT create session TO <Schema User>;

    • GRANT create table TO <Schema User>;

    • GRANT create view TO <Schema User>;

    • GRANT create any trigger TO <Schema User>;

    • GRANT create any procedure TO <Schema User>;

    • GRANT create sequence TO <Schema User>;

    • GRANT ALL privileges TO <Schema User>;

    • Grant execute on dbms_rls to <Schema User>;

    • Grant execute on sys.dbms_session to <Schema User>;

- ALTER USER <Schema User> QUOTA 100M ON users;

- Grant create sequence to <Schema User>;

- Grant create SYNONYM to <Schema User>;

- Grant create any context to <Schema User>;

- Grant execute on dbms_rls to <Schema User>;

> **Note:** If dropping the schema is not an option, then drop the tables and sequence as mentioned in the Studio Schema Tables and Sequences.

## Cleanup for BD Atomic Schema

Clean up the BD atomic schema by dropping the table and sequence as mentioned in the BD Atomic Schema Tables and Sequences.

## Cleanup for BD Config Schema

Clean up the BD config schema by dropping the table and sequence as mentioned in the BD Config Schema Tables.

## Cleanup for MySQL Database

Clean up the MYSQL database by dropping the MySQL schema. Create a new MySQL schema with appropriate permissions.

> **Note:** If dropping the schema is not an option, then drop all the tables in the MySQL schema.

# 5

# Post Installation Configurations

On successful installation of the OFS Crime and Compliance Studio application, follow these post installation steps:

This chapter includes the following sections:

## OFSAA Configurations for Batch Execution

Perform the following OFSAA configurations for batch execution:

1. Copy the files in `<FCC_STUDIO_INSTALLATION_PATH>/ficdb/bin` path to the server where BD pack is installed and to the path `$FIC_DB_HOME/bin`.

2. Provide the following execute permission to the files:

   `chmod +x <filenames>`

3. Copy all the files in the `<FCC_STUDIO_INSTALLATION_PATH>/ficdb/lib` path to the `$FIC_DB_HOME/lib` path.

## Hive Data Movement

This section includes the following topics:

### Obtain Required Files

To obtain required files, follow these steps:

1. Rename the keytab file as `ofsaa.keytab`.

2. Place the `krb5.conf` and `keytab` file in the `<FCC_STUDIO_INSTALLATION_PATH>/batchservice/conf` path.

## Configuring Schema Creation

To configure Schema Creation, follow these steps:

1. Set `FIC_DB_HOME` path to `<FCC_STUDIO_INSTALLATION_PATH>/ficdb`.

2. Copy all the jar files located in the `<FCC_STUDIO_INSTALLATION_PATH>/ficdb/lib` path to the `<OFSAA_FIC_HOME_PATH>/ficdb/lib` path.

3. Create a Hive Schema with the name mentioned in the `HIVE_SCHEMA` parameter in the `config.sh` file.

   For information on config.sh file, see Configuring config.sh.

4. Create tables in Hive Schema by executing the shell script in `<FCC_STUDIO_INSTALLATION_PATH>/ficdb/bin/FCCM_Studio_SchemaCreation.sh HIVE`.

   This creates tables in the Hive Schema.

## Creating Credential Keystore

To create credential keystore, follow these steps:

1. Login as HDFS SuperUser.

2. Create a credential keystore on HDFS by executing the following command:

   ```
   hadoop credential create mydb.password.alias -provider
   jceks://hdfs/user/root/oracle.password.jceks
   ```

3. Verify the credential keystore file by executing the following list command:

   ```
   hadoop credential list -provider
   jceks://hdfs/user/root/oracle.password.jceks
   ```

4. Grant Read permission to the keystore file by executing the following command:

   ```
   hadoop fs -chmod 744 /user/root/oracle.password.jceks
   ```

   **Note:** Ensure the credential keystore file path and the alias is given correctly in the `config.sh` file.

## Placing Hive Jars

Perform the following to place the Hive jars:

1. Obtain the following jars from your CDH:

   - hive-exec-1.1.0-cdh5.13.0.jar
   - HiveJDBC4.jar
   - hive-metastore-1.1.0-cdh5.13.0.jar
   - hive-service-1.1.0-cdh5.13.0.jar

2. Place the jars in `<FCC_STUDIO_INSTALLATION_PATH>/batchservice/lib/`.

3. Navigate to `<FCC_STUDIO_INSTALLATION_PATH>/batchservice/bin` and modify the `batchservice` file by adding the following code to the existing classpath:

```
:$APP_HOME/lib/hive-exec-1.1.0-cdh5.13.0.jar:$APP_
HOME/lib/hive-metastore-1.1.0-cdh5.13.0.jar:$APP_
HOME/lib/hive-service-1.1.0-cdh5.13.0.jar:$APP_HOME/lib/HiveJDBC4.jar
```

> **Note:** If the server is already started and running then you must restart the server again.

## Performing Data Movement and Graph Load

> **Note:** Before running the `FCCM_Studio_SqoopJob.sh` ensure that the spark `classpath` does not contain `log4j jar` files. If it contains the `log4j jar` files, remove the following jars present in the path `<PGX installed path>/pgx-3.1.2/lib`

To perform Data Movement and Graph Load, follows these steps:

1. Execute the `FCCM_Studio_SqoopJob.sh` file with the required parameters as follows:

```
./FCCM_Studio_SqoopJob.sh <Batch Name> <Batch ID> EXEC <FIC_MIS_Date>
SNAPSHOT_DT=<SNAPSHOT_Date>,DATAMOVEMENTCODE=ALL
```

# Oracle DB Data Movement

This section includes the following topics:

- Configuring Schema Creation
- Performing Data Movement
- Creating and Loading Graph

> **Note:** If `STUDIO_DB_USERNAME` and `BD_ATOMIC_USERNAME` are same, then the steps to configure schema creation and perform data movement must not be performed.

## Configuring Schema Creation

To configure Schema Creation, follow these steps:

1. Set `FIC_DB_HOME` path to `<FCC_STUDIO_INSTALLATION_PATH>/ficdb` in`.profile`.

2. Copy all the jar files located in the `<FCC_STUDIO_INSTALLATION_PATH>/ficdb/lib` path to the `<OFSAA_FIC_HOME_PATH>/ficdb/lib` path.

3. Create tables in Oracle DB Studio Schema by executing the following shell script in `<FCC_STUDIO_INSTALLATION_PATH>/ficdb/bin` location:

```
./FCCM_Studio_SchemaCreation.sh ORACLE
```

This creates tables in the Studio Schema.

## Performing Data Movement

To perform Data Movement, follows these steps:

1. Go to the `<FCC_STUDIO_INSTALLATION_PATH>/ficdb/bin/` path.

2. Provide select grant from the Source Atomic Schema as follows:

   ```
   GRANT select ON <TABLE NAME> to <STUDIO SCHEMA NAME>;
   ```

   > **Note:**
   >
   > - The Table Name can be obtained from the `SCHEMA_SRC_OBJ_NAME` column of the `fcc_datastudio_schemaobjects` table.
   > - Ensure to provide Grants to any newly added tables as well.

3. Execute the `FCCM_Studio_DB_DataMove.sh` file with the required parameters as follows:

   ```
   ./FCCM_Studio_DB_DataMove.sh <Batch Name> <Batch ID> EXEC <FIC_MIS_
   Date> SNAPSHOT_DT=<SNAPSHOT_Date>,DATAMOVEMENTCODE=ALL or <Data
   Movement Code of a Table>
   ```

   > **Note:** • `DATAMOVEMENTCODE` of each table can be found in the `DMCODE` column of the `FCC_DM_DEFINITION`.
   >
   > - If you want to load data in slices, then perform the following manual steps:
   >
   >   1. Login to Studio Schema.
   >
   >   2. Modify the `FCC_DM_DEFINITION` table by adding the filter value, `DATA_DUMP_ DT=$MISDATE` in the `V_SRC_FILTER` column.
   >
   >   3. Ensure this field is added to all the rows in which you want to filter the data.

## Creating and Loading Graph

To create and load graph, follow these steps:

1. Go to the `$FIC_DB_HOME/bin`.

2. Execute `./FCCM_Studio_GraphLoad.sh <Batch Name> <Batch ID> EXEC <FIC_ MIS_Date> SNAPSHOT_DT=<SNAPSHOT_Date>`.

# Enabling VPD

To Enable VPD, enter the following in the Studio schema table *FCC_GROUPFILTER*:

1. **GroupCode** must be the same group code as defined in *csms_group_master*.

2. **GroupFilter** must be a username and the user should be mapped to a specific jurisdiction.

3. **Jurisdiction** is a user defined value and must be set as required. For example, US or AMEA.

## Configuring PGX

To configure PGX, follow below steps:

1.  Navigate to the `<FCC_STUDIO_INSTALLATION_PATH>/pgx/server/` path.

2.  Unzip the `pgx-distribution-3.1.2-server.zip` folder.

3.  Go to `<FCC_STUDIO_INSTALLATION_PATH>/pgx/server/pgx-3.1.2/conf` path.

4.  Configure the following properties as per the requirement:

    In `server.conf` file:

    `enable_tls: false,`

    `enable_client_authentication: false`

    In `pgx.conf` file:

    `allow_local_filesystem": true`

    Here, true is to enable, and false is to disable.

5.  Navigate to `<FCC_STUDIO_INSTALLATION_PATH>/pgx/javaclient`.

6.  Unzip the `pgx-distribution-3.1.2-java-client.zip` file.

7.  Copy the `pgx-3.1.2` directory from the `<FCC_STUDIO_INSTALLATION_PATH>/pgx/javaclient/` and paste it to any location inside the node servers, and set this location as `PGX_HOME`.

    > **Note:** Ensure that the location where you have placed the `pgx-3.1.2` directory is same across all node servers.

    For example, If you have placed the `pgx-3.1.2` directory in `/scratch/user/pgx-client/` location, then the `PGX_HOME` path will be as follows:

    `PGX_HOME=/scratch/user/pgx-client/pgx-3.1.2/lib/*`

    This is performed to copy the PGX Client to all the nodes in the cluster.

8.  Set the values for the `SPARK_CLASSPATH` and `JAVA_HOME` parameters in the `spark-env.sh` file as follows:

    `export SPARK_CLASSPATH=<FCC_STUDIO_INSTALLATION_PATH>/pgx/javaclient/pgx-3.1.2/lib/*:$HADOOP_CONF_DIR`

    `export JAVA_HOME=<JAVA_INSTALLED_PATH>/jdk1.8.0_101`

9.  Place the `ojdbc7` jar file in the `<Cloudera_Installation_Path>/sqoop/jars` path.

## Starting Studio Services

Start the Studio services in the order mentioned in Appendix B, "Starting/Stopping Infrastructure Services".

You can now view the Studio interface. You can access the Studio application from the URL as follows:

`http://<HOST>:7008`

# A

# Tables and Sequences

The list of tables and sequences that are to be dropped during reinstallation of the Studio application are as follows:

This section includes the following:

- Studio Schema Tables and Sequences
- BD Atomic Schema Tables and Sequences
- BD Config Schema Tables

## Studio Schema Tables and Sequences

The following tables include the details of the Studio Schema tables and sequences that have to be dropped during reinstallation of the Studio application.

*Table A–1   Studio Schema Tables*

| Tables | | |
|---|---|---|
| DATABASECHANGELOG | FCC_DM_AUDIT | FCC_ OPERATIONDETAIL |
| DATABASECHANGELOGLOCK | FCC_DM_DEFINITION | FCC_OPERATIONSET |
| FCCMSTUDIO_PATCHES | FCC_DM_ERROR_ DETAILS | FCC_PGBCONFIG_ DETAILS |
| FCC_ATTRCOL_MAP | FCC_DM_FIELD_ MAPPING | FCC_PIPELINE |
| FCC_ATTRIBUTE | FCC_EXPRESSION | FCC_PIPESTAGEMAP |
| FCC_ATTRIBUTES | FCC_FILTERS | FCC_PROPERTY |
| FCC_ATTRIBUTESET | FCC_ FINALEDATAFRAME_ QUERY | FCC_STAGES |
| FCC_BATCH_RUN | FCC_GRAPH | FCC_STUDIO_ OBJECTCREATION |
| FCC_COLS | FCC_GRAPH_EDGE | FCC_TABLES |
| FCC_DATAFRAME | FCC_GRAPH_NODE | FCC_TABLESET |
| FCC_DATAMOVEMENT_ MASTER | FCC_GRAPH_ PROPALIASNAME | FCC_USER_SESSION_ MAPPING |
| FCC_DATASET | FCC_GRAPH_PROP_ ALIAS | FCC_AM_EVENTS |

*Table A–1   Studio Schema Tables*

| Tables | | |
|---|---|---|
| FCC_DATASETS | FCC_GRAPH_QUERY | FCC_AM_EVENT_BINDING |
| FCC_DATASET_SESSION_MAPPING | FCC_GROUPFILTER | FCC_AM_EVENT_DETAILS |
| FCC_DATASTUDIO_BATCH | FCC_GROUPFILTER_MAP | FCC_AM_EVENT_ENTITY_MAP |
| FCC_DATASTUDIO_CONFIG | FCC_INPUTDSSET | |
| FCC_DATASTUDIO_SCHEMAOBJECTS | FCC_JOIN | |

*Table A–2   Studio Schema Sequences*

| Sequences | | |
|---|---|---|
| CM_BATCH_DETAIL_SEQ | FCC_SEQUENCES_EVENT_CD | FCC_TEMP_TABLE_SEQ |
| CM_BATCH_RUN_SEQ | FCC_SEQUENCES_RUN_ID | |

# BD Atomic Schema Tables and Sequences

The following tables include the details of the BD Atomic Schema tables and sequences that have to be dropped during reinstallation of the Studio application.

*Table A–3   BD Atomic Schema Tables*

| Tables | | |
|---|---|---|
| DATABASECHANGELOG | FCC_GROUPFILTER | FCC_AM_EVENT_BINDING |
| DATABASECHANGELOGLOCK | FCC_GROUPFILTER_MAP | FCC_AM_EVENT_DETAILS |
| SCNRO_NB_PUBLISH | FCC_AM_EVENTS | FCC_AM_EVENT_ENTITY_MAP |

*Table A–4   BD Atomic Schema Sequences*

| Sequences |
|---|
| SCNRO_NB_PUBLISH_SEQ |
| FCC_SEQUENCES_EVENT_CD |
| FCC_SEQUENCES_RUN_ID |
| FCC_TEMP_TABLE_SEQ |

# BD Config Schema Tables

The following tables include the details of the BD Config Schema tables and sequences that have to be dropped during reinstallation of the Studio application.

*Table A–5   BD Config Schema Tables*

| Tables |
| --- |
| DATABASECHANGELOG |
| DATABASECHANGELOGLOCK |

# B

# Starting/Stopping Infrastructure Services

This section details about how to start and stop the infrastructure services needed for OFS Crime and Compliance Studio application.

This section covers the following topics:

- Starting/Stopping Livy Service
- Starting/Stopping PGX Service

## Starting/Stopping Livy Service

The Livy service is installed with Cloudera.

To start the Livy service, navigate to the path where Livy service is installed and run the following:

```
./livy-server start
```

To stop the Livy service, navigate to the path where Livy service is installed and run the following:

```
./livy-server stop
```

## Starting/Stopping PGX Service

To start the PGX service, navigate to the path where PGX service is installed and run the following:

```
./start-server
```

The start service for PGX will be located in the path as follows:

```
<Studio_Installation_Path>/pgx/server/pgx-3.1.2/bin
```

To stop the PGX service, kill the process.

Once all the Services are up and running, Studio Application can be accessed with the following URL:

```
http://<HOST>:7008
```

# C

# JDBC Jar Files

## Overview

The `ojdbc<version>.jar` file should be copied based on the Oracle Database version and the supported Java (JDK/JRE) version. See the following table for details:

*Table C–1    JDBC Jar files version details*

| Oracle Database Version | JDK/JRE Version Supported | JDBC Jar files specific to the release |
|---|---|---|
| 12.1 or 12cR1 | JDK 8 and JDK 7 | ojdbc7.jar for JDK 7 and JDK 8 |

# D

# Setting Up Password Stores with Oracle Wallet

This section includes the following topics:

- Overview
- About Password Stores and Oracle Wallet
- Setting Up Password Stores for Database User Accounts

## Overview

As part of an application installation, administrators must setup password stores for database user accounts using Oracle Wallet. These password stores must be installed on the application database side. While the installer handles much of this process, the administrators must perform some additional steps.

A password store for the application and application server user accounts must also be installed; however, the installer takes care of this entire process.

## About Password Stores and Oracle Wallet

Oracle databases have allowed other users on the server to see passwords in case database connect strings (user name/password@db) were passed to programs. In the past, users could navigate to ps -ef | grep <username> and see the password if the password was supplied in the command line when calling a program.

To make passwords more secure, sensitive information such as user credentials now must be encrypted and stored in a secure location. This location is called password stores or wallets. These password stores are secure software containers that store the encrypted user credentials.

Users can retrieve the credentials using aliases that were set up when encrypting and storing the user credentials in the password store. For example, if username/password@db is entered in the command line argument and the alias is called db_username, then the argument to a program would be the following: sqlplus /@db_username

This would connect to the database as it did previously, but it would hide the password from any system user. After this is configured, as in the previous example, the application installation and the other relevant scripts are no longer need to use embedded usernames and passwords. This reduces any security risks that may exist because usernames and passwords are no longer exposed.

When the installation starts, all the necessary user credentials are retrieved from the Oracle Wallet based on the alias name associated with the user credentials. There are two different types of password stores or wallets. One type is for database connect

strings used in program arguments (such as sqlplus /@db_username). The other type is for java application installation and application use.

# Setting Up Password Stores for Database User Accounts

After the database is installed and the default database user accounts are set up, administrators must set up a password store using the Oracle Wallet. This involves assigning an alias for the username and associated password for each database user account. The alias is used later during the application installation. This password store must be created on the system where the application server and database client are installed.

This section describes the steps you must take to set up a wallet and the aliases for the database user accounts. For more information on configuring authentication and password stores, refer to the Oracle Database Security Guide.

> **Note:** In this section, `<wallet_location>` is a placeholder text for illustration purposes. Before running the command, ensure that you specify the path to the location where you want to create and store the wallet.

Perform the following steps to set up a password store for the database user accounts:

1. Create a wallet using the following command:

   ```
   mkstore -wrl <wallet_location> -create
   ```

   After you run the command, a prompt appears. Enter a password for the Oracle Wallet in the prompt.

   > **Note:** The mkstore utility is included in the Oracle Database Client installation.

   The wallet is created with the auto-login feature enabled. This feature enables the database client to access the wallet contents without using the password. For more information, refer to the Oracle Database Advanced Security Administrator's Guide.

2. Create the database connection credentials in the wallet using the following command:

   ```
   mkstore -wrl <wallet_location> -createCredential <alias-name>
   <database-user-name>
   ```

   Run the above command for the following <alias-name>:

   - BD_Config_Schema

   - BD_Atomic_Schema

   - Studio_Schema

   After you run the command, a prompt appears. Enter the password associated with the database user account in the prompt.You are the prompted to re-enter the password. Then you are prompted for the wallet password used in Step 1.

3. Repeat step 2 for all the database user accounts.

**4.** Update the tnsnames.ora file to include the following entry for each alias name to be set up.

```
<alias-name> =

(DESCRIPTION =

(ADDRESS_LIST =

(ADDRESS = (PROTOCOL = TCP) (HOST = <host>) (PORT = <port>))

)

(CONNECT_DATA =

(SERVICE_NAME = <service>)

)

)
```

> **Note:** You can either update the existing tnsnames.ora file with the above details or create a new tnsnames.ora file and make required entries.

# E

# Installing RServe Manually

## Overview

You must install Rserve manually on a host to expose the local R installation on that host to the network, so that remote Rserve clients such as the R interpreter can use the local R installation.

The R interpreter always connects to an Rserve instance and runs the R code remotely. The interpreter needs to be configured with the hostname or IP and the port of the remote instance (where Rserve is running). When the interpreter is initialized, it connects to the remote instance.

This section includes the following topics:

- Prerequisites
- Installing Rserve
- Configuring Rserve
- Starting Rserve
- Adding the Certificate to the Keystore
- Installing Additional Libraries

## Prerequisites

The following are list of prerequisites required before beginning the installation of RServe:

- Ensure that Oracle Linux 7.x and Oracle JDK 8 are validated against Oracle Linux 7.4 and Oracle JDK 8u161.
- The user must be a root user.
- 800 MB disk space is required for package installation.

The following subsections provide more details for prerequisites:

- Install Oracle R Distribution
- Install Dependencies
- Install ORE Client

### Install Oracle R Distribution

To install the Oracle R Distribution (ORD), enable the **addons** and **optional_latest** channels in yum as shown in the following:

```bash
(root)# yum-config-manager --enable ol7_addons
(root)# yum-config-manager --enable ol7_optional_latest
```

After the completing the previous step, pull ORD from the yum repository using the following command:

```bash
(root)# yum install R.x86_64 R-core-extra
```

To install ORD, see https://docs.oracle.com/cd/E83411_01/OREAD/installing-R-for-ORE.htm#OREAD129.

## Install Dependencies

Rserve has certain dependencies to run correctly. The **openssl-devel** is required for SSL support. The dependencies change based on the libraries you have installed. For example, to let **knitr** send plots as **base64 encoded** strings, you require **pango-devel**.

The following dependent packages must be installed for Rserve to support SSL:

```bash
(root)# yum install openssl openssl-devel pango-devel
```

## Install ORE Client

To connect to ORE through Rserve:

- Install the corresponding client libraries. For more information, see https://docs.oracle.com/cd/E83411_01/OREAD/installing-ORE-client.htm#OREAD167 from the ORE project.

- The knitR and PrintR packages must be installed.

# Installing Rserve

To install Rserve, call the following code in your R shell:

```R
> install.packages('Rserve', repos='https://www.rforge.net/')
```

If you are behind a proxy, ensure that R is communicated about it when you start the R shell.

For example, you can start R shell as shown in the following before installing any package:

```bash
$ http_proxy=http://your-proxy:80 R
```

# Configuring Rserve

You can base your config on the following example configuration, which you should store in a `Rserve.conf` file. You will require `Rserve.conf` as reference when you start Rserve.

```
```

auth required

plaintext disabled

pwdfile /path/to/Rserve.pwd

remote enable

switch.qap.tls enable

tls.port 6311

qap disable

interactive no

rsa.key /path/to/server.key

tls.key /path/to/server.key

tls.cert /path/to/server.crt
```

This configuration tells Rserve to encrypt the communication with TLS and listen for incoming connections on port **6311**. The `Rserve.pwd` file appears as shown in the following:

```
```

exampleuser $5baa61e4c9b93f3f0682250b6cf8331b7ee68fd8

```
```

The file contains one line per user, where the first part is the username and the second part is the password. The password can either be plain text or a **MD5/SHA1** hash. In this example the password `password` is hashed with SHA1. If you use hashed passwords, the password must start with a `$` sign.

The `rsa.key,` `tls.key` and `tls.cert` settings point to the private key files you require for TLS. These keys can be generated using the **openssl** command line tool as shown in the following example:

```bash
$ openssl genrsa -out server.key 2048

$ openssl req -new -key server.key -out server.csr

$ openssl x509 -req -days 265 -in server.csr -signkey server.key -out
server.crt
```

The preceding sample is an example and for a production deployment, you should use relevant certificates. You can find more information about configuration options on the Rserve homepage - https://www.rforge.net/Rserve/doc.html.

## Starting Rserve

After installing Rserve and placing configuration files in correct location, start the Rserve as shown in the following:

````bash

$ R CMD Rserve --no-save --RS-conf /path/to/Rserve.conf
````

The Rserve starts in the background. Once started, the R Interpreter will be able to connect to it. The Rserve process is running before you start the R Interpreter.

## Adding the Certificate to the Keystore

The certificates that were generated in the previous step to configure Rserve to encrypt the communication must be added to the Java keystore in order to be used by the R interpreter. The add procedure depends on your setup.

Add the certificate to a keystore as shown in the following:

```bash

$ $JAVA_HOME/bin/keytool -import -alias rserve -file /path/to/server.crt -keystore /path/to/keystore-storepass storepassword -noprompt
```

The certificate must be imported correctly and the correct keystore is used by the Java process you use to start the R interpreter. Else you will get SSL related exceptions when the interpreter attempts to connect to Rserve.

You can specify the keystore when starting the R interpreter as shown in the following example:

````bash

$ $JAVA_HOME/bin/java -Djavax.net.ssl.trustStore=/path/to/keystore -

Djavax.net.ssl.trustStorePassword=storepassword <additional paramters>
```

## Installing Additional Libraries

Depending on your use case, you must install further R libraries. For example, you can install **knitr** or **ggplot2**, in the same manner that you installed Rserve previously. You can use *package.install* within your R shell to perform the installation.

For example:

```R

> install.packages('knitr')
```