Machine Learning Installation Manual
Oracle FLEXCUBE Investor Servicing
Release 12.4.0.11.6

[Oct][2019]

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1 Glossary:

Abbreviation	Detailed Description
FCIS	**Oracle FLEXCUBE Investor Servicing**
ML	**Machine Learning**
LTV	**Life Time Value**
ORE	**Oracle R Enterprise**
IDE	**Integrated Development Environment**

2 Introduction:

This document contains detailed guidelines to install Oracle FLEXCUBE Investor Servicing Machine Learning framework.

***Note**: Please refer Oracle FLEXCUBE Investor Servicing Machine Learning User Manual for Model execution and control*

3 Application Compatibility:

3.1 Oracle FLEXCUBE Investor Servicing

Version: 12.4.0.11.6

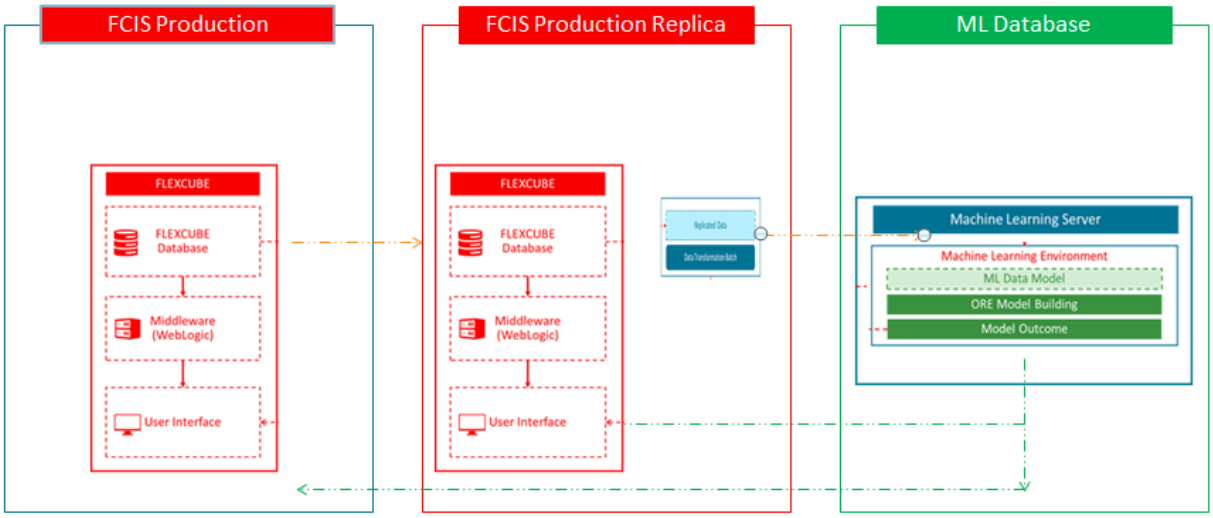
3.2 Oracle R Enterprise (ORE)

- All the Machine Learning models were built using Oracle R Enterprise 1.5.1
- For installation and setup please refer to the guidelines received with the licensed version of Oracle R Enterprise Software.
- Oracle Enterprise Linux server 7.1 (x86 64 bit)

3.3 Machine Learning Database

- Oracle Database 18c

4 Oracle FLEXCUBE Machine Learning Architecture



Note:

i. FLEXCUBE Investor Servicing replicated database and Machine learning database should be on two different servers

ii. This is to ensure that the machine learning workload is not on the critical path of banking operations and hog critical server memory

5 Pre-Installation Checklist:

5.1 FLEXCUBE Investor Servicing replicated Database Instance

- FLEXCUBE Investor Servicing replicated database instance should be up and available.

5.2 Machine Learning Database Instance

Note: ORE database MUST be a separate instance from Oracle FLEXCUBE Investor Servicing replicated Instance. This is to ensure that the machine learning workload is not on the critical path of banking operations and hog critical server memory

Please follow the sequential steps are detailed below.

1) Install Oracle Database on the Machine Learning server. Refer to 3.3 for compatible database versions**.**

2) Oracle R Enterprise should be installed in Machine Learning database server. Please refer 3.2 for compatible ORE version.

3) For ORE installation and setup please refer to the guideline received with licensed version**.**
4) R Client needs to be installed to access Oracle R Enterprise server from client machine. R client could be open source R or Oracle R Distribution. Below are the links to install the same.

    a. Open source R: https://cran.r-project.org/bin/windows/base/
    b. Oracle R Distribution (ORD): https://oss.oracle.com/ORD/

5) RStudio IDE can be installed for developer friendly environment. Below is the link to download RStudio. Download the version based on the operating system in client machine https://www.rstudio.com/products/rstudio/download/#download

6) Set up Oracle R Enterprise client in client machine. Please refer to the guideline received with licensed version.

5.3 Data Replication

FCIS Data replication will happen on the production replica environment which will be on separate server.

It is left to the bank/solution team to decide on the data Replication Software including the mode of replication and frequency of replication

Please ensure FLEXCUBE Investor Servicing data is already replicated into the Machine Learning Schema, before proceeding ahead with the Installation

6 Installation Steps:

To proceed with the installation steps first check if all the checkpoints mentioned in section **Pre-Installation Checklist** are met. Follow below steps sequentially for the installation**.**

6.1 Machine Learning Instance

6.1.1 Object Summary

No.	OBJECT TYPE	COUNT
1	TABLES	9
2	PACKAGE SPECIFICATION(SPC)	1
3	PACKAGE BODY (SQL)	1
4	R BINARY PACKAGES (ORE)	2
5	R WRAPPER SCRIPT (ORE)	1
	Total Object Count	**14**

6.1.2 User Creation and granting privileges

6.1.2.1 Create User

Log in to the Machine Learning database with SYSDBA credentials and execute below query to create a machine learning user.

CREATE USER <*username*> IDENTIFIED BY <*password*>;

If the user has been already created at the time of ORE installation, then proceed to next step

6.1.2.2 Give necessary privileges

Grant the below privileges to the machine learning user created in the previous step (6.1.2.1)

i. **grant CONNECT,ODMRUSER,RQADMIN TO <*username*>;**
ii. **grant CREATE SESSION to <*username*>;**
iii. **grant CREATE TABLE to <*username*>;**
iv. **grant CREATE VIEW to <*username*>;**
v. **grant CREATE DATABASE LINK to <*username*>;**
vi. **grant CREATE MINING MODEL to <*username*>;**
vii. **grant CREATE PROCEDURE to <*username*>;**
viii. **grant CREATE JOB to <*username*>;**

6.1.3 Installation of Database Objects

6.1.3.1 Login to the Machine Learning schema

Connect using the user credentials defined in step (6.1.2.1)

6.1.3.2 Execute DDL scripts

Execute the DDL scripts mentioned in section *Machine Learning Data Model* . Below are the DDL scripts (8 Tables)

1. MLTB_FCIS_INVACC_CHURN.ddl
2. MLTB_FCIS_INCH_PROCESSSTATUS.ddl
3. MLTB_FCIS_INCH_RISK_CAT.ddl
4. MLTB_FCIS_INCH_SEG.ddl
5. MLTB_FCIS_INVACC_CHURN_HIST.ddl
6. MLTB_FCIS_FUND_MASTER.ddl
7. MLTB_FCIS_INCH_SEG_HIST.ddl
8. MLTB_FCIS_INCH_RISK_CAT_HIST.ddl

6.1.3.3 Execute the VIEW scripts

Not Applicable.

6.1.3.4 Execute the INSERT Scripts

Not Applicable.

6.1.3.5 Execute Sequence Scripts

Not Applicable.

6.1.3.6 Create PROCEDURE

Not Applicable.

6.1.3.7 Create PACKAGES

Compile the SQL script(s) mentioned in section *Machine Learning Data Model* . Below are the SQL script(s) for creating package specification(s) and body (One SPC and one SQL)

1. MLPKS_PROCESSOR.SPC
2. MLPKS_ PROCESSOR.SQL

6.1.3.8 Create FUNCTION

Not Applicable.

6.1.4 Installation of ORE packages

6.1.4.1 Download ML binary packages.

There will be two binary packages, one for the global function and another one for FCIS.

Linux Binary Packages:

1. globalfunction_0.1.0_R_x86_64-pc-linux-gnu.tar.gz
2. FCISML_0.1.0_R_x86_64-pc-linux-gnu.tar.gz

6.1.4.2 Check the user access and environment variables.

Usually those things are already set up while installing ORE in the server

The user should have the following access rights

- *Has sudo rights access or root access for installing Oracle R Distribution.*
- *Is a member of the dba group for installing and using Oracle R Enterprise*
- *Has write access to $ORACLE_HOME/lib.*

The following environment variable should be set up…

- *$ORACLE_SID specifies the identifier (SID) of the database.*
- *$ORACLE_HOME specifies the home directory of the database.*
- *$LD_LIBRARY_PATH includes $ORACLE_HOME/lib.*
- *$PATH includes $ORACLE_HOME/bin.*

6.1.4.3 Now install the packages in the server by executing following command.

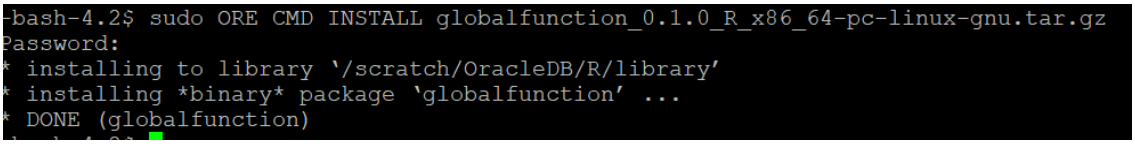
Use sudo command in case current user does not have write access to the ORE library folder

ORE CMD INSTALL {package name}

E.g.

ORE CMD INSTALL globalfunction_0.1.0_R_x86_64-pc-linux-gnu.tar.gz

ORE CMD INSTALL FCISML_0.1.0_R_x86_64-pc-linux-gnu.tar.gz



```
-bash-4.2$ sudo ORE CMD INSTALL FCISML_0.1.0_R_x86_64-pc-linux-gnu.tar.gz
Password:
* installing to library '/scratch/OracleDB/R/library'
* installing *binary* package 'FCISML' ...
* DONE (FCISML)
```

6.1.4.4 After successful installation the packages will be present in ORE library path…

```
-bash-4.2$ cd /scratch/OracleDB/R/library
-bash-4.2$
-bash-4.2$ ll
total 92
drwxr-xr-x 9 db19c db19c 4096 Sep 18 07:55 arules
drwxr-xr-x 7 db19c db19c 4096 Sep 18 07:55 Cairo
drwxr-xr-x 7 db19c db19c 4096 Sep 18 07:55 DBI
drwxr-xr-x 6 root  root  4096 Sep 24 03:15 FCISML
drwxr-xr-x 6 root  root  4096 Sep 24 03:01 globalfunction
```

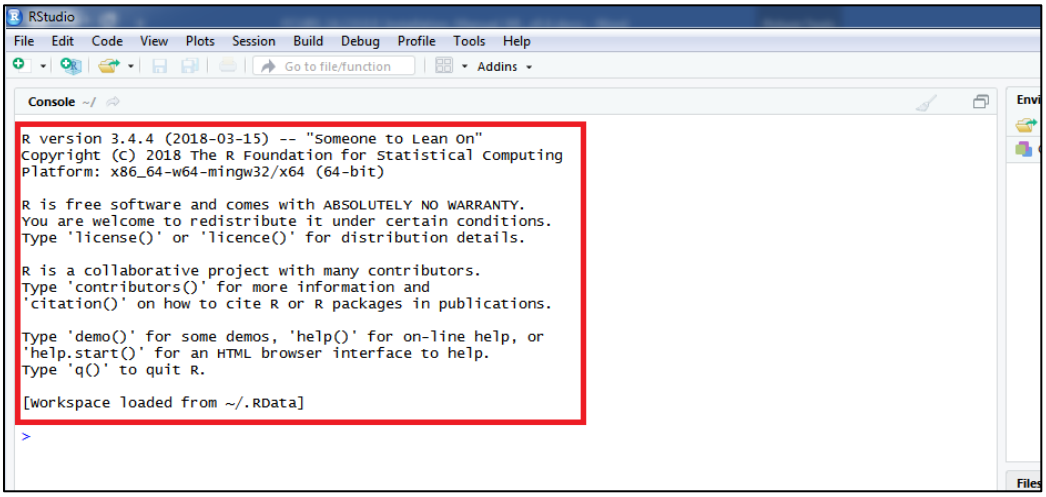
6.1.5 Installation of ORE wrapper scripts

Set up the ORE client softwares in client machine before proceeding. Please refer to the guidelines received with the licensed version.

6.1.5.1 Launch RStudio

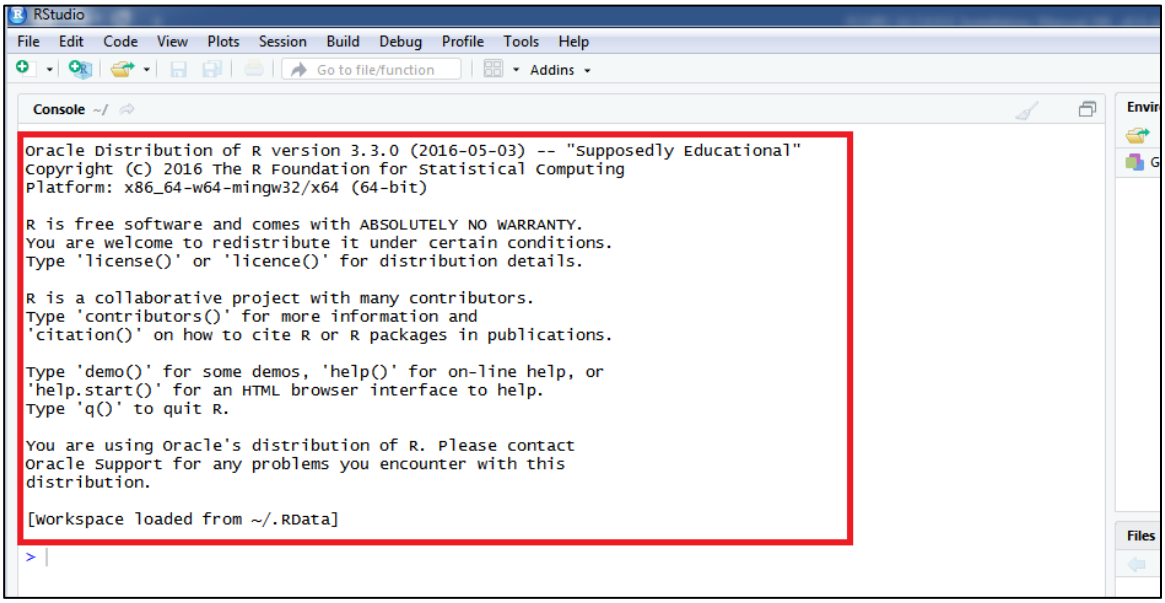
1. Launch RStudio IDE.
2. The default screen will be displayed as shown below.
3. If open source R is installed, then it will show the version of Open Source R

Open source R:



4. Or, if Oracle R Distribution (ORD) is used, it will show the version of ORD.

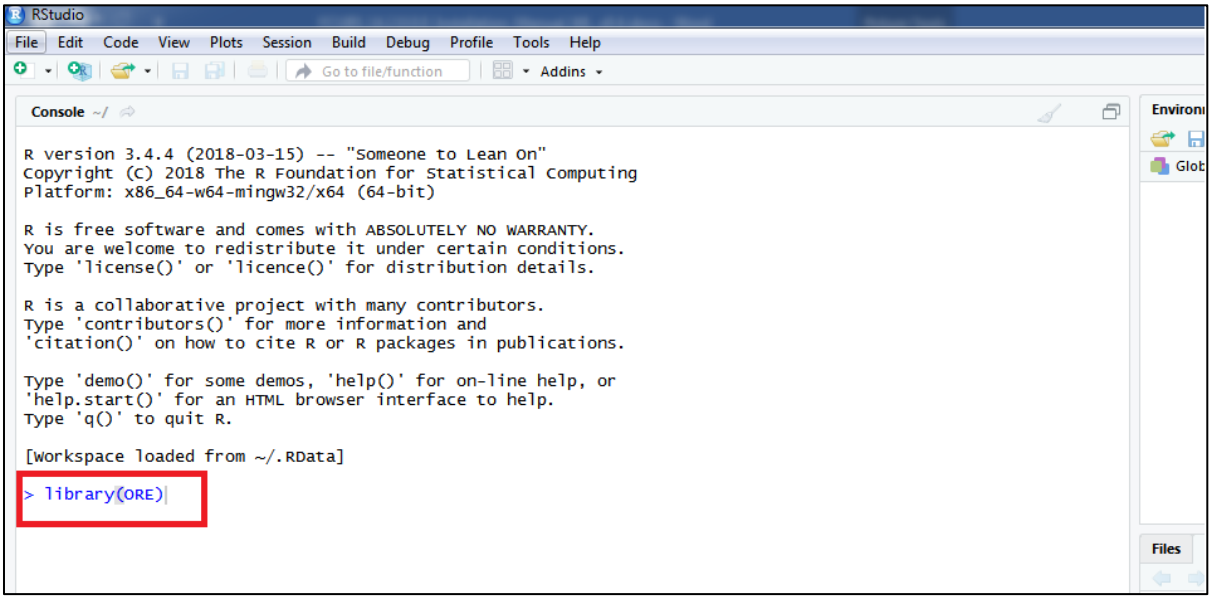
Oracle R Distribution (ORD):



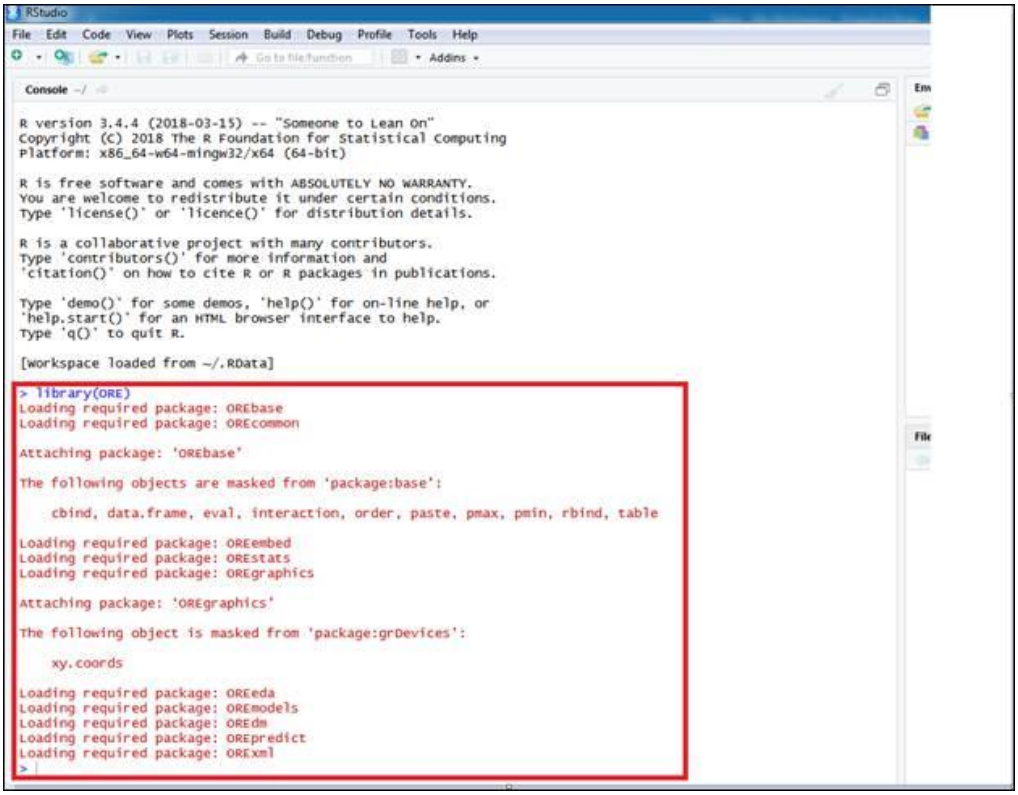
6.1.5.2 Loading ORE Library

1. From RStudio console execute below command

```
> library(ORE)
```



2. Once executed, it will show the following output in console

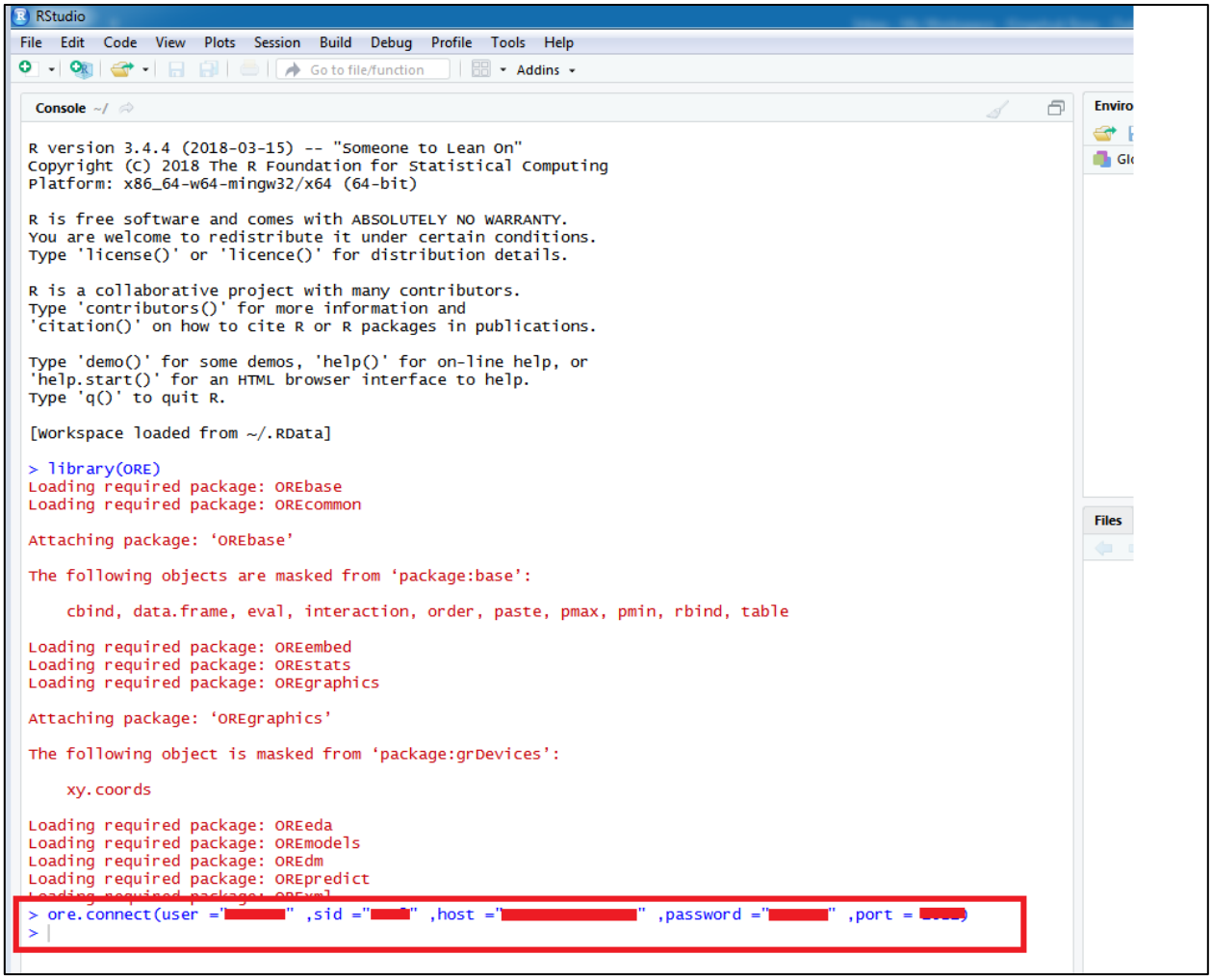


6.1.5.3 Connecting to the ORE Server

1. To connect ORE server from the client machine, execute below command.

   ore.connect (user = <username>, sid =<sid>, host =<hostname>, password=<password>, port = <port>)

Note: *The credential created in step 6.1.2.1*

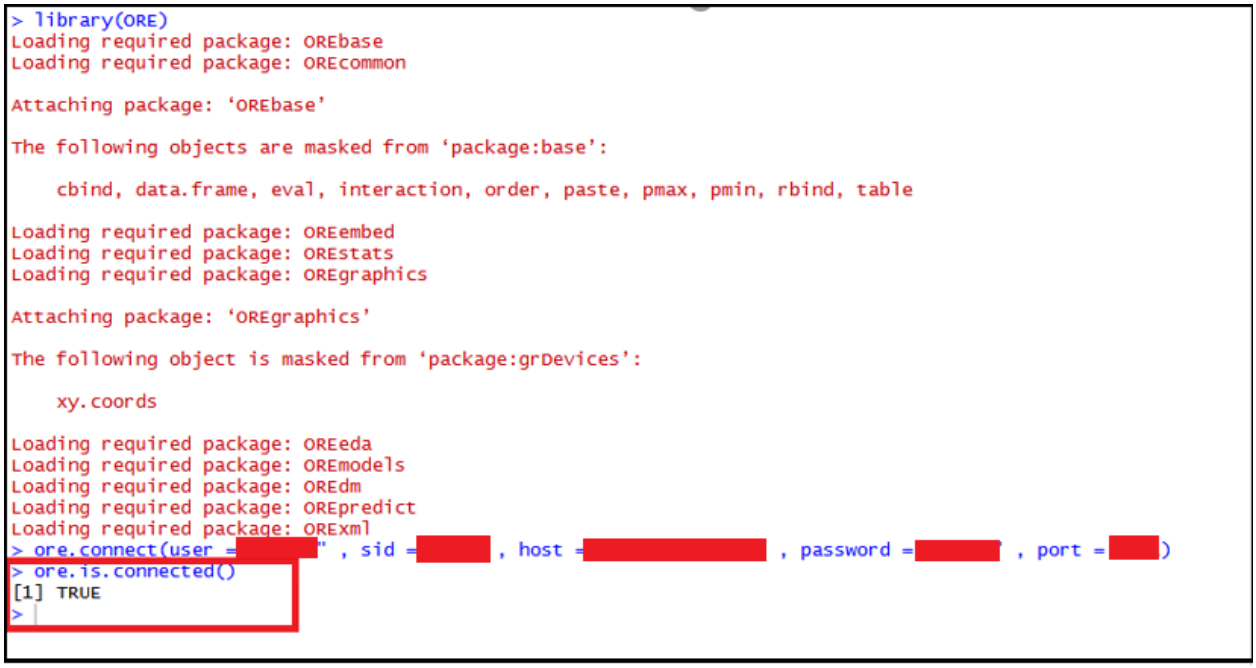


6.1.5.4 *Testing the ORE Connection:*

1. To check if ORE client is connected to ORE server, execute below command from RStudio console.

   ore.is.connected()

2. It should return TRUE if ORE connection is successful, otherwise it will return FALSE.



6.1.5.5 *Download the FCISML wrapper script and save it in a local directory.*

E.g. D:\FCIS

Script Name: **FCISML_0.1.0_WRAPPER_CUSTOM.R**

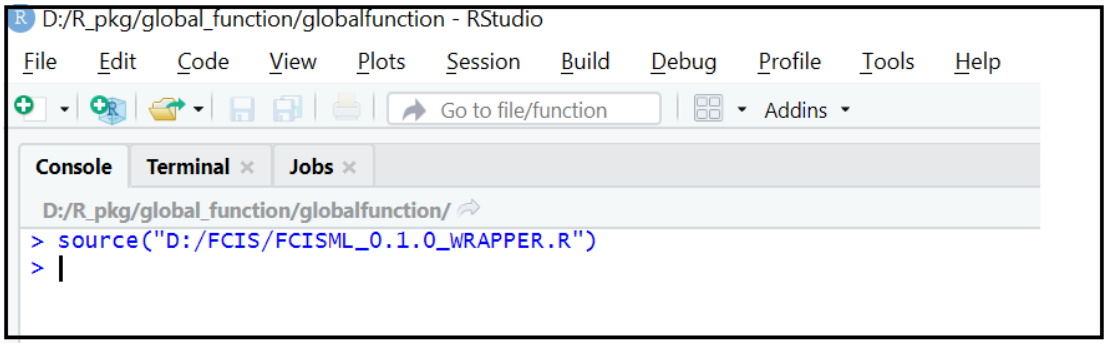
6.1.5.6 *Run ORE Wrapper Scripts:*

1. To run ORE scripts, execute below commands from Rstudio console

>source("<directory_path>/<filename.R>")

E.g. source("D:/FCIS/FCISML_0.1.0_WRAPPER_CUSTOM.R")

Note: Please note the forward slash ("/")



6.2 FLEXCUBE Investor Servicing Instance

6.2.1 Object Summary

No.	OBJECT TYPE	COUNT
1	Database Link	01
2	INC	02
3	Function IDs	04
	Total Object Count	**07**

6.2.2 Login to FLEXCUBE Investor Servicing Instance

Connect to the FLEXCUBE Investor Servicing Database using the required credentials

6.2.3 Database Link

1. The database link **MLFCISLINK** must point to the machine learning user
2. Edit the database link script **MLFCISLINK**.SQL with the machine learning user credentials created as part of section 6.1.2.1
3. Execute the modified script **MLFCISLINK** SQL

Note: Do not change the Database link name MLFCISLINK

6.2.4 Execute the INSERT scripts

Execute the INC scripts mentioned in section FLEXCUBE database objects, under section 5.1.2 below is the INC script(s) (one INC)

1. SMTB_FUNCTION_DESCRIPTION.INC
2. SMTB_MODULES.INC
3. SMTB_FCC_FCJ_MAPPING.INC
4. SMTB_ROLE_DETAIL.INC
5. ERTB_MSGS.INC
6. CSTB_LABELS.INC
7. CSTB_SUMMARY_INFO.INC

6.2.5 FLEXCUBE Investor Servicing User Interfaces

Please refer the standard Oracle FLEXCUBE Installation Manual for deploying these new user interface screens

1. MLDINCHP
2. MLDINCHB
3. MLDINCHS

6.3 Machine Learning Validation Checkpoints:

6.3.1 Validate Database Objects

1. Log in to the ML schema and run below SQL query

```
Select owner, object_name, object_type, status, created from all_objects
where object_name  like 'ML%'
 order by object_name;
```

2. The SQL query should return the following details.

OWNER	OBJECT NAME	OBJECT TYPE	STATUS	CREATED
< *Schema name*>	MLPKS_PROCESSOR	PACKAGE	VALID	Creation Date
< *Schema name*>	MLPKS_PROCESSOR	PACKAGE BODY	VALID	Creation Date
< *Schema name*>	MLTB_FCIS_FUND_MASTER	TABLE	VALID	Creation Date
< *Schema name*>	MLTB_FCIS_INCH_PROCESSSTATUS	TABLE	VALID	Creation Date
< *Schema name*>	MLTB_FCIS_INCH_RISK_CAT	TABLE	VALID	Creation Date
< *Schema name*>	MLTB_FCIS_INCH_RISK_CAT_HIST	TABLE	VALID	Creation Date
< *Schema name*>	MLTB_FCIS_INCH_SEG	TABLE	VALID	Creation Date
< *Schema name*>	MLTB_FCIS_INCH_SEG_HIST	TABLE	VALID	Creation Date
< *Schema name*>	MLTB_FCIS_INVACC_CHURN	TABLE	VALID	Creation Date
< *Schema name*>	MLTB_FCIS_INVACC_CHURN_HIST	TABLE	VALID	Creation Date
< *Schema name*>	MLVW_FCIS_INVACC_CHURN	VIEW	VALID	Creation Date
< *Schema name*>	MLVW_FCIS_INCH_RISK_CAT	VIEW	VALID	Creation Date
< *Schema name*>	MLVW_FCIS_INCH_SEG	VIEW	VALID	Creation Date
< *Schema name*>	MLVW_ISML_INVACC_CHURN	VIEW	VALID	Creation Date
< *Schema name*>	MLTB_MODEL_PERF_LOG	TABLE	VALID	Creation Date

6.3.2 Validate ORE scripts:

1. Log in to the Machine Learning schema and run below SQL query

```
select * from user_rq_scripts order by name;
```

2. The SQL query should produce following result

NAME	SCRIPT

NAME	SCRIPT
FCIS_FUND_SEG_ORE	<CLOB content>
FCIS_INVACC_CRN_ORE_BLD	<CLOB content>
FCIS_INVACC_CRN_ORE_EXE	<CLOB content>
FCIS_INVACC_SEG_ORE_BLD	<CLOB content>
FCIS_INVACC_SEG_ORE_EXE	<CLOB content>

6.4 FLEXCUBE Validation Checkpoints:

6.4.1 Validate Database Objects

1. Log in to the Flexcube schema and run below SQL query

```
Select owner, object_name, object_type, status, created from all_objects
where object_name  like 'ML%'
 order by object_name;
```

2. The SQL query should return 42 rows with the following details.

OWNER	OBJECT NAME	OBJECT TYPE	STATUS	CREATED
< *Schema name*>	**MLFCISLINK**	**DATABASE LINK**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHP_KERNEL**	**PACKAGE**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHB_MAIN**	**PACKAGE**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHP_UTILS**	**PACKAGE**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHP_MAIN**	**PACKAGE**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHB_KERNEL**	**PACKAGE**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHP_KERNEL**	**PACKAGE BODY**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHP_MAIN**	**PACKAGE BODY**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHP_UTILS**	**PACKAGE BODY**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHB_MAIN**	**PACKAGE BODY**	VALID	Creation Date
< *Schema name*>	**MLPKS_MLDINCHB_KERNEL**	**PACKAGE BODY**	VALID	Creation Date
< *Schema name*>	**MLTB_FCIS_INCH_RISK_CAT**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTB_FCIS_INCH_SEG**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTB_FCIS_INCH_RISK_CAT_HIST**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTB_FCIS_INCH_SEG_HIST**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTB_FCIS_INVACC_CHURN**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTB_FCIS_INVACC_CHURN_HIST**	**SYNONYM**	VALID	Creation Date

< *Schema name*>	**MLTB_FCIS_INCH_PROCESSSTATUS**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTB_FCIS_FUND_MASTER**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTBS_FCIS_INCH_RISK_CAT**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTBS_FCIS_INCH_SEG**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTBS_FCIS_INCH_RISK_CAT_HIST**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTBS_FCIS_INCH_SEG_HIST**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTBS_FCIS_INVACC_CHURN**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTBS_FCIS_INVACC_CHURN_HIST**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTBS_FCIS_INCH_PROCESSSTATUS**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTBS_FCIS_FUND_MASTER**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLPKSS_MLDINCHP_KERNEL**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLPKSS_MLDINCHB_MAIN**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLPKSS_MLDINCHB_KERNEL**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLPKSS_MLDINCHP_MAIN**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLPKSS_PROCESSOR**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLVW_FCIS_INVACC_CHURN**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLVW_FCIS_INCH_RISK_CAT**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLVW_FCIS_INCH_SEG**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLVWS_FCIS_INVACC_CHURN**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLVWS_FCIS_INCH_RISK_CAT**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLVWS_FCIS_INCH_SEG**	**SYNONYM**	VALID	Creation Date
< *Schema name*>	**MLTW_FCIS_INCH_TXNINFO_TEMP**	**TABLE**	VALID	Creation Date
< *Schema name*>	**MLTW_FCIS_INCH_RATE_TEMP**	**TABLE**	VALID	Creation Date
< *Schema name*>	**MLTW_FCIS_INCH_INVINFO_TEMP**	**TABLE**	VALID	Creation Date
< *Schema name*>	**MLTW_FCIS_INCH_JOBSTAT_TEMP**	**TABLE**	VALID	Creation Date

6.4.2 Validate database link credentials

1. Execute the following SQL query in FLEXCUBE database

   ```
   select Count(1) as COUNT from MLTB_FCIS_INCH_PROCESSSTATUS@FCISML
   ```

2. It should produce following result

COUNT
0

6.4.3 Validate FLEXCUBE menu

1. Execute the following SQL query in FLEXCUBE database

   ```
   select LANG_CODE,FUNCTION_ID,MAIN_MENU,SUB_MENU_1,SUB_MENU_2 ,
   RAD_FUNCTION_ID
   from smtb_function_description
   where function_id in ('MLDINCHP','MLSINCHP','MLDINCHB','MLSINCHS')
   ```

2. It should produce following result

LANG_CODE	FUNCTION_ID	MAIN_MENU	SUB_MENU_1	SUB_MENU_2	RAD_FUNCTION_ID
ENG	MLDINCHP	ML	Detail	Model Administration Detail	MLDINCHP
ENG	MLSINCHP	ML	Summary	Model Administration Summary	MLDINCHP
ENG	MLDINCHB	ML	Detail	Model Analysis Detail	MLDINCHB
ENG	MLSINCHS	ML	Summary	Customer Attrition Summary	MLSINCHS

Installer FCIS Machine Learning Setup
[Oct] [2019]
Version 12.4.0.11.6
Oracle Financial Services Software Limited
Oracle Park
Off Western Express Highway
Goregaon (East)
Mumbai, Maharashtra 400 063
India

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Fax: +91 22 6718 3001
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