Oracle Financial Services Model Management and Governance

User Guide

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Oracle Financial Services Model Management and Governance User Guide, Release 8.1.3.2.0

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About This Guide

This guide has information about configuring and publishing workspaces using the OFS Model Management and Governance application. Use it for information about workspace and model management or help with the processes in the application.

Audience

This document is intended for the system administrators and users configuring the workspace and models in OFS MMG.

See these Oracle resources:

- MMG Documentation Library
- How Oracle Financial Services Solves Real Business Problems

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Getting Started

This section gives an introduction to OFS Model Management and Governance and the requirements to use the application.

About this Guide

This guide has information about configuring and publishing workspaces using the OFS Model Management and Governance (MMG) application. The further sections in this guide provide information for the creation and deployment of models into production. Use it for information about workspace and model management or help with the processes in the application.

About Oracle Financial Services Model Management and Governance

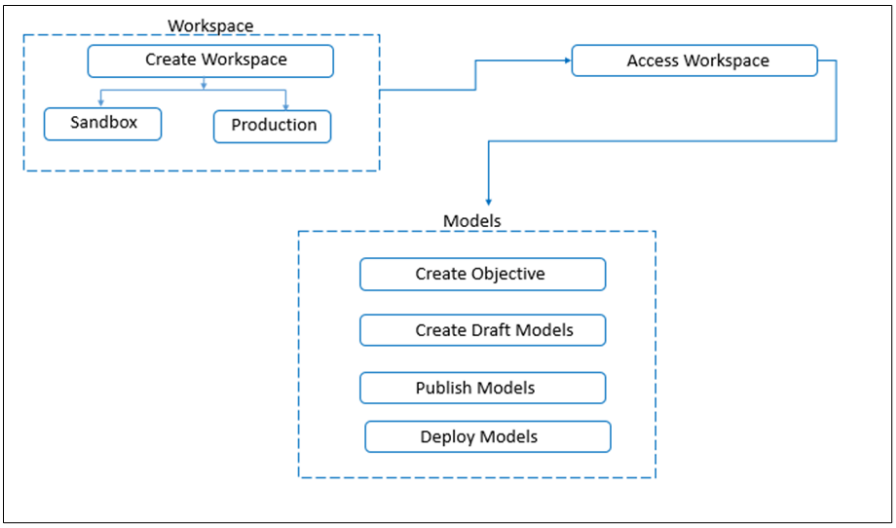
Financial Institutions require models that work on traditional statistical techniques, modern machine-learning methods, computational and simulation models. Oracle Financial Services Model Management and Governance leverage the Data Studio environment to develop, deploy, and manage models at the enterprise level.

The OFS Model Management and Governance application enables institutions to implement their IT policies while providing flexibility and freedom that Data Scientists and Statistical Modelers desire. OFS MMG's design facilitates financial institutions to manage external regulatory and internal governance policies by building testing models in a workspace environment. A workspace is provisioned and authorized for use (usually by an administrator) before making it available to modelers. Administrative users grant analysts and modelers access to workspaces along with a subset of production data to build models. Validated and approved models can then be promoted from workspaces to the enterprise model repository. Models in the repository can then be woven into analytical application flows crafted by mixing data management tasks, model execution, and deterministic business logic.

Workflow

The workflow involves the creation of workspaces and the creation of Models mapped to the Workspaces. Models are then configured as training models that you can use to perform model visualizations and test for the outcomes. You can then publish a model into production and make it available to users after you have determined that the models and the parameters used to construct the models meet the requirements of your business logic.

Figure 2-1 Oracle Financial Services Model Management and Governance Workflow



Components

The following are the components of Oracle Financial Services Model Management and Governance application:

- Workspace Management
- Model Management
- Datasets
- Model Pipelines
- Model Actions
- Graphs
- Scheduler Service
- Audit Trail
- Data Studio Options
- Object Migration
- Model Training
- Data Management

Workspaces

Workspace Management is where the workspace Administrators define datasets and make them available to modelers in Oracle Financial Services Model Management and Governance. It is an environment where the data is prepared for modelers to use in their modeling creation activity.

Workspaces are provisioned with the data required for modeling by the Administrators, who configure workspaces with subsets of production data. The data in the workspace is made available to modelers using datasets, who then build models. In effect, the data is ready for the modelers, and they do not have to undergo the arduous task of accessing and querying the database. See the Using Workspaces section for information on how to use Workspace Management in the application.

Datasets

Datasets allow for the creation of a dataframe, a data structure that captures the logic that organizes data into a 2-dimensional table of rows and columns. Datasets allow for the reuse of these dataframes across models, as well as the features derived from the data source(s).

The Dataset allows you to manage the entire operation related to data set. You can perform the following two things using the Dataset window:

- Define a metadata on how you want to create a dataset.
- In addition, a mechanism where you can take a snapshot of real time data and store it. So, it can be used later in the pipeline.

Model Pipelines

Modeling refers to the process of designing a prototype based on a structured data model, for statistical analysis and to simulate real events and processes. Models in a workspace can be created or modified by a user with access to the workspace. Model versions are preserved in the workspace along with execution and output histories. Once a model has been validated in the workspace and considered fit for use, modelers can request to push the model into the production environment.

> **Note**
>
> When you save a model pipeline in the **Pipeline Builder**, you can enter comments in the **Add** comments text box that appears in the **Save Pipeline** dialog box. Saved comments are available for review in the **Audit** tab (Audit panel) of the **Pipeline Builder**.

> **Note**
>
> The Add new pipeline field is added to set limits on memory usage by notebook session. When a user executes a pipeline, the memory limit will be applied. Ideally, the user should not consume the entire memory available. However, if they exceed the maximum memory limit, they will get a memory error.

Model Actions

The Model Actions window allows you to view the list of models for which the Workflow action has been taken which requires review or approve across the workspace.

Graphs

Unlike traditional relational database management systems, the Graph Pipeline feature allows you to view the data relationships in a graphical format.

This feature uses the latest technology to harness the power of Graph Analytics to give Financial Institutions the ability to monitor the data financial institutions effectively. The data is organized as nodes, relationships, and properties (property data is stored on the nodes or relationships). The results of analytics algorithms are stored as transient properties of nodes and edges in the Graph.

Scheduler Service

The Scheduler Service is a service in the Infrastructure system that automates behind-the-scenes work that is necessary to sustain various enterprise applications and functionalities. This automation helps the applications to control unattended background jobs program execution.

The Scheduler Service contains a graphical user interface and a single point of control for the definition and monitoring of background executions.

Scheduler Configuration/Admin UI

Audit Trail

The Audit Trail window provides the complete details of model. This shows the information such as, when Model was created, who created the Model, workflow of Model, for example, when this Model became champion or deployed, and so on.

Data Studio Options

The application's Notebook Server has the following configurable options:

- Interpreters
- Tasks
- Permissions
- Credentials
- Templates

To access the Data Studio Options page:

1. Click **Launch Workspace** to launch the workspace to display the **Dashboard** window with the application configuration and model creation menu.
2. Hover your mouse over the Data Studio Options widget . The following options are available:
    - Interpreters
    - Tasks
    - Permissions
    - Credentials
    - Templates

> **Note**
>
> DS 23.4.10 has introduced 'Select-Multiple' forms in Data Studio. The same should now be handled in MMG (parameters sets, dashboard, execute pipeline drawer, simulations, and so on).

Object Migration

Object Migration is the process of migrating or moving objects between environments.

You may want to migrate objects for several reasons such as managing global deployments on multiple environments or creating multiple environments so that you can separate the development, testing, and production processes.

Object Migration Rest Endpoints to support Migration of Object available in MMG

Table 2-1 Object Migration Rest Endpoints to support Migration of Object available in MMG

Sr No	Object Migration API	Technical Standards to Follow	Method	Endpoint	Sample Request	Sample Response
1	Save Export Definition	Headers: ofs_workspace_id ofs_remote_user locale (default set as en-US)	POST	/v1/public/migrate/export/outline	{ "migrationCode":"testexp42", "exportObjects": [{"objectCode":"TEST_population", "objectType":"BATCH" }]}	output success-> { "response": { "message": "Migration outline definition saved successfully." } } output failed -> { "migrationCode": "testexp42", "errorMessage": "objectCode/Type missing", "statusCode": "INVALID_INPUT", "status": "FAILED" }

Table 2-1 (Cont.) Object Migration Rest Endpoints to support Migration of Object available in MMG

Sr No	Object Migration API	Technical Standards to Follow	Method	Endpoint	Sample Request	Sample Response
2	Invoke Export	Headers: ofs_workspace_id ofs_remote_user locale (default set as en-US)	POST	/v1/public/migrate/export/{code}		`{ "response": { "message": "Object Migration Triggered Successfully" } }`
3	Save Import Definition	Headers: ofs_workspace_id ofs_remote_user locale (default set as en-US)	POST	/v1/public/migrate/import/outline	`{ "migrationCode":"imp1_exp41", "fileName":"TEST_TESTEXP41_06082024_680336", "code":"imp1_exp41" }`	`{ "response": { "message": "Migration outline definition saved successfully." } }`
4	Invoke Import	Headers: ofs_workspace_id ofs_remote_user locale (default set as en-US)	POST	/v1/public/migrate/import/{code}		`{ "response": { "message": "Object Migration Triggered Successfully" } }`

All APIs should be invoked through Gateway port, if enabled, and UI port, if not enabled. Auth should be the bearer token, which is same as OFS_AAI.

Use Bearer Token Authentication

We can execute these APIs: `https://[<mmg_ui_gateway_url/ui_url>/<contextname>/rest-api/v1/token|https://ofss-mum-1035.snbomprshared1.gbucdsint02bom.oraclevcn.com:6773/mmg8127/rest-api/v1/token]`

Basic Auth: `ofsauser/secret` (configured as properties in the `app.property` file)

Response:

`{"token_type":"Bearer","expires_in":3600,"token":"eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1NiJ9.eyJqdGkiOiJhZTZkNTUyMC0zYTQwLTRhMjctYTg1OC0yNzFmY2FjN2YzMWQiLCJpc3MiOiJPRlNBQSIsInN1YiI6Im9mc2F1c2VyIiwic3ViamVjdFR5cGUiOiJjbGllbnRJRCIsImlhdCI6MTc0MTA4MjQ4MCwiZXhwIjoxNzQxMDg2MDgwfQ.XqbtbZYqKnY1RQv4EW371iZHxrpNWBuNMX8ef161AhwKozc3qfYgLG3fXYfwrQhT9VdSUfoGu1-stdTYWIs2O3RtWBniuYyjkR5ghXCYwVkzypxmLALx6v8H3bl1g248GrNPZHTy1tgKfhYbDM-nCl5f__ztZh8I0IApA6xImRHFisd5MRv0dVvNn3vsdJd7onLgEQWnCEBGgT6HQ2QfuAECeulv5V4gtOlc`

```
Aib8BWoKJM-NCVPiov5uaDPYOklyMljdvA6z5Cmr6-
gOMWIjyX16GLtBSDgBAvsEopLznwnmiQLSEPwAnp8Y3KJZwQQVlS2zY033XDv9B8eufXkeOA"}

# save export definition eg:-[https://<mmg_ui_gateway_url/ui_url>/<contextname>|
https://host/]/v1/public/migrate/export/outline input json:

{ "migrationCode":"testexp42", "exportObjects":[ \
{"objectCode":"TEST_population", "objectType":"BATCH" } ]} headers:-
ofs_workspace_id (default set as TEST) ofs_remote_user (default set as aaaiuser)
locale (default set as en-US) output success-> { "response": \{ "message":
"Migration outline definition saved successfully." } } output failed -> \
{ "migrationCode": "testexp42", "errorMessage": "objectCode/Type missing",
"statusCode": "INVALID_INPUT", "status": "FAILED" }
```

Invoke Export

For example:`[https://<mmg_ui_gateway_url/ui_url>/<contextname>|https://host/]/v1/public/migrate/export/\{migrationCode} output-> { "response": \{ "message": "Object Migration Triggered Successfully" } } headers:- ofs_workspace_id (default set as TEST) ofs_remote_user (default set as aaaiuser) locale (default set as en-US)`

Save Import Definition

For example:`[https://<mmg_ui_gateway_url/ui_url>/<contextname>|https://host/]/v1/public/migrate/import/outline input Json:- \{ "migrationCode":"imp1_exp41", "fileName":"TEST_TESTEXP41_06082024_680336", "code":"imp1_exp41" } headers:- ofs_workspace_id (default set as TEST) ofs_remote_user (default set as aaaiuser) locale (default set as en-US) output success-> { "response": \\{ "message": "Migration outline definiton saved successfully." }`

```
}
```

Invoke Import

For example:`[https://<mmg_ui_gateway_url/ui_url>/<contextname>|https://host/]<context>/v1/public/migrate/import/\{migrationCode} headers:- ofs_workspace_id (default set as TEST) ofs_remote_user (default set as aaaiuser) locale (default set as en-US) output success->output-> { "response": \\ { "message": "Object Migration Triggered Successfully" }`

```
}
```

Object Migration REST APIs (MMG)

Object Migration enables moving MMG objects between environments (for example, DEV to UAT to PROD) to support controlled deployments and environment separation.

Base URL and Connectivity

All Object Migration APIs must be invoked by using the MMG base URL:

If the gateway is enabled, then use the gateway host and port.

If the gateway is not enabled, then use the MMG UI host and port.

Base URL format: `https://<MMG_SERVICE_HOST>:<MMG_GATEWAY_OR_UI_PORT>/<WEB_CONTEXT>/`

For example:`https://<host>:<port>/mmg8133/`

Authentication (Bearer Token same as OFS_AAI)

All migration APIs require Bearer token authentication, using the same token mechanism as OFS_AAI.

Get Bearer Token

Endpoint:`POST /rest-api/v1/token`

Authentication: Use the basic auth (client/user credentials configured in your deployment)

Example (curl):

```
curl -k -u "<CLIENT_ID>:<CLIENT_SECRET>" -X POST
"https://<MMG_SERVICE_HOST>:<MMG_GATEWAY_OR_UI_PORT>/<WEB_CONTEXT>/rest-api/v1/token"
```

Sample Response:

```
{
"token_type": "Bearer",
"expires_in": 3600,
"token": "<JWT_TOKEN_VALUE>"
}
```

Use the Token

For all Object Migration APIs, include:

Authorization: Bearer `<JWT_TOKEN_VALUE>`

Required Headers (All Object Migration APIs)

Include the following headers on every request:

ofs_workspace_id: `<WORKSPACE_ID>`

ofs_remote_user: `<REMOTE_USER>`

locale: `en-US (default)`

Also include standard headers as applicable:

Content-Type: `application/json`

Authorization: Bearer `<JWT_TOKEN_VALUE>`

Object Migration Endpoints

Save Export Definition

Creates an export outline definition (objects to export).

Method/Endpoint:`POST /v1/public/migrate/export/outline`

Request Body (example):

```
{
"migrationCode": "testexp42",
```

```
"exportObjects": [
{
"objectCode": "TEST_population",
"objectType": "BATCH"
}
]
}
```

Success Response (example):

```
{
"response": {
"message": "Migration outline definition saved successfully."
}
}
```

Failure Response (example):

```
{
"migrationCode": "testexp42",
"errorMessage": "objectCode/Type missing",
"statusCode": "INVALID_INPUT",
"status": "FAILED"
}
```

Example (curl):

```
curl -k -X POST
"https://<MMG_SERVICE_HOST>:
<MMG_GATEWAY_OR_UI_PORT>/<WEB_CONTEXT>/v1/public/migrate/export/outline"
-H "Authorization: Bearer <JWT_TOKEN_VALUE>"
-H "Content-Type: application/json"
-H "ofs_workspace_id: <WORKSPACE_ID>"
-H "ofs_remote_user: <REMOTE_USER>"
-H "locale: en-US"
-d '
{ "migrationCode": "testexp42", "exportObjects": [ { "objectCode":
"TEST_population", "objectType": "BATCH" }
]
}'
```

Invoke Export

Triggers export execution for a previously saved export definition.

Method/Endpoint:

```
POST /v1/public/migrate/export/
```

```
Where:
```

```
= migrationCode used in Save Export Definition
```

```
Success Response (example):
```

```
{
"response": {
"message": "Object Migration Triggered Successfully"
}
}
```

Example (curl):

```
curl -k -X POST
"https://<MMG_SERVICE_HOST>:
<MMG_GATEWAY_OR_UI_PORT>/<WEB_CONTEXT>/v1/public/migrate/export/testexp42"
-H "Authorization: Bearer <JWT_TOKEN_VALUE>"
-H "ofs_workspace_id: <WORKSPACE_ID>"
-H "ofs_remote_user: <REMOTE_USER>"
-H "locale: en-US"
```

Save Import Definition

Creates an import outline definition (dump file to import and import code).

Method/Endpoint:`POST /v1/public/migrate/import/outline`

Request Body (example):

```
{
"migrationCode": "imp1_exp41",
"fileName": "TEST_TESTEXP41_06082024_680336",
"code": "imp1_exp41"
}
```

Success Response (example):

```
{
"response": {
"message": "Migration outline definition saved successfully."
```

```
}
}
```

Example (curl):

```
curl -k -X POST
"https://<MMG_SERVICE_HOST>:
<MMG_GATEWAY_OR_UI_PORT>/<WEB_CONTEXT>/v1/public/migrate/import/outline"
-H "Authorization: Bearer <JWT_TOKEN_VALUE>"
-H "Content-Type: application/json"
-H "ofs_workspace_id: <WORKSPACE_ID>"
-H "ofs_remote_user: <REMOTE_USER>"
-H "locale: en-US"
-d '{
"migrationCode": "imp1_exp41",
"fileName": "TEST_TESTEXP41_06082024_680336",
"code": "imp1_exp41"
}'
```

Invoke Import

Triggers import execution for a previously saved import definition.

Method/Endpoint:`POST /v1/public/migrate/import/`

```
Where:
= migrationCode used in Save Import Definition
```

Success Response (example):

```
{
"response": {
"message": "Object Migration Triggered Successfully"
}
}
```

Example (curl):

```
curl -k -X POST
"https://<MMG_SERVICE_HOST>:
<MMG_GATEWAY_OR_UI_PORT>/<WEB_CONTEXT>/v1/public/migrate/import/imp1_exp41"
-H "Authorization: Bearer <JWT_TOKEN_VALUE>"
-H "ofs_workspace_id: <WORKSPACE_ID>"
```

```
-H "ofs_remote_user: <REMOTE_USER>"

-H "locale: en-US"
```

> **Note**
>
> Use the gateway port when the gateway is enabled; else use the UI port. Authorization must be the Bearer token (OFS_AAI token mechanism). Ensure that `ofs_workspace_id` and `ofs_remote_user` are correctly populated per your deployment conventions.

Model Libraries

The Model Library information is used to bind a particular technique and its details to one unique Model Library. The Starting point for the Model builder is to register a model library with MMG application after it is properly set up in the python environment to be used.

Model Techniques

Model Technique is the algorithm/technique used to create python model using the library/ package which was created in the Model Library Screen. It is the actual information captured in the MMG application that helps in training the model (Upload and Build).

Model Catalog

The Model Catalog page allows you to add and manage the Model Technique, Model Library, and Model Objectives. You can either import the models from external sources or create, train and label it as champion model.

Data Management

The Data Management module allows users to efficiently manage data stores within a workspace. It provides key features for importing both data models and data from Source Schemas. With features like Data Modelling and Data Population, users can replicate database structures, create data ingestion jobs, and schedule or manually run those jobs to bring in new data. This module simplifies schema integration, supports data migration, and ensures consistent data flow across environments.

Managing User Groups

Users must be mapped to User Groups that are mapped to access OFS MMG. The following subsections provide information about the user groups and roles required in addition to the information about configuring the user groups.

User Groups

The following table gives details about the User Groups in the Oracle Financial Services Model Management and Governance application.

Table 2-2 User Groups

User Group Name	User Group Description
IDNTYADMN	Identity Administrator group
IDNTYAUTH	Identity Authorizer group
MDLREV	The Modeling Reviewer Group. Users mapped to this group have access to the menu items in the OFS MMG application that are related to model review activities.
MDLAPPR	The Modeling Approver Group. Users mapped to this group have the rights to approve models created by the users.
MDLBATCHUSR	The Modeling Batch User. Scheduler can use this Group for executing batches.
WKSPADMIN	The Workspace Administrator Group. Users mapped to this group have access to create and populate workspaces. For vieweing the MMG landing page this group is required.
MDLUSR	The Modeling User Group. Users mapped to this group have access to all the menu items in the OFS MMG application that is related to model creation.
DSUSRGRP	Data Studio User Group This User Group provide access to modify Interpreter configurations.
DSREDACTGRP	Roles for applying redaction in graph. This group will be applicable to only those users for whom graph redaction is required.
OBJMIGADMIN	Users mapped to this group have access to Object Migration links and UI to perform import or export of objects.
GRPADMIN	The Graph Administrator Group. Users mapped to this group have access to all the menu items in the OFS MMG Application related to graph and Pipeline/Refresh graphs related health services.
GRPUSR	The Graph User Group. Users mapped to this group have access to all the menu items in the OFS MMG Application related to graph and Pipeline/Refresh graphs related health services.
SCHEDULERADMIN	This group contains all the roles and functions related to the Scheduler feature. The SCHEDULERADMINACCESS role contains has all the functions that are related to LINKSCHDLR. The new function LINKSCHDLRCNF, enables you to open the scheduler configuration.

If you create a custom user group (other than the seeded OFS MMG groups) and want users in that group to access the OFS MMG Studio operations, then you must add the group in the following configuration files:

`mmgstudio/conf/application.yml`

`mmgstudio/conf/ofsaa-permissions.init.yml`

These updates ensure that the custom group is recognized by OFS MMG Studio and is mapped to the required Studio permissions.

> **Note**
>
> Enter group names in UPPERCASE, because AAI/OFSAA groups are stored and validated in uppercase.

> **Note**
>
> At the first-time login, User Group mappings are initialized from AAI/IDCS for the newly provisioned users. These will be reflected in MMG Admin Console in next MMG login.
> If User Group mappings are deleted in AAI/IDCS, it would not delete in MMG Admin Console. Admin needs to delete this in MMG Identity screens too.
>
> Only the group with MDLSUMM role will be displayed in the Workspace provisioning steps.
>
> MDLSUMM function is mapped to the MDLACCESS role.

> **Note**
>
> **Behavior of USER_USERGROUP Map when User directly creates in MMG**
>
> - If new mappings are created in MMG Identity (and not in AAI/IDCS), those will not get deleted (synced with AAI/IDCS) on next login. The Usergroups which are present in MMG Schema and not in AAI/IDCS will not get deleted unless manually removed from MMG.
> - If mappings are deleted in MMG Identity (and not in AAI/IDCS), mappings will re-appear on next login.

Role Mapping

Map the user groups in the application to the roles in the following table to enable access to the OFS MMG application.

Table 2-3 User Group to Role Mapping

Group Name	Role Name
DSREDACTGRP	DSREDACT
IDNTYADMN	Batch Advance Role
IDNTYADMN	Batch Write Role
IDNTYADMN	Admin Link Role
IDNTYADMN	User Advanced Role

Table 2-3 (Cont.) User Group to Role Mapping

Group Name	Role Name
IDNTYADMN	Group Advanced Role
IDNTYADMN	Role Advanced Role
IDNTYADMN	Function Advanced Role
IDNTYAUTH	Group Authorize Role
IDNTYAUTH	User Authorize Role
IDNTYAUTH	Group Read Role
IDNTYAUTH	Admin Link Role
IDNTYAUTH	Function Read Role
IDNTYAUTH	Role Read Role
IDNTYAUTH	Role Authorize Role
MDLAPPR	DSINTER
MDLAPPR	Model Authorize
MDLAPPR	Model Deployment
MDLAPPR	Workspace Read
MDLAPPR	Model Read
MDLAPPR	Model Access
MDLAPPR	Workspace Access
MDLAPPR	DSAPPROVER
MDLBATCHUSR	DSBATCH
MDLREV	Workspace Read
MDLREV	Model Review
MDLREV	Model Access
MDLREV	Workspace Access
MDLREV	DSUSER
MDLREV	Model Read
MDLUSR	Model Advanced
MDLUSR	Model Write
MDLUSR	Model Read
MDLUSR	Batch Advance Role
MDLUSR	Model Execute
MDLUSR	DSUSER
MDLUSR	Model Access
MDLUSR	Workspace Access
MDLUSR	Workspace Read
MDLUSR	Datasource Access
MDLUSR	Datasource Write
MDLUSR	Datasource Read
WKSPADMIN	Workspace Access
WKSPADMIN	DSADMIN
WKSPADMIN	Identity MGMT advanced
WKSPADMIN	Workspace Authorize
WKSPADMIN	Workspace Read
WKSPADMIN	Workspace Write
DSUSRGRP	DSADMIN

Table 2-3 (Cont.) User Group to Role Mapping

Group Name	Role Name
GRAPHUSER	Graph Administrator
GRAPHUSER	Graph Read Role
GRAPHUSER	Graph Read Role
GRAPHUSER	Graph Execute Role
GRAPHADMINISTRATOR	Graph Administrator Role
OBJMIGADMIN	OMEXADVND
OBJMIGADMIN	OMEXPHTM
OBJMIGADMIN	OMEXREAD
OBJMIGADMIN	OMEXWRITE
OBJMIGADMIN	OMIMADVND
OBJMIGADMIN	OMIMPHTM
OBJMIGADMIN	OMIMREAD
OBJMIGADMIN	OMIMWRITE
SCHEDULERADMIN	BATCH_ADV
SCHEDULERADMIN	SCHEDULERADMINACCESS
SCHEDULERADMIN	BATCH_ADMIN_ROLE

Function-Role Matrix for Conda CRUD Operations

The following table provides details about the Functions and Roles required to perform CRUD operations for Conda in the Oracle Financial Services Model Management and Governance application.

For more information, see the Conda Environments section.

Table 2-4 User Groups

Function	Role	Groups Mapped	Access
CONDAENVSUMM	CONDAENVACCESS	• MDLUSR • MDLREV • MDLAPPR	Summary view
CONDAENVVIEW	CONDAENVREAD	• MDLUSR • MDLREV • MDLAPPR	Read
CONDAENVEXP	CONDAENVREAD	• MDLUSR • MDLREV • MDLAPPR	Export yml file
CONDAENVEXP	CONDAENVWRITE	• MDLREV • MDLAPPR	Export yml file
CONDAENVDEL	CONDAENVWRITE	• MDLREV • MDLAPPR	Delete a registered Conda environment
CONDAENVEDIT	CONDAENVWRITE	• MDLREV • MDLAPPR	Edit a Conda environment
CONDAENVADD	CONDAENVWRITE	• MDLREV • MDLAPPR	Add a Conda environment

Sign in

After the application is installed and configured, you can access the Oracle Financial Services Model Management and Governance application.

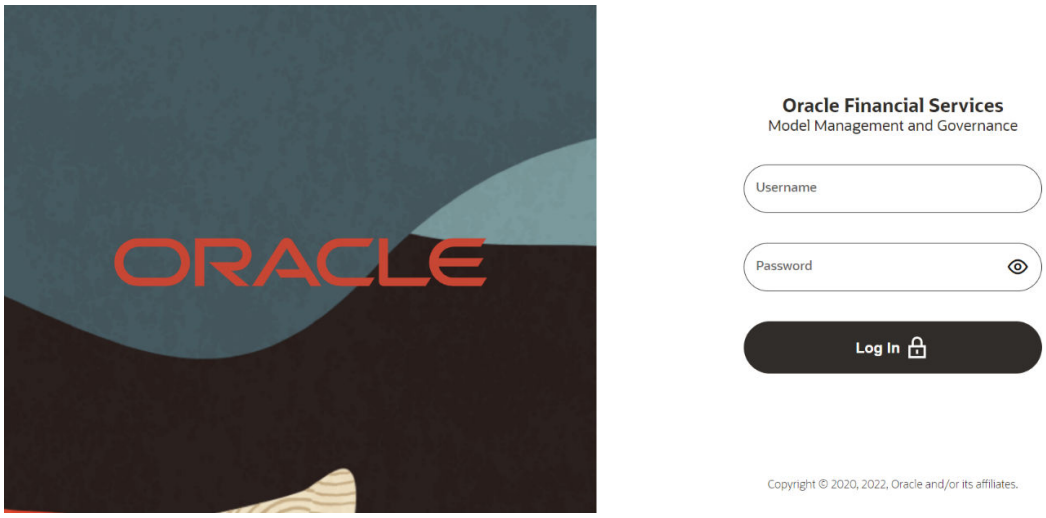
To access the application:

1. Enter the application URL in your browser.

   The **Login** page is displayed.

> **Note**
>
> The below screen is an example of AAI type login. The log in page is different for saml type based on the configuration.

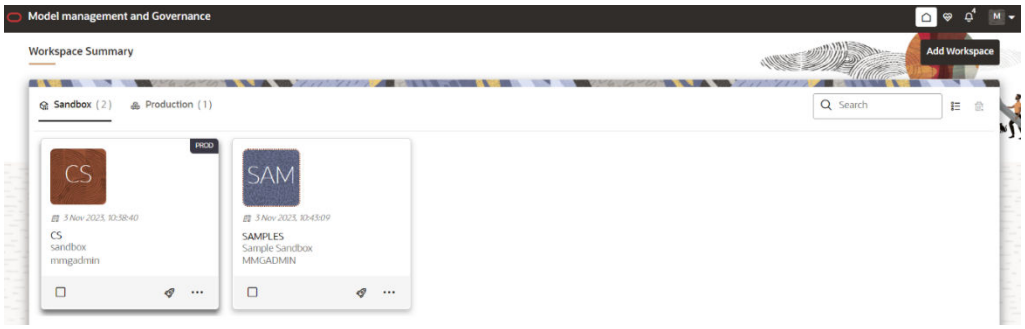
Figure 2-2 OFS Model Management and Governance Application Login Page



2. Enter your **Username**and **Password**.
3. Click **Log in**.

   The **Home Page**is displayed.

Figure 2-3 Home Page



3

Execute the Production Workspace Models from Analytical Applications Infrastructure

To execute the Production Workspace Models from AAI, follow these steps:

- To execute the Production Workspace Models from AAI, log in to My Oracle Support, and search for **33603448** patch under the **Patches & Updates** tab, download and apply it on the OFSAAI sever.
- Ensure the AAI Infodom and the Workspace names are same before you execute the Production Workspace Models.
- The Logged In user should also be same as the Workspace Create user.

1. In the AAI Configuration Schema, update the value for `MMG_SERVICE_URL` in the `nextgenemf_config` table with the values in the installation.

   Example: `MMG_SERVICE_URL :<FQDN/IP>:<mmg_be_port>/<mmg_context_name>`

   > **Note**
   >
   > If the Target Application is using secured connection, import the Target Server Certificate to the AAI Application Java Truststore and restart the services.

2. Restart the AAI services.

   A new component STUDIOMODEL will be available in ICC, RRF, and PMF modules for selecting the Production Workspace Models of the application.

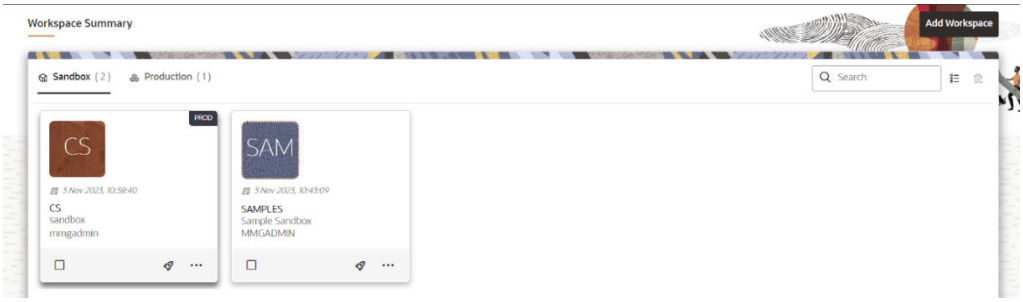
   For more details, refer to the Component: STUDIO section of AAI User Guide.

4

User Interface

Access all features from the home page. Familiarize yourself with the menus, icons, and their location to quickly complete your tasks.

Figure 4-1 Workspace Summary page



The following table provides descriptions for the fields and icons on the Workspace Summary page.

Table 4-1 Fields and Icons of the Workspace Summary page

Field or Icon	Description
Search	The field to search for Workspace. Enter specific terms in the field for which you want to search, and press Enter on the keyboard to display the results. You can search a Workspace using Workspace Code, Owner, Creation Date, or Workspace Type fields. The search list shows the Workspace details with Workspace Code, Owner, Creation Date and time, and Type.
Card and Grid View	Click the Card View or Grid View on the top-right corner of this pane to view the workspace as a block or a table, respectively.
Delete	Click Delete to delete the Workspaces.
Workspace Code	The code of the Workspace. NOTE: Use up to 20 characters consisting of alphanumeric and space characters only. Do not use "ALL" as a workspace code.
Description	The description for the Workspace.
Owner	The owner of the Workspace.
Creation Date	The date and time on which the Workspace was created.
Data Source Type	Shows the type of the Data Source.

Table 4-1 (Cont.) Fields and Icons of the Workspace Summary page

Field or Icon	Description
Add Workspace	Click Add Workspace to create a new Workspace. See the Create a Workspace section for more information.
Launch Workspace	Click Launch next to corresponding workspace to display the Workspace Dashboard with application configuration and model creation menu. See the Launch a Workspace section for more information.
View Workspace	Click Action next to corresponding Workspace and select View to view the workspace with dataset data. See the View a Workspace section for more information.
Populate Workspace	Click Action next to corresponding Workspace and select Populate to populate the workspace with dataset data. See the Populate a Workspace section for more information.
Edit Workspace	Click Action next to corresponding Workspace and select Edit to edit the Workspace.
Delete Workspace	Click Action next to corresponding Workspace and select Delete to delete the Workspace. See the Delete a Workspace section for more information.
Download Workspace	Click Action next to corresponding Workspace and select Download to download the Workspace. See the Download a Workspace section for more information. The file is downloaded in .cfg format.

Home Page Components

The Home page contains the following sections:

- Navigation Menu
- Home
- Data Source Summary
- API Configurations
- Conda Environments
- Kafka Topics
- Health
- Notification
- Profile

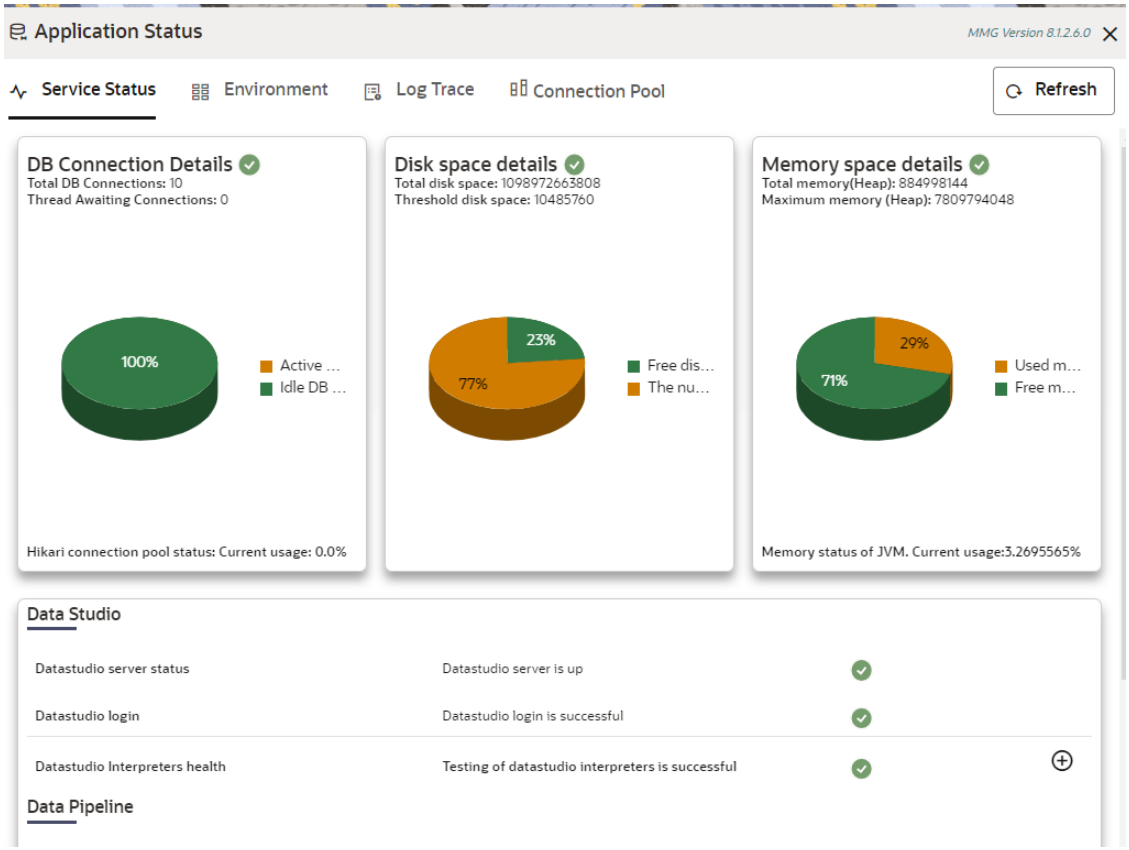
Home

Click **Home** to navigate to **Workspace Summary** page from any other window in the application. You can add and manage Workspaces from this page.

Health

Click **Health** icon to view the application status and version details. The Health page consists of four tabs:

Figure 4-2 Application Status



- **Service Status**:The Database connection, Disk space, Memory allocation details are displayed in graphical chart format. Hover on the chart to view more details. In addition, the status information of the services that are running such as Data Studio, Data Pipeline, and Graph Services are displayed. Click on the + icon to view individual services status.

  > **Note**
  >
  > The Data Pipeline Service Health status is displayed as "Not healthy" when the response is other than "UP" status. You must be mapped to the Graph role 'GRPSUM' as the Data Pipeline Health check is present in Graph services.

- **Environment**: The System and Application properties details are displayed.
- **Log Trace**: The individual logs are displayed that will help you during analysis and debugging of the issue. You can set the last lines of the log based on your requirements. For example, if you wish to see only 10 last lines of the log, enter 10 in the Show last lines text box. By default, the files are displayed in alphabetical order and **mmg-service.log** is displayed. Click on the required log file to view specific details.

> **Note**
>
> Access logs are available in the following location for UI and Services.
> $LOG_HOME/services/access/mmg-ui-access.log
>
> $LOG_HOME/services/access/mmg-service-access.log

- **Connection Pool**: The information of connections used for the data source are displayed. Select the data source from the drop-down list to view the connections and the maximum capacity. This will help you in monitoring the connections of the specific data source. Clicking on the **Refresh** icon will refresh the application status details.

> **Note**
>
> Logs can be downloaded from Health UI screen, under log trace tab. User can download the zip files of individual logs, and Bulk download is also supported. The user needs to have LOGADMN role to access the download option.

Notification

Click **Notification** icon to display the notifications from the application. In the current release, only data population related notifications are displayed. You can delete the notifications by clicking on the **Delete** when no longer needed.

To add or modify the notification details, perform the following:

1. In the header of the Home page, click on the **Notifications** icon.

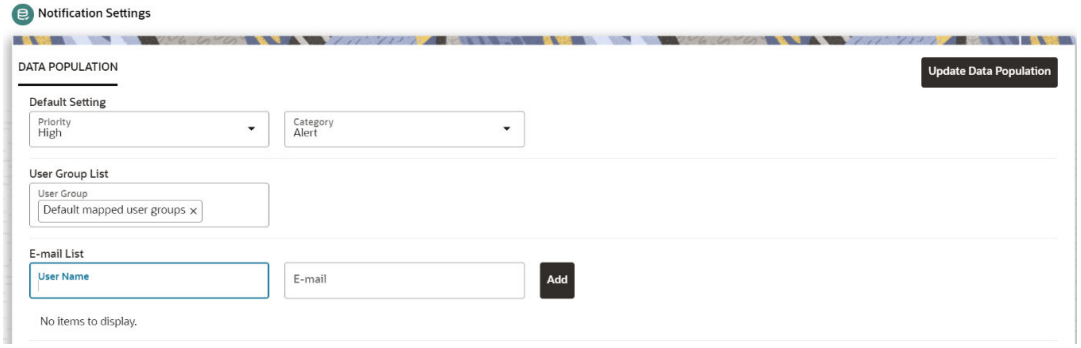
   The Notifications are displayed.

2. In the Notifications screen, click **Notification Settings** icon.

   The Notifications Settings page is displayed.

3. Select the required options from the **Notification Settings** page and click **Update Data Population**. If you select the User group, they will be notified via User Interface with the alerts under Notification icon and if you want to get the notifications in email, add the user name and email ID so that whenever a data population is triggered, an email notification is shared to the user.

Figure 4-3 Notification Settings



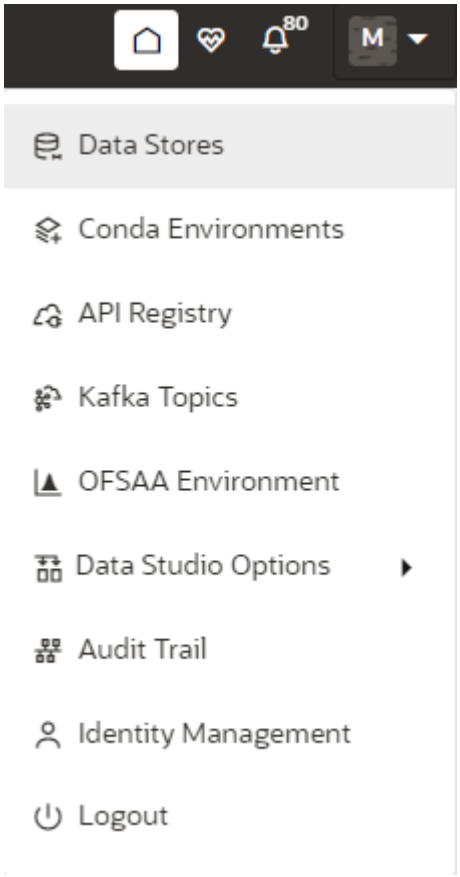
The notification alerts details are updated.

> **Note**
>
> An email notification is sent to the default email id added in AAICL_SMS_USER_PROFILE present in the Config Schema.

Profile

The Header displays icons, buttons, and text for generic information and access to the OFSAA application's features. The following user-interface elements are displayed.

Figure 4-4 User Interface Elements



- **User Name**: Displays the first letter of the logged-in user name. Hover over to view the complete name of the user. Click this to select from the following options in the drop-down list:
  - **Data Stores**: Click to navigate to Data Store Summary page. You can add and manage data stores from this page.
  - **Conda Environments**: Click to navigate to Environment Summary page. You can configure and manage conda environments from this page.
  - **API Registry:** Click to navigate to API Summary page. You can configure and manage APIs from this page.
  - **Kafka Topics**: Click to navigate to Kafka Topics page. You can configure and manage kafka topics and clusters from this page.

- **OFSAA Environment**: Click to navigate to OFSAA Environment page. You can register and OFSAA environments (Simulation and Production) from this page.
- **Data Studio Options**: Contains an underlying Notebook Server which has the following configurable options:
  - Interpreters
  - Tasks
  - Permissions
  - Credentials
  - Templates

  Clicking on the option will navigate you to the specific page. For more details, see Data Studio Options section.
- **Admin**: Navigates to IDCS page.
- **Audit Trail**: The Audit Trail window provides the information such as start and stop of UI and Service, add or delete of datasource, API Registry, Kafka topics, Conda Environments and so on are displayed. Click on **Audit Timeline View** to display the sequence of actions performed is listed. In addition, the Audit Table view (graphical representation) can also be viewed. You can search the model by entering the name in the search box.
- **Identity Management**: Click to navigate to IDCS page. You can manage users, groups, roles, and functions from this page.
- **Logout**: Select to log out of the application.

Mega Menu Components

To view the Mega Menu components, launch a Workspace. The Dashobaord page is displayed with menu options such as Modeling, Orchestration, More, and other sections of the Application.

Modeling

The Modeling component contains the following features:

- **Datasets**: Explore data, engineer features and monitor data drifts.
- **Model Libraries**: Manage python libraries for model creation and usage.
- **Model Techniques**: Manage techniques and algorithms from registered model libraries.
- **Model Catalog**: Centralized hub for all your machine learning models.
- **Pipelines**: Design, deploy and govern end-to-end machine learning pipelines for seamless model development.
- **Graphs**: Analyze complex relationships within your data through interactive graph representations.

For more details, see Modeling section.

Orchestration

The Orchestration component contains the following features:

- **Scheduler Dashboard**: Get an overview of scheduled tasks and processes.
- **Define Batch**: Manage and configure batch definitions.
- **Define Tasks**: Create tasks, configure parameters and set execution dependencies within a batch process.
- **Schedule Batch**: Set execution schedules for your batch processes.
- **Monitor Batch**: Track and monitor batch process executions.

For more details, see Orchestration section.

More

The More component contains the following features:

- **Export Objects**: Utilize Object Migration feature to efficiently export and save objects.
- **Import Objects**: Import previously exported objects into the system.
- **Model Actions**: Review and approve model deployments in bulk.
- **Audit Trail**: Monitor all system activities and changes.
- **Data Pipelines**: Create and manage data pipelines for efficient data flow and processing.

For more details, see More section.

Using the Application

The Application displays windows and pages that are interconnected to the OFS AAI. Primarily, you will create Workspace. Within these Workspaces, you will create models, compare them for the best fit, and promote one to production.

Use the information in the following topics to create the workspaces and models:

- Workspaces
- Pipelines

The prerequisites for Workspace are as follows:

- To create a workspace, your user profile must be mapped to the Workspace Administrator role.
- To use a workspace to create models, your user profile must be mapped to the Model User role (such as a modeler).

5

Access MMG from Analytical Applications Infrastructure

You can now access the MMG Application and its features from AAI.

Prerequisite

- To access the MMG application from AAI, log in to My Oracle Support, and search for **36336349** patch under the **Patches & Updates** tab, download and apply it.
- A valid MMG setup should be up and running.

> **Note**
>
> Embedding the OFS MMG UI from the OFS AAI page is supported only when both OFS AAI and OFS MMG use the same protocol (either both HTTP or both HTTPS). Mixed protocol usage may cause authentication/session failures due to browser security restrictions.

To access the MMG application, perform the following steps:

1. In the AAI Configuration Schema, update the value for `MMG_UI_URL`, and `MMG_SERVICE_URL`in the `nextgenemf_config`table with the values in the MMG installation.

   Example:

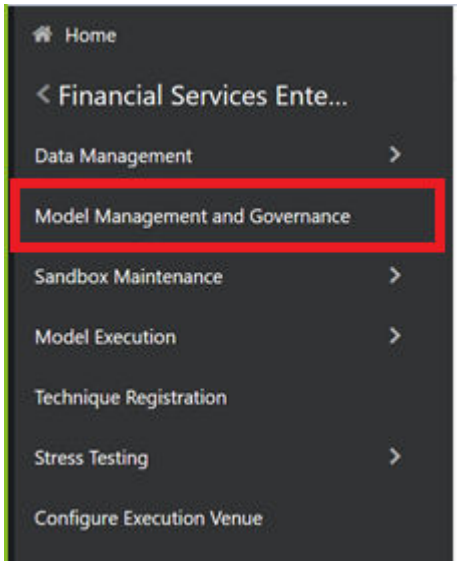
   - `MMG_UI_URL:http(s)://<FQDN/IP>:<mmg_ui_port>/<mmg_context_name>/home`
   - `MMG_SERVICE_URL :<FQDN/IP>:<mmg_be_port>/<mmg_context_name>`

   > **Note**
   >
   > If the target MMG is using secured connection, import the target server certificate to the AAI application Java Truststore and restart the services.

2. You must map the **MMGACCR** role to the required user. In addition, **MMGACCGRP** group is preseeded with the above role.
3. You must map the `OFS_MMG_HOME` Menu ID to the desired Parent ID in the `AAI_MENU_TREE` table in the AAI Configuration Schema.
4. Restart the AAI services.

   After successful login to the AAI application, a menu named **Model Management and Governance** is displayed. Based on your menu tree configuration, the left pane is displayed as shown below:

Figure 5-1 Model Management and Governance menu



5. When you click on Model Management and Governance, the MMG Login page is displayed, enter the credentials to access the MMG application.

6
Workspaces

Use the Dashboard to create and manage workspaces. By default, a Sample workspace is created which you can provision and use it to understand the workspace workflow.

Workspaces can be in the production environment (deployed), or they can exist in a separate instance on their own (on local for testing purposes) with a copy of data that comes from the desired data source (production or external data source).

You can view the following details on Workspace Summary page:

- Number of Sandbox Workspaces
- Number of Production Workspaces
- File Manager
  File manager is a ftpshare home path. It has option to Upload a new file., create a new folder, preview the file, delete and download options.

> **Note**
>
> For File Manager to be visible on Workspace Summary, File Read, File Write, and File Delete roles must be mapped.

The Workspace Dashboard allows you to view the models of the launched workspace. To access the Dashboard window, follow these steps:

1. Navigate to Workspace Summary page.
   The page displays workspace records in a tile format.
2. Click next to corresponding Workspace to Launch Workspace.
   The **Dashboard** window is displayed with application configuration and model creation menu.

   The Workspace Dashboard shows the following details of a launched workspace:

   - Mega Menu
   - Recently Used
   - Most Used Tags
   - Models Status
   - Job Status
   - Models Timeline

Create a Workspace

The Workspace creation requires entry of the source of dataset, validation, and deployment. Besides, the application may require users of different function groups to create and approve a Workspace. In other words, a user associated with the modeler function group creates a Workspace and the approval and deployment are done by a user associated with the Modeling Administrator function group.

UGDOMMAP function should be mapped to the user performing sandbox creation operation. Otherwise, the create operation will fail.

Two new objects are added during data sourcing in workspace creation:

- Materialized View
- Triggers

Create workspace process can be time-consuming, typically may take between 2 to 3 hours. However, if certain scenarios are not carefully considered, the creation may encounter failures, leading to unwanted delays. To prevent such setbacks and ensure a seamless creation, it is crucial to address these potential issues beforehand.

The possible issue and solution are as follows:

- **Adding Views, Materialized Views, or Triggers without selecting their respective parent tables**
  - **Issue**: If a user adds views, materialized views, or triggers without confirming the selection of their corresponding parent tables, it can lead to the workspace creation failure.
  - **Solution**: It is essential to verify that all dependent objects, such as Views, Materialized views, and Triggers, have their corresponding parent tables included in the selection before initiating the creation process.

To create a Workspace, follow these steps:

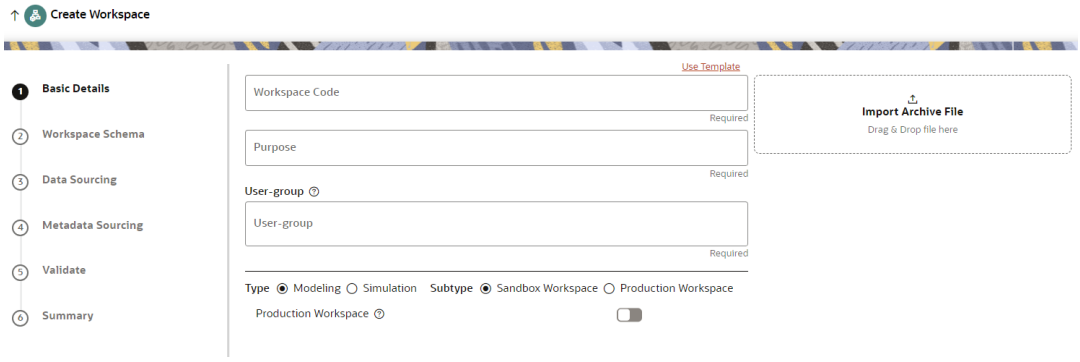
1. Navigate to **Workspace Summary**page.

   The page displays workspace records in a table.

2. Click **Add Workspace**.

   The **Create Workspace** page is displayed.

Figure 6-1 Create Workspace



The window displays a progress indicator at the left that indicates the active window where you are entering details. Click **Previous** to go back a step and click **Next** to go to the next step.

The following steps show the various phases from workspace creation to deployment:

a. Basic Details

b. Workspace Schema

c. Data Sourcing

d. Metadata Sourcing

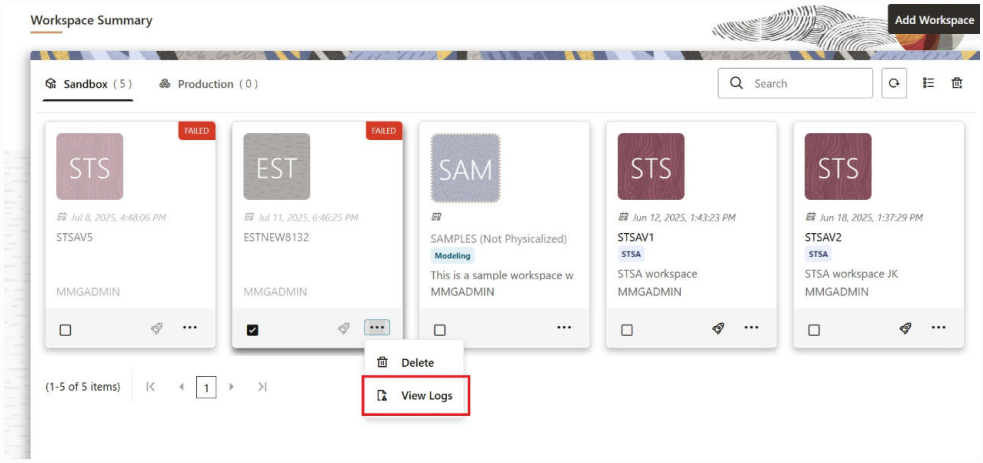
e. Validate

f. Summary

> **Note**
>
> During the Workspace creation, simulation segment code parameter is added. Simulation segment code can be provided as anything. It should be 10Char Name and it can be same as the workspace name.

> **Note**
>
> The **View Logs** option has been added for failed workspaces to view error log details.

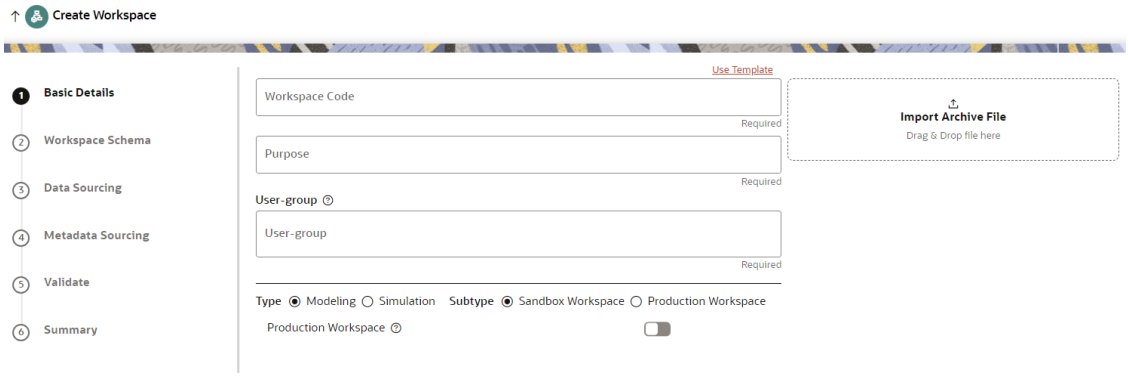
Figure 6-2 View Logs



Configure Basic Details

Enter basic configuration details in this window.

Figure 6-3 Basic Details



To configure the basic details for the workspace, follow these steps:

1. Enter the required details in the **Basic Details** pane as shown in the following table:

Table 6-1 Details for Basic Details pane

Field	Description
Use Template	Click on this field to create a workspace from a template. The zip files stored on the path: <Installation path> /scratch/ofsaadb/ftpshare/mmg/seeded/workspace-templates will be displayed in the **Library** drop-down. On selecting the template, any pre-filled values will be overridden with the template provided values.
Workspace Code	Enter the code of the workspace. **Note** Use up to 20 characters consisting of alphanumeric and space characters only. Do not use "ALL" as a workspace code.
Purpose	Enter the purpose of the creation of the Workspace.
User-group	Click on this field to display a list of User-group values. Select the required value. For Example: Modeling Approver, Modeling Reviewer, and Modeling User.
Type	Select the type of Workspace as Modeling or Simulation. NOTE: If Simulation is selected, fields to add the simulation data are displayed. The simulation option is displayed only when the user is mapped to **SIMULATIONACCESS** role. Select the subtype of Workspace as Sandbox or Production.
Production Workspace	NOTE: This option is not displayed when the **Type** field is selected as Production. Move the toggle switch to the right to enable this option. Enabling it attaches the production schema, which selects the Workspace being created for automatic model promotion. Based on the selection of the Source Workspace, the model is promoted to the environment.

Table 6-1 (Cont.) Details for Basic Details pane

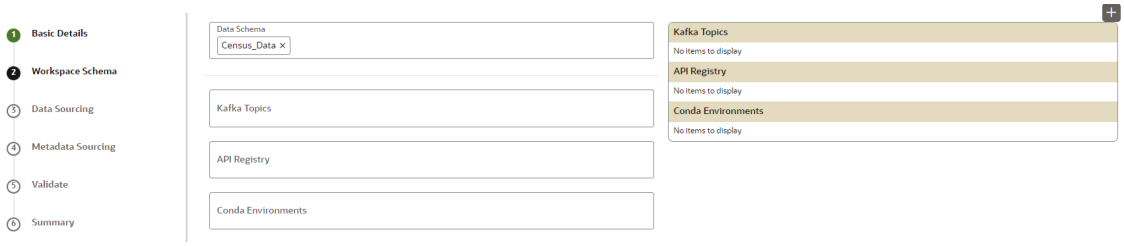
Field	Description
Import archive file	Enter the archived file to import for basic details. If you use this feature, the other fields described in the preceding rows are auto populated. Click on the box to open the file selector dialog and select the required configuration file or drag the file from its directory and drop it in the box.

2. Click **Next** to go to the next step.

Configure Workspace Schema

Enter schema operation and enter connection details in this window.

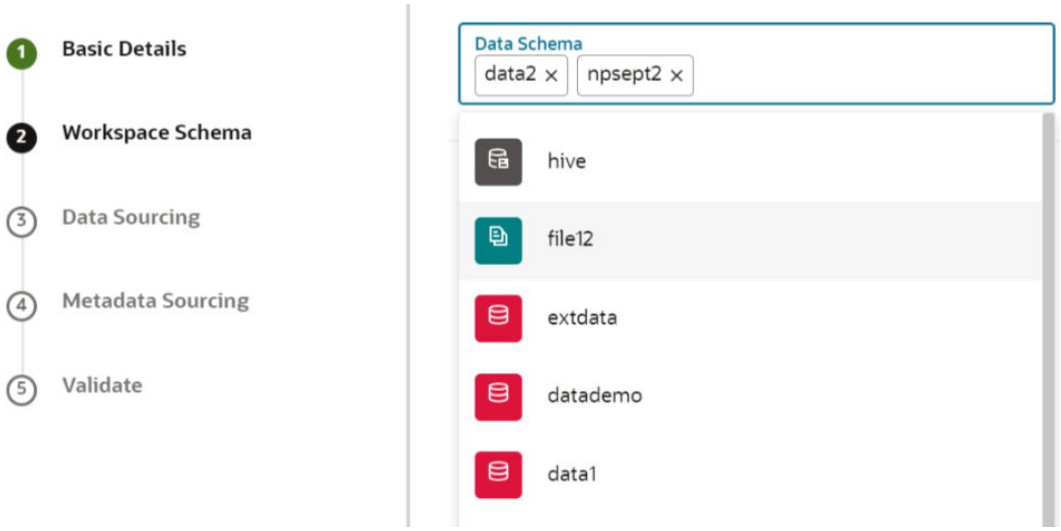
Figure 6-4 Workspace Schema



To configure the Workspace Schema:

1. Select the required schemas from the **Data Schema** drop-down list. This is the actual data used for model building. You can use multiple Data Schemas for one Meta Source. You can select an existing Schema or add a new Schema by clicking on + icon. The data source options such as Oracle, Hive, and File are displayed.

Figure 6-5 Data Schema



> **Note**
>
> For details on adding a new data store, see Data Store section.

2. Select the required options from the **Kafka Topics** list. The selected Kafka topics are listed in the right side menu with the order of selection. For more details, see Kafka Topics.
3. Select the required options from the **API Registry** list. The selected API Registry are listed in the right side menu with the order of selection. For more details, see API Registry.
4. Select the required options from the **Conda Environments** list. For more details, see Conda Environments.
5. Click **Next** to go to the next step.

   OR

   Click **Skip** to skip the step.

Configure Data Sourcing

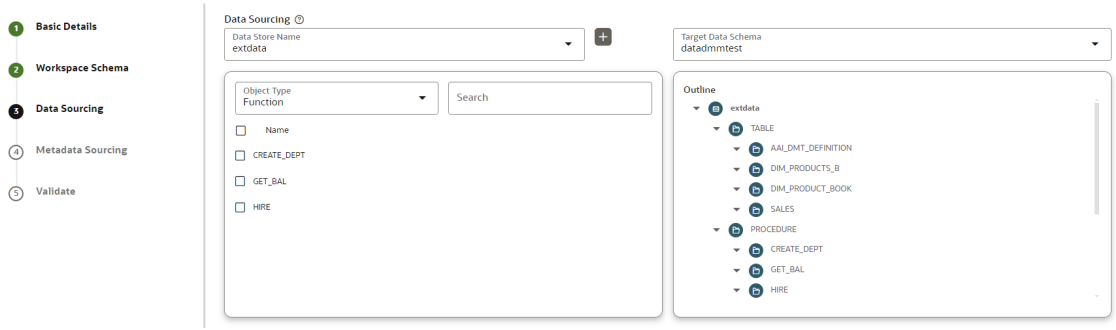
The schema type selected in the previous step requires the definition of database objects to be used for model creation. Data Sourcing step of Workspace provisioning allows to select tables from Oracle, Hive, or File based data sources from which data has to pulled into the Oracle based Workspace Data Schemas. However, unlike the data sourcing from RDBMS data sources, the tables will not get physicalized in the target schema and hence it is expected that the tables with compatible structures are already present in target RDBMS Schema. You can also select DMM operations such as Procedures, Functions, Sequences, and Package while configuring Data Sourcing. Once a workspace has been provisioned using DMM, it is stored in ftpshare path- ftpshare/dmm/DATE.

In case any of the selected tables are not present in the target schema, those tables are included in the failed objects count in workspace provisioning summary.

This window shows the different icons for Oracle, File, and Hive data sources.

Enter the details in this window.

Figure 6-6 Data Sourcing - External Data Source



To configure Data Sourcing, follow these steps:

1. You can select Data Source from Data Source Name drop-down list or create a new Data Source. To create a new Data Source, see the Configure Workspace Schema section.
2. Select the Target Data Schema. You can select multiple Data Sources for a Target Data Schema.

3. For example, if there are D1, D2 and D3 Data Sources, then you can select the tables from all these Data Sources, tables from two Data Sources, tables from one Data Source, or as required. Here, multiple combination of tables are possible with Data Source and Target Data Source.
4. If two Data Sources are having same tables (from different Data Sources), then the columns from the first selected table will be used. For example:
5. If table A has columns C1, C2, C3 and Table B has columns C1, C2, and C4,then the data from the first table will be used.
6. During the data population, only columns C1 and C2 will be used and those will be marked in Green color.
7. Select the type of objects to be displayed in the pane that follows the drop-down list. The Object Type drop-down list will be enabled after selecting the Data Source from Data Source Name drop-down list. The following are the options in the drop-down list:
   - Table
   - View
   - Synonym
   - Function
   - Procedure
   - Package
   - Sequence
8. Click **Next** to go to the next step. or Click **Skip** to skip the step.

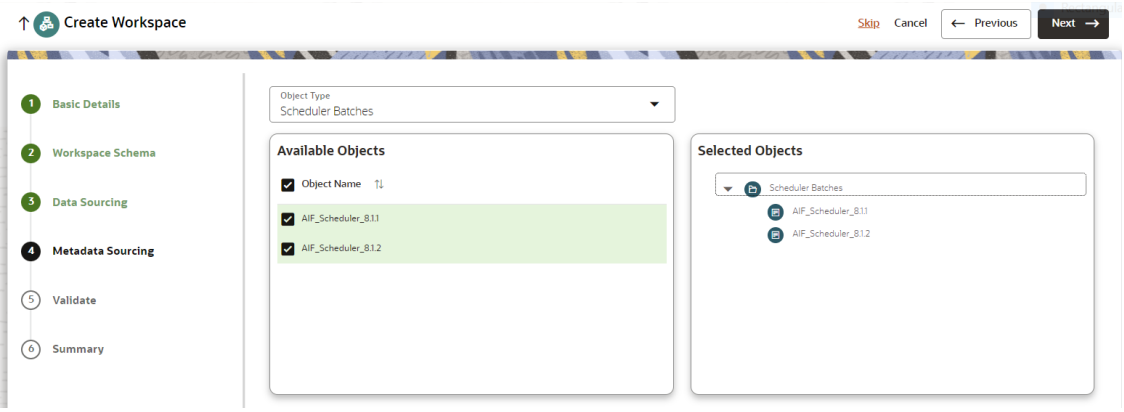
Configure Metadata Sourcing

The database objects selected in the previous step can be added with metadata for selected objects. Metadata Sourcing is a stage during Workspace provisioning to allow seeding of metadata like scheduler batches at the time of workspace provisioning.

Also, by default there will be seeded metadata. However, if you wish to seed the metadata, navigate to <installed path>/ftpshare/mmg/seeded/batches and drag and drop the metadata in SQL format.

> **Note**
>
> This step is optional.

Figure 6-7 Metadata Sourcing



To configure Metadata Sourcing, follow these steps:

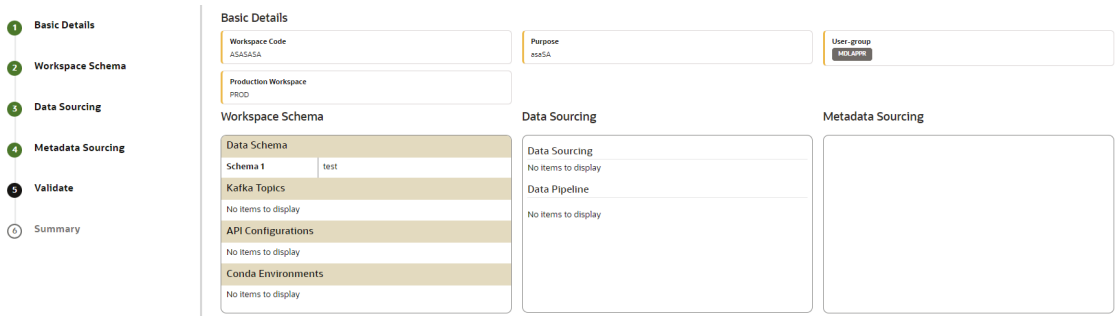
1. Select the required schema from the **Object Type (Optional)** drop-down list.

   The **Available Objects** are displayed in **Selected Objects** pane.
2. Click **Next** to go to the next step. or Click **Skip** to skip the step.

Validate Workspace

The **Validate** pane displays a preview of the configuration values entered in the previous panes.

Figure 6-8 Validate Workspace



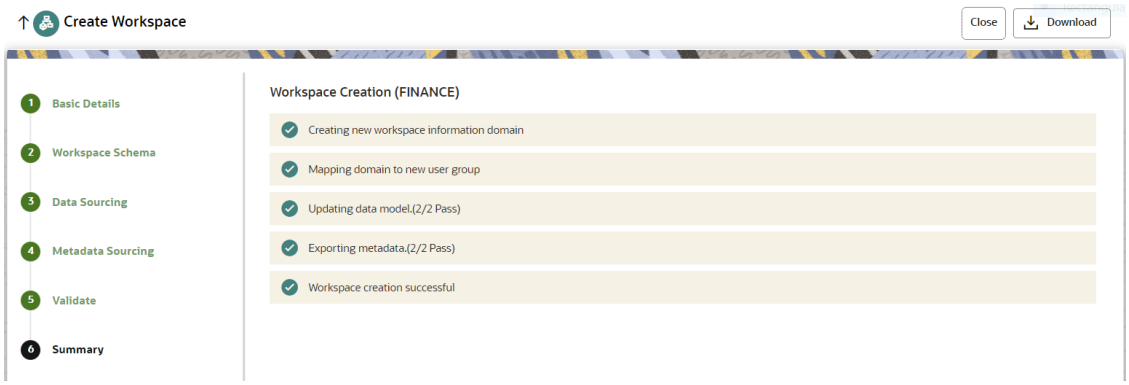
To validate the Workspace and deploy, follow these steps:

1. Review the details in the **Validate** pane. You can edit the Workspace by clicking on Edit.
2. Click **Finish** to creation of the Workspace using **Physicalize Workspace** option or **Download Configurable Archive**.
   - When you click **Download Configurable Archive**, it exports the metadata information of the workspace in .zip format which can be used later using the Import option.
   - When you click **Physicalize Workspace**, it creates actual workspace.

Display Summary

The **Summary** pane displays the status of the workspace creation.

Figure 6-9 Workspace Creation Summary



- Click **Download** to download the Deployment Report.

  During workspace creation, if any of the DMM operations such as Procedures, Functions, Packages, and so on fails, workspace creation will be rolled back. You can verify the details in MMG_SANDBOX_DETAILS, MMG_SANDBOX_MASTER, MMG_SANDBOX_SCHEMA tables.

Populate a Workspace

The workspace is populated with data from the datasets in External sources.

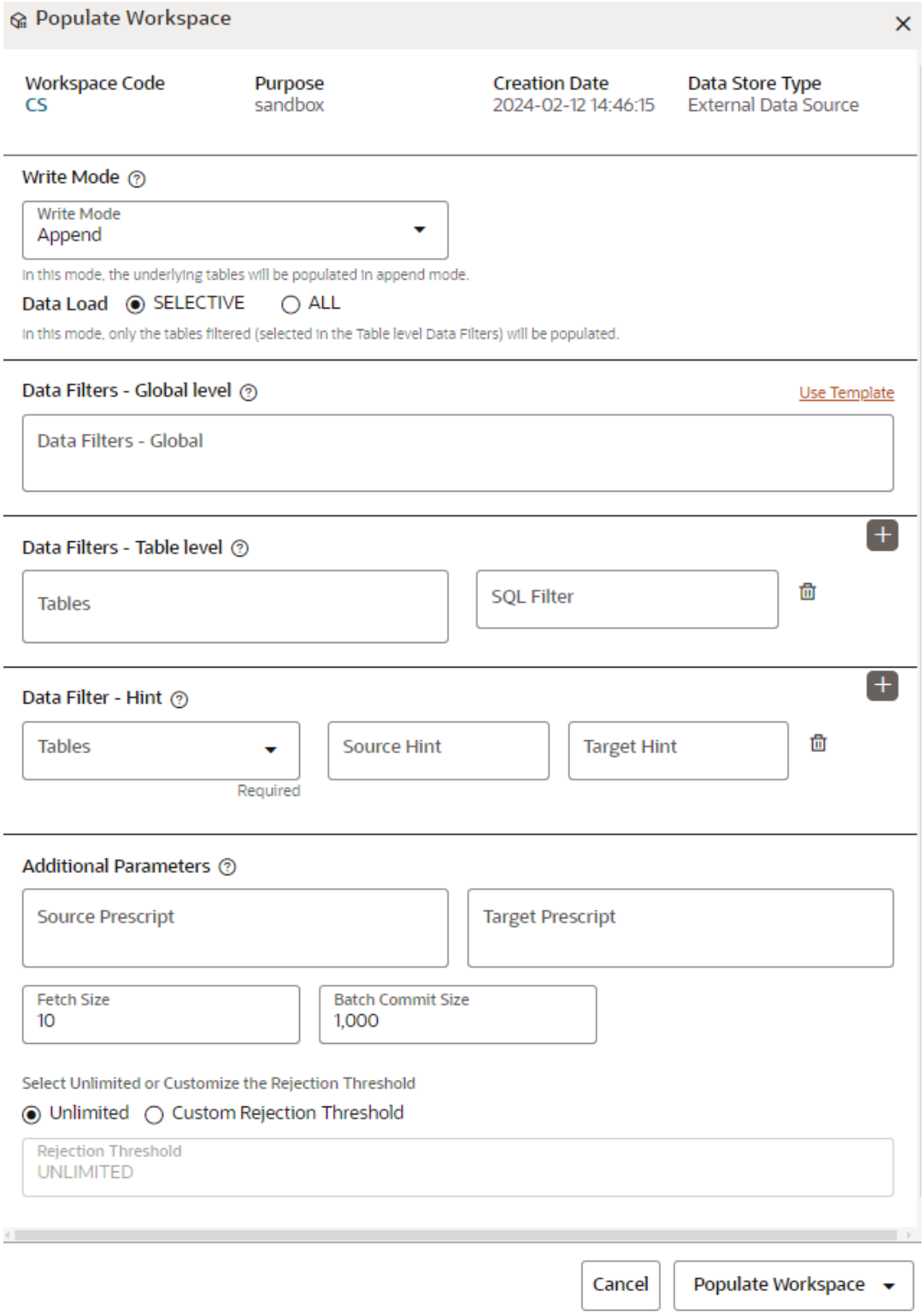
To populate the Workspace, follow these steps:

1. Navigate to the **Workspace Summary** page.

   The page displays Workspace records in a table.

2. Click Action next to corresponding Workspace and select **Populate** to populate the Workspace with data from a dataset in the **Populate Workspace** window.

Figure 6-10 Populate Workspace window



The following table provides descriptions for the fields in the Populate Workspace window.

Table 6-2 Details for the Populate Sandbox Window

Field	Description
Workspace Code	The code of the Workspace.
Purpose	The description for the Workspace.
Creation Date	The date and time on which the Workspace was created.
Data Source Type	The source of data. The value can be the OFSAA Data Schema or an external data source.
Write Mode	You can either overwrite the existing data (truncate and insert) or append to the existing data. • **Overwrite**: In this mode, the underlying tables are truncated (overwritten on existing data) followed by an insert operation. • **Append**: In this mode, the underlying tables will be populated (added to the existing data) in the append mode.
Data Load	You can select few tables or add all the tables from the source. • **Selective**: In this mode, only the tables filtered (selected in the Table level Data Filters) are populated. • **ALL**: In this mode, all the underlying tables mapped to the workspace are populated along with the filters mentioned below for specific tables.
Data Filter- Global Level	Enter the data filter that needs to be applied on all the tables selected for data sourcing. For example: If MISDATE is equal to Today, then it is applied to all tables (wherever it is available) for selected Data Sources during population. If this field is not found (MISDATE) in the tables, it is not updated. OR Click **Use Template** to select a library. On selecting the template, any pre-filled values will be overridden with the template provided values.
Data Filter- Table level	You can provide the data filters individually on the tables here. Select the table and enter the SQL filter. **Note**: You can provide multiple table names for the same SQL filter. For example, there are two tables called Student and Employee in the target data source, and below filters are applied MISDATE as Today for Student and Employee tables ID as 1 for Student table Then, Student table will be populated with MISDATE and ID filters and Employee table will be populated with only MISDATE filter. **Note**: Global filters are not applicable for those tables on which filters have been applied individually. If the same table name is provided in more than one rows here, then filter condition is generated as a conjunction of all the provided filters.

Table 6-2 (Cont.) Details for the Populate Sandbox Window

Field	Description

Data Filter - Hint	You can provide database Hints at table-level and SQL Prescripts at schema level for data load performance improvement during Workspace Population.
	Select the table and enter source and target hint filters. You can add multiple filters by clicking on Add icon.
	Note:
	You can also pass runtime values in workspace population for the user-defined parameters in **Data Filter – Global/Table**.
	Example: Table Filter /Global Filter
	`[{"id":1,"filter":"CUSTOMER_ID =$CUSTID and INCOME =$income and CUSTOMER_NAME =$customerName","tables": ["CUSTOMERS"]}]`
	Additional Parameters:
	`{"fetch_size" :10, "batch_commit_size" :1000, "rejection_threshold" :"UNLIMITED", "write_mode" :"APPEND", "dynamic_parameters": [\ {"key":"$CUSTID","value":"125"} , {"key":"$income$","value":"30000"}, {"key":"$customerName","value":"Cust125"}]}`
	The Runtime parameters can be passed as part of additional parameters json .Key = "dynamic_parameters" .It will replace all the $ values in Table filter /Global Filters.

Source Prescript	Enter the source prescript of JDBC properties for data upload.
Target Prescript	Enter the target prescript of JDBC properties for data upload.
Fetch Size	Enter the Fetch size of JDBC properties for data upload
Batch Commit Size	Enter the Batch Commit size of JDBC properties for data upload
Write Mode	You can either overwrite the existing data (truncate and insert) or to append to the existing data. You can choose to either overwrite the data or append to the existing data.
Rejection Threshold	Following two options are available: • Unlimited - Here, all the errors will be ignored during the data population. • Custom Rejection Threshold - Enter the maximum of number of inserts that may fail for any of the selected tables. You can provide the maximum number of inserts that can fail while loading data to a given table from all the sources. In case of threshold breach, all the inserts into the particular target schema will be rolled back. However, it will continue with populating the next target schema.

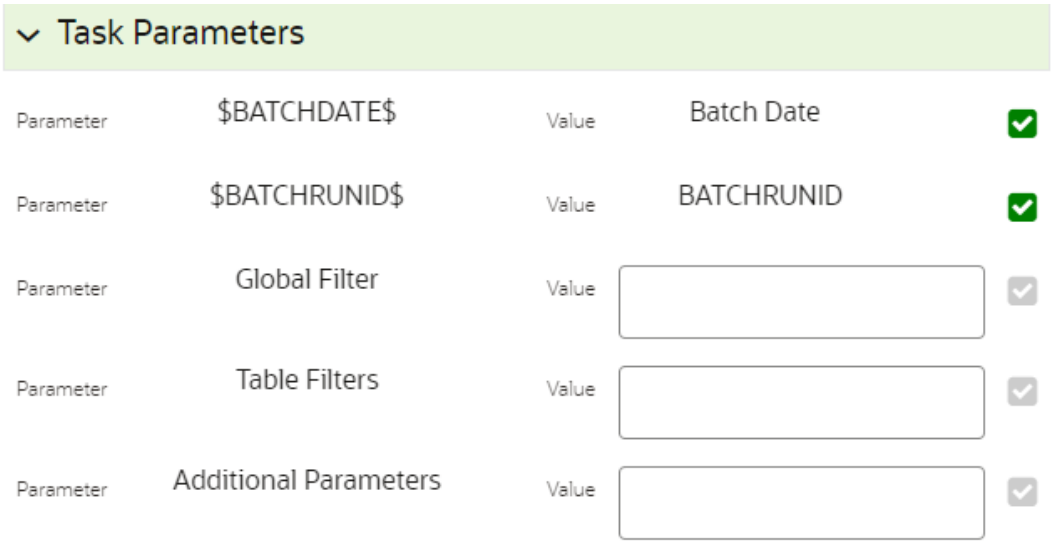
3. Click **Populate Workspace** to start the process.

   Here, you can create the batch using Create Batch, or create and execute using Create and Execute Batch option. On selecting either of these options, a workspace population task gets added to the batch.

   - When you select Create and Execute Batch option, it allows you to create batch and triggers the batch as well.
   - When you select 'Create Batch' option, it allows you to prepare the batch and then execute or schedule the batch at a later time through Scheduler Service window. The Workspace population task execution can be tracked in the 'Monitor Batch' window in the Scheduler Service.

- For a workspace population task, you have to mandatory check the logs whether the target table is getting populated. Workspace population logs can be found under: <MMG_HOME>/OFS_MMG/logs/execution/<MISDATE>/<WORKSPACENAME>/workspace-population/

Figure 6-11 Task Parameters



4. Enter the following parameters for workspace population.

   This step is optional.

   - **Additional Parameters** Enter the Additional Parameters in following format: {"fetch_size" :10, "batch_commit_size" :1000, "rejection_threshold" :"UNLIMITED", "write_mode" :"OVERWRITE"}
   - **Global Filter**
     Provided input will be applied as a data filter on all the tables selected for data sourcing.
   - **Table Filter**
     You can provide data filters individually on the tables here. You must provide multiple table names for the same SQL filter. Global Filters will not be applicable for those tables on which filters have been applied individually. In case the same table name is provided in more than one rows here, the filter condition will be generated as a conjunction of all the provided filters.

     Enter the Table filters in following format:

     [{"id":1,"filter":"<filter condition>","tables":["TABLE1",

     "TABLE2"]}, {"id":2,"filter":"<filter condition>","tables":["TABLE2"]}]

> **Note**
>
> You can run workspace population for a given workspace any number of times. New tables may be added to the definition. Any new table added to the definition, that is not present in the target schema will be physicalized on update of the workspace. Also, user can add new sources if required.
> Any table that is deselected from the data sourcing definition will **NOT**be dropped.

Edit a Workspace

The Edit Workspace process can be time-consuming, typically may take between 2 to 3 hours. However, if certain scenarios are not carefully considered, the update may encounter failures, leading to unwanted delays. To prevent such setbacks and ensure a seamless update, it is crucial to address these potential issues beforehand.

The possible issue and solution are as follows:

- **Adding Views, Materialized Views, or Triggers without selecting their respective parent tables**
  - **Issue**: If a user adds views, materialized views, or triggers without confirming the selection of their corresponding parent tables, it can lead to the failure of the edit workspace update.
  - **Solution**: It is essential to verify that all dependent objects, such as Views, Materialized views, and Triggers, have their corresponding parent tables included in the selection before initiating the update process.
- **Manually adding additional tables in the Target Workspace Schema instead of using Workspace functionality**
  - **Issue**: If a user manually creates a table (for example, ABC) in both the Source and Target Schemas, independent of the workspace functionality, and then tries to map it to an existing workspace, the edit process may fail. This would lead to an inconsistency between the Target Schema and Source Schema Database objects.
  - **Solution**: To resolve this issue you need to sync up the inconsistency between the Workspace Source and Target Database objects, for which you can execute the following API with the respective headers and payload.
    - **HTTP Method**: POST
    - **URL**: http(s)://<MMG_BE_HOSTNAME>:<MMG_BE_PORT>/<MMG_CONTEXT_NAME>/dmm-service/v1/modelupload/dbcatalog
    - **Header Parameter**:
      - **ofs_workspace_id**: MMG Workspace Code.
      - **ofs_remote_user**: Login User of the application.
      - **locale**: Locale in languageCode-countryCode format. The values should be en-US.
      - **ofs_service_id**: Target Workspace Data Store Name.
      - **ofs_connection_type**: Connection type and the value shoule be OFSAA-DATA.
    - **Payload**:
      - **Case 1:** This will retrieve all table definitions, and since the list is empty, it will fetch all tables, making the process time-consuming.

```
{
            "tableNames":[]
    }
```

* **Case 2:** This will retrieve only the tables specified in the request body. If you want to include specific tables, ensure they are listed.

```
{
        "tableNames":["A","B"]
}
```

– **Response**: The response will serve as an acknowledgment that the request has been received, and it will be asynchronous due to the time-consuming nature of the process.

* **Success**:

```
{
        "status": "received",
        "errorMessage": null,
        "additionalInfo": null
}
```

* **Error**:

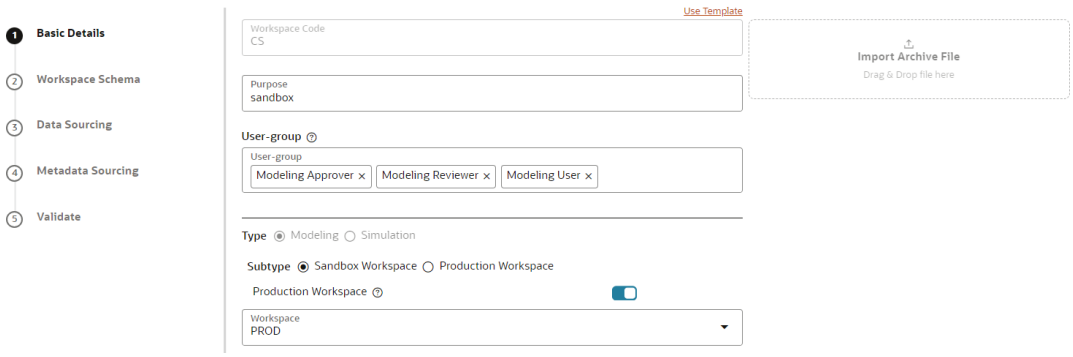
```
{
        "status": "error",
        "errorMessage": <Error Message>,
        "additionalInfo": null
}
```

Once the execution is successful, utilize the workspace edit functionality to update the workspace by selecting the externally created table. This update is expected to proceed without issues.

To edit a workspace, follow these steps:

1. Navigate to **Workspace Management** to display the **Workspace Summary**page. The page displays Workspace records in a table.
2. Click Action next to corresponding workspace and select **Edit** to edit the workspace.

Figure 6-12 Edit Workspace window



> **Note**
>
> You can modify the Workspace Type from Sandbox to Production or vice versa.

For more details on the Basic Details fields, see Configure Basic Details section.

> **Note**
>
> While updating a workspace, if any of the DMM operations such as Procedures, Functions, Packages, and so on fails, DMM operations alone will be rolled back and workspace will not be rolled back. You can verify the details in MMG_SANDBOX_DETAILS, MMG_SANDBOX_MASTER, MMG_SANDBOX_SCHEMA tables.

3. Click **Save**.

> **Note**
>
> The **Details** option has been added, replacing Edit Workspace in Action list of workspace. In the Details screen, the Edit Workspace is available.
> The background concept has been added while adding/editing workspace. Once a user clicks on update option, the confirmation message will pop up and the user will be redirected to Sandbox Summary screen where the workspace will display as loading, indicating add/edit process is going on. Meanwhile, the user can proceed with other tasks and operations, instead of waiting for the workspace to be created or edited.

> **Note**
>
> The users should not perform manual modifications on the Target and Source Schema objects.
> Currently, there are scenarios where in manual changes are performed directly on the Target Schema and this leads to failure when user performs Workspace Edit operation. Therefore, the user should ensure not to perform any manual modification to underlying database objects in Source and Target Schema.

> **Note**
>
> The Edit workspace icon with details has been added post launching the workspace.

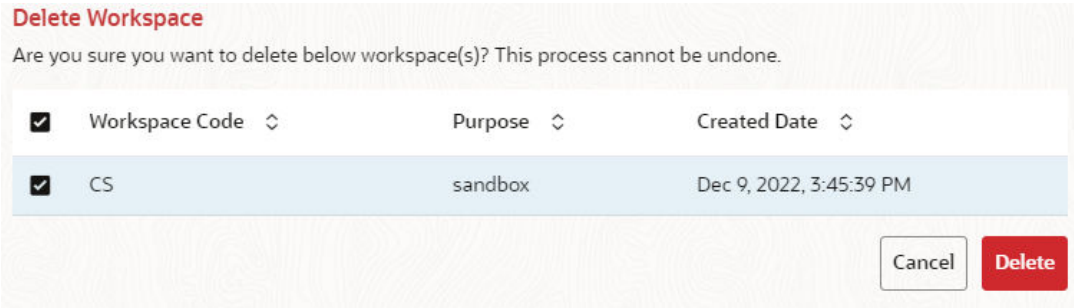
Delete a Workspace

> **Note**
>
> When you delete a Workspace, all the underlying objects such as Dataset, Scheduler service metadata and so on from the associated tables are deleted.

To delete a Workspace, follow these steps:

1. Navigate to **Workspace Management** to display the **Workspace Summary** page. The page displays workspace records in a table.
2. Click Action next to corresponding Workspace and select **Delete** to delete the workspace.

Figure 6-13 Delete Workspace window



The following table provides descriptions for the fields in the Delete Workspace window.

Table 6-3 Details on the Delete Sandbox window

Field	Description
Workspace Code	The code of the workspace.
Purpose	The description for the workspace.
Created Date	The date on which the workspace was created.

3. Click **Delete**.
4. Click **OK** on the confirmation dialog box to confirm or click **Cancel** to cancel.

> **Note**
>
> Ensure that you de-link the Sandbox workspaces from Production Workspace before deleting the Production Workspace.

Download a Workspace

Downloading a workspace allows you to export the workspace metadata definition (without underlying objects such as Models, Pipeline, Graphs, and so on) in a zip format. Further, the same can be used to re-create the workspace.

To download a workspace, follow these steps:

1. Navigate to **Workspace Management**to display the **Workspace Summary**page. The page displays Workspace records in a table.
2. Click Action next to corresponding workspace and select **Download**to download the workspace.

   OR

   Navigate to the Summary screen during the creation of a Workspace and click Finish and select **Download Configuration Archive**option.

> **Note**
>
> The file is downloaded in .cfg format.

Managing Data Sources

This feature allows you to manage the Data Schemas registered with the application. The Data Source Summary window shows the list of Data schemas registered with the application. These Data schemas can be used either for workspace or for sourcing data. Click **Data Source Summary** to navigate to Data Source Summary window.

This window also allows you to manage these registered external sources.

The Data Source Summary is divided into two sections: Used Data Source and Unused Data Source.

To view the Data Source details., Click **Action** next to corresponding Workspace and select **View**

- **Used Data Source**: This shows the list of Data Sources registered with any workspace. Here, you can only view the Data Source details. The count of Used Data Sources also displayed at the top of Data Source Summary page.
- **Unused Data Source**: This shows the list of Data Sources those are not registered with any workspace. Here, you can only view, edit, or delete the Data Source details. The count of Unused Data Sources also displayed at the top of Data Source Summary page.

To add a Data Source from Workspace Summary window, follow these steps:

1. Navigate to **Workspace Summary** window.
2. Click **Data Source Summary** to navigate to **Data Source Summary** window and click **Add Datasource**
   The Add Data Source window is displayed.

To add a Data Source from Data Source Summary window, follow these steps:

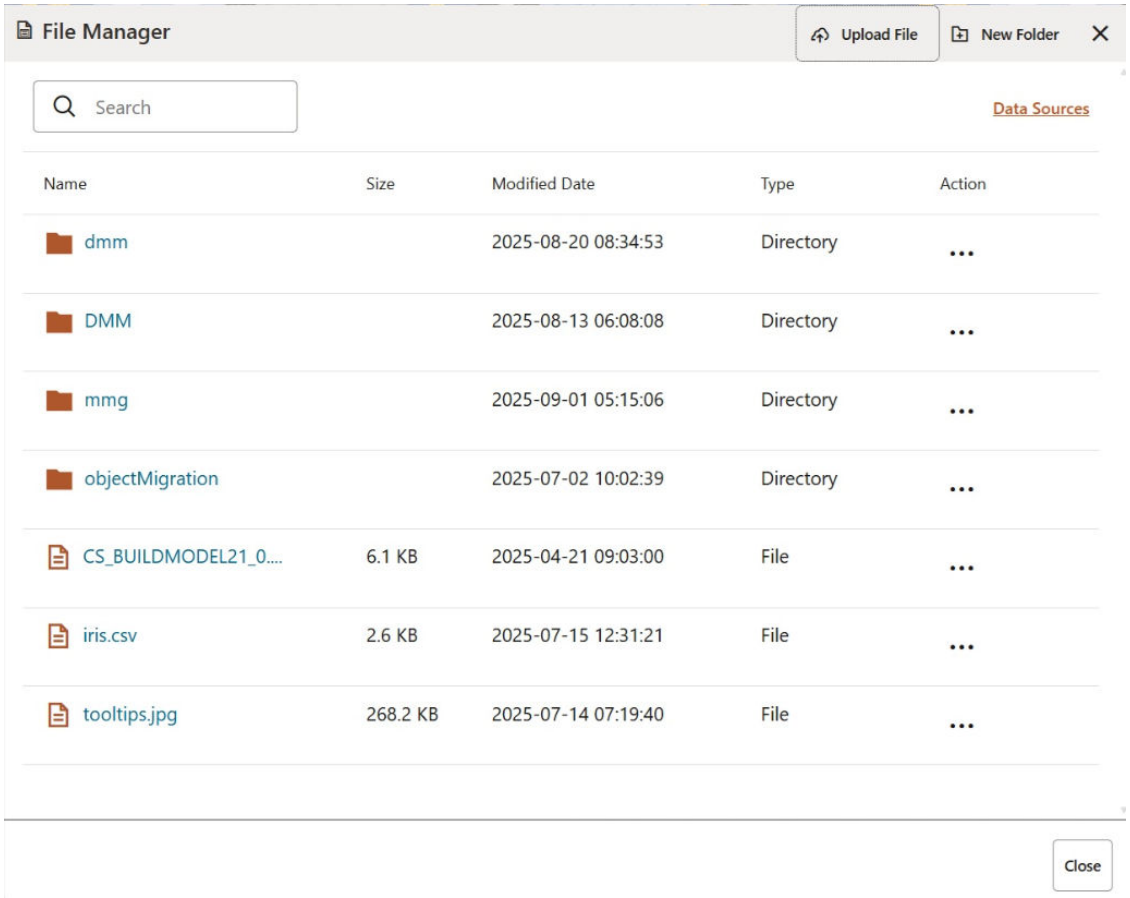
1. Navigate to **Data Source Summary** window.
2. Click **Add Datasource** .

For more information, see the Create a Workspace section.

File Manager

File Manager is a new feature that is added in the **Workspace Summary** screen.

Figure 6-14 File Manager



User is required to map File Admin User to view it on the headers of Home screen. The File Admin user has the following roles mapped to it:

- File Read
- File Delete
- File Write

The File Manager stores the files and folders and replicates the data of the ftpshare folder from the deployed location. User can use those stored files directly during pipeline notebook and any other location where file manager option is added. It has the option to Upload a new file, create a new folder, preview the file, and delete and download options. The user can view only those workspace folders to which he is mapped.

Additionally, workspace-level access controls are also applicable to files/folder. To access files/folders in python see the Access Module for File/Folder Operations section in Notebook.

Details Screen

The user logs into the **Details** screen to edit and view a workspace.

Log into the User Interface. Click on the three dots and click on **Details**, which directs you to the **Details** screen.

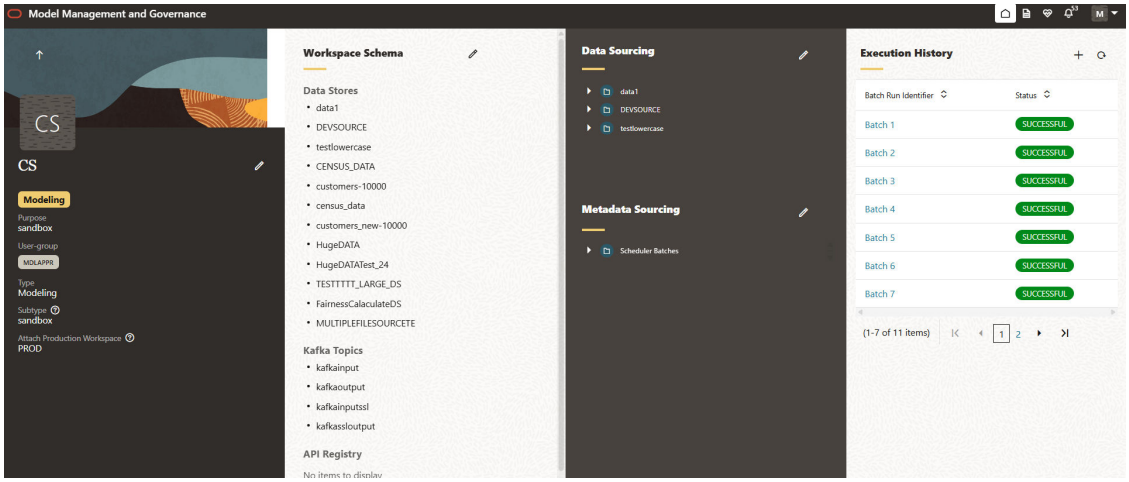
This screen is divided into four columns: The first three gives information about the workspace and fourth (extreme right) focuses on the execution history of the workspace population.

The information present in first three columns is the one that user enters when creating/editing a workspace.

The workspace data/information is given by the user when they create or edit a workspace.

The basic **Details** screen is as follows:

Figure 6-15 Details screen



The first panel(column) is the basic Details screen, which contains workspace name, description, type and so on.

Workspace Schema

The Workspace Schema is divided into four sections:

- Data Stores
- Kafka Topics
- API Registry
- Conda Environment

Figure 6-16 Workspace Schema

Click on the **pencil** icon next to Workspace Schema to edit the same.

A pop-up box is displayed with the edit options. Click **Save** to save the information edited.

Figure 6-17 Workspace Schema

Click the **plus** icon next to the Workspace Schema to create/add a **Datastore**.

Figure 6-18 Add a Datastore

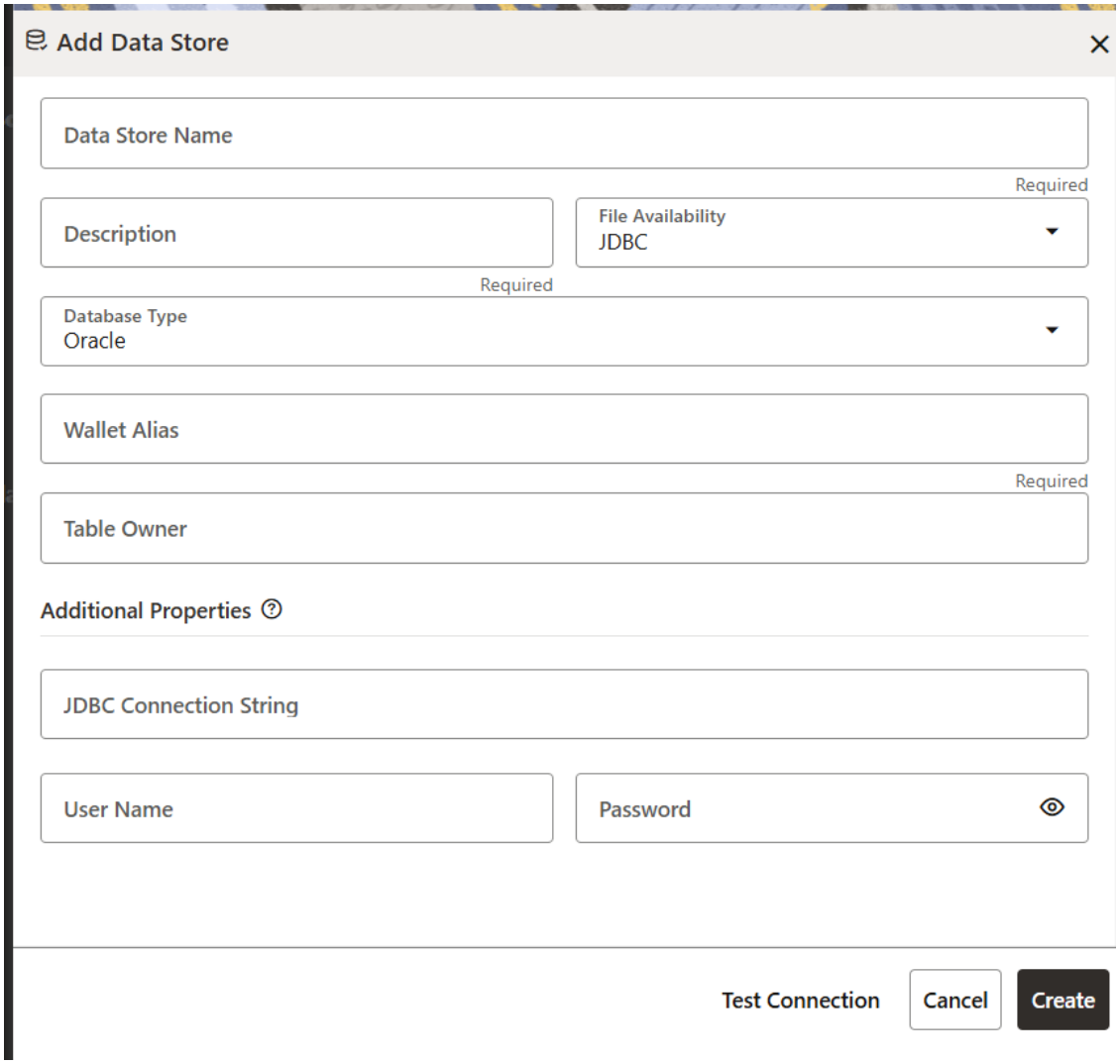
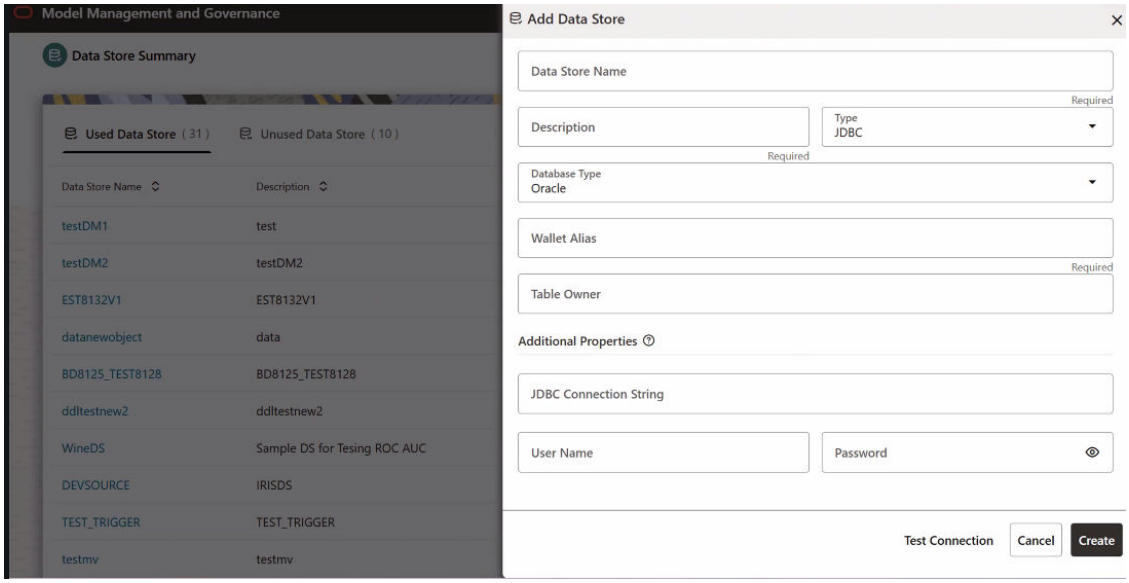


Figure 6-19 Additional Properties

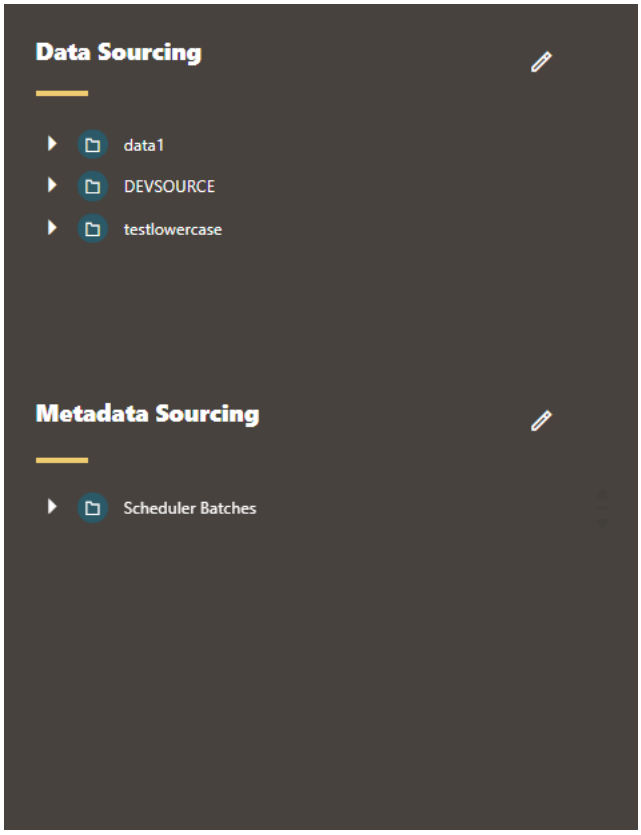


Data Sourcing

Data Sourcing is divided into two sections:

- Data Sourcing
- Metadata Sourcing

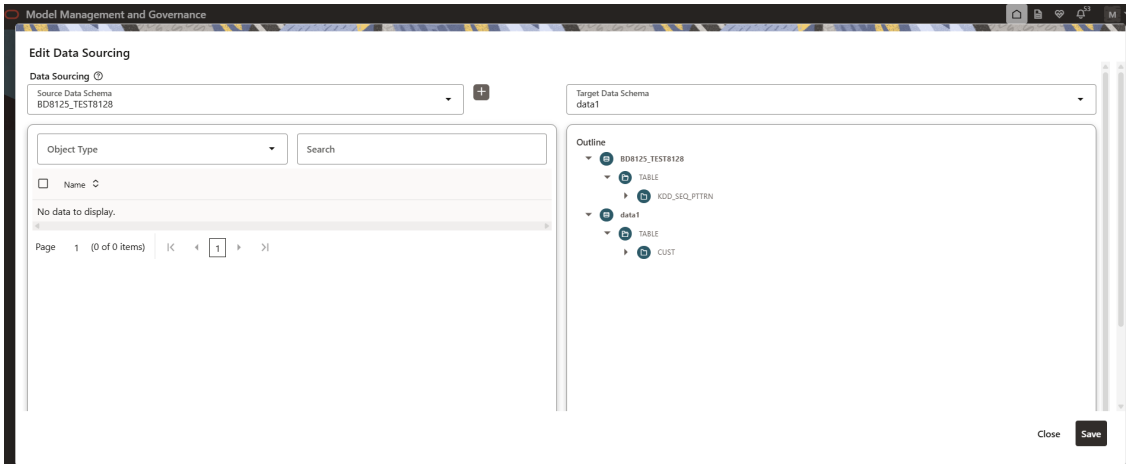
Figure 6-20 Data Sourcing



Click on the **pencil** icon next to Data Sourcing to edit the same.

A pop-up box is displayed with the edit options.

Figure 6-21 Edit Data Sourcing

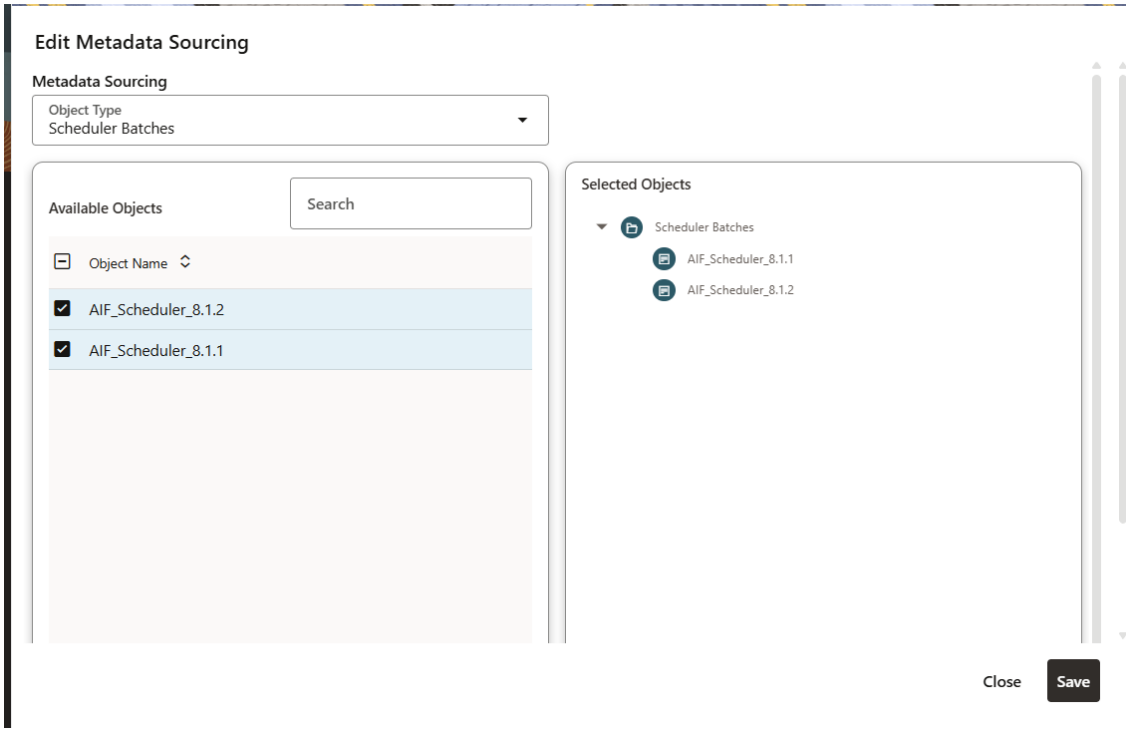


Click **Save** to save the information edited.

Click on the **pencil** icon next to Metadata Sourcing to edit the same.

A pop-up box is displayed with the edit options.

Figure 6-22 Edit Metadata Sourcing page

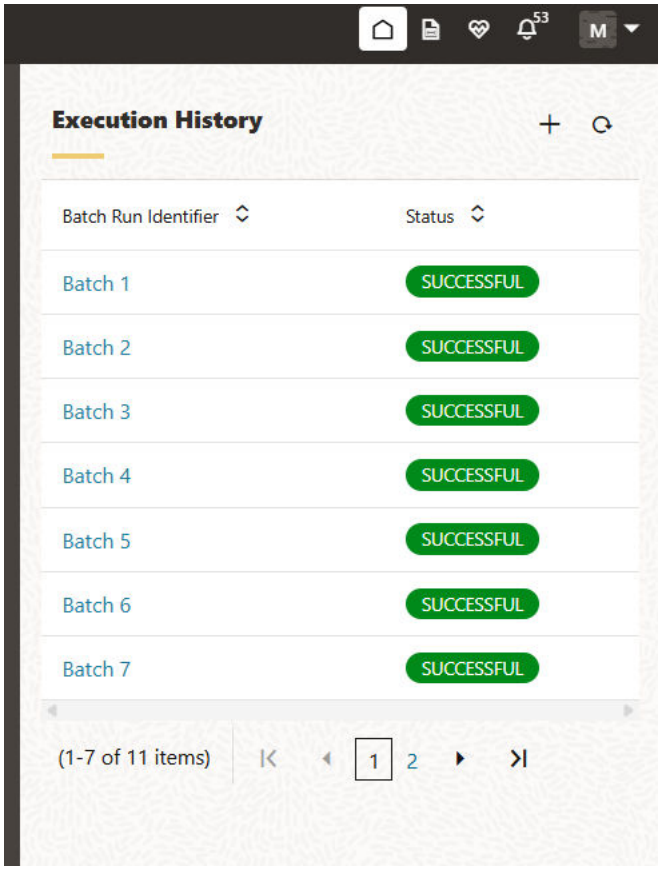


Click **Save** to save the information edited.

Execution History

In the Execution History column, the user can see the output of the population under Batch Run Identifier and status of each workspace population.

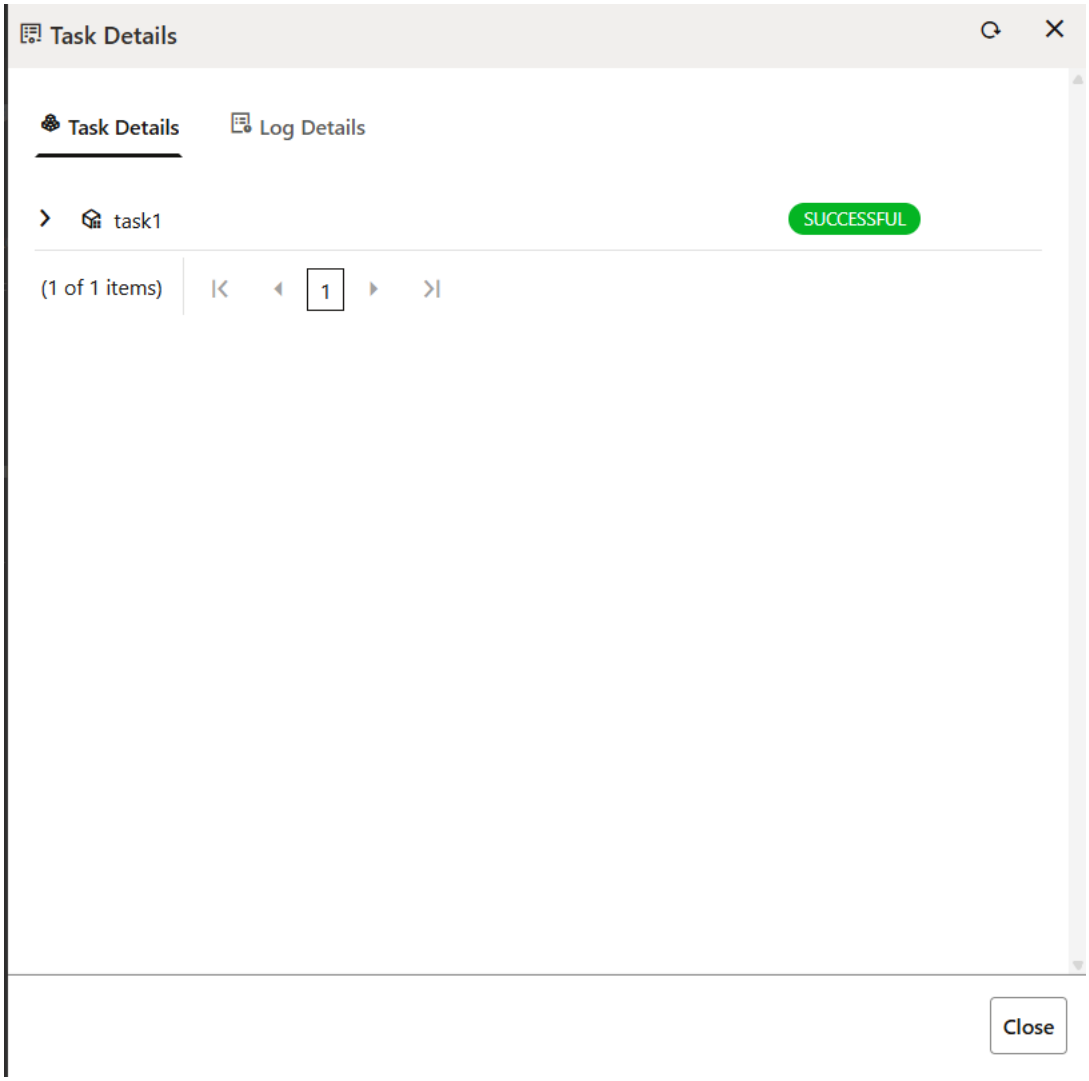
Figure 6-23 Execution History column



Click **Save** to save the information edited.

Click on the **Batch Number** and a pop-up box is displayed with the **Task** details.

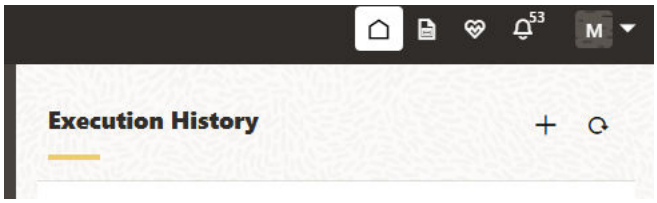
Figure 6-24 Task details



Click **Save** to save the information edited.

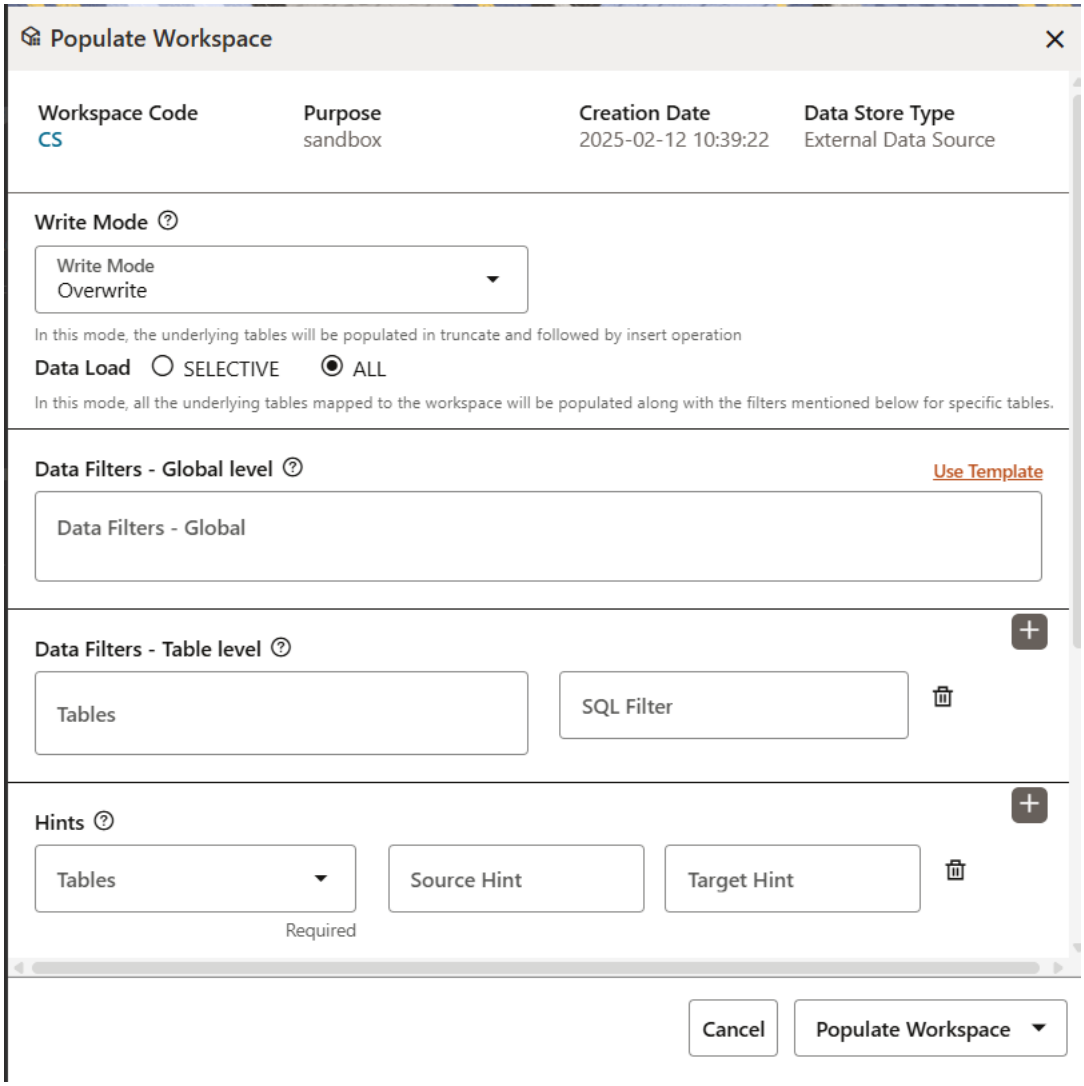
Click on the **Plus** icon next to the Execution History to populate a workspace:

Figure 6-25 Plus icon



A pop-up box is displayed where you can populate the workspace.

Figure 6-26 Populate Workspace page



Click **Save** to save the information edited.

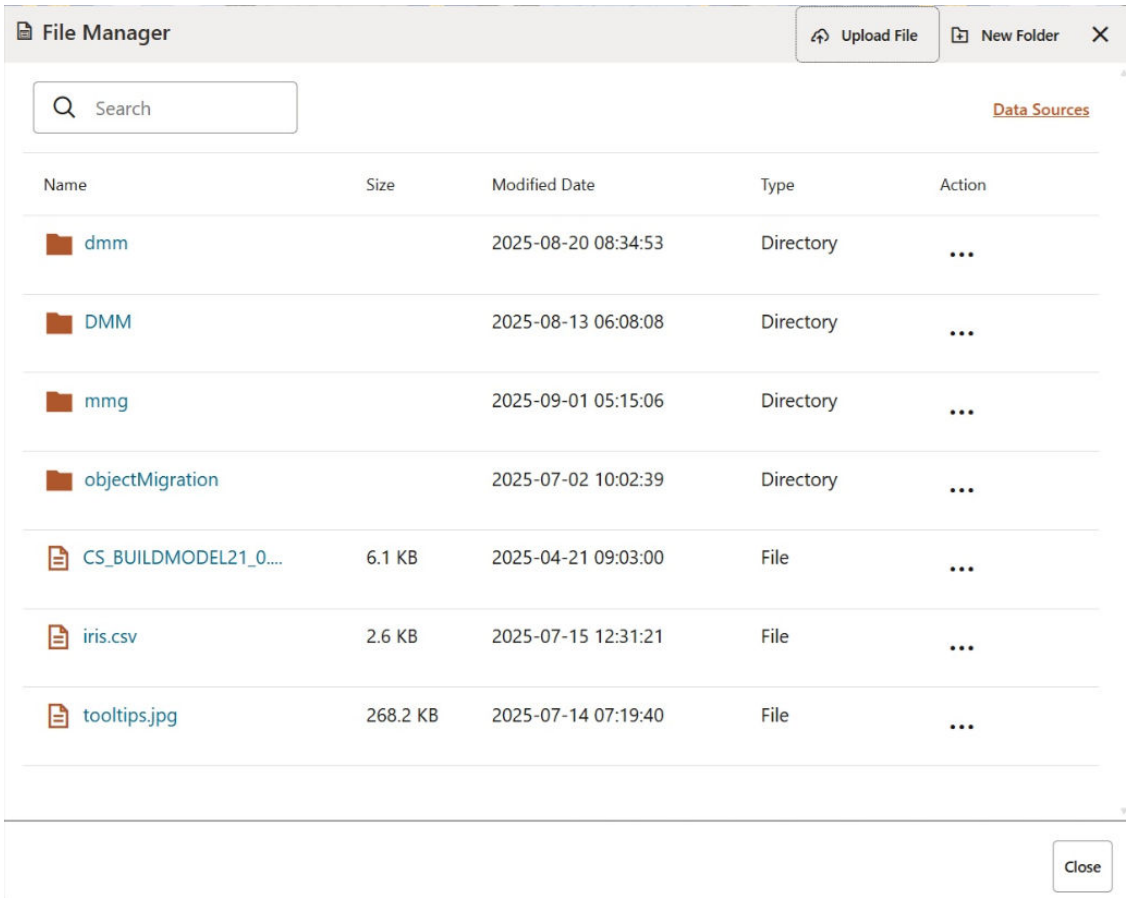
> **Note**
>
> The View Workspace screen and the Edit Workspace screen has now been merged into one and is called the Details screen.

7

File Manager

File Manager is a new feature that is added in the **Workspace Summary** screen.

Figure 7-1 File Manager



User is required to map File Admin User to view it on the headers of Home screen. The File Admin user has the following roles mapped to it:

- File Read
- File Delete
- File Write

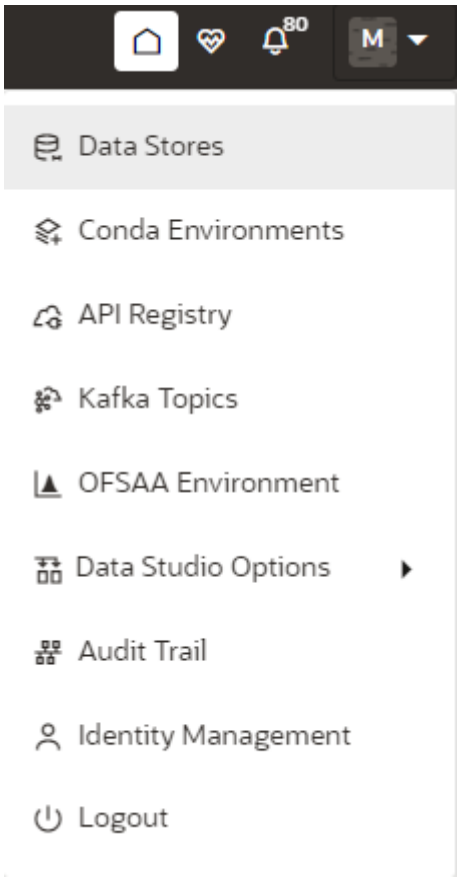
The File Manager stores the files and folders and replicates the data of the ftpshare folder from the deployed location. User can use those stored files directly during pipeline notebook and any other location where file manager option is added. It has the option to Upload a new file, create a new folder, preview the file, and delete and download options. The user can view only those workspace folders to which he is mapped.

Additionally, workspace-level access controls are also applicable to files/folder. To access files/folders in python see the Access Module for File/Folder Operations section in Notebook.

8
Administration

The Header displays icons, buttons, and text for generic information and access to the OFSAA application's features. The following user-interface elements are displayed.

Figure 8-1 Administration menu



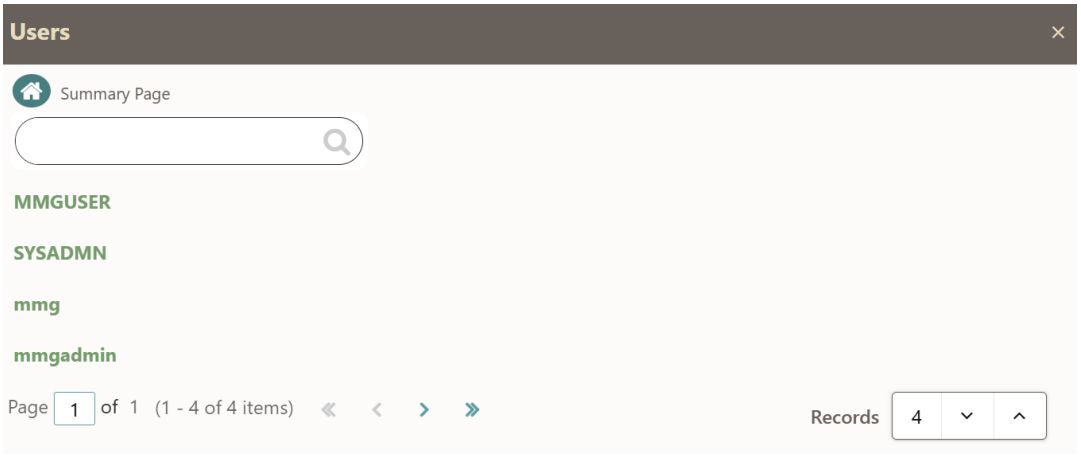
- **User Name**: Displays the first letter of the logged-in user name. Hover over to view the complete name of the user. Click on this icon to select from the following options in the drop-down list:
- **Data Stores**: Click to navigate to Data Store Summary page. You can add and manage data stores from this page.
- **Conda Environments**: Click to navigate to Environment Summary page. You can configure and manage conda environments from this page.
- **API Registry**: Click to navigate to API Summary page. You can configure and manage APIs from this page.
- **Kafka Topics**: Click to navigate to Kafka Topics page. You can configure and manage kafka topics and clusters from this page.

- **OFSAA Environment**: Click to navigate to OFSAA Environment page. You can register OFSAA environments (Simulation and Production) from this page.
- **Data Studio Options**: Contains an underlying Notebook Server which has the following configurable options:
  - Interpreters
  - Tasks
  - Permissions
  - Credentials
  - Templates

  Clicking on the option will navigate you to the specific page. For more details, see Data Studio Options section.
- **Admin**: Navigates to IDCS page.
- **Audit Trail**: Click to navigate to Audit Trail page The details such as start and stop of UI and Service, add or delete of datasource, API Registry, Kafka topics, Conda Environments and so on are displayed. You can view the sequence of actions performed in table view or timeline view (graphical representation) by clicking on Audit Table View, and Audit Timeline View options respectively. You can search the model by entering the name in the search box.
- **Identity Management**: Click to navigate to IDCS page. You can manage users, groups, roles, and functions from this page.

Figure 8-2 Identity Management Summary page

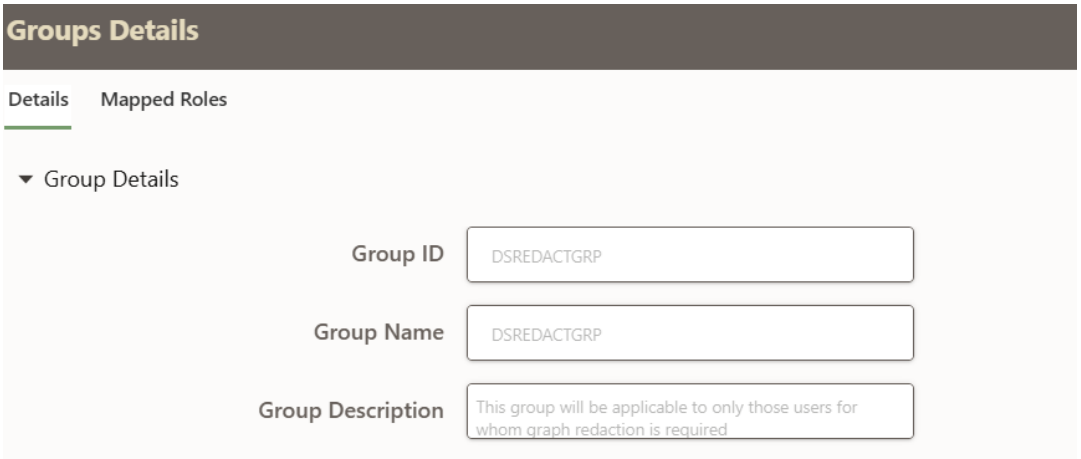
Figure 8-3 Identity Management Users



The users who are mapped to the application are listed here.

Figure 8-4 Identity Management Groups

Figure 8-5 Group Details



The MMG Admin users has groups. The above image displays the groups assigned to a particular user.

Figure 8-6 Identity Management Roles

Figure 8-7 New Mapping and Unmap

All the groups have specific roles mapped to it.

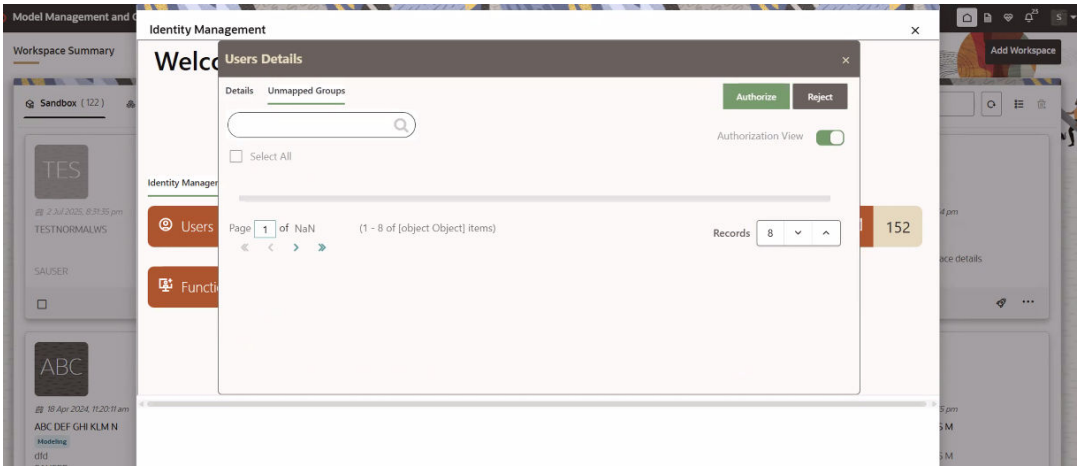
- **New Mapping:** The user can click on New Mapping for a new additional role.
- **Unmapping:** The user can remove any role by clicking unmapping.

> **Note**
>
> However, if an individual has mapped in with a particular user credential, they can unmapp only other groups, and not the user group they have logged in with.

Figure 8-8 Identity Management Functions

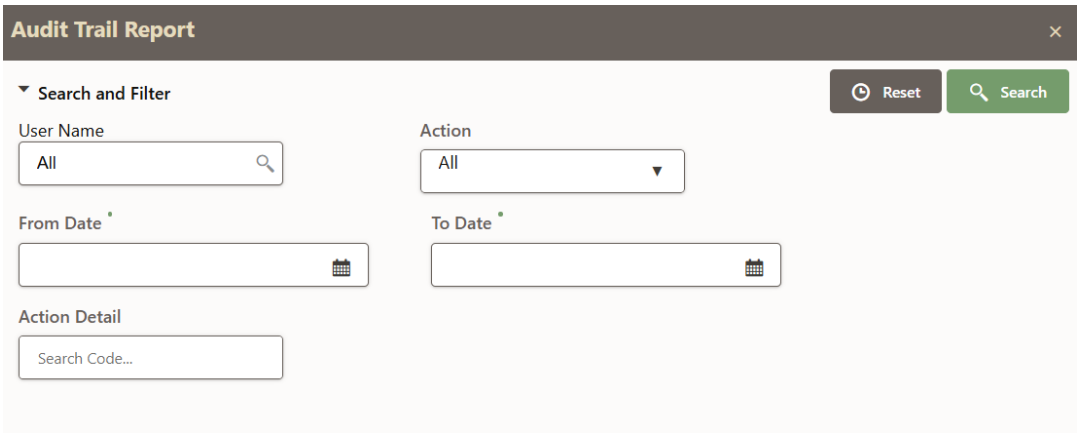
Authorization View screen in Admin

Figure 8-9 Authorization View screen in Admin



Authorization: When you need to map a new role, you request for a new role or User Group mapping. From the authorization view you can click on the **Authorize** button to authorize the that role/ group by approving the request. You also have the option of clicking the **Reject** button to reject the request.

Figure 8-10 Audit Trail Report



The Audit Trail Report reflects the activities the user performs during a particular period.

- **Reset:** You can click the Reset button to reset the data in the Audit Trail Report.
- **Search:** You can click the Search button to track a particular activity.

- **Logout**: Click to log out of the application.

Data Stores

This feature allows you to manage the Data Schemas registered with the application. The Data Store Summary window shows the list of Data schemas registered with the application. These Data schemas can be used either for workspace or for sourcing data. Click Data Stores to navigate to Data Source Summary window.

This window also allows you to manage these registered external sources.

Figure 8-11 Data Source Summary window

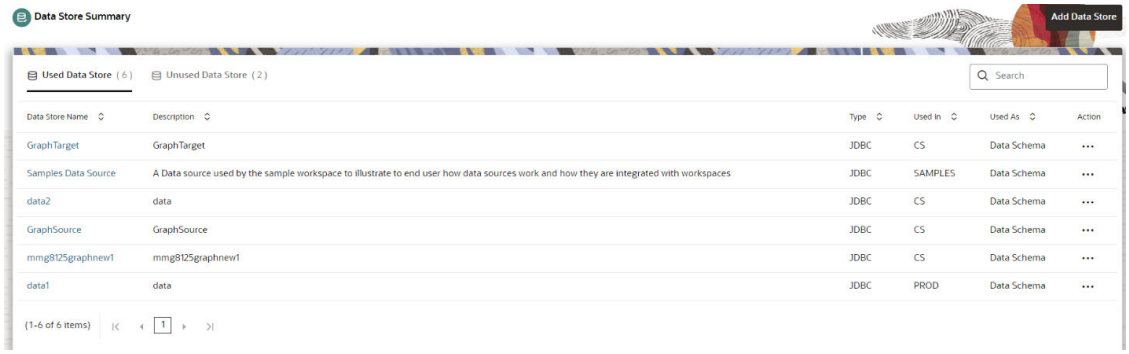
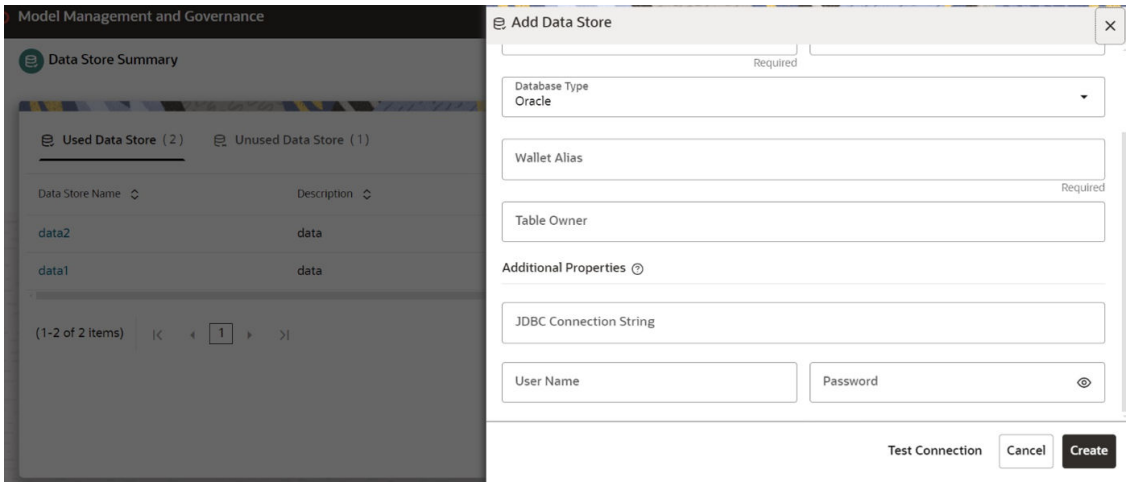


Figure 8-12 Add Data Store



The Data Store Summary consists of two sections: Used Data Source and Unused Data Source.

- **Used Data Source:**
- This shows the list of Data Sources registered with any workspace. Here, you can only view the Data Source details. The count of Used Data Sources also displayed at the top of Data Source Summary page.
- **Unused Data Source:**
- This shows the list of Data Sources those are not registered with any workspace. Here, you can only view, edit, or delete the Data Source details. The count of Unused Data Sources also displayed at the top of Data Source Summary page.

> **Note**
>
> Data Store name should not be allowed to be created with spaces at the start and end of Data Store name and with multiple spaces in between.

Adding a Data Store

To add a Data store, follow these steps:

1. Navigate to **Workspace Summary** window.
2. Click **Profile** icon and select **Data Stores**.

   The **Data Store Summary** page is displayed.
3. Click **Add Store**.

   The **Add Data Store** window is displayed.

Figure 8-13 Add Data Store with Type File

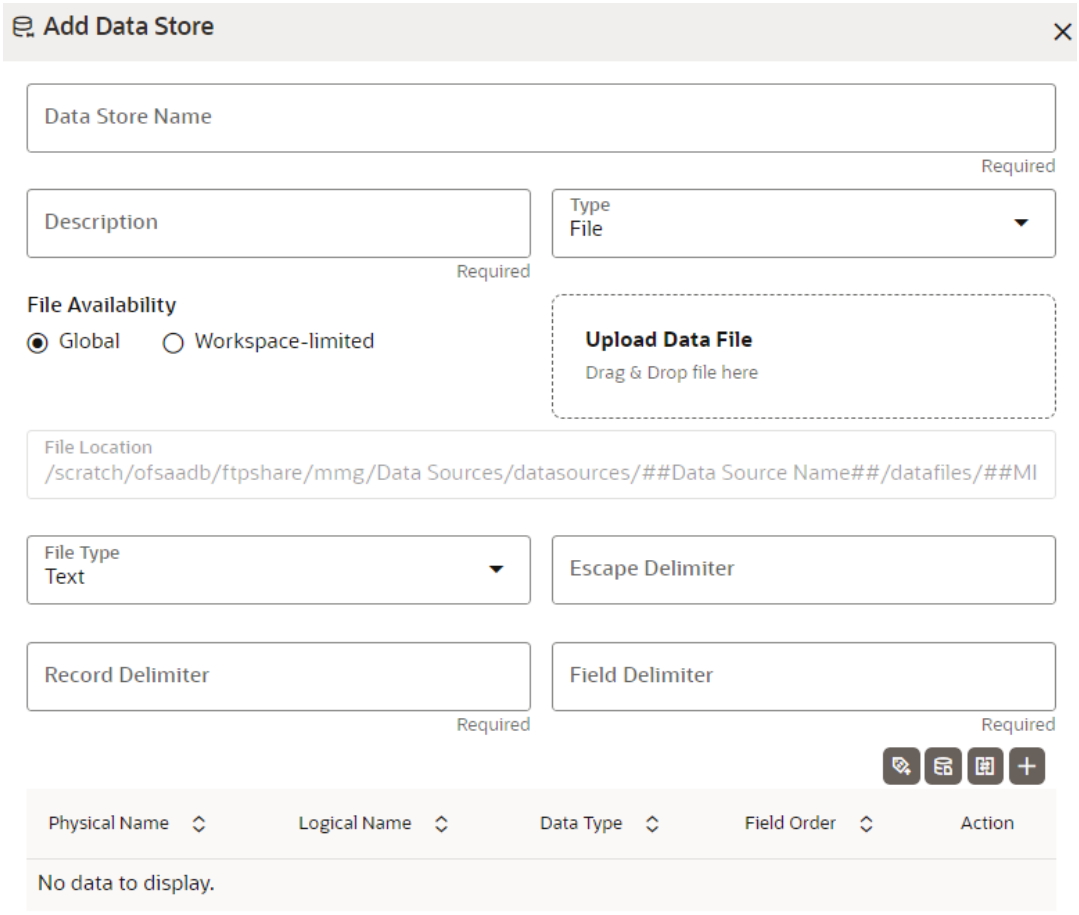


Figure 8-14 Add Data Store with Oracle Database

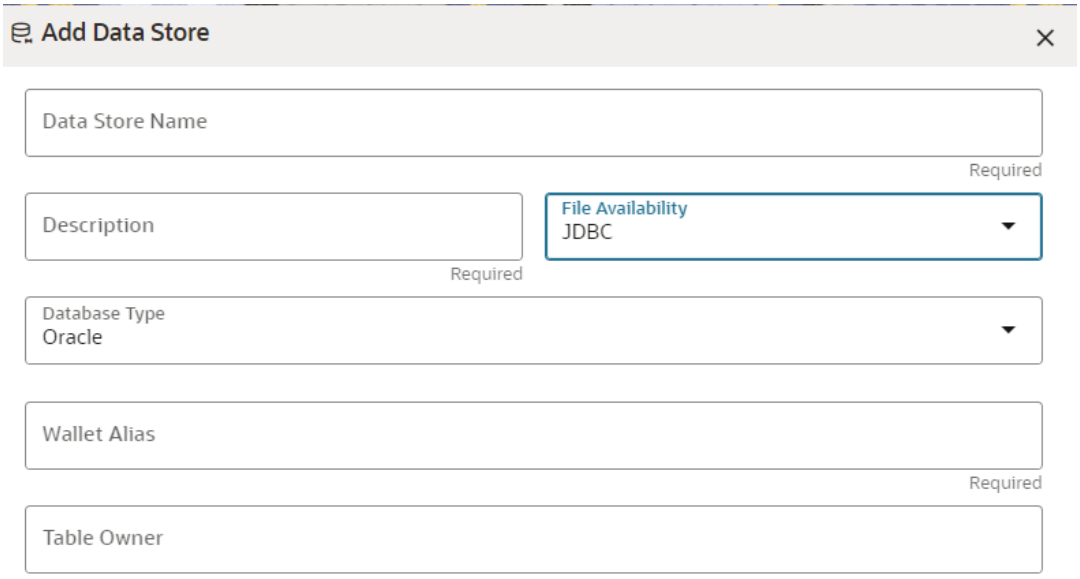
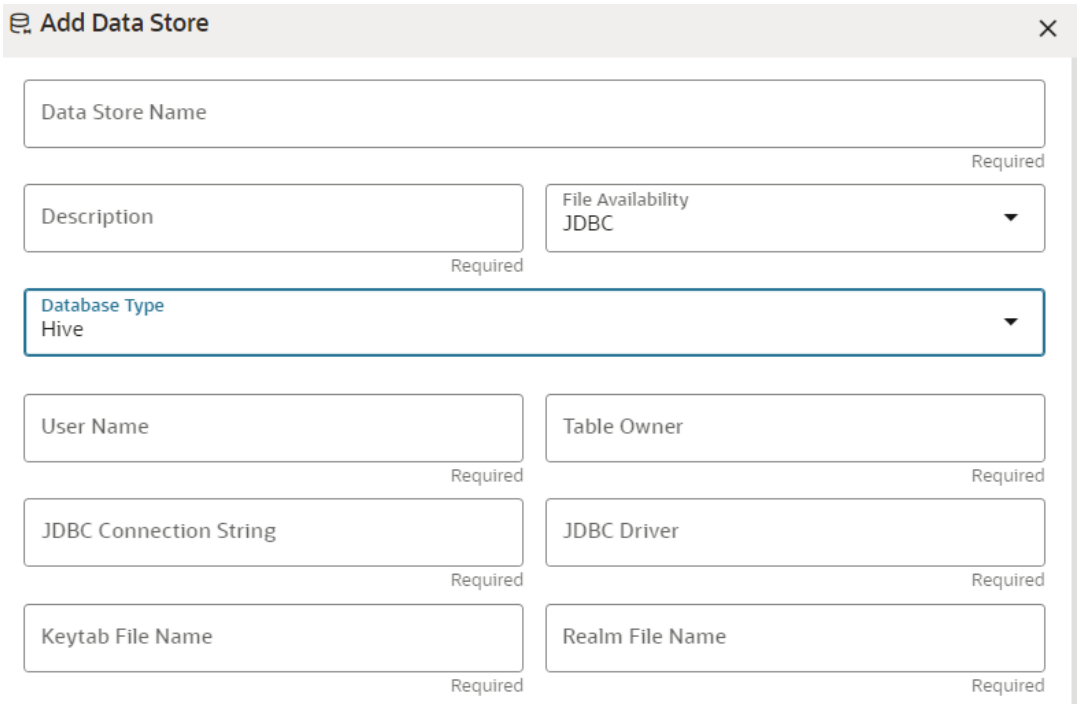


Figure 8-15 Add Data Source with Hive Database



4. Enter the required details as shown in the following table.

Table 8-1 Add Data Source

Field	Description
Data Store Name	Enter the connection URL to the database for the data schema.

Table 8-1 (Cont.) Add Data Source

Field	Description
Description	Enter the description of database connection.

Table 8-1 (Cont.) Add Data Source

Field	Description
Type	Enter the type of the database connection. The supported types are JDBC and File. • **JDBC** : If selected, the Database type options Oracle and Hive are displayed. • **File**: If selected, the following options are displayed. **Global**: Select this option if you want to fetch the global level datasource details. You need to place the file with the datasource details in JSON format in the following location: <installed path>/ftpshare/mmg/Data Sources/datasources/##Data Source Name##/datafiles/##MISDATE##/* **Workspace-limited**: Select this option if you want to fetch the workspace level datasource details. You need to place the file with the datasource details in JSON format in the following location: <installed path>/ftpshare/mmg/##Workspace##/datasources/##Data Source Name##/datafiles/##MISDATE##/* **Upload Data File**: Click to upload data file in text or csv format. Any pre-filled values will be overridden with the selected data file. Once the file is uploaded, you can derive the schema which will auto populate the values based on the file. **File Type** : Select the Type as text or csv format. **Escape Delimiter**: An escape delimiter is simply a sequence that is recognized and ignored during parsing. Its purpose is to allow the use of escape sequences to embed byte sequences in data that would otherwise be seen as delimiter occurrences. This option differentiates multiple records in one single column from second column. Escape delimiter (eg. '), added in from of multiple records will treat it as multiple records for one single column. For example, if there is a normal delimiter “+” at a given level, and you define an escape delimiter “\+” as shown in the following figure, then aaa+b\+c+ddd will parse as three fields: aaa, b\+c, and ddd. If the escape delimiter were not defined, the sequence would then parse as four fields: aaa, b\, c, and ddd. **Record Delimiter**: There is a separation of the records using a delimiter character like a comma, semicolon, hyphen, and so on for the rows. Enter the delimiter in the Record Delimiter field. This is a mandatory field and limited to two characters. **Field Delimiter**: There is a separation of the records using a delimiter character for the columns. Enter the delimiter in the Field Delimiter field. This is a mandatory field. **Derive Schema**: It is an optional feature that populates the data grid by analyzing schema details from any data file stored in the above

Table 8-1 (Cont.) Add Data Source

Field	Description
	specified directory. This is applicable when you upload data file in previous steps. You can either add the file details using data template or manually. Click Data File Template icon to select the Data Source entities and click Save. **OR** Click Add icon to add the details such as Physical Name, Logical Name, Data Type, and Field Order manually and click Save. Click Reorder Grid option to reorder the field orders.

Table 8-1 (Cont.) Add Data Source

Field	Description
Database Type	If the Type field is selected as JDBC, the following options are displayed. Select the Database Type as Oracle or Hive. NOTE: Selected tables during Hive sourcing should be preexisting in the RDBMS data schema before the workspace population. If you select Database Type as Oracle (see Figure 10), then following additional fields are displayed to enter details: • Wallet Alias : Enter the Wallet Alias. This value should be same as configured using Oracle Wallet. For more information, see the Oracle Financial Services Model Management and Governance Installation Guide • Table Owner: Enter the Oracle Database schema name. If you select Database Type as Hive (see Figure 11), then following additional fields are displayed to enter details: User Name: User Name / Principal is used for Kerberos authentication. Example: mmg/hostname@ORACLE.COM. Table Owner: Enter the Hive schema. JDBC Connection String: Enter the JDBC Connection String. Example: jdbc:hive2://hostname:10000/default;principal=hive/hive-service-hostname@ORACLE.COM. JDBC Driver: Supports org.apache.hive.jdbc.HiveDriver and com.cloudera.hive.jdbc4.HS2Driver. Keytab File Name: Enter the Name of the keytab file present in conf directory. Example: mmg.keytab Realm File Name: Enter the Name of the configuration file present in conf directory. Example: krb5.conf NOTE: • Schema population for Hive as target is not supported. • This is applicable only for Sandbox Workspace. For more information on setting the environment, see the Oracle Financial Services Model Management and Governance Installation Guide.

5. Click **Create**.

   The Data Store is created.

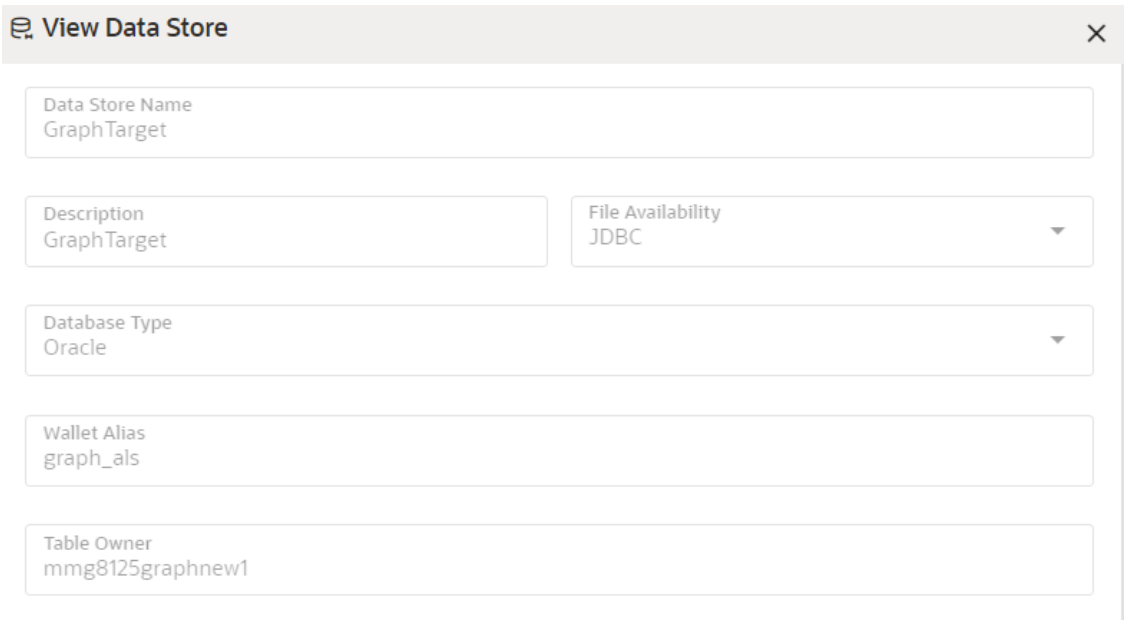
> **Note**
>
> Click **Test Connection** to check the connection. A success message is displayed.

> **Note**
>
> Data Store needs to be created with additional properties giving JDBC connection string, username and password.
> The user should not provide '//' for the JDBC connection string. For example: jdbc:oracle:thin:@//sevicehost:port/servicename
>
> The correct JDBC connection string which the user should provide is: jdbc:oracle:thin:@sevicehost:port/servicename
>
> The reason because AAI does not accept the string with //, thereby leading to workspace creation failure.

Viewing the Data Store Details

To view the Data Store details, click the **Action** icon next to corresponding Workspace and select **View**.

Figure 8-16 View Data Store



Conda Environments

Conda as a package manager helps you to find and install packages. With the capability of environment manager, you can set up a totally separate environment to run different versions of Python. In addition, you can continue to run your usual version of Python in your normal environment. You can configure the channels required for the Conda environment creation in the .condarc file.

> **Note**
>
> The supported version of Conda is 3.9.x.

You must add the miniconda/bin directory in the following path variable as shown below:

PATH=/scratch/ofsaadb/miniconda3/bin:$PATH

For proxy support, you need to manually configure the .condarc file present in the root directory.

Limitation: Conda support currently does not include linking externally created environments to the application.

To configure:

Add the below in the .condarc file.

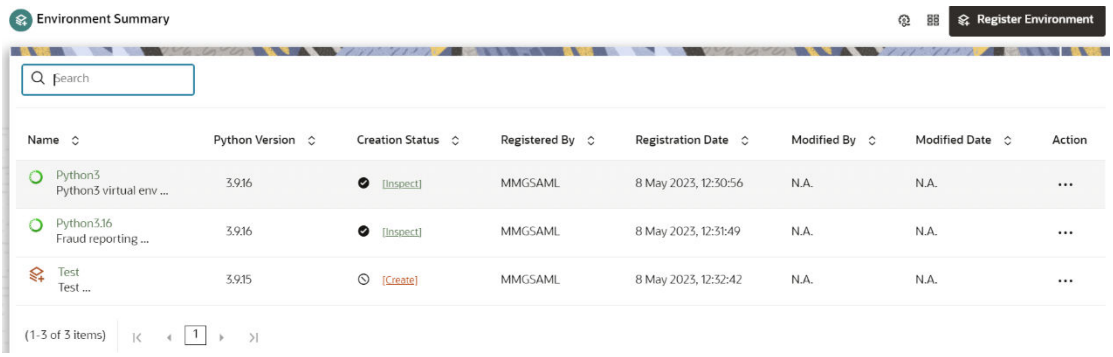
proxy_servers:

- `http: http://www-proxy.idc.oracle.com:80`
- `https: http://www-proxy.idc.oracle.com:80`

> **Note**
>
> - Conda package search is restricted only to the package name and does not include versions.
> - Python version displayed in the Register Conda UI.

Click **Conda Environments** to navigate to **Environment Summary** page from any other window in the application. You can register and manage Conda environments from this page.

Figure 8-17 Environment Summary page



The following table provides descriptions for the fields and icons on the **Environment Summary**page.

Table 8-2 Fields and icons on the Sandbox Summary page

Field or Icon	Description
Search	The field to search for a Conda environment. Enter specific terms in the field for which you want to search, and press Enter on the keyboard to display the results. **NOTE**: Conda package search is restricted only to the package name and does not include versions.
Name	The name of the Conda environment.
Python Version	The python library version of the Conda environment.
Creation Status	The status of the Conda environment. The status can be either Inspect or Create. • **Inspect**: The environment is registered and created. You can perform functions such as Edit/View/Inspect/Clone/Export/Remove for the Inspect status environments. • **Create**: The environment is registered but not created. You can perform functions such as Create/Edit/View/Deregister for the Create status environments
Registered By	The User Id of the User who registered the Conda environment.
Registration Date	The date on which the Conda environment has been registered.
Modified By	The ID of the Last Modified by user who has modified the Conda environment.
Modified Date	The date on which the Conda environment was modified.
Register Environment	Click to register a new Conda environment.
Conda Settings	Click to add or modify the Conda components settings.
Conda Properties	Click to view the Conda properties.
Action	Click the three dots to perform Edit/View/Inspect/Clone/Export/Remove functions on selected Conda environment. The functions might vary based on the selected Conda environment.

Register a Conda Environment

To register a Conda environment:

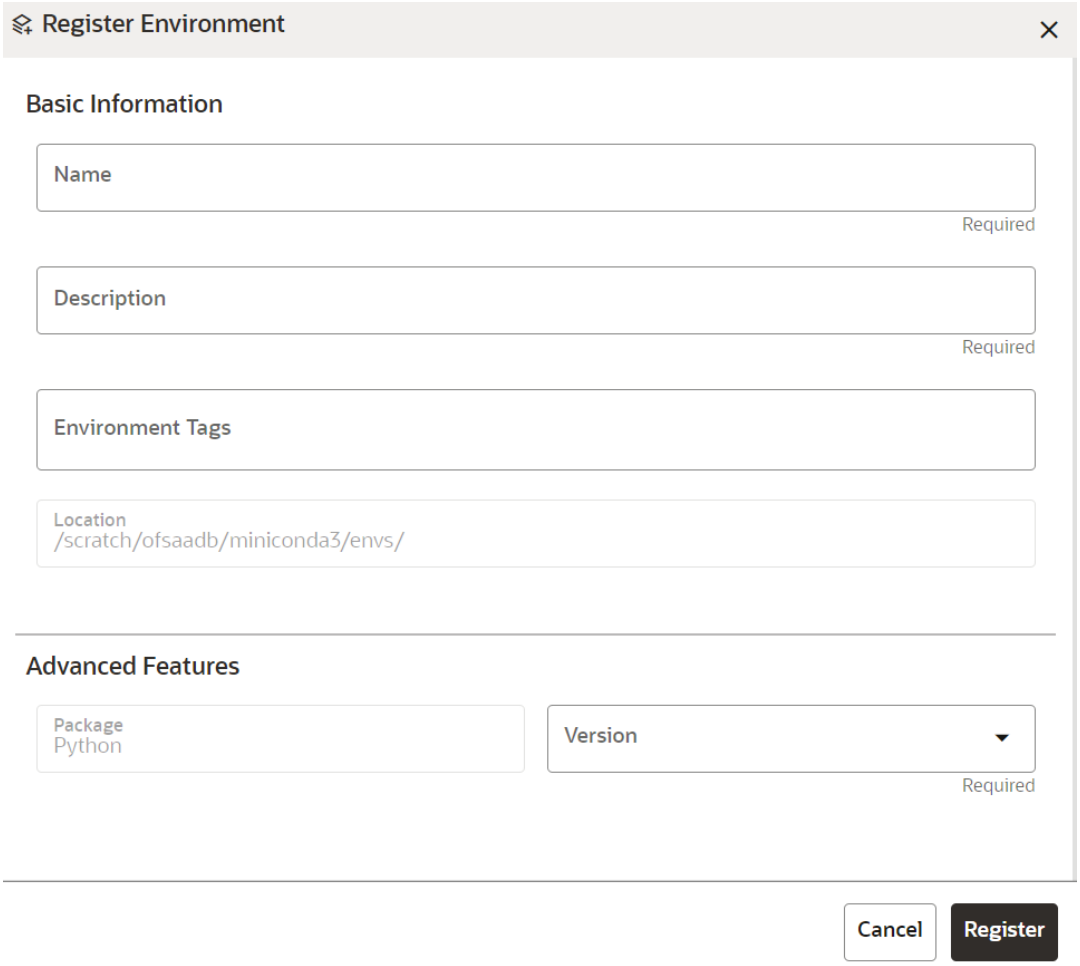
1. Click **Conda Environments**to navigate to **Environment Summary** page from any other window in the application.

   This page displays the Conda environments in a table.

2. In the **Environment Summary** screen, click **Register Environment**.

   The **Register Environment** page is displayed.

Figure 8-18 Register Environment page



3. Enter the **Name** for the environment. This field is mandatory.
4. Enter the **Description** for the environment. This field is mandatory.
5. Enter a tag in the **Environment Tags** field. You can add multiple tags.

> **Note**
>
> The **Location** of the Conda environment is displayed. This field is greyed out and cannot be modified.

6. In the **Advanced Features** drop-down list, select the required python package for the Conda environment. Python as a package is selected by default.
7. Click **Register**.

   The Conda environment is registered and displayed in the Environment Summary page.

   After the environment registration is complete, you must create the Conda environment. For more details, see the Create a Conda Environment section.

Create a Conda Environment

To create a Conda environment:

1. Click **Conda Environments** to navigate to **Environment Summary** page from any other window in the application.

   This page displays the Conda environments in a table.

2. Click **Action**next to corresponding environment and select **Create** to create the Conda environment.

   > **Note**
   >
   > The **Create** option is not displayed for the Conda environment with the creation status **Inspect**.

   A confirmation dialog is displayed.

3. Click **Create**.

   The Conda environment is created.

   These environments can be selected while creating a Workspace. For more details, see the Workspace Schema section.

   In addition, these environments can be selected during the Model pipeline execution.

Edit a Conda Environment

To edit a Conda environment:

1. Click **Conda Environments**to navigate to **Environment Summary**page from any other window in the application.

   This page displays the Conda environments in a table.

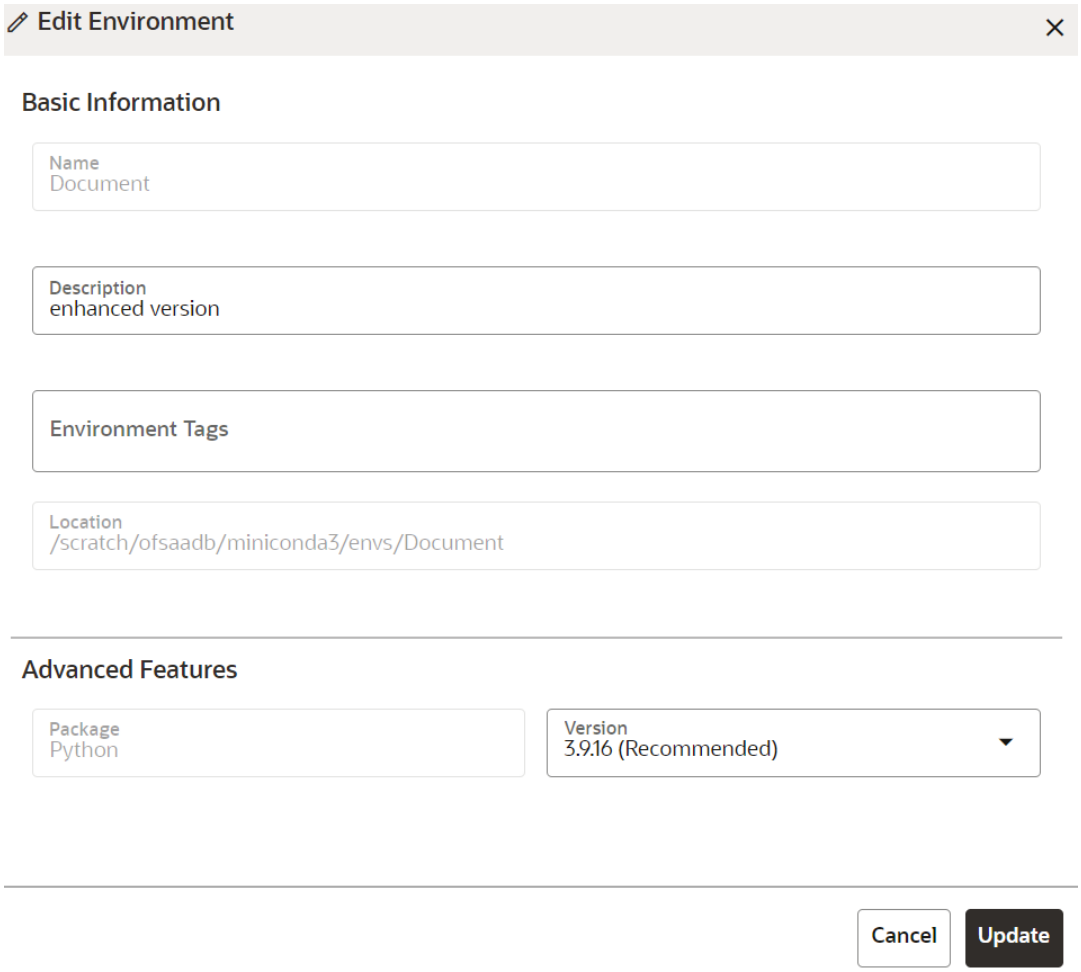
2. Click **Action**next to corresponding environment and select **Edit** to edit the details.

   The **Edit Environment** page is displayed.

   For more details on the Edit environment fields, see Register a Conda Environment section.

   > **Note**
   >
   > The **Name**of the Conda environment is greyed out and cannot be modified.

Figure 8-19 Edit Environment page



3. Click **Update**.

   The details of the Conda environment is updated.

View a Conda Environment

To view a Conda environment details, follow these steps:

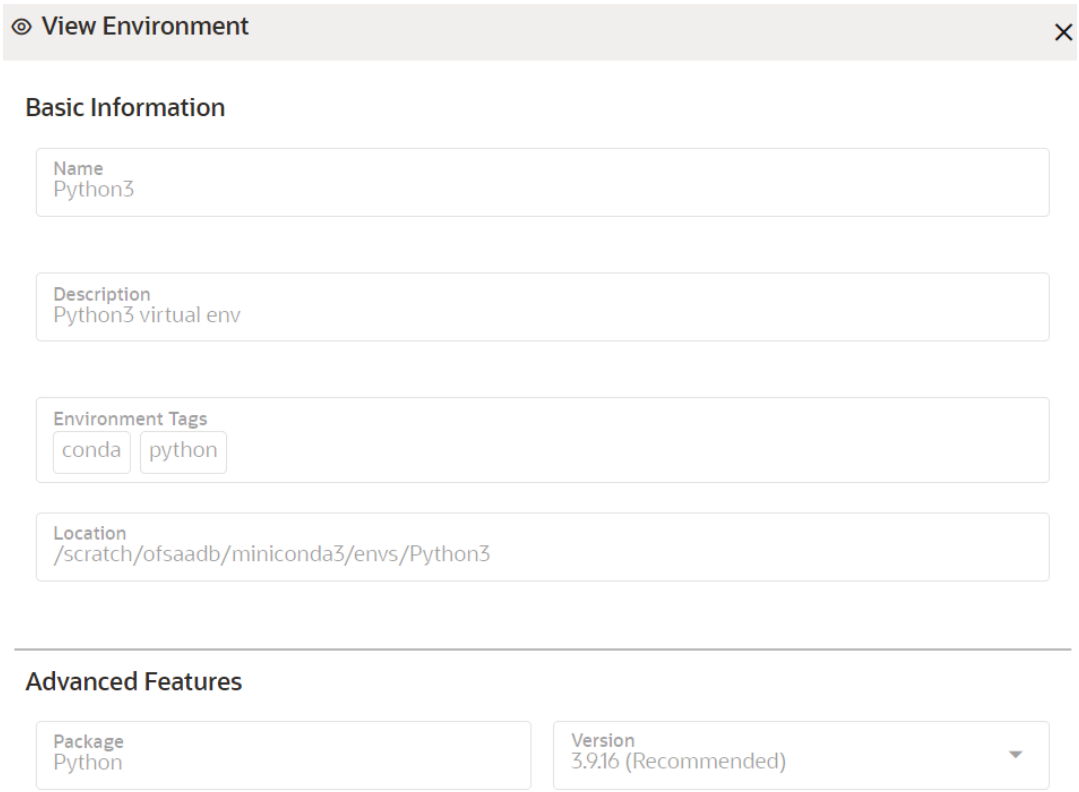
1. Click **Conda Environments** to navigate to **Environment Summary** page from any other window in the application.

   This page displays the Conda environments in a tabular format.

2. Click **Action**next to corresponding environment and select **View** to view the details.

   The details of the Conda environment are displayed.

Figure 8-20 View a Conda Environment



Deregister a Conda Environment

To Deregister a Conda environment:

1. Click **Conda Environments**to navigate to **Environment Summary** page from any other window in the application.

   This page displays the Conda environments in a table.

2. Click **Action**next to corresponding environment and select **Deregister** to deregister the Conda environment.

   > **Note**
   >
   > The **Deregister** option is not displayed for the Conda environment with the creation status **Inspect**. A confirmation dialog is displayed.

3. Click **Deregister**.

   The registered Conda environment is deregistered and removed from the Environment Summary page.

Inspect a Conda Environment

To inspect a Conda environment:

1. Click **Conda Environments** to navigate to **Environment Summary** page from any other window in the application.

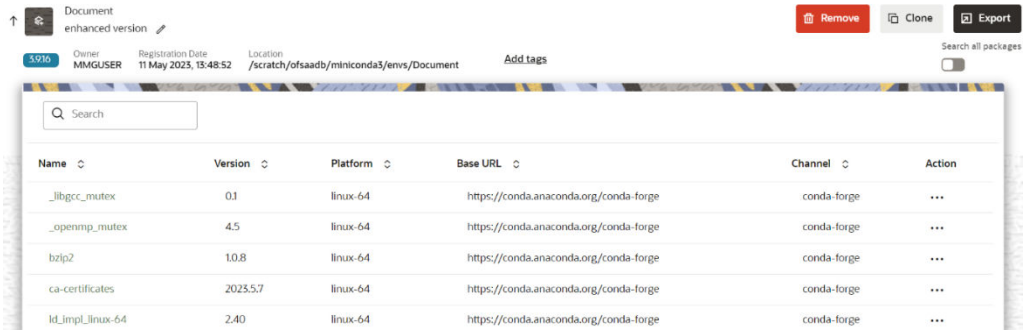
This page displays the Conda environments in a table.

2. Click **Action**next to corresponding environment and select **Inspect** to edit the details.

> **Note**
>
> The **Inspect** option is not displayed for the Conda environment whose creation status is **Create**.

The Conda environment details are displayed.

Figure 8-21 Conda environment details



You can perform the following in the above page:

- Remove Environment
- Clone Environment
- Export Environment
- Edit a Conda Environment Description
- Add or Remove the Environment Tags
- Search All Packages
- View Package Properties
- Update Package
- Remove Package

Remove Environment

To remove a Conda environment:

1. In the Conda details page, click **Remove**.

   A confirmation message is displayed.

2. Click **Remove**.

   The Conda environment is deregistered and removed from the **Environment Summary** page.

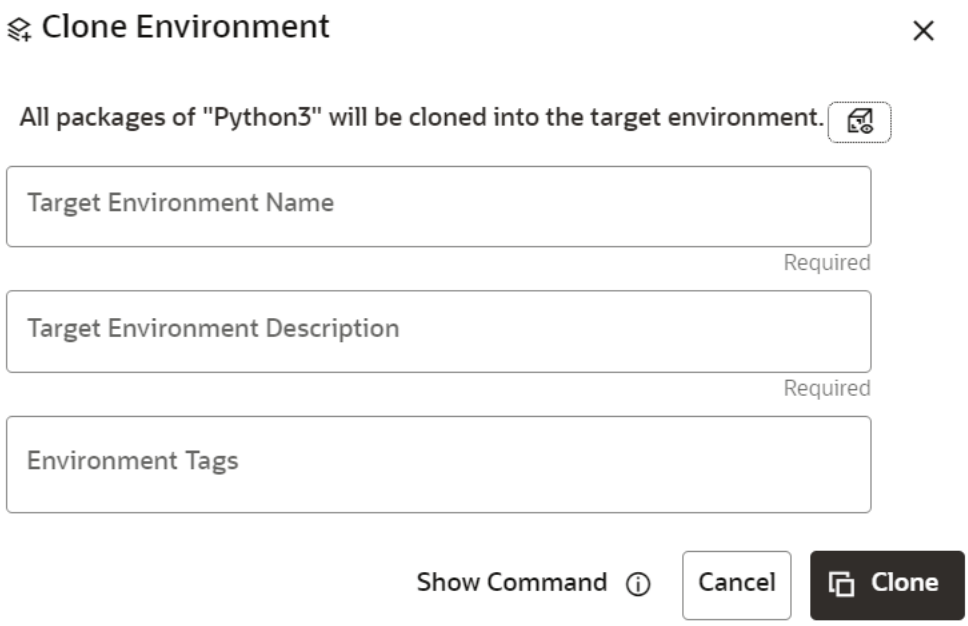
Clone Environment

To clone a Conda environment:

1. In the Conda details page, click **Clone**.

   The **Clone Environment** page is displayed.

Figure 8-22 Clone Environment



> **Note**
>
> You can preview the packages of the current Conda environment by clicking the **Preview** icon.

2. Enter the **Target Environment Name**to which the current environment needs to be cloned.
3. Enter the **Target Environment Description**.
4. Enter a tag in the **Environment Tags**field. You can add multiple tags.
5. Click **Clone**.

   The Conda environment is cloned to the targeted environment.

Export Environment

To export a Conda environment:

- In the Conda details page, click **Export**.

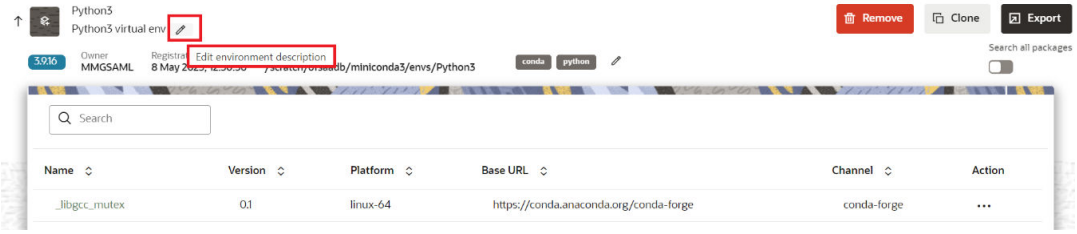
  The Conda environment is exported in **yml** format.

Edit a Conda Environment Description

To edit a Conda environment description:

1. In the Conda details page, click **Edit** icon.

Figure 8-23 Conda details page



2. Modify the description and click **Save**.

> **Note**
>
> The **Name** of the Conda environment cannot be modified.

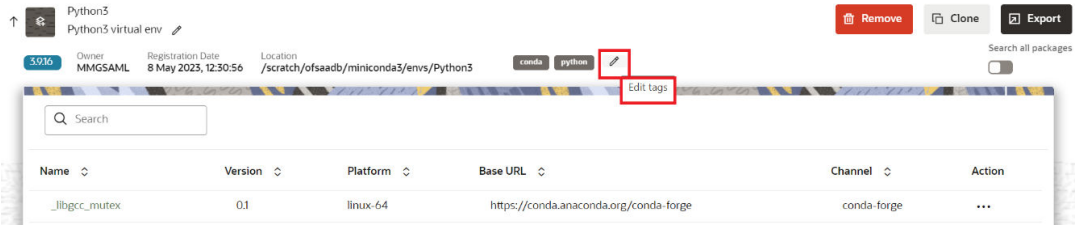
The details of the Conda environment is updated.

Add or Remove Environment Tags

To add or remove Environment Tags:

1. In the Conda details page, click **Edit**.

Figure 8-24 Conda details page



2. Add or remove the environment tags, and click **Save**.

   The environment tag details of the Conda environment are updated.

Search All Packages

To search all the packages:

1. In the Conda details page, enable the **Search all packages** option.
2. If you want to search the packages in cache, enable the Look up in cache option.

   This option is set to true by default for faster processing. The searched package is looked up in the cache and the result published, if found. If not, a new search in the conda-forge

channel is performed. You can toggle this option if you expect more recent versions to be available.

3. Enter the package name in the search bar and press **Enter**.

   All the packages meeting your search criteria are displayed.

   Click the **Action** icon to view and install packages.

View Package Properties

To view package properties of the Conda environment, on the Conda Details page, click **Action** and select **View**.

The details of the package are displayed.

Figure 8-25 Package Properties

Update Package

To update the package of the Conda environment:

1. In the Conda details page, click **Action** and select **Update**.

   A confirmation message is displayed.

2. Click **Update**.

   The selected package is updated.

Remove Package

To remove a package from the Conda environment:

1. In the Conda details page, click **Action** and click **Remove**.

   A confirmation message is displayed.

2. Click **Remove**.

   The selected package is removed.

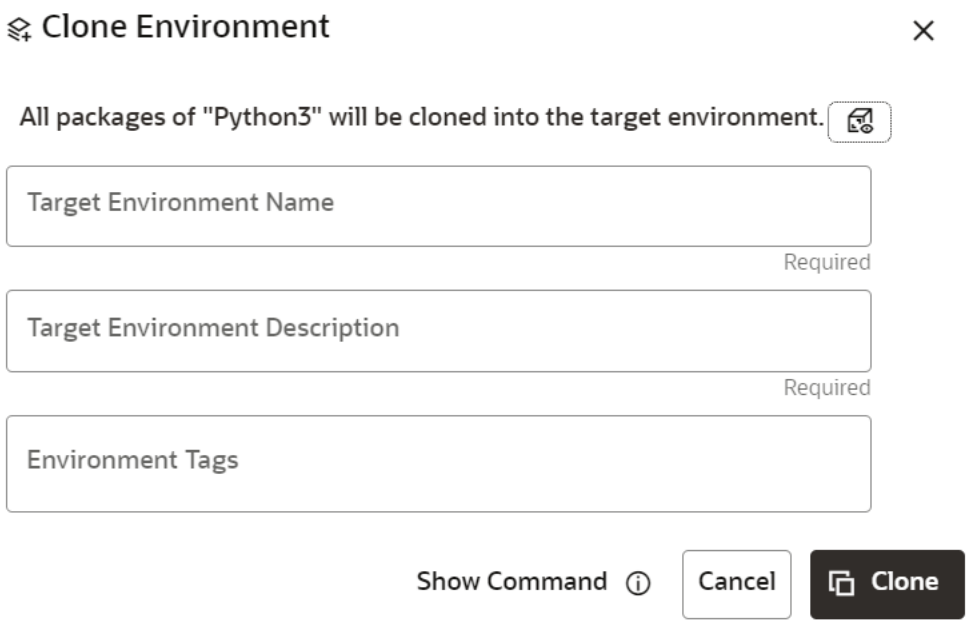
Clone Environment

To clone a Conda environment:

1. In the Conda details page, click **Clone**.

   The **Clone Environment** page is displayed.

Figure 8-26 Clone Environment page



> **Note**
>
> You can preview the packages of the current Conda environment by clicking the Preview icon.

2. Enter the **Target Environment Name** to which the current environment needs to be cloned.
3. Enter the **Target Environment** Description.
4. Enter a tag in the **Environment Tags** field. You can add multiple tags.
5. Click **Clone**.

   The Conda environment is cloned to the targeted environment.

Export Environment

To export a Conda environment:

1. Click the **Conda Environments** icon to navigate to the **Environment Summary** page from any other window in the application.

This page displays the Conda environments in a tabular format.

2. Click **Action** and select **Export**.

   The Conda environment is exported in **yml** format.

Modify Conda Settings

To modify the Conda Settings:

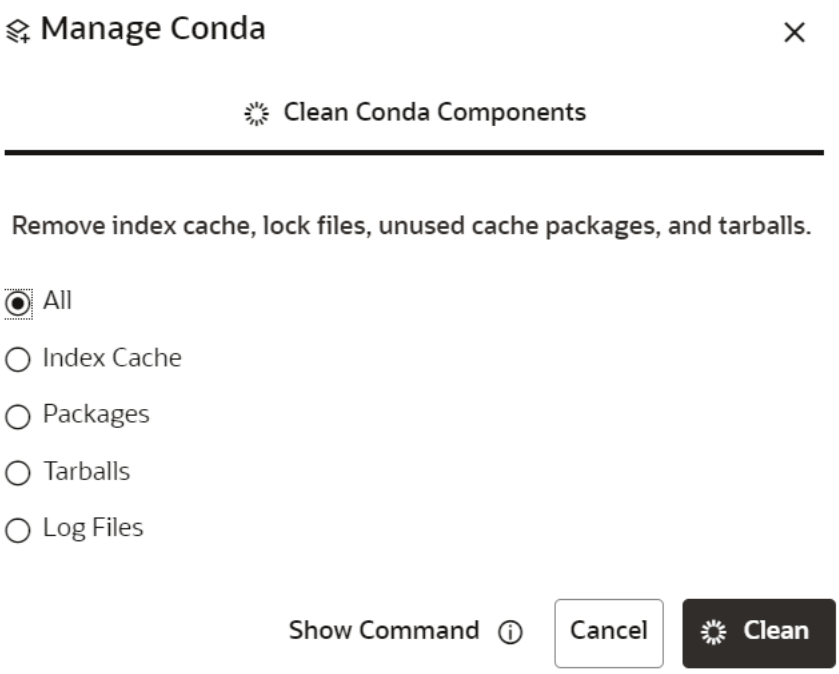
1. Click the **Conda Environments** icon to navigate to the **Environment Summary** page from any other window in the application.

   This page displays the Conda environments in a tabular format.

2. Click the **Conda Settings** icon.

   The **Manage Conda** screen is displayed.

Figure 8-27 Manage Conda screen



3. Select the required option and click **Clean**.
   - **All**: Removes index cache, lock files, unused cache packages, and tarballs.
   - **Index Cache**: Removes index cache.
   - **Packages**: Removes unused packages from writable package caches. WARNING: This does not check for packages installed using symlinks back to the package cache.
   - **Tarballs**: Removes cached package tarballs.
   - **Log Files**: Removes log files.

   This will clean up the Conda components based on the selection.

View Conda Properties

To view Conda Properties:

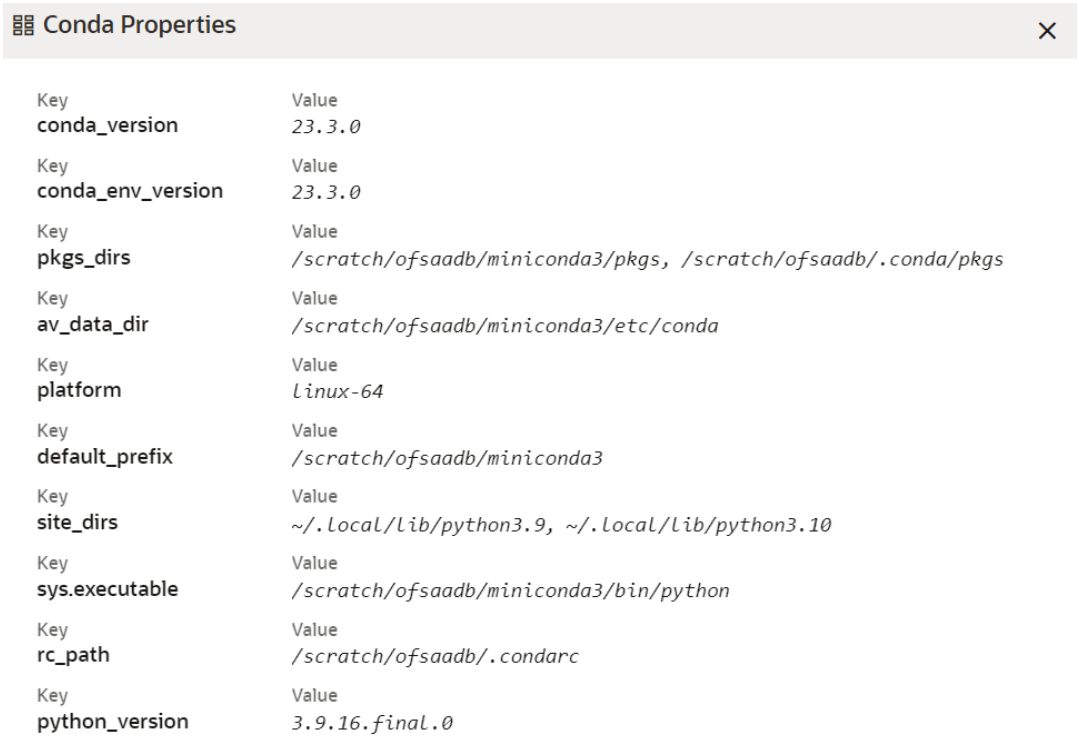
1. Click the **Conda Environments** icon to navigate to the **Environment Summary** page from any other window in the application.

   This page displays the Conda Environments in a tabular format.

2. Click the **Conda Properties** icon.

   The Conda properties are displayed in a key-value format.

Figure 8-28 Conda Properties



Using the .condarc Conda Configuration File

Overview

The Conda configuration file, `.condarc`, is an optional runtime configuration file that allows advanced users to configure various aspects of Conda, such as which channels it searches for; packages, proxy settings, and environment directories.

> **Note**
>
> A `.condarc` file can also be used in an administrator-controlled installation to override the users' configuration. See Administering a multi-user Conda Installation.

The `.condarc` file can change many parameters, including:

- Where Conda looks for packages.
- If and how Conda uses a proxy server.
- Where Conda lists known environments.

- Whether to update the Bash prompt with the currently activated environment name.
- Whether user-built packages should be uploaded to Anaconda.org.
- What default packages or features to include in new environments.

Creating and Editing

The `.condarc` file is not included by default, but it is automatically created in your home directory the first time you run the `conda config` command. To create or modify a `.condarc` file, open a terminal and enter the `conda config` command. The `.condarc` configuration file follows a simple YAML syntax.

Example:

```
conda config --add channels conda-forge
```

Alternatively, you can open a text editor such as Notepad on Windows, or TextEdit on MacOS, or VS Code. Name the new file `.condarc` and save it to your user home directory or root directory. To edit the `.condarc` file, open it from your home or root directory and edit it in the same way you would with any other text file. If the `.condarc` file is in the root environment, it will override any in the Home Directory.

You can find information about your `.condarc` file by typing Conda info in your terminal. This will give you information about your `.condarc` file, including where it is located.

You can also download a sample .condarc file to edit in your editor and save to your user Home Directory or Root Directory.

Example:

To set the `auto_update_conda` option to `False` run:

```
conda config --set auto_update_conda False
```

For a complete list of Conda Config commands, see the command reference. The same list is available at the terminal by running `conda config --help`. You can also see the Conda Channel Configuration for more information.

Conda supports a wide range of configuration options. This section gives a non-exhaustive list of the most frequently used options and their usage. For a complete list of all available options for your version of conda, use the `conda config --describe` command.

Searching for .condarc

Conda looks in the following locations for a `.condarc file`:

- `XDG_CONFIG_HOME` is the path to where the user-specific configuration files should be stored or defined by following the XDG Base Directory Specification (XDGBDS).
- Default to `$HOME/.config` must be used. `CONDA_ROOT` is the path for your base conda installation.
- `CONDA_PREFIX` is the path to the current active environment.
- `CONDARC` must be a path to a file named `.condarc`, `condarc`, or end with a YAML suffix (`.yml` or `.yaml`).

> **Note**
>
> Any `condarc` files that exist in any of these special search path directories need to end in a valid `yaml` extension (`.yml` or `.yaml`).

Channels

You can create or configure the `.condarc` file (the global configuration file for Conda) by using the following example:

```
channels:

- conda-forge

- defaults

channel_alias: https://oracle.repo

default_channels:

- https://oracle.repo

ssl_verify: False

proxy_servers:

http: http://www-proxy.us.oracle.com:80

https: http://www-proxy.us.oracle.com:80
```

Channel Locations

When you list the channel locations in the `.condarc` file, it overrides the Conda defaults that in turn cause Conda to only search the listed channels in a given order.

To automatically include all default channels, use `defaults`. Non-URL channels are interpreted as an Anaconda.org user or as per the organization names. Perform the steps documented in the Set a channel alias (channel_alias) to modify the `channel_alias`. The default is `defaults`.

Example

```
channels:

- <anaconda_dot_org_username>

- http://some.custom/channel

- file:///some/local/directory

- defaults
```

Add a `.condarc` file in the root directory of the environment (or when you are using `conda config`, use the `--env` option) to select channels for a single environment. For example, you have installed Miniconda with Python 3 in your home directory and the environment is named `newenvironment`, the path may be:

```
~/miniconda3/envs/newenvironment/.condarc
```

Default channels (default_channels)

The defaults channel points to several channels in the repo.anaconda.com repository, but a new list of default channels are set if the `default_channels` is defined. This is especially useful for airgapped and enterprise installations:

Setting both the channel_alias and `default_channels` by an administrator, ensures that all users only pull packages from an on-premises repository, for example:

```
default_channels:

- http://some.custom/channel

- file:///some/local/directory
```

Conflict Merging Strategy

When conflicts between configurations arise, the following strategies are employed:

- Lists-merge
- Dictionaries-merge
- Primitive-clobber

Precedence

The precedence by which the Conda configuration is built is shown in this. Each new arrow takes precedence over the ones before it. For example, `config` files (by parse order) will be superseded by any of the other configuration options. Configuration environment variables (formatted as `CONDA_<CONFIG NAME>`) will always take precedence over the other 3.

Obtaining Information from the .condarc file

You can use the following commands to get the effective settings for conda. The effective settings are those that have merged settings from all the sources mentioned above.

To get all keys and their values:

```
conda config --get
```

To get the value of a specific key, such as channels:

```
conda config --get channels
```

To show all the configuration file sources and their contents:

```
conda config --show-sources
```

Saving Settings to your .condarc file

The `.condarc` file can also be modified via conda commands. The following are several examples of how to do this.

To add a new value, such as http://conda.anaconda.org/mutirri, to a specific key, such as channels:

```
conda config --add channels http://conda.anaconda.org/mutirri
```

To remove an existing value, such as http://conda.anaconda.org/mutirri from a specific key, such as channels:

```
conda config --remove channels http://conda.anaconda.org/mutirri
```

To remove a key, such as channels, and all of its values:

```
conda config --remove-key channels
```

To configure channels and their priority for a single environment, make a `.condarc` file in the root directory of that environment.

Sample .condarc file

Because the `.condarc` file is just a YAML file, it means that it can be edited directly. Below is an example `.condarc` file:

API Registry

Using API Registry, you will be able to register APIs above workspace level. Configured APIs can be mapped to multiple workspaces and the mapped APIs will be available for use in model pipelines.

Currently, only token-based and noAuth authentications are supported. Additionally, body parameters can only be provided with text data. All values that needs to be replaced during run time can be given in the format '<<placeholder variable name>>'.

Configured API can be viewed, edited (API code is not editable) and deleted. APIs that are not mapped to any workspace can only be deleted.

Integrating API with Model Pipelines

Mapped APIs will be available for use in model pipelines for the workspace. By selecting a specified API from the dropdown, you can link a node with an API. Additionally, you can provide an output variable name which will be assigned with the response from the API when that node is executed.

> **Note**
>
> API Registry is available only for %python interpreters. Output variable will be a python variable accessible only for paragraphs with %python interpreters.

In pipeline execute screen, values can be entered for all the placeholder variables during run time.

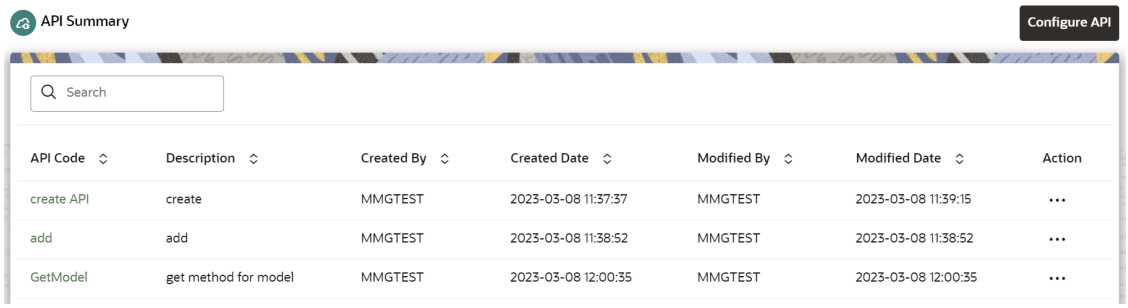
> **Note**
>
> Since variables are fetched during run time, it will be available in notebook or execute screen only after the first execution. This is the default behavior of all programmatic dynamic forms in Datastudio.

On executing the node/pipeline, result of the API executed can be accessed from the variable given under 'Output_variable_name'.

When the pipeline is imported to another workspace, it will seamlessly use the API that is mapped with the target workspace in the same order as that of the API mapped in source workspace.

Click **API Registry** to navigate to **API Summary** page from any other window in the application. You can configure and manage APIs from this page.

Figure 8-29 API Summary page



The following table provides descriptions for the fields and icons on the **API Summary**page.

Table 8-3 Fields and icons on the Sandbox Summary page

Field or Icon	Description
Search	The field to search for an API. Enter specific terms in the field for which you want to search, and press Enter on the keyboard to display the results.
API Code	The code of the API.
Description	The description for the API.
Created By	The User Id of the User who created the API.
Created Date	The date on which the API was created.
Modified By	The ID of the Last Modified by user who has modified the API.
Modified Date	The date on which the API was modified.
Configure API	Click Configure API to create a new API.
Action	Click the three dots to perform View/Edit/Delete functions on selected API.

Configure an API

To configure an API:

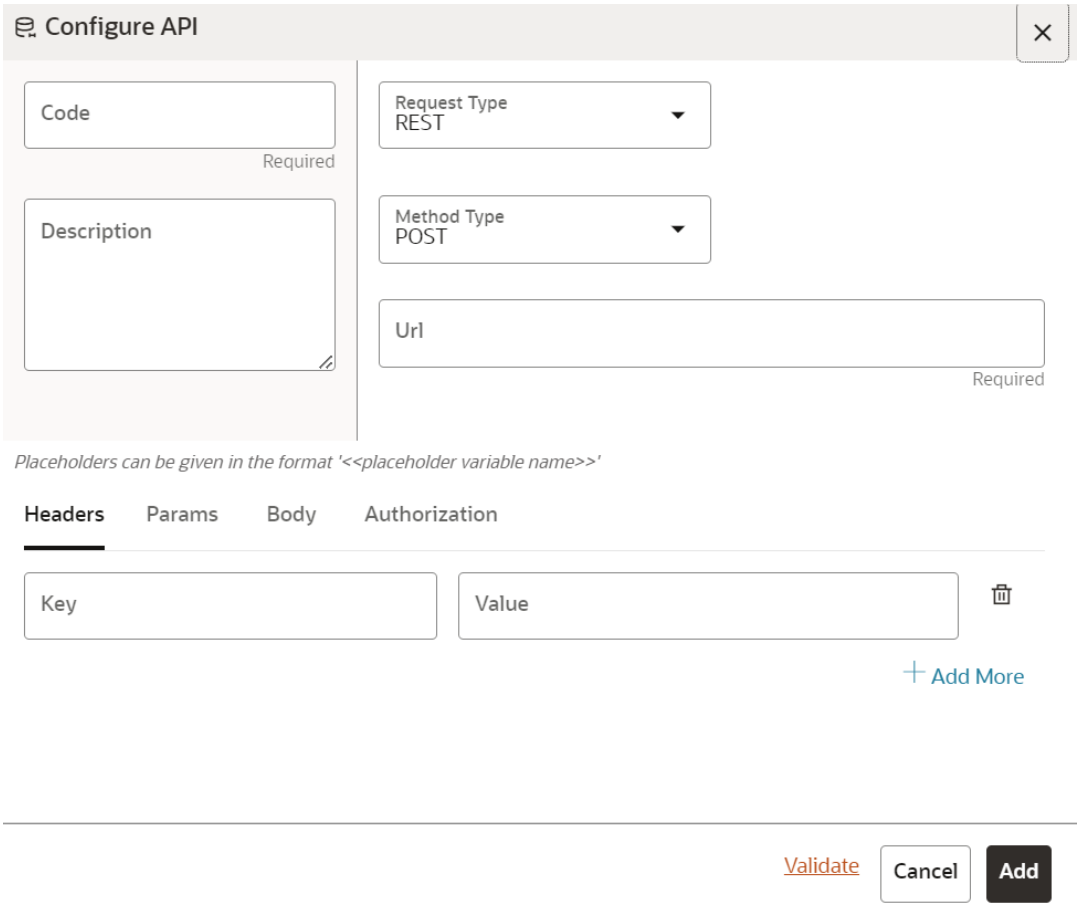
1. Click **API Registry**to navigate to **API Summary** page from any other window in the application.

   This page displays the API records in a tabular format.

2. Click the **Configure API** button.

   The **Configure API**page is displayed.

Figure 8-30 Configure API page



3. Enter the **Code**for the API. This field is mandatory.
4. Enter the **Description**for the API.
5. In the **Request Type**drop-down list, select the required option. Currently, REST type is supported.
6. In the **Method Type** drop-down list, select the required option. The supported types are GET, POST, PUT, and DELETE.
7. Enter the **URL** for the API. This field is mandatory.
8. You can provide the details such as Headers, Params, Body, and Authorization under the respective fields.
9. Click **Validate** to validate the API details.

   You are prompted to add the values for all the placeholder variables. After entering the values for placeholders, click the **Validate** button to view the API responses.
10. Click **Add**.

    The API is added and displayed in the API Summary page. These API's can be selected while creating a Workspace. For more details, see the Workspace Schema section.

View an API Registry

To view an API Registry:

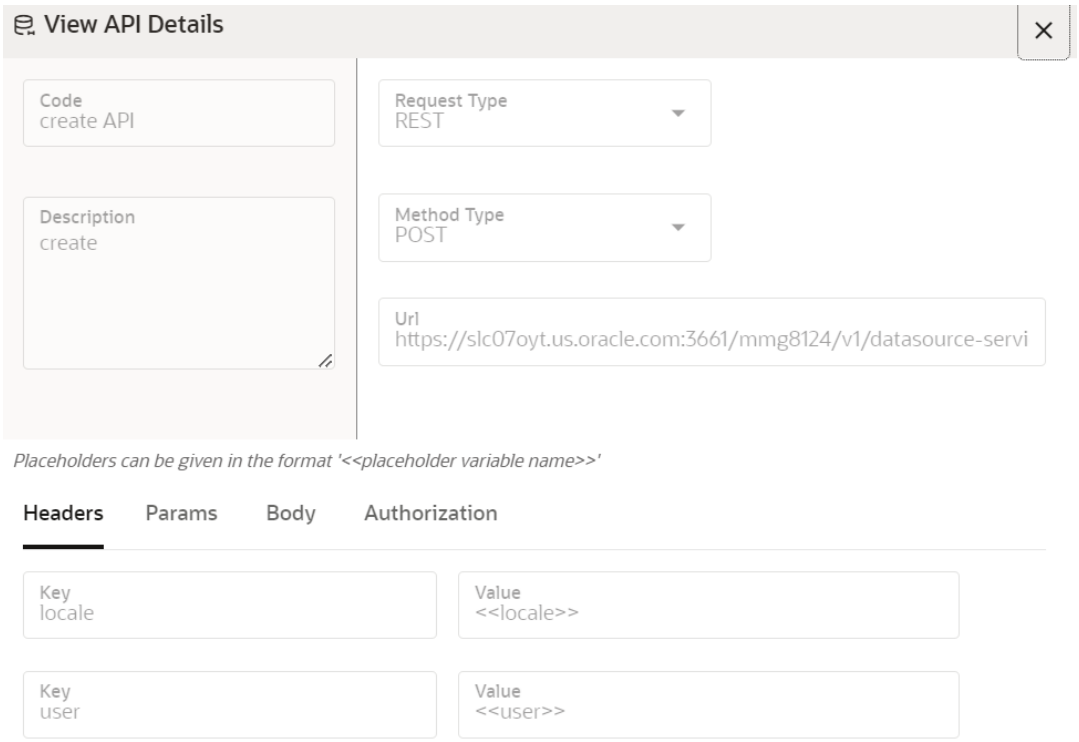
1. Click **API Registry**to navigate to **API Summary** page from any other window in the application.

   This page displays the API records in a tabular format.

2. Click **Action**and select **View** to view the API.

   The details of the API is displayed.

Figure 8-31 View API Details



3. Navigate to the Headers, Params, Body, and Authorization to view the respective details.

Edit an API Registry

To edit an API configuration:

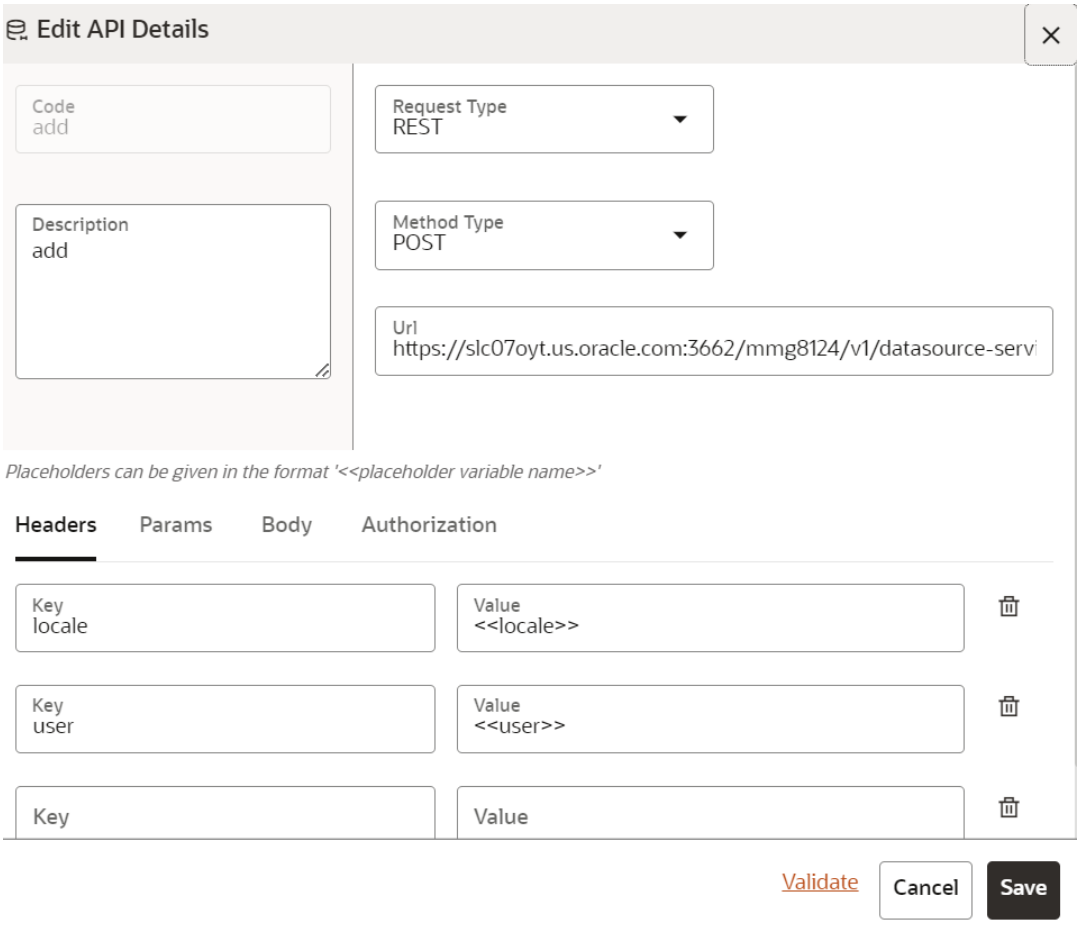
1. Click **API Registry** to navigate to **API Summary page** from any other window in the application.

   This page displays the API records in a table.

2. Click Action next to corresponding API and select **Edit** to edit the API.

   The **Edit API Details**page is displayed.

Figure 8-32 Edit API Details page



For more details on the Edit API Details fields, see Configure an API section.

3. Click **Save**.

Delete an API Registry

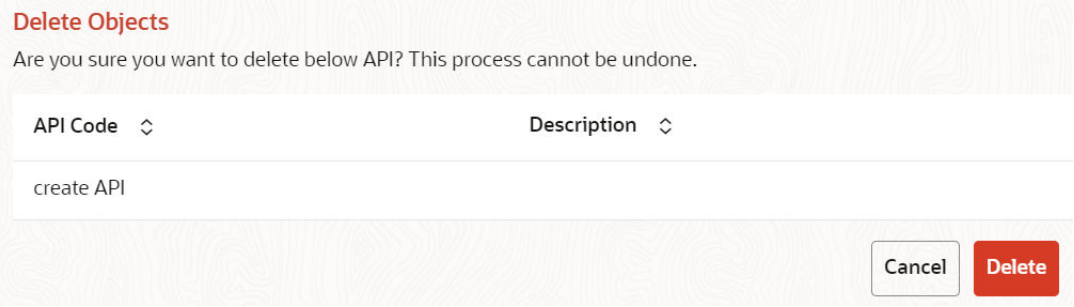
To delete an API Registry:

1. Click **API Registry**to navigate to **API Summary** page from any other window in the application.

   This page displays the API records in a tabular format.

2. Click Action and select **Delete**.

Figure 8-33 Delete Objects screen



3. Click **Delete**.

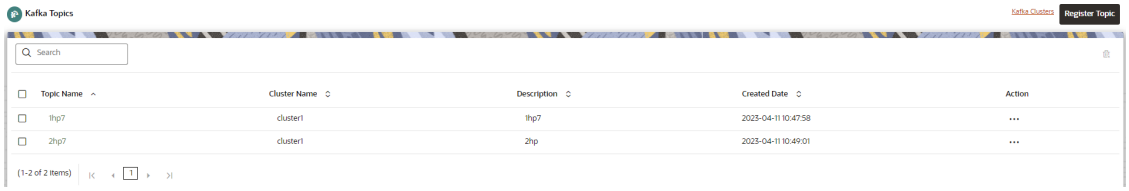
   The API Registry is deleted.

Kafka Topics

Kafka is a distributed data source which is used to create real-time data pipelines and allows you to decouple data streams and systems.

Click **Kafka Topics** icon to navigate to **Kafka Topics** page from any other window in the application. You can configure and manage Kafka topics and clusters from this page.

Figure 8-34 API Summary page



The following table provides descriptions for the fields and icons on the **Kafka Topics**page.

Table 8-4 Fields and icons on the Sandbox Summary page

Field or Icon	Description
Search	The field to search for a Kafka topics and clusters. Enter specific terms in the field for which you want to search, and press Enter on the keyboard to display the results.
Topic Name	The topic name of the Kafka.
Cluster Name	The cluster name of the Kafka.
Description	The description of the Kafka.
Created Date	The date on which the API was created.
Kafka Clusters	Click Kafka Clusters to view/create/delete Kafka Clusters.
Register API	Click Register API to create a new Kafka topic.
Action	Click the three dots to perform View/Edit/Delete functions on selected Kafka topic.

Create a Kafka Cluster

To create a Kafka Cluster:

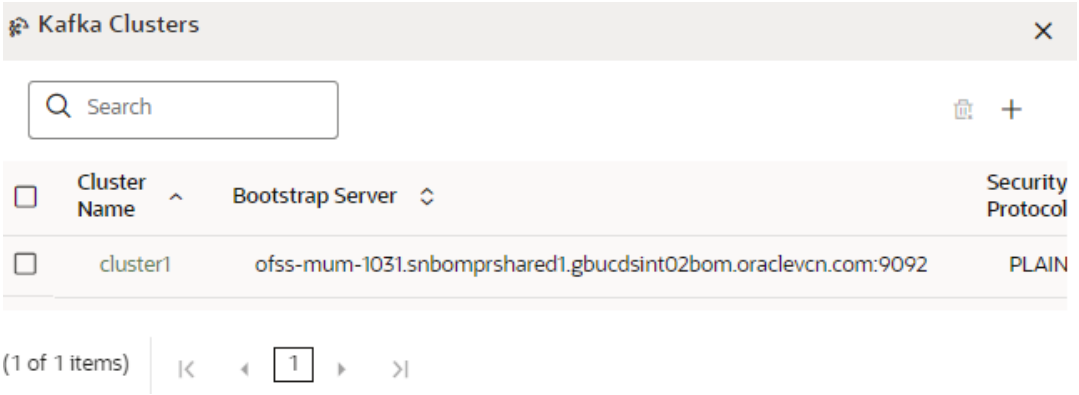
1. Click **Kafka Topics** to navigate to **Kafka Topics** page from any other window in the application.

   This page displays the Kafka Topics in a tabular format.

2. Click **Kafka Clusters**option.

   The **Kafka Clusters**page is displayed.

   Figure 8-35 Kafka Clusters page



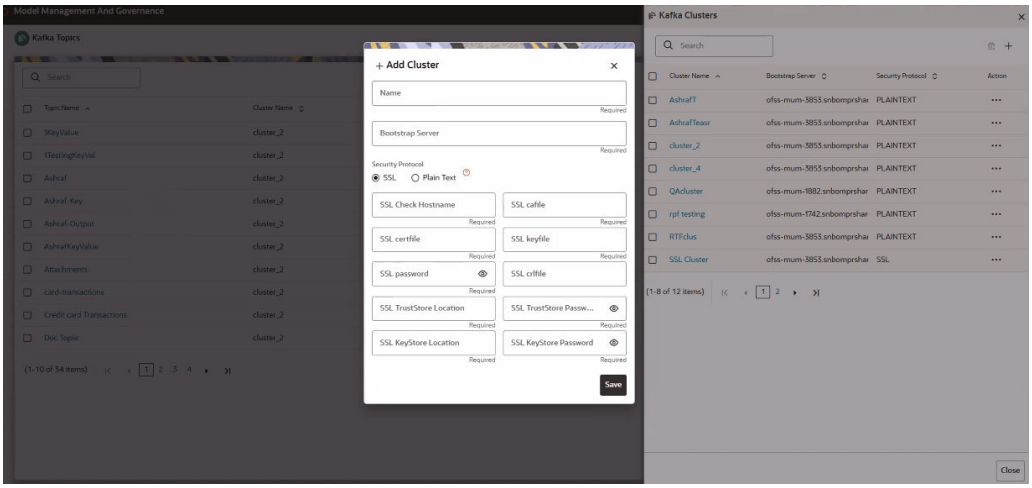
3. Click **Add** .

   The Add Cluster window is displayed.

4. Enter the **Cluster Name**. This field is mandatory.
5. Enter the **Bootstrap server** details. This field is mandatory.
6. Select the **Security Protocol** as:

   - **Plain Text**
     OR
   - **SSL**

   Figure 8-36 SSL Type Cluster



Populate the mandatory fields. For detailed reference click the **Help** icon.

> **Note**
>
> In the current release:
>
> - The Kafka feature is not supported in Solaris OS.

7. Click **Save**.

   The Kafka cluster is created, and this will be displayed while registering the Kafka Topic.

Delete a Kafka Cluster

To delete a Kafka Cluster:

1. Click **Kafka Topics** to navigate to **Kafka Topics** page from any other window in the application.

   This page displays the Kafka Topics in a tabular format.

2. Click **Kafka Clusters**option.

   The **Kafka Clusters**page is displayed.

3. Select the Kafka Cluster which you want to delete and click **Delete**.

   A confirmation message is displayed.

4. Click **Delete**.

   The Kafka Cluster is deleted.

Register a Kafka Topic

To register a Kafka Topic:

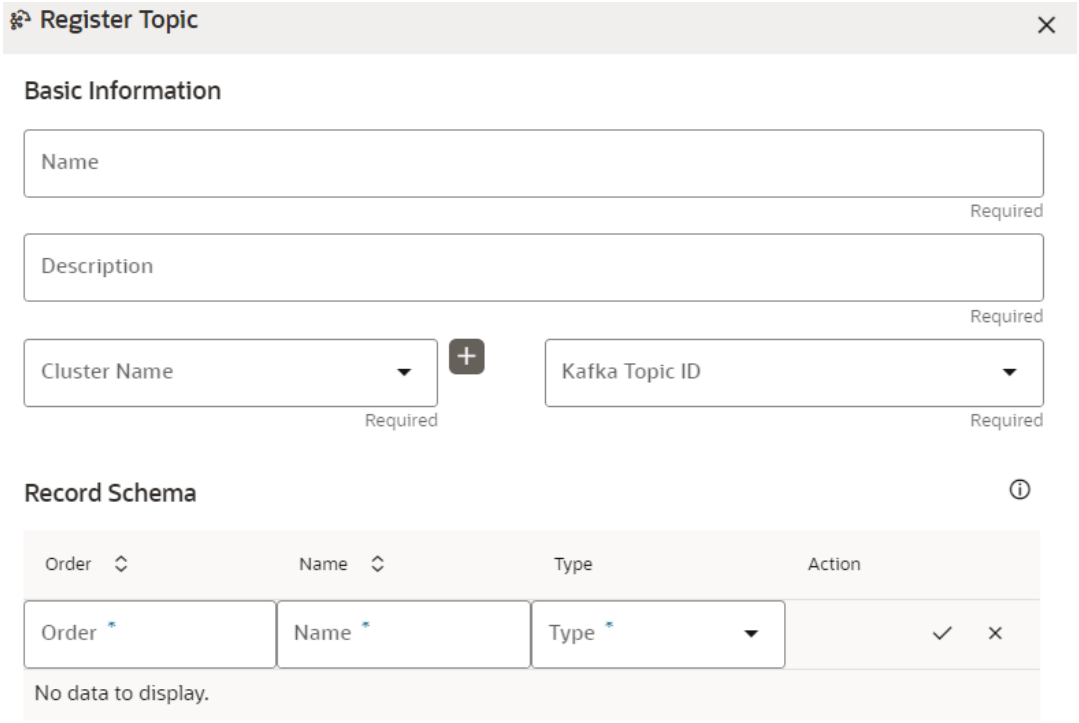
1. Click **Kafka Topics**to navigate to **Kafka Topics**page from any other window in the application.

   This page displays the Kafka Topics in a tabular format.

2. Click **Register Topic** button.

   The Register Topic page is displayed.

Figure 8-37 Register Topic page



3. Enter the **Kafka Topic Name**. This field is mandatory.
4. Enter the **Description** for the Kafka Topic. This field is mandatory.
5. In the **Cluster Name** drop-down list, select the required option and enter a unique Kafka Topic ID. This field is mandatory.
6. In the **Record Schema**field, enter the order, name, and the data type for the Kafka topic.

> **Note**
>
> Currently, **PyFlink, Python,** and **Java Schema** types are supported. For more details, click the icon next to Record Schema field.

7. Click **Register**.

   The Kafka topic is added and displayed in the Kafka Topics page. These topics can be selected while creating a Workspace.

View a Kafka Topic

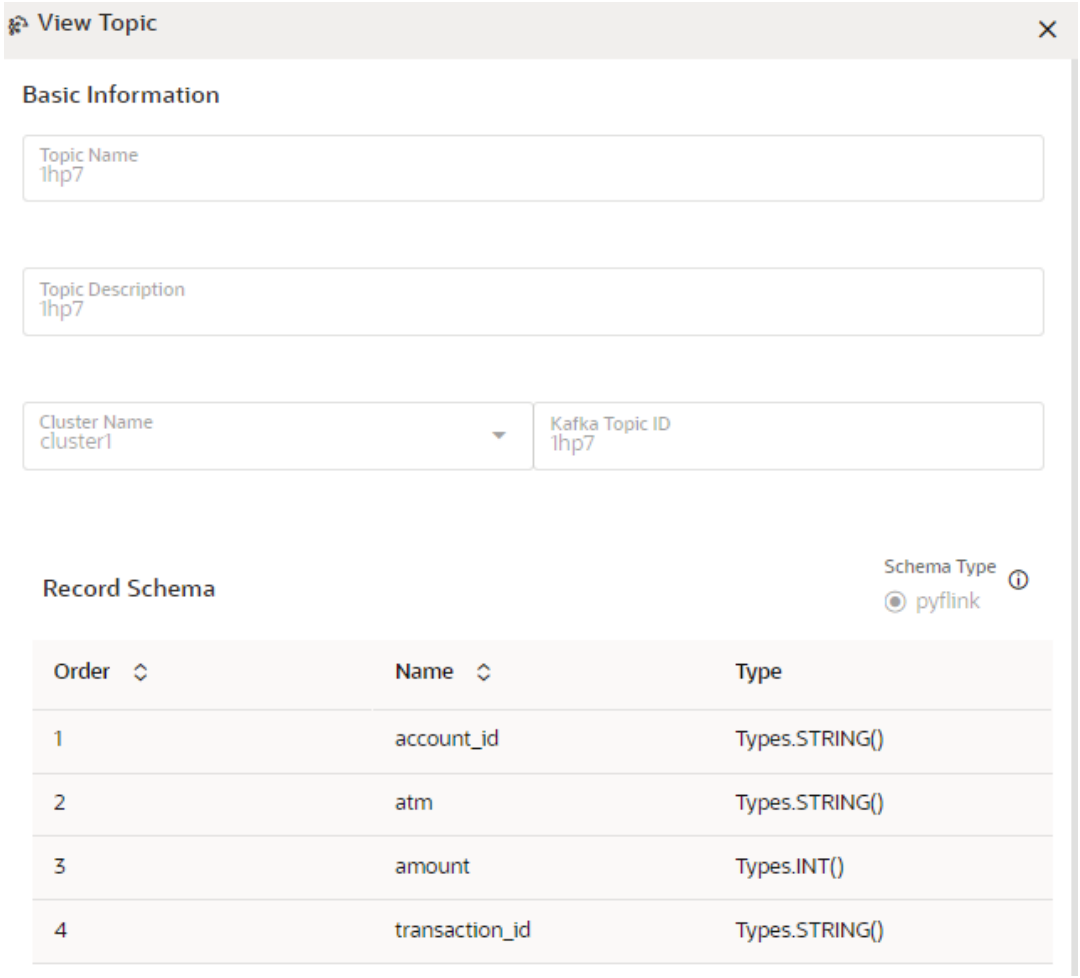
To view a Kafka Topic:

1. Click **Kafka Topics** to navigate to **Kafka Topics** page from any other window in the application.

   This page displays the Kafka Topics in a tabular format.
2. Click **Action**and select **View**.

   The details of the Kafka Topic is displayed.

Figure 8-38 Kafka Topics page



Edit a Kafka Topic

To edit a Kafka Topic:

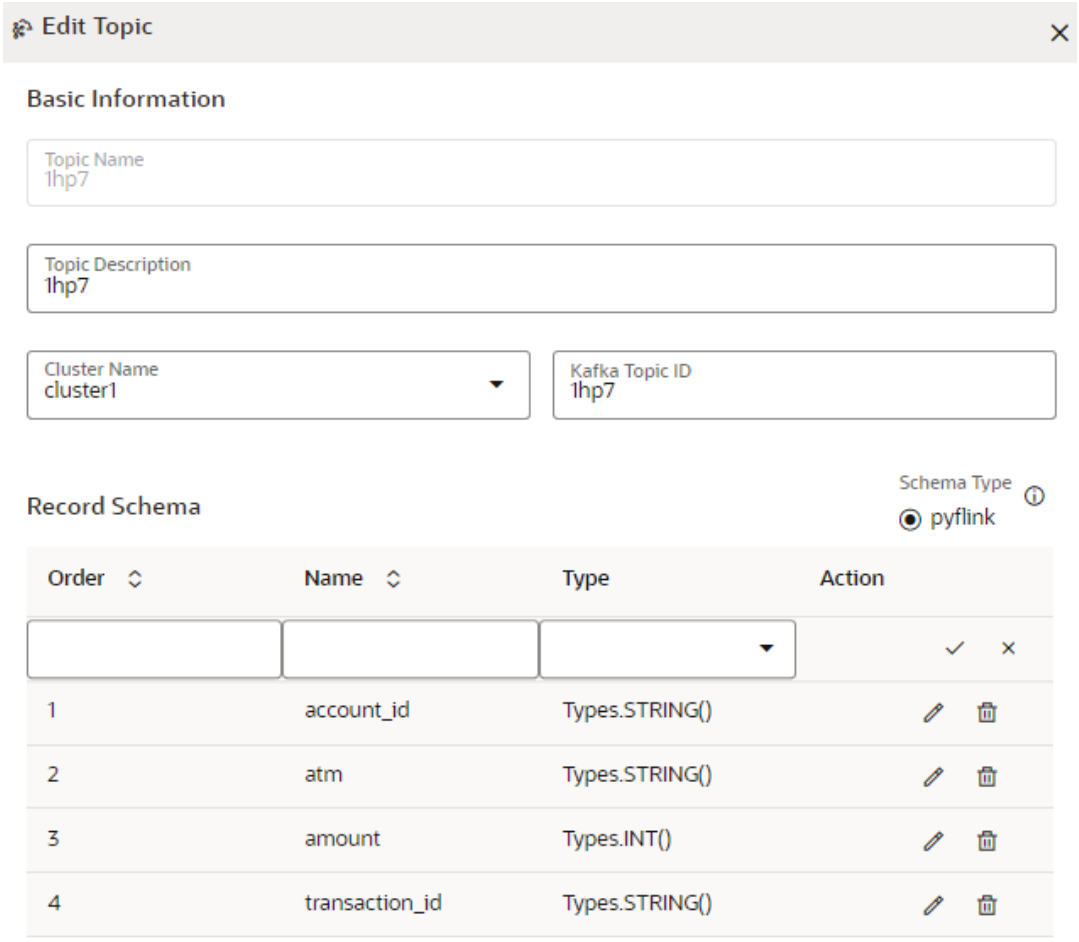
1. Click **Kafka Topics**to navigate to **Kafka Topics**page from any other window in the application.

   This page displays the Kafka Topics in a tabular format.

2. Click **Action** next to corresponding Kafka Topic and select **Edit**.

   The **Edit Topic** page is displayed.

Figure 8-39 Edit Topic page



For more details on the Kafka Topic fields, see Register a Kafka Topic section.

3. Click **Update**.

Delete a Kafka Topic

To delete a Kafka Topic:

1. Click **Kafka Topics** icon to navigate to **Kafka Topics** page from any other window in the application.

   This page displays the Kafka Topics in a tabular format.

2. Click **Action** and select **Delete**.

   A confirmation message is displayed.

> **Note**
>
> You cannot delete a Kafka Topic mapped to a workspace.

Click **Delete**. The Kafka Topic is deleted.

OFSAA Environment

You can register OFSAA environment (Simulation and Production) from this page.

> **Note**
>
> The user must be mapped to ENVACCESS role to view the OFSAA Environment option.

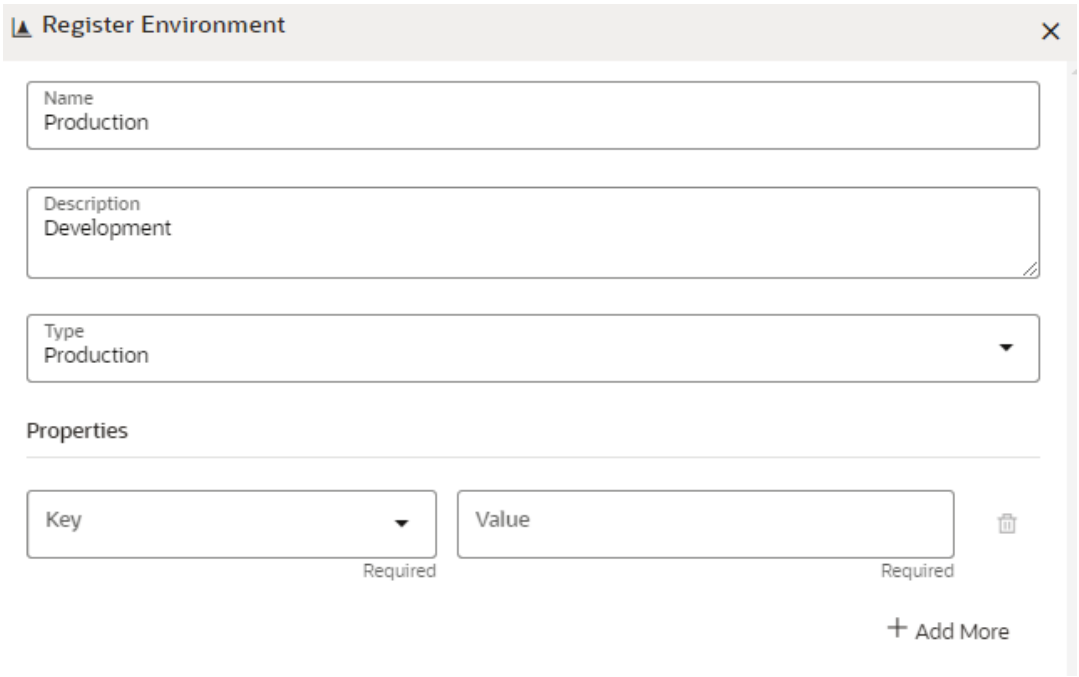
To register a OFSAA environment:

1. Navigate to the OFSAA environment page.

   This page displays the OFSAA environments in a tabular format.
2. Click **Register Environment**.

   The Register Environment page is displayed.

Figure 8-40 Register a OFSAA Environment



3. Enter the environment **Name**. This field is mandatory.
4. Enter the **Description** for the environment. This field is mandatory.
5. In the **Type** field, select the environment as either Production or Simulation.
6. In the **Key** field, select the required option from the drop-down and enter value for the selected property. You can add more properties by clicking **Add More** icon.
7. Click **Create**.

   The OFSAA Environment is added and displayed in the OFSAA Environment page.

   You can view, edit, and delete OFSAA environments by clicking Actions icon.

Data Studio Options

The application's Notebook Server has the following configurable options:

- Interpreters
- Tasks
- Permissions
- Credentials
- Templates

To access the Data Studio Options page:

1. Click **Launch Workspace** to launch the workspace to display the **Dashboard** window with the application configuration and model creation menu.
2. Hover your mouse over the Data Studio Options widget . The following options are available:
   - Interpreters
   - Tasks
   - Permissions
   - Credentials
   - Templates

> **Note**
>
> DS 23.4.10 has introduced 'Select-Multiple' forms in Data Studio. The same should now be handled in MMG (parameters sets, dashboard, execute pipeline drawer, simulations, and so on).

Configure Interpreters

An Interpreter is a program that directly executes instructions written in a programming or scripting language without requiring them previously to be compiled into a machine language program. Interpreters are plug-ins that enable users to use a specific language to process data in the backend. Examples of Interpreters are jdbc-interpreter, spark-interpreters, python-interpreters, etc. Interpreters allow you to define customized drivers, URLs, passwords, connections, SQL results to display, etc.
In OFS Compliance Studio, Interpreters are used in Notebooks to execute code in different languages. Each Interpreter has a set of properties that are adjusted and applied across all notebooks. For example, using the python-interpreter makes it possible to change between versions, whereas the jdbc-interpreter offers to customize the URL, schema, or credentials. You can either use a default interpreter variant or create a new variant for an interpreter. You can create more than one variant for an interpreter. The benefit of creating multiple variants for an Interpreter is to connect different versions of interpreters (Python ver:3, Python ver:2, etc.). This helps to connect a different set of users and database schema. For example, Compliance Studio schema, BD schema, etc. Compliance Studio provides secure and safe credential management such as Oracle Wallet (jdbc wallet), Password (jdbc password), or KeyStores to link to interpreter variants to access secured data.

The application has ready-to-use interpreters and you can configure them based on the use case. Additional variants of interpreters are created as multiple users might require different settings to access the database securely. The jdbc Interpreters use the credentials to enable secure data access.

> **Note**
>
> Pyspark, spark, and ore are a few other available interpreters.
> For more information on the Spark interpreter, see the OFS MMG Installation Guide.

Interpreters are configured when you want to modify URL, data location, drivers, enable or disable connections, etc.

To configure ready-to-use interpreters:

1. Click the Interpreter that you want to view from the list displayed on the LHS. The default configured interpreter variant is displayed.
2. Modify the values in the fields as per requirement. For example, to modify a parameter's limit, connect to a different schema, PGX server, and so on.
3. Click **Update**. The modified values are updated in the Interpreter.

Manage Tasks

Tasks are created when notebooks or paragraphs are executed by the Notebook users. It is important to know the status of the execution, whether the tasks are created, rejected, canceled, etc. The Tasks page allows you to view the status of the task and associated notebooks, paragraphs, interpreters, etc. By default, all the tasks are listed on the Task page. You can view the specific task using filters such as task status, date of creation, and notebook name.

Manage Tasks

You can view the logged-in users and view, add, or modify ready-to-use permissions granted to the users, roles, or groups. You can create groups, roles, and permission templates (actions).

> **Note**
>
> You can only view users and their details.

See the *User Access and Permissioning Management* section in the OFS Compliance Studio Administration and Configuration Guide.

Manage Credentials

Compliance Studio provides secure and safe credential management. Examples of credentials are passwords, Oracle Wallets, or KeyStores. This section links credentials (a wallet and a password) to the jdbc interpreter variant to enable secure data access. This linking enables the jdbc interpreter to securely connect to the specified Oracle Database. You can also create new credentials based on your requirement to connect to the new interpreter variants.

For more information on Credentials, see the Link Credentials section in the OFS Compliance Studio Administration and Configuration Guide.

> **Note**
>
> You can link credentials only to the jdbc interpreter. The Credentials section is enabled if an Interpreter variant can accept credentials.

Configure Templates

To create, import, and set the default FCCM template in the Template Dashboard:

1. Click CS Launch Workspace to display the CS Production Workspace window.
2. Click Templates from Design Studio Options.

   Compliance Studio offers different formats to view the result after a paragraph's execution. Templates enable you to define parameters to customize the result formats. You can customize the visualization of the result by defining parameters in a template and then applying that template to a notebook.

   > **Note**
   >
   > - Compliance Studio comes with a default template, but users can customize this at the template level but can also override any global template settings in each notebook paragraph.
   > - It is recommended to use the template that is available from out-of-the-box Compliance Studio.

   For more information, see the *Interpreter Configuration and Connectivity* section in the OFS Compliance Studio Administration and Configuration Guide.

9

Interpreter Configuration and Connectivity

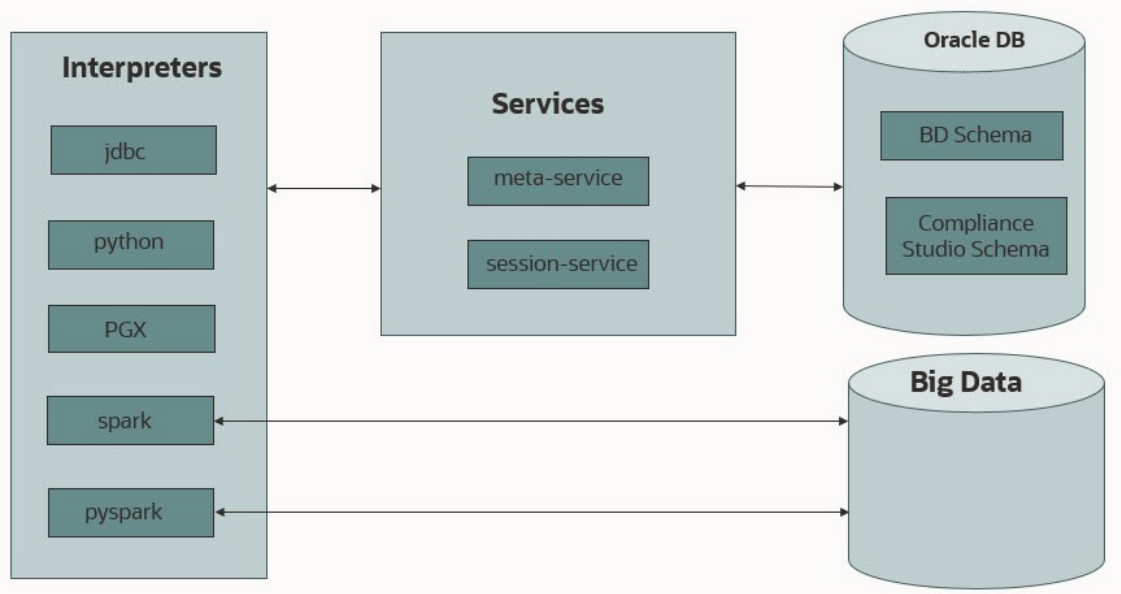
An interpreter is a program that directly executes instructions written in a programming or scripting language without requiring them previously to be compiled into a machine language program. Interpreters are plug-ins that enable users to use a specific language to process data in the backend. Examples of Interpreters are jdbc-interpreter, spark-interpreters, python-interpreters, etc. Interpreters allow you to define customized drivers, URLs, passwords, connections, SQL results to display, etc.

In OFS MMG, Interpreters are used in Notebooks to execute code in different languages. Each Interpreter has a set of adjusted and applied properties across all notebooks. For example, using the python-interpreter makes it possible to change between versions, whereas the jdbc-interpreter offers to customize the URL, schema, or credentials. In OFS MMG, you can either use a default interpreter variant or create a new variant for an interpreter. You can create more than one variant for an interpreter. The benefit of creating multiple variants for an Interpreter is to connect different versions of interpreters (Python version: 3, Python version: 2, etc.). This helps to connect a different set of users and database schema. For example, OFS MMG schema, BD schema, etc. OFS MMG provides secure and safe credential management such as Oracle Wallet (jdbc wallet), Password (jdbc password), or KeyStores to link to interpreter variants to access secured data.

> **Note**
>
> By default, the interpreter configuration is refreshed from the filesystem `interpreter.json` the next time you restart the application. If you update `interpreter.json` on the filesystem, the changes take effect after the restart. Changes made only in the UI are not overwritten when you restart (overwrite is driven only by the filesystem JSON).

The following image illustrates the examples of interpreters used in OFS MMG and database connections.

Figure 9-1 Examples of Interpreters



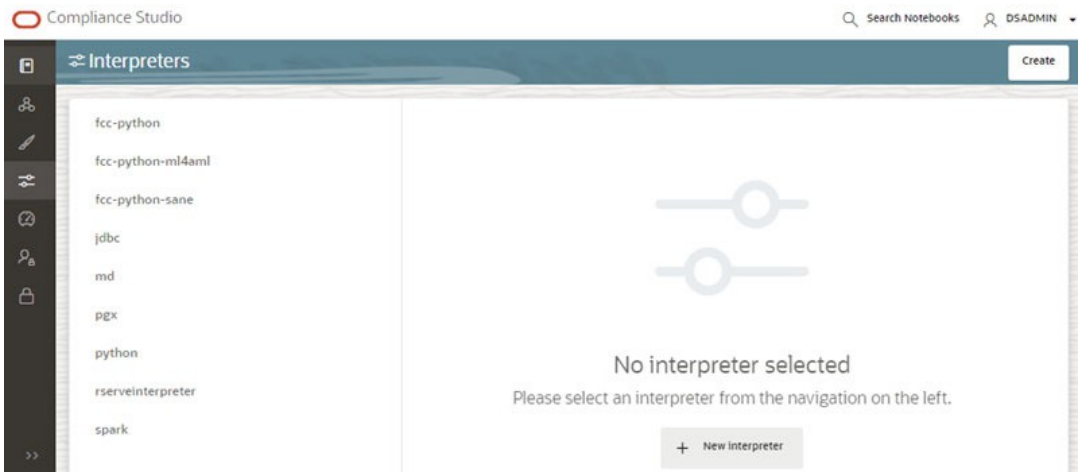
Configure Interpreters

Interpreters are configured when you want to modify URL, data location, drivers, enable or disable connections, etc.

To configure ready-to-use interpreters, follow these steps:

1. On the **Workspace Summary** page, select Launch workspace to display the **CS Production workspace** window.
2. Click the **User Profile** drop-down list and select **Data Studio Options** widget. The following options are available:
   - Interpreters
   - Tasks
   - Permissions
   - Credentials
   - Templates
3. Click **Interpreters** that you want to view from the list displayed on the LHS. The default configured interpreter variant is displayed on the RHS.

Figure 9-2 Interpreters' screen

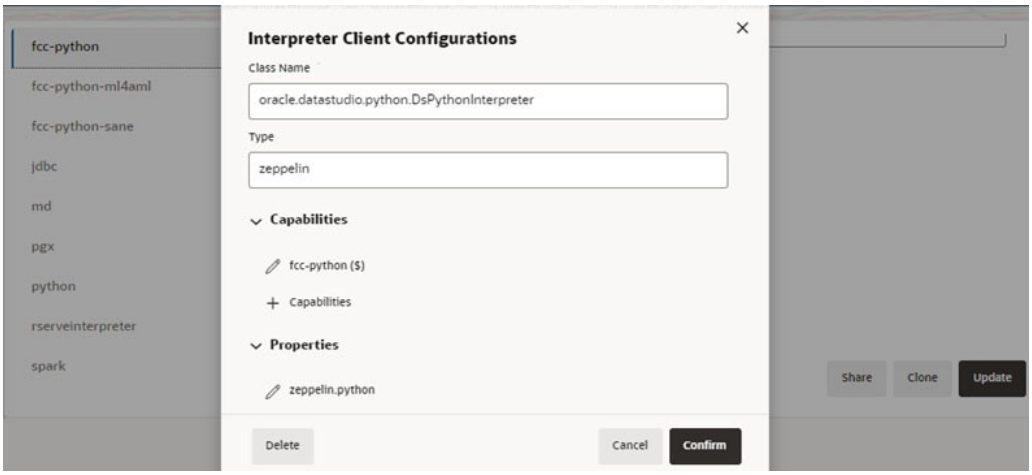


4. Modify the values in the fields as per requirement. For example, to modify a parameter's limit, connect to a different schema, PGX server, etc.

   You can modify the values in the following UI options:

   - Wizard

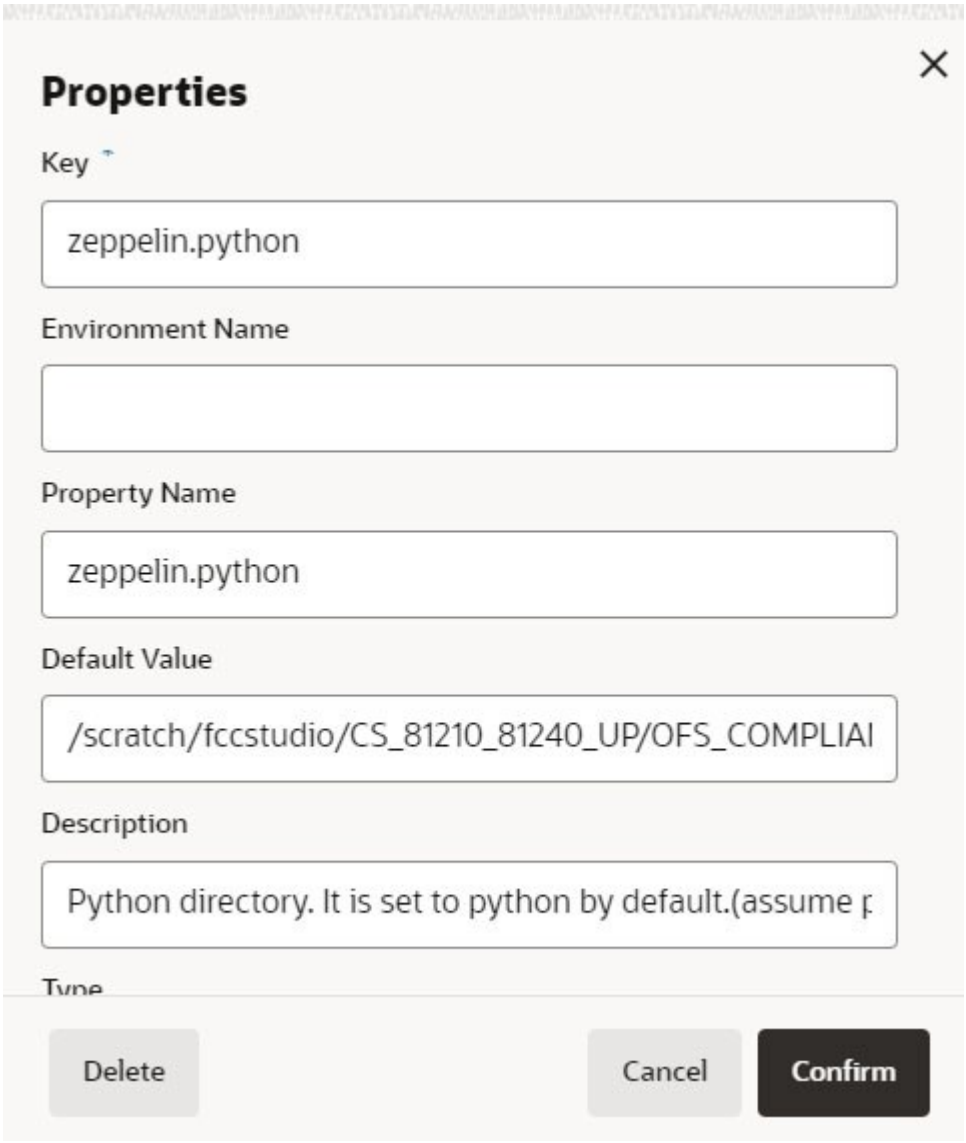
Figure 9-3 Wizard UI options



An interpreter can group multiple interpreter clients that all run in one JVM process and can be stopped together.

For example, the spark interpreter group contains the spark and pyspark interpreter client.

Figure 9-4 Properties screen



Group Configuration

Initial Code

For example, when using a Spark interpreter group with spark and pyspark interpreter clients. If you define the initialization code for the spark interpreter group, the initialization code will run when the runtime environment is created, i.e., the first time a user runs a paragraph of either spark or pyspark in a notebook with OFS MMG running in NOTEBOOK session mode.

Initial Code Capability

The initial code capability defines what interpreter client to use to run the group initial code. For example, in the spark interpreter group, you would select the spark capability as the initial code capability to create a spark context for the group JVM process.

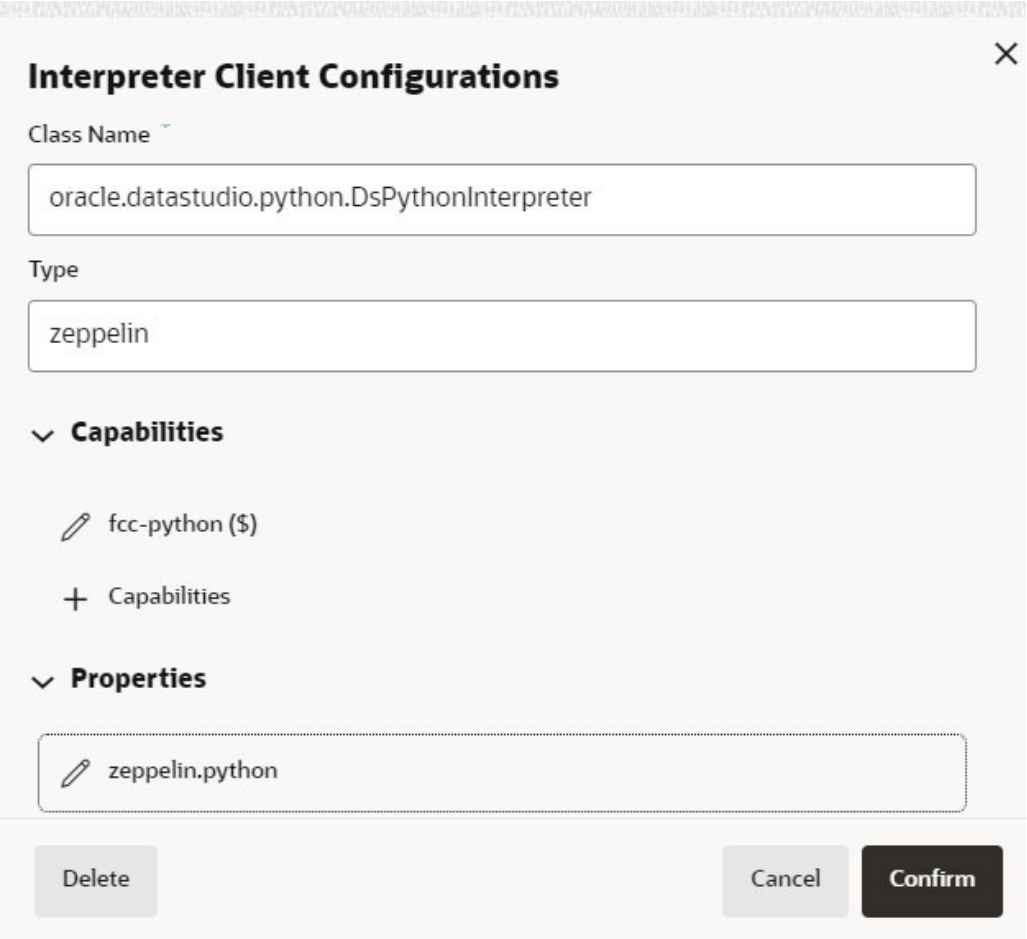
Credential Configurations

For linking any credentials to the interpreter, you have to define what credential types should be used and what credential mode to use. For example, the jdbc interpreter supports a credential type of type Password for the credential qualifier **jdbc_password** and a credential type of type Oracle Wallet for the credential qualifier **jdbc_wallet**. After defining the credential configuration, a new section for selecting the respective credential values will appear.

Interpreter Client Configuration

Interpreter properties can be configured for each interpreter client.

Figure 9-5 Interpreter Client Configuration



Lifecycle Configuration

Host Mode

In the Host lifecycle mode, the following properties can be configured:

- **Host**: The hostname on which the interpreter is listening. For example, localhost if the **interpreter** runs on the same machine as the server.
- **Port**: The port on which the interpreter is listening.

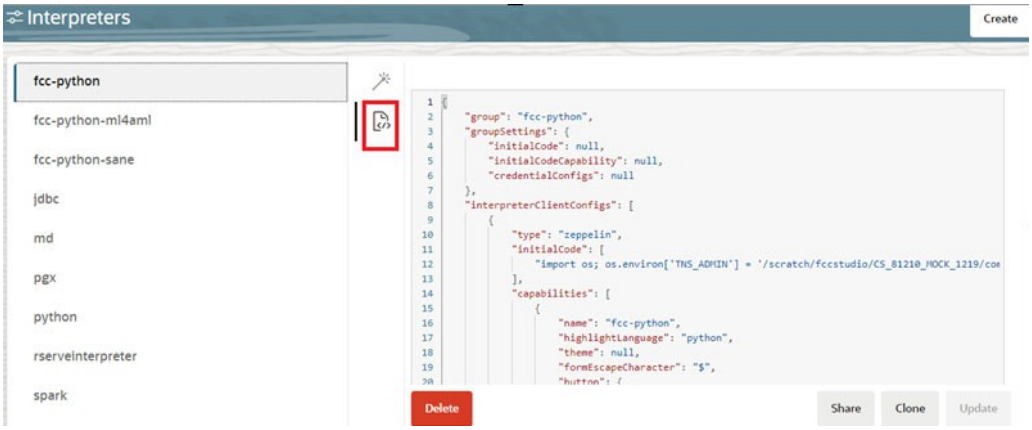
Credentials

A credential section appears if you have defined a credential configuration as part of the group settings. For each credential qualifier, an already defined credential can be

selected. If the credential mode Per User is used, each individual user has to select their own credential.

- JSON:
  You can modify the values in the properties of the interpreter in the JSON file, as shown in the following figure.

Figure 9-6 JSON file properties



5. Click Update. The modified values are updated in the Interpreter.
6. The user can also perform Share, Clone, and Delete operations on this screen.

The following table lists the Ready-to-use interpreter in OFS MMG.

Table 9-1 Ready-to-use interpreter

Interpreters	Description
python Interpreter	The python interpreter is used to write Python code in a notebook to analyze data from different sources, machine learning, artificial intelligence, etc. The python interpreter uses a python conda environment. OFS MMG comes with predefined conda environments as follows: • default_<CS version> • ml4aml_<CS version> • sane_<CS version> Before executing any python notebooks, you need to attach the conda environment using drop-down list.

Table 9-1 (Cont.) Ready-to-use interpreter

Interpreters	Description
jdbc Interpreter	The jdbc interpreter is a ready-to-use interpreter used to connect to Studio schema. This Interpreter is used to connect and write SQL queries on any schema without any restriction. In the jdbc Interpreter, you can configure schema details, link Wallet Credentials to the jdbc Interpreter, etc. **Note**: This feature is not recommended approach because it can only be used to connect to a single schema, and all users will have access to that, rather than access being managed per user. In future releases this interpreter will not be enabled by default but instructions will be given to enable if required. **Limitation** • Data source configuration is not dynamic; instead, it is static from the Interpreter Configuration screen. • There is no restriction or secure access of data provided with this interpreter.
jdbc Interpreter	**Recommendation** Users are recommended to use a python interpreter to get dynamic data source configuration; even data access permission features can also be used with this interpreter.
md Interpreter	The md interpreter is used to configure the markdown parser type. This Interpreter displays text based on Markdown, which is a lightweight markup language. The connection does not apply to this Interpreter.
pgql Interpreter (part of PGX interpreter)	The pgql interpreter is a ready-to-use interpreter used to connect the configured PGX server. This Interpreter is used to perform queries on the graph in OFS MMG. PGQL is a graph query language built on top of SQL, bringing graph pattern matching capabilities to existing SQL users and new users interested in graph technology but who do not have an SQL background.
pgx-python (part of PGX interpreter)	The pgx-python interpreter is a ready-to-use interpreter used to connect to the configured PGX server. It is a **python** based interpreter with a PGX python client embedded in it to query on graph present in the PGX server. By default, this Interpreter points to ml4aml Python Virtual environment.
pgx-algorithm Interpreter (part of PGX interpreter)	The pgx-algorithm interpreter is a ready-to-use interpreter that connects to the configured PGX server. This Interpreter is used to write an algorithm on the graph and is also used in the PGX interpreter.

Table 9-1 (Cont.) Ready-to-use interpreter

Interpreters	Description
pgx-java Interpreter (part of PGX interpreter)	The pgx-java interpreter is a ready-to-use interpreter that connects to the configured PGX server. It is **Java11** based interpreter with a PGX client embedded in it to query on graph present in the PGX server.
spark Interpreter	The spark interpreter connects to the big data environment by default. Users must write for connection either in the Initialization section or in the notebook's paragraph. This Interpreter is used to perform analytics on data present in the big data clusters in the Scala language. This requires additional configuration, which must be performed as a prerequisite or as post-installation with the manual change of interpreter settings. In the spark interpreter, you can configure the cluster manager to connect, print the Read Eval Print Loop (REPL) output, the total number of cores to use, etc.
pyspark Interpreter	The pyspark interpreter connects to the big data environment by default. Users must write code for connection either in the Initialization section or in the notebook's paragraph. This Interpreter is used to write the pyspark language to query and perform analytics on data present in big data. This requires additional configuration, which must be performed as a prerequisite or as post-installation with the manual change of interpreter settings. In the pyspark Interpreter, you can configure the Python binary executable to use for PySpark in both driver and workers, set true to use IPython, else set to false, etc.

python Interpreter

In OFS MMG, the python interpreter uses a python conda environment. OFS MMG comes with predefined conda environment as follows:

- **default_<CS Version>**
- **ml4aml_<CS Version>**
- **sane_<CS Version>**

%python interpreter points to a different conda environment. The following table lists the predefined conda environment.

Table 9-2 Predefined Conda Environment

Conda Environment	Description
default_<CS version>	Default python interpreter.
ml4aml_<CS version>	Python interpreter for ML4AML use cases.

Table 9-2 (Cont.) Predefined Conda Environment

Conda Environment	Description
sane_<CS version>	Python interpreter for scoring Name and Address Matching.

> **Note**
>
> Users can also configure the python libraries. For more information about python libraries, see the Python Libraries for Predefined Conda Environment section.

Configure a Python Interpreter

To configure an python interpreter, follow these steps:

1. On the Interpreter page LHS menu, select python. The python interpreter pane is displayed.
2. On the Interpreter Settings page, expand **Interpreter Client Configurations** and click the Edit icon for **<Class Name> (zeppelin)**. The Interpreter Client Configurations Window is displayed.
3. Enter the following information in the python interpreter variant pane as described in the following table.

Table 9-3 Python Interpreter Settings

Field	Description
zeppelin.python	Enter the Python installed path. The value points to the default Python version set for the Interpreter.
zeppelin.python.useIPython	Set to **True** to use IPython, else set to **False**.
zeppelin.python.maxResult	Enter the maximum number of results that must be displayed. By, default the value is **1000**. **Note**: To update the default value for this property, see the Setting the Maximum Number of Results in the Python Interpreter section.
zeppelin.interpreter.output.limit	Output message from interpreter exceeding the limit will be truncated. Set the default value and the value ranges from 102400 to 10240000 bytes. **Note**: Increasing the Default Value from 102400 bytes to a higher value may slow down output rendering in the python paragraph. If the zeppelin.interpreter.output.limit property is unavailable, create and set a default value. For more information, see the Create Zeppelin Interpreter Output Limit in the Python Interpreter section.

Change Version in the Python Interpreter

In the python Interpreter, the Linux console uses the default python version in. /user/fccstudio/python_user/bin/python as value. If you want to modify the python version, either you can

create an interpreter variant or modify the existing python version in the same interpreter variant.

> **Note**
>
> The **python2** is the default version used in the Linux console and is no longer supported. Hence, you can use any version of **python3** or any conda environment with a specific python version or a specific version of python packages.

To use a different version of Python, follow these steps:

1. Navigate to the **python** Interpreter Settings page.
2. Expand **Interpreter Client Configurations** and click the Edit icon for <Class Name> (zeppelin). The Interpreter Client Configurations Window is displayed.
3. Click `zeppelin.properties`. The Properties window is displayed.
4. Change the default Python version in the `Default Value` parameter to the new version. `<MMG_INSTALLATION_PATH>/deployed/python-packages/ defaultVirtualEnv/bin/ <Python Version>.`

   By default, it is python3.

   For example, `<MMG_INSTALLATION_PATH>/deployed/pythonpackages/ defaultVirtualEnv/bin/python3`.
5. Create a new interpreter variant and configure the version in the Default Value parameter. For information on creating a new interpreter variant, see Create an Interpreter Variant section. For example, to use Python 3.6.13, create a new python interpreter variant and enter the value as python 3.6.13.

Create Zeppelin Interpreter Output Limit in the Python Interpreter

> **Note**
>
> This section is applicable only when zeppelin.interpreter.output.limit is unavailable in the Python Interpreter.

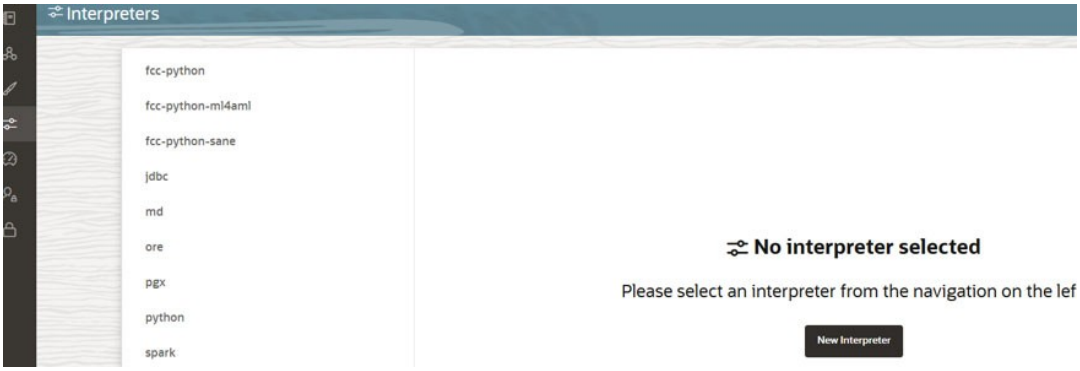
You can create the Zeppelin Interpreter Output Limit in the Python interpreter either in OFS MMG UI or in OFS MMG Server.

OFS MMG UI

To create the Zeppelin Interpreter Output Limit in Python Interpreter via OFS MMG UI, follow these steps:

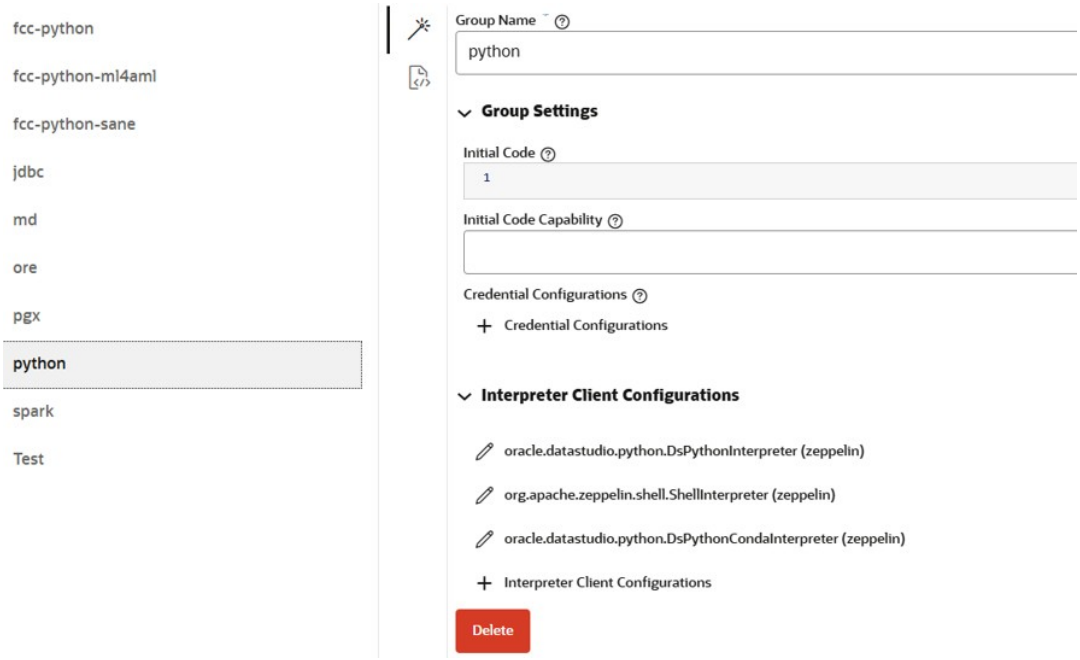
1. Log in to OFS MMG UI.
2. Click **User Profile**, select **Data Studio Options** and then click **Interpreters**. The **Interpreters** page is displayed.

Figure 9-7 Interpreters



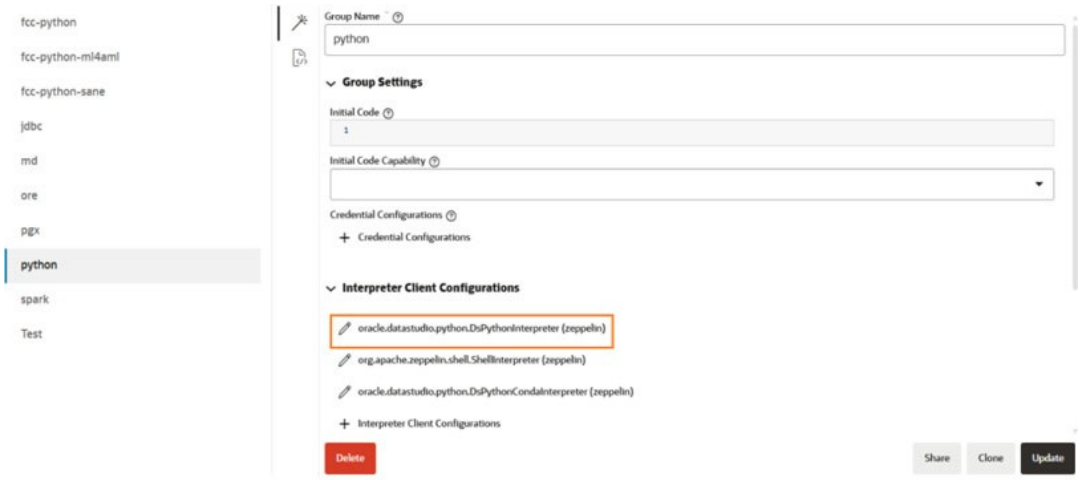
3. On the Left-Hand Side, click **python** interpreter. By default, **Wizard** pane is displayed.

Figure 9-8 Python Interpreter



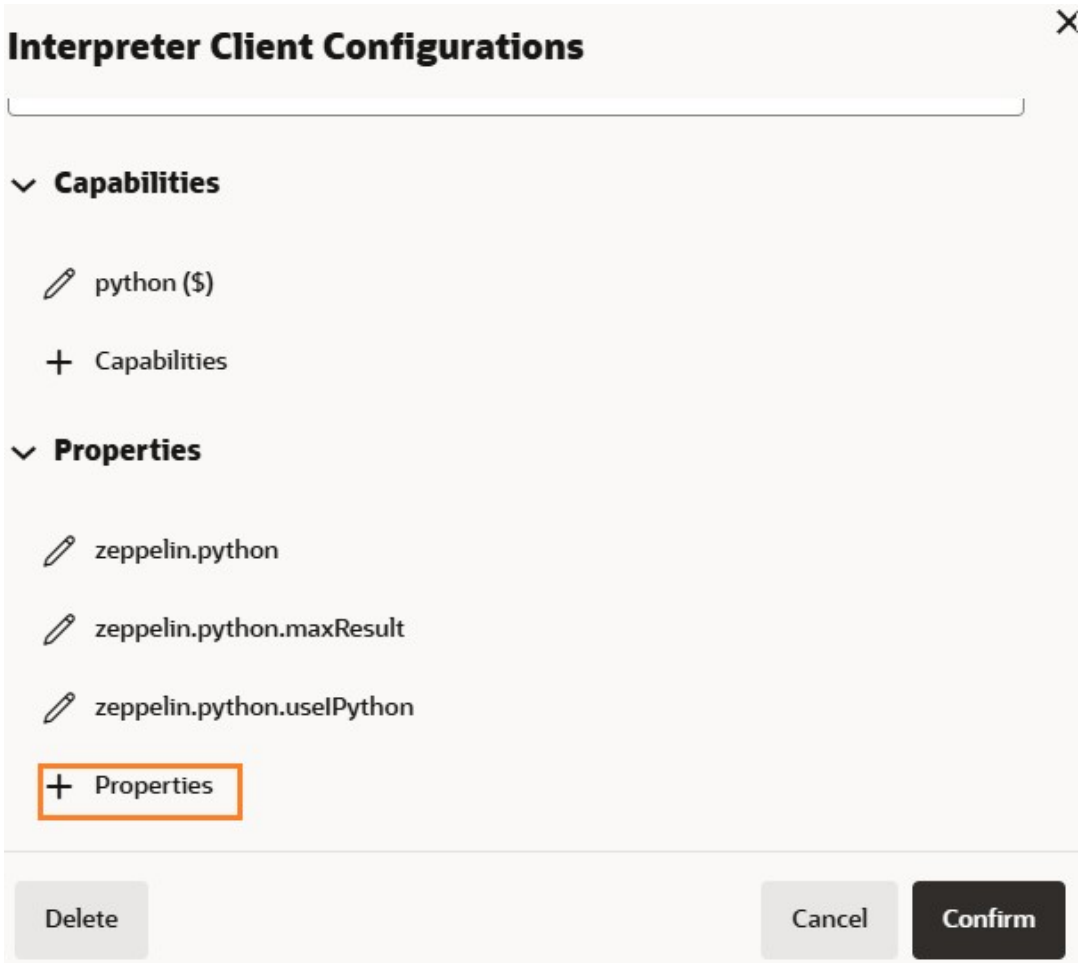
4. On the Right-Hand Side, navigate to **Interpreter Client Configurations**.

Figure 9-9 Interpreter Client Configurations



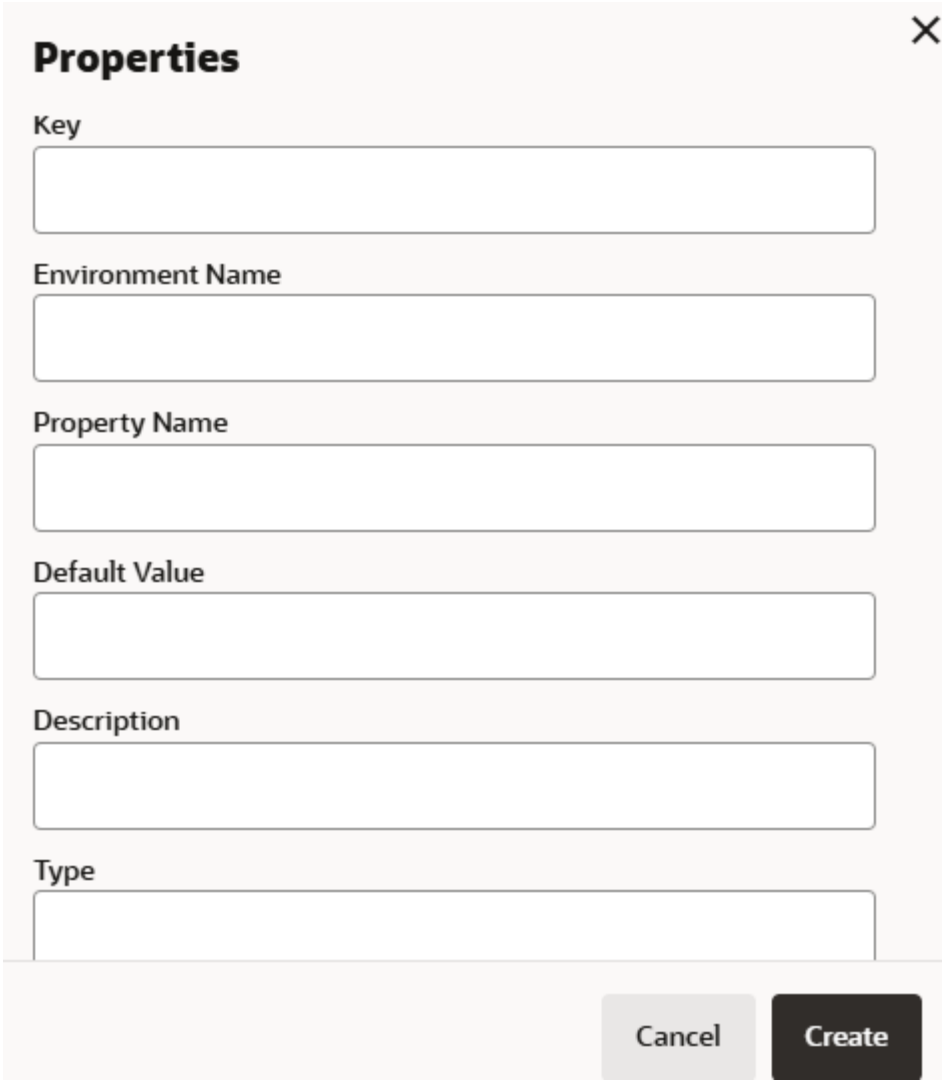
5. Click **oracle.datastudio.python.DsPythonInterpreter (zeppelin)**. The **Interpreter Client Configurations** pane is displayed.

Figure 9-10 Zeppelin Properties



6. Navigate to Properties and click **+ Properties**. The **Properties** pane is displayed.

Figure 9-11 Properties of Zeppelin Interpreter Output Limit



7. Enter the **Key** and **Property Name** as **zeppelin.interpreter.output.limit**.

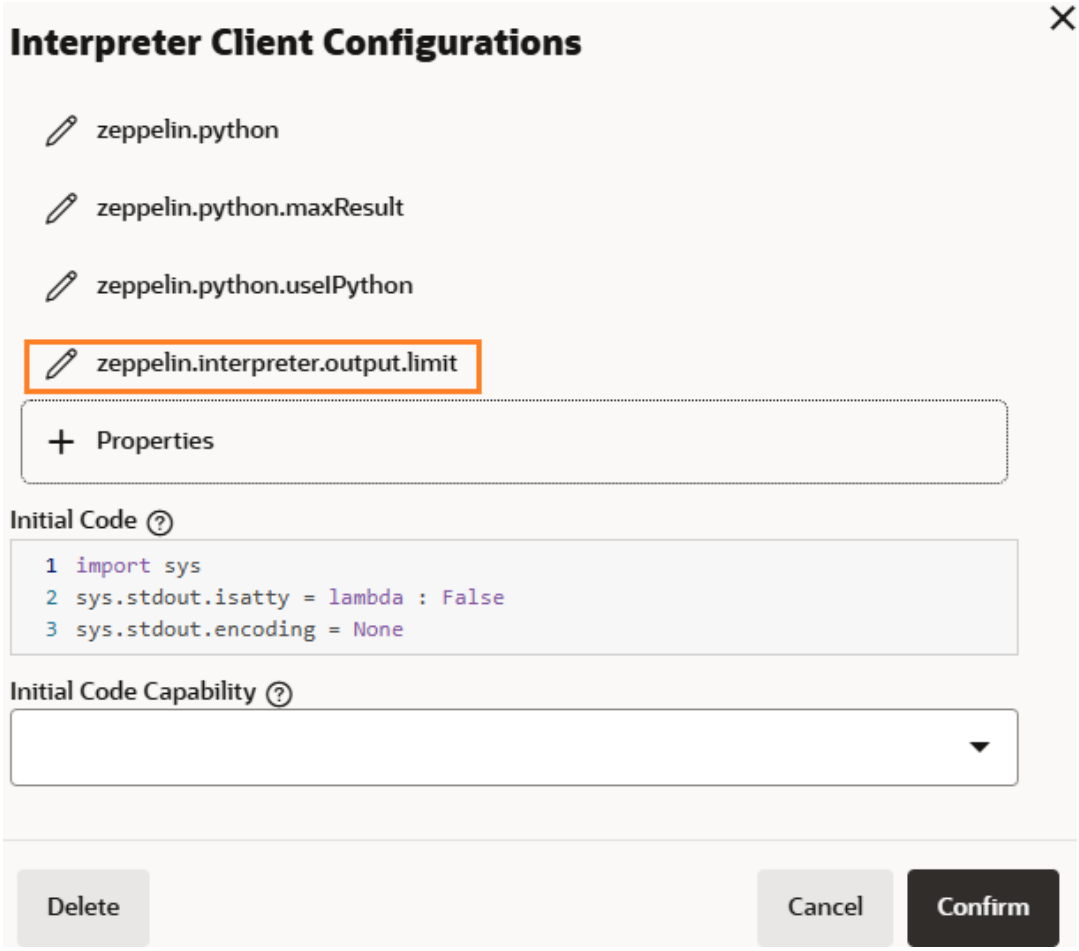
> **Note**
>
> The **Environment Name**, **Description**, and **Type** fields are optional, and you can provide the details if required.

8. Update the preferred value in the **Default Value**. The value ranges from **102400** to **10240000** bytes.

> **Note**
>
> Increasing the Default Value from 102400 bytes to a higher value may slow down output rendering in the python paragraph.

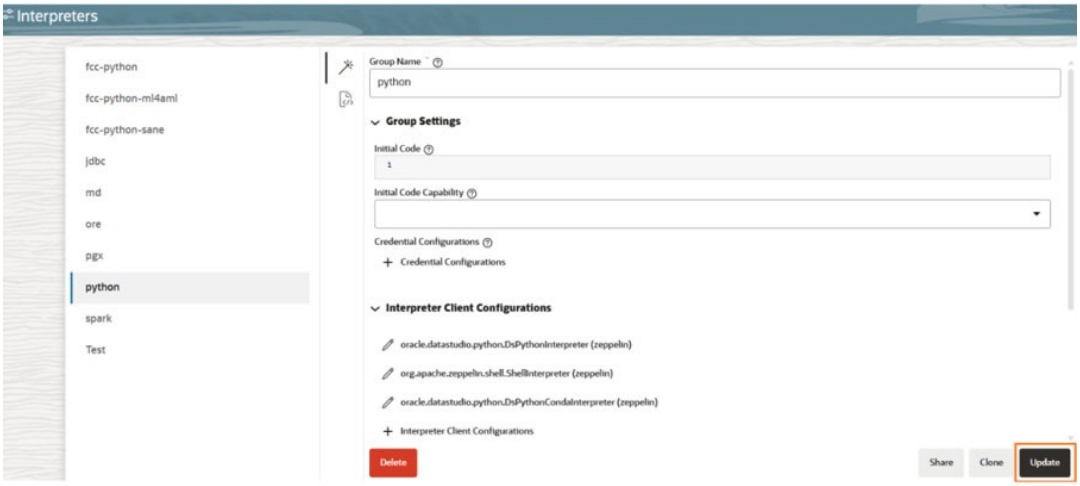
9. Click **Create**. The zeppelin.interpreter.output.limit property will be created and displayed in the Interpreter Client Configurations section.

Figure 9-12 Zeppelin Interpreter Output Limit



10. Click **Confirm** to confirm the changes. The **Python Interpreter** page is displayed.

Figure 9-13 Update Python Interpreter



11. On the Right-Hand Side, click **Update** to save the modifications. A confirmation message will indicate that the Python interpreter has been updated.

12. Restart OFS MMG. The new zeppelin.interpreter.output.limit will be created in the python interpreter.

OFS MMG Server
To create the Zeppelin Interpreter Output Limit in the Python interpreter in OFS MMG Server, follow these steps:

1. Navigate to the `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ server/builtin/interpreters` directory.
2. Open the **python.json** file and navigate to className": "oracle.datastudio.python.DsPythonInterpreter.
3. Add the following lines at the end of the zeppelin properties.

```
"zeppelin.interpreter.output.limit ": {
                        "envName": "",
                        "propertyName": "",
                        "defaultValue": "",
                        "description": "",
                        "type": ""
}
```

You can refer the following example when default value is 102400 bytes.

```
"zeppelin.interpreter.output.limit ": {
                        "envName": "null",
                        "propertyName":
"zeppelin.interpreter.output.limit",
                        "defaultValue": "102400",
                        "description": "Output message from interpreter
exceeding the limit will be truncated",
                        "type": "number"
}
```

4. Save and close the **python.json** file.
5. Restart OFS MMG. The new zeppelin.interpreter.output.limit will be created in the python interpreter.

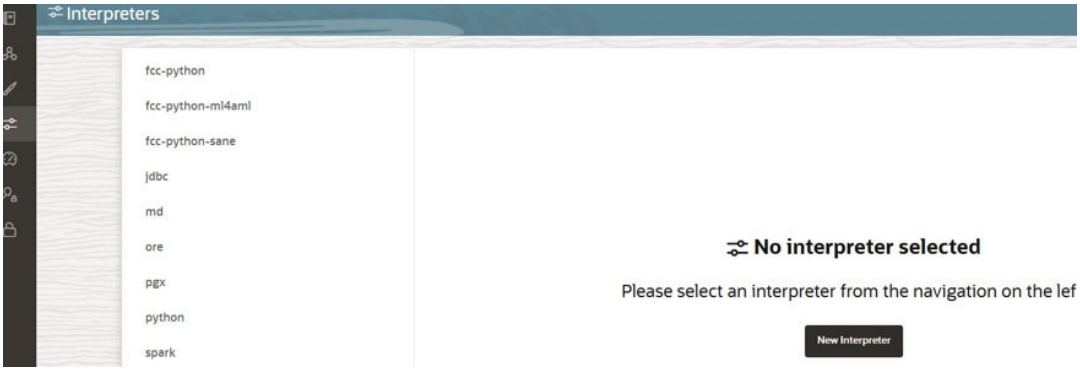
Setting the Maximum Number of Results in the Python Interpreter

> **Note**
>
> This section is applicable only when modifying the default value of the **zeppelin.python.maxResult** property.

To set the maximum number of results in the Python Interpreter, follow these steps:

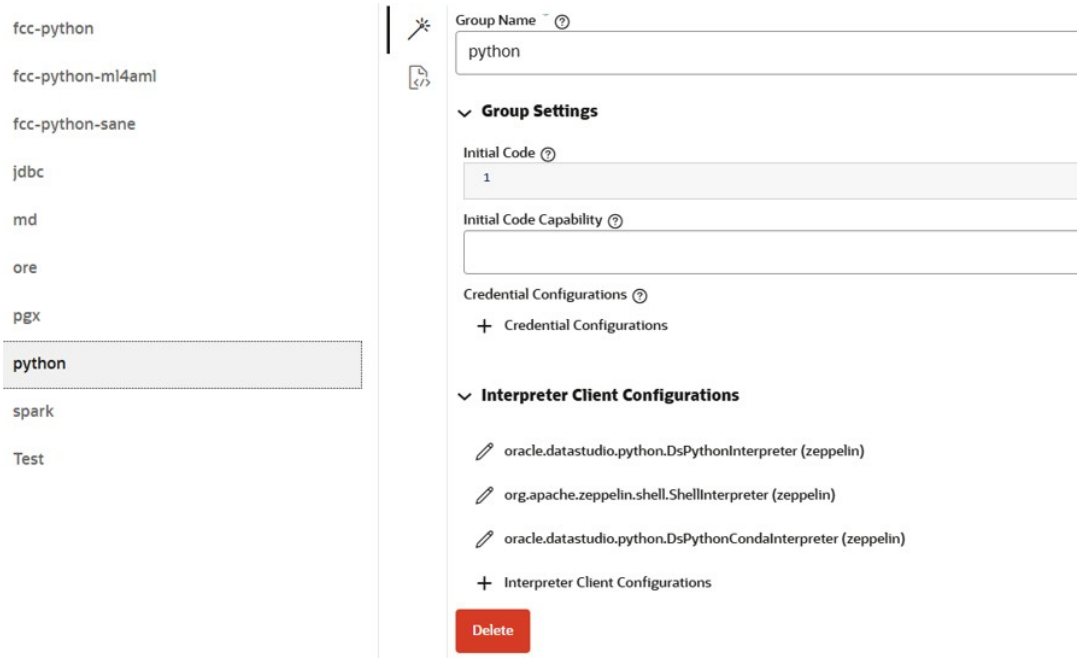
1. Log in to OFS MMG UI.
2. Click **User Profile**, select **Data Studio Options** and then click **Interpreters**. The **Interpreters** page is displayed.

Figure 9-14 Interpreters



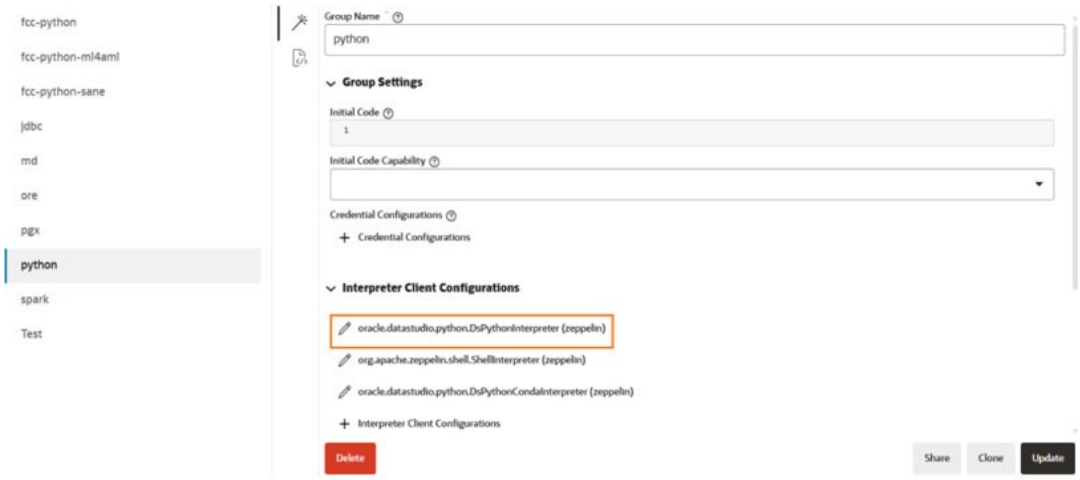
3. On the Left-Hand Side, click **python** interpreter. By default, **Wizard** pane is displayed.

Figure 9-15 Python Interpreter



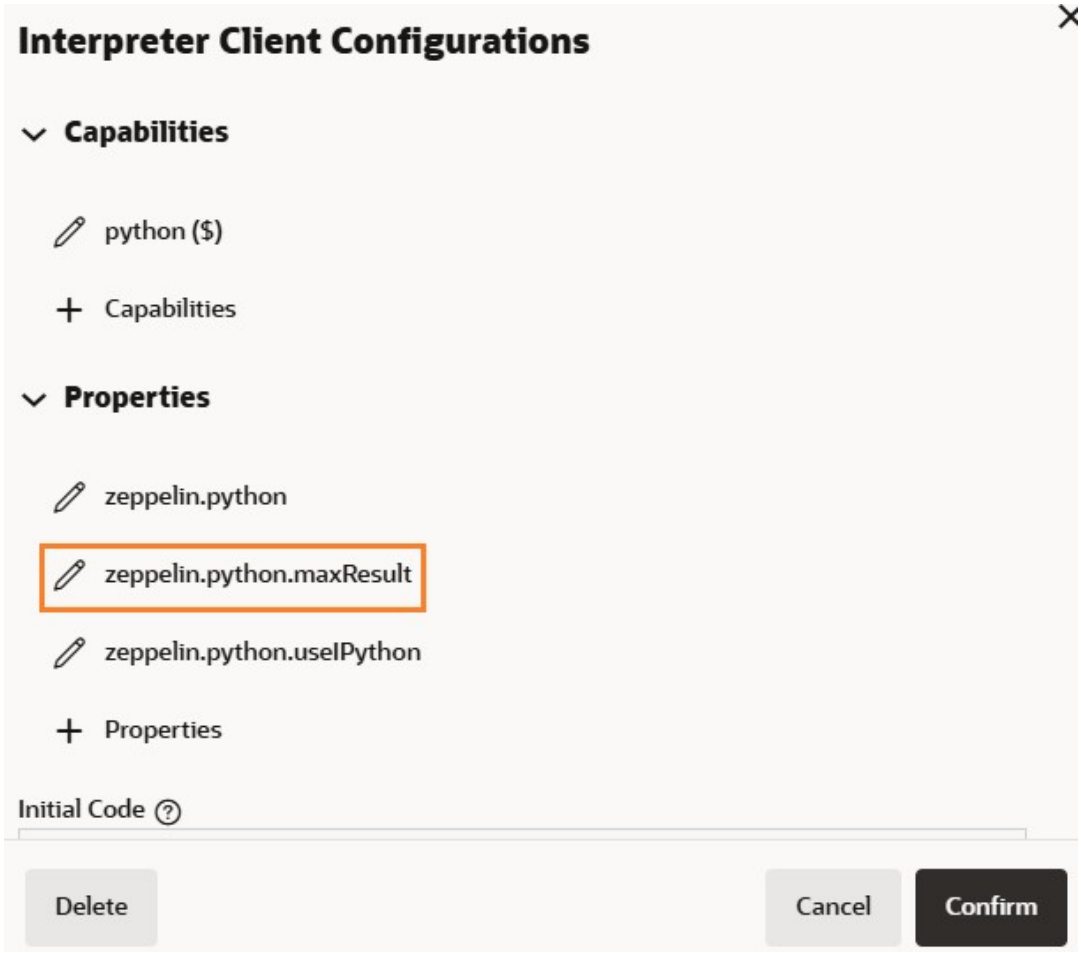
4. On the Right-Hand Side, navigate to **Interpreter Client Configurations**.

Figure 9-16 Interpreter Client Configurations



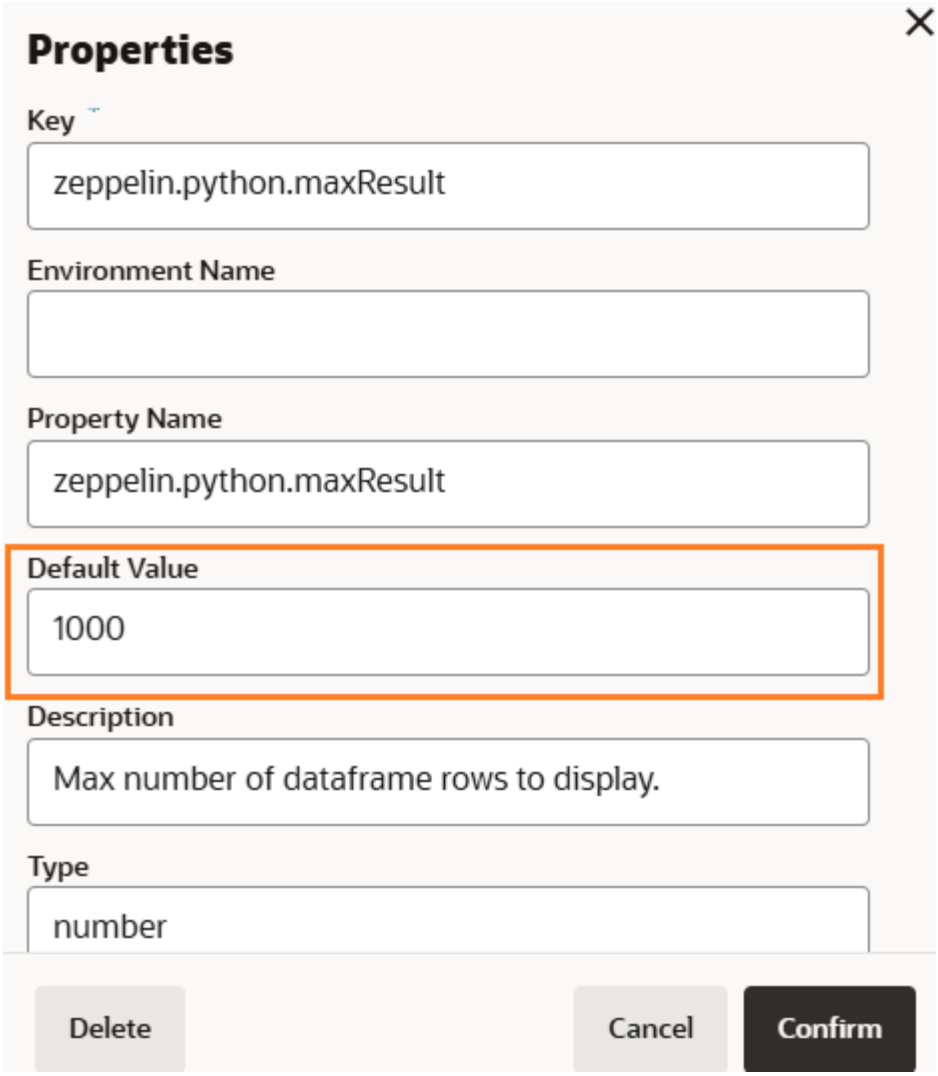
5. Click **oracle.datastudio.python.DsPythonInterpreter (zeppelin)**. The **Interpreter Client Configurations** pane is displayed.

Figure 9-17 Zeppelin Python maxResult



6. Click **zeppelin.python.maxResult**. The **Properties** pane is displayed.

Figure 9-18 Properties of zeppelin.python.maxResult



7. Update the **Default Value** based on your preference. By, default the value is **1000**.
8. Click **Confirm** to confirm the changes. The **Interpreter Client Configurations** page is displayed.
9. Again, click **Confirm** to confirm the changes. The **Python Interpreter** page is displayed.
10. On the Right-Hand Side, click **Update** to save the modifications. A confirmation message will indicate that the Python interpreter has been updated.
11. Restart Compliance Studio. The default value for the maximum number of results will be updated in the Python Interpreter.

jdbc Interpreter

> **Note**
>
> This feature is not recommended approach because it can only be used to connect to a single schema, and all users will have access to that, rather than access being managed per user. In future releases this interpreter will not be enabled by default but instructions will be given to enable if required.
> **Limitation**
>
> - Data source configuration is not dynamic; instead, it is static from the Interpreter Configuration screen.
> - There is no restriction or secure access of data provided with this interpreter.
>
> **Recommendation**
>
> Users are recommended to use a python interpreter to get dynamic data source configuration; even data access permission features can also be used with this interpreter.

The jdbc Interpreter is a ready-to-use interpreter used to connect Studio schema without OFSAA. This Interpreter is used to connect and write SQL queries on any schema without any restriction. The jdbc interpreter has no security attributes. It can be used to access any schema. In the jdbc interpreter, you can configure schema details, link Wallet Credentials to the jdbc Interpreter, etc.

Prerequisites

1. Navigate to `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ conf` directory.
2. Open the `application.yml` file and update **overwrite-builtin** property as **false**.
3. Save the changes and close the `application.yml` file.
4. Restart OFS MMG.

Configure a jdbc Interpreter

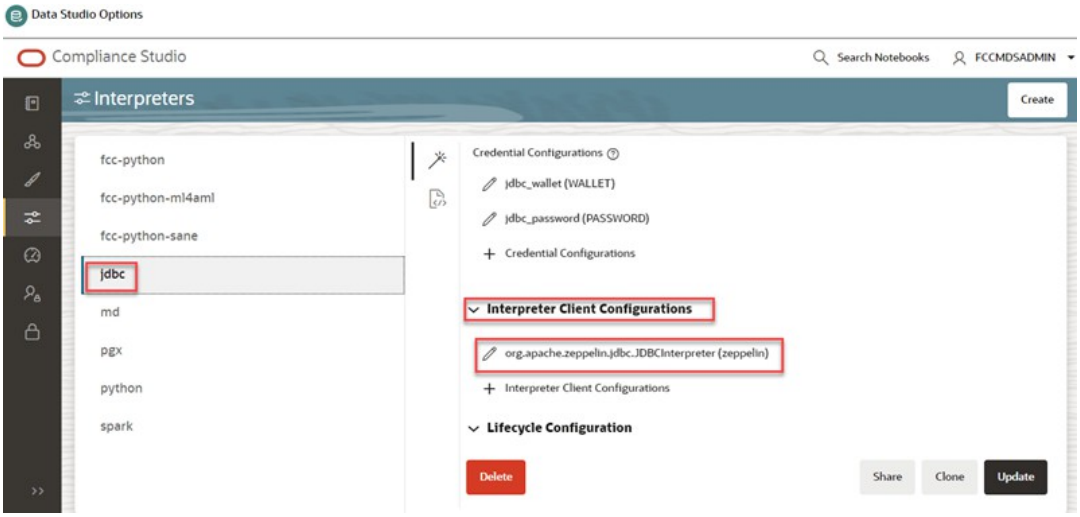
> **Note**
>
> This feature is not recommended approach because it can only be used to connect to a single schema, and all users will have access to that, rather than access being managed per user. In future releases this interpreter will not be enabled by default but instructions will be given to enable if required.
> **Limitation**
>
> - Data source configuration is not dynamic; instead, it is static from the Interpreter Configuration screen.
> - There is no restriction or secure access of data provided with this interpreter.
>
> **Recommendation**
>
> Users are recommended to use a python interpreter to get dynamic data source configuration; even data access permission features can also be used with this interpreter.

To configure a jdbc interpreter, follow these steps:

1. Navigate to `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ bin` directory.
2. Open `startup.sh` file, navigate to line 29 and update jdbc value as **7011**.

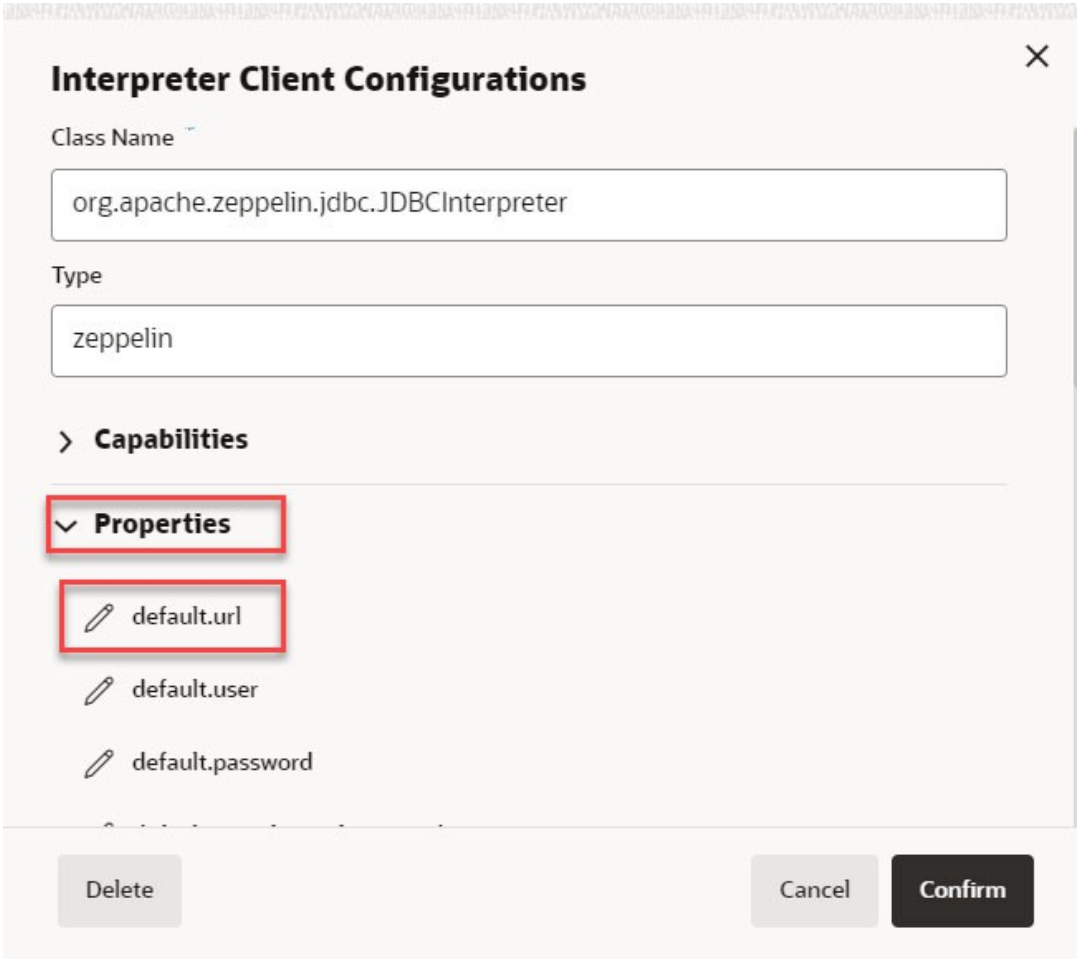
   For example: . ./"$DIR"/datastudio --port 7008 --markdown 7009 --spark 7014 --python 7012 - -**jdbc 7011** --shell -1 --pgx 7022 --external
3. Navigate to `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ bin` directory.
4. Open the `config.sh` file and update DATASTUDIO_JDBC_INTERPRETER_PORT as **7011**.
5. Navigate to `<MMG_INSTALLATION_PATH>/deployed/mmg-home/bin` directory.
6. Open the `config.sh` file and update DATASTUDIO_JDBC_INTERPRETER_PORT as **7011**.
7. Navigate to `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ server/builtin/interpreters/jdbc.json` directory.
8. Navigate to line 154 and update port value as **7011**.
9. Restart OFS MMG.
10. On the Interpreter page LHS menu, select jdbc. The jdbc interpreter pane is displayed.

Figure 9-19 jdbc Interpreter



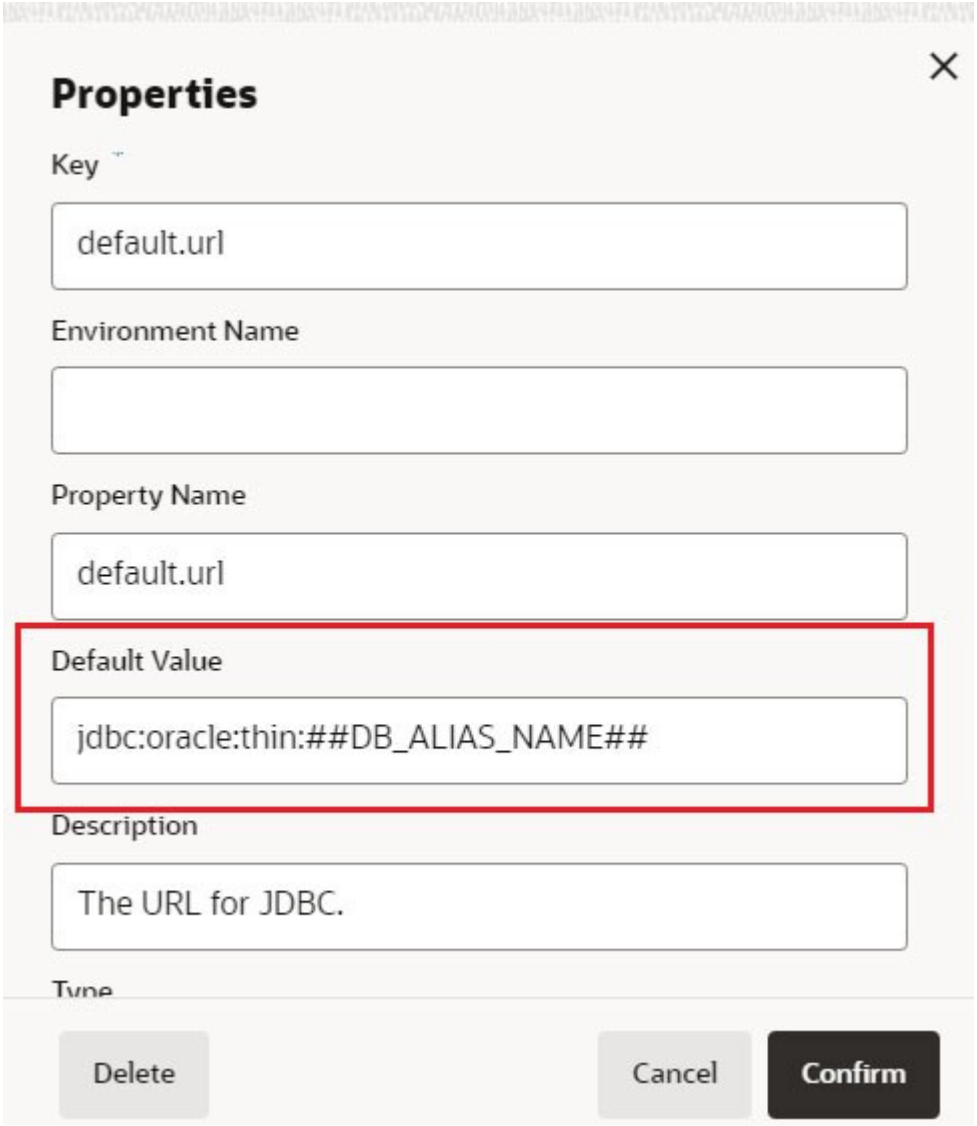
11. On Interpreter Settings page, expand **Interpreter Client Configurations** and click the Edit icon on the **<Class Name> (zeppelin)**. The Interpreter Client Configurations Window is displayed.

Figure 9-20 Interpreter Client Configurations



12. Click **default.url** under the Properties. The Properties page is displayed.

Figure 9-21 Properties



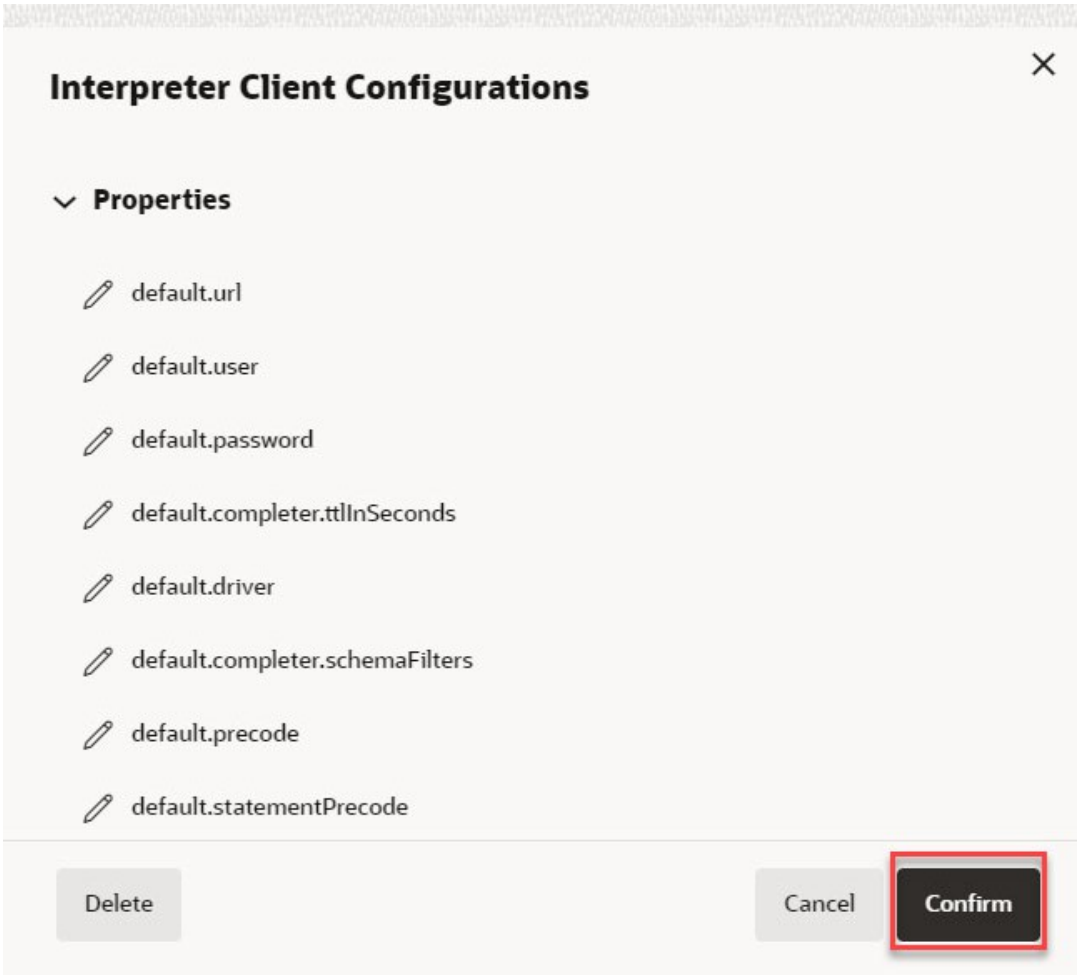
13. Enter the alias name in the **Default Value** field.

    The alias name is available in the `<MMG_STUDIO_INSTALLATION_PATH>/wallet/tnsnames.ora` directory.

    For example, jdbc:oracle:thin:##DB_ALIAS_NAME##

14. Click **Confirm**. The Interpreter Client Configurations page is displayed.

Figure 9-22 Interpreter Client Configurations



15. Click default.user property and it should be null in the **Default Value** field.
16. Click default.password property and it should be null in the **Default Value** field.

> **Note**
>
> Retain the default settings for the remaining properties in the Interpreter Client Configurations.

17. Click **Update**. The modified values are updated in the Interpreter.

Link Wallet Credentials to jdbc Interpreter

> **Note**
>
> This feature is not recommended approach because it can only be used to connect to a single schema, and all users will have access to that, rather than access being managed per user. In future releases this interpreter will not be enabled by default but instructions will be given to enable if required.
> **Limitation**
>
> - Data source configuration is not dynamic; instead, it is static from the Interpreter Configuration screen.
> - There is no restriction or secure access of data provided with this interpreter.
>
> **Recommendation**
>
> Users are recommended to use a python interpreter to get dynamic data source configuration; even data access permission features can also be used with this interpreter.

OFS MMG provides secure and safe credential management. Examples of credentials are passwords, Oracle Wallets, or KeyStores. To link credentials (a wallet and a password) to the jdbc interpreter variant to enable secure data access. This linking enables the jdbc interpreter to securely connect to the specified Oracle database. For more information on linking Wallet Credentials to jdbc Interpreter, see the Link Credentials section.

> **Note**
>
> The Credentials section is enabled if an interpreter variant can accept credentials.

You can also create new credentials and link to jdbc Interpreter. For more information, see Create a Credential section.

md Interpreter

This Interpreter displays text based on Markdown, which is a lightweight markup language. In the md interpreter, you can configure the markdown parser type. Markdown (md) is a plain text formatting syntax designed so that it can be converted to HTML. Use this section to configure the markdown parser type.

To configure the md interpreter variant, follow these steps:

1. On the md Interpreter page LHS menu, select md. The md interpreter pane is displayed.
2. On the Interpreter Settings page, expand **Interpreter Client Configurations** and click the Edit icon for **<Class Name> (zeppelin**). The Interpreter Client Configurations Window is displayed.
3. Enter the markdown parser type and click **Update**. To confirm the modified configuration.

PGX Interpreter

The PGX has the following interpreters:

- **pgql**: The pgql interpreter is a ready-to-use interpreter used to connect the configured PGX server. This Interpreter is used to perform queries on the graph in OFS MMG. PGQL is a graph query language built on top of SQL, bringing graph pattern matching capabilities to existing SQL users and new users interested in graph technology but who do not have an SQL background.
- **pgx-algorithm**: The pgx-algorithm is a ready-to-use interpreter used to connect to the configured PGX server. This Interpreter is used to write an algorithm on the graph and is also used in the PGX interpreter.
- **pgx-java**: The pgx-java interpreter is a ready-to-use interpreter used to connect to the configured PGX server. It is **Java11** based interpreter with a PGX client embedded in it to query on graph present in the PGX server.
- **pgx-python**: The pgx-python interpreter is a ready-to-use interpreter used to connect to the configured PGX server. It is a **python** based interpreter with a PGX python client embedded in it to query on graph present in the PGX server. By default, this Interpreter points to ml4aml Python Virtual environment.
- **java**: The java interpreter is a ready-to-use interpreter based on **Java11**, where users can write the java code.

To configure the pgql interpreter variant, follow these steps:

1. On the Interpreter page LHS menu, select pgql. The pgql interpreter pane is displayed.
2. On the Interpreter Settings page, expand **Interpreter Client Configurations** and click the Edit icon for **<Class Name> (zeppelin)**. The Interpreter Client Configurations Window is displayed.
3. Enter the following information in the pgql interpreter variant pane as tabulated in the following table.

Table 9-4 PGX interpreter

Field	Description
graphviz.formatter.class	Enter the class which implements the formatting of the visualization output. For example,`oracle.datastudio.graphviz.formatter.DataStudi oFormatter`
graphviz.driver.class	Enter the class which implements the PGQL driver. For example:`oracle.pgx.graphviz.driver.PgxDriver`
base_url	Enter the base URL of the PGX. For example, `http://<HOSTNAME>:7007`
zeppelin.interpreter.outpu t.limit	Enter the output message limit. Any message that exceeds the limit is truncated. For example, 102 or 400.

Table 9-4 (Cont.) PGX interpreter

Field	Description
num_cached_resultsets	Maximum number of results sets kept open on the PGX server per interpreter session. Only checked when the interpreter is used, and therefore it should only be used with expiring interpreter sessions. For example: 5
resultset_expiration_time _secs	Number of seconds after which unused results sets are closed on the PGX server. Only checked when interpreter session is used and should only be used with expiring interpreter sessions. For example: 3600
zeppelin.python.useIPyth on	Set to 'True' to use IPython, else set to 'False'.
zeppelin.python	Enter the Python installed path. The value points to the default Python version set for the Interpreter. **Note**: To use a different Python version, see Change Version in the Python Interpreter section.

Spark Interpreter

This section explains about Spark Interpreter configurations.

Spark Interpreter in Local Mode

To start spark interpreter in the local mode, follow these steps:

1. Download `spark-3.0.3-bin-hadoop2.7.tgz` from the website.
2. Unzip the spark hadoop cluster's zip file in the below mentioned locations:
   - `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmg-studio/ interpreter-server/spark-interpreter-<version>/extralibs`
   - `<MMG_INSTALLATION_PATH>/mmg-home/mmg-studio/interpreter- server/spark-interpreter-<version>/extralibs`
3. Navigate to `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ bin` directory.
4. Open the `startup.sh` file and add following line before the line containing "counter=1";`nohup "$DIR"/../interpreter-server/spark-interpreter-<version>/bin/spark-interpreter &>> <path_to_save_the_logs>/<log_file_name>.log &`

Figure 9-23 Snapshot of startup.sh file

5. Save and close the file.
6. Open the `shutdown.sh` file and add following line before the line containing “SL=”.

```
I7014=`ps -eaf | grep java | grep RemoteInterpreterServer | grep 7014 |
awk '{print $2}'`
if [[ "" != "$I7014" ]];
then kill -9 $I7014;
fi
```

Figure 9-24 Snapshot of shutdown.sh file

> **Note**
>
> In the above step, the port number for the spark interpreter is assumed to be 7014, the default port that comes with the installer. If a different port is used, then change the configuration accordingly.

7. Save and close the file.
8. Navigate to `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ bin` directory.
9. Open the `startup.sh` file, navigate to line 29 and update spark value as **7014**.

   For example: . ./"$DIR"/datastudio --port 7008 --markdown 7009 --**spark 7014** --python 7012 --jdbc 7011 --shell -1 --pgx 7022 --external
10. Navigate to `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ bin` directory.
11. Open the `config.sh` file and update the following parameters:
    - MMG_SPARK_ENABLED=true

- SPARK_HOME=<MMG_INSTALLATION_PATH>/deployed/mmg-home/ mmg-studio/ interpreter-server/spark-interpreter-<version>/extralibs/ spark-<version>-bin-hadoop<version>
- HADOOP_HOME=##HADOOP_HOME##

> **Note**
>
> Retain the placeholder as it is.

- SPARK_MASTER=local
- SPARK_DEPLOY_MODE=

> **Note**
>
> Retain the SPARK_DEPLOY_MODE as **blank**.

- DATASTUDIO_SPARK_INTERPRETER_PORT=7014

12. Navigate to <MMG_INSTALLATION_PATH>/deployed/mmg-home/bin directory.
13. Open the config.sh file and update the following parameters:
    - MMG_SPARK_ENABLED=true

> **Note**
>
> By default, it is set to false. You can configure the following parameters only when **MMG_SPARK_ENABLED** is set to **true**.

    - SPARK_HOME=<MMG_INSTALLATION_PATH>/deployed/mmg-home/ mmg-studio/ interpreter-server/spark-interpreter-<version>/extralibs/ spark-<version>-bin-hadoop<version>
    - HADOOP_HOME= ##HADOOP_HOME##

> **Note**
>
> Retain the placeholder as it is.

    - SPARK_MASTER= local
    - SPARK_DEPLOY_MODE=

> **Note**
>
> Retain the SPARK_DEPLOY_MODE as blank.

    - DATASTUDIO_SPARK_INTERPRETER_PORT=7014
14. Navigate to <MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ server/ builtin/interpreters/spark.json directory.
15. Navigate to line 169 and update port value as **7014**.

16. Update **default value** as **local** for spark.master and **blank** for spark.submit.deployMode.

    For example:

```
"spark.master": {
                            "envName": "MASTER",
                            "propertyName": "spark.master",
                            "defaultValue": "local",
                            "description": "Spark master uri. ex) spark://
masterhost:7077",
                            "type": "string"
},
                            "spark.submit.deployMode": {
                                "envName": null,
                                "propertyName":"spark.submit.deployMode",
"defaultValue": "",
                            "description": "The deploy mode of Spark driver
program, either 'client' or 'cluster'",
                            "type": "string"
                 },
```

17. Navigate to `<CMMG_INSTALLATION_PATH>/bin` directory.
18. Restart OFS MMG using the following command.

    ```
    ./MMG.sh –restart
    ```

19. Verify if the spark-interpreter has started using the following command:

    ```
    netstat –nltp | grep 7014
    ```

Enable Additional Spark Interpreter

Interpreter variant does not apply to spark interpreters. Hence, you must enable an additional set of interpreters.

To enable an additional spark interpreter, see Enable Additional Spark Interpreter section in the Appendix.

Pyspark Interpreter

OFS MMG uses PySpark 2.4.0. Before you begin the configurations, check the prerequisites depending on your operation mode.

Prerequisites

The PySpark interpreter has the same prerequisites as that as the Spark Interpreter. For more information, see Spark Interpreter. Also, all Spark components must be configured to use the same Python version.

Configuration

The PySpark interpreter can be configured through the Spark interpreter, with the only exception being the Python version used. By default, the Python version is set to 3 that can be changed either in the interpreter JSON files before the startup or from the Interpreters page of the OFS MMG application UI during runtime by changing the following properties:

To change the value of the `spark.pyspark.python` property before installing the OFS MMG, follow these steps:

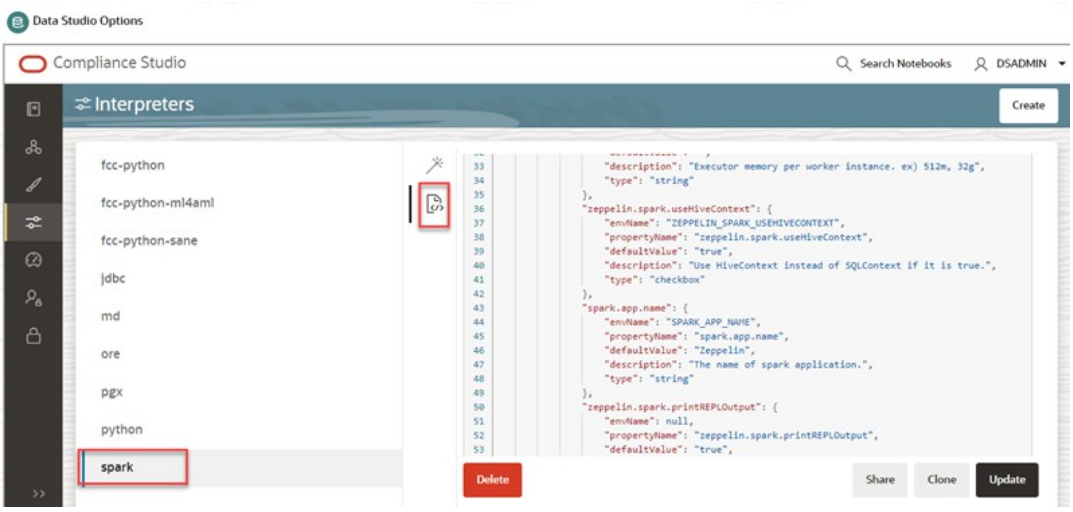
1. Navigate to `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmgstudio/ server/builtin/interpreters/spark.json` directory.
2. Update the value in `spark.pyspark.python` property of the spark.json file.

To change the value of the `spark.pyspark.python` property after installing the OFS MMG, follow these steps:

1. Login to the MMG application.
2. Launch the **CS Production** Workspace.
3. Click the **User Profile** drop-down list and select **Data Studio Options**.
4. Click Interpreters.

   By default, the Interpreters page lists all the available interpreters on the LHS.

Figure 9-25 Spark Interpreter



5. Click **spark** interpreter on the LHS and then click **Plain Configuration** on the RHS.
6. Update the value in the spark.pyspark.python property and click **Update**.

   In the **Spark Interpreter Settings** page of the OFS MMG application UI (or `spark.json` file), change the value of the `spark.pyspark.python` property to the Python executable path that is to be used by the Spark executors.

   In the **PySpark Interpreter Settings** page of the OFS MMG application UI (or `pyspark.json` file), change the value of the `zeppelin.pyspark.python` property to the Python executable path that is to be used by the Spark driver.

Use Python Virtual Environments with PySpark

To ensure that the two Python versions match, in case your components run on different machines, you must use the Python virtual environments with PySpark.

Create a Virtual Environment with Conda

> **Note**
>
> You can also use **virtualenv** to create your virtual environment instead of **conda**.

To create a virtual environment with Conda, follow these steps:

1. Ensure that you have conda and conda-Pack installed.

   > **Note**
   >
   > To check if conda is installed, then execute the following command: "`conda --version`"

2. Create your virtual environment using the following command:

   ```
   conda create -y -n <environment-name> python=<python-version>
   <additional-packages>
   ```

   > **Note**
   >
   > The <environment-name> can be chosen freely and subsequently has to be substituted in further commands.

3. Activate your virtual environment using the following command:

   ```
   conda activate <environment-name>
   ```

4. Execute the following to obtain the path to your virtual environment:

   ```
   which python
   ```

   The obtained result is referred to as `<environment-abs-path>`.

5. Compress your virtual environment using the following command:

   ```
   conda pack -n <environment-name> -o <environment-abs-path>/
   <environmentname>.
   tar.gz
   ```

Update Interpreter Properties

The interpreter properties can either be configured in the interpreter JSON files or from the Interpreters page of the OFS MMG application UI after starting the OFS MMG application.

- In the Spark Interpreter Settings page of the OFS MMG application UI (or `spark.json`), change the following:
  - Change the value of the `spark.yarn.dist.archives` property to `<environment-abspath>/< environment-name>.tar.gz#<environment-name>`
  - Change the value of the `spark.pyspark.python property to ./<environmentname>/bin/python`

- In the **PySpark Interpreter Settings** page of the OFS MMG application UI (or `pyspark.json`), change the value of the `zeppelin.pyspark.python` parameter to `<environment-abs-path>/bin/python`.

Configure Pyspark Interpreter

Users must write for connection either in the Initialization section or in the notebook's paragraph. This interpreter is used to write the pyspark language to query and perform analytics on data present in big data. This requires additional configuration, which must be performed as a prerequisite or as postinstallation with the manual change of interpreter settings.
In the pyspark interpreter, you can configure the Python binary executable for PySpark in both driver and workers, set 'True' to use IPython, else set it to 'False'.

To configure the pyspark interpreter variant, follow these steps:

1. On the Interpreter page LHS menu, select pyspark. The pyspark interpreter pane is displayed.
2. On the Interpreter Settings page, expand **Interpreter Client Configurations** and click the Edit icon for **<Class Name> (zeppelin)**. The Interpreter Client Configurations Window is displayed.
3. Enter the following information in the pyspark interpreter variant pane as tabulated in the following table

Table 9-5 pyspark interpreter

Field	Description
zeppelin.pyspark.python	Enter the Python binary executable for PySpark in both drivers and workers. The default value is python. For example, `python`
zeppelin.pyspark.useIPython	Set to 'True' to use IPython, else set to 'False'.
zeppelin.interpreter.output.limit	Output message from interpreter exceeding the limit will be truncated

Enable Additional PySpark Interpreter

Interpreter variant does not apply to pyspark interpreters. Hence, you must enable an additional set of interpreters.

To enable an additional pyspark interpreter, see Enable Additional Spark or PySpark interpreter section in the Appendix.

R Interpreter

The R interpreter allows execution of R code within OFS MMG interactive notebooks and pipelines, supporting exploratory analytics, reproducible research, and statistical computing, while integrating seamlessly with big data tools to provide an interactive environment for advanced analytics.

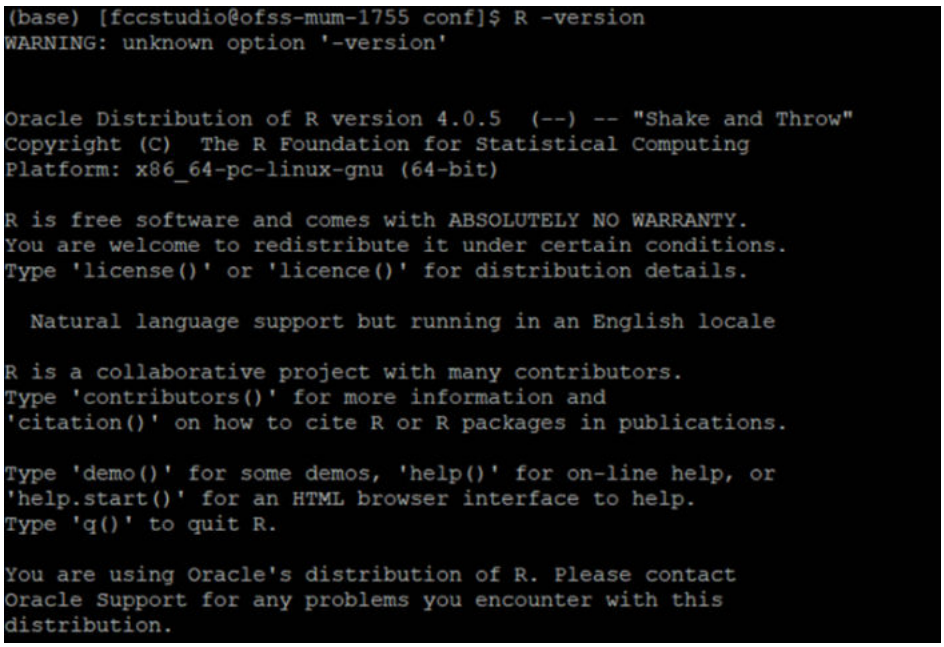
You can configure the R Interpreter support either with **ORD-3.6.1** or **R 4.1.2**.

ORD-3.6.1 Installation

To install ORD-3.6.1, follow the steps:

1. Check Linux version. For example, `cat /etc/os-release`
   You can install R interpreter based on the following Linux version.
   a. To install Oracle R Distribution on Linux 7, see Using Yum.
   b. To install Oracle R Distribution on Linux 8, see Using Yum or Dnf.
2. In the terminal, check installation using **R -version**.

Figure 9-26 R Interpreter



3. To install other packages, execute the following.
   a. `R-e "install.packages('Rserve', repos='https://www.rforge.net/')"`
   b. `R-e "install.packages(c('knitr', 'ggplot2', 'backports'),repos='https://mirror.las.iastate.edu/CRAN/')"`

R 4.1.2 Installation

> **Note**
> This setup might update some of the older root level files and using Non-Oracle Yum Repository for getting R rpm files.

To install R 4.1.2, follow these steps:

1. In the terminal, execute the following.
   a. `curl- O https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm`
   b. `yum install epel-release-latest-7.noarch.rpm`

c. `curl- O https://cdn.rstudio.com/r/centos-7/pkgs/R-${R_VERSION}-1-1.x86_64.rpm`

d. `sudo yum install R-${R_VERSION}-1-1.x86_64.rpm`

e. `sudo ln -s /opt/R/${R_VERSION}/bin/R /usr/bin/R`

2. Check installation using **R -version**.
3. To install other packages, execute the following.

a. `R-e "install.packages('Rserve',repos='https://www.rforge.net/')"`

b.
```
R-e "install.packages(c('knitr', 'ggplot2', 'backports'),repos='https://
mirror.las.iastate.edu/CRAN/')"
```

Configuration

This section describes about how to configure R interpreter.

To configure R interpreter, follow these steps:

1. Navigate to the `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmg-studio/conf` directory.
2. To configure Rserve, execute the following.

```
nano /scratch/software/R/Rserve.conf (sample file)
>
auth required
plaintext disabled
pwdfile /scratch/software/R/creds/Rserve.pwd
remote enable
switch.qap.tls enable
tls.port 6311
qap disable
interactive no
rsa.key /scratch/software/R/creds/server.key
tls.key /scratch/software/R/creds/server.key
tls.cert /scratch/software/R/creds/server.crt
```

3. Create a password file (Rserve.pwd) using the following.

```
>
oml $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 string needs to start with a `$` sign.

4. To generate the SSL key, execute the following.

```
openssl genrsa -out server.key 2048
openssl req -new -key server.key -out server.csr # password 1234
openssl x509 -req -days 365 -in server.csr -signkey server.key -out
server.crt
```

5. To generate a keystore file, execute the following.

```
keytool -import -alias <keystore-alias> -file <path-to-server.crt>/
server.crt -keystore <output-path-to-keystore/rinterpreterkeystore -
storepass <keystore-secret> -noprompt
```

For example,

```
keytool -import -alias <rserve -file> <MMG_INSTALLATION_PATH>/deployed/mmg-
home/mmg-studio/conf/Rserver.crt -keystore <MMG_INSTALLATION_PATH>/
deployed/mmg-home/mmg-studio/conf/rinterpreterkeystore -storepass changeit
-noprompt
```

After execution, the following files are generated in the `<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmg-studio/conf` directory.

- rinterpreterkeystore
- Rserve.conf
- Rserve.pwd
- Rserver.crt
- Rserver.csr
- Rserver.key

6. Open the `Rserve.conf` file and update the following:

Table 9-6 Rserve.conf File

Parameter	Value
rsa.key	`<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmg-studio/conf/Rserver.key`
tls.key	`<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmg-studio/conf/Rserver.key`
tls.cert	`<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmg-studio/conf/Rserver.crt`
maxbufsize	1000000004 in bytes

7. Navigate to the `<MMG_INSTALLATION_PATH>/bin` directory.
8. Open `config.sh` file and update the following parameters:
   a. **R_ENABLED**=true
   b. **RS_CONF_PATH**=`<MMG_INSTALLATION_PATH>/mmg-home/mmg-studio/conf/Rserver.conf`
   c. **RS_KEYSTORE**=`<MMG_INSTALLATION_PATH>/mmg-home/mmg-studio/conf/rinterpreterkeystore`

d. **RS_KS_SECRET**=changeit

9. Run OFS MMG. To run, execute the following command.

```
./MMG.sh --update
```

10. Restart OFS MMG. The R interpreter will be visible in the UI and you can execute the R paragraph.
11. Navigate to the `<MMG_INSTALLATION_PATH>/deployed/mmg-home/bin` directory.
12. Open `config.sh` file and validate the following parameters:
    a. **R_ENABLED**=true
    b. **RS_CONF_PATH**=`<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmg-studio/conf/Rserver.conf`
    c. **RS_KEYSTORE**=`<MMG_INSTALLATION_PATH>/deployed/mmg-home/mmg-studio/conf/rinterpreterkeystore`
    d. **RS_KS_SECRET**=changeit
13. Navigate to the `<MMG_INSTALLATION_PATH>/mmg-home/bin` directory.
14. Open `config.sh` file and validate the following parameters:
    a. **R_ENABLED**=true
    b. **RS_CONF_PATH**=`<MMG_INSTALLATION_PATH>/mmg-home/mmg-studio/conf/Rserver.conf`
    c. **RS_KEYSTORE**=`<MMG_INSTALLATION_PATH>/mmg-home/mmg-studio/conf/rinterpreterkeystore`
    d. **RS_KS_SECRET**=changeit

If users get an SSL error while executing the R interpreter, follow these steps:

1. Log in to the Linux server as root and change to the `/etc/yum.repos.d` directory.
2. Download Rserve_1.8-10.tar.gz.
3. Install openssl-devel - yum install openssl-devel
4. To install, execute the following.

```
R CMD INSTALL --configure-args="--with-ssl-headers=/usr/include --with-ssl-libraries=/usr/lib64" Rserve_1.8-10.tar.gz
```

   The following steps can be executed from R session to check that rserve configuration is working before starting the services.

5. Open the **Putty** and enter **R -version**.
6. Execute the following command.
    a. `library(Rserve)`
    b. `Rserve(args="--RS-conf <MMG_INSTALLATION_PATH>/deployed/mmg-home/mmg-studio/conf/Rserve.conf --no-save")`
7. After verifying, stop Rserve and ensure the port is free.
8. Navigate to the `<MMG_INSTALLATION_PATH>/bin` directory.

9. Restart OFS MMG.
10. Navigate to the interpreter notebook and run the R paragraph to validate the output.

Create a Credential

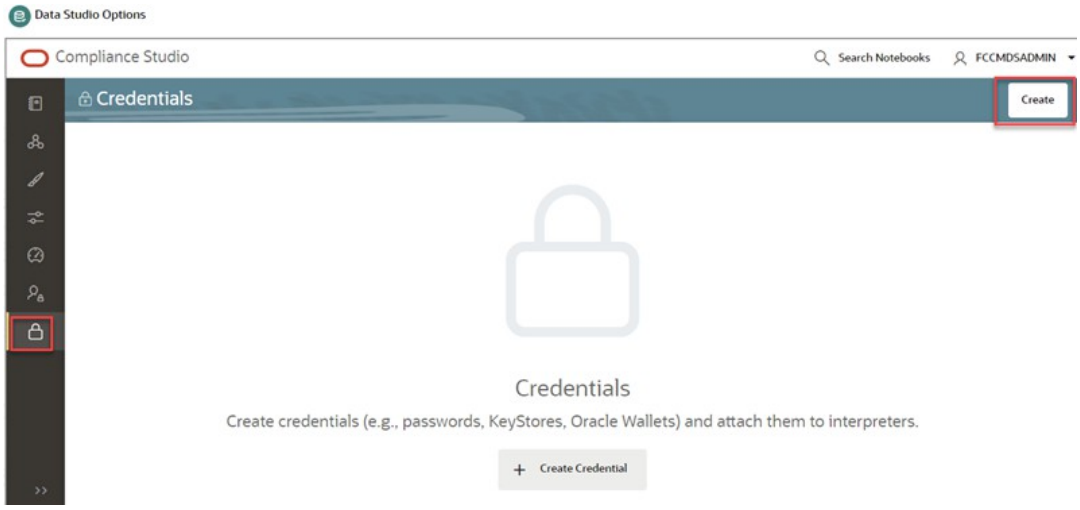
New credentials are created when database details are changed or updated. For example, change in Transparent Network Substrate (TNS) due to hostname change or compulsory periodic update of schema passwords.

Oracle Wallet provides a simple and easy method to manage database credentials across multiple domains. It allows you to update database credentials by updating the Wallet instead of having to change individual data store definitions.

To create a new password credential for the wallet, follow these steps:

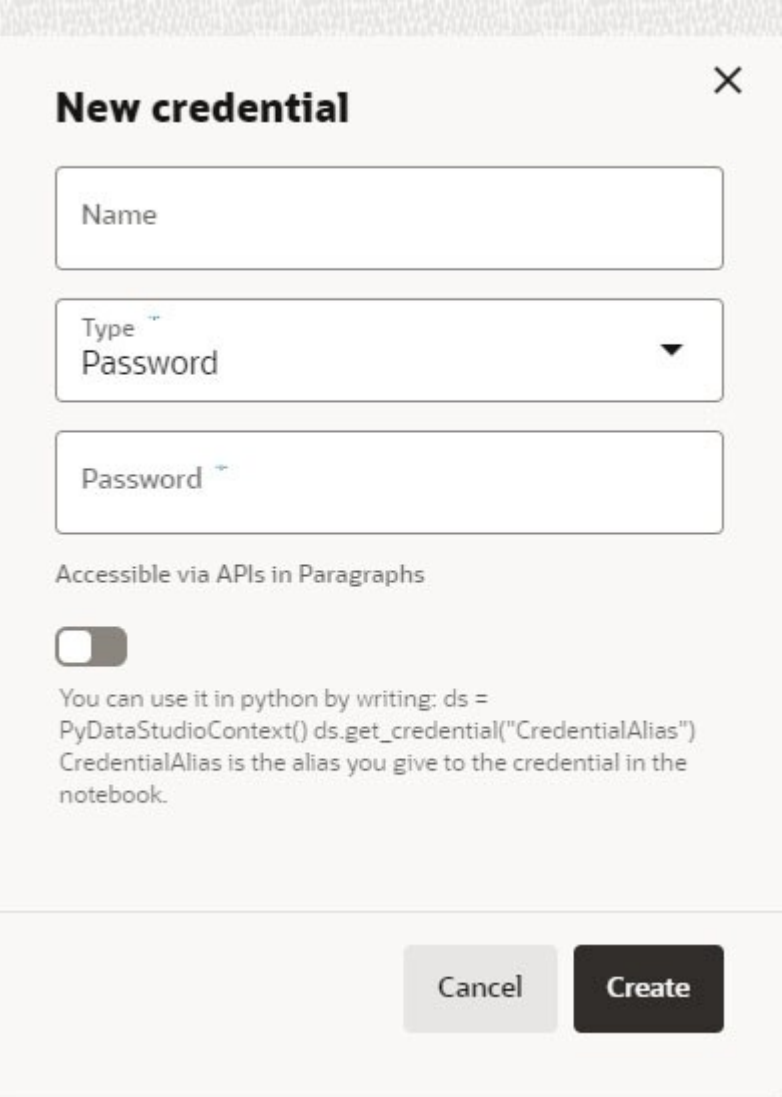
1. On the Compliance Studio workspace LHS Menu, click **Credentials**. The Credentials page is displayed.

Figure 9-27 Credentials Page



2. Click **Create**. The **New Credential** dialog box is displayed.

Figure 9-28 New Credential for Password



3. Enter the following information in the New credential dialog as tabulated in the following table.

Table 9-7 Create Credential dialog

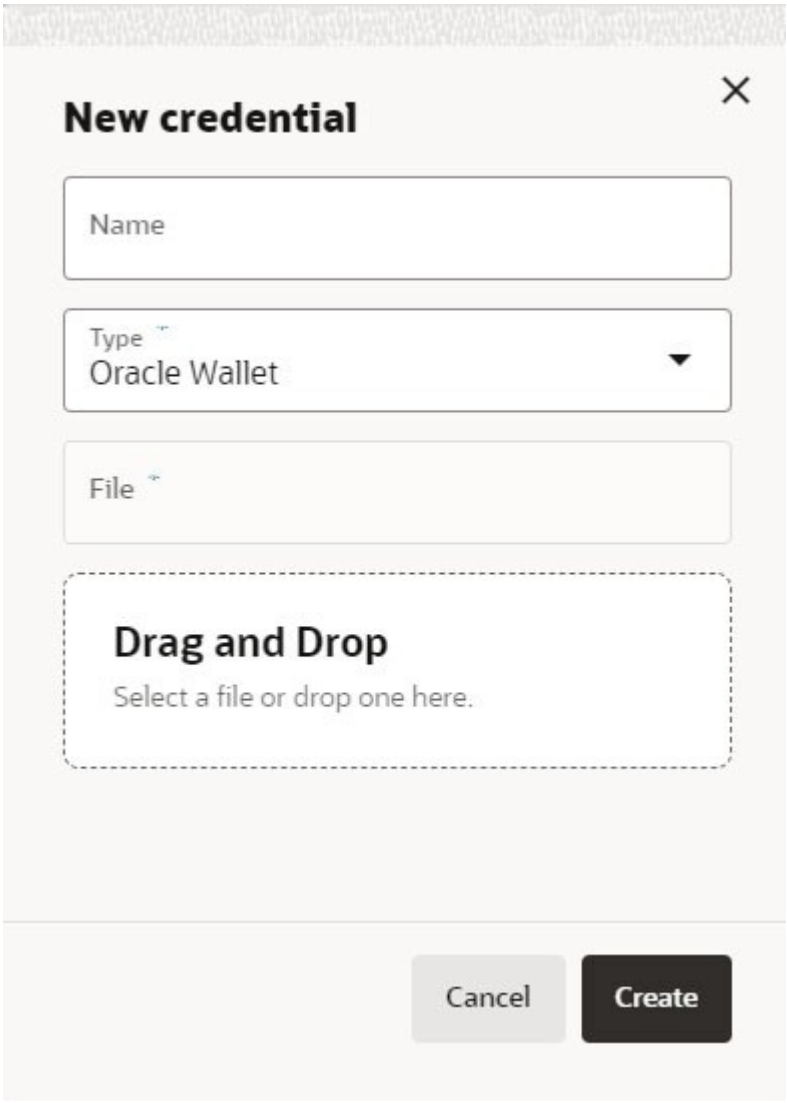
Field	Description
Name	Enter the name for the password credential.
Type	From the drop-down list, select the Password type.
Password	Enter the wallet password for the password credential.
Accessible via APIs in Paragraphs	Move this toggle switch to right to enable this option.

4. Click **Create**. The password is created for the wallet and displayed on the Credentials page.

To create a wallet credential, follow these steps:

1. Click **Create**. The **New Credential** dialog box is displayed.

Figure 9-29 New Credential for Wallet



2. Enter the following information in the New credential dialog as tabulated in the following table.

Table 9-8 Create Credential dialog box

Field	Description
Name	Enter the name for the wallet credential.
Type	From the drop-down list, select the Oracle Wallet type.

Table 9-8 (Cont.) Create Credential dialog box

Field	Description
File	Upload the wallet zip file that includes the following files: • `tnsnames.ora` • `ewallet.p12` • `cwallet.sso` These files are available in the `<COMPLIANCE_STUDIO_INSTALLATION_PATH>/wallet` directory. **Note**: • The wallet file must be in .zip format. • The maximum file size allowed for the credential file is 128Kb.

3. Click **Create**. The wallet credential is created and displayed on the Credentials page.

Link Credentials

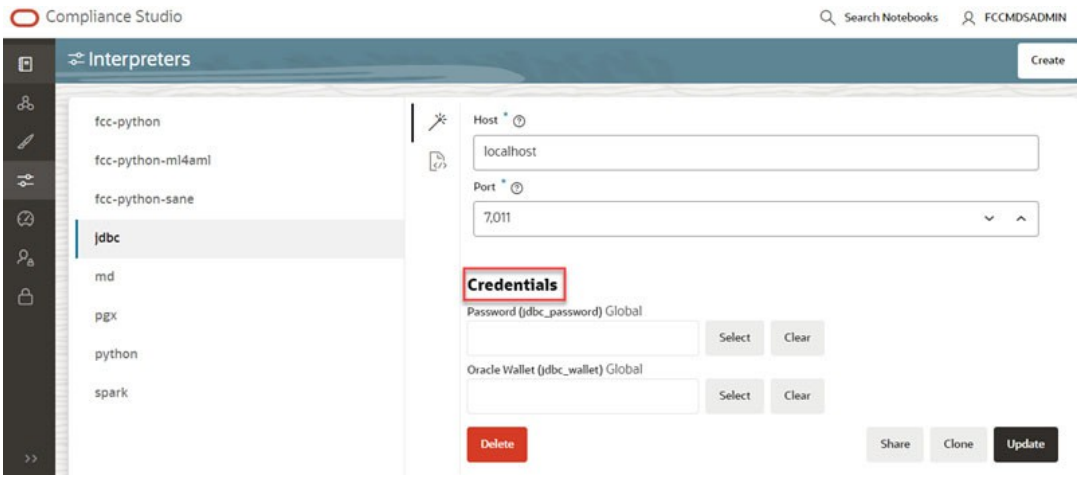
Compliance Studio provides secure and safe credential management. Examples for credentials are passwords, Oracle Wallets, or KeyStores. To link credentials (a wallet and a password) to the jdbc interpreter variant to enable secure data access. This linking enables the jdbc interpreter to securely connect to the specified Oracle Database. You can also create new credentials to connect to the new interpreter variants based on your requirement. For more information, see Create a Credential section.

> **Note**
>
> You can link credentials only for jdbc interpreters. The Credential section is enabled if an Interpreter variant can accept credentials.

To link ready-to-use credentials to the required interpreters, follow these steps:

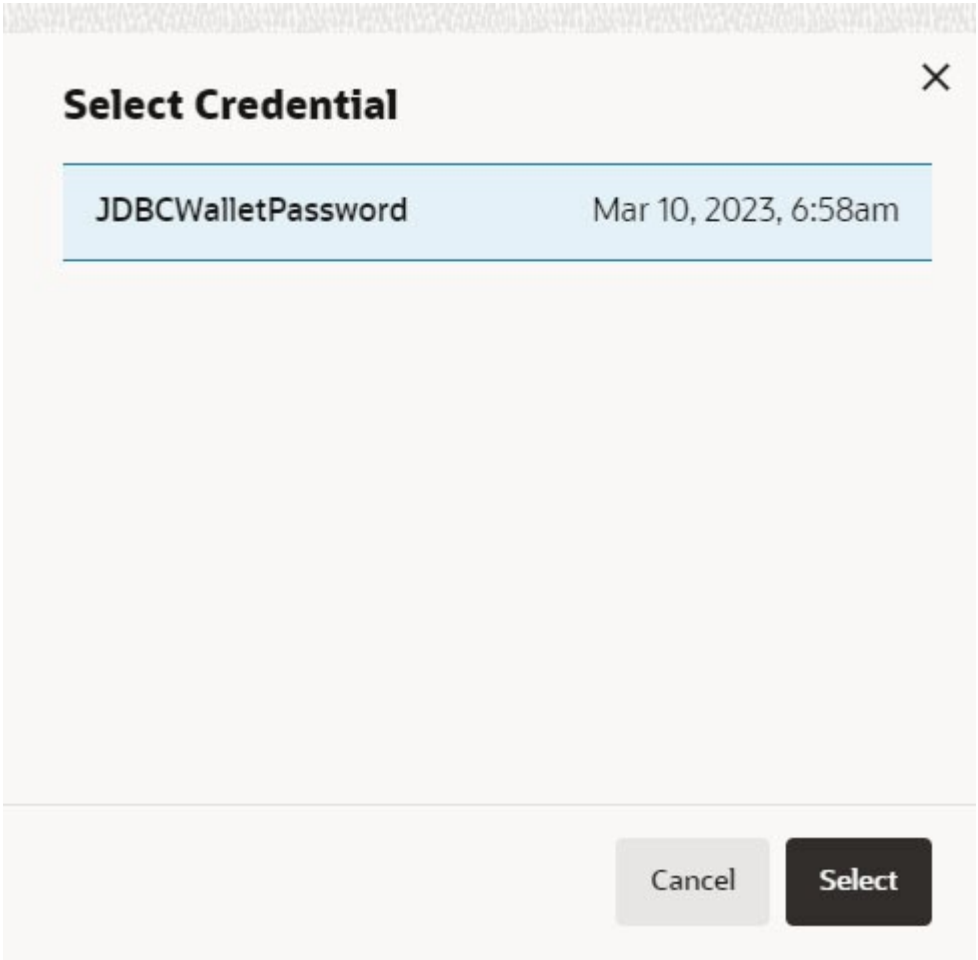
1. On the Interpreters page, select the required interpreters. For example, jdbc.
2. Navigate to the Credentials section.

Figure 9-30 Credentials



3. Click **Select** to select the Password (jdbc password) that you want to link to the Interpreter variant. The Select Credential dialog is displayed.

Figure 9-31 Select Credential



4. Select the required Password (jdbc_password) and click **Select**.

5. Click **Select** on the Credentials section to select the Oracle Wallet (jdbc_wallet) that you want to link to the Interpreter variant. The Select Credential dialog is displayed.
6. Select the required Oracle Wallet (jdbc_wallet) and click **Select**.
7. Click **Update** on the Credentials section to save the changes.

   The required password and Oracle Wallet are linked to the jdbc Interpreter.
8. Restart Compliance Studio.

Create an Interpreter Group

In Compliance Studio, you can either use a default interpreter group or create a new group for an interpreter. You can create more than one group for an interpreter. Multiple groups for an interpreter are created to connect different versions of interpreters (Python version: 3, Python version: 2) and connect a different set of users and database schema. For example, Compliance Studio schema, BD schema, etc.

To create a new interpreter group, follow these steps:

1. On the Interpreters page, click the required interpreters from the LHS list. For example, jdbc interpreter.
2. The default interpreter group is displayed on the RHS.
3. On the default interpreter, click **Clone** button to create a new group. The Create Interpreter Group dialog box is displayed.
4. Enter the Name for the new interpreter group. Click **Create**. A new group is created with a name, **<Interpreter Type>.<Group Name>.**
5. Provide the new schema details, such as the default.url, default.user, and default.password.

Clone an Interpreter

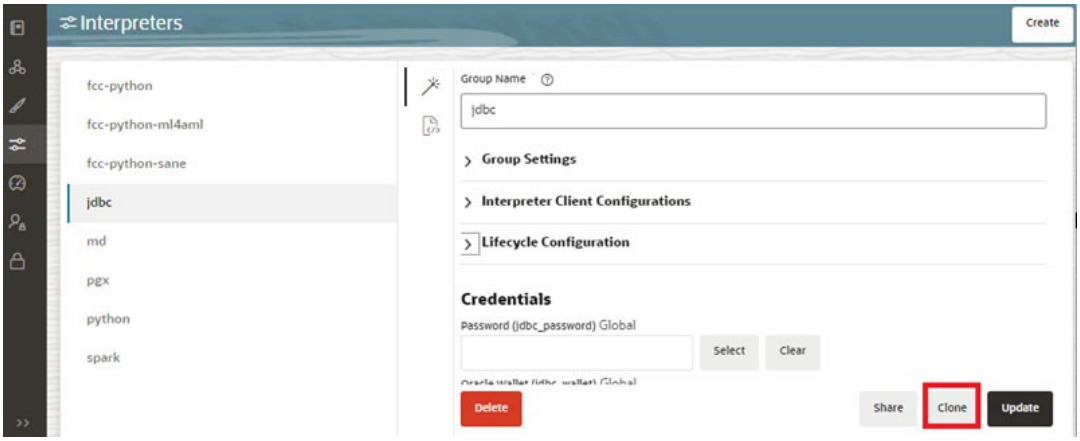
You can either use a default interpreter group or create a new group for an interpreter. You can create more than one group for an interpreter.

Multiple groups for an interpreter are created to connect different versions of interpreters (Python version: 3, Python version: 2) and connect a different set of users and database schema. For example, Compliance Studio schema, BD schema, etc.

1. Log in to the Compliance Studio application.
2. Launch the **CS Production** Workspace.
3. Click the **User Profile** drop-down list and select **Data Studio Options**.
4. Click **Interpreters**.

   By default, the Interpreters page lists all the available interpreters.
5. Click **jdbc** interpreter on the LHS. The default configured interpreter variant is displayed on the RHS:

Figure 9-32 jdbc interpreter screens



6. Click **Clone** on the RHS. The pop-up window displayed for the group name.
7. Enter the group name in the **Group Name** text box and click **Create**. The new group is created and displayed on LHS.
8. Enter **Name** for the new interpreter group.
9. Click **Create**. A new group is created with a name, **<Interpreter Type>.<Group Name>**.
10. Provide the new schema details, such as the default.url, default.user, and default.password.

    You can modify the values in the interpreter properties in the JSON file or Wizard view.

10

Data Management

The Data Management module allows users to efficiently manage data stores within a workspace. It provides key features for importing both data models and data from Source Schemas. With features like Data Modelling and Data Population, users can replicate database structures, create data ingestion jobs, and schedule or manually run those jobs to bring in new data. This module simplifies schema integration, supports data migration, and ensures consistent data flow across environments.

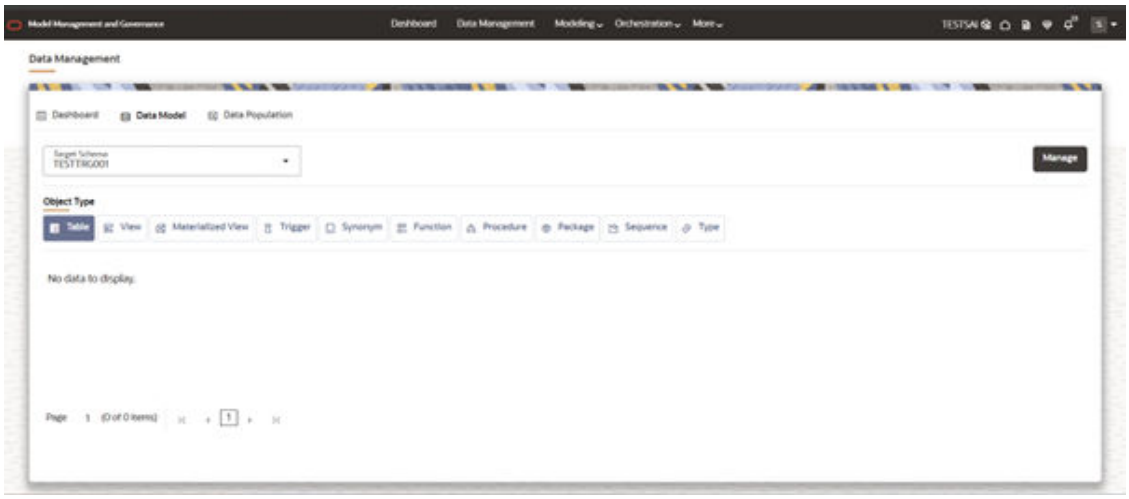
Data Management also has a feature where user can see the structure of the database object.

> **Note**
>
> Currently, Hive Data Stores does not support Data Management.

Data Modeling

Data Modeling refers to the process of replicating database objects from a source schema to a target schema. During this process, the structural definitions and metadata of the database objects are transferred to the target environment. This replication ensures that the logical design and structural components of the database are accurately maintained across schemas, supporting development activities for modelers. Database Objects are tables, views, functions, triggers, synonyms, Materialized views, procedures, packages, Sequences, and types.

Figure 10-1 Data Modeling tab

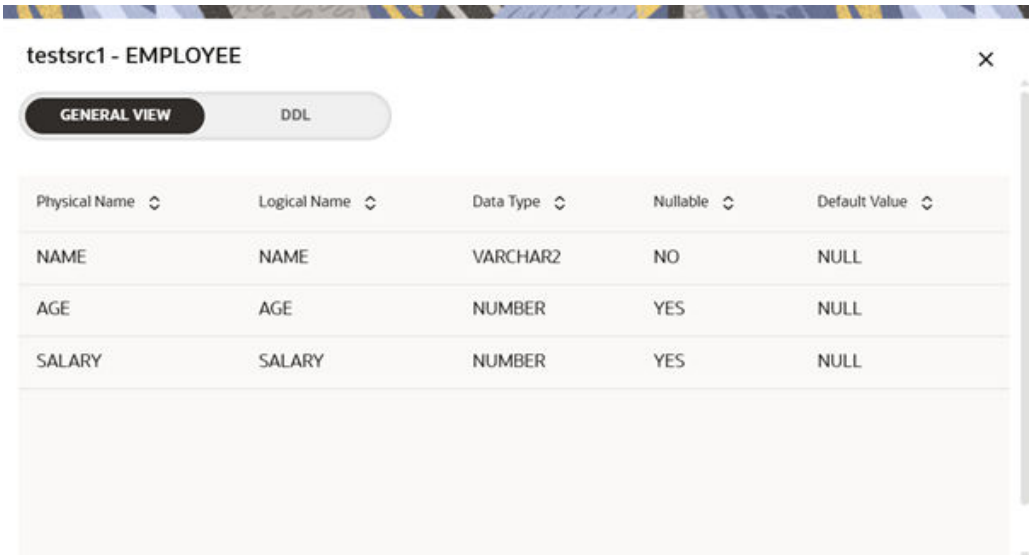


- **Database Objects List menu**
  - The interface displays a list of database object types. Users can select any object type to view the corresponding objects available within the schema.

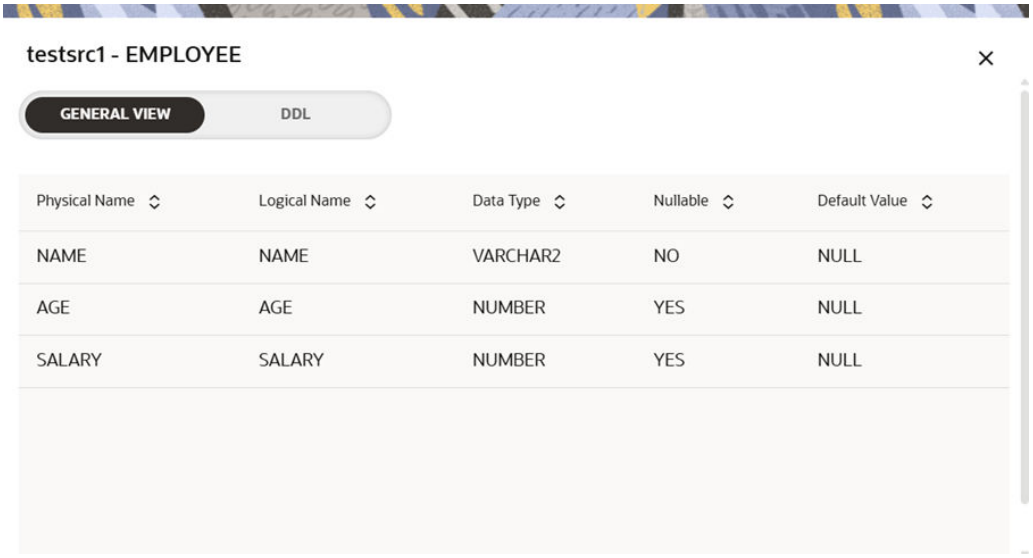
- **Target Schemas Dropdown**
  - The user can select the target schema from a dropdown menu. Based on the selected target schema, the system will display the corresponding list of database objects—filtered by the selected object type—in the left panel.
- **Database Objects List**
  - A table displays the list of database objects based on the selected object type and schema. This table includes the source schema name, object name, and a **View** option.
    * The **View** option allows users to view the DDL (Data Definition Language) of the selected database object, along with a **Generic View** (applicable only for tables and views).

> **Note**
>
> The **Generic View** presents a simplified tabular representation containing details such as column name, data type, nullability, and default value.

  - **Figure 10-2 Data Definition Language View**

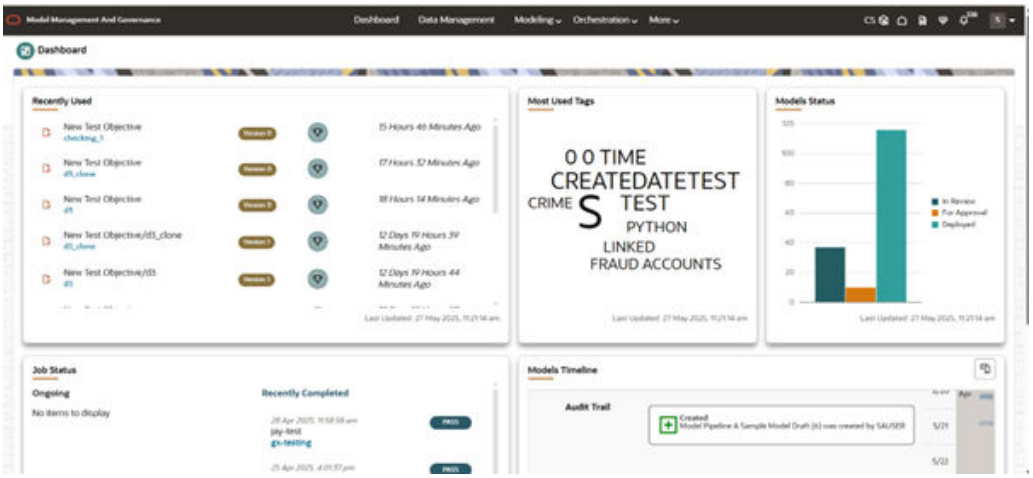


– **Figure 10-3 Generic View**



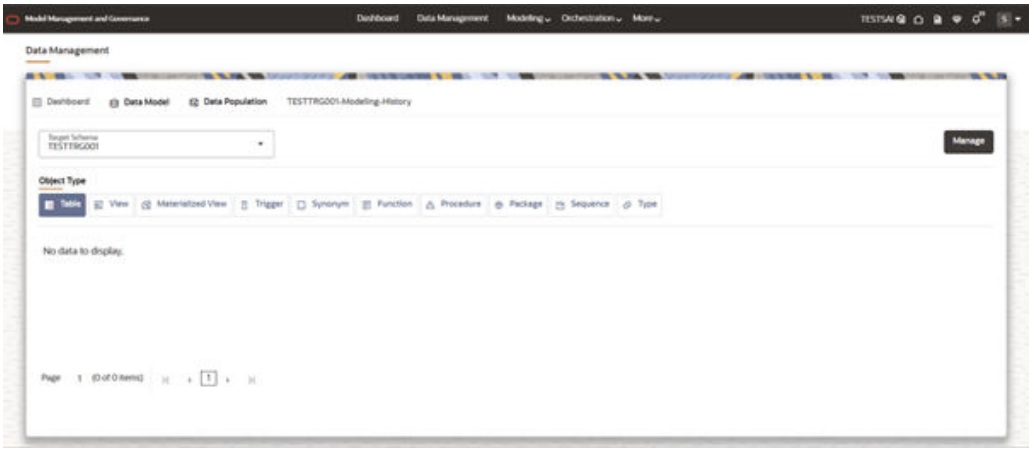
- **Tree View and Add Item buttons**
  - **Tree View:**
    1. Clicking this option opens a new tab within the Data Management UI, titled [TargetSchemaName] - Modeling.
    2. This view provides a hierarchical structure to assist users in creating and organizing new data models.
  - **Add Item:**
    1. This button opens a pop-up window that facilitates data modeling for the selected database object type (as chosen from the left panel).
- **Steps/Process of Data Modeling**
  1. Launch any workspace where you wanted to do **Data Modeling** and go to **Data Management** tab from main menu.

Figure 10-4 Data Management tab from main menu



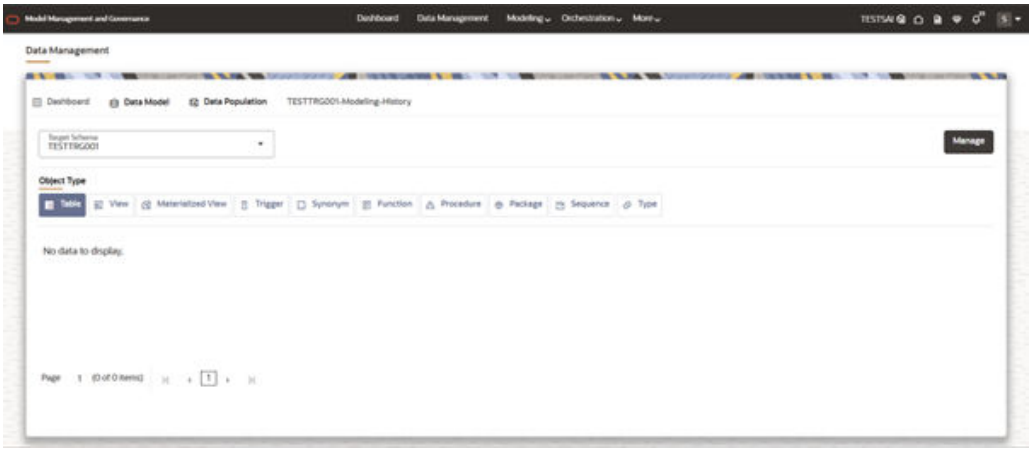
2. Click on **Data Model** sub-tab.

Figure 10-5 Data Model sub-tab



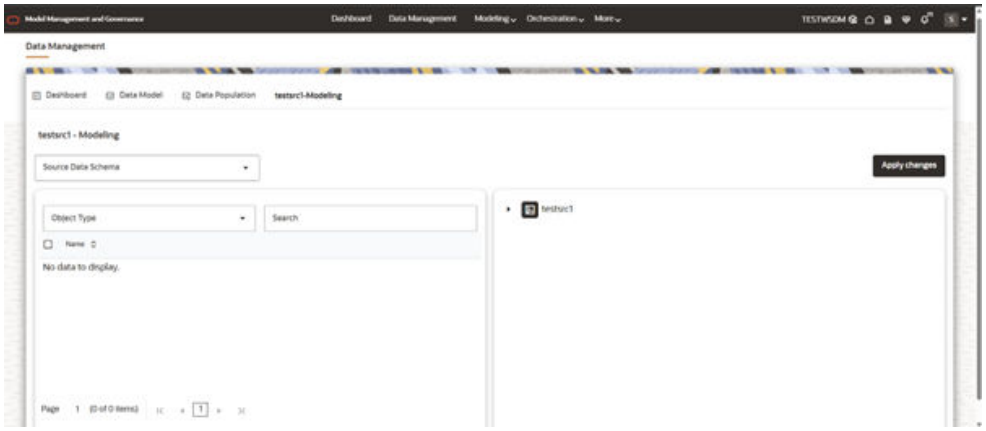
3. Now user can see the list of **Database** objects on left panel, **Tree View** and **Add Item** options and a table (Refer to content on Data Modeling tab).
4. Click on **Manage** button which will open a new tab within MMG- Data Management UI.

Figure 10-6 Manage button tab



5. When a new tab opens, it includes the following components:
   - **Source Schema Drop down:**
     a. Allows the user to select the desired source schema for Data Modeling. Users can switch between multiple Source Schemas and select the required database objects from each—all in a single Modeling session.
   - **Left panel:**
     a. Contains an object type drop down and a search bar for filtering.
     b. Displays a table listing the available database objects based on the selected type and schema.
   - **Right panel:**
     a. If the user is initiating Data Modeling for the first time, this panel will be empty.
     b. As the user selects database objects from the Left panel, they will be added to and displayed in the Right panel for further configuration.

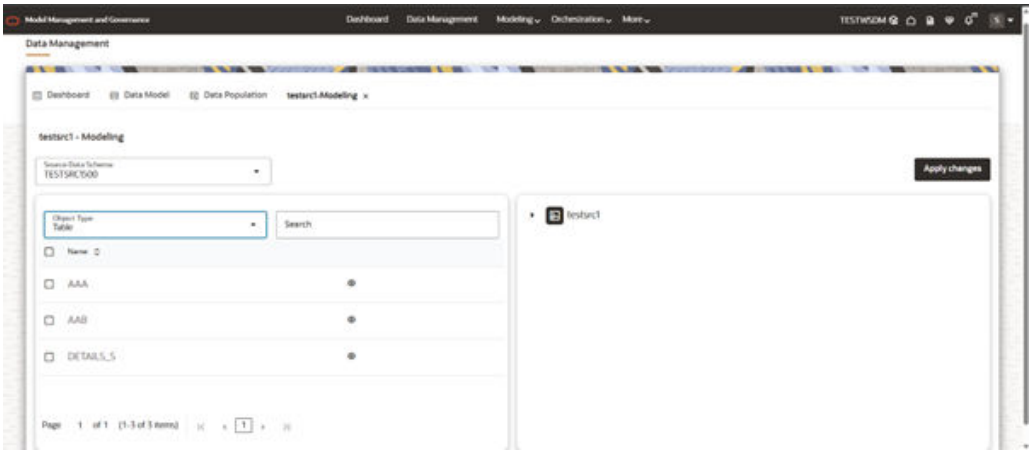
Figure 10-7 Left panel and Right panel



6. Now the user can choose source schema from where user wants to bring in the database objects.
7. After selecting the Source Schema, the user can choose the desired database object type from the left panel. The table in the left panel will then display all available database objects that match the selected type and schema.

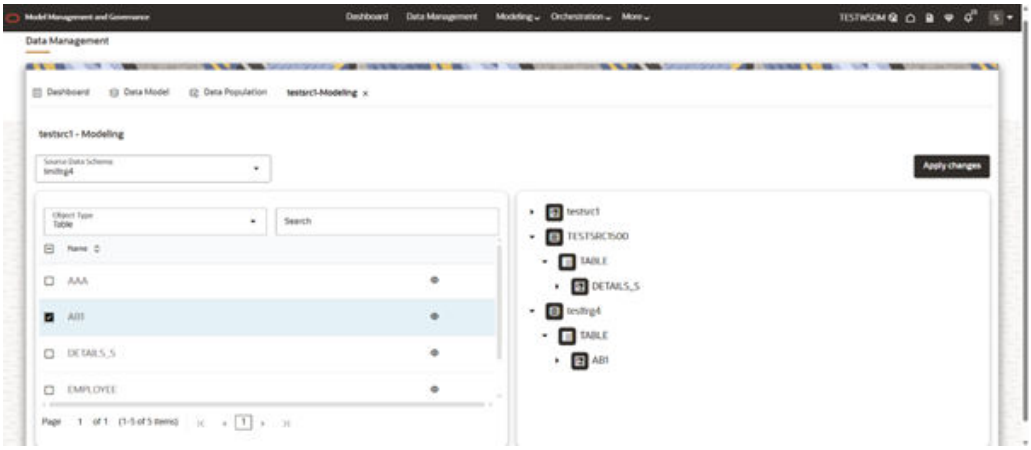
> **Note**
>
> Each database object listed in the table includes an eye icon. Clicking this icon opens a pop-up that provides both the **DDL View** and the **Generic View** of the selected object.

Figure 10-8 DDL and Generic View of the selected object



8. User can choose the required and the selected ones automatically comes into the right panel in following structure.
   a. **Source Schema-Name1**: DB object type 1, DB Object 1 2, DB Object 2.
   b. **Source Schema-Name2**: DB object type 1, DB Object 1 2, DB Object 2.

Figure 10-9 Source Schema Name



9. Once all the required database objects are selected, the user can click the **Apply Changes** button to initiate the Data Modeling process. On triggering, a confirmation pop-up will be displayed, indicating that the Data Modeling process has started. This tab will automatically close after a few seconds.

Figure 10-10 Apply Changes button

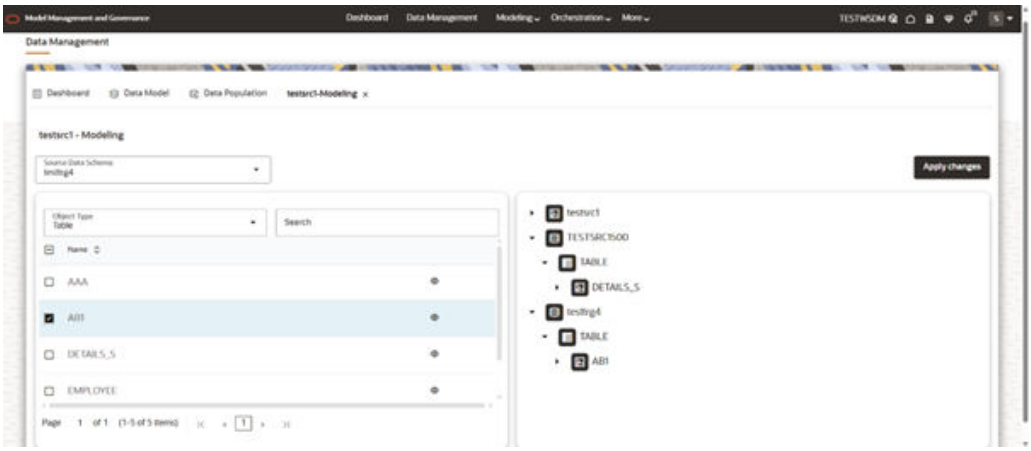
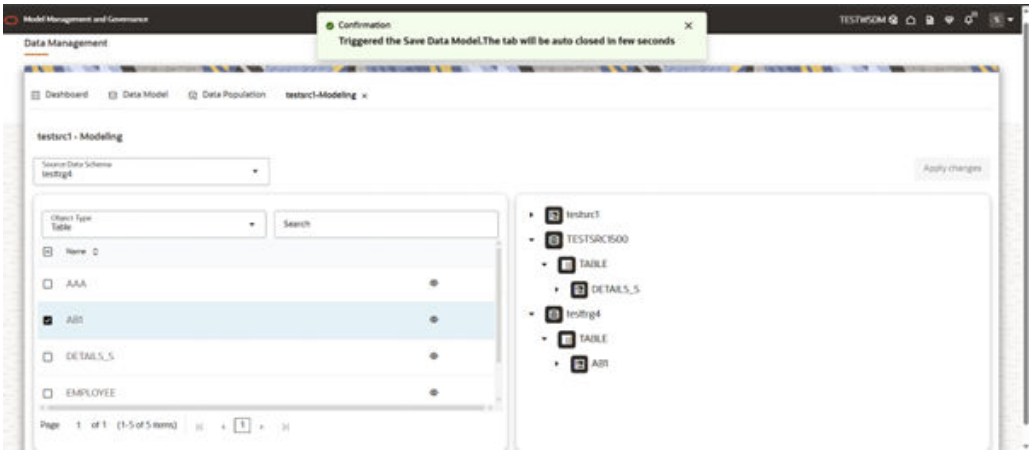


Figure 10-11 Confirmation message



> **Note**
>
> The user can choose database objects from multiple Source Schemas at a time. The user can also choose multiple database object types at a single time.

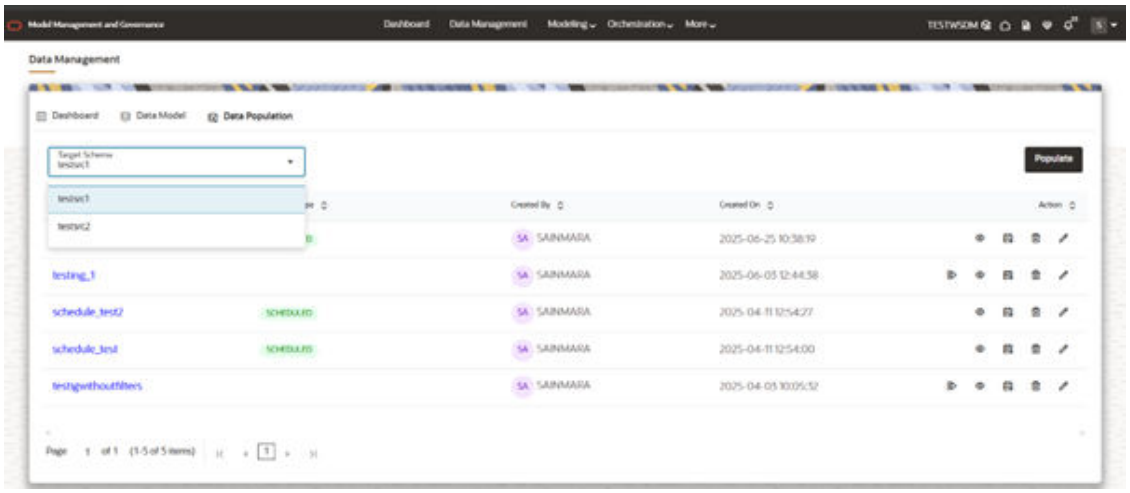
> **Note**
>
> For a selected Target Schema, if any previous Data Modeling is in progress, the user is not allowed to do another Data Modeling.

Data Population

Data Population is about getting the data of tables from Source Schemas to Target Schema by applying the filters at table level and global level. Data is very important aspect of Modeling and we need data to be up to date, so keeping this point we have came up with scheduling idea for Data Population which periodically refreshes the data in the tables.

Data Population tab

Figure 10-12 Target Schema selection and populate button



Target Schemas dropdown

- It will show list of Target Schemas mapped to current workspace.
- We can select any Target Schema, by default 1st one is selected (The one which is selected firstly in workspace creation step 2).
- By choosing one schema, it will show the list of data populations that are created as a table.

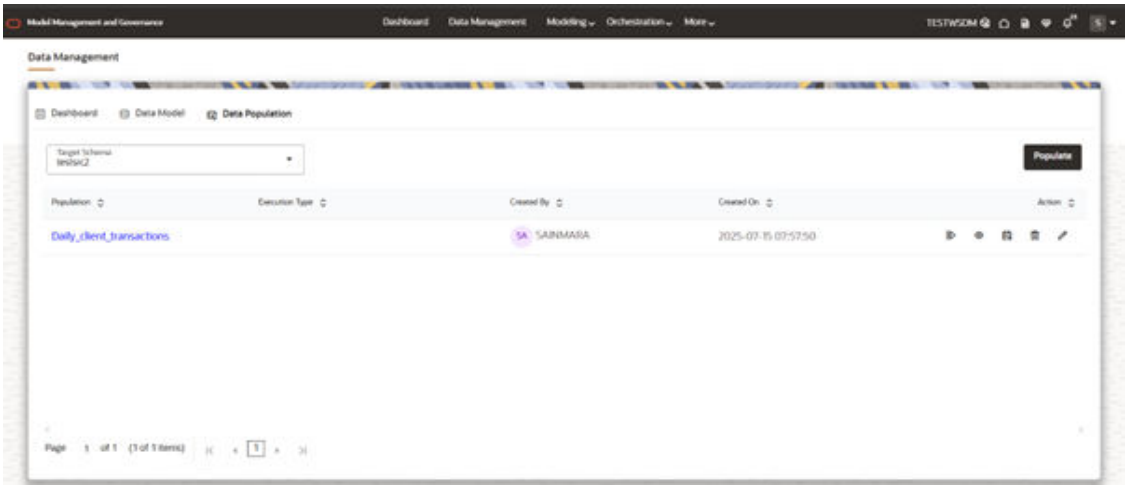
Populate button

- This button helps to create a new Data Population.
- By clicking on this, user will be taken through few steps for creating a Data Population.

Data Population List

- This will show the list of populations that created for the selected Target Schema (From dropdown).

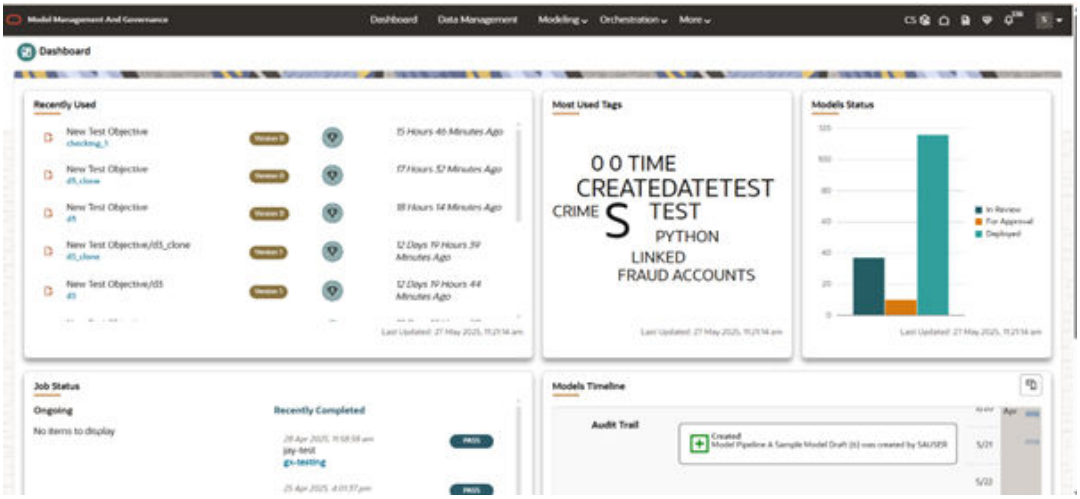
Figure 10-13 Data Population List



Steps of Data Population

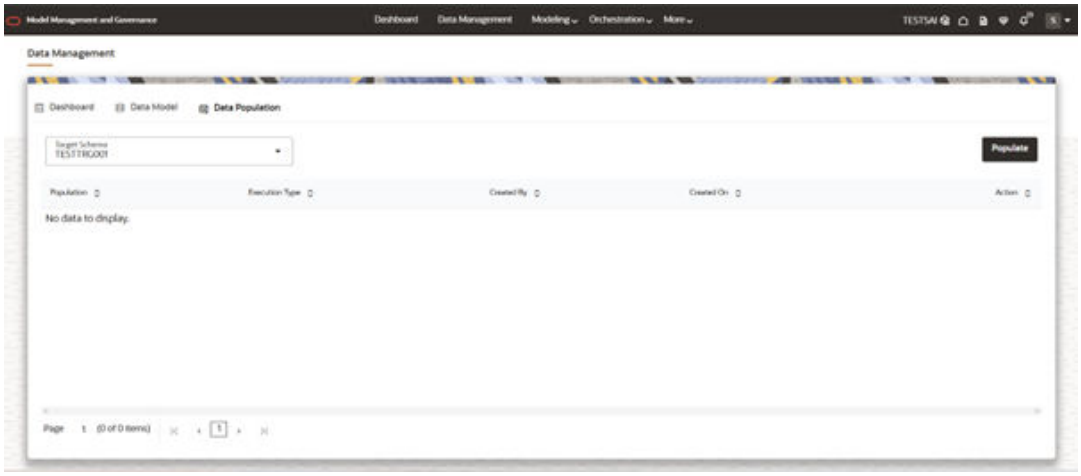
1. Launch any workspace where you wanted to do Data Population and go to Data Management tab from main menu.

Figure 10-14 Data Population Dashboard



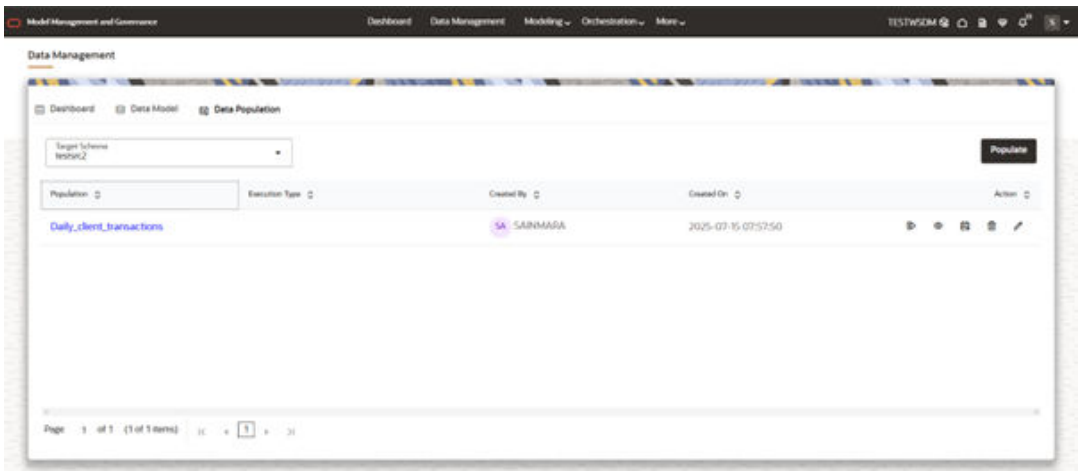
2. Click on Data Population sub-tab.

Figure 10-15 Data Population Sub-tab



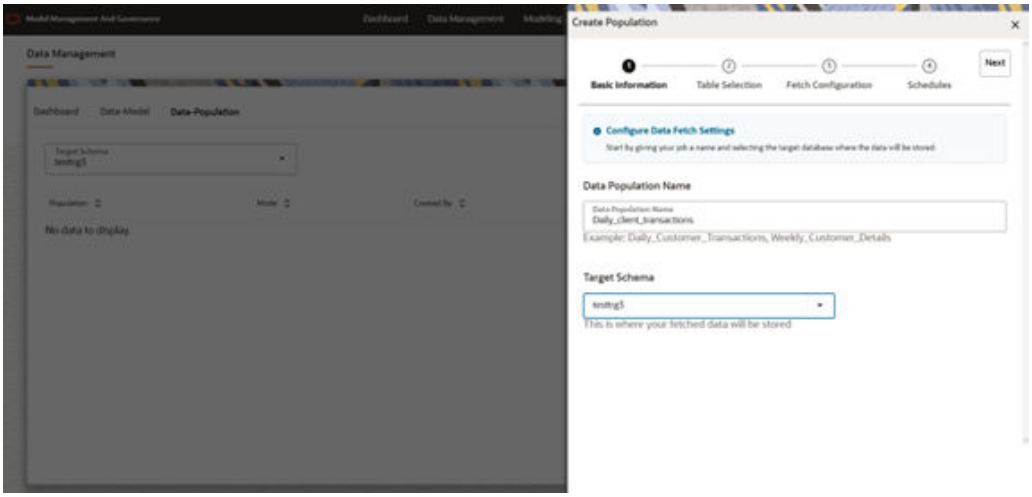
3. Now the user can see the list of Data Population which are created. When we launch for first time, it will be empty.
4. Click on Populate button, which will take you through the step-by-step process to create a new Data Population.

Figure 10-16 New Data Population



5. Now a drawer will open on the right side where it consists of the following stages:
   - Basic Information
   - Table Selection
   - Fetch Configuration
   - Schedule
6. **Basic Information**
   - Here user need to provide the basic information about Data Population Name and can choose the Target Schema for which user wants to create Data Population.
     For example: Data Population Name –> Daily_client_transactions, Target Schema –> Testtrg3

Figure 10-17 Basic Information

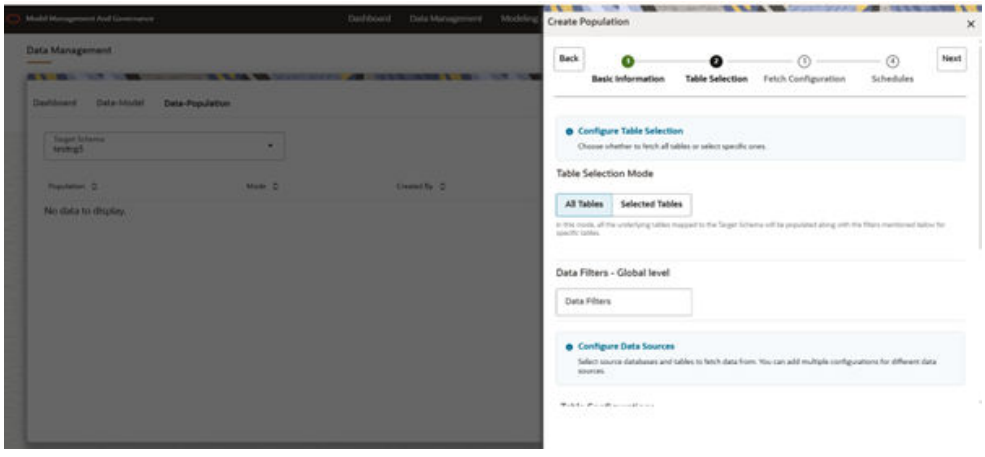


7. **Table Selection**

   - This step includes tables selection mode and table filters to be seeded.
   - **Table Selection**
     - Table selection mode is about to refresh All tables data or Selected tables data.
     - We have two modes in this: All tables and Selected tables, where All tables fetches data for all the tables from Source Schema to Target Schema, by applying the filters. Selected tables are the ones that have been selected as part of Table Filter Configuration, for fetching data.

> **Note**
>
> All tables mean the tables that are created by using MMG in Target Schema.

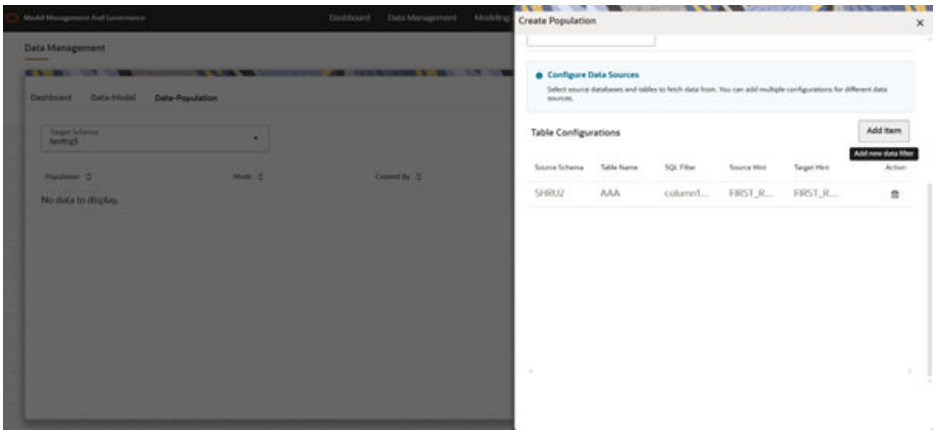
Figure 10-18 Table selection and global filter



   - **Table Filters**
     - Table filters are applied to the tables when fetching the data from Source table. We have Global Filters and Table level Filters:

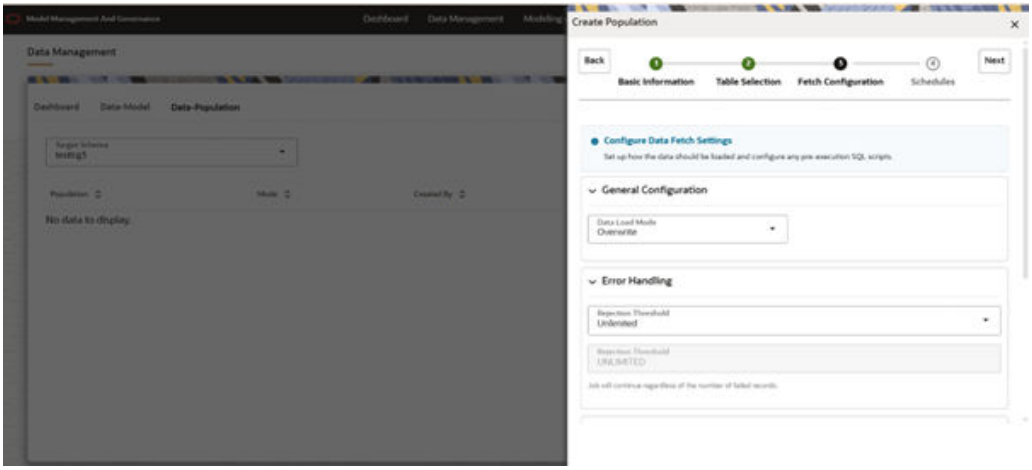
- **Global Filter**: This filter will be applied to all the tables that are part of data population. If the individual table have any table level filters then this is not applied to the specific table.
- **Table Level Filters**: This filter can be applied to individual table level. Click on Add item. This will add an empty row in the table where we need to fill the details of Source schema, table name, SQL Filter, Source Hint, Target hint.
  a. **Source Schema**: This is dropdown where it lists the Source Schemas, which are already mapped to this Target Schema.
  b. **Tables**: This is dropdown, where we select a table from list of tables, this list of tables is the tables list that are selected when doing data modeling or workspace creation step.
  c. We can select more than one table.
  d. **SQL Filter**: This is the filter that will be applied to the tables that are selected and used while fetching the data.
  e. **Source Hint**: You can provide database Hints at table-level, Source hint is applied in the source schema while fetching the Data from Source.
  f. **Target Hint**: You can provide database hints at table-level, Target hint is applied in the Target Schema while doing the inserting Data to Target.

Figure 10-19 Table Level Filters



8. **Fetch Configurations**
   - This has mainly three configurations:

Figure 10-20 General Configuraitons and Error Handling



a. **General Configurations**

   – It has data load mode dropdown, where we have two options: Overwrite and Append.

   – Overwrite mode: In this mode, the underlying tables are truncated (overwritten on existing data) followed by an insert operation.

   – Append mode: In this mode, the underlying tables will be populated (added to the existing data) in the append mode.

b. **Error Handling**

   – It has Rejection Threshold configuration, whereby default it is set to Unlimited. So Here, all the errors will be ignored during the data population.

   – We can also set a custom rejection threshold, for this we need to change the dropdown value to Custom Rejection Threshold, which in turns enables the input box for giving custom value. You can provide the maximum number of inserts that can fail while loading data to a given table. In case of threshold breach, all the inserts into the table will be rolled back. However, it will continue populating to the next table.

c. **Performance Configuration**

   – This consists of Fetch Size, Batch Commit Size, Source prescript, Target prescript.

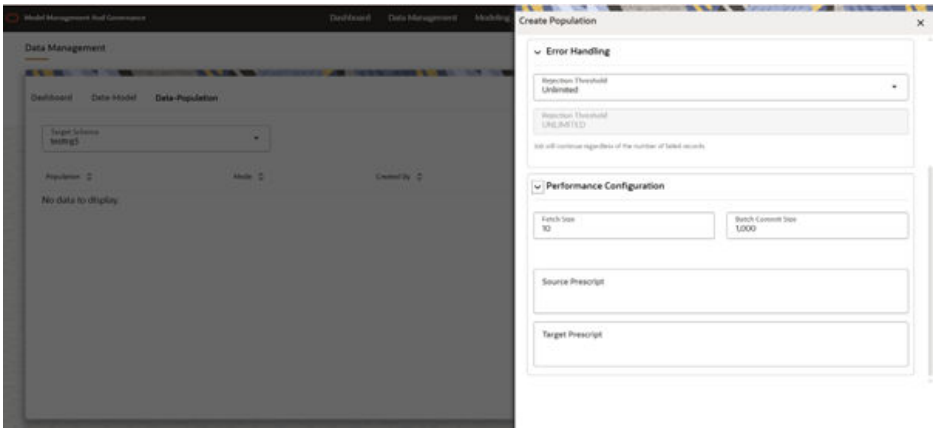
   – **Fetch Size**: Enter the Fetch size of JDBC properties for data upload. By default it is set to 10. Therefore, every time it fetches 10 records from the available records.

   – **Batch Commit Size**: Enter the Batch Commit size of JDBC properties for data upload. By default it is set to 1000.

   – **Source Prescript**: Enter the source prescript of JDBC properties for data upload.

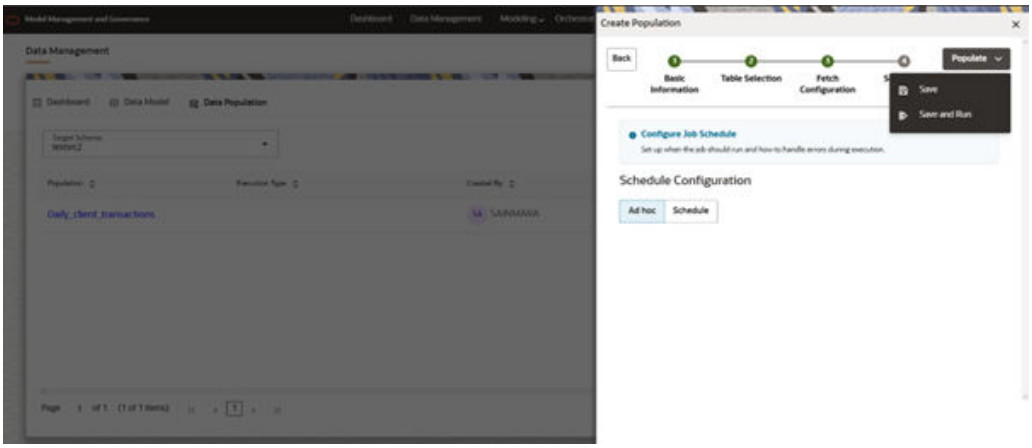
   – **Target Prescript**: Enter the target prescript of JDBC properties for data upload.

Figure 10-21 Performance Configuration



9. **Schedules**
   a. We have two options Ad hoc and Schedule, when Ad hoc is selected Populate button at the right acts as drop down and gives two options **SAVE** and **SAVEANDRUN**.
   b. **Save Mode**: In this mode, after filling all the details we will save this configuration. This population can be run manually from the data population lists screen.
   c. **Save And Run Mode**: In this mode, after filling all the details we will save this configuration and run the population once. This population can be run manually from the data population lists screen.

Figure 10-22 Save and Run option



   d. If the selected mode is SCHEDULE, then we need to choose whether we need to bring data Daily/Weekly/Monthly/CRON.
      i. Based on mode we need to fill in few details.
      ii. **DAILY**: We need to configure Start Date, End Date and Time when schedule should run daily.
      iii. **WEEKLY**: We need to configure Start Date, End Date, Time and Days of week when schedule should run.
      iv. **MONTHLY**: We need to configure Start Date, End Date, Time and Months of year and day of the month when schedule should run.

v. **ONCE**: We need to configure Start Date and time when schedule should run.

vi. **CRON**: We need to give a CRON Expression.

e. Once after giving the information then we need to click on populate.

Figure 10-23 Schedule Type options

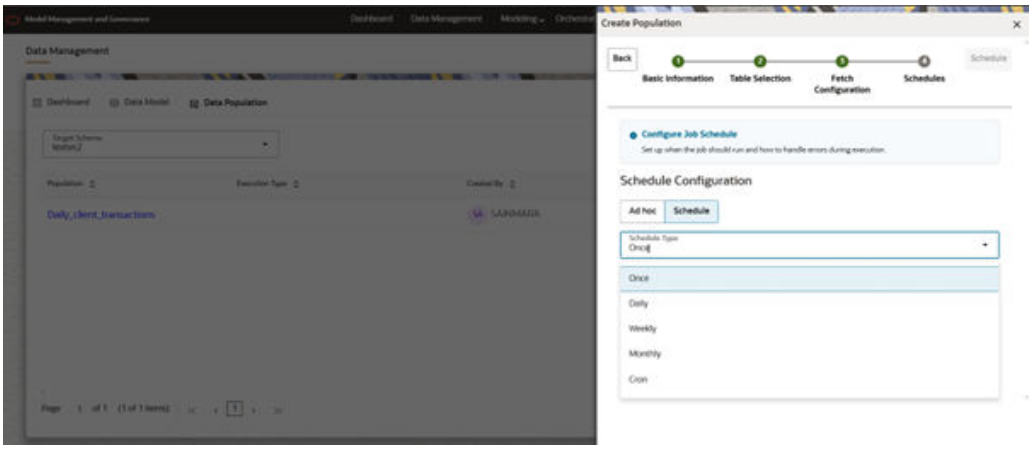


Figure 10-24 Schedule Daily options

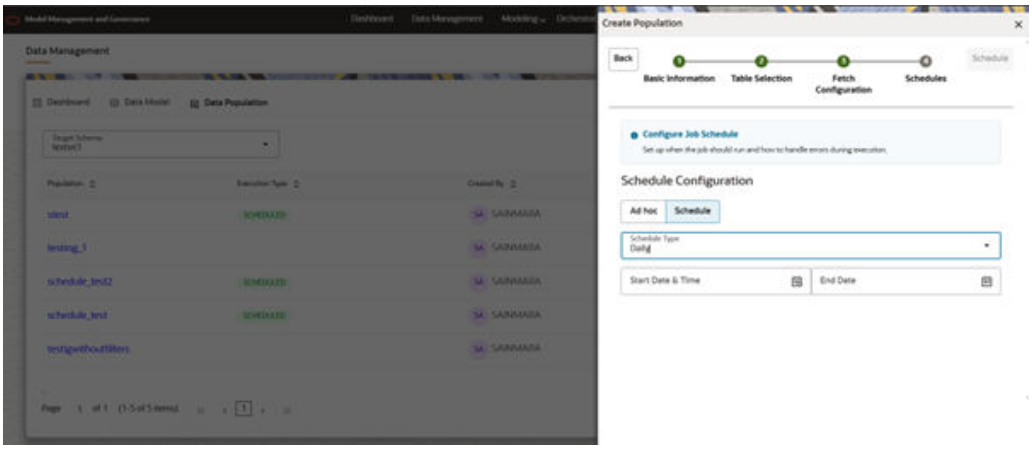


Figure 10-25 Schedule Weekly options

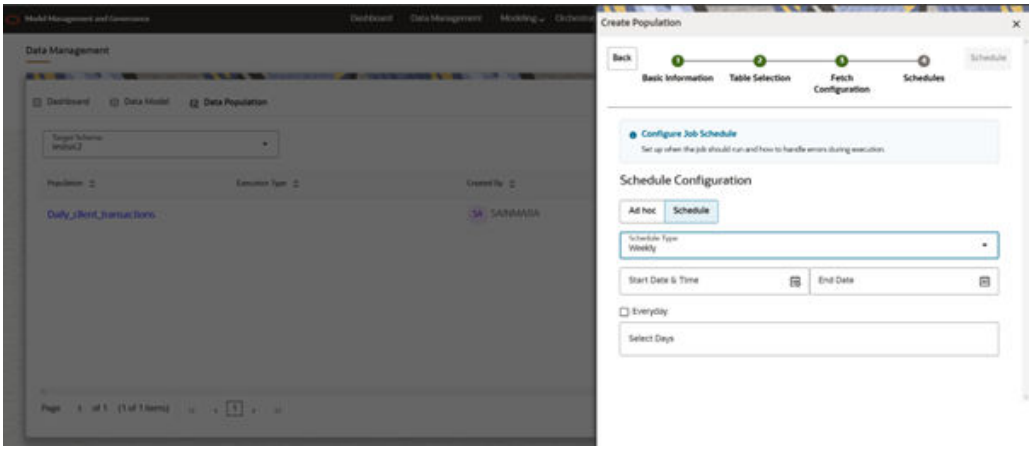


Figure 10-26 Schedule Monthly options

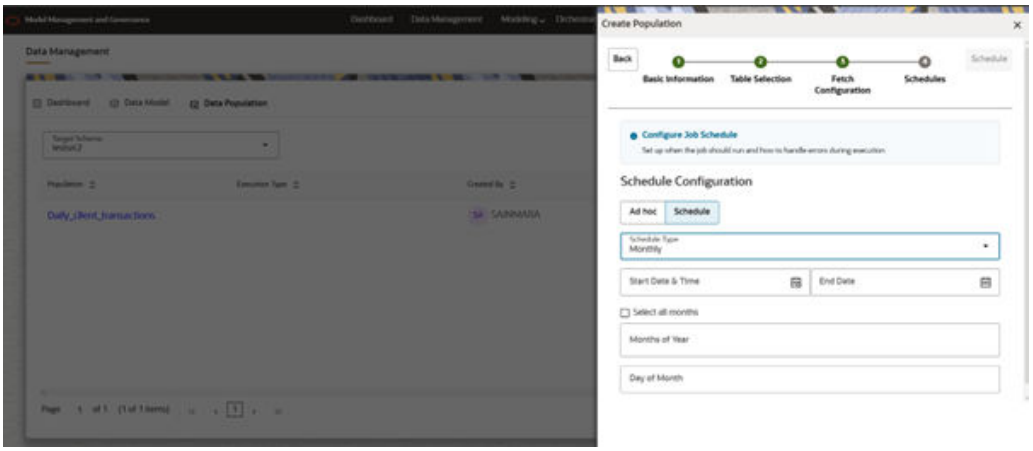


Figure 10-27 Schedule Cron Expression

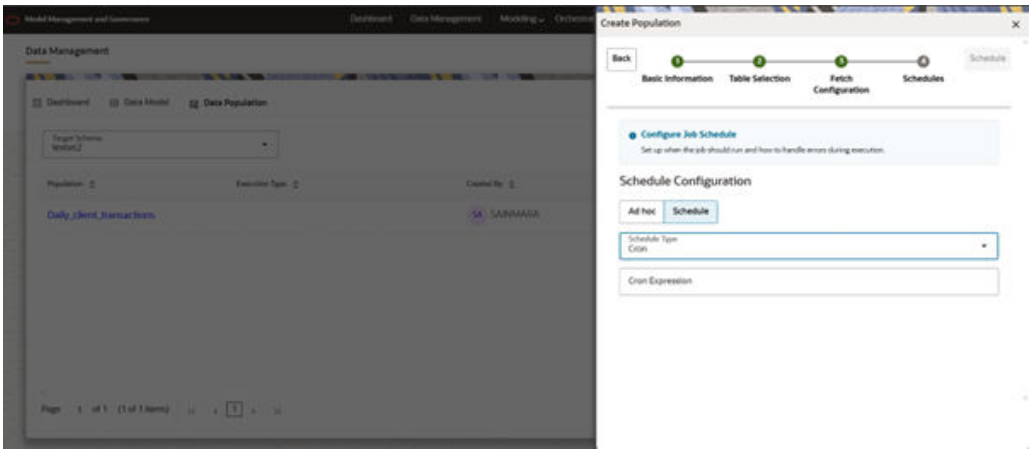
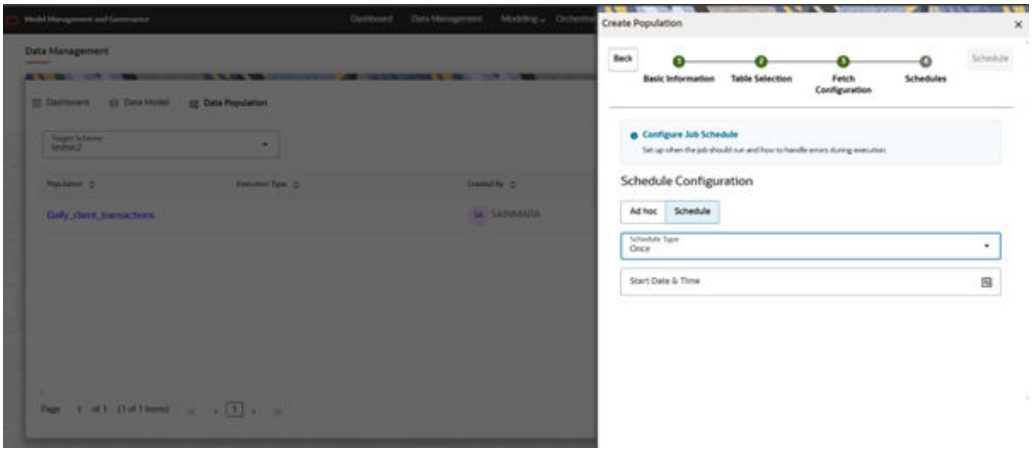


Figure 10-28 Schedule Once options



Data Populations List Action buttons

There are Actions associated to every Data Population based on mode (**SCHEDULE**, **SAVE** OR **SAVEANDRUN**).

Common Actions

1. **DELETE**: When user click on this, it deletes the Data Population.
2. **EDIT**: This option will open a drawer and enables users to edit the data population information which consists of Table level filters, Global filters, Table selection mode, General configuration, Error Handling, Performance Configuration.
3. **VIEW**: When the user clicks on this, it opens a new tab and show the information related to the population.

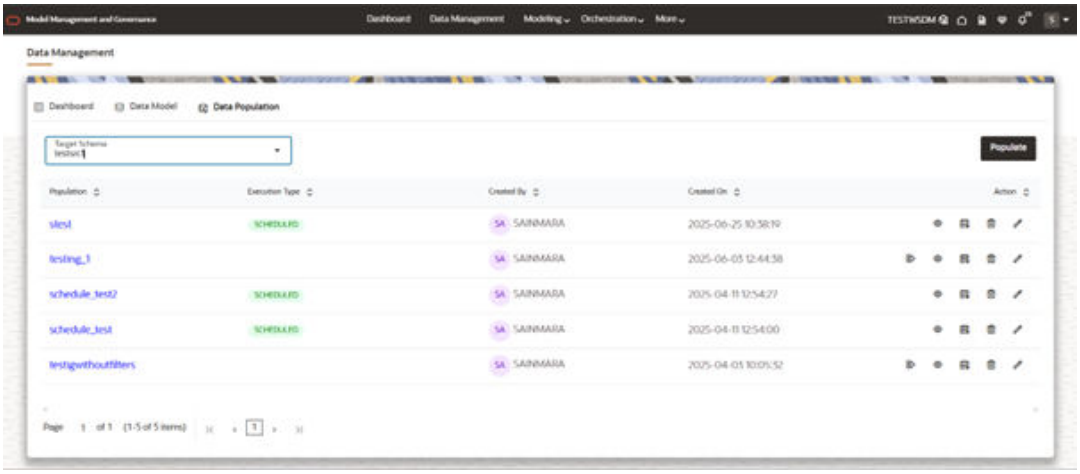
SAVE or SAVEANDRUN Mode Actions

1. **RUN**: We can Run the data population which is already configured. When we click on this the data population is triggered.
2. **SCHEDULE**: We can schedule a data population which is created in this mode. We convert the manually triggered data population to Scheduled one.

SCHEDULE Mode Actions

1. **RESCHEDULE**: This option enables the user to re-schedule already existing scheduled data population.

Figure 10-29 Data Population List Actions



11

Modeling

Modeling covers the following:

- **Datasets**: Explore data, engineer features, and monitor data drifts.
- **Model Libraries**: Manage python libraries to create and use models.
- **Model Techniques**: Manage techniques and algorithms from registered model libraries.
- **Model Catalog**: A centralized hub for all your machine learning models.
- **Pipelines**: Design, deploy and govern end-to-end machine learning pipelines for seamless model development.
- **Graphs**: Analyze complex relationships within your data through interactive graph representations.

Dataset

You can define a metadata about how you want to create a dataset and also take a snapshot of real time data and store it, which you can later use in the pipeline.

This is similar to T2Ts, where you can select data from Data Source, such as file, table or another dataset and so on. The data can be imported from one column of one table, and another column from another table, or any file. After extracting the data from tables or files, provide the name to Target Dataset.

The Dataset is a trail-based UI that allows you to configure the Dataset details.

Access the Dataset Summary

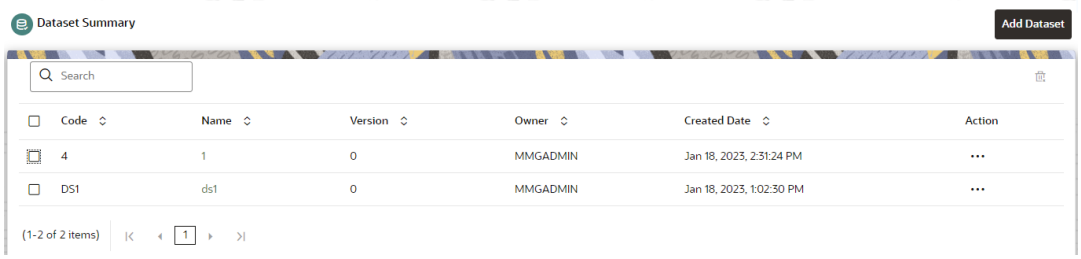
The Dataset Summary page gives access to the various Dataset functions such as create, view, and delete.

To access the Dataset Summary page, follow these steps:

1. Click **Launch Workspace**next to corresponding Workspace to Launch Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. In the LHS menu, click **Dataset** to display the **Dataset Summary** window.

   This window displays the dataset records in a table.

Figure 11-1 Dataset Summary page

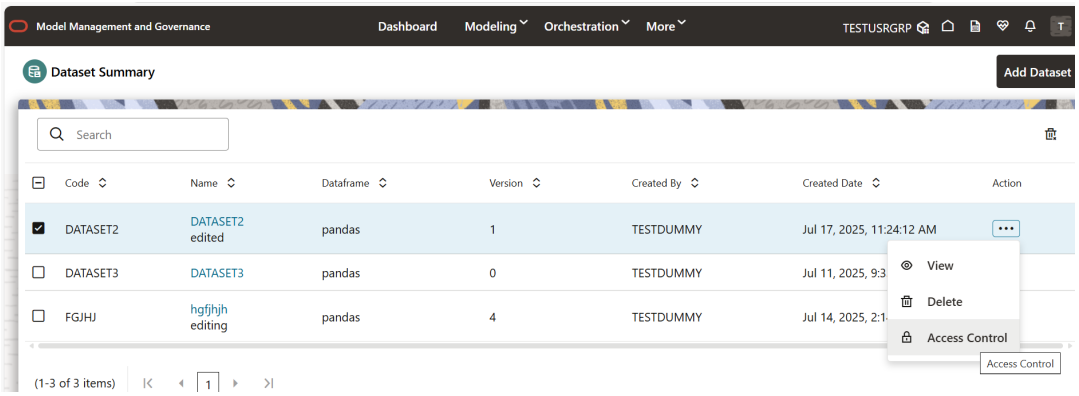


The following table provides the descriptions for the fields and icons on the Dataset Summary page.

Table 11-1 Fields and icons on the Dataset Summary page

Field or Icon	Description
Search	The field to search for Dataset. Enter specific terms in the field for which you want to search, and press Enter on the keyboard to display the results.
Code	The code of the dataset.
Name	The name of the dataset.
Description	The description for the Workspace
Version	Version of dataset
Created Date	The date on which the Dataset was created.
Owner	The owner of the dataset.
Add Dataset	Click Add Dataset to create a new Dataset.
Delete	Click Delete to delete multiple Datasets.
Action	Click the three dots to perform View/Delete/ Access Control functions on selected dataset.

Figure 11-2 Access Control Menu option under Action



Access Control Pop has two Access Level Radio button: Restricted Mode and Public Mode.

Figure 11-3 Restricted Mode

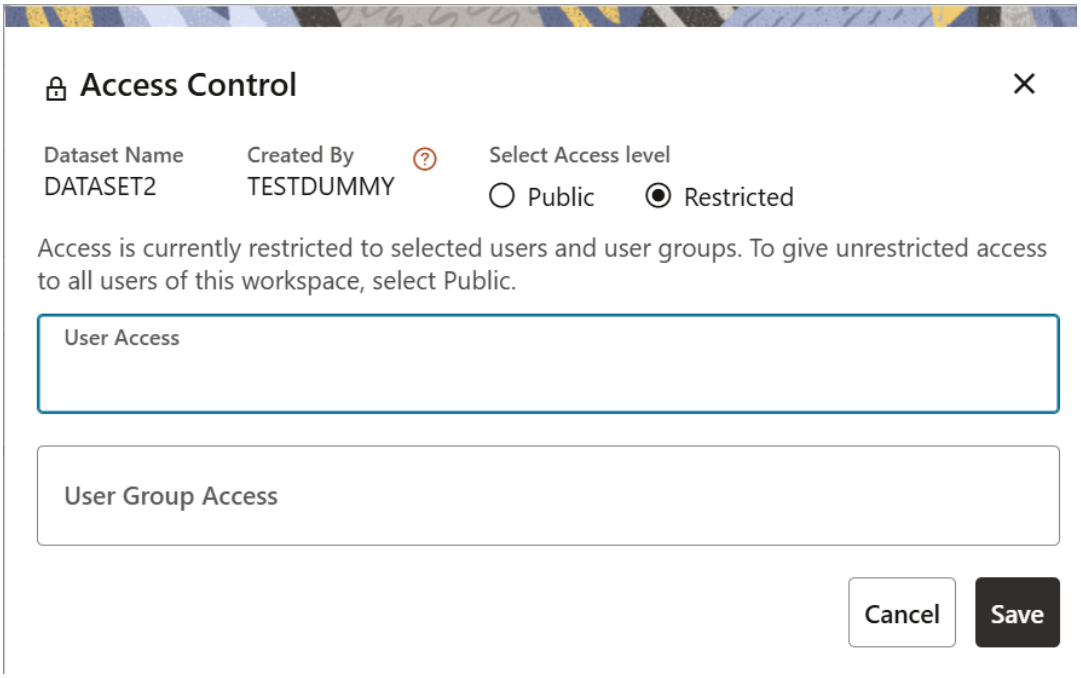
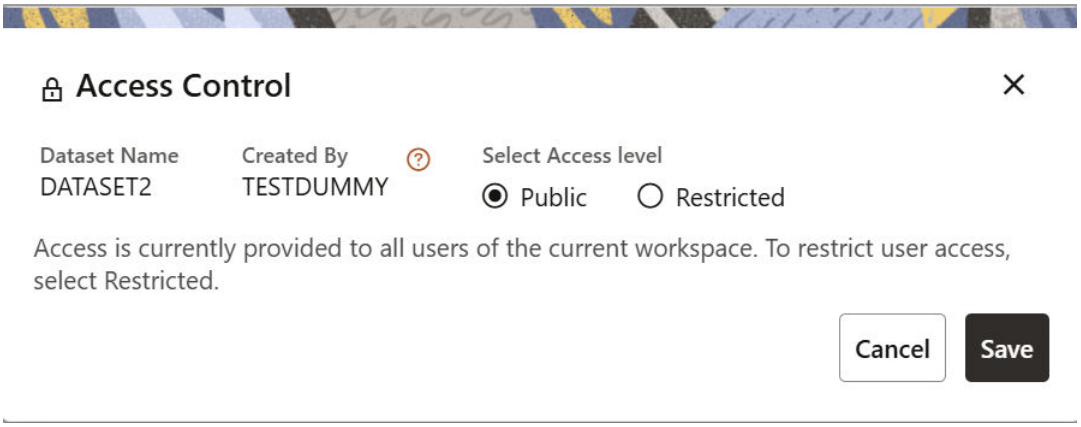


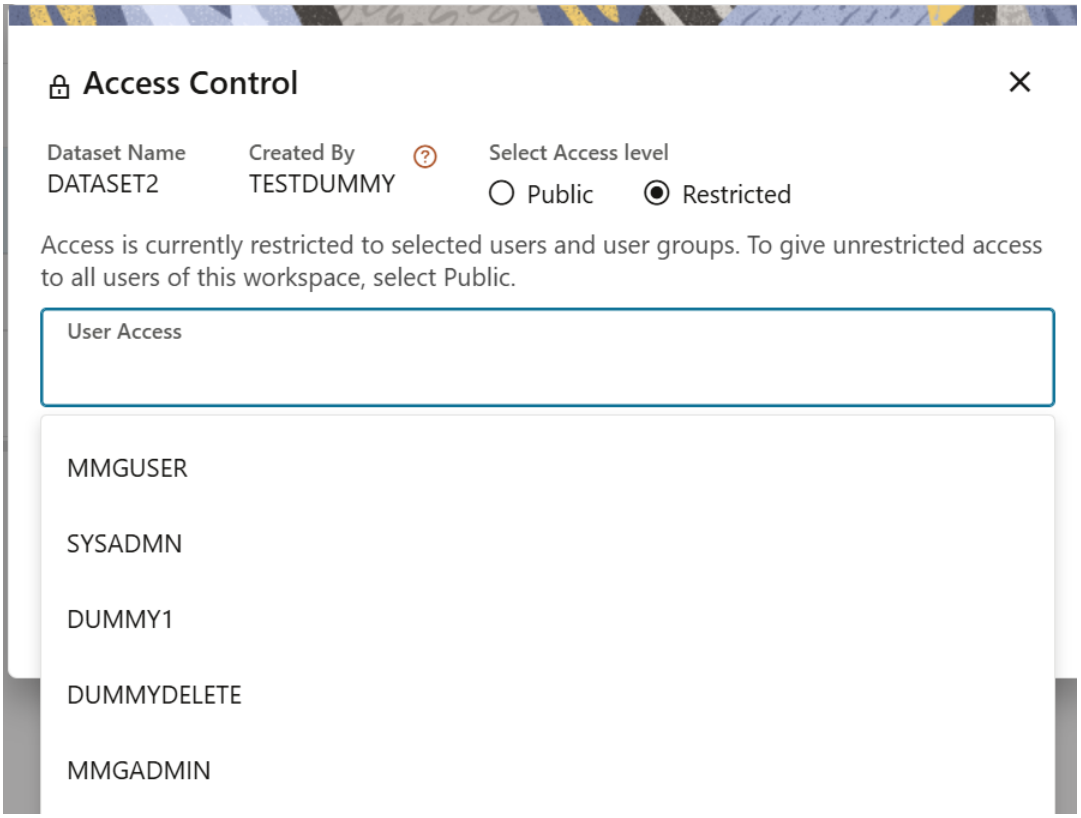
Figure 11-4 Public Mode



The Access Control pop-up have the below details:

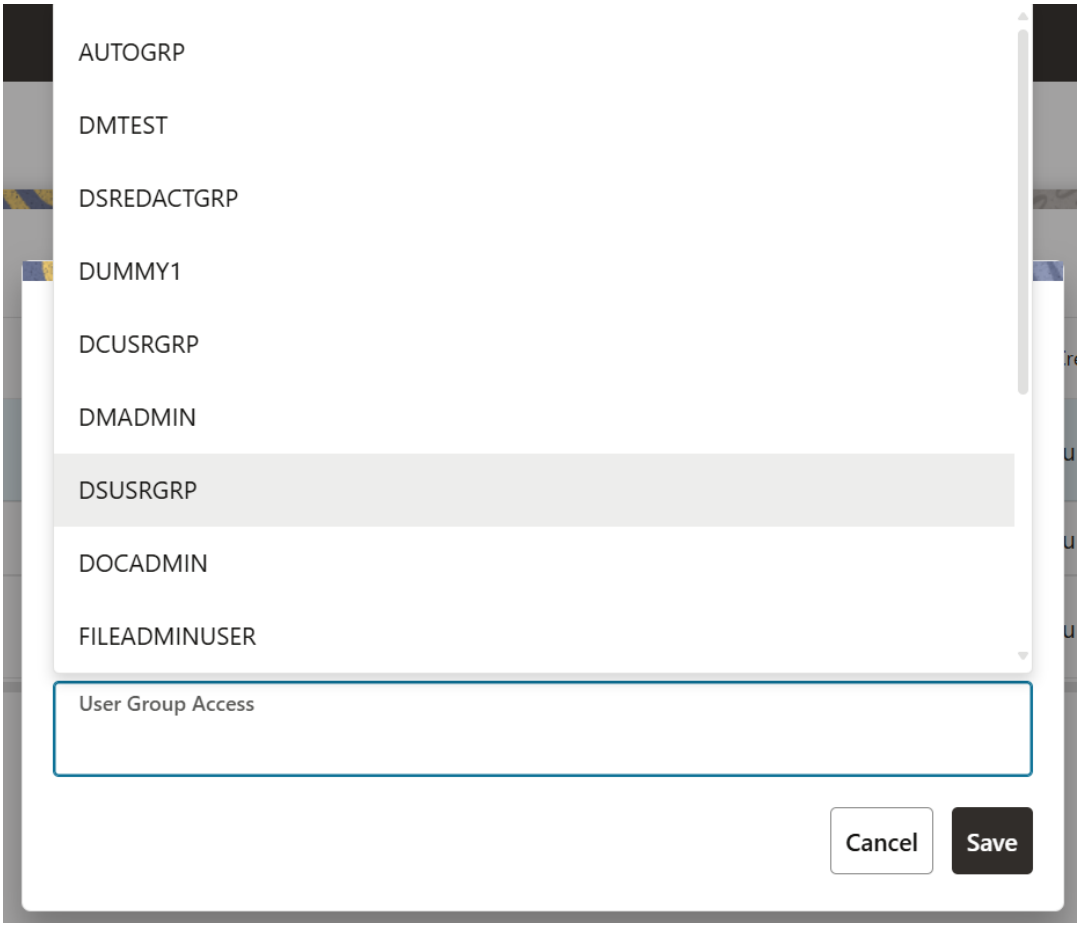
- Dataset Name
- Created By
- Info
- Select Access level with two radio button options: Public and Restricted
- User Access and User Group Access should list all the users present in the Identity Management
- Cancel button
- Save button

Figure 11-5 Access Control User Dropdown



The Access Control User Groups dropdown fetches all the User Groups present in the Identity Management.

Figure 11-6 Access Control User Groups dropdown



Create a Dataset

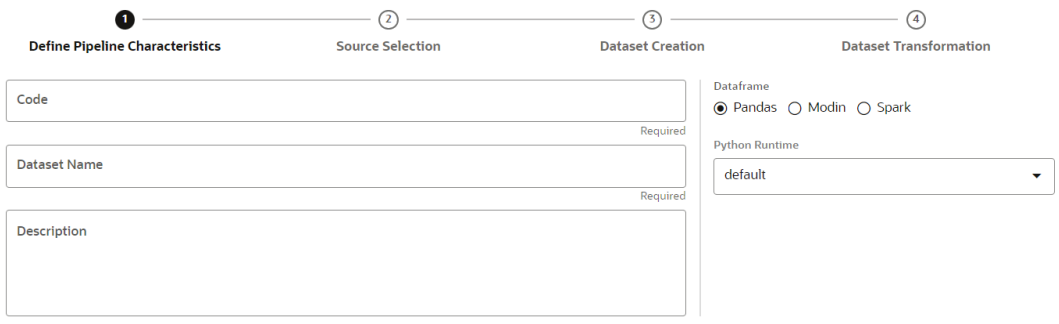
The Dataset creation requires entry of the source of dataset and validation. These datasets are required for schema creation.

Creating a Dataset

To create a Dataset:

- On the Dataset Summary page, click **Add Dataset**.

Figure 11-7 Dataset Creation window



Provide the following information to create a Dataset:

- Define Pipeline Characteristics
- Source Selection
- Dataset Creation
- Dataset Transformation

Define Pipeline Characteristics

Enter basic configuration details in this window.

To configure the basic details for the dataset:

1. Enter the required details in the **Define Pipeline Characteristics** window as shown in the following table.

Table 11-2 Details for Basic Details pane

Field	Description
Code	Enter the identification code of the dataset. This field is limited to 30 alphanumeric characters.
Dataset Name	Enter the name of dataset. This field is limited to 30 alphanumeric characters. Space not exceeding 30 characters. You cannot keep this field blank.
Description	Enter the purpose of the creation of the dataset. This field is limited to 150 alphanumeric characters. Space not exceeding 150 characters.

2. Select the data library from the options: **Pandas**, **Modin**, or **Spark** and select **Python Runtime** from the drop-down and click **Close**.
   - **Pandas**: An open-source data manipulation library for Python. It provides data structures such as Series (1-dimensional) and DataFrame (2-dimensional) that allow for easy manipulation and analysis of data. It also provides tools for reading and writing data to various file formats, including CSV, Excel, and SQL databases. **Pandas** is the default selection.
   - **Modin**: An open-source library that allows for faster operations on DataFrames using distributed computing which can lead to significant speed improvements, particularly for large datasets or computationally expensive operations.
   - **Spark** : Pyspark option for scaling dataset.
     If Spark library is selected, the Python Runtime drop-down option is not displayed.
3. Click **Next** to go to the next step.

Source Selection

This section allows you to define the source of data. Here, you can choose the data structures from an existing datasources. Click on the icon next to Data Source field to view the tables/ data source information associated with the data source.

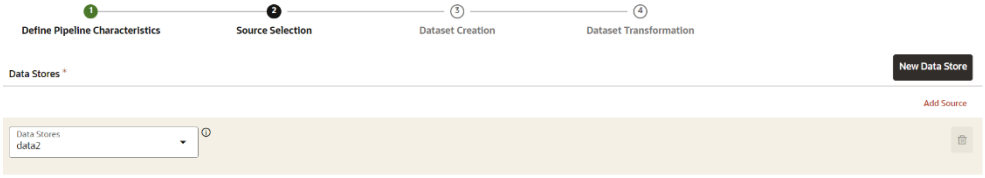
To configure the Source details for the dataset, follow these steps:

1. Select the required **Data Store** from the drop-down.

   OR

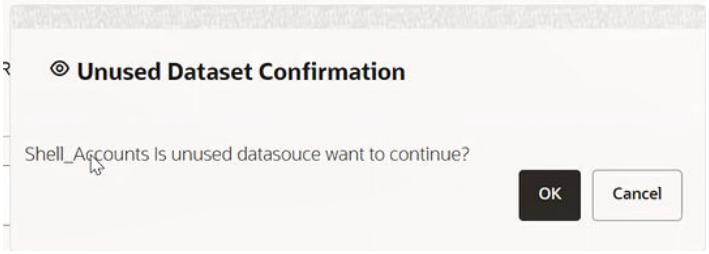
Click **New Data Store** to create a data source.

Figure 11-8 Source Selection Details screen



> **Note**
>
> The MISDATE feature is displayed only when the Data Source field is selected as a **File Type**.
> If enabled, you need to add the Physical and Feature name for the Data Source.

Table 11-3 Details for Basic Details pane

Field	Description
Data Stores	The Data Stores drop-down list shows all the data sources and the data dorms those are tagged with the corresponding workspace. In addition, this lists all the available unused data source, which can be used. You can search the data sources by clicking on **Data Store information** icon. A confirmation message is displayed to tag an unused datasource with workspace. **Figure 11-9 Unused Dataset Confirmation message**  Here, either use the unused or create a new datasource using **New Datasource**. When you create a new datasource, it becomes as unused. You can add more Data Sources using **Add More** link. Use **Delete**to delete added Data Source.

2. Click **Next** to go to the next step or click **Previous** to go back to previous step.

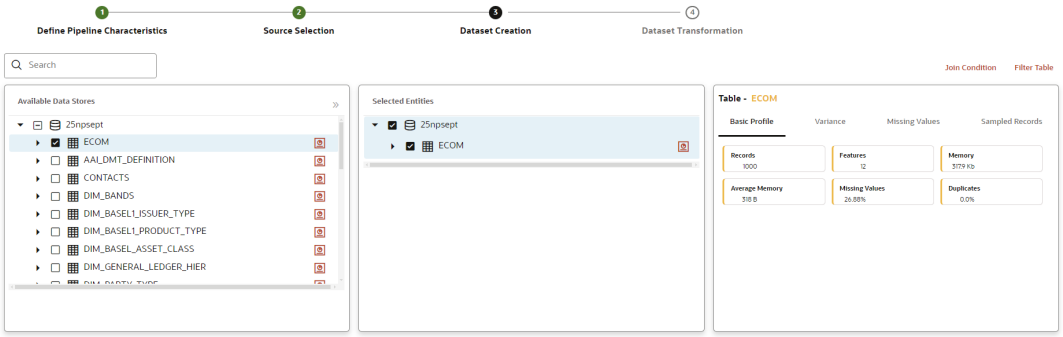
Create a Dataset

This window allows you to select entity part (for example, column of table) of the datasource. The data source selected in the previous step requires the definition of database objects to be used.

To configure the Dataset Creation:

1. Select the required data source from the **Available Data Sources** pane and click >> to move the selected data to **Selected Entities**pane. The **Available Data Sources** section shows the high-level data sources. You can select data from multiple data source entities. The selected Data Sources are displayed in **Selected Entities** pane. You can use to select or use to de-select the data in the **Selected Entities** pane. Additionally, clicking on **View Profile** icon displays the profile details in the **Basic Profile** tab.

Figure 11-10 Dataset creation page



2. For more information on Joins, see Joining Tables section.

   For more information on Filtering, see Filtering Tables section.

3. Click **Next** to go to the next step or click **Previous** to go back to previous step.

Joining Tables

Use Join Condition to combine the data source details. Each data sources have multiple tables and multiple columns, so you can join them using Join Condition window. Joins can be applied only when user has selected more than one table.

Figure 11-11 Join tables

You can join Tables either using drop-down or using the Joinscript option.

Using Drop-down

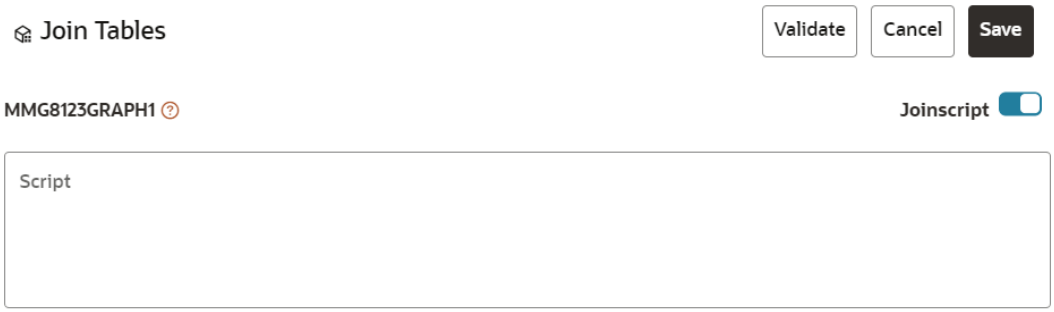
Select the Column name of Table from the drop-down list. You can use multiple join conditions by using icon.

> **Note**
>
> In the current release, only INNER JOIN is present.

Using Script

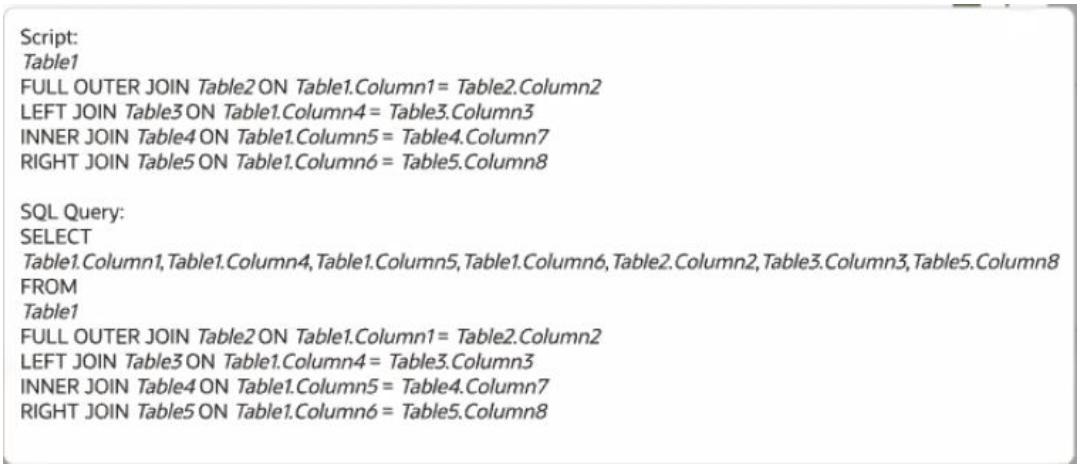
1. To use script, enable **Join Script** option.
   The Join Tables window is displayed to add scripts.

Figure 11-12 Join Tables window



You must provide the script in below format:

Figure 11-13 Script



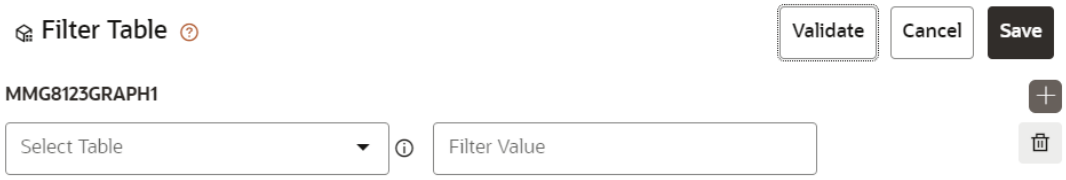
2. Click Validate to check the Join conditions.
3. Click Save.

Filtering Tables

You can also use the filters in dataframe creation from entity.

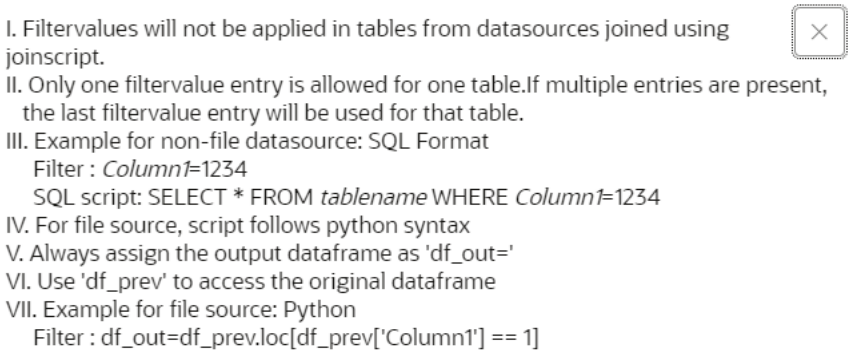
1. Click **Filter Table** to navigate to Filter tables window.

Figure 11-14 Filter Table



There are certain rules to be followed when adding filters.

Figure 11-15 Rules to be followed when adding filters

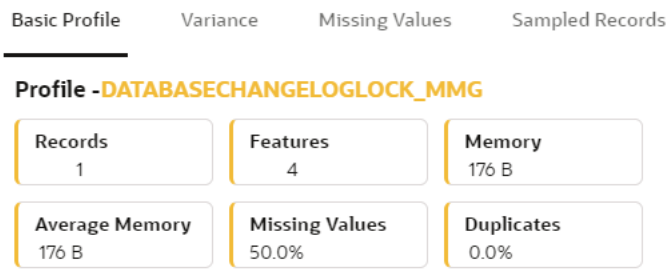


2. Multiple filters can be added by using **Add**.
3. Click **Validate** to check the Filter conditions.
4. Click **Save**.

Viewing Profile

The Profile section from RHS shows the report based on Selected Objects (complete dataset) section. For example, Missing Values report shows the details of missing data in selected table in Selected Objects section.

Figure 11-16 Selected Objects section



Dataset Transformation

This window allows you to transform the data source information. This complete grid displays the Table like structure, which helps you to make the data better using many methods, such as by remove all the missing values, performing scaling and so on.

This window shows the following columns:

- **Physical Name**: Shows the Physical Name of column.
- **Feature Name**: Shows the Feature Name of column along with its data type. You can edit the Feature Name.
- **Observations**: The Observations field shows the value of column. For example, if any column is missing any value, you can easily identify missing value columns. Use Transformation button to fix these values.
- **Create Feature**: To create a new feature/column by doing operations on the existing features.
- **Calculate Fairness**: You can calculate the fairness metrics of the dataset by choosing the required metric, target variable, and protected features. For more details, see Fairness section. Click Help icon for more details on how the fairness is calculated.
- **View Report**: To view the complete report of the sampled data.
- **Re-Validate**: To re validate all the transformations.
  You can also revalidate an individual transformation by clicking the More Action and select the Re-Validate option
- **Add Transformation**: To add new transformations

The profile button helps you to view profile the final data frame that you have selected. For more information, see the Viewing Profile section.

Here, you can perform the following actions:

- Re-ordering of transformations
- Insertion of transformation

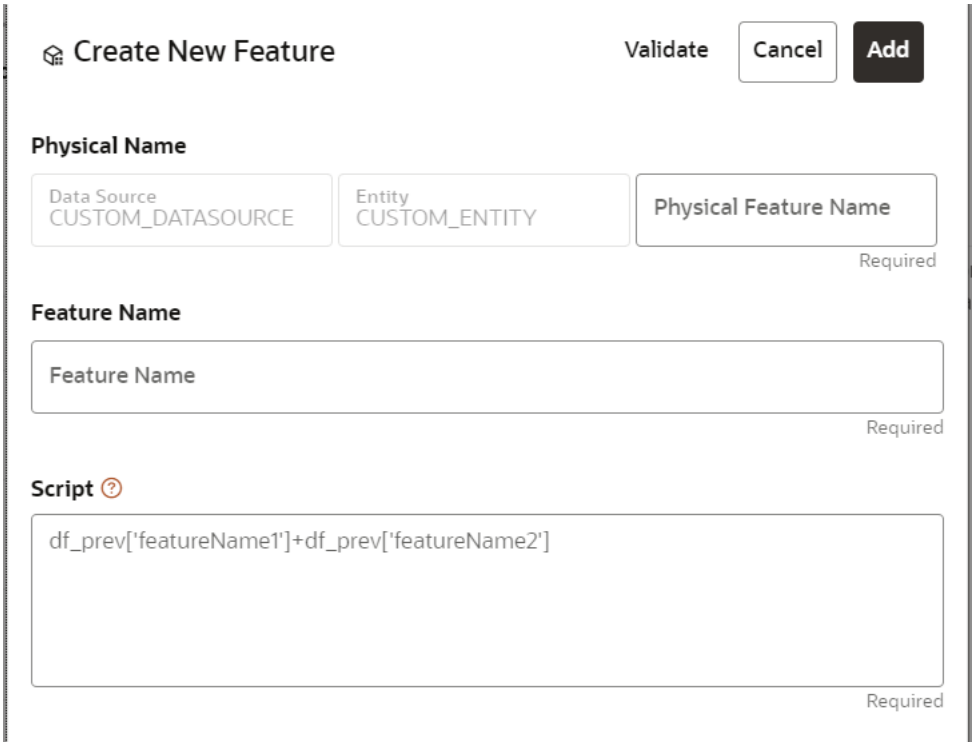
Create New Feature

The Create New Feature window allows you to create a new feature. This is used to add a new column to dataset. This is useful, if you want to add a new column based on derived T2Ts (from data source).

To create a New Feature, follow these steps:

1. Click Create Feature on Dataset Transformation of Dataset UI.

Figure 11-17 Create Feature on Dataset Transformation of Dataset UI



2. Enter the following details:
   - **Physical Feature**: Name of Physical feature
   - **Feature Name**: Logical Name of feature
   - **Script**: Update the script
3. Click **Add** after validating the feature.

   The new feature will be added at end of LHS section.
4. You can also edit or delete a newly added feature.

Add Data Transformation

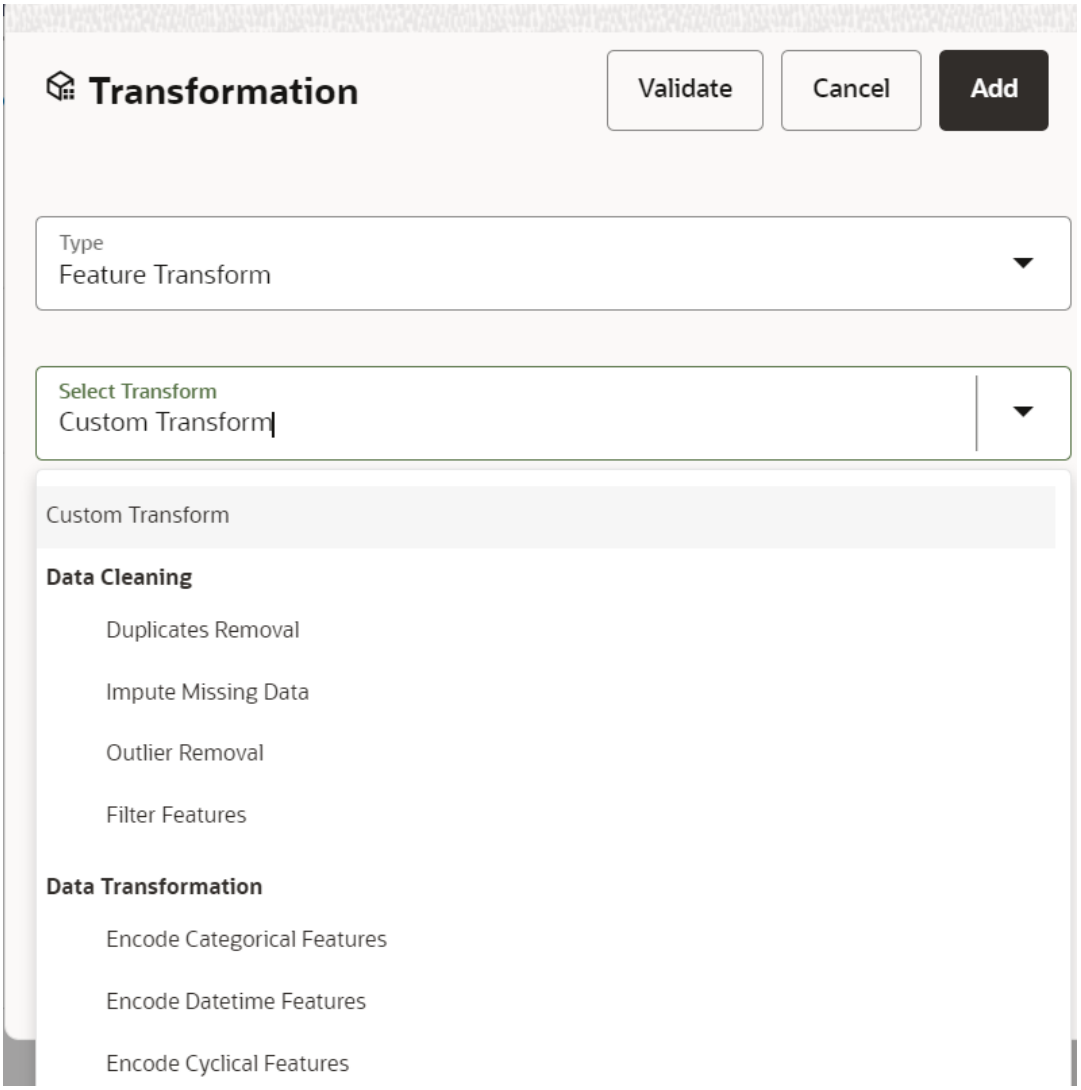
To add the data transformation, follow these steps:

1. Click **Add**.

   The Transform window is displayed.
2. Select the Transformation Type.

   Following types are available:
   - **Dataframe Transform**: This is used to transform entire dataframe. For example, if you want to remove all missing values from all the columns of entire sampled data.
   - **Feature Transform**: This is used to transform a particular column of dataframe.

Figure 11-18 Transformation screen



3. Select **Transform**: Here you either enter values using Method and Argument fields, or script.
4. Click **Validate** to validate the details.
5. Click **Add** to add the new transformation.

   The New Transform is created and displayed at RHS section.
6. Click **Finish** to navigate to Dataset Summary window.

   This saves the metadata of dataset.

   Example:

   If there is “missing value” for one of the columns, then perform following steps to add the transform.

   a. Click Add on Dataset Transformation window.
   b. Select Type as Feature Transform.
   c. Select Transform as Impute Missing Value.
   d. Select the Physical Name from Physical Name drop-down list.

e. Select the Method and enter parameter in Argument field. The Method is updated on selected Column type. For example, if the selected column type is numerical, then following methods will be available: Simple, Constant, KNN, and Mice
OR

Enter the script
Below are the Sample Custom Scripts:

- Directly pass input data frame to output: df_out=df_prev
- Drop first row of data frame: df_out=df_prev.drop(0,axis=0) if not df_prev.empty else df_prev
- Drop column from data frame: df_out = df_prev.drop('colname',axis=1)

Sample Custom Scripts

Below are few sample scripts which the users can refer to create transformations.

Table 11-4 Sample Custom Scripts

Function	Script	Comments
Directly pass input data frame to output	df_out=df_prev	
Drop first row of data frame	df_out=df_prev.drop(0,axis=0) if not df_prev.empty else df_prev	
Drop column from data frame	df_out= df_prev.drop('colname',axis=1)	FEATURE TRANSFORMATION

Transformations

These are the various transformations which can be done from the UI.

Table 11-5 Transformations

No.	Transformation	Function
1.	Add New Feature	A new feature can be added to the dataset which could be derived from the existing features using Script. Physical Feature Name and Feature Name are the names of the new feature. Script can be used to create a pandas Series for the new feature
2.	Encode Categorical Features	This function performs One Hot Encoding on a categorical feature and replaces it with multiple numerical features in the dataset.
3.	Encode Datetime Features	This function encodes a datetime feature and replaces it with multiple numerical features having the following information derived from the datetime feature - year, month, week, day, hour, minute, dayofweek.

Table 11-5 (Cont.) Transformations

No.	Transformation	Function
4.	Encode Cyclical Features	This function encodes a cyclical feature having hour, minute data, and so on and returns two features carrying the sine and cosine transformation of the cyclical data. 'fmax ' denotes the maximum possible value of the cyclical feature data.
5.	Impute Missing Data	This function imputes missing data within a feature. For numerical features, there are 4 methods for imputing missing data. simple - imputes with mean, median, most_frequent values based on chosen arg value using the SimpleImputer in sklearn. const - fills the missing values with the value given in the arg knn - imputes using the KNNImputer in sklearn with k value given in arg mice - imputes using the IterativeImputer in sklearn For non-numerical data, missing values can be imputed using the 'const' method by replacing all missing values with the value given in arg
6.	Feature Scaling	This function is used to scale multiple selected numerical features using the StandardScaler in sklearn
7.	Dimensionality Reduction	This function performs PCA on selected numerical features to reduce the dimensionality using sklearn.decomposition.PCA module. The number of output features can be specified using dim field. The names of the output features' names can be specified in the fields 'Physical Feature Name' and 'Feature Name'
8.	Outlier removal	This function is used to remove outliers present in a feature based on the specified zscore value. Non-numerical features are label encoded before removing the outliers.
9.	Duplicates Removal - Data Frame	This function removes all duplicate rows in the dataframe.
10.	Duplicates Removal - Feature	This function removes all duplicate rows within a specified subset of features and consequently removes those rows from the data frame

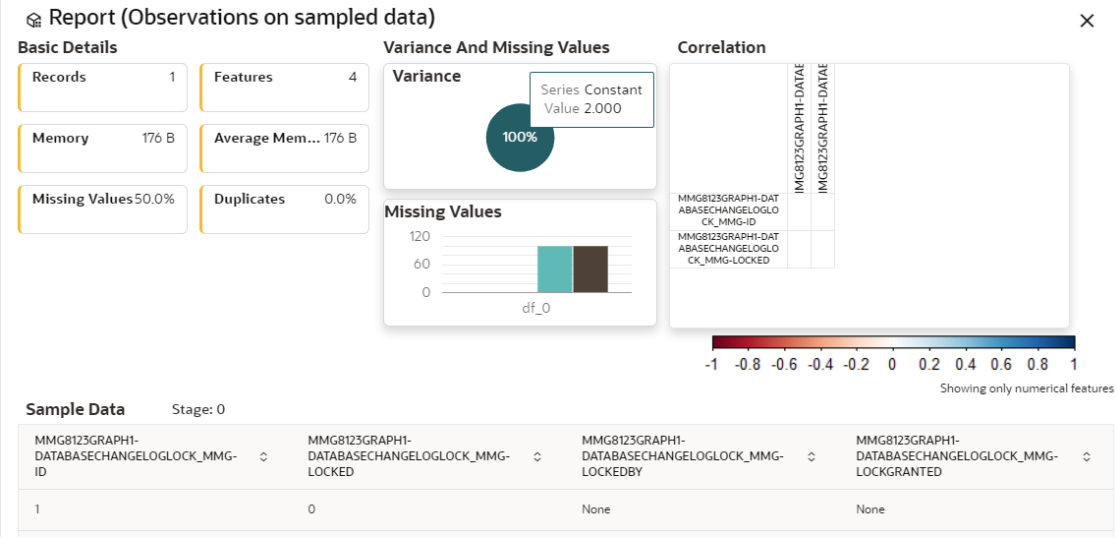
Table 11-5 (Cont.) Transformations

No.	Transformation	Function
11.	Filter Features	This function is used to filter the data frame based on conditions specified on features Operations allowed : >,>=,=,!=,<,<=,isin When the chosen operation is 'isin', the input to 'Filter Value' is a list of values that should be present in the output data frame

View Reports

This report shows the Observation on Sampled data, profiles, Variance, Correlation Matrix (correlation between columns), Sample Data. This report is based on sampled data.

Figure 11-19 Sampled Data Report



Re-ordering of Transformations

You can re-order the transformations using the drag-drop. During the transformation re-order, you can compare the profile of transformations. The transformation order gets adjusted accordingly.

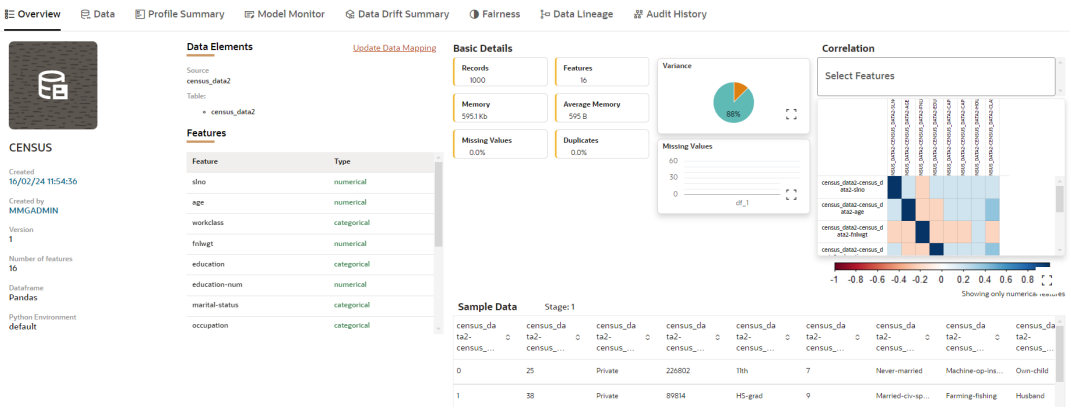
View a Dataset

To view a Dataset, follow these steps:

1. Navigate to Dataset Summary page.
2. Click **Action** next to corresponding Dataset and select **View**.

   The Profile Summary screen is displayed.

Figure 11-20 Dataset Details screen



Overview

The details such as Data Elements, Features, Basic Details, Correlation, and Sample Data are displayed in graphical format.

To view the Overview of a Dataset, follow these steps:

1. Navigate to **Dataset Summary** page.
2. Click the **Next** to corresponding Dataset and select **View**.

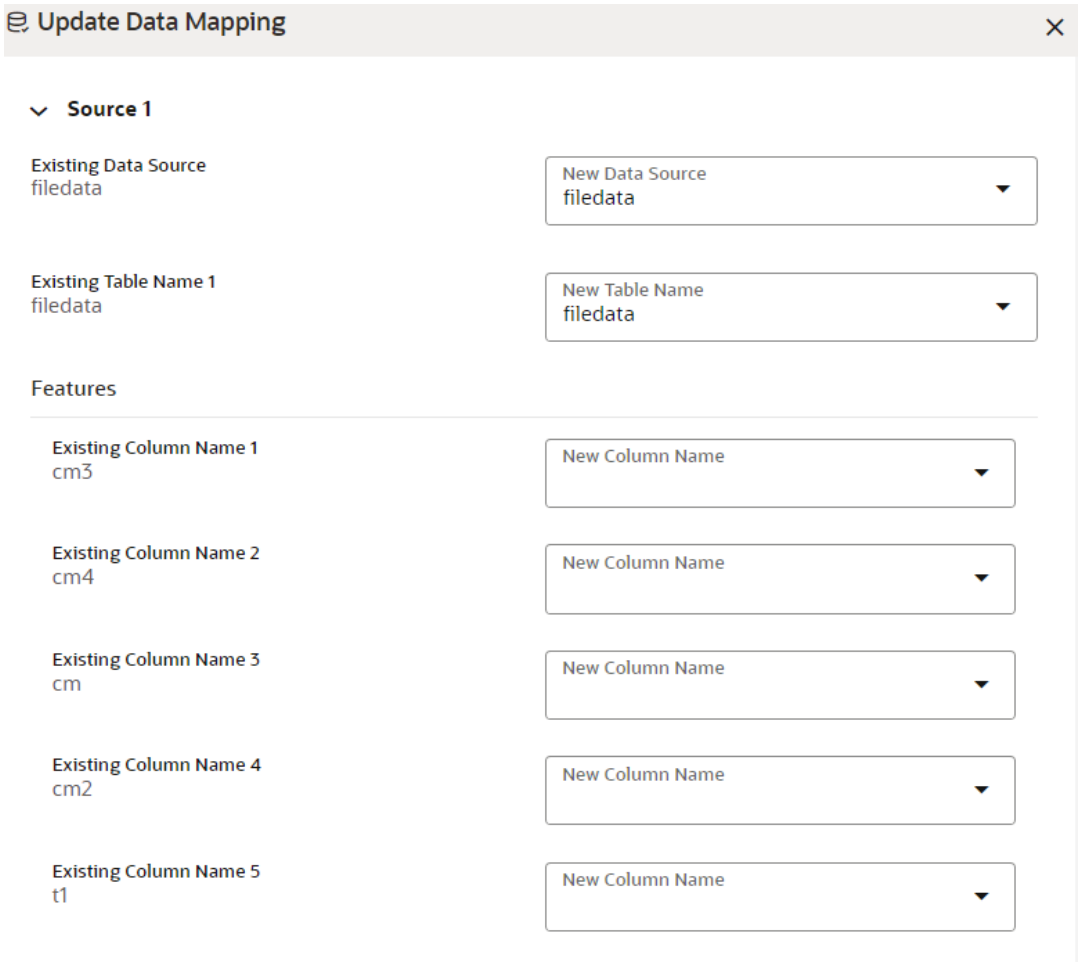
   OR

   Click on the Dataset **Name** column which you want to view.

   The Overview page is displayed.

   You can update the data mapping details by clicking on Edit icon in Data Elements group.

Figure 11-21 Update Data Mapping



Data

To view the data of a Dataset, follow these steps:

1. Navigate to the **Dataset Summary** page.
2. Click **Next** to the corresponding Dataset and select **View**.

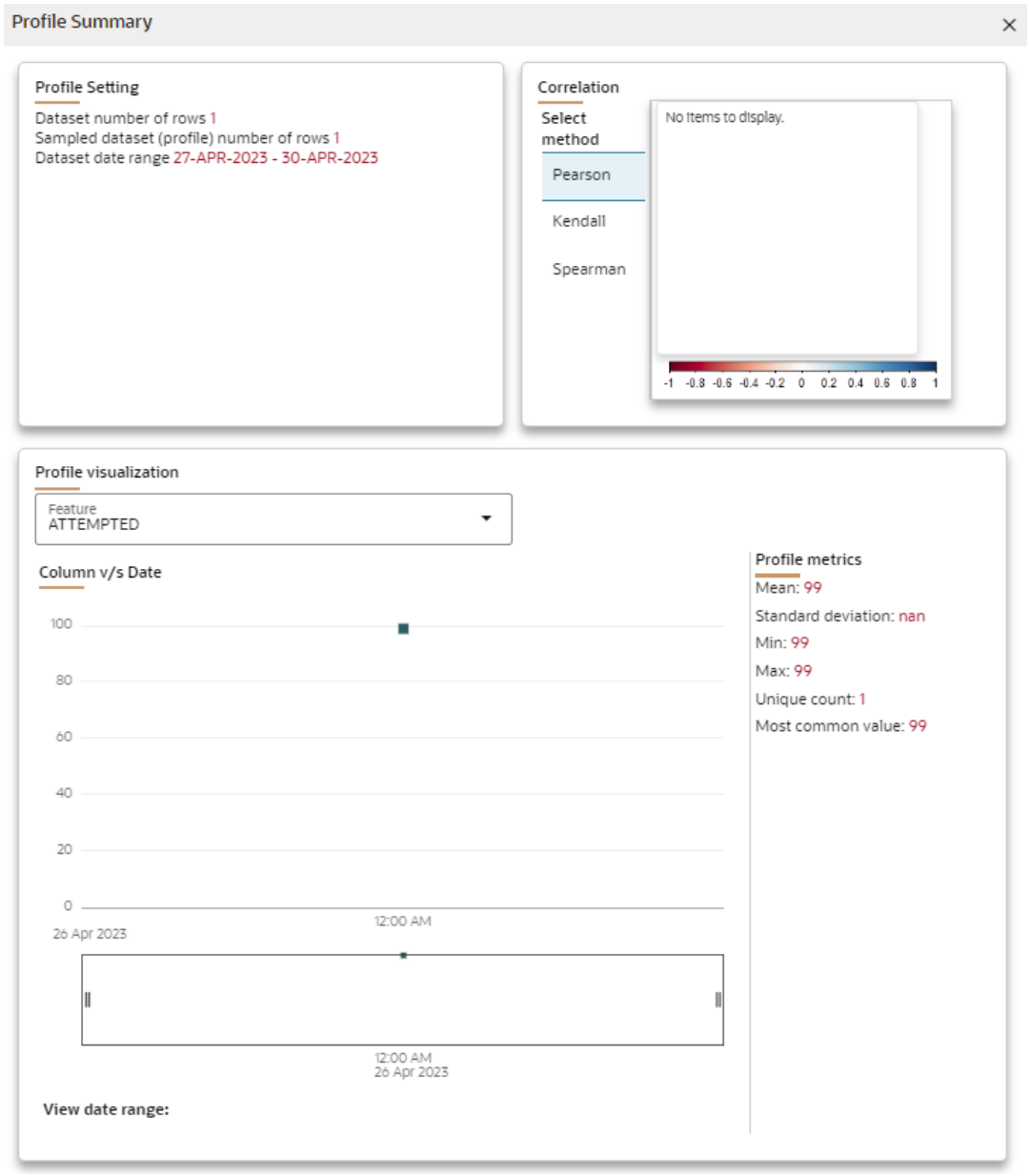
   The Overview page is displayed.
3. Navigate to **Data** tab.

Profile Summary

To view the Profile Summary, perform the following steps:

1. In the Profile Summary screen, click next to corresponding data profile and select View Summary.
   This window displays the following details in graphical format:
   - Profile Setting
   - Correlation
   - Profile visualization along with the metrics

Figure 11-22 Profile Summary



Start Profiling

Prerequisite: You must create a Dataset with a datasource having columns with **DATA_TYPE** as **DATE**.

To start a Profile:

1. Navigate to Dataset Summary page.
2. Click **Action** next to corresponding Dataset and select **View**.

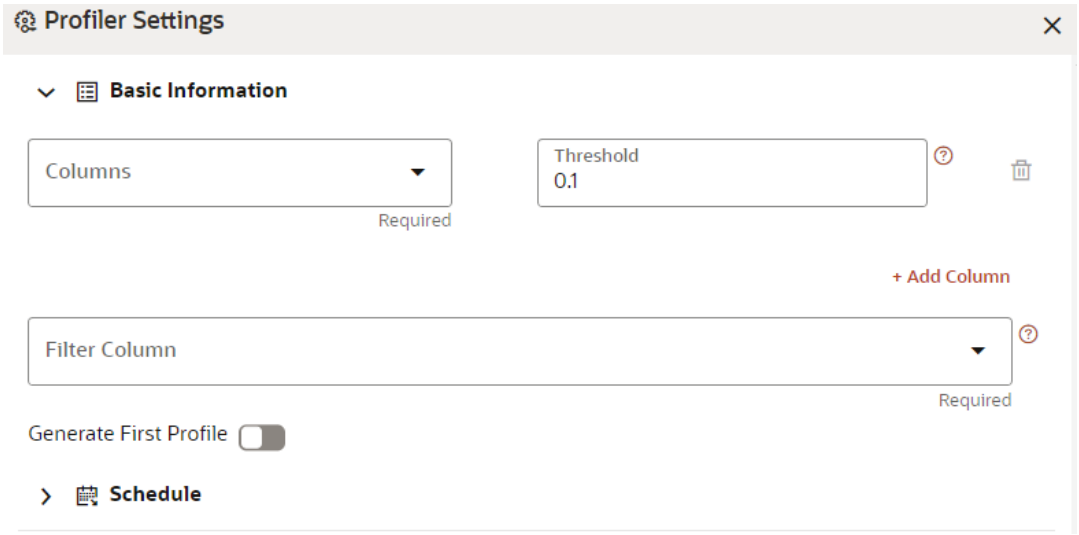
   This window displays the Dataset profiles in a table.

Figure 11-23 Dataset Profiles

3. Click **Start Profiling** or click **Settings** .

   The Profiler Settings page is displayed.

Figure 11-24 Profiler Settings page



4. Under Basic Information section, enter the following details:
   a. Select the required columns from the drop-down. All the numeric options are displayed under the Columns drop down. You can select multiple columns by clicking on + icon.
   b. Enter the threshold for the columns. Threshold defines the Drift detection threshold for each column and only numerical columns can be selected for profiling.
   c. Select the required filter column from the drop-down. Filter column contains date column of the dataset to filter.
   d. Enable **Generate First Profile** option if you want to generate a profile.
5. Under Schedule section, enter the following details:
   a. Enter a Schedule Name.
   b. Select the Schedule Type as required:
      - **Daily**: Select to run the schedule everyday.
      - **Weekly**: Select to run the schedule once in a week or the selected days in a week.
      - **Monthly**: Select to run the schedule once in a month or the selected days in a month.
   c. Click **Save**.

   The Data Profiling has been started and Stop Profiling option is displayed in the Profile Summary screen.

For more details on disabling dataset profile, see Stop Profiling section.

6. Click **Generate Profile**.

   The Data Profile is created.

   Schedule Daily

   To schedule the profiler to run daily, perform the following steps:

   a. In the **Profiler Settings** screen, select the Schedule Type as **Daily**.
   b. Select the start date on which you want to run the profiler.
   c. Select the end date on which you want to stop your schedule.
   d. Enter the time at which you want to run the profiler.
   e. Click **Save**.

   Schedule Weekly

   To schedule the profiler to run weekly, perform the following steps:

   a. In the **Profiler Settings** screen, select the Schedule Type as **Weekly**.
   b. Select the start date on which you want to run the profiler.
   c. Select the end date on which you want to stop your schedule.
   d. Enter the time at which you want to run the profiler.
   e. Select the day on which you want to run the profiler. You can select multiple days to run the profiler.
   f. Click **Save**.

   Schedule Monthly

   To schedule the profiler to run monthly, perform the following steps:

   a. In the **Profiler Settings** screen, select the Schedule Type as **Daily**.
   b. Select the start date on which you want to run the profiler.
   c. Select the end date on which you want to stop your schedule.
   d. Enter the time at which you want to run the profiler.
   e. Select the month on which you want to run the profiler. You can select multiple months to run the profiler.
   f. Select the date on which you want to run the profile of the selected month to run.
   g. Click **Save**.

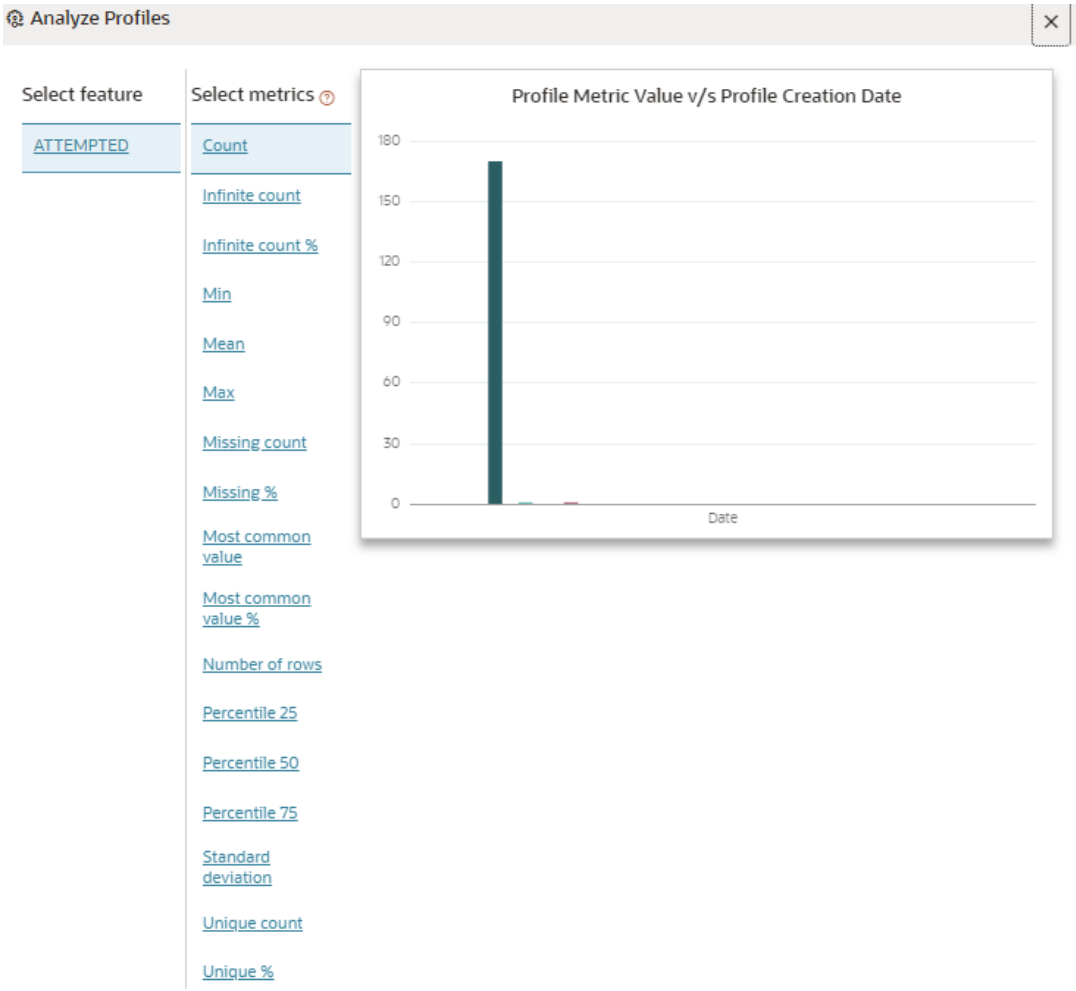
Analyze Profiles

To analyze multiple data profiles, perform the following steps:

1. In the Profiler Summary screen, select the data profiles that you want to analyze profiles. You can select multiple data profiles.
2. Click **Analyze Profiles**.

   A window is displayed with multiple metrics of the selected profiles. Click on each metric to view the data in graphical format.

Figure 11-25 Analyze Profiles screen



Compare Profiles

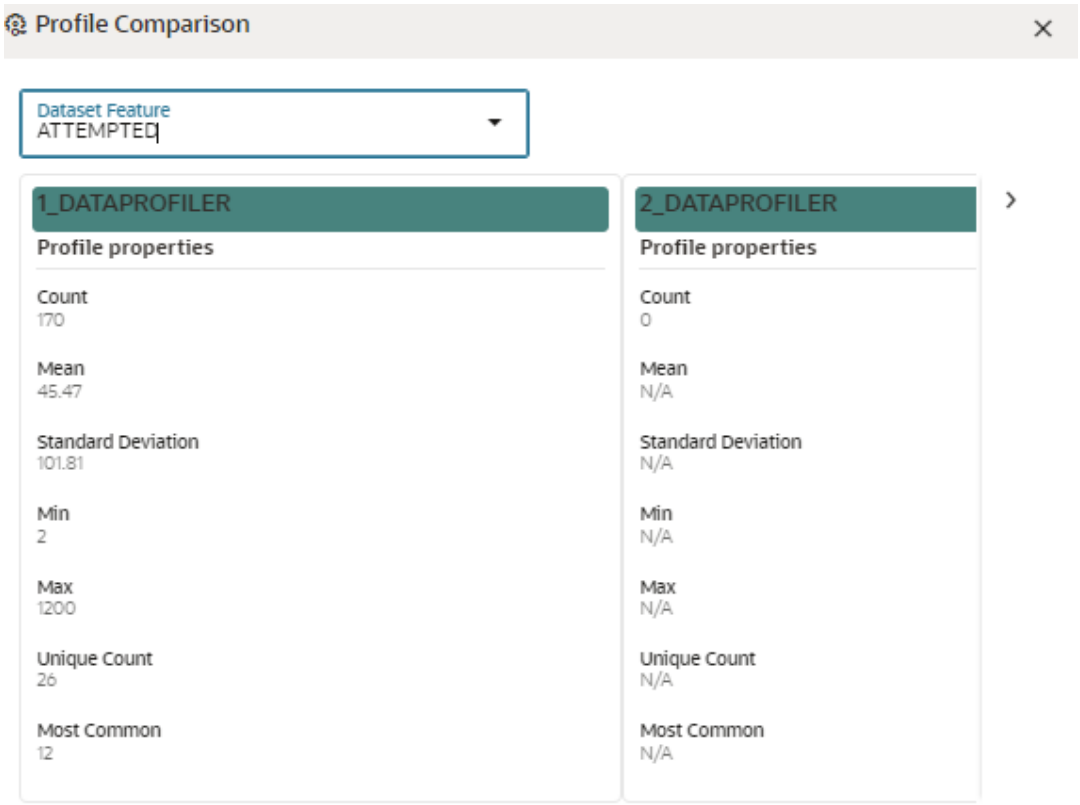
To compare the data between two data profiles, perform the following steps:

1. In the Profiler Summary screen, select two data profiles that you want to compare.
2. Click **Compare Profiles**.

   The Profile Comparison is displayed.
3. In the Dataset Feature drop-down, select the feature that you want to compare.

   The properties of both the profiles is compared and displayed in a tabular format.

Figure 11-26 Profile Comparison screen



Stop Profiling

To stop the profiling, perform the following steps:

1. In the Profiler Summary screen, select the data profiles that you want to stop profiling. You can select multiple data profiles.
2. Click **Stop Profiling**.

   A confirmation pop-up window is displayed.
3. Click **Yes**to disable the dataset profile.

   The dataset profiling has been disabled and Start Profiling option is displayed. For more information on profile, see Create a Profile section.

Model Monitor

Model Monitoring refers to the process of closely tracking the performance of models in production and helps you to frequently monitor the distribution of the model and provides alerts in case of any exceptions.

In addition, it enables you to identify and eliminate bad quality predictions and poor technical performance of the models.

The model's robustness depends not only on the training of the feature-engineered data but also on how well the model is monitored after deployment. Typically a model's performance degrades over time, and it essential to detect the cause of the decrease in performance of the model. The main cause of the decline in performance can be drift in the independent or/and dependent features which may violate the model’s assumption and distribution about the data. When models are built, the model builder will create a snapshot of the dataset used for training

the model and save it in a file which is later used for calculating drift with the current snapshot of the dataset.

To start the model monitoring, perform the following steps:

1. In the LHS menu, click **Dataset**to display the **Dataset Summary** window.

   This window displays the dataset records in a table.

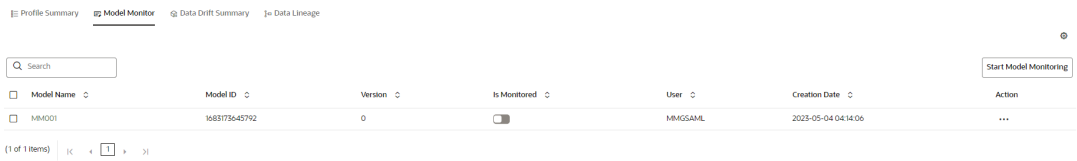
2. Click **Action**next to corresponding Dataset and select **View**.

   The Profile Summary screen is displayed.

3. Navigate to **Mode Monitor**page.

   All the models associated with the selected dataset will be displayed.

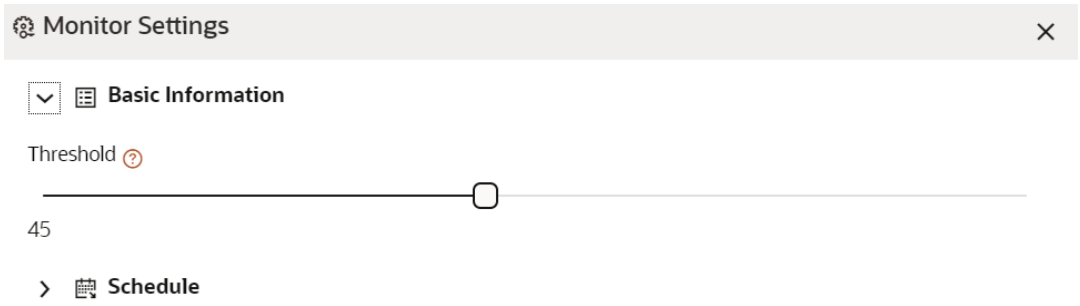
Figure 11-27 Mode Monitor page



4. Click **Start Model Monitoring**or **Monitor Settings** icon.

   The Monitor Settings page is displayed.

Figure 11-28 Monitor Settings page



5. Drag the slider and set the threshold settings. Threshold is the value in percentage, beyond which it is labelled as drifted.
6. Select the Schedule Type as required:
   - Daily: Select to run the schedule everyday.
   - Weekly: Select to run the schedule once in a week or the selected days in a week.
   - Monthly: Select to run the schedule once in a month or the selected days in a month.

   The monitoring for the model is started and Is Monitored option is enabled by default and you can disable it if you do not want to monitor.

Stop the Model Monitoring

To stop the model monitoring, perform the following steps:

1. Navigate to **Model Monitor** page.

   All the models associated with the selected dataset will be displayed.

2. Click **Stop Model Monitoring**.

   A confirmation pop-up window is displayed.

3. Click **Yes**.

   The Model Monitoring is stopped.

Viewing the Model Summary

To view the Model Summary, perform the following steps:

1. Navigate to **Model Monitor** page.

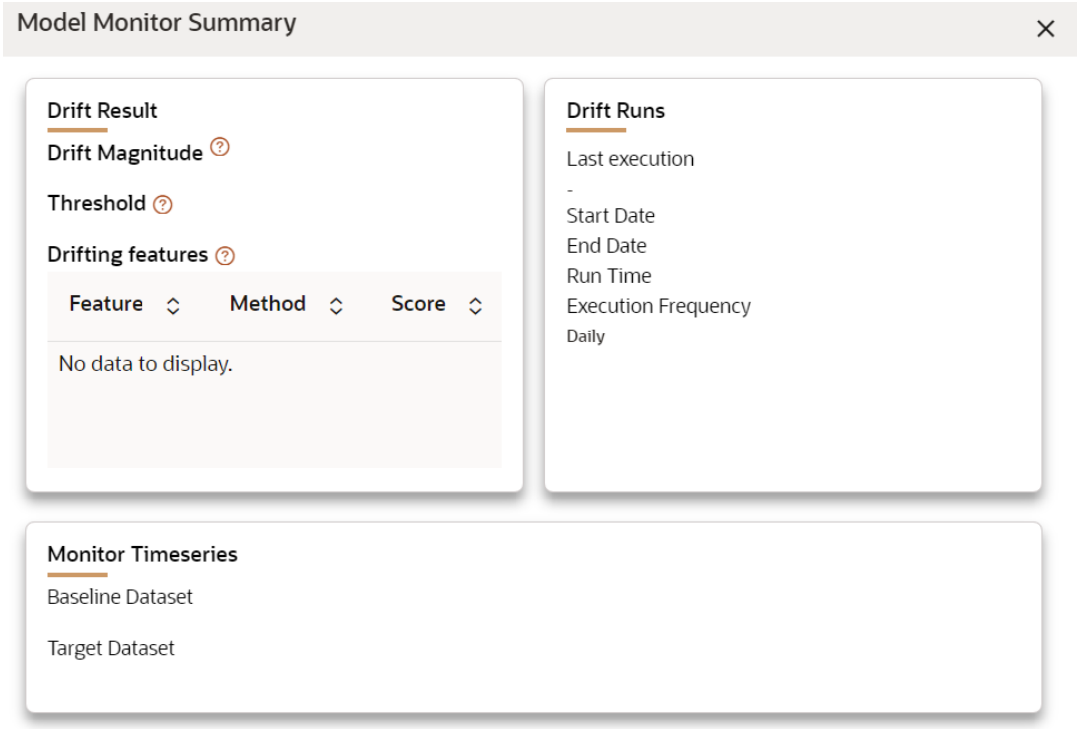
   All the models associated with the selected dataset will be displayed.

2. Click **Action** next to corresponding model and select **View Summary**.

   This window displays the following details in graphical format.

   - Drift Result
   - Drift Runs
   - Monitor Timeseries

Figure 11-29 Model Monitor Summary



Viewing the Model Latest Report

To view the Model Latest Report, perform the following steps:

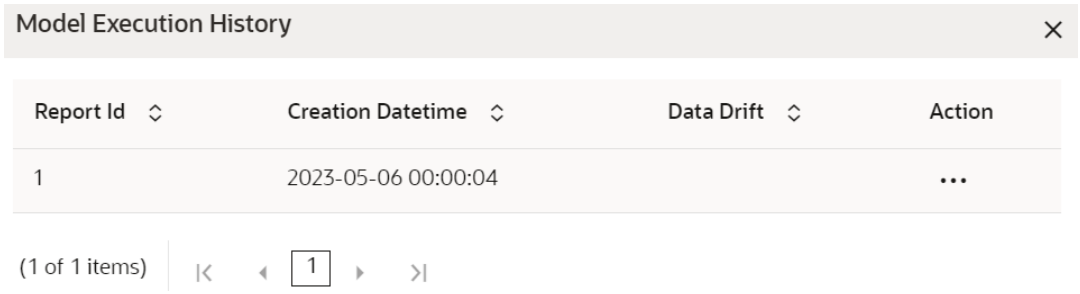
1. Navigate to **Model Monitor** page.

   All the models associated with the selected dataset will be displayed.

2. Click **Action** next to corresponding model and select **View Latest Report** .

   The execution details of the model are displayed.

Figure 11-30 Model Execution History



To view the report of each execution, click **Action** next to corresponding report and select **View Report**.

Viewing the Model Execution History

To view the Model Execution History, perform the following steps:

1. Navigate to **Model Monitor**page.

   All the models associated with the selected dataset will be displayed.

2. Click **Action**next to corresponding model and select **View Execution History**.

   This window displays the details such as Baseline Distribution, Target Distribution, Drift Method, Drift Score, and Data Drift of the models.

Data Drift Summary

A Data Drift Summary report summarizes the changes in a dataset over time. It typically includes information for any changes in the data distribution of the selected features over the selected baseline and target date ranges.

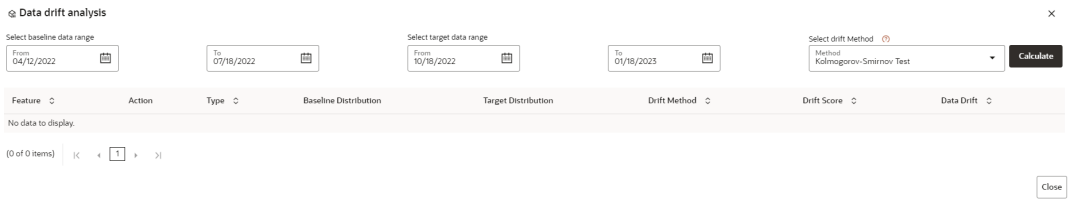
The report is used to help identify potential issues with data quality which helps the users to take necessary actions further.

To calculate the data drift, perform the following steps:

1. In the Data Drift Summary screen, click Calculate Drift.

   The Data Drift Analysis window is displayed.

Figure 11-31 Data Drift Summary screen



2. Select the data range (From and To) dates for the baseline.
3. Select the data range (From and To) dates for the target.
4. Select the drift method from the drop-down.

   The available drift methods are:

- Kolmogorov–Smirnov (K-S) test
  - Only for numerical features
  - Output: p_value, drift detected when p_value < threshold.
- Kullback-Leibler divergence
  - For numerical and categorical features
  - Output: divergence, drift detected when divergence >= threshold.
- Wasserstein distance (normed)
- Only for numerical features
- Output: distance, drift detected when distance >= threshold.
- Population Stability Index (PSI)
  - For numerical and categorical features
  - Output: psi_value, drift detected when psi_value >= threshold.
- Jensen-Shannon distance
  - For numerical and categorical features
  - Output: distance, drift detected when distance >= threshold.

5. Click **Calculate**.

   The drift analysis report is displayed.
6. Click **Save**.

   The reports are displayed under Data Drift Summary screen.

Disabling the Data Drift Monitoring

To stop the Data Drift monitoring, perform the following steps:

1. Navigate to **Data Drift Summary**page.

   The data drift summary reports are displayed in a table.
2. Click **Stop Data Monitoring**.

   A confirmation pop-up window is displayed.
3. Click **Yes**.

   The Data Drift Monitoring is disabled.

Start the Data Drift Monitoring

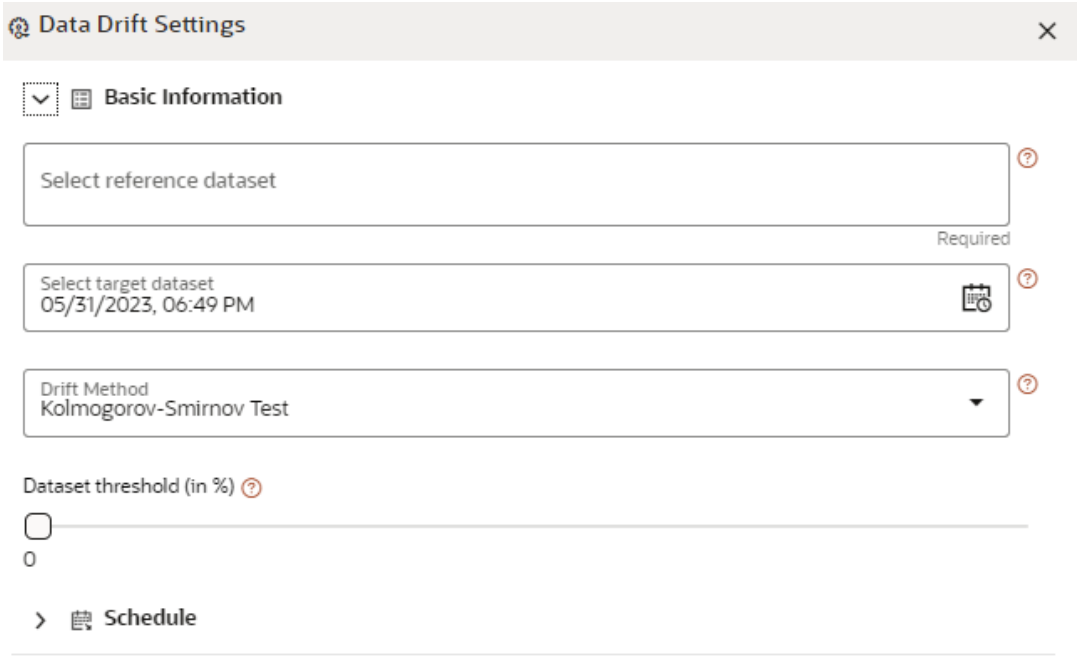
To start the Data Drift monitoring, perform the following steps:

1. Navigate to **Data Drift Summary**page.

   The data drift summary reports are displayed in a table.
2. Click **Start Data Monitoring**or **Data Drift Settings** icon.

   The Data Drift Settings window is displayed.

Figure 11-32 Data Drift Settings



3. Enter the basic information and schedule details and click **Save**.

   For more details, see Data Drift Summary section.

   The Data Drift Monitoring is started.

Viewing the Data Drift Summary Report

To view the Data Drift Summary Report, perform the following steps:

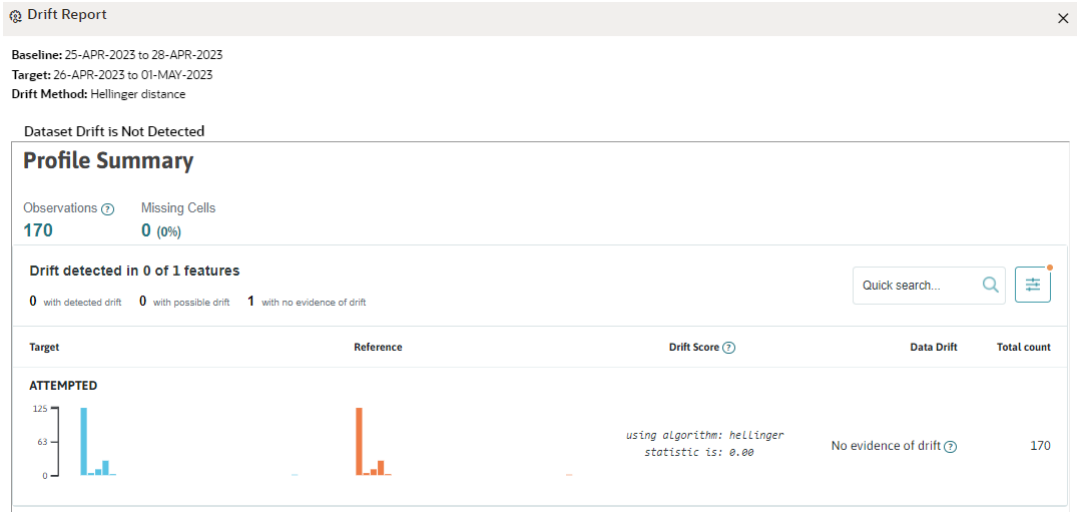
1. Navigate to **Data Drift Summary** page.

   The data drift summary reports are displayed in a table.

2. Click **Action** next to corresponding drift report Id and select **View**.

   The drift report is displayed in a graphical format.

Figure 11-33 Drift Report



Deleting the Data Drift Summary Report

To delete the Data Drift Summary Report, perform the following steps:

1. Navigate to **Data Drift Summary**page.

   The data drift summary reports are displayed in a table.

2. Click **Action** next to corresponding drift report Id and select **Delete** .

   OR

   If you wish to delete multiple data drift reports, select reports and click **Delete**.

   A confirmation pop-up window with report details is displayed.

3. Click **Delete**.

   The Data Drift Report is deleted.

Fairness

You can calculate the fairness metrics of the dataset by choosing the target variable and protected features. The module provides metrics dedicated to assessing and checking whether the model predictions and/or true labels in data comply with a particular fairness metric. For this example, the statistical parity metric also known as demographic parity, measures how much a protected group's outcome varies when compared to the rest of the population. Thus, such fairness metrics denote differences in error rates for different demographic groups/ protected attributes in data. Therefore, these metrics are to be *minimized*to decrease discrepancies in model predictions with respect to specific groups of people. Traditional classification metrics such as accuracy, on the other hand, are to be maximized.

You can perform the following functions:

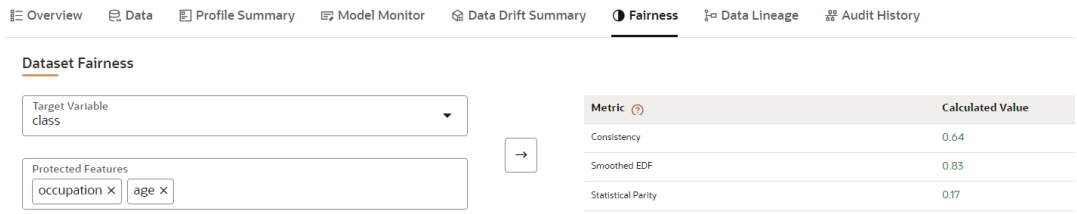
- Measure Fairness Metrics of Dataset
- Models Bias Mitigation of Models
- Privacy Estimation of Models

For Example: In model pipeline, a new widget can be added to calculate the fairness metrics of a trained model or an advanced option can be added to model training widget to calculate the fairness metric of the model after training.

To calculate the dataset fairness, perform the following steps:

1. In the Fairness screen, select the Target Variable from the drop-down.
2. In the Protected features, select the required features to understand the fairness of the dataset.

Figure 11-34 Fairness screen



The metric and calculated values are displayed. Click Help icon for more details on how the fairness is calculated.

Data Lineage

Data Lineage provides a summary view or visualization of Data Sources and its associated dataset and features in a graphical format. Also displays the complete data flow from start to finish.

To view the data lineage, perform the following steps:

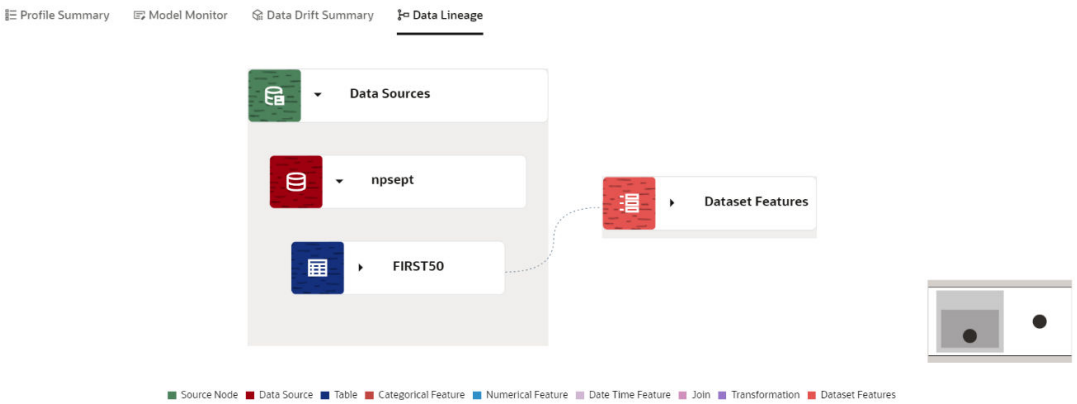
1. In the LHS menu, click **Dataset** to display the **Dataset Summary** window.

   This window displays the dataset records in a table.
2. Click **Action** next to corresponding Dataset and select **View**.

   The Profile Summary screen is displayed.
3. Navigate to **Data Lineage** page.

   A summary view of Data Sources and its associated dataset and features in a graphical format.

Figure 11-35 Data Lineage page



Click the drop-down of the respective features to view granular details and its workflow.

Audit History

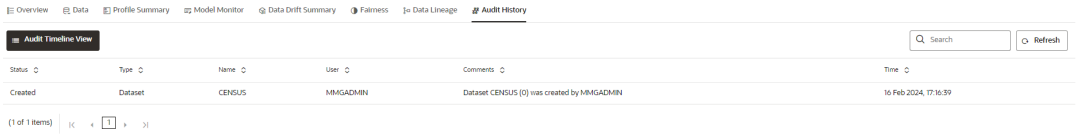
At any time, you can audit the datasets from the Audit History page. The Audit Trail window provides the complete details of datsets. The sequence of actions performed in the dataset lifecycle is listed in the table view and the timeline view (graphical representation).

To audit datasets:

1. Click **Launch Workspace** next to corresponding Workspace to Launch Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Navigate to **Dataset Summary** page.
3. Click More Options icon next to corresponding Dataset and select View.

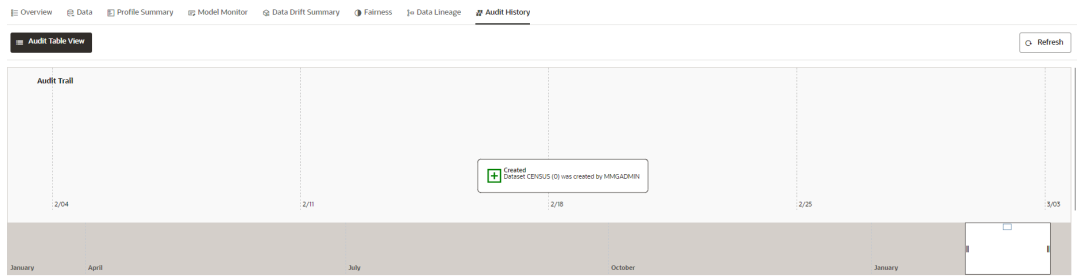
   The **Overview** screen is displayed.
4. Navigate to **Audit History** page.

Figure 11-36 Audit History



Click for **Audit Timeline View** for Timeline View and **Audit Table View** to switch to the regular view. Click to **Refresh**to refresh the Audit History. You can search the datasets by entering the name in the search box.

Figure 11-37 Audit History window Timeline View with Horizontal Time Axis



Create a Cache Snapshot

You can create a Cache Snapshot of the Dataset from this page.

To create a cache snapshot, follow these steps:

1. Navigate to Dataset Summary page.
2. Click next to corresponding Dataset and select View.

   The Overview page is displayed.
3. Click on the header and select Create a cache snapshot.

4. Enter the **Snapshot Name** having alphanumeric character, underscore and hyphen not exceeding 30 characters and click Create.

   This screen additionally allows users to cache a snapshot of the current state of data. The cached snapshots can be accessed later in Model Pipelines without any recompilation or re-read from data sources.

   To use the dataset in model pipeline or data pipeline, the actual data is fetched using the Cache option. For example, to take the data from dataset on As of Date, create the data frame and provide the name to cache. Only Cache pulls the data from dataset.

   This helps the things to work faster when you have millions of records, and you want to use intermediate data for use. For example, if you have 1 million records and want to use only 10,000 out of that, then perform the sampling for that 10, 000 entries. This increases the speed of processing, validation of information.

   - Once the metadata is created, the original data can be cached. A snapshot of the actual data in the dataset at the current time can be stored referenced by a tag name.
   - The location for caching is in the datastudio server location `$DS_HOME/work/ftpshare/mmg/workspace_name/dscode/tag`. The dataset will be saved as a parquet file with name dscode_tag.parquet
   - When executing all APIs from notebook, workspace has to be attached.
   - Caching can be performed in two ways:
     – From UI, immediately after saving the metadata.

   Or the users will have to fetch(create) a new snapshot/dataframe of the dataset using the API 'Fetch New Snapshot of dataset' and manually cache using the 'Caching Data Frame' API.

   The following table provides information on the error and the troubleshooting procedure in case of dataset failure.

Table 11-6 Information on the error and the troubleshooting procedure

Error	Troubleshooting procedure
`ModuleNotFoundError: No module named '_bz2'`	Install the package 'libbz2-dev' before building python.
`ModuleNotFoundError: No module named '_sqlite3'`	Install the package 'libsqlite3-dev' before building python.
`Python-env-health-check fails if pandas version is less than 1.4.1.` **NOTE:** `modin dataframe library is supported only from pandas version 1.4.1 and higher.`	You can switch between the options modin[dask] and pandas for the underlying dataframe library if pandas version 1.4.1 is installed.
`“Not a valid file"` errorwhile profiling the Hive Data sources.	Copy the following required files : kbank.keytab , krb5.conf , hive-jdbc-driver.jar into the path : $DS_HOME/conf folder of datastudio

Edit a Dataset

To edit a Dataset, follow these steps:

1. Navigate to **Dataset Summary** page.
2. Click on the Dataset Name column which you want to edit.

The Overview page is displayed.

3. Click **Edit**.

   You can edit the Dataset fields except Code and Dataset Name.

Delete a Dataset

To delete a Dataset, follow these steps:

1. Navigate to **Dataset Summary**page.
2. Click next to corresponding Dataset and select **Delete**.

   OR

   Click next to corresponding Dataset and select **View**. You can delete a Dataset from this page.

Python functions for accessing Dataset from Model Pipelines/Notebooks

This section provides information on the Python functions for accessing Dataset from Model Pipelines/Notebooks.

List tags of Datasets Cached from UI

To get a list of all snapshots/tags of a dataset cached from UI, use the API below:

Table 11-7 Listing tags of Datasets Cached from UI

API	Notebook Script	Notes/Input
List Tags of a Dataset	from mmg.datasets import list_tags list_tags(dscode)	dscode = dataset code - string tag = tag with which the dataset was cached - string

Delete Cached Dataset

A Cached Dataset can be deleted by using the API below where tag refers to a particular snapshot/timestamp of the dataframe.

Table 11-8 Delete Cached Dataset

API	Notebook Script	Notes/Input
Delete Dataset	from mmg.datasets import delete_df delete_df(dscode, tag)	dscode = dataset code - string tag = tag with which the dataset was cached - string

List all Datasets with Metadata saved from UI

Table 11-9 List all Datasets with Metadata saved from UI

API	Notebook Script	Notes/Input
List Datasets	from mmg.datasets import list_datasets list_datasets()	

Fetch Dataset in Notebook

Dataset whose metadata has been saved from UI can be fetched in two ways:

1. Dataset that has already been cached from UI can be fetched using first API below by providing the dataset code and tag.(DataFrame will not be recalculated. It will be read from cache.)
2. A new data frame for a dataset can be calculated/fetched using data from the present time with the metadata saved for that dataset as given in second API.

Table 11-10 Fetching Dataset in Notebook

API	Notebook Script	Notes/Input
Fetch Dataset Cached from UI	from mmg.datasets import fetch_ds df = fetch_ds(dscode,tag)	dscode = dataset code - string tag - string
Fetch New Snapshot of Dataset	from mmg.datasets import fetch_ds df = fetch_ds(dscode)	dscode = dataset code - string

Cache User's Dataframe from Notebook

A user-made data frame can also be cached using the below API. It will be stored in the datastudio server in location : `$DS_HOME/work/ftpshare/mmg/workspace_name/cached/tag`. The dataset will be saved as a parquet file with name `cached_tag.parquet`.

> **Note**
>
> This dataframe is not related to dataset created from UI. This is independent of dataset metadata.

Table 11-11 Cache User's Dataframe from Notebook

API	Notebook Script	Notes/Input
Caching Data Frame	from mmg.datasets import cache_df path=cache_df(df, tag) path	df = dataframe to be cached - pandas dataframe tag - string

Fetching Data Frame Cached from Notebook

The data frame cached from notebook can be fetched using the below API.

Table 11-12 Fetching Data Frame Cached from Notebook

API	Notebook Script	Notes/Input
Fetch dataset cached manually	from mmg.datasets import fetch_ds df = fetch_ds("cached",tag)	tag - string

List Tags of all Data Frames Cached from Notebook

Table 11-13 List Tags of all Data Frames Cached from Notebook

API	Notebook Script	Notes/Input
List Tags of Manually Cached Datasets	from mmg.datasets import list_tags list_tags()	

Model Libraries

The Model Library information is used to bind a particular technique and its details to one unique Model Library. The Starting point for the Model builder is to register a model library with the application after it is properly set up in the python environment to be used.

Currently, the following libraries are supported:

- keras
- ONNX
- scikit-learn
- xgboost

As an example, the following section provides information on how to set up and register the scikit-learn library.

Setting up the Python Library in the python environment:

Open the terminal and install the scikit-learn library using the following command:

```
python3 -m pip install scikit-learn
```

> **Note**
>
> Proxy might be required to install the packages from pip.

Once the installation is complete, check for the package details using the following command:

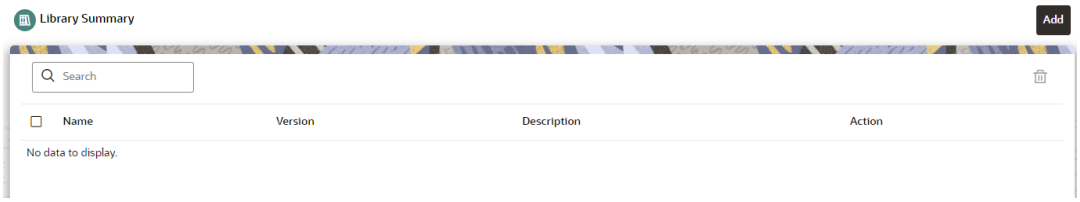
```
pip show scikit-learn
```

Once the installation is complete in Python environment, you need to register the library into the application.

Registering the Python Library

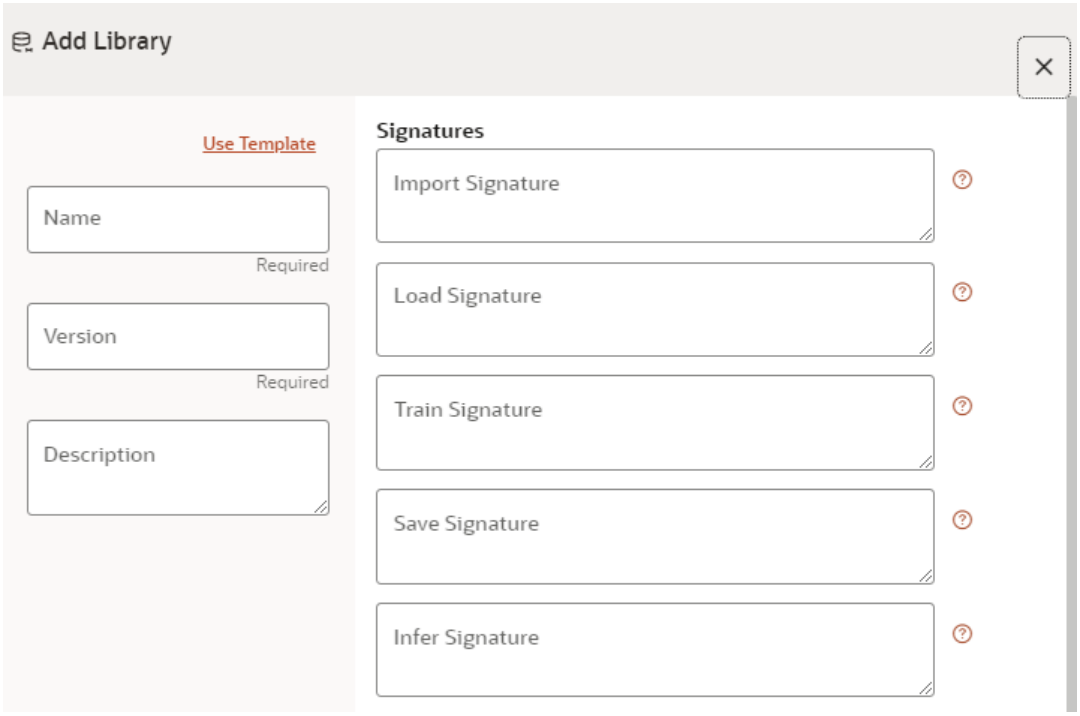
1. In the Mega menu, click Modeling > Model Libraries.
   The **Library Summary** page is displayed.

Figure 11-38 Library Summary page



2. In the **Library Summary** page, click **Add**.
   The **Add Library** page is displayed.

Figure 11-39 Add Library page



3. Enter the name of the library.
4. Enter the version and description of the library.
5. Enter the signatures such as Import, Load, Train, Save, and Infer. For more details on the signatures, click the respective help icons.
   Some of the signatures captured in library stage might not be standard across different algorithm/techniques provided by the library.
6. Click **Create**.
   The Model Objective is created and displayed in the Model Objective screen.

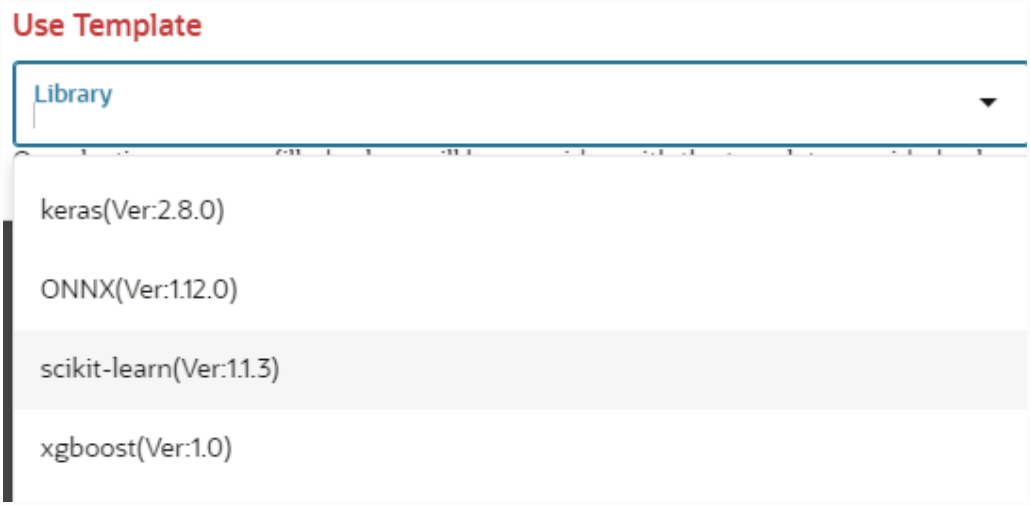
Note

The User must check the details provided above from the home page of the library being captured.
For example: `https://scikit-learn.org/stable/`.

OR

You can select the **Use Template** option to pre-fill the entries from the seeded list of Libraries. Currently, the following libraries are present in the template.

Figure 11-40 Use Template



You can also edit the data based on your requirements.

Note

The .whl file for MMG-Python is available in the below location: OFS_MMG/mmg-service/python-lib/mmg-8.1.3.2.0-py3-none-any.whl

This can be installed using the command Python3 -m pip install MMG-8.1.3.2.0-py3-none-any.whl

On successfull installation, the user will get a message: "Successfully installed MMG-8.1.3.2.0".

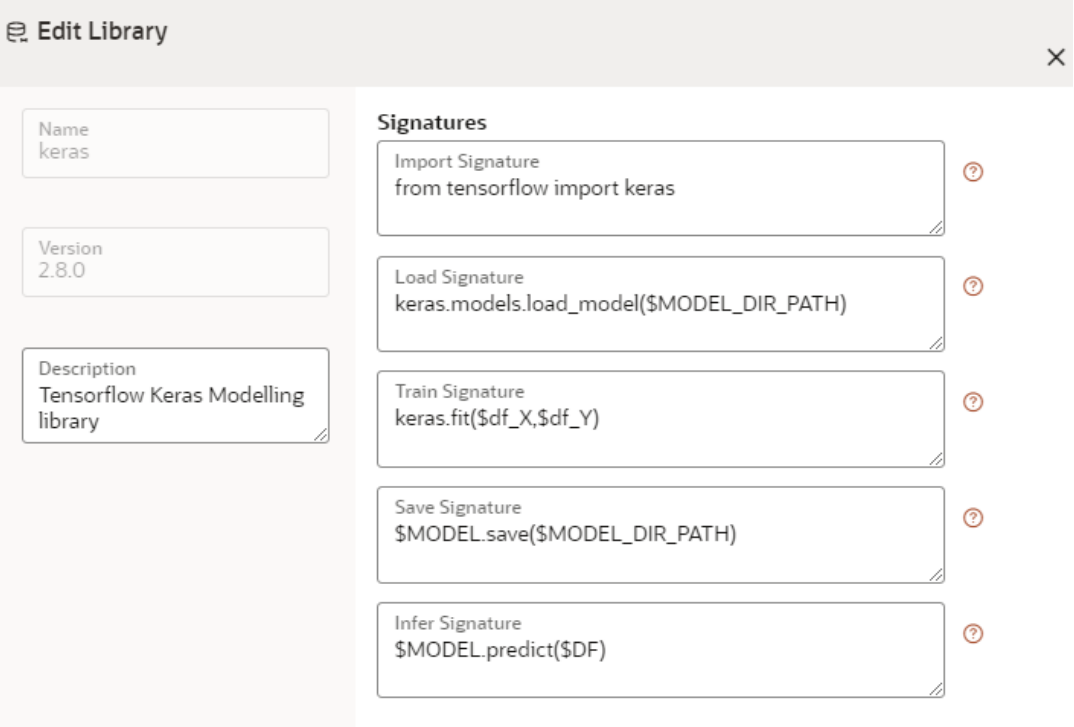
Edit a Model Library

To edit a Model Library:

1. Navigate to **Library Summary** page.
2. Click and select Edit.

   The **Edit Library** screen is displayed.

Figure 11-41 Edit Library screen



3. Make the necessary changes and click **Update**.

> **Note**
>
> The Model Library name and version are unique and cannot be modified.

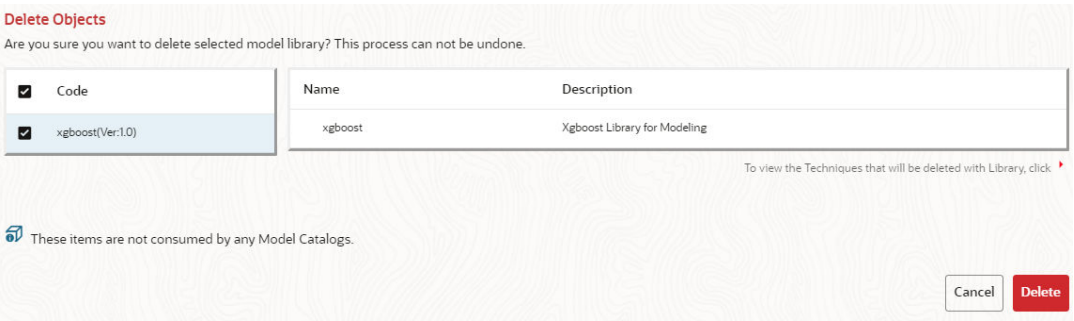
Delete a Model Library

To delete a Model Library:

1. Navigate to **Library Summary** page.
2. Click and select **Delete**.

   A confirmation message is displayed.

Figure 11-42 Confirmation Message



3. Click **Delete**.

   The selected model library and all the associated model techniques are deleted. The libraries that are deleted cannot be consumed by any model catalog.

   To delete multiple model libraries select all the model libraries that you want to delete and click the icon on the page header.

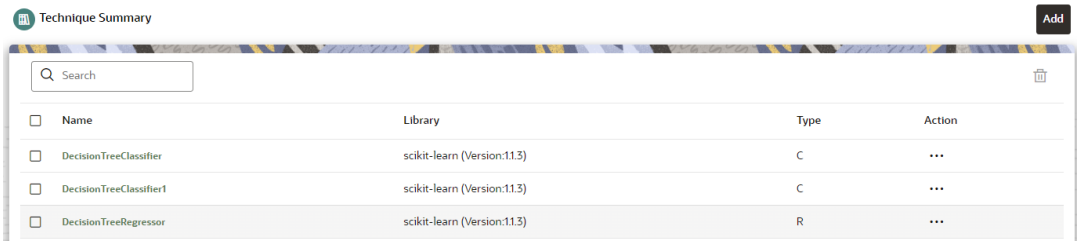
Model Technique

Model Technique is the algorithm/technique used to create python model using the library/ package which was created in the Model Library Screen. It is the actual information captured in the application that helps in training the model (Upload and Build).

1. In the LHS menu, click **Model Catalog > Model Technique**option.

   The **Technique Summary**page is displayed.

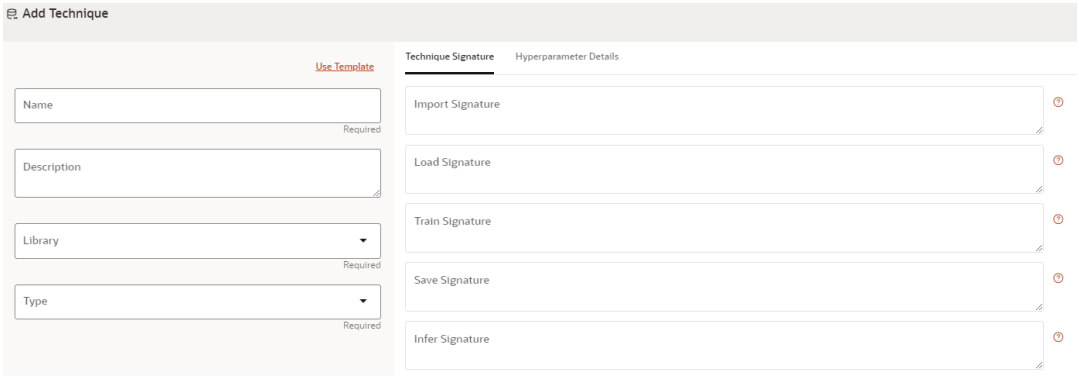
Figure 11-43 Technique Summary page



2. In the **Technique Summary** page, click **Add**.

   The **Add Technique** page is displayed.

Figure 11-44 Add Technique page



3. Enter the name of the technique.
4. Enter the description of the technique.
5. Select the library from the drop-down. Currently, the application supports the libraries such as keras, ONNX, scikit-learn, and xgboost.
6. Select the type as either as **Classification** or **Regression**.

   Classification: Classification is a process of finding a function which helps in dividing the dataset into classes based on different parameters. The task of the classification algorithm is to find the mapping function to map the input(x) to the discrete output(y).

Regression: Regression is a process of finding the correlations between dependent and independent variables. The task of the Regression algorithm is to find the mapping function to map the input variable(x) to the continuous output variable(y).

7. Enter the signatures such as Import, Load, Train, Save, and Infer. For more details on the signatures, click on the respective help icon.

   Some of the signatures captured in library stage might not be standard across different algorithm/technique provided by the library.

8. Navigate to **Hyperparameter Details** tab and click **Add** to add the parameters.

   You can add the type of parameters such as String, Integer, Float, and Boolean.

9. Click **Create**.

   The Model Technique is created and displayed in the **Technique Summary**screen.

> **Note**
>
> The user needs to check the details provided above from the homepage of the library being captured.
> For example: `https://scikit-learn.org/stable/.`

OR

You can select the Use Template option to pre-fill the entries from the seeded list of Libraries.

You can also edit the data based on your requirements.

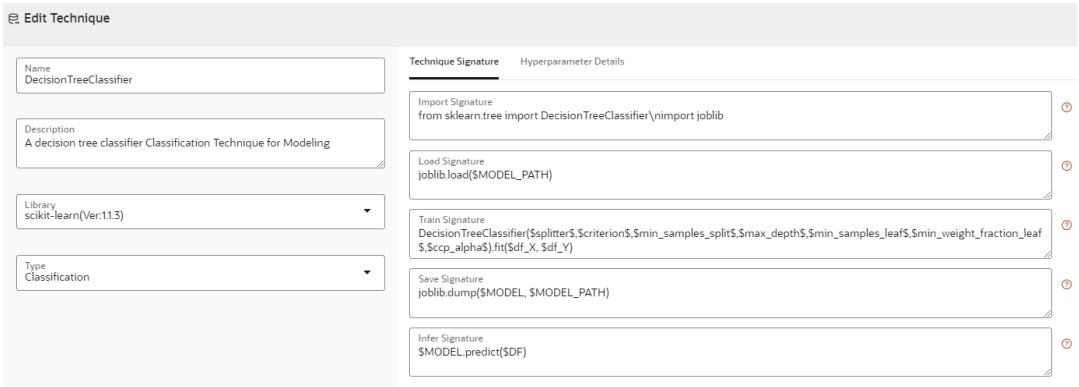
Edit a Model Technique

To edit a model technique, follow these steps:

1. Navigate to **Technique Summary** page.
2. Click **Action** next to corresponding model technique and select **Edit**.

   The **Edit Technique** screen is displayed.

Figure 11-45 Edit Technique screen



3. Make the necessary changes and click **Update**.

   For more details, see Model Technique section.

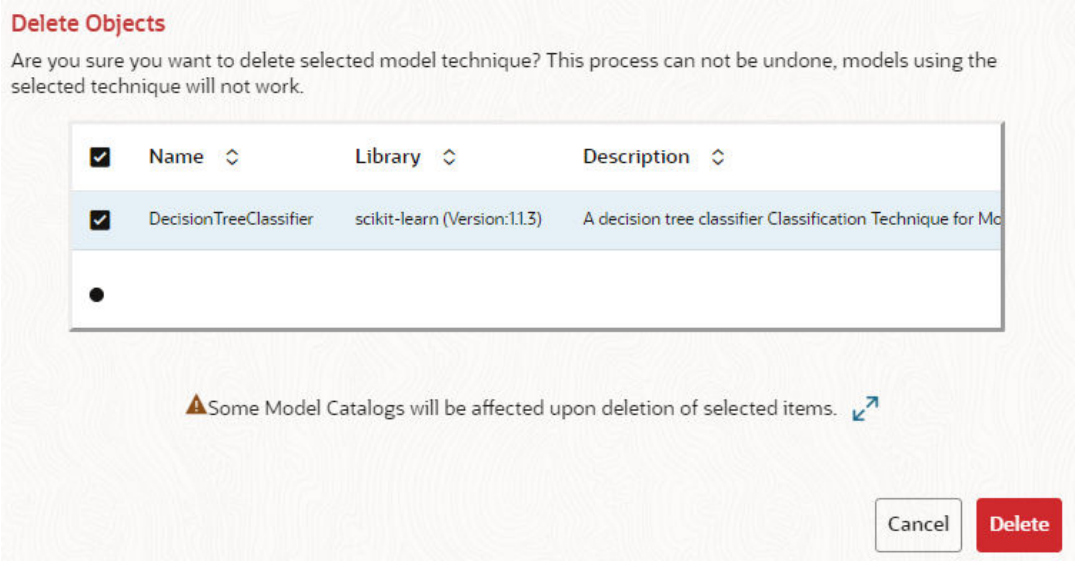
Delete a Model Technique

To delete a model technique, follow these steps:

1. Navigate to **Technique Summary** page.
2. Click **Action** next to corresponding model technique and select **Delete**.

   A confirmation message is displayed.

Figure 11-46 Confirmation Message



3. Click **Delete**.

   The selected model technique and all the model catalogs associated are deleted.

   To delete multiple model techniques, select all the model techniques that you want to delete and click the **Delete**icon on the page header.

Model Catalog

The Model Catalog page allows you to add and manage the Model Technique, Model Library, and Model Objectives. You can either import the models from external sources or create, train and label it as champion model.

Model Objective

Model Objective is the top level metadata where further models are created or trained which can be consumed in the upcoming steps.

> **Note**
>
> Ensure Data Studio is up and running. A validation message is displayed when the Data Studio is down during creation of Model Objectives.

To add a Model Objective:

1. Click **Launch Workspace** next to the corresponding workspace to display the **Dashboard** window with application configuration and model creation menu.
2. In the LHS menu, click **Model Catalog** to display the **Model Objective Summary** window.

   This window displays the model objectives in a table.

   The following table provides descriptions for the fields and icons on the **Model Objective Summary** page.

Table 11-14 Fields and icons on the Model Objective Summary page

Field or Icon	Description
Search	The field to search for Model Objectives. Enter specific terms in the field for which you want to search, and press Enter on the keyboard to display the results.
Code	The unique identifier of the Model Objective.
Name	The name of the Model Objective.
Dataset	The dataset which is used to create the Model Objective.
Target Variable	Target Variable is the important parameter after the dataset. During the dataset selection, target variable is selected that constitutes of number of columns/features.
Type	The type which is selected during model objective creation. The type can be either Classification or Regression.
Action	Click the three dots to perform View/Delete functions on the selected model objective..

> **Note**
>
> On the **Objective Summary** page, use the **Show Empty Objectives** checkbox to toggle the display of empty objectives. By default, empty objectives are hidden. You can select **Show Empty Objectives** to display them. After you successfully add a new objective, **Show Empty Objectives** is automatically enabled.

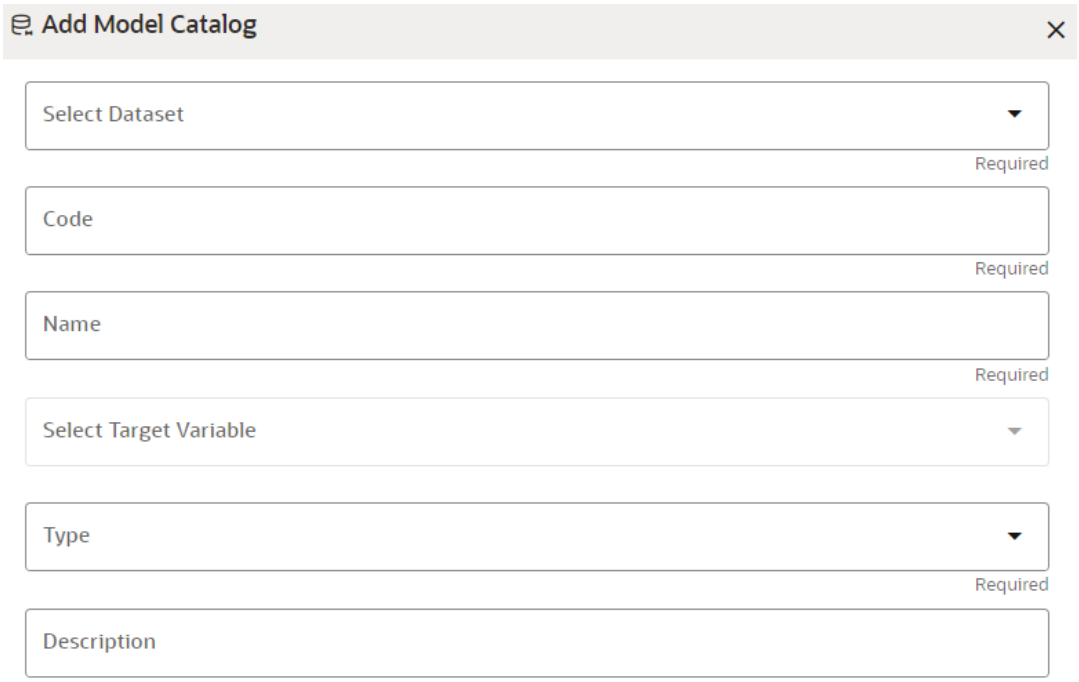
Add a Model Objective

To add a Model Objective:

1. In the **Model Objective Summary** screen, click **Add**.

   The **Add Model Objective** screen is displayed.

Figure 11-47 Add Model Objective screen



2. Select the required dataset from the drop-down.

   For more details on the dataset, see Dataset section.

3. Enter the code for the Model Objective.

   The code should be unique for each model objective.

4. Enter the name and description for the Model Objective.

5. Select one of the column/feature as the target variable for the models which needs to be trained/uploaded.

6. Select the Type from options such as **Classification** , **Regression**, or **Others**.

   Classification: Classification is a process of finding a function which helps in dividing the dataset into classes based on different parameters. The task of the classification algorithm is to find the mapping function to map the input(x) to the discrete output(y).

   Regression: Regression is a process of finding the correlations between dependent and independent variables. The task of the Regression algorithm is to find the mapping function to map the input variable(x) to the continuous output variable(y).

   Others: If the Type is not Classification or Regression, select this option.

7. Enter the description for the Model Objective.

8. Click **Create**.

   The Model Objective is created and displayed in the **Model Objective Summary** screen.

> **Note**
>
> In the objective summary UI, a new button is introduced to show/hide empty objectives. By default "Show Empty Objectives" will be disabled (i.e. empty objectives wont be shown) User can enable this checkbox to view empty objectives. On successful addition of new objectives this checkbox is enabled automatically.

View a Model Objective

To view a Model Objective:

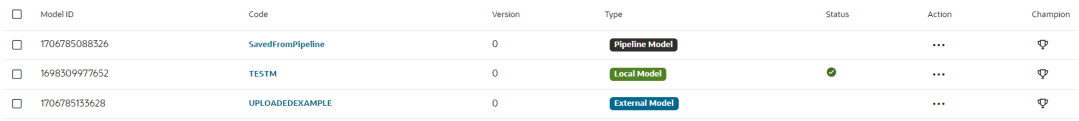
1. Navigate to **Model Objective Summary** page.
2. Click **Action** and select **View**.

   OR

   Click on the Model.

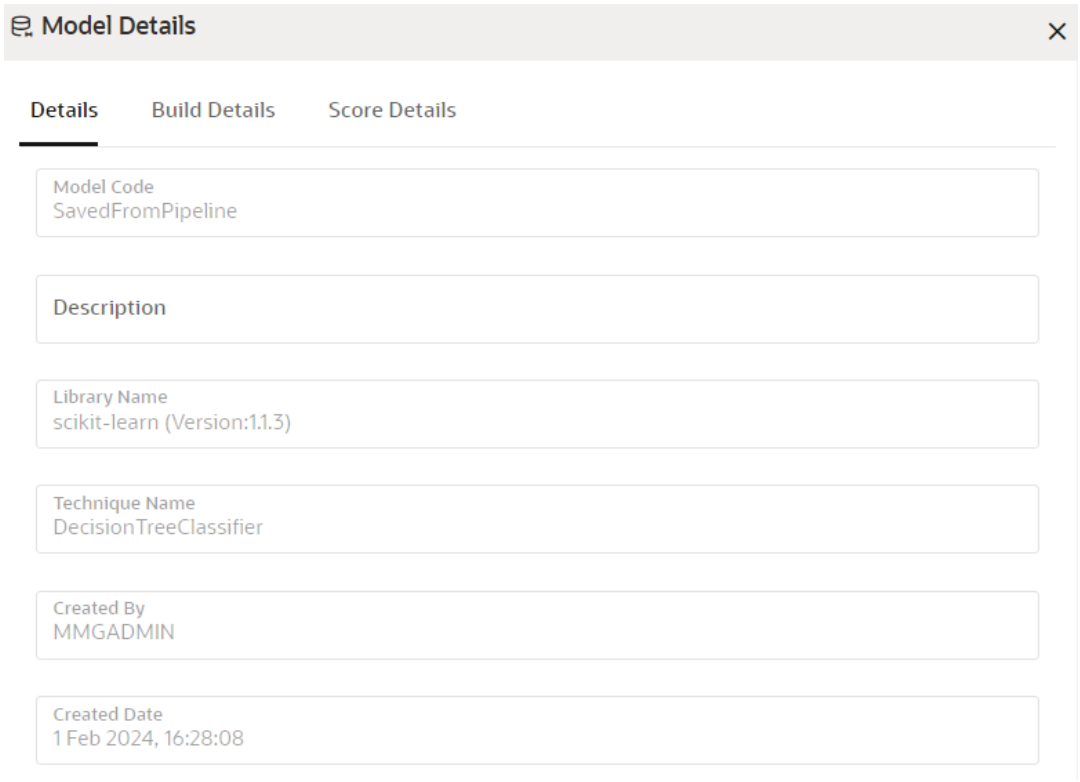
   The following page is displayed.

Figure 11-48 View page



Click on Type to view the model, build, and score details.

Figure 11-49 Model details



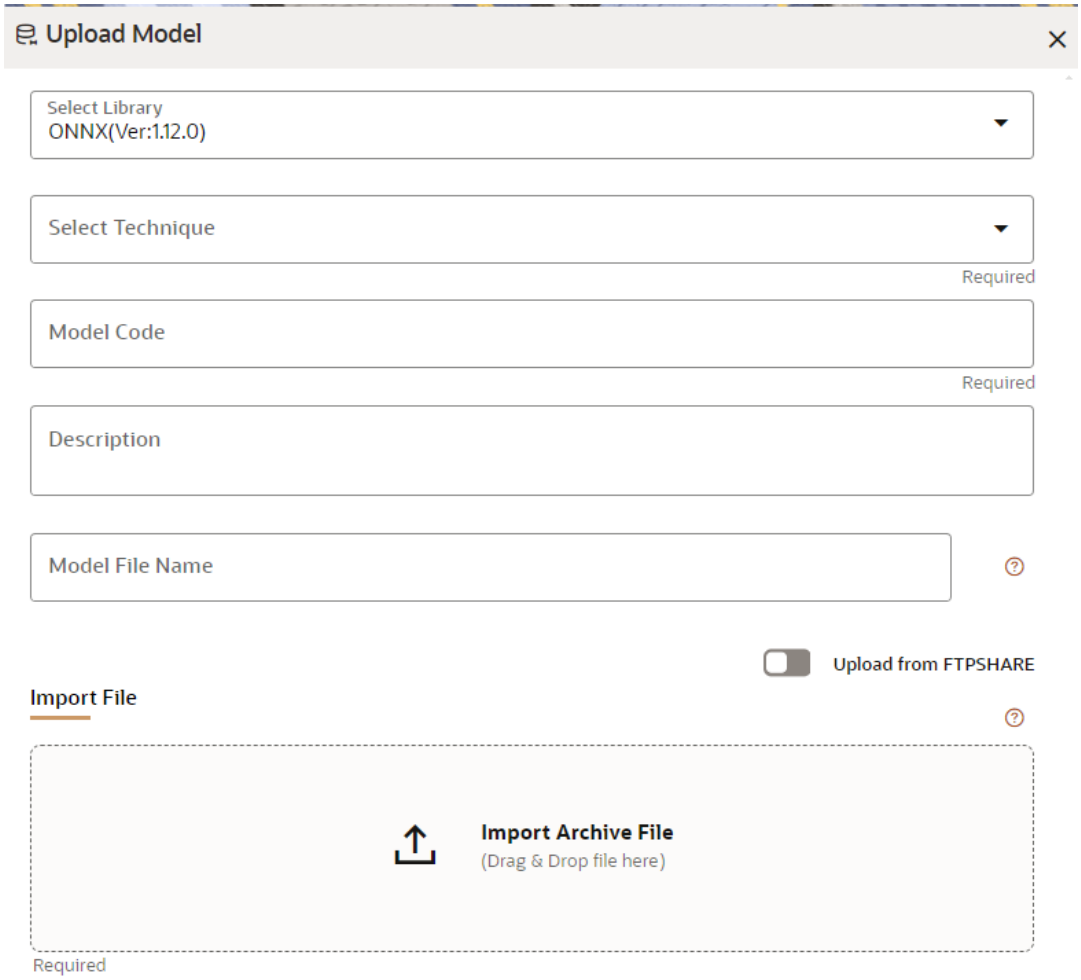
Upload a Model

To upload a model:

1. In the **View Model Objective** page, click **Add** and select **Upload Model**.

   The **Upload Model** page is displayed.

Figure 11-50 Upload Model page



2. Select the library from the drop-down.

   For more details on the model library, see the Model Libraries section.

3. Select the required technique from the drop-down.

   For more details on the model technique, see the Model Technique section.

4. Enter the model code and description for the Model Objective.

5. Enter the name of model file with extension for use during Save and Load.

6. Import the model using **Import Archive File**option. File format should in be zip format.

   OR

   Enable **Upload from FTPSHARE** option to import the model. File Path entered is the zip file path present on the Server relative to ftpshare path including file.
   Example: <installation path>/temp/models/model.zip

7. Click **Upload Model**.

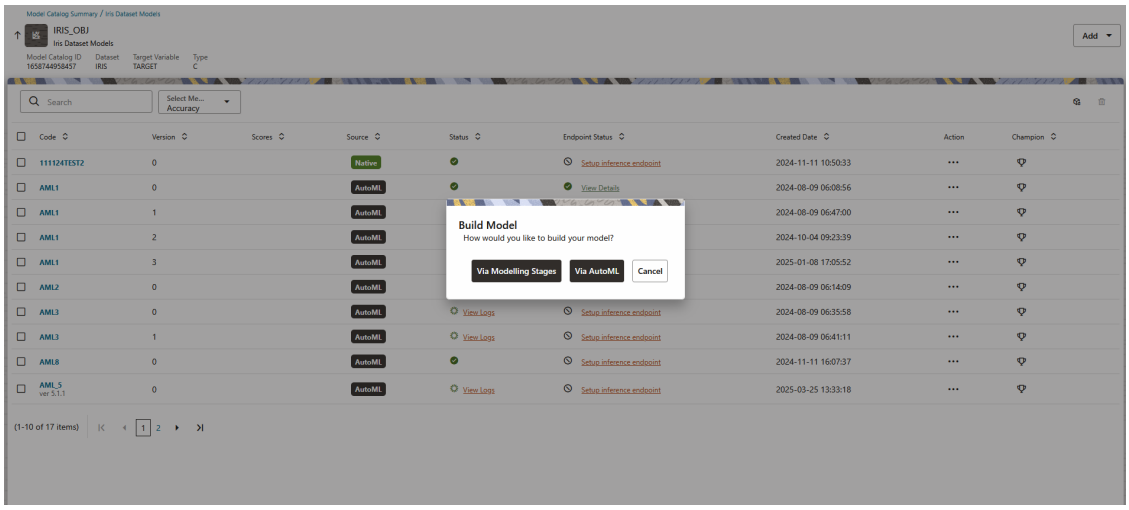
   The model is uploaded successfully.

Build a Model

Building a model consists of the following steps:

- Model Details
- Pre–Processing Stage
- Model Training Stage
- Model Validation Stage
- Model Summary

Figure 11-51 Model Building screen



Build via Modelling Stages

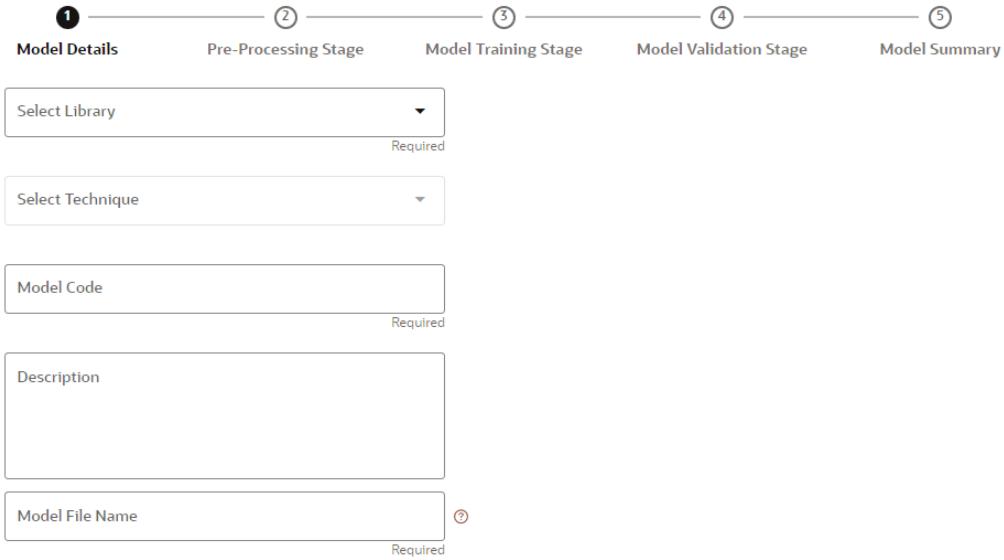
This section describes about building a model using traditional Machine Learning steps.

Model Details

1. In the **View Model Objective** page, click **Add** and select **Build Model**.

   The **Model Details** page is displayed.

Figure 11-52 Model Details page

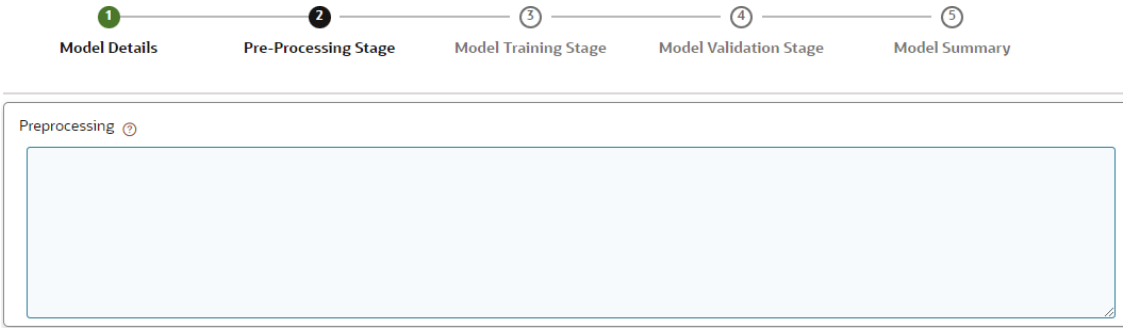


2. Select the library from the drop-down. Currently, the supported libraries are keras, ONNX, scikit-learn, and xgboost. For more details, see the Model Libraries section.
3. Select the required technique from the drop-down. For more details, see the Model Technique section.
4. Enter the model code and description for the model.
5. Enter the name of model file with extension for use during Save and Load.
6. Click **Next** to go to the next step.

Pre–Processing Stage

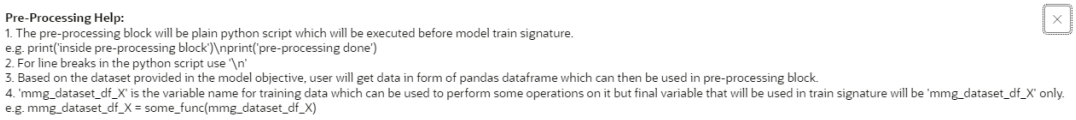
After adding the details in the Model Details page, the Pre-Processing Stage screen is displayed.

Figure 11-53 Pre-Processing Stage screen



1. Enter the data in the Pre-Processing text box as shown in an example is provided here.

Figure 11-54 Pre-Processing text box

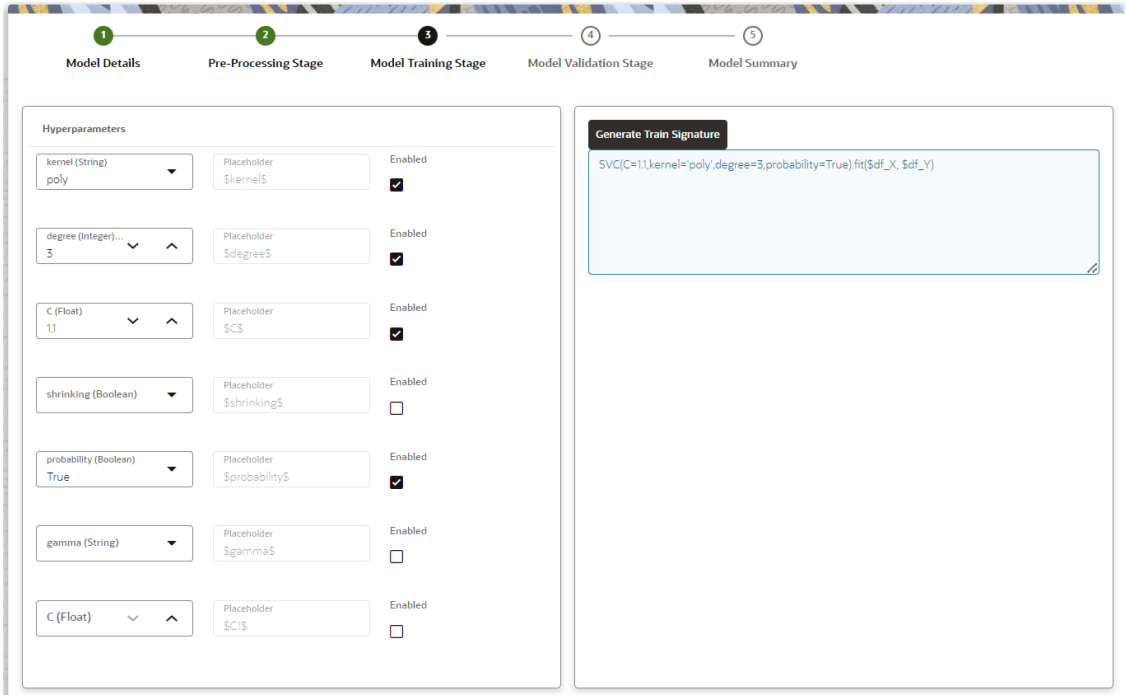


2. Click **Next** to go to the next step.

Model Training Stage

After adding the details in the Pre-Processing Stage page, the Model Training Stage screen is displayed.

Figure 11-55 Model Training Stage screen



1. Select the hyperparameters.

   When the parameters is selected, the **Enabled** check box is selected by default.

2. Click **Generate Train Signature**.

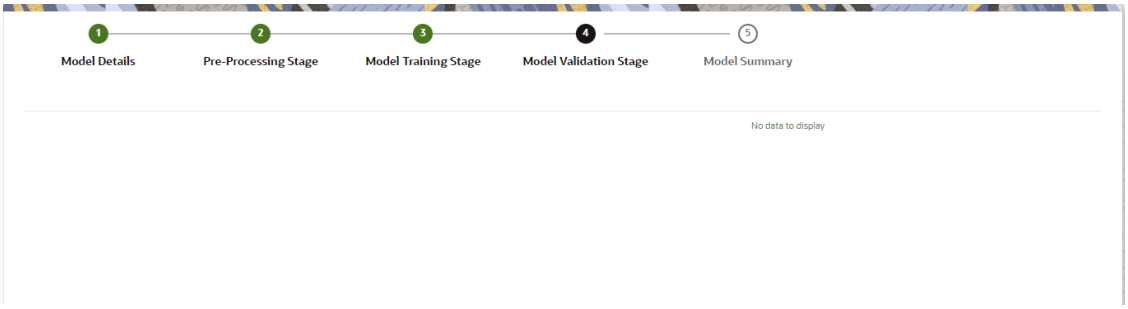
   The signature is displayed.

3. Click **Next** to go to the next step.

Model Validation Stage

After adding the details in the Model Training Stage page, the Model Validation Stage screen is displayed.

Figure 11-56 Model Validation Stage screen



The Validation is work in progress.

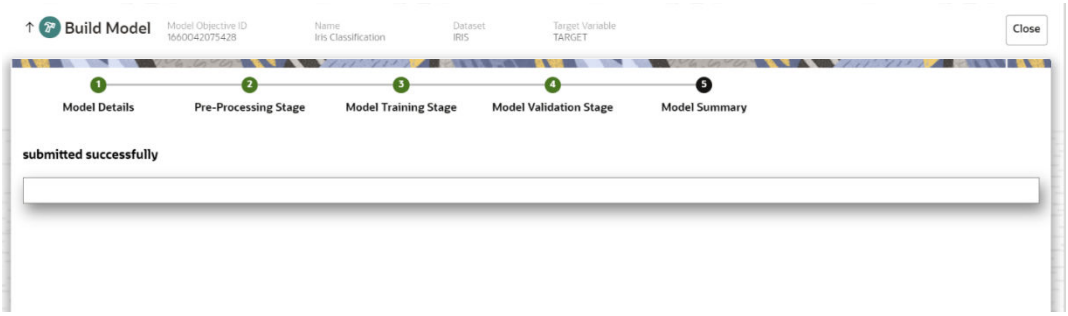
- Click **Finish** to start the training of the model.

Model Summary

Once the validation of the model is completed, the Model Summary screen is displayed. Follow the below steps to publish Models from Model Summary:

1. Navigate to Model Summary.
2. Click on the three dots.
3. Select publish Datastudio option.
4. Check the links.

Figure 11-57 Model Summary screen



- Click **Close**.

  The model is created and displayed in the Model Objective screen.

Build via AutoML

The AutoMLx python package automatically creates, optimizes and explains machine learning pipelines and models. The AutoML pipeline provides a tuned ML pipeline that finds the best model for a given training dataset and a prediction task at hand. AutoML has a simple pipeline-level Python API that quickly jump-starts the data science process with an accurate tuned model.

The AutoML pipeline consists of five major stages of the ML pipeline: preprocessing, algorithm selection, adaptive sampling, feature selection, and model tuning.

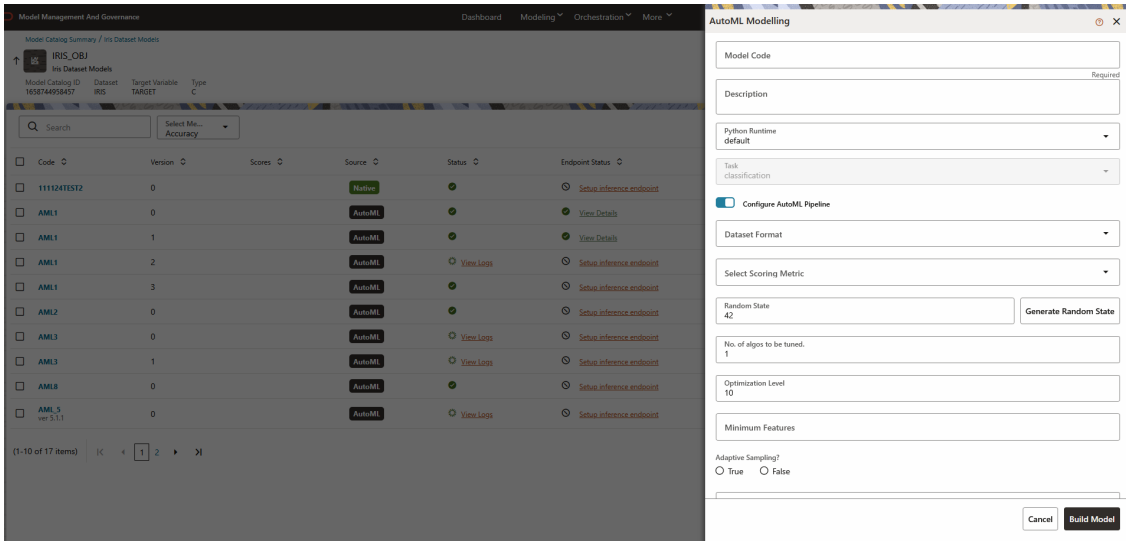
These pieces are readily combined into a simple AutoML pipeline which automatically optimizes the whole pipeline with limited user input/interaction.

> **Note**
>
> The user needs to manually install the Oracle-AutoMLX Python package.

Installation of AutoML
To use Model Building via AutoML, the oracle-automlx version 25.2.1 package must be installed. Some existing packages will automatically be downgraded from their current versions. For a smoother experience, users are recommended to create a Conda environment and install the required packages.

For automlx installation refer to: http://automl.oraclecorp.com/multiversion/v25.2.1/installation.html

Figure 11-58 Build via AutoML



Follow these steps to build via AutoML:

1. Enter the **Model Code** for the model.

   This field is mandatory.

2. Enter the **Description** for the model.

3. Click on the **Python Runtime** dropdown to select any Conda environment.

   You can select the environment only if it is created. Otherwise it will be a default environment.

4. Click the **toggle** button to configure the pipeline.

> **Note**
>
> You can enter the required inputs for all the parameters. However, they are not mandatory. You can also click the Help icon on the top right of the drawer for more details on each one of them.

5. Click on the **Build Model**.

   An AutoML model will be created and displayed in the **Model Objectives** page.

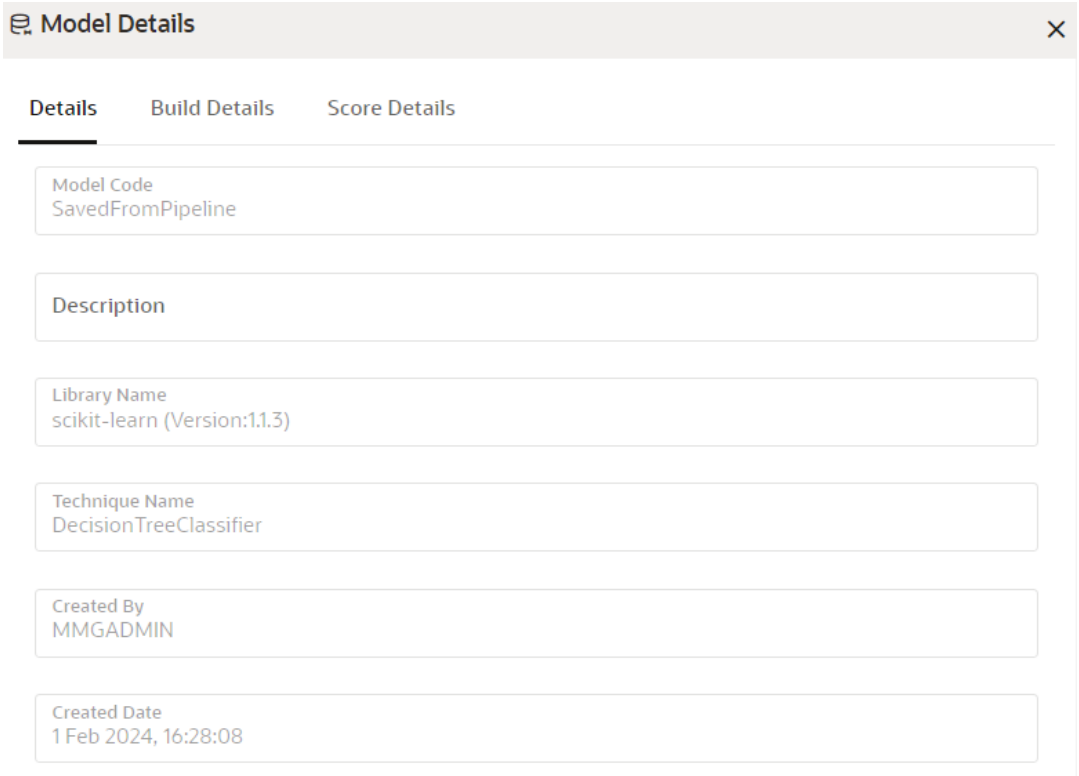
View Details of a Model

To view details of a model, follow these steps:

1. In the **View Model Objective** page, click **Action** next to corresponding model and select **View Details**.

   The model details are displayed.

Figure 11-59 Model details



2. Click on the **Build Details**tab to view the Preprocessing, and Hyperparameters details of the model.
3. Click the **Score Details** tab to view the Latest score, and Scoring details of the model.

> **Note**
>
> The Download option is now available for Model Catalog-Upload/Build Model. In the View Model Objective page, click on *three dots* under *Action* next to corresponding model and select *Download option*. The models get downloaded in a zip format.

Setting the Model as Champion

You can set the trained models as champion model.

To set a champion model:

1. In the **View Model Objective**page, hover over the model which you want to set as champion and click the **Set Champion**icon.

Figure 11-60 View Model Objective page

A confirmation message is displayed.

2. Click **Update**.

   The model is set as champion for the selected model objective.

Delete a Model

To delete a model:

1. In the **View Model Objective**page, select the models which you want to delete.
2. Click **Delete** and acknowledge the confirmation message.
3. Click **Delete**.

Delete a Model Objective

To delete a Model Objective:

1. Navigate to **Model Objective Summary** page.
2. Click **Delete** and acknowledge the confirmation message.
3. Click **Delete**. The selected model objective and all its associated models are deleted.

Pipelines

Model Pipeline enable you to create and publish models based on the workspaces created from datasources. The published models are then deployed in production to be consumed by other services and applications. Modelers create models by using model templates available as part of ML4AML or by developing them independently in Compliance Studio Notebooks. After building and evaluating, multiple models, the best model or champion model can be selected. The champion model can then be deployed for scoring. In this document the champion model can also be referred to as the scoring model.

Prerequisites

The prerequisites for model pipeline are as follows:

- To create a model, your user profile must be mapped to the Modeler Group.
- To create a model, a workspace must be deployed.
- To approve and deploy a model, your user profile must be mapped to the Modeling Administrator Group.

Access Model Pipelines

The Model Pipeline window allows you to create and publish models.

To access the Model Pipeline window:

1. Navigate to **Workspace Summary**page.

   The page displays workspace records in a table.

2. Click **Launch** next to corresponding Workspace to Launch Workspace.

   The **Dashboard** window is displayed with application configuration and model creation menu.

3. In the LHS menu, click **Model Pipelines** to display the **Model Pipelines** page.

   The window displays objectives that contain drafts and models. When you hover on the count that are next to the ID column, it displays the count of sub objectives, Drafts, Models, and Champion if available.

Figure 11-61 Model Pipelines page

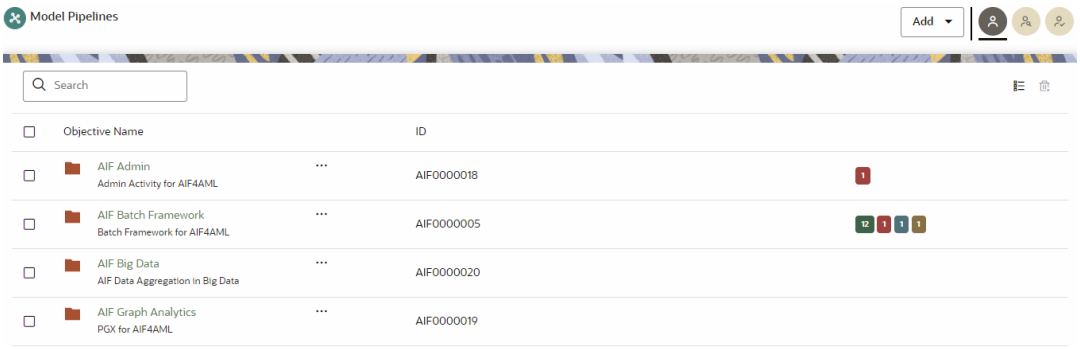
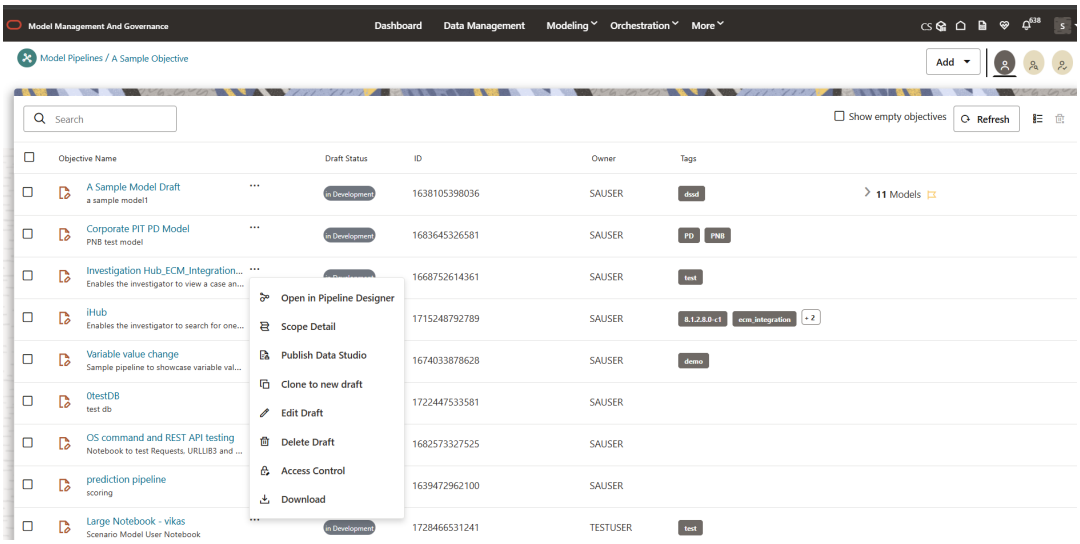


Figure 11-62 Dropdown under Hierarchical View



You can switch the Model Summary page view from Flat to Hierarchical and vice-versa. Flat list is the default view in Production workspace while Hierarchical list is the default in Sandboxes.

- **Hierarchical option**: The Model Management window shows the hierarchical list of the Objectives using the **Hierarchical** option. In the Hierarchy view, you can see the following details of the Objectives such as Objective Name, and ID.
- **Flat option**: The Model Pipeline window shows the flat list of all the models (published and drafts) using the **Flat** option. Flat list is not objective-specific. It shows the models across all the objectives. You can search the models using the Filter by Version, Filter by Status, and All champions. You can also sort the drafts and models by Default or Latest first options.
  - In the Flat list of models, you can see the following details of the models such as Name, ID, Version, Objective ID, Objective Name, Owner, and Status.

Figure 11-63 Model Pipelines

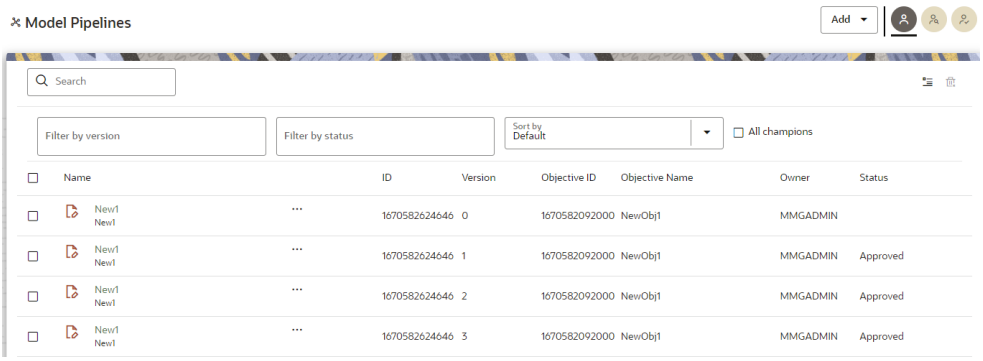
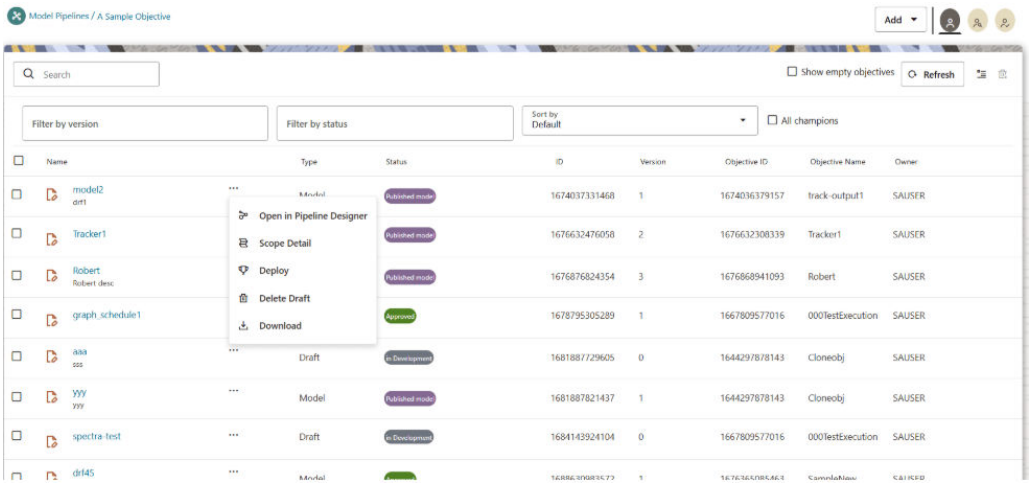


Figure 11-64 Dropdown under Flat List



The following table provides descriptions for the fields and icons on the Model Pipeline page.

Table 11-15 Fields and icons on the Model Pipeline page

Field or Icon	Description
Model Pipeline Page Header	The header that follows the global header in the application.
Breadcrumbs	Indicates the position of the current page in the Model Management hierarchy. Use breadcrumbs locator links to navigate back to higher levels in the hierarchy after you have drilled down through levels of functions. Click to navigate to Model Summary page. Click or to navigate back to Workspace Summary page.

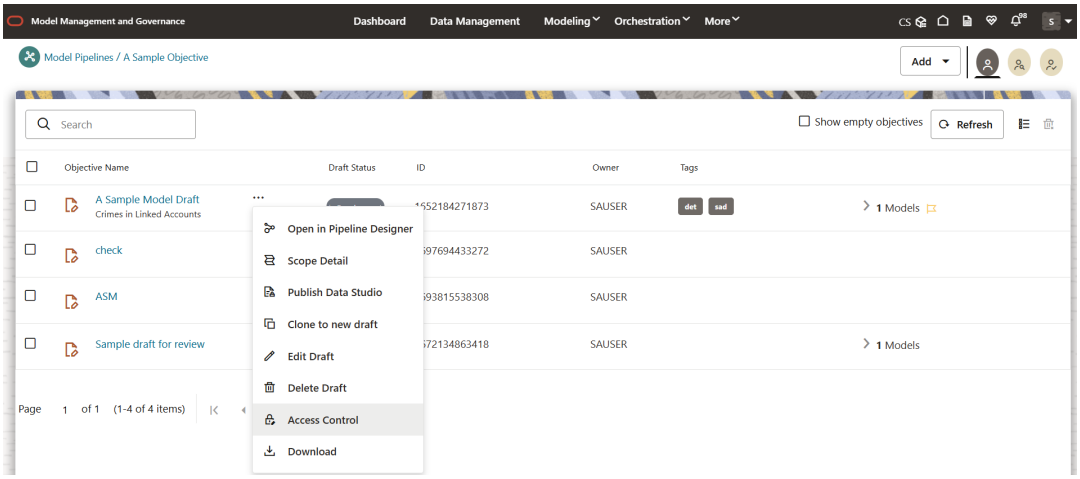
Table 11-15 (Cont.) Fields and icons on the Model Pipeline page

Field or Icon	Description
Create Objectives and Models	Select Add to display a list with the following options: • Draft • Objective • Seeded Models To create Models, select Draft. To create Objectives, select Objective. See the Create Objective (Folders) and Create Draft Models sections for more information. When you are creating a Model by using the extraction widget, you might want to increase the **ZEPPELIN_LIMIT_INTERPETER_OUTPUT** in the Python Interpreter. For information on how to do this, see the question on how to increase the **ZEPPELIN_LIMIT_INTERPETER_OUTPUT** in the Python Interpreter in the Frequently Asked Questions topic of the OFS MMG Installation Guide. However, if you want to know about the cycle of model creation, see the Create, Review, Approve, and Deploy a Model Section.
Requester	Displays that the logged-in user has the Requester privileges when the status is green. You can create a model. However, to approve and publish, the model must be reviewed by a user with reviewer privileges and approved by a user with approver privileges.
Reviewer	Displays that the logged-in user has the Reviewer privileges when the status is green. You can review models. However, to approve and publish, the model must be approved by a user with approver privileges.
Approver	Displays that the logged-in user has the Approver privileges when the status is green. You can approve models that are created and reviewed.
Model Pipeline Page Table	The table displays the objective and model records on the page.
Objective Name	Displays the name and description of the Objective
ID	Displays the ID of the objective.
Owner	Displays the owner who created the Drafts. This information does not display for an Objective.
Tags	Displays the tags associated with the Models or Drafts. This information does not display for an Objective.
Delete Objective	Select to delete the model from the Confirmation dialog box. Click Delete to process or click Cancel to cancel. This information does not display for an Objective.
Edit Objective	Select to edit the models in Data Studio. See the Edit Models section for more information. This information does not display for an Objective.

Note

When executing PGX, the user is unable to access the interpreter 'PGX-Java' for the Notebook type 'Jupyter'. The allowed interpreters are: Python and MD. However, when the user changes the Notebook type from Notebook Interface, the user is able to access the PGX-Java.

Figure 11-65 Access Control Menu option



Access Control Pop has two Access Level Radio button: Restricted Mode and Public Mode.

Figure 11-66 Restricted Mode

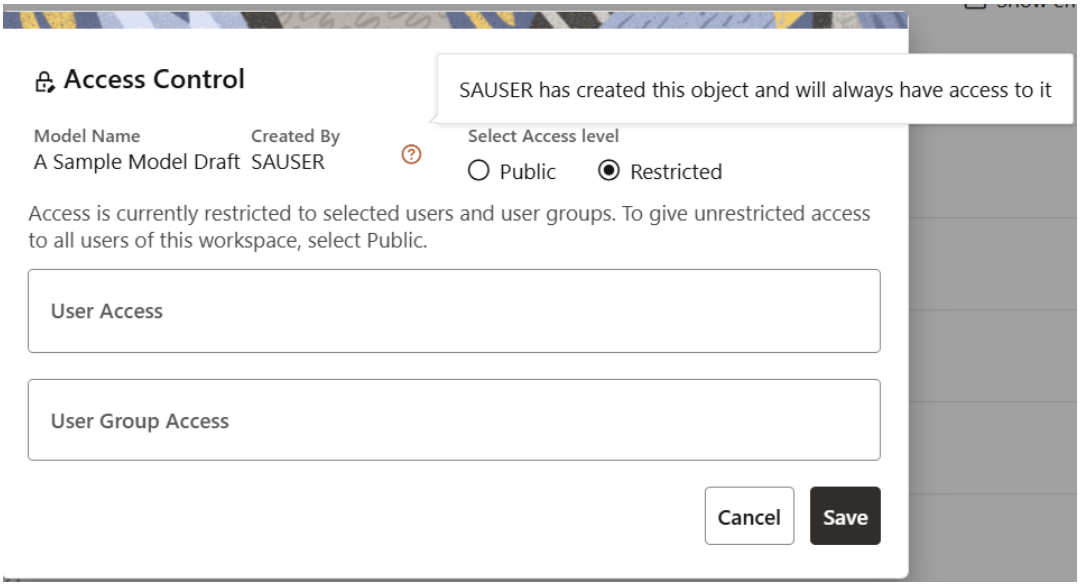
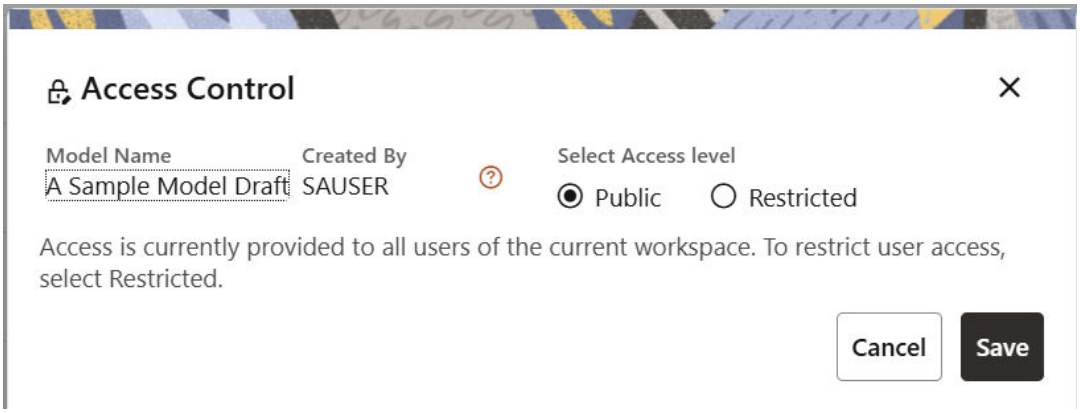


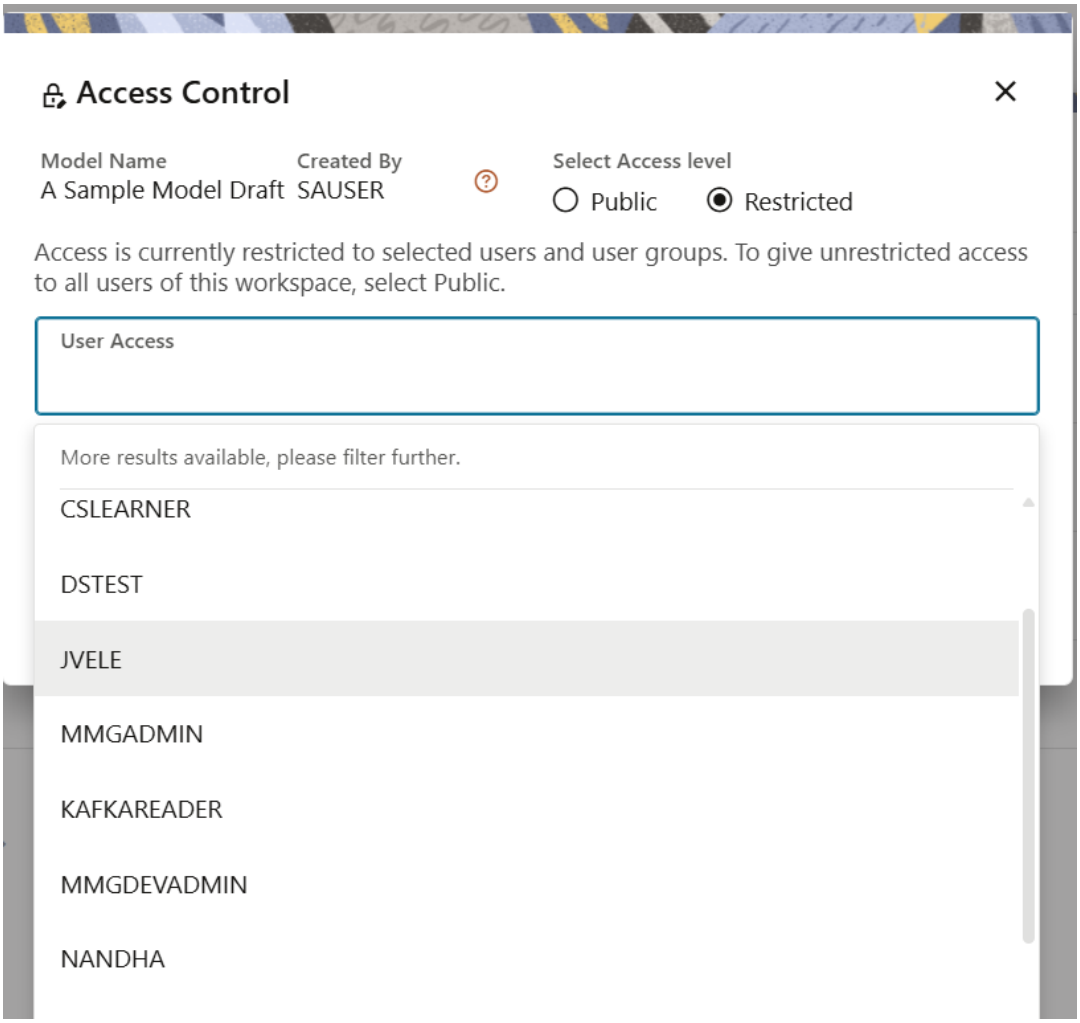
Figure 11-67 Public Mode



The Access Control pop-up have the below details:

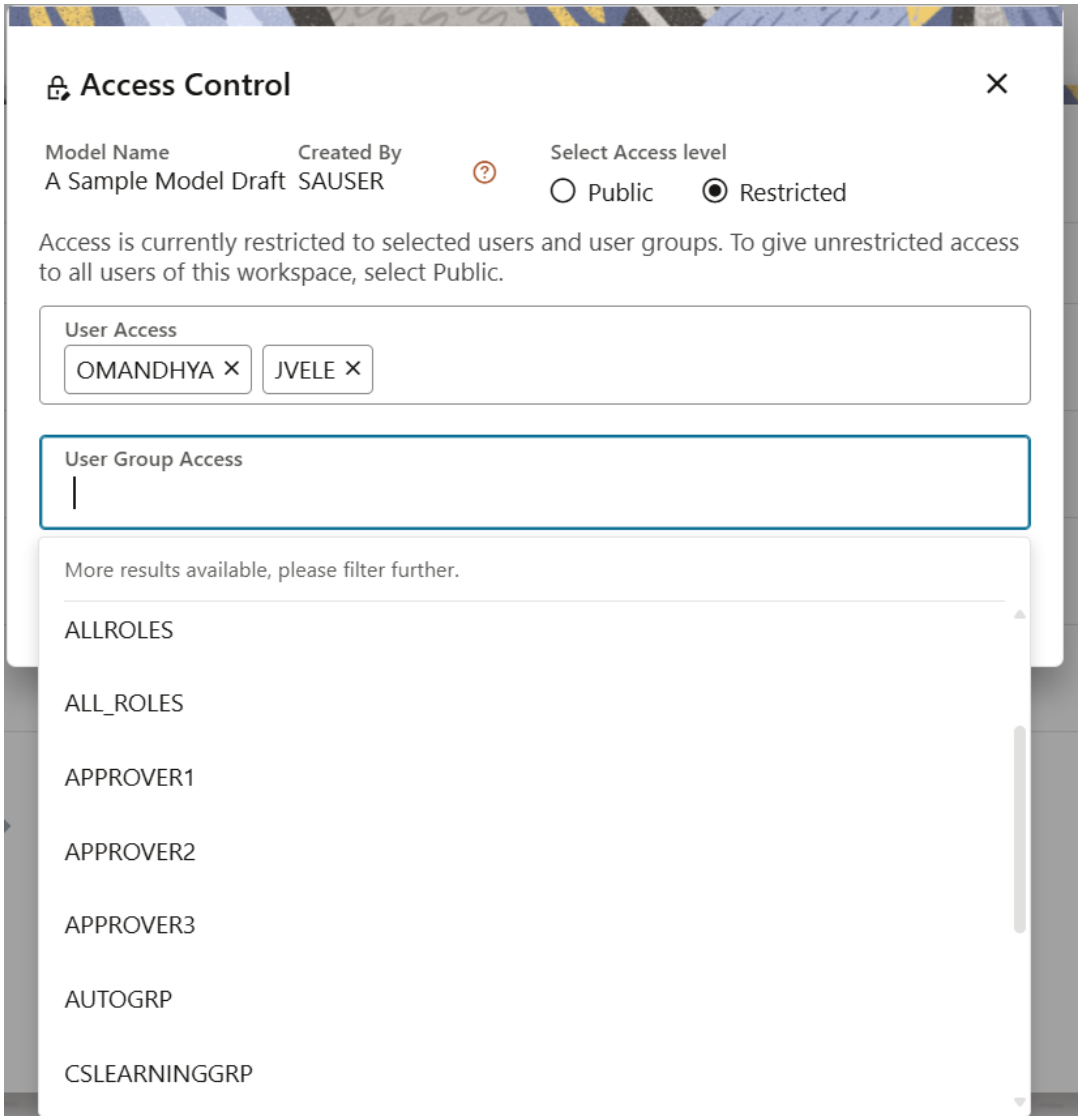
- Model Name
- Created By
- Info
- Select Access level with two radio button options: Public and Restricted
- User Access and User Group Access should list all the users present.
- Cancel button
- Save button

Figure 11-68 Access Control User Dropdown



The Access Control User dropdown fetches all the Users present in the Identity Management.

Figure 11-69 Access Control User Groups dropdown



The Access Control User Groups dropdown fetches all the User Groups present in the Identity Management.

> **Note**
>
> New stage selector in execution drawer is added for execution from pipeline canvas with auto populated selected stage in canvas. User can now run independent stages from pipeline canvas and even from the scheduler. The idea of stage remains same as before, since the stages are dynamic in nature. The stage executed is not shown in the execution history, instead we follow filtering of nodes to execute or nodes that have been executed at runtime.

Manage Models

A Model has to go through an approval workflow before it can be deployed to production. The following types of users in the system have privileges that restrict the activities, they can do in the model creation and deployment workflow.

Table 11-16 Field or icons for the Model creation and deployment

Field or Icon	Description
Requester	You can create a model. However, to approve and publish, the model must be reviewed by a user with reviewer privileges and approved by a user with approver privileges. **NOTE**: User Groups must be mapped to the MDLDEPLOY role to access Requester functions.
Reviewer	You can review models. However, to approve and publish, the model must be approved by a user with approver privileges. **NOTE**: User Groups must be mapped to the MDLREVIEW role to access Reviewer functions.
Approver	You can approve models that are created and reviewed. You can then promote to production and make the model the champion in the production. **NOTE**: User Groups must be mapped to the MDLAUTH role to access Approver functions.

The following sections in this topic provide details for the cycle of creation of a model, review, approval, and deployment:

- Create Objective (Folders)
- Create Draft Models
- Publish Models (Scoring)
- View Model Details
- Compare Models
- Understand Model Governance
- Request Model Acceptance
- Review Models and Move to Approve or Reject
- Approve Models and Promote to Production
- Deploy Models in Production and Make it a Global Champion

Create Objective (Folders)

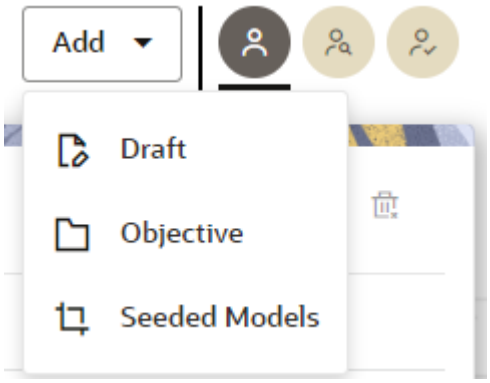
Create folders called Objectives within which you can create Models.

To create an Objective, follow these steps:

1. Click **Launch Workspace** next to the corresponding Workspace to Launch the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

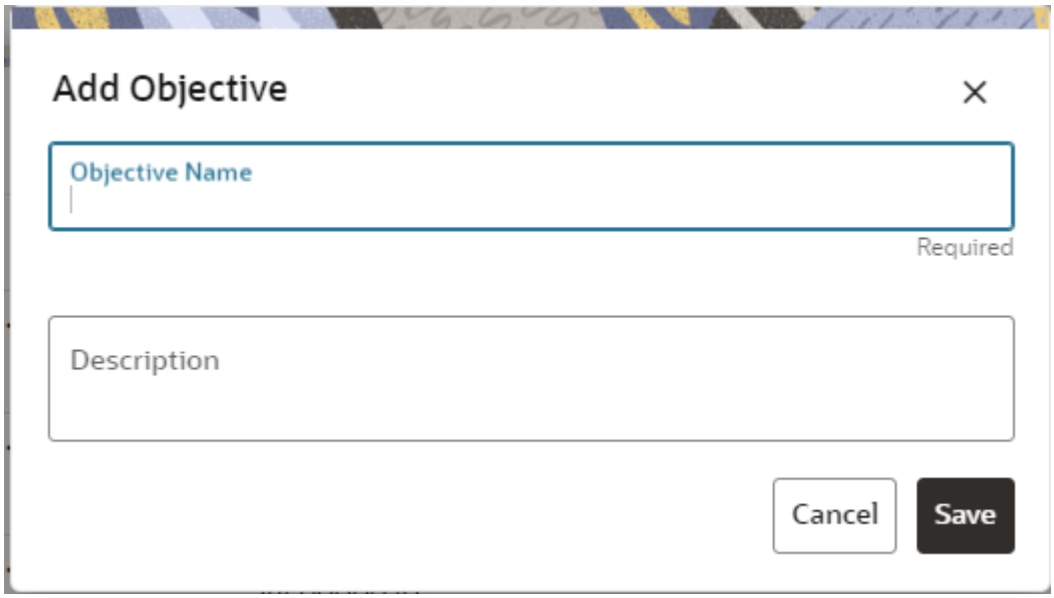
   The window displays folders that contain models and model records in a table.
3. Click **Add** and select **Objective** from the list to display the **Objective Details** dialog box.

Figure 11-70 Select Objective from Add



4. Enter details in Objective **Name** and **Description** fields in the **Add Objective** dialog box.

Figure 11-71 Objective Details Dialog box



5. Click **Save**.

Create Draft Models

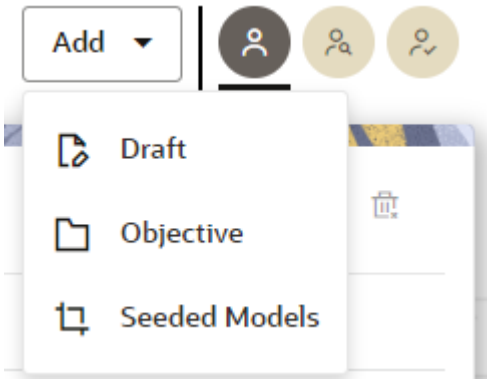
Once an objective has been created, a model draft or notebook can be created where model development can start.

To create a Draft Model:

1. Click **Launch Workspace** next to the corresponding Workspace to Launch the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

   The window displays folders that contain models and model records in a table.
3. Click **Add** and select **Draft** from the list to display the **Add Draft** dialog box.

Figure 11-72 Create Model



4. **Create New Model** is the default setting in the **Model Details** dialog box. Drag the toggle button to select **Import Dump**. Use Create New Model to start from a blank Notebook in Compliance Studio. You can also create a draft under Objective (Folder) also. Click an Objective to open it.

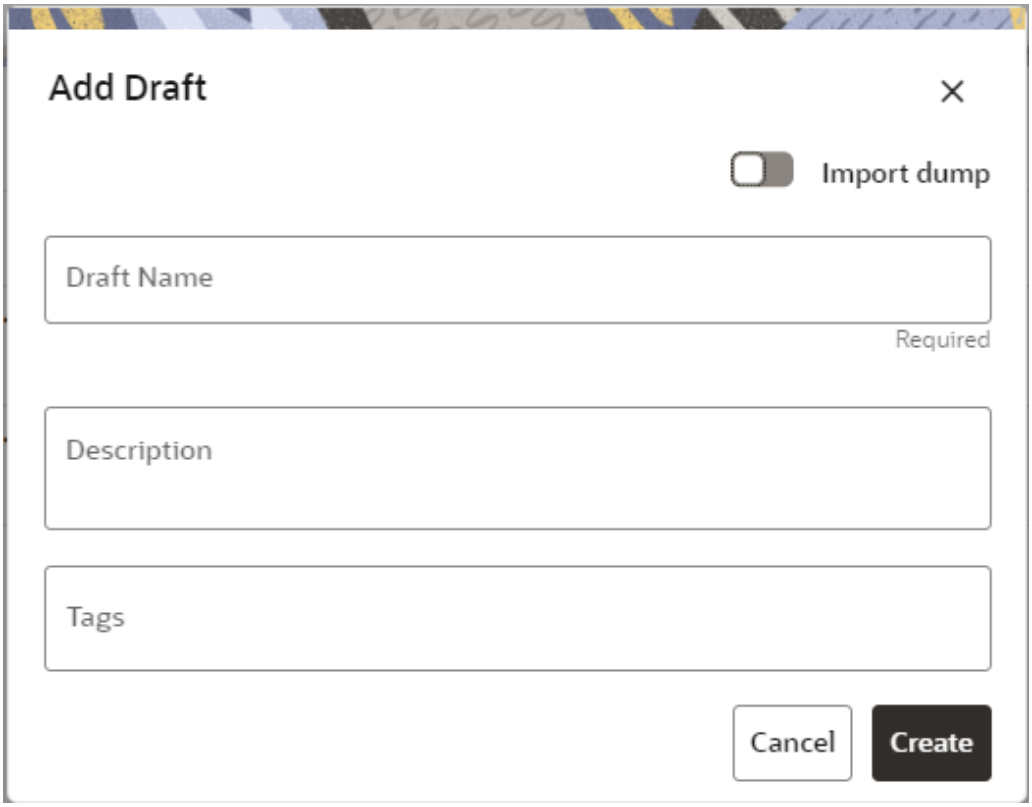
   OR

   Drag the toggle button to select **Import Dump**. Import Dump lets you drag and drop an existing file with model data and modify it. To import a model data dump from another model, see the Import a Workspace Model Data into a New Model section.

   To create a new model:

   a. Enter details for Draft **Name** and **Description**.

Figure 11-73 Model Details- Create New Model



b. Enter a tag in the **Tags** field.

c. Click **Create**.

Create Seeded Models

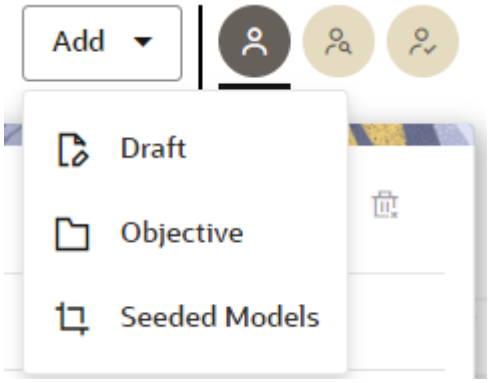
You can seed the models from the external sources which can be imported in the application.

To import the models:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

   The window displays folders that contain models and model records in a table.
3. Click **Add** and select **Seeded Models** from the list to display the **Add Draft** dialog box.

Figure 11-74 Add Seeded Models

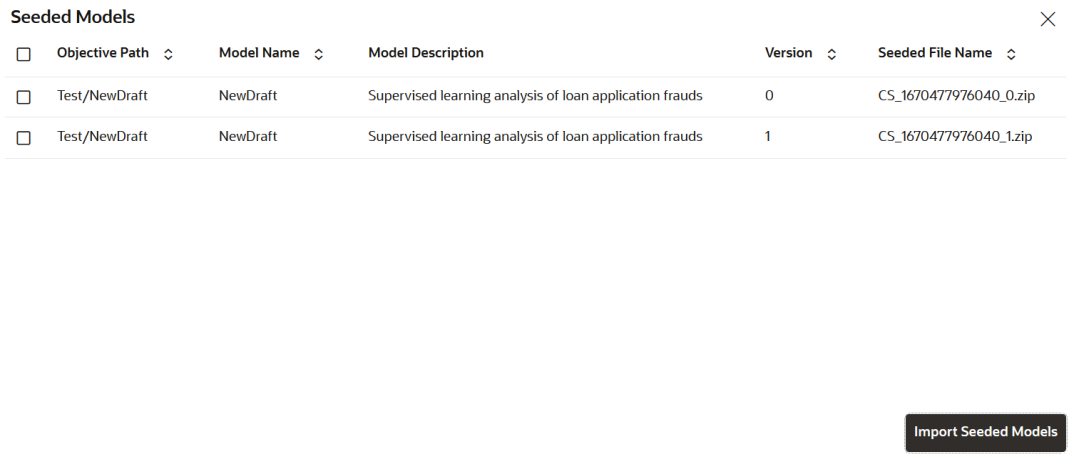


4. You must add the models in the following installed path location:

   `/scratch/ofsaaweb/ftpshare/mmg/seeded/models`

   The added models is displayed in the Seeded Models page.

Figure 11-75 Seeded Models



5. Select the models which you want to import and click **Import Seeded Models**.

The selected models are imported and displayed in the **Model Pipelines** page.

Model Report

This option allows you to view the Model report and download the same in PDF format.

To view and download Report, follow these steps:

1. Open a Model in Pipeline Designer.
2. Click **Generate Model Report**.

   The Model Report window is displayed.
3. Select the Parameters to generate the report.
4. Click **Preview Report**.

   The report is displayed based on selected parameters.
5. Click **Export as PDF** to save the report as PDF in local system.

Download a Model

This option allows you to download the Model. To download a model, follow these steps:

1. Open a Model in Pipeline Designer.
2. Click **Download**.

   A zip folder is downloaded. This folder contains .cfg and .dsnb files.

Delete

This option is used to delete the Model.

Cloning a Model

You can pick any published model and clone the contents to a new draft in the same objective or clone the content to the current parent draft. The cloned draft can be edited and used further. Audit Trail window also captures the clone information.

To clone the model details, follow these steps:

1. Open a Published Model in Pipeline Designer.
2. Select Clone to new Draft or Reimage parent draft with current.

Pipeline Designer

Clicking on the model navigates you to the Pipeline Designer page.

The following sections are available on the Pipeline Designer window:

- Pipeline Canvas
- Dashboard
- Notebook
- Simulations
- Execution History
- Compare

> **Note**
>
> 1. Models in Production workspace have the 'Dashboard' as the default tab.
> 2. Drafts or Models in the Sandbox workspace have the 'Pipeline Canvas' as the default tab.

Pipeline Canvas

You can perform following functions on Pipeline Canvas:

- Creating a Pipeline
- Creating Script Template
- Viewing a Pipeline
- Using Link Connector Nodes
- Execution of Pipeline
- Publishing a Pipeline

> **Note**
>
> Users are now able to view the sub-stages from the canvas with the help of the new stage dropdown.

Create Paragraphs using Pipeline Designer

After creating the Models in the Workspace, create Paragraphs using the **Pipeline Designer** window.

Pipeline Designer enables you to design the paragraph using widgets (graphical representation) instead of using python codes. In addition, if you add new paragraphs in Data Studio, the added paragraphs are displayed in the widget format on Pipeline. Similarly, if you create a Notebook using Pipeline Designer, it can be opened for editing in Data Studio using Studio Notebook option.

> **Note**
>
> When you open the notebooks from the UI, the attach workspace call will be made from mmg service and proper workspace will get attached. If the Studio is opened outside of mmg, then the attach_workspace command has to be used.

This helps the Financial Institutes and Banks in following ways:

- Visualization of the data (for example, based on data tasks)
- View the dependency
- Modify the flow of execution or execution order
- Easy for Auditing purpose

You can execute the flow based on requirement. For example, if you have created one flow and want to execute a flow of training paragraphs out of that and other flow as experimental way, then you can modify using the Training and Experimentation link types. One flow can be break into 2-3 flows for execution purpose.

When a draft is edited using the Pipeline Designer/Data Studio, and published, then a new version of published model is displayed in Model Summary page.

> **Note**
>
> When you add a new paragraph from studio and opened the same in pipeline designer, it gets linked to multiple paragraphs. For example, you have paragraphs P1, P2 and P3 in the same order in a Notebook. It shows in Pipeline Designer canvas as P1 > P3 > P2.
> If you add two new paragraphs P1a and P1b in the Notebook after the P1 and open the canvas, this gets reflected as the following:
>
> 1. P1 -> P1a -> P1b -> P2
> 2. P1 -> P3 -> P2

After opening a Model in the Pipeline Designer, following options are displayed:

- Generate Model Report
- Download
- Delete
- Clone Model

After opening a Draft in the Pipeline Designer, following options are displayed:

- Generate Model Report
- Download
- Delete
- Publish
- Script Template list

Create a Pipeline

To create a paragraph using pipeline:

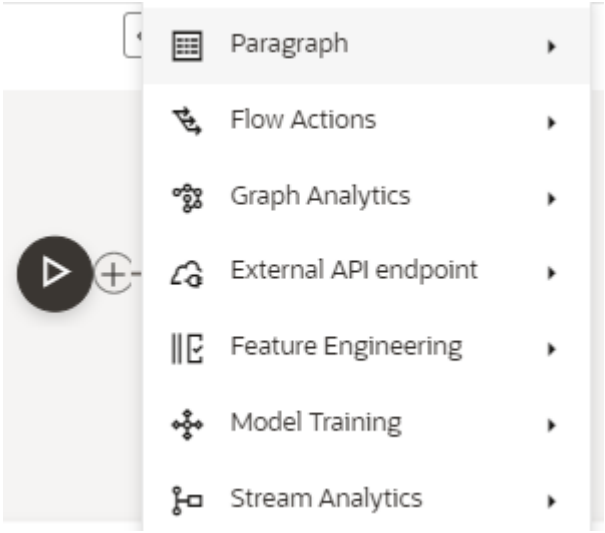
1. Navigate to the **Pipeline Designer** page.

   The Start widget is displayed by default in the canvas screen.

2. Hover over on Start widget and new nodes can be added using the add button in the Pipeline Canvas.

   This will open a menu which contains all the widgets sectioned into different categories. The spectra diagram builder is based on row and column positioning.

Figure 11-76 Create a Pipeline menu



> **Note**
>
> Click on each menu to select the widgets of the required types.

You cannot edit or delete this widget. Whenever a new draft is created (not by importing dump files), the default paragraph created is converted into a start widget. The visibility of code/result/title in notebook of this node will be kept to invisible.

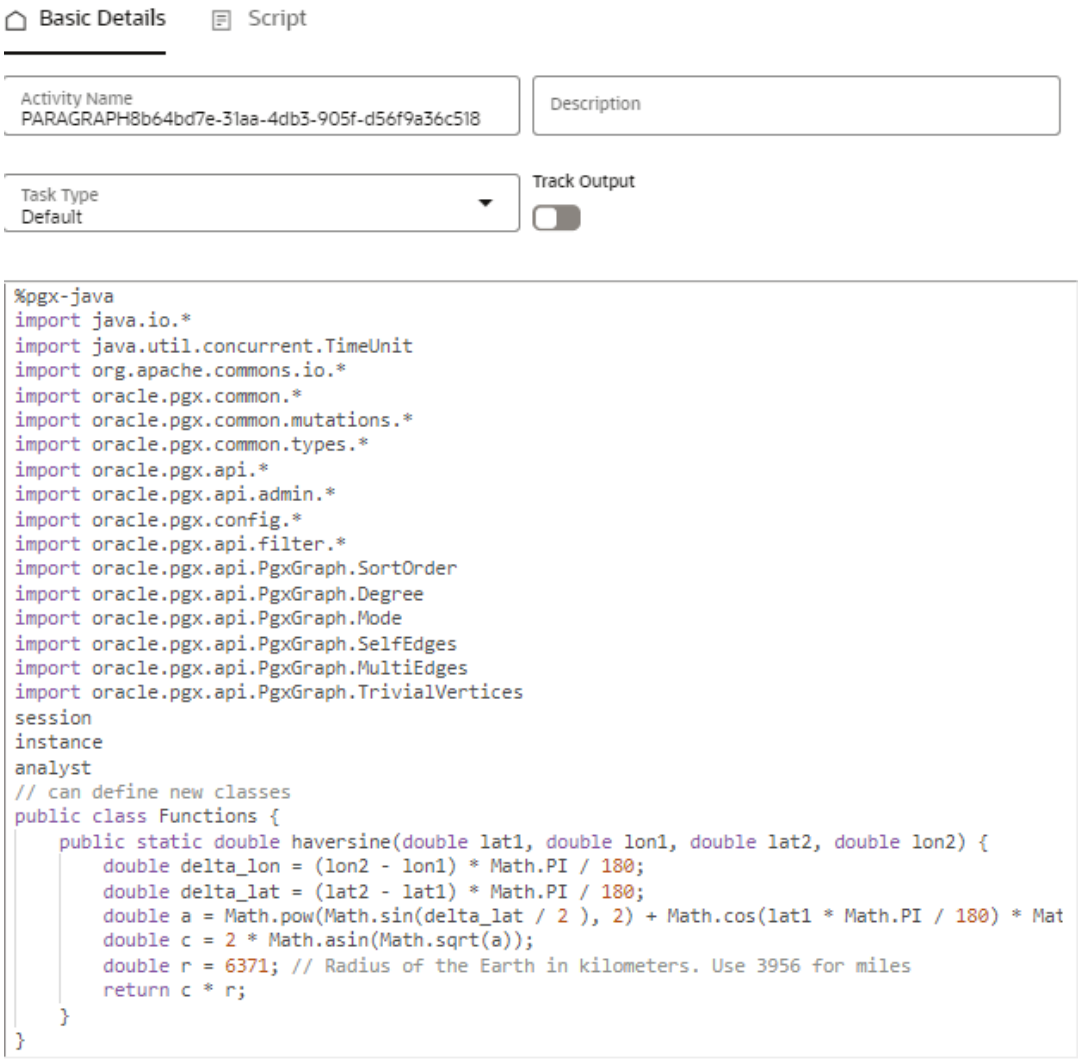
Whenever the notebook is opened, init script execution including workspace attach will happen in this start node.

Title of the node is called 'Start widget'. Publish /download and import /promote to production of model with start widget will keep this widget. Publish from canvas will keep the start widget in the published model. When you publish model from model summary, you can explicitly select the start widget paragraph from the list of paragraphs. After this only, start widget will appear in the published model.

3. Click on the node to add the basic details.

   The Basic Details page is displayed.

Figure 11-77 Basic Details for Paragraph



4. Provide details as described in the following table:

Table 11-17 Adding Details

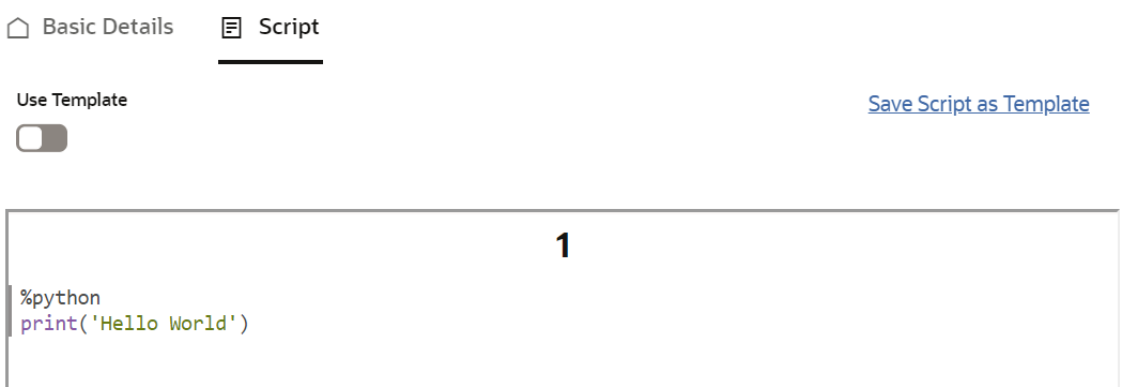
Field	Description
Activity Name	Enter the Activity Name
Description	Enter the description of Activity
Task Type	Select the task type. For example, Model Training, Data Analysis and so on. You can also search the task type.
Track Output	If this option is selected for any paragraph, then during the model comparison the output details are displayed. Keep the Track Output to ON in case you want to execute the paragraph and view the result from the Dashboard tab.
Script	Shows the script. You can edit the script in this screen or in the Script tab. This script can also be saved as the Script Template.

> **Note**
>
> **If** is a conditional node, which behaves based on the execution of the user. It has a script which evaluates **"True"** or **"False"** and based on the value, it chooses either of them. Additionally, we can also add a new node that comes with a default link. The default path will execute irrespective of the result.

Create Script Template

Navigate to Script tab to manage scripts. These scripts can be called for paragraph. You can also create the Script template by clicking on the More options icon in the Pipeline Designer.

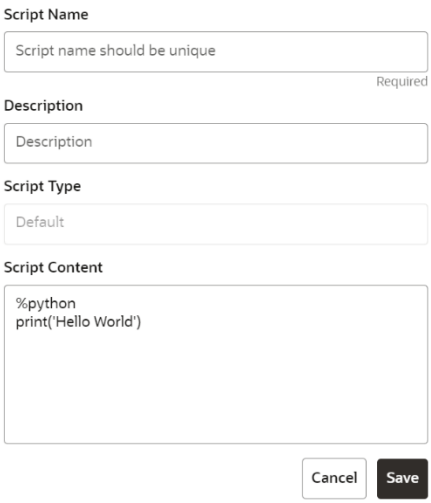
Figure 11-78 Script template



To add a script template:

1. In the **Script** tab, Click **Save Script as Template** link.

Figure 11-79 Script tab



2. Enter the following details:

Table 11-18 Creating Script Template

Field	Description
Script Name	Enter the Script Name
Description	Enter the description of Script
Task Type	Select the task type. For example, Model Training, Data Analysis and so on. You can also search the task type.
Script Content	Enter Python script

3. Click **Save**.

   A node is created.

   You can perform the following functions on Pipeline Designer window:

   - Parameter Sets: Allows you to view, edit, clone, and delete the Parameter Set. Use the Clone option to duplicate the parameter set with different values and name.
   - Publish: Allows publishing the pipeline. This option is displayed for the Drafts.
   - Deploy: Allows you to deploy the model. This option is displayed for the published models.
   - More Actions icon:
     - Generate Model Report: To generate model report
     - Download: Use Download to download the current working version in opened in canvas
     - Script Template list: Allows you to add, edit, view, and delete the script templates.
     - Delete: Allows to delete the current working version. If this is first draft of Model, it will delete all the dependent published version in the Sandbox. If the Model is not first version, then it will delete only the current working version.

     The following options are displayed only for the published models.

     - Clone to new draft: Allows to create a new draft with the same pipeline.
     - Overwrite existing draft: Allows to overwrite the existing draft with the current published model.

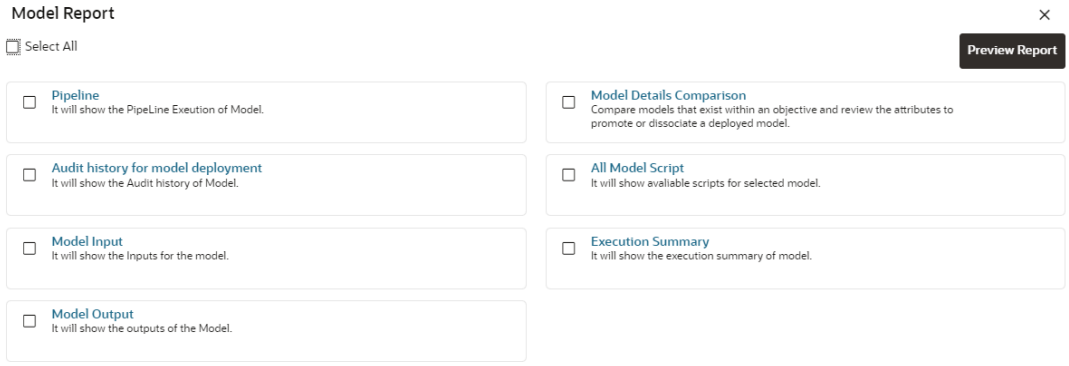
Model Report

This option allows you to view the Model Report and download the same in PDF format.

To view and download report:

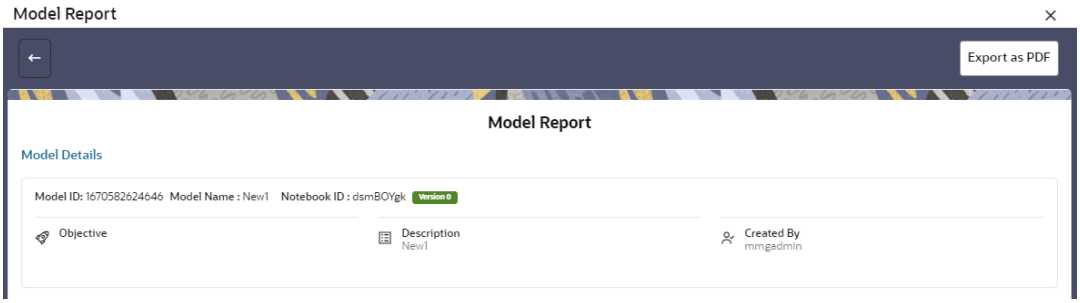
1. Open a Model in Pipeline Designer.
2. Click **Generate Model Report**.
   The Model Report window is displayed.

Figure 11-80 Model Report window



3. Select the Parameters to generate the report.
4. Click **Preview Report**.
   The report is displayed based on selected parameters.

Figure 11-81 Model Report



5. Click **Export as PDF** to save the report as PDF in local system.

Download a Model

This option allows you to download the Model.

To download a model:

1. Open a Model in Pipeline Designer.
2. Click **Download**.
   A zip folder is downloaded. This folder contains .cfg and .dsnb files.

Delete

This option is used to delete the Model.

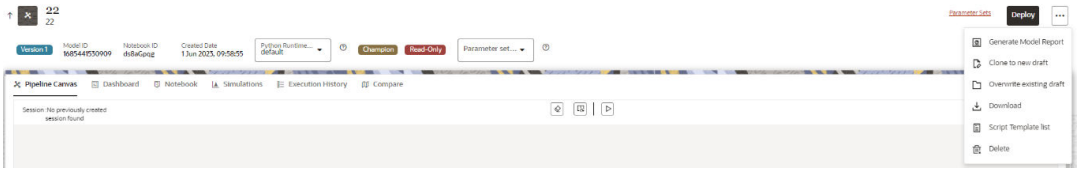
Cloning a Model

You can pick any published model and clone the contents to a new draft in the same objective or clone the content to the current parent draft. The cloned draft can be edited and used further. The Audit Trail window also captures the cloning information.

To clone the model:

1. Open a Published Model in Pipeline Designer.

Figure 11-82 Published Model in Pipeline Designer

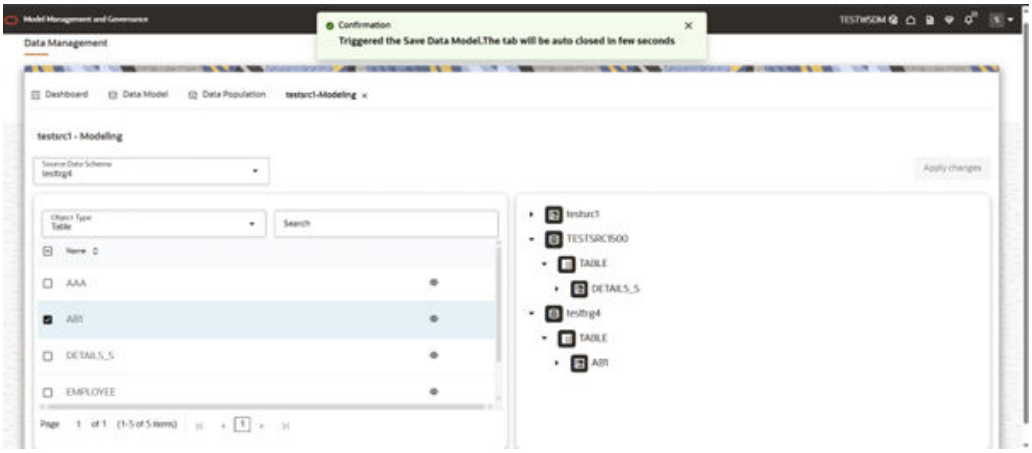


2. Click **More Actions** icon and select **Clone to new draft** or **Overwrite existing draft** option.
   You can perform the following functions on Pipeline Canvas window:

   - **Clear Execution Results:** Clears the execution details.
   - **Invalidate session:** Deletes the previous session details.
   - **Execute:** Allows you to execute the pipeline.
   - **Save Now:** Allows saving the pipeline.
   - **Open Notebook in session:** Allows you to open the notebook in canvas. This is displayed after the pipeline is executed.
   - **Execute Notebook in another session:** Allows you to provide different data for the same notebook execution. This option is only displayed when execution is in progress.
   - **Stop Execution:** Allows you to stop the execution which is in progress. This option is only displayed when execution is in progress.
     Whenever user executes a batch, a user session is created. This execution time can be less or more for any execution. Sometime, user doesn't want to wait for execution to complete and navigate away from the Pipeline Canvas page.

     For example, if user does not want to execute all the paragraphs and want to execute only Paragraph 1 and Paragraph 2. Paragraph 1 takes 15 minutes time for execution and Paragraph 2 takes 10 minutes for execution. Paragraph 2 execution also wants to use the execution of Paragraph 1. In this case, user can navigate away from the page. A confirmation message is displayed to close the current session. Here, this session time is configurable.

Figure 11-83 Confirmation message



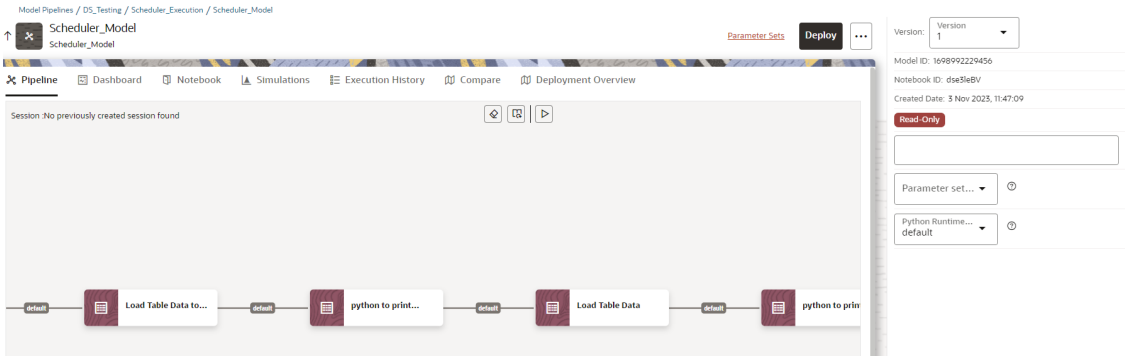
   - If user clicks **Yes**, then execution thread will be closed for this given session time.
   - If user clicks **No**, then execution thread will be valid for this given kill time and run in the background.

You can configure these values in Application.xml file. For more information, see the *MMG Installation Guide*.

Add a Version, Parameter set, and Python Runtime parameters

The Pipeline canvas window allows you to add a Version, Parameter set, and Python Runtime parameters.

Figure 11-84 Pipeline canvas window



- **Version**: Select the version for the pipeline.
- **Parameter Set**: Select the required parameter set. The selected parameter set will be promoted along with the model pipeline at the time of deployment and you can update this dependency based on your requirements.
- **Python Runtime Parameters**: Select the required Python Runtime parameter. The selected Python runtime parameter will be used during all the executions and you can update this dependency based on your requirements.

View a Pipeline

The Pipeline canvas window allows you to view the Pipeline using the following options:

- **Auto-align**: Arrange all the widgets in vertical order. After saving, the reverting option will not work.
- **Revert-align**: Revert all the widgets if they are Auto-aligned.
- **Refresh**: Refresh the pipeline canvas.

Execute a Notebook

The Execute icon on Pipeline Canvas allows us to execute the notebook.
The following link types are available in the Pipeline Designer:

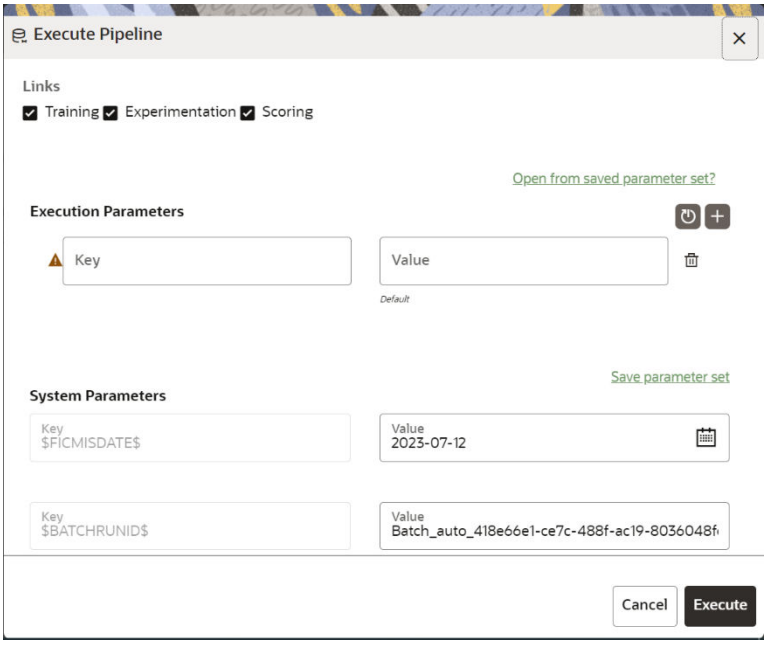
- Default
- Scoring
- Training
- Experimentation

> **Note**
>
> When a model gets published from Model summary page, the Link types configured in Pipeline Designer are set to Default link type.

To execute the notebook:

1. Click **Execute** to view **Execute Pipeline** window.

Figure 11-85 Execute Pipeline



2. Execution parameters are the parameters defined in the notebook required for execution. Select the flow, which you want to execute Scoring, Training, and Experimentation. It displays all the keys defined for all the paragraphs in the notebook with a placeholder for providing the values.
3. Enter the execution Key and Value.

   You can also use Runtime parameters for execution. This runtime parameter must be defined in Notebook. If this is defined, you can enter execution value during the process execution.

   For more information, see Create Paragraphs in Model Studio Notebooks section.

   The System Parameters window also shows the execution ID, execution Date, and execution Batch. These are required for executing all the paragraphs along with other parameters. It also shows from where the parameter comes from as a subscript.

   - **Parameter Sets**: These are the set of parameters with a specific value required for an instance of execution. It consists Key and Value. You can save the parameters set that can be used for one execution instance and reuse it for the next execution. It consists of parameters with a specific value to each parameter. Parameters containing no value will not be taken. Each set is identified with a unique code for each objective. While saving the parameter, you have to provide a code for identifying the name and description which is not mandatory.
     You can save Key Value parameter set using the Save Parameter Set option. To Save Parameter Set, enter the Threshold Value and Description in the Parameter Set window.
   - **Selecting Parameter Set**: These saved Parameter Set can be selected during the execution. It will replace the values of the parameters from the chosen Parameter Set. To select the Parameter Set, follow these steps:

- Click “Open from saved Parameter Set". The Threshold Code window is displayed.
- Select the Parameter Set from the available list. You can select multiple Parameter Set in the same execution instance. In that case, if there are any common keys, value will be replaced with that from the latest Parameter Set selected.

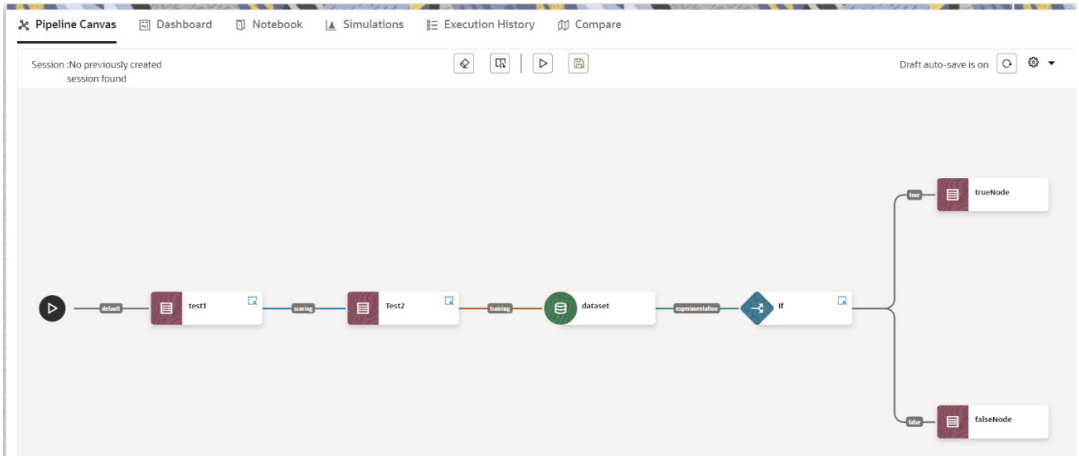
4. You can add new parameters using **Save parameter set** option.

> **Note**
>
> If the parameter is not defined in the notebook, it will not be used for the execution. In case of multi select, if there are common parameters among the chosen scenarios, it will take the value based on the order of selection. that is first chosen scenario parameter will be taken.

5. But if open from saved Parameter Set again (not on single go), then already added will get replaced by the newly added (same as what existed).
6. Execution is performed based on selected link types. It filters out all the not required/ unused parameters. And all the unused parameters for the current execution are displayed with a warning. To view the only required parameters, click **Show only required**link.
7. Click **Reset**to reset the entered data.
8. Click **Delete** to delete the entered Key and Value.

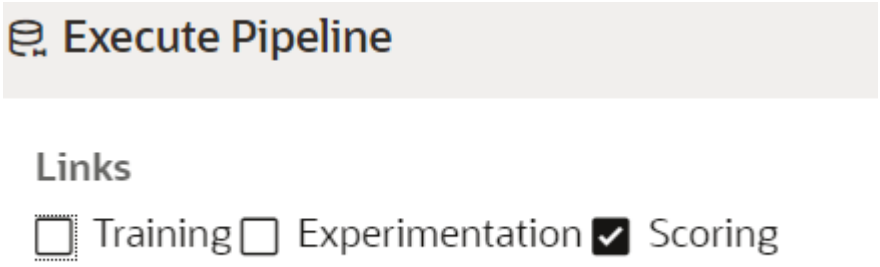
   For example, refer to below figure.

Figure 11-86 Example of Pipeline Canvas



- Here, if you want to execute this Notebook for scoring purpose, then the flow will be executed till Test 2. To perform this, Click Execute Notebook and select Links as Scoring.

Figure 11-87 Execute Pipeline



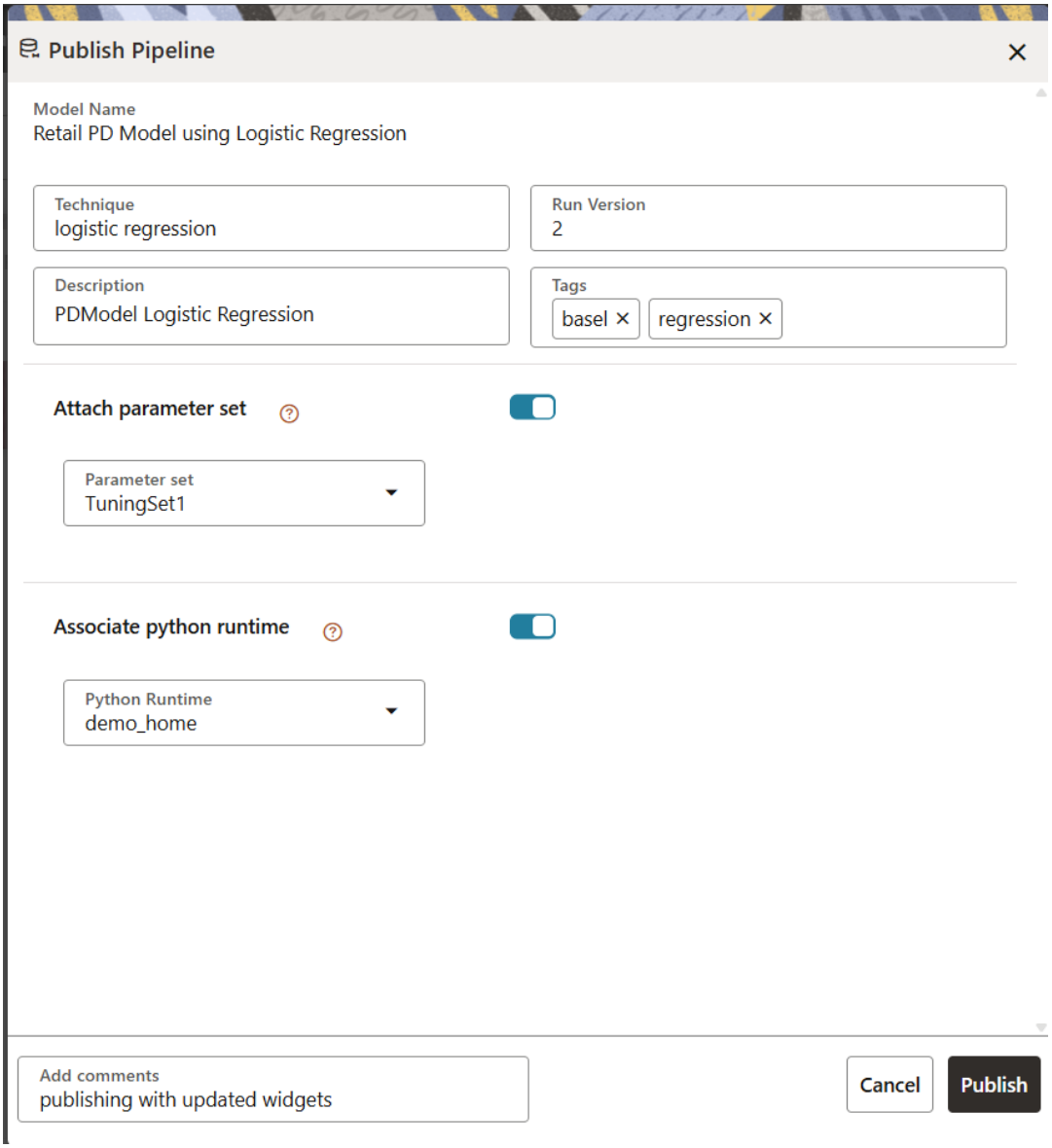
- Similarly, if you want to execute this Notebook for training purpose, then the flow will be executed till dataset with default paragraphs. To perform this, Click Execute Notebook and select Links as Training.

Publish a Pipeline

To publish the pipeline:

1. Click **Publish** to view **Publish Pipeline** window.

Figure 11-88 Publish Pipeline



2. Enter the details as shown in the following table.

Table 11-19 Field and its description for the Publish pop up window

Field or Icon	Description
Model Name	The field displays the name of the Model.
Model Description	The field displays the description for the Model. Enter or modify the description if required.
Technique	Enter the registered technique to use.
Run Version	Select a run version.
Tags	Enter one or more tags to associate with the Model Pipeline. The tags help to categorize your pipeline. These tags are permanent and cannot be modified after publishing.

Table 11-19 (Cont.) Field and its description for the Publish pop up window

Field or Icon	Description
Attach Parameter set	If this option is enabled: • Selected parameter set will be associated with the published model. • Best performing parameter set or prime reference of the objective is recommended to be associated with the model. • This set is further used for promoting to production at the time of deployment. • Users can update this dependency from model details screen.
Associate python runtime	If this option is enabled: • Selected python run time will be associated with the published model. • This python run time will be further used for promoting the model to production at the time of deployment. • Users can update this dependency from model details screen.

3. Click **Publish**.

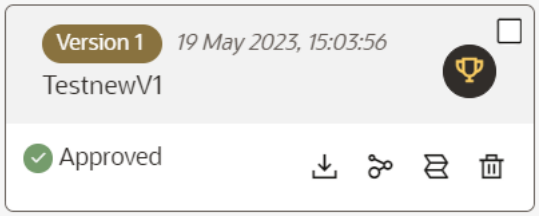
View Model Details

You can view model information for deployed models, models that require approval, and so on.

To view model details:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.
   The window displays folders that contain models and model records in a table.
   - The icon indicates that Model 1 is the champion.
3. Hover over the model records to view the various icons.

Figure 11-89 Mouse over the Model



The icon actions are listed in the following:

a. Download
b. Open in Pipeline Designer. See the Create Paragraphs using Pipeline Designer section for more details.
c. Scope Detail. See the Scope Detail section for more details.

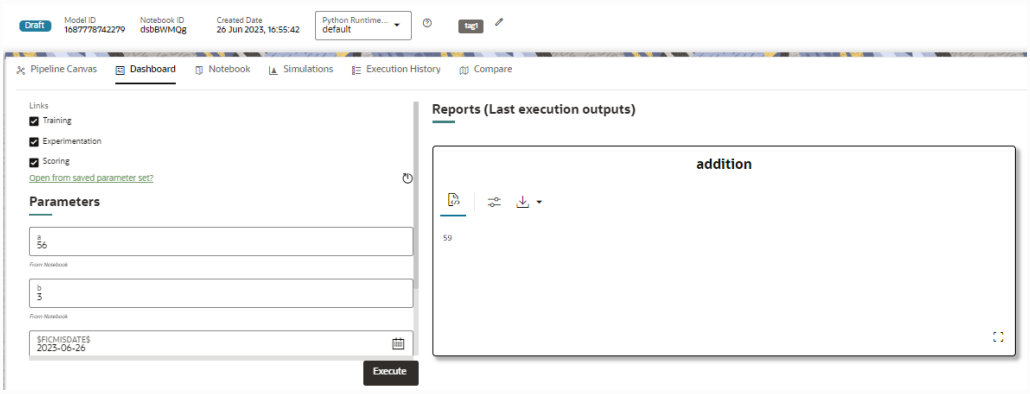
d. Delete Model.

Dashboard

This section of Pipeline Designer allows you to execute the models and also displays the execution output of a model if the widgets are saved with the Track output option enabled.

> **Note**
>
> For *Promoted* models, the **Dashboard** is the default tab.

Figure 11-90 Dashboard



This tab contains two options for execution:

- **Batch:** This provides all the required inputs upfront and executes the pipeline end-to-end in a single run.
- **Interactive:** This executes the pipeline stage-by-stage; the run pauses at each stage to prompt the required inputs for that stage before continuing further.

> **Note**
>
> In an Interactive execution, when two or more paragraphs within the same stage are configured to run in parallel, the input prompt may not list the parameters for all the parallel paragraphs, for example, parameters for *Para2* may not be displayed. As a workaround, avoid parallel executions for paragraphs that require interactive inputs, or move the paragraphs to separate stages so that inputs are collected sequentially.

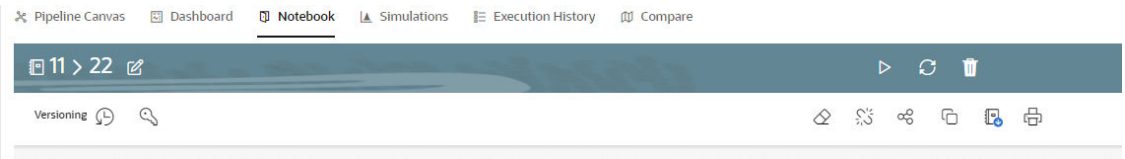
> **Note**
>
> There is no Cancel button in Settings tab of reports in the Dashboard tab. You can press 'Escape' key to close the Settings.

Notebook

> **Note**
>
> The Username is case sensitive. Ensure you use the correct case for the username when accessing and executing the notebook.

Navigate to **Notebook** page to view the paragraphs. You can run, Restart session, edit, add, export the notebook, and so on.

Figure 11-91 Notebook page



> **Note**
>
> The following features on Notebook are not supported in the current release.
>
> - Cloning the Notebook
> - Sharing the Notebook
> - Versioning the Notebook
> - Modifying the Notebook
> - Deleting the Notebook
> - Attaching credentials to the Notebook
> - Entering dependency modes to the Notebook

Steps to enable two or more users to access the same Notebook with distinct sets of permissions

To enable two or more users to access the same notebook with distinct sets of permissions, follow these steps:

1. Create a New Role in Data Studio
   Log in to MMG with a user account that has DSUSRGRP (Data Studio User) access:
   - Navigate to Data Studio Options > Permissions and switch to the Roles tab. # Click Create Entity and create a new role (For example, DSREADONLY). Assign the desired permissions, such as:
   - View Code
   - View Notebook
   - View Sessions
   - View Result

- View Paragraph for Read-Only access to Data Studio Notebooks.

2. Create a Corresponding User Group.
   Navigate to your Identity Management page and create a new user group with the same name as the role created in Data Studio. For example, DSREADONLY.
3. Update Application Configuration.
   To validate the new user group, update the `application.yml` file:
   - Navigate to `mmg-studio/conf/application.yml. #`
   - Under studio-server.security, append the newly created role to the validRoles field, separated by commas (For example, validRoles{*}: "MDLUSR,MDLREV,MDLAPPR,MDLBATCHUSR,DSUSRGRP,DSREDACTGRP,MDLVIEW,DSREADONLY").
4. Restart Data Studio.
   Restart Data Studio using the following commands:
   - # ./shutdown.sh
   - # ./startup.sh
5. Map the New User Group to a User.
   Navigate back to the Identity Management screen and map the newly created user group (DSREADONLY) to the user(s) you want to grant these permissions.

   Markers for track output and link types from Notebook and syncing up with Canvas

   Markers for track output and link types from notebook and syncing up with canvas Using specific key words like "##track output##", there should be an option to provide these key words from the notebook paragraph and sync up with the pipeline. User will not have to use canvas interface here. This has to be done for output tracking and link types to determine execution paths (training,scoring,experimentation).

   These are only applicable for draft and 'PARAGRAPH type nodes:

   - ##track_output## - For paragraph output tracking
   - ##training## - For training nodes
   - ##scoring## - For scoring nodes ##Experimentation
   - ## - For Experimentation nodes

   If the marker "##track_output##" is added in the Notebook paragraph, the canvas will automatically be synced up with this and corresponding node output will be tracked. If the marker is removed, the output tracking will be set to off.

   On execution, if any of the nodes are associated with a path, the paths added on the links will not be considered for the execution. There is also an option to choose these path types from the node basic details window.

Access Module for File/Folder Operations

The OFS MMG Access feature provides utility functions where code can be used with OFS MMG workspaces and the file system within the OFS MMG Studio to perfrom file/folder related operations.

It is assumed that the module has already been imported by using one of the following codes:

```
from mmg.access import
```

or

```
import mmg.access as mac
```

> **Note**
>
> The workspace attachment step must be performed before using any of the following API mentioned in this section. The current working directory will always be the path inside the FTPSHARE of the attached workspace. For example, <FTPSHARE_PATH>/mmg/<WS>
>
> If the source and the destination starts with /, then it is assumed to be an absolute path (as is the case with os and shutil. Hence, to maintain the compatibility, the same is the case with the OFS MMG access feature module APIs

Table 11-20 List of APIs

Name	Description	Usage Example	Note
getcwd	Returns the current working directory path within MMG FTPSHARE for the active workspace.	getcwd()	The getcwd() function returns the path inside the attached workspace that is within FTPSHARE. It does not reflect the actual cwd path that is returned from the os.getcwd() function. Hence, using os.chdir() will not affect the getcwd() function implemented from the OFS MMG access module library.
move	Moves a file or directory to another location.	move(src='/source/path', dst='/destination/path')	
copy	Copies a file with metadata from one location to another.	copy(src='/source/path', dst='/destination/path')	
copyfile	Copies a file without its' metadata.	copyfile(src='/source/file', dst='/destination/file')	
copytree	Recursively copies a directory tree to the destination.	copytree(src='/source/dir', dst='/destination/dir', dirs_exist_ok=True)	
listdir	Lists all files in the specified directory.	listdir(path='/your/dir')	
remove	Removes a single file from the specified path.	remove(path='/file/to/remove')	
rename	Renames a file within the current workspace.	rename(src='/old/filename', dst='/new/filename')	

Limitation:

- **%shell:** This is not enabled by default. Shell execution is generally considered a security risk and is disabled unless explicitly required and approved as per internal security guidelines.
- **%spark:** This is the Data Studio default configuration (spark.json) and enables both `%spark` and `%pyspark`; however, the **Add** button is enabled only for `%pyspark` by default. Enable `%spark` only if it is required by the application or customer and is approved.
- **%jdbc:** This is the Data Studio default configuration and enables the **Add** button for `%mysql` but not for `%jdbc`. Enable `%jdbc` only if it is required by the application or customer and is approved.

Create Paragraphs in Model Studio Notebooks

When logged in to the OFS MMG application, the operating system and similar libraries can be used to view/edit/delete the files that are outside the FTPSHARE or workspace bounded path.

1. Log in to the application.
2. Create a notebook.
3. Create script by using the operating system library.
4. Use `os.remove(), os.listdir()` by providing the path that is outside the scope of FTPSHARE.
5. The above operations will be run successfully.

Create Paragraphs

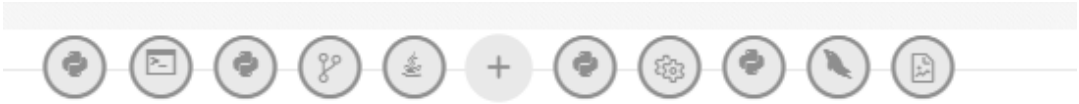
The paragraph should be added after the start widget paragraph. Navigate to Notebook page to create the paragraphs.
The following types of paragraph creation are supported for model creation:

- Python Paragraph
- Shell in Python Paragraph
- Conda Paragraph
- PGQL Paragraph
- PGX - Java Paragraph
- Paragraph
- PGX - Python Paragraph
- PGX – Algorithm Paragraph
- PGX - PySpark Paragraph
- MySQL Paragraph
- Markdown Paragraph

To create Paragraphs in the Model Studio Notebooks:

1. Open the draft in Pipeline Designer and click **Notebook** tab.
2. Hover your mouse above or below a paragraph to display the interpreter toolbar.

Figure 11-92 Interpreter toolbar



3. Click an icon in the toolbar to select an interpreter and add a new paragraph that uses that interpreter. When you click some of the icons, the paragraph that's created includes example code that you can run.

> **Note**
>
> You should not delete the start widget paragraph or rewrite the contents of this seeded paragraph.

Add Python Paragraph

- Click **Add Python Paragraph** in Model Studio to add a python paragraph in the Notebook and add the following scripting instructions.

  1. To fetch connection objects:
     `conn = mmg.getConnection(<workspace name>)`

     This creates a cx_oracle based connection object to the datadom of the workspace being passed:

  2. To fetch current Notebook and Model Objective details, use the following predefined parameters:

     - `currentNotebookId` - fetches the current notebook ID
     - `objectiveId` - fetches the current objective ID

     To fetch the runtime parameters supported in Model Studio runtime or to access optional parameters passed from scheduler services:

     - To access predefined batch runtime parameters like `taskid`, `batchrunid`, and `ficmisdate` passed during the model execution from scheduler, use the following variables : $BATCHRUNID$, $TASKID$, $FICMISDATE$.
       Example:

       ```
       %python
       print('BATCHRUNID value is : ${$BATCHRUNID$}')
       print('TASKID value is : ${$TASKID$}')
       print('FICMISDATE value is : ${$FICMISDATE$}')
       ```

     - To access any optional parameters passed during the model execution from scheduler, use the below sample script:

       ```
       %python
       print('threshold value is : ${threshold}')
       ```

> **Note**
>
> Threshold is the optional parameter passed during the model execution.

> **Note**
>
> For more details on the predefined functions available in MMG for python scripting, see Appendix -I.
> Click the icon to run the script.

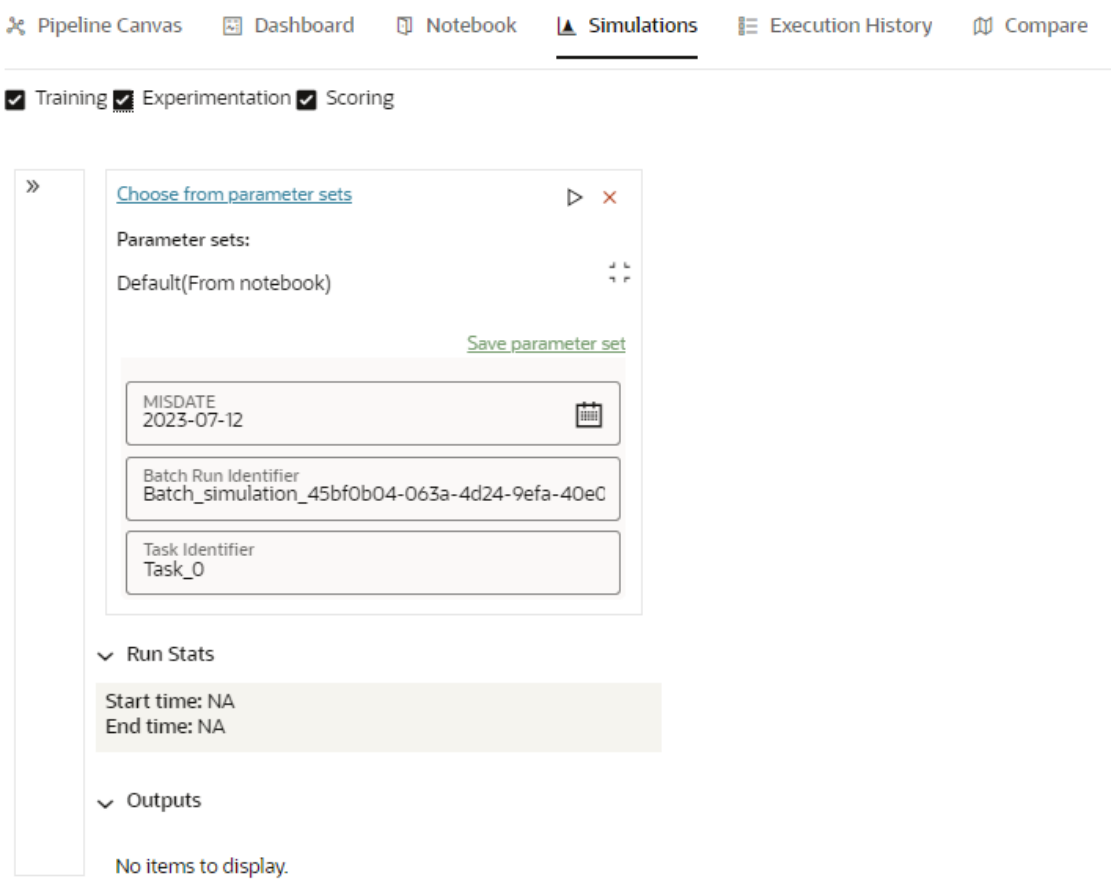
> **Note**
>
> The execution result from the Pipeline Canvas screen is not displayed in the notebook tab.

Simulations

Simulation run is for executing a single notebook in parallel by giving different values for same parameters. The simulation flow allows for iterative execution along that path with input drivers (variables) that are passed through a parameter set.

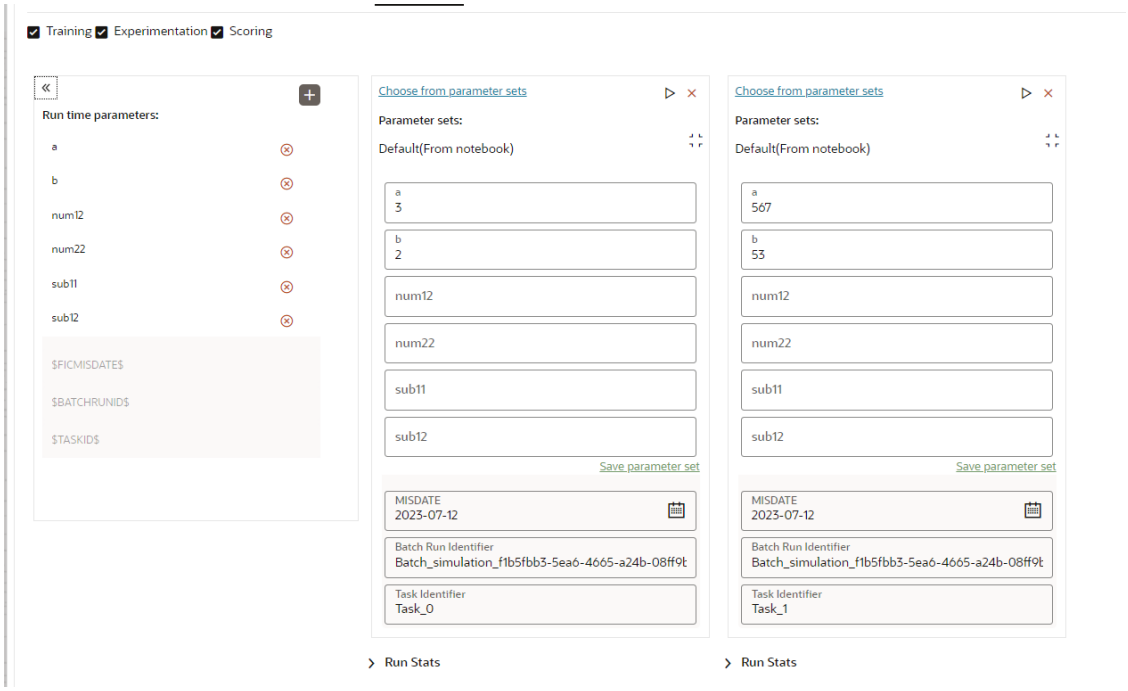
You can either create a new parameter set or use the existing parameter set and execute it from this tab. In addition, you can select or deselect the link types which you want to execute.

Figure 11-93 Simulation tab



If you want to add different values for the same parameter, click Add Run. You can add any number of Run based on your requirements and then click Execute all to execute at one time. The Batch Run Identifier will be same for all runs and the Task id will be incremented for newly created run.

Figure 11-94 Run Stats



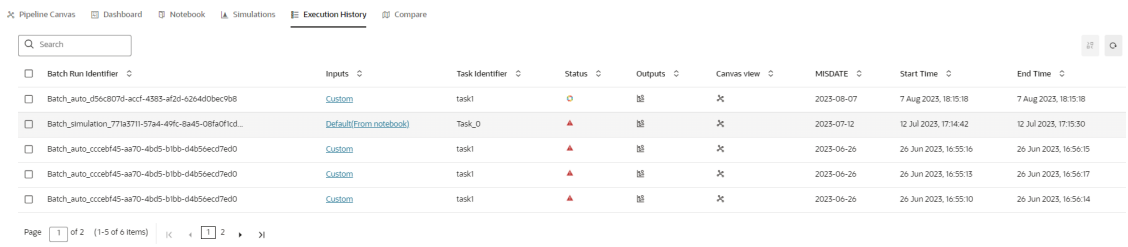
The Run Stats displays the execution start and end date. The Outputs of the tracked nodes will be shown under the inputs of each run panel.

Execution History

This section of Pipeline Designer shows the history of the executed pipelines.

> **Note**
>
> Add file output button in execution history tab that opens file manager at a specific path exposed by the save dataframe widget in the pipeline window. When the save dataframe widget is not available in the pipeline, show that the path does not exist from file manager.

Figure 11-95 Execution History tab



You can compare and refresh the executions by clicking on **Compare**and **Refresh** icons.

To view the inputs, output, and canvas view, click on the corresponding options in the table.

Clicking the **Output** icon displays the Output Details page, where you can view "Executed-only" paragraph outputs. By default, this option is enabled, you can disable this option based on your requirements.

By default, **Tracked** option is selected that displays outputs tracked from the time of the execution. Select **All** option to view all the outputs.

Compare

This section allows you to compare the models with Champion model.

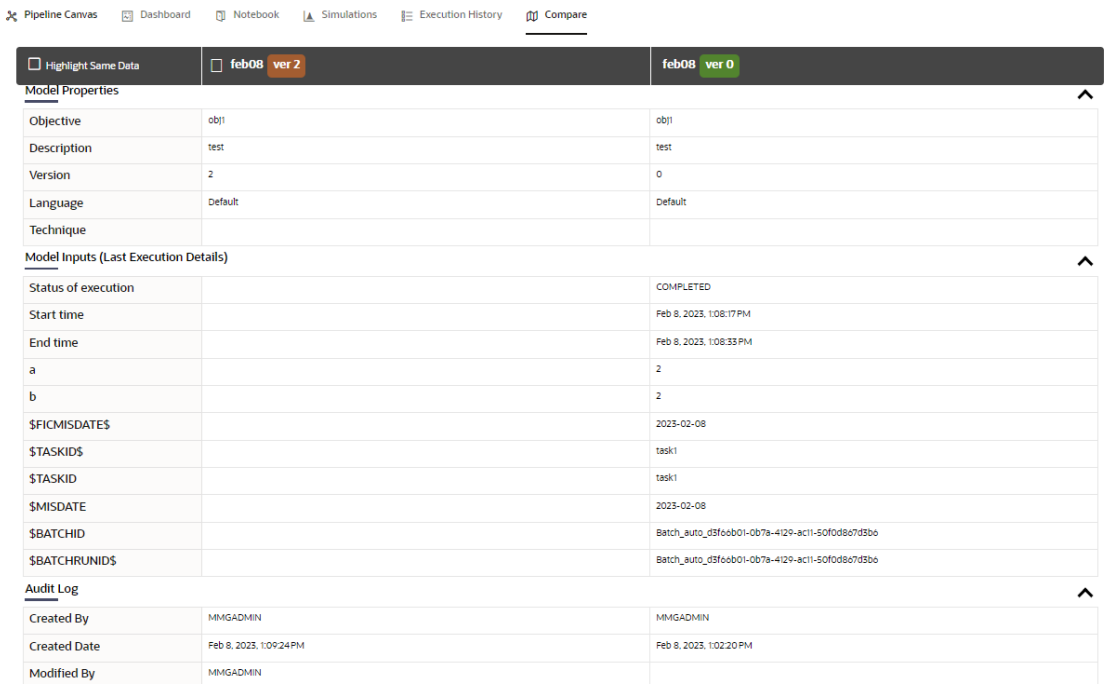
To compare:

Navigate to Pipeline Designer window and click **Compare** tab.

This shows the following comparison details:

- Model Properties
- Model Inputs (Last Execution Details)
- Audit Log
- Model Script
- Model Output

Figure 11-96 Compare tab



Parameter Set

The Parameter Set page displays a list of parameter sets added by the user. For each parameter set, the following information is shown: the set code (also known as the threshold code), a description of the set, its champion status, and a list of available actions (edit, clone, delete, export). A checkbox is located on the left side of each parameter set; when checked, it indicates that the corresponding set will be used during pipeline execution.

To add a new parameter set follow these steps:

1. Click the **"+"** icon at the top right of the page.

   You will need to provide a set code, which serves as the name of the parameter set. The description field is optional and can be used for your own reference.

2. Click the **"+"** icon next to Execution Parameters to add new key-value pairs.

   This will insert an empty key-value pair where you can input the desired values.

   The newly created parameter set will be displayed in the list. Click the **star** icon under the Prime Reference column to assign champion status to this set.

   > **Note**
   >
   > Only one set can hold champion status at a time.

   You can perform several actions on the parameter set from the Actions column:

   - **Edit**: Opens the same popup as the Create Parameter Set option. You can modify the description and key-value pairs, but the set code cannot be changed.
   - **Clone**: Opens the Create Parameter Set popup with values pre-filled from the selected set. You will need to provide a new, unique set code.
   - **Delete**: Removes the parameter set from the list.
   - **Export**: Generates a ZIP file containing the parameter set, which is downloaded to your local machine. A corresponding dump is also created on the server.

   There are also several buttons located at the top right of the page:

   - **Import**: Opens a popup to upload a ZIP file containing an exported parameter set. A new parameter set will be created based on the contents of the file.
   - **Create**: Opens the Create Parameter Set popup, as described earlier.
   - **Edit**: Opens a Bulk Edit popup, allowing you to edit multiple parameter sets, simultaneously.
   - **Delete**: Deletes the selected parameter sets.
   - **Refresh**: Refreshes the list of parameter sets.

Import/Export Parameter Sets using Utility

You can import and export the parameter sets between Sandbox to Production or vice versa using the Utility.

Prerequisite:

Before you import, ensure the Parameter Sets artifacts are available in the <installed path>/ftpshare.

To import the parameter sets:

- Navigate to `<MMG_PACK>OFS_MMG/bin`and execute in the following format:

  ```
  ./parameter_set_export_import_utility.sh IMPORT TARGET_WORKSPACE LOGIN_USER
  LOCALE FILE_NAME OBJECTIVE_ID OVERWRITE_FLAG
  ```

  Example:

```
./parameter_set_export_import_utility.sh IMPORT CS SAUSER en_US
CS_1638105398036_set-1 1638105398036 true
```

Table 11-21 Fields and icons on the Sandbox Summary page

Field	Description
Import	Command to import the Parameter Set into Workspace
Workspace	The name of the Workspace to which you are importing the Parameter Set
Login_User	The logged in user name.
Locale	The application language preferences For example: en_US
File_name	The file name with the following format: Workspace name_Objective ID_Threshold Code For example: `CS_1638105398036_set-1`
Overwrite_Flag	To be set True, if existing threshold has to be overwritten. Else, False.

To export the parameter set, perform the following steps:

Prerequisite:

Before you export, ensure the Parameter Sets are available in the UI / setup.

1. Navigate to <MMG_PACK>OFS_MMG/bin and execute in the following format:
   `./parameter_set_export_import_utility.sh EXPORT WORKSPACE LOGIN_USER LOCALE THRESHOLD_CODE OBJECTIVE_ID`

   Example:

   ```
   ./parameter_set_export_import_utility.sh EXPORT CS SAUSER en_US set-1
   1638105398036
   ```

   Table 11-22 Fields and icons on the Parameter Set page

Field	Description
Export	Command to export the Parameter Set from the Workspace
Workspace	The name of the Workspace from which the Parameter Set is exported
Login_User	The logged in user name.
Locale	The application language preferences. For example: en_US
Threshold Code	Parameter Set Name
Objective ID	The Objective ID

Scheduler Configuration UI

A new UI is introduced for Scheduler notification and other configurations.

To integrate the new UI to MMG, a new user group called SCHEDULERADMIN is created, which has all roles and functions related to Scheduler.

The SCHEDULERADMINACCESS Role is created, which has all functions related to LINKSCHDLR.

The new function LINKSCHDLRCNF opens the Scheduler Configuration. The SCHEDULERADMIN group is mapped with BATCH_ADV, SCHEDULERADMINACCESS, and BATCH_ADMIN_ROLE.

> **Note**
>
> Admin UI is now available. Now the user is able to configure email notification to specific users. To access UI user requires BATCH_ADMIN role. This role is default mapped to the seeded group SCHEDULERADMIN group. All the configurations are SYSTEM level, which means, if the configuration is changes in one workspace the same will be reflected in all. To access UI user requires BATCH_ADMIN role. This role is default mapped to the seeded group SCHEDULERADMIN group.

Publish Model Draft

After creating the Draft Models, publish the Notebooks, which have the Model script.

You can publish a model draft to Data Studio from the Pipelines flow. Publishing can be initiated from either of the following locations:

- From the pipeline or draft screen.
- From the **Model Summary** screen by using the **Actions** icon (three dots)
- From **Model Summary** (Actions menu)

To publish from the **Model Summary** screen:

1. Navigate to the **Model Summary** screen.
2. Click the **Actions** icon (three dots).
3. Select **Publish Model Draft**.

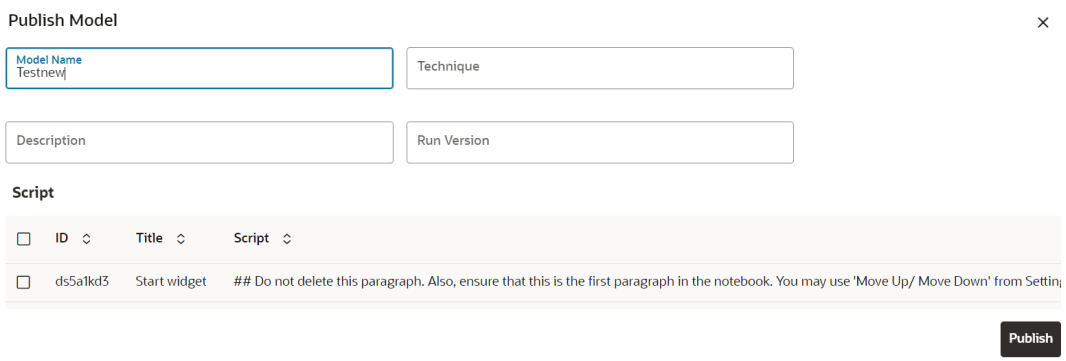
> **Note**
>
> **(Limitation)**: When you are publishing from the **Model Summary** screen, the link information (for example, training and scoring links) is not retained because the **Publish** action is executed from the summarized content (selected paragraphs). As a result, the trainingor scoring links are defaulted to *default* in the published output. To preserve the configured links, publish the model draft from the pipeline or draft screen.

To publish:

1. Create a Draft Model. See the Create Draft Models section for more information.
2. Click next to corresponding Draft Model and select **Publish Data Studio** option.

   The Publish Model window is displayed.

Figure 11-97 Publish Model



3. Enter the details as shown in the following table.

Table 11-23 Field and its description for the Publish popup window

Field or Icon	Description
Model Name	The field displays the name of the Model. Modify the name if required.
Model Description	The field displays the description for the Model. Enter or modify the description if required.
Technique	Enter the registered technique to use.
Run Version	Select a run version.
Script	The table displays the Paragraphs created in the Training Model. Select the Paragraphs that you want to use to create the Scoring Model. Track Output - Select this to track the output of the paragraph.

4. Click **Publish**.

Scope Detail

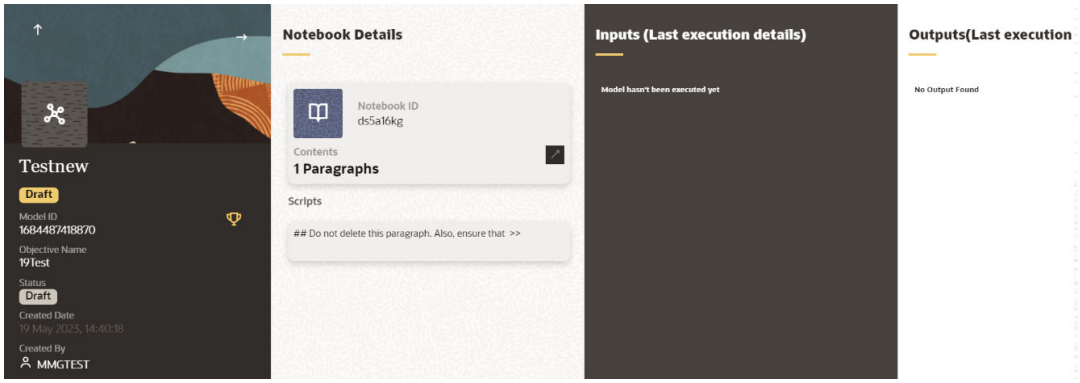
To view the scope details of the model:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

   The window displays folders that contain models and model records in a table.
3. Click next to corresponding Model and select **Scope Detail** option. This is available for both Draft and Published models.

   The details such as Notebook, Inputs (Last execution details), Deployment Details, and Outputs (Last execution outputs) are displayed.

Figure 11-98 Scope Details



View Model Details

You can view model information for deployed models, models that require approval, and so on.

To view model details:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

   The window displays folders that contain models and model records in a table.

   The icon indicates that Model 1 is the champion.
3. Hover over the model records to view the various icons.

   The icon actions are listed in the following:

   a. Download

   b. Open in Pipeline Designer. See the Create Paragraphs using Pipeline Designer section for more details.

   c. Scope Detail. See the Scope Detail section for more details.

   d. Delete Model.

Model Governance

After comparing models, you must understand the Model Governance system in the application. The Model Governance has an impact on how the application functions with the various user types and the requests they can place from the Model Details window. You require to understand Model Governance before you request model acceptance, review models, or approve models for production.

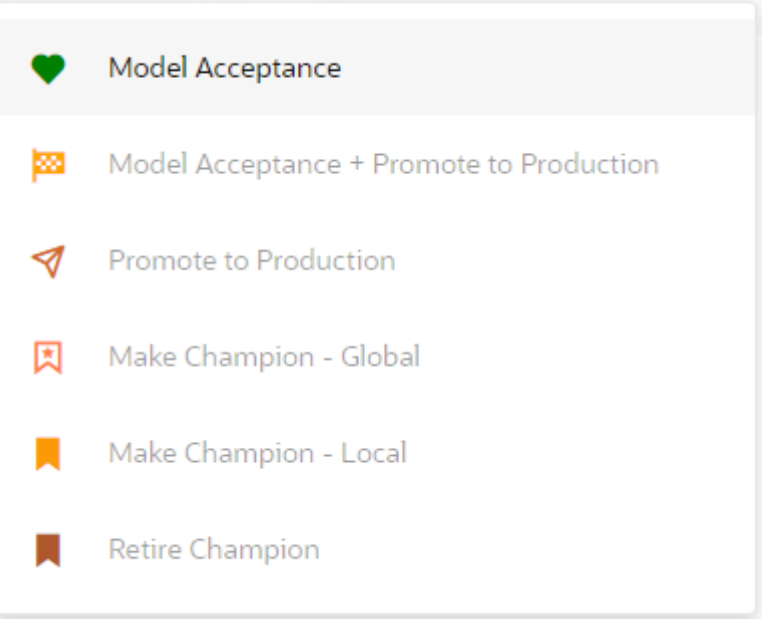
As discussed earlier, the users are of three types:

- Requester
- Reviewer
- Approver

The request consists of the following phases in the Request drop-down list (see the Request Model Acceptance section for how to access the drop-down list in the Model Deployment window):

- Model Acceptance
- Model Acceptance + Promote to Production
- Promote to Production
- Make - Champion - Global
- Make - Champion - Local
- Retire Champions

Figure 11-99 The Request Drop-down List



The values in the drop-down list are active based on the type of user (Requester, Reviewer, or Approver) and the phase that the model is in (accepted, promoted to production, global champion, and so on). Let us look at these with a few examples.

Example 1:

Assume that you are a user with Requester privileges, and you create a model. Now you can request for the model to be accepted on the Model Details window from the **Request** drop-down list. The values enabled for selection are **Model Acceptance** and **Model Acceptance + Promote to Production**. Let us proceed and assume that you select Model Acceptance, then a user with Reviewer privileges forwards your model to a user with Approver privileges. At this stage, the Approver can choose to reject or accept your model acceptance request. A rejection would bring the model back to the initial state with comments on the updates required before it can be requested for acceptance again. However, if the Approver accepts your model, then the **Make Champion- Local** selection is enabled when you log in. You can create many models and send them for acceptance. After acceptance, any model that is accepted can be made the champion on your local workspace at any time replacing the earlier local champion.

Example 2:

Assume that in the previous example, you selected **Model Acceptance + Promote to Production**, then a Reviewer forwards it to the Approver. The Approver, at this stage, chooses to promote the model to production by selecting **Promote to Production**. The model is now available in the production environment and the Approver can choose at any time to select a

model from these models in production and select **Make Champion- Global**. If there exists a Champion model in the production environment, then it will be replaced by the new global champion. However, the earlier champion will still be available in the production environment along with other models and the Approver can choose to make it the global champion again at any time or select any of the other models and make one of them the global champion.

Request Model Acceptance

After comparing models, move the selected models to acceptance. Only a user with the Requester role can request for model acceptance. The model will be moved to review which will be available to Reviewer and Approver role, and then to acceptance is available to users with the Approver role, who can promote to production. See the Understand Model Governance section before you start here.

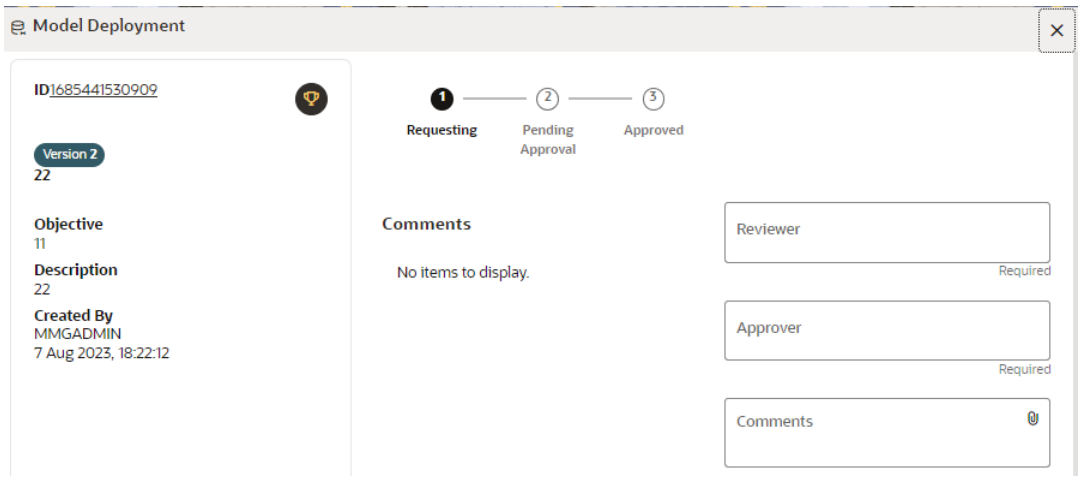
To request a model to promote to production, follow these steps:

1. Click **Model Pipeline** to display the **Model Pipeline** window.

   The window displays folders that contain models and model records in a table.

2. Click on the Deploy icon on the Model to open it.
3. If a model is a champion, the icon is displayed on it.
4. To make a model a champion from this window, place the mouse in the selected model columns. and click to display the **Model Details** window. If a model is a champion model, the icon is displayed.

Figure 11-100 Model Deployment



5. Select the Reviewer group from the **Reviewers** drop-down list.
6. Select the Approver group from the **Approvers** drop-down list.
7. Enter comments in Comments and click **Attach** to attach files supporting the comments.
8. Use the following features on the window to perform additional actions.
   - View the model status change in the progress indicator. The Progress Indicator displays the various states of progress that the model has been through. Accordingly, you must request, review, or approve models.

Figure 11-101 Model Approval Progress Indicator

- Click the type of **Request** from the drop-down list:
  - Model Acceptance: To review and accept the model creation.
  - Model Acceptance + Promote to Production: To review and promote the model to production.
  - Make Champion- Local: If the model is not the champion model, select to make it the local champion.
  - Promote to Production: To promote a model to production
  - Make Champion- Global: If the model is not the champion model, select to make it the Global champion.
  - Retire Champion: To retire a Champion model
- Comment History: A record of comments entered in the cycle of model creation and approval with the feature to download attachments.

The model sent for acceptance or for promotion to production is now displayed to a Reviewer to review it and then to Approver when signed in, who must either accept the request or reject it.

Review Models and Move to Approve or Reject

The Reviewer must provide comments describing the action (approve or reject). If comments are related to rejection and if the Approver rejects, then model goes back to the Requester to make changes or to delete it. If comments are related to approval, then model moves further in the workflow and is displayed to an Approver. See the Understand Model Governance section before you start here.

To review a model:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

   The window displays folders that contain models and model records in a table.
3. Click to display the **Model Details** window.
4. Review the details and send it back to the Requester for modifications or send it to an Approver.

Approve Models and Promote to Production

The models reviewed and set to promote to production by either the Requester or Reviewer is displayed to the Approver when signed in. The Approver has to either reject the model and send it back to the requester with supporting comments or approve it for pushing to production. See the Understand Model Governance section before you start here.

> **Note**
>
> When dataset has used the datasource which is of order (N) for example 5 , and the Production workspace does not contain the datasources at order 5, then promotion of models containing dataset from Sandbox to Production workspace fails.
> To remedify this issue, ensure that Sandbox and Production workspace contain the same number of Datasources before you perform promotion of models.

To approve or reject models:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

   The window displays folders that contain models and model records in a table.
3. Select a model from the records in the objective.
4. Click to display the Model Details window.
5. Click **Approve** or **Reject** with appropriate comments.

Deploy Models in Production and Make it a Global Champion

After approving the models, deploy it to the production environment. You must have an Approver function role and privileges to do this activity.

> **Note**
>
> Sandbox should have the production workspace attached in order to have this option enabled.

To deploy Models in production:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines**window.

   The window displays folders that contain models and model records in a table.
3. Select the model to deploy and click **Model into Champion** to display the details of the model. If a model is a champion, the **Champion** icon is displayed.

Import a Model Data into a New Model

The model data from existing models in .dmp format and the existing model data in .dsnb can be imported during the creation of a new model.

> **Note**
>
> The import should happen inside an Objective only.

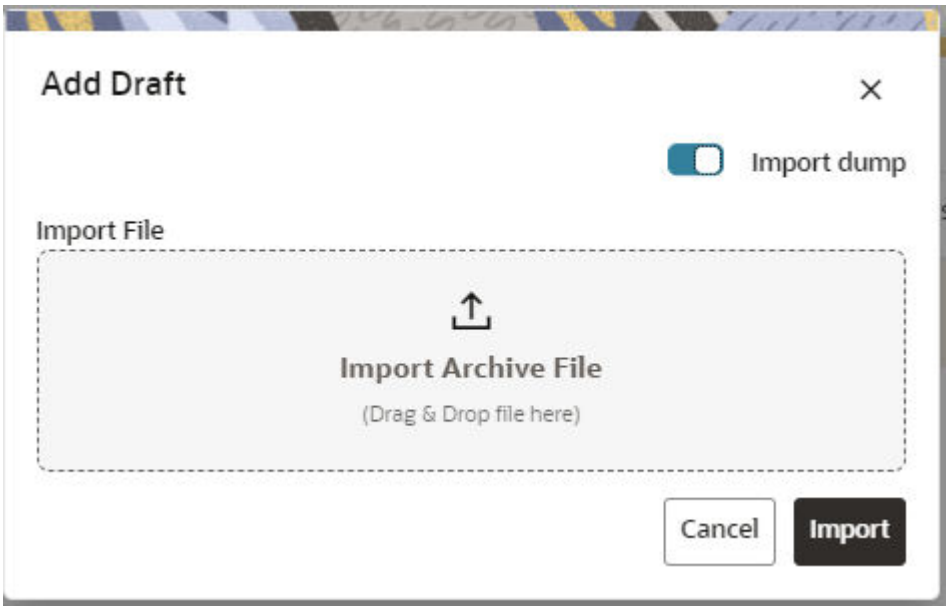
The import of model data lets you reuse and extend on model creation. This topic is part of the procedure of creating Draft Models and after creating a new model using this method, see the Create Draft Models section for instructions on how to proceed further.

To import model data:

1. Click **Launch Workspace** next to corresponding Workspace to Launch Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

   The window displays folders that contain models and model records in a table.
3. Select an **Objective**.
4. Double click a model to display the model versions in the expanded display.
5. Hover over a model and click **Download** to download the model data dump.
6. Click **Add** and **Drafts** to display the **Model Details** dialog box for the creation of a new model.

Figure 11-102 Model Details - Import Dump



7. Drag the toggle switch to select **Import Dump**.
8. Drag and drop the file into the **Import Dump File** field or click in the box to open the file selector dialog and select a file.

> **Note**
>
> If the upload file size is more than 8 MB, you can increase the file size upto 100 MB by modifying the below properties. Restart of services are required once the file size is updated.
> mmg-ui/conf/application.properties:
>
> **********
>
> spring.servlet.multipart.max-file-size=8MB
>
> spring.servlet.multipart.max-request-size=8MB
>
> mmg-service/conf/application.properties:
>
> **********
>
> spring.servlet.multipart.max-file-size=8MB
>
> spring.servlet.multipart.max-request-size=8MB

9. Click **Import**. A new model is created by importing the model data dump of another model.

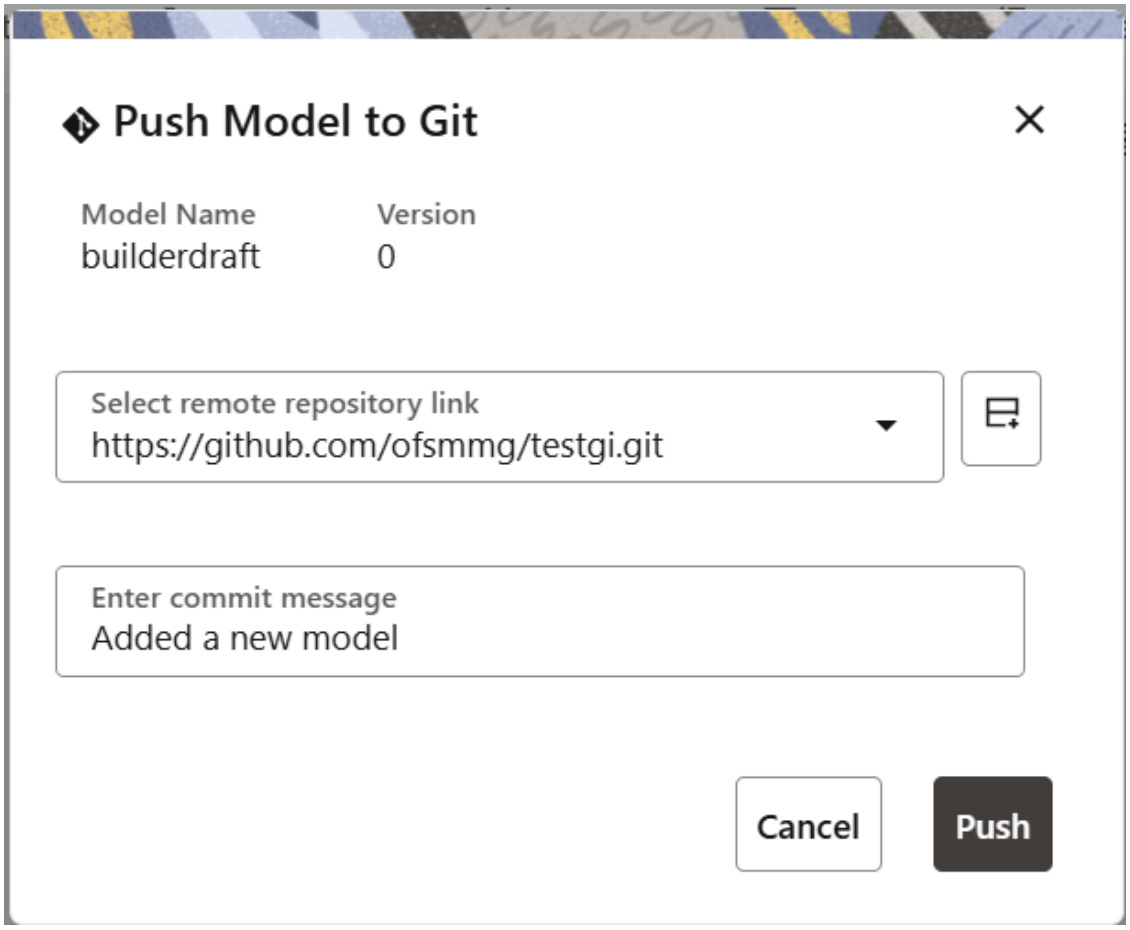
Git Functionalities

This section describes the following Git functionalities:

- Git Push
- Git Pull
- Git Clone

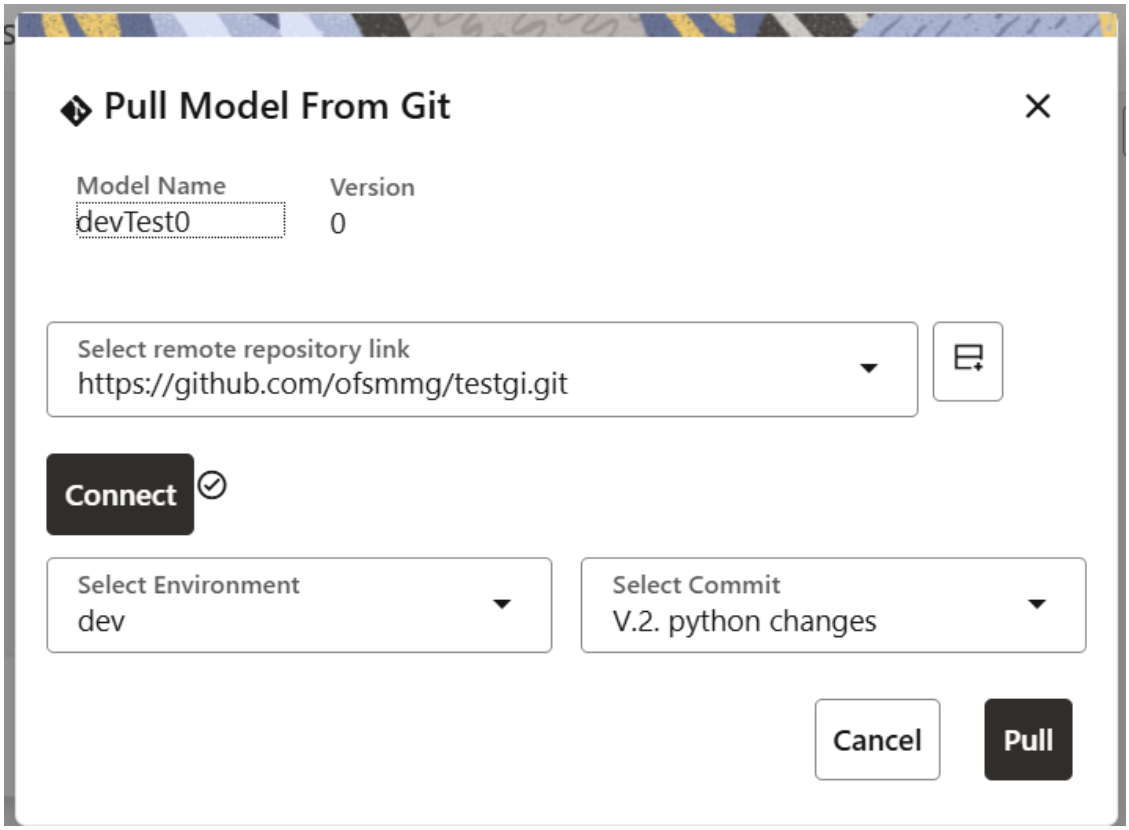
Git Push: This feature allows users to save and upload (push) changes made to the model to the remote Git Repository, but only on their assigned working branch that matches their environment (For example: Dev, QA). Users can commit their changes locally and then push them remotely with a single option. If the model is not yet linked to any repository, the system will create a new local Git repository and connect it to a remote one using a repository URL provided by the user, ensuring the model is properly tracked and synchronized.

Figure 11-103 Git Push



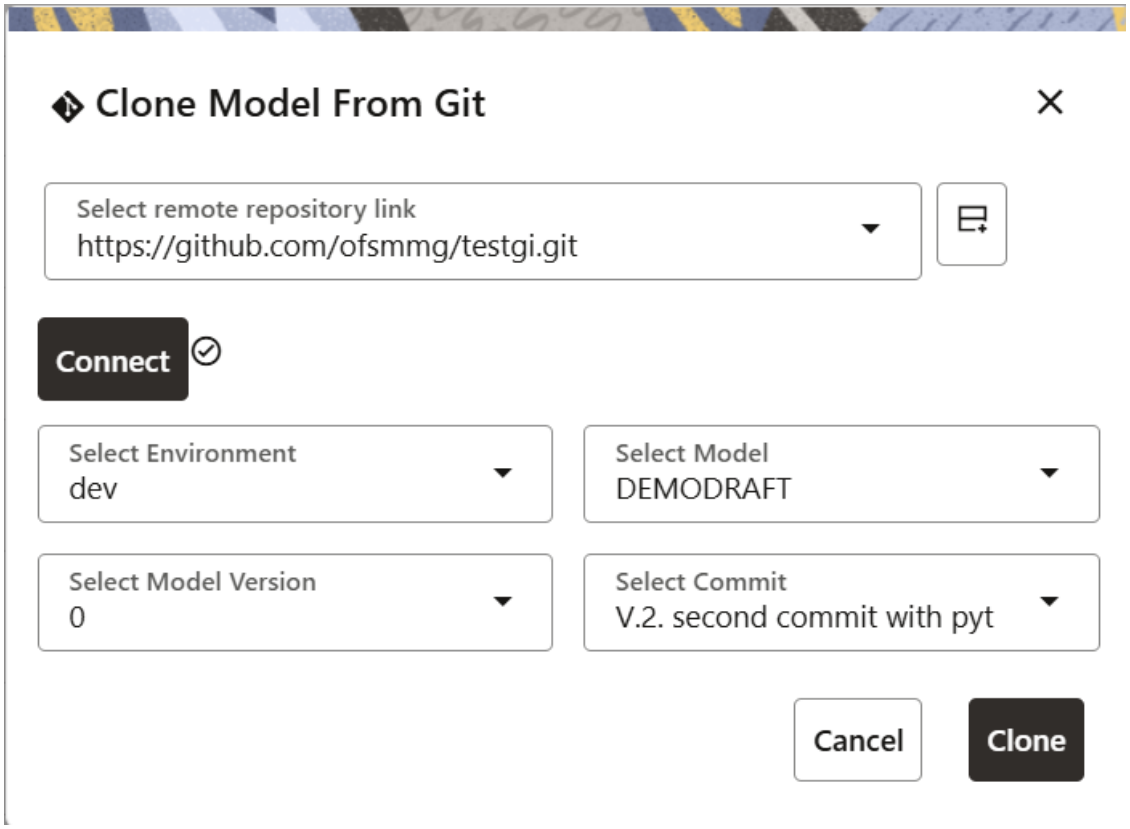
Git Pull: This feature allows users to fetch and load a Model Pipeline from a remote Git Repository into their environment. Users can select from any linked environment branches and also choose a specific commit version to pull, giving them flexibility to work with different stages or snapshots of the model as needed.

Figure 11-104 Git Pull



Git Clone: This feature allows users to clone a model from a remote Git Repository by selecting the model, its environment branch, a specific Git commit version, and the corresponding MMG version, enabling precise replication of the desired model state locally.

Figure 11-105 Git Clone



Execute Models using Scheduler Service

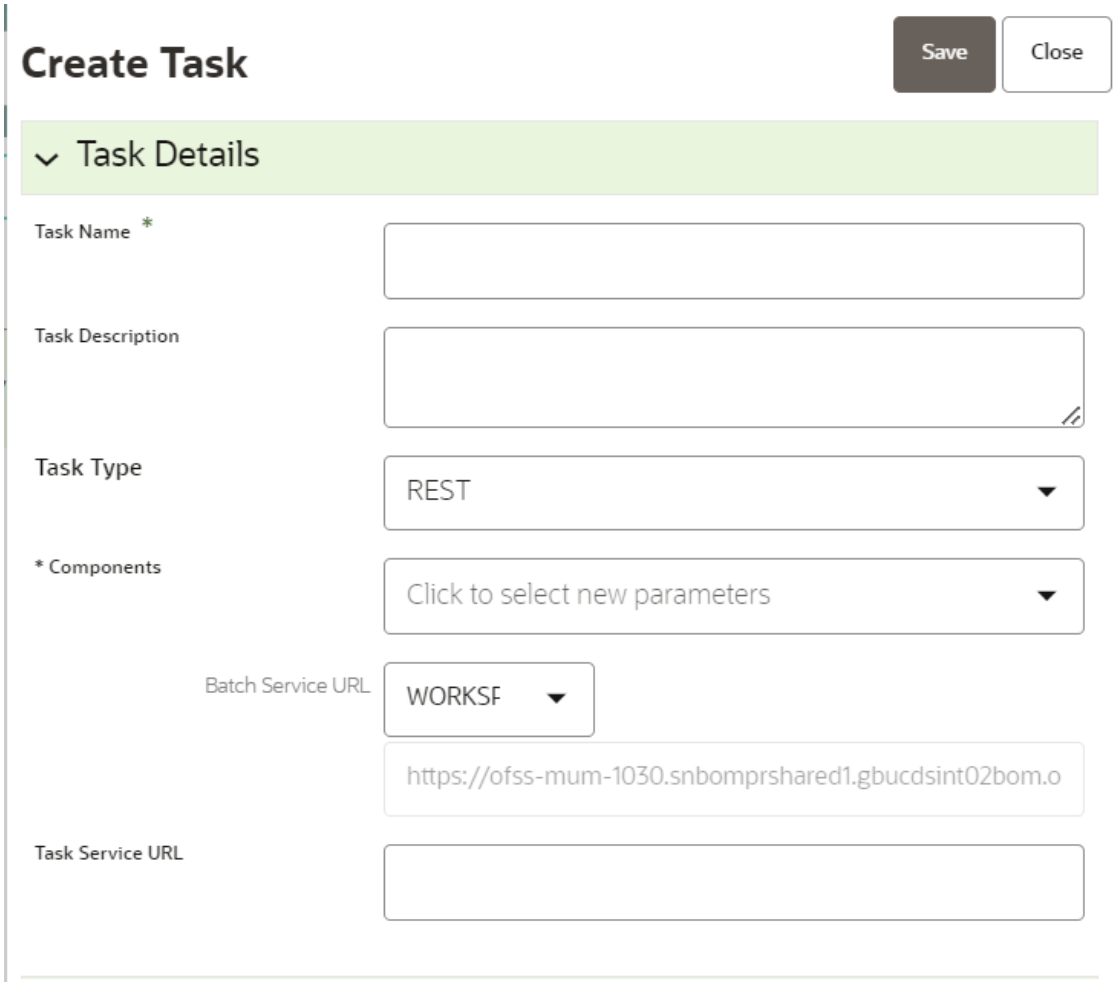
The models that you have created require that they are executed using Scheduler Service before they can be available to the users of OFSAA applications. For more information on this, see the Scheduler Service.

Define a Task

The following three Components are supported during the task creation:

- Model
- Populate Workspace
- Custom

Figure 11-106 Create Task



Enter the following details in Task Details section:

- **Task Name**: Enter the task name.

> **Note**
>
> The Task Name must be alphanumeric and should not start with a number. The Task Name should not exceed 60 characters in length. The Task Name should not contain any special characters except underscore (_).

- **Task Description**: Enter the task description. No special characters are allowed in Task Description. Words like Select From or Delete From (identified as potential SQL injection vulnerable strings) should not be entered in the Description
- **Task Type**: Select the task type from the drop-down list. The options are REST and SCRIPT. You can enter Shell script for Model, Populate Workspace, Custom components. Status key in the curl command should be in uppercase as STATUS.
- **Batch Service URL**: Select the required Batch Service URL from the drop-down list. This can be blank, and you can provide the full URL in the Task Service URL field.
- **Task Service URL**: Enter task service URL if it is different from Batch Service URL.

> **Note**
>
> Task Parameters will vary based on the selected Component.

When Component is Model

The following window shows the Task Parameters for Model Component.

Figure 11-107 Task Parameters

> **Note**
>
> Fields marked with * are mandatory fields.

The Scheduler Service feature provides a system-generated runtime parameter **RUNSKEY**, `$RUNSK$`, to support the delta processing of the Data Pipeline and Match Rules. **RUNSKEY** is generated during execution and is propagated from the batch to downstream tasks or components so they can process specific execution context. You will see `$RUNSK$` listed along with other runtime parameters such as; **RUNSKEY** and is not user-editable. This is populated by the scheduler service at runtime.

RUNSKEY lifecycle follows the `BatchRunID` behavior.

- **Rerun:** `$RUNSK$` changes. A new **RUNSKEY** is generated for the rerun execution.
- **Restart:** `$RUNSK$` remains the same. The restart continues the same execution context.
- **Batch Date**: Shows the batch execution date. You can enable or disable this parameter.
- **Batch Run ID**: Shows the batch execution run ID. You can enable or disable this parameter.
- **Objective**: Select the Object which you want to use for execution. For more information, see the Create Objective (Folders) section. The Sub Objective is displayed with path. For example, if Test1 is Objective and Test11 is Sub Objective, and you want to use Test11 Objective for execution, then select this field as Test1/Test11.
- **Model**: Select the Model of selected Objective. It can be any specific model of Objective or All models of Objective.

  - If the ALL_CHAMPION is selected here, then Objectives with no Champion Model is skipped, and the Objectives with Champion Models gets executed.
  - If CHAMPION is selected, and no Champion is present, then Model Execution gets fail.
- **Link Type**: Select the link type for execution. For example: Training, Scoring, or Training+Scoring. For more information, see the Links in the Pipeline Designer section.
- **Synchronous Execution**: You can set this parameter to Yes or No.
  - If Synchronous Execution is set to Yes, then execution will wait for the notebook execution status.
  - If Synchronous Execution is set to No, then execution will not wait for the notebook execution status, it will trigger the notebook and update task status as successful in batch monitor.
- Optional Parameters: This is used pass the parameters dynamically.
  For example:

  model_group_name=LOB1,benford_flag=Y,benford_digit=1,from_date=01-Jul-2020,to_date=31-Jul-2021

  Model_group is parameter defined in model and value can be passed here.

The Create Task window also shows the following Header Parameters, which are not editable:

- User: logged in user name
- Workspace: shows the launched workspace name
- Locale: shows the locale. For example: en_US

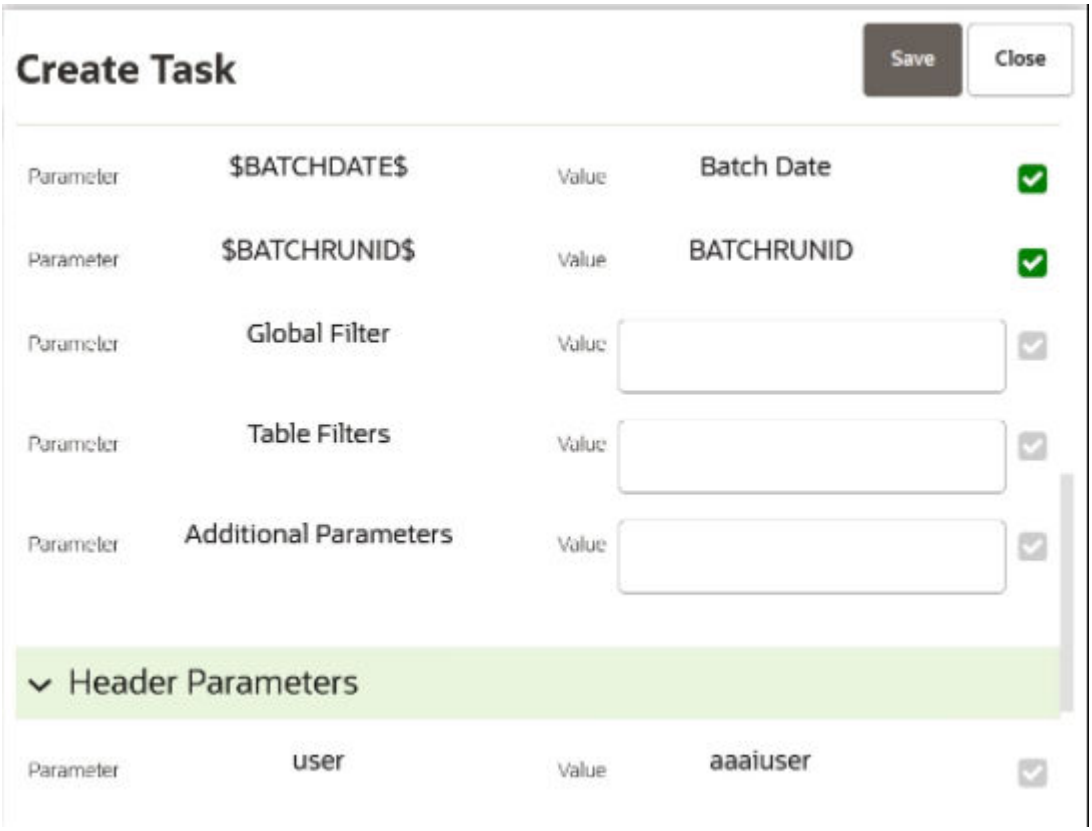
When Component is Populate Workspace

If you select Component as Populate Workspace, then to use the data population, enter the following parameters.

- Additional Parameters
- Data Filters - Global level
- Data Filters - Table level
- Data Filters - Hint

For more information, see the Populating Workspace section.

Figure 11-108 Populate Workspace screen



SS $RUNSK support for processing Delta Data by Data Pipeline and Match Rules

A new parameter to pass RUNSK is being implemented in the Scheduler UI.

Dynamic Parameters screen for new batches are created.

1. RUNSKEY will be present in Task Parameters while copying task for existing batches.
2. RUNSKEY should be visible in View Execution Parameters - Task Parameters in Monitor screen.
3. RUNSKEY will change just as BatchRunID in "Rerun" Case.
4. RUNSKEY will remain same just as BatchRunID in "Restart" Case.
5. RUNSKEY will be stored for batches in "AAICL_SS_BATCH_RUN" in column "N_RUNSKEY".

Data Pipeline Execution

For standalone Data Pipeline definitions, you must pass the following parameters as optional during execution from the scheduler service, after selecting the graph data pipeline as component.

- `$<Runtime Parameter1>=<Value>`
- `$<Runtime Parameter2>=<value>`
- `$RUNTYPE$=PROD`

- $batchRunType$=run
- $BATCHTYPE$=DATA
- $JOBNAME$=<DataPipeline_Name>

Export/Import Models via Utility

You can import and export the models between Sandbox to Production or vice versa using the Utility.

Prerequisite:

Before you import, ensure the Model artifacts are available in the <installed path>/ftpshare.

To import the models:

- Navigate to <MMG_PACK>OFS_MMG/bin and execute in the following format:

  ```
  ./model_export_import_utility.sh IMPORT WORKSPACE LOGIN_USER LOCALE FILE_NAME Y/N
  ```

  Example:

  ```
  ./model_export_import_utility.sh IMPORT CS SAUSER en_US CS_1638105398036_0.zip Y
  ```

Table 11-24 Fields and icons on the Sandbox Summary page

Field	Description
Import	Command to import the Model into Workspace
Workspace	The name of the Workspace to which you are importing the Model
Login_User	The logged in user name.
Locale	The application language preferences For example: en_US
File_name	The file name with the following format: Workspace name_Model ID_Model version.zip For example: CS_1638105398036_0.zip

> **Note**
>
> If you enter input as **Y**, the utility imports the models in the approved status.
> If you enter as **N**, the models are imported but not in the approved status.

To export the models, perform the following steps:

Prerequisite:

Before you export, ensure the Models and Drafts are available in the UI / setup.

1. Navigate to <MMG_PACK>OFS_MMG/bin and execute in the following format:
   ```
   ./model_export_import_utility.sh EXPORT WORKSPACE LOGIN_USER LOCALE MODELID MODEL_VERSION
   ```

   Example:

   ```
   ./model_export_import_utility.sh EXPORT CS SAUSER en_US 1638105398036 0
   ```

Table 11-25 Fields and icons on the Sandbox Summary page

Field	Description
Export	Command to export the Model from the Workspace
Workspace	The name of the Workspace from which the model is exported
Login_User	The logged in user name.
Locale	The application language preferences. For example: en_US
Model ID	The Model ID
Model Version	The version of the Model

> **Note**
>
> The migration utility allows administrators to import objects into any target workspace, including a Production workspace. If objects are imported directly into the Production workspace, then a few objects may appear in a non-final state (for example, *Pending Approval* or *Invalid*) until the required approvals or promotions are completed. Hence, you must plan the imports accordingly and then validate the object status after importing.

View Models

The View Models feature launches the OFS Data Studio window. You can view models on this window.

To use View Models:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

   The window displays folders that contain models and model records in a table.
3. Click **Action** next to corresponding Model and select Open in Pipeline Designer.

   See the Create Paragraphs in Pipeline Designer section for details on how to use the OFS Data Studio.

Edit Models

The editing of models created versions that are different from the previously saved model and the cycle of Model Governance applies to any edited model. You can edit models from the OFS Data Studio window using Python scripting language.

You can edit the script of version 0 only even in Pipeline Designer and Studio. It is not possible in other versions.

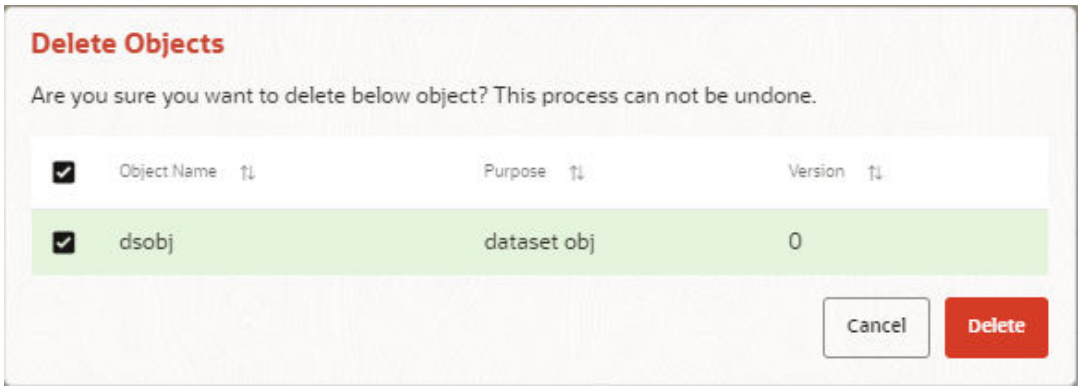
Delete Objectives and Draft Models

To delete Objectives and Models that exist in the Objectives, follow these steps:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click **Model Pipelines** to display the **Model Pipelines** window.

   The window displays objectives that contain models and model records in a table.
3. Click **Action** next to corresponding record (objective/draft) and select **Delete**.
4. You can select two or more objectives or models from the records.
5. Click **Delete** to display the Delete dialog box.
6. Click **Delete** to delete or click **Cancel** to cancel.

Figure 11-109 Delete Objects screen



> **Note**
>
> If the Model is promoted to Production, you cannot delete the model even it is retired.

Programmatic Dynamic Forms and Fixed Dynamic Forms

The Programmatic Dynamic Forms and Fixed Dynamic Forms scripts are supported.

A dynamic form is a user input field that is generated from the code of a paragraph. Dynamic forms allow users to bind free variables in a paragraph.

For Example:

Textbox

The Textbox dynamic form allows users to input any string of characters. Its format is as follows:

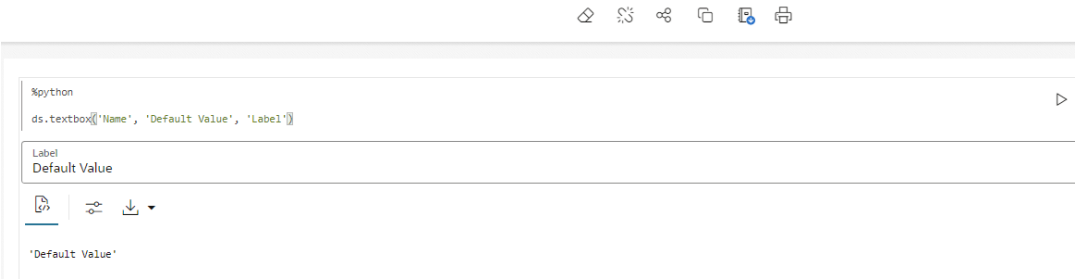
- Click **Add Python Paragraph** in Model Studio to add a Paragraph in the Notebook and fetch the runtime parameters supported in Model Studio runtime as shown in the following example. This is available for all the interpreters.

  For example, enter as follows:

```
%python
ds.textbox('Name', 'Default Value', 'Label')
```

Click **Play** to run the script and display.

Figure 11-110 Run the script and display tab



> **Note**
>
> In the current release, the MMG Studio supports Textbox, Select, Slider, Checkbox, Date Picker, Time Picker and DateTime Picker dynamic forms.

Session Management in Model Pipeline

Overview

The application now supports enhanced session management for executing model pipelines. This feature resolves earlier limitations where pipeline executions were bound to an implicit session, with no visibility or control for users. The update brings consistency between pipeline and notebook behavior. Each session has its own context, keeping pipeline and notebook outputs in sync.

Figure 11-111 Model Pipeline Session screen

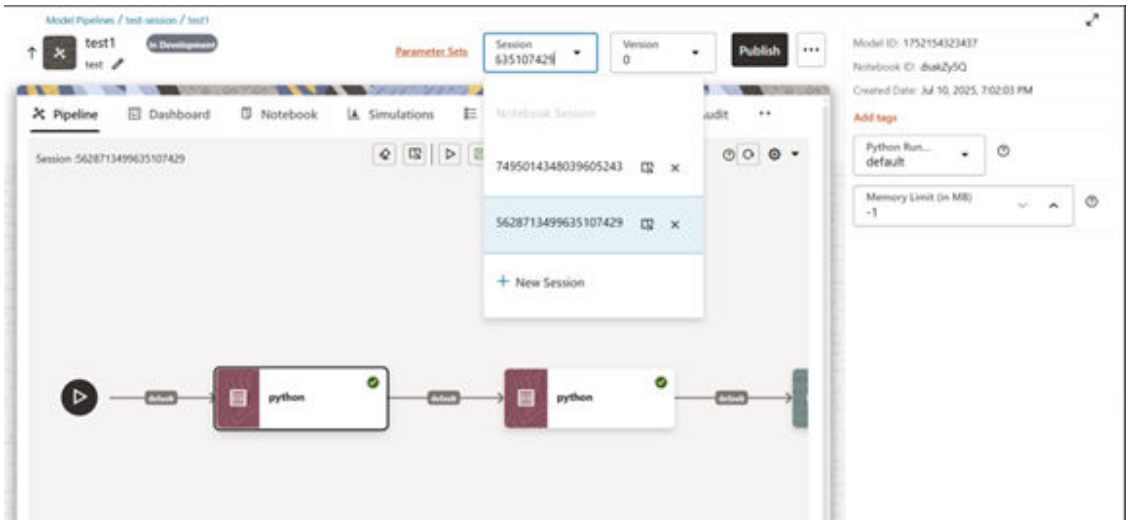
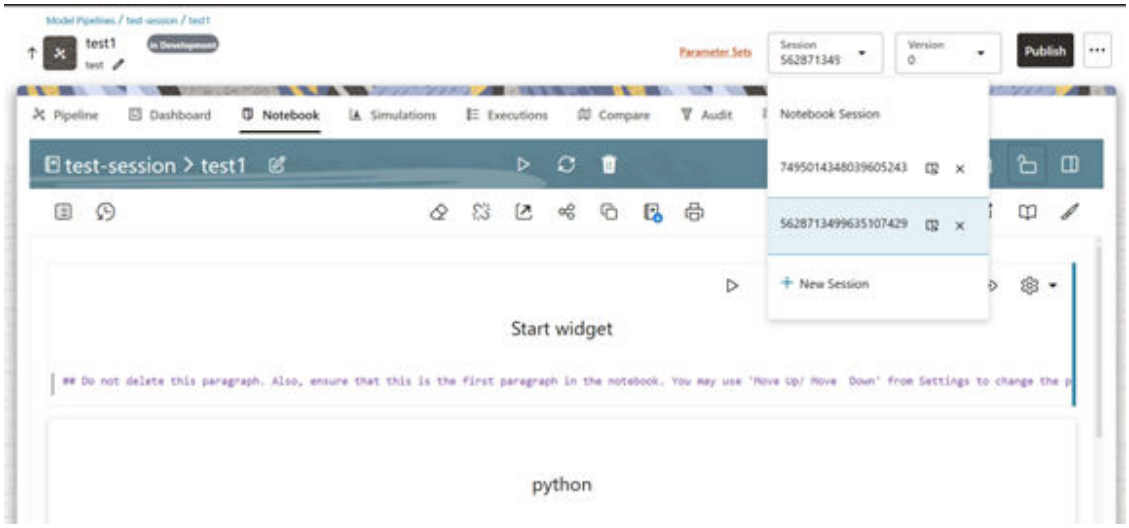


Figure 11-112 Session drop-down screen with multiple sessions shared between Pipeline Canvas and Notebook



Key Features

- Session dropdown available in both pipeline and notebook tabs.
- Default state is No session selected' users must create or choose a session.
- A prompt appears if execution starts without a selected session.
- Sessions can be created, switched, reinitialized, or cleared.
- Selected session syncs automatically across notebook and pipeline.
- Pipeline outputs and notebook results are isolated per session.

> **Note**
>
> - Session selection is mandatory before running pipelines.
> - Sessions help isolate workflows, making debugging and reruns easier.

Creating a Session

Go to the pipeline or notebook tab, open the Session drop-down, and select 'Add Session'.

Figure 11-113 Add session

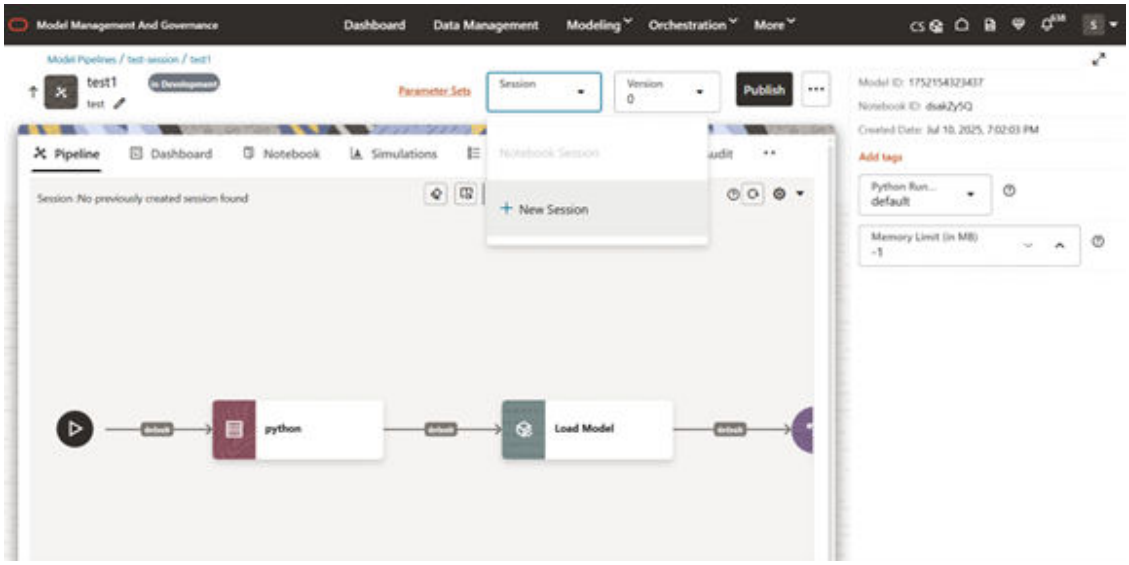
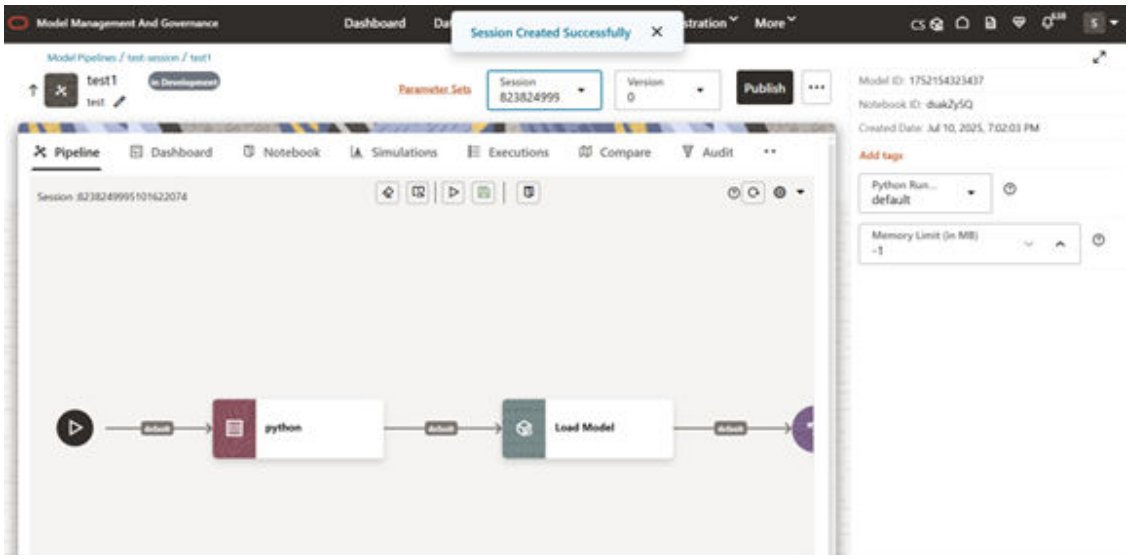


Figure 11-114 Add session created



Clearing a Session

Clearing a Session In the Session drop-down, click the cross icon beside the session to delete it.

Figure 11-115 Clearing a Session screen

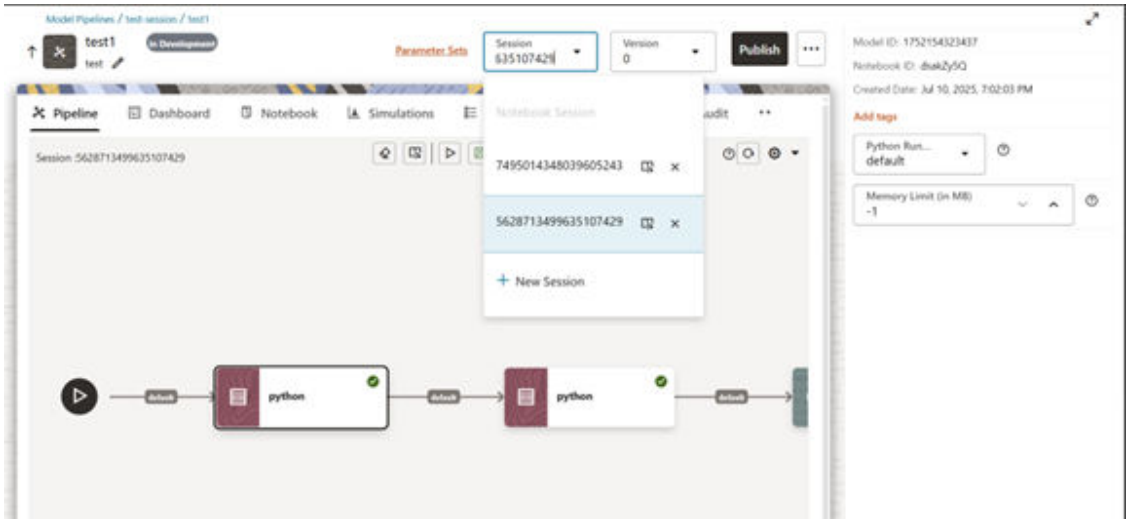
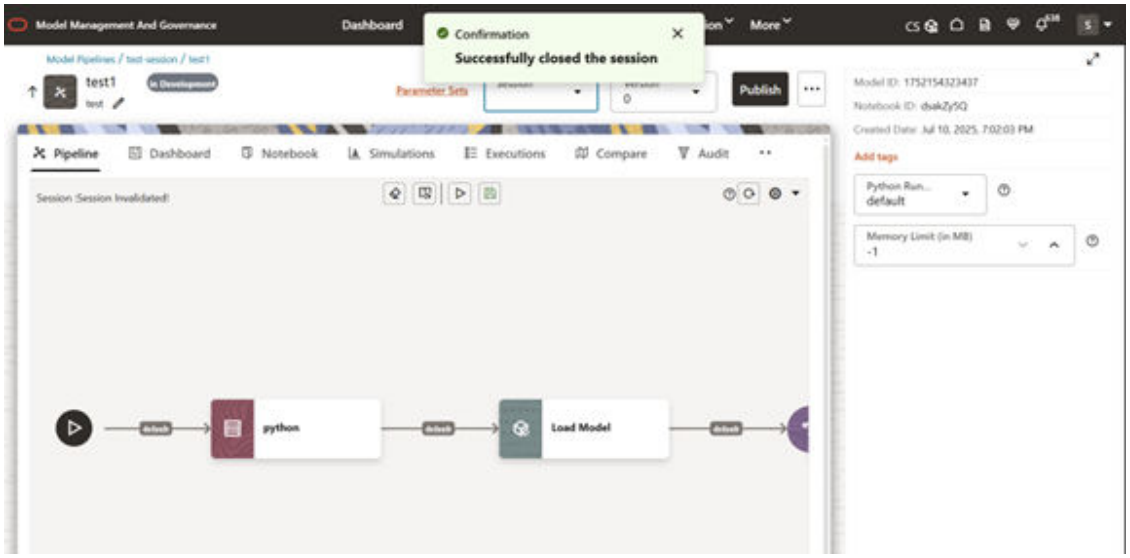


Figure 11-116 Closing the Session screen



Reinitializing a Session

Click the re-initialize icon next to a session in the drop-down to reload its state.

Figure 11-117 Reinitializing a Session

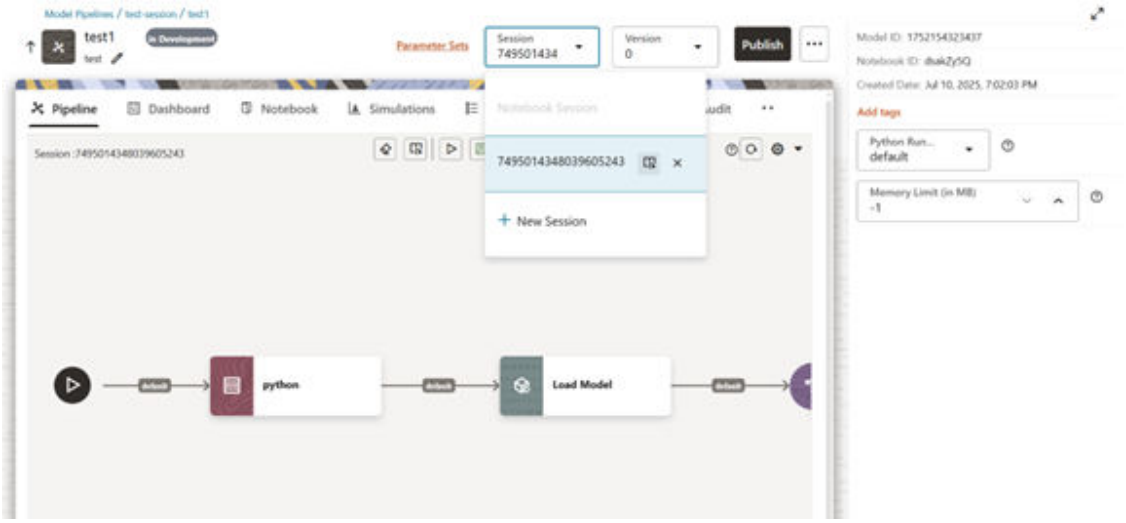
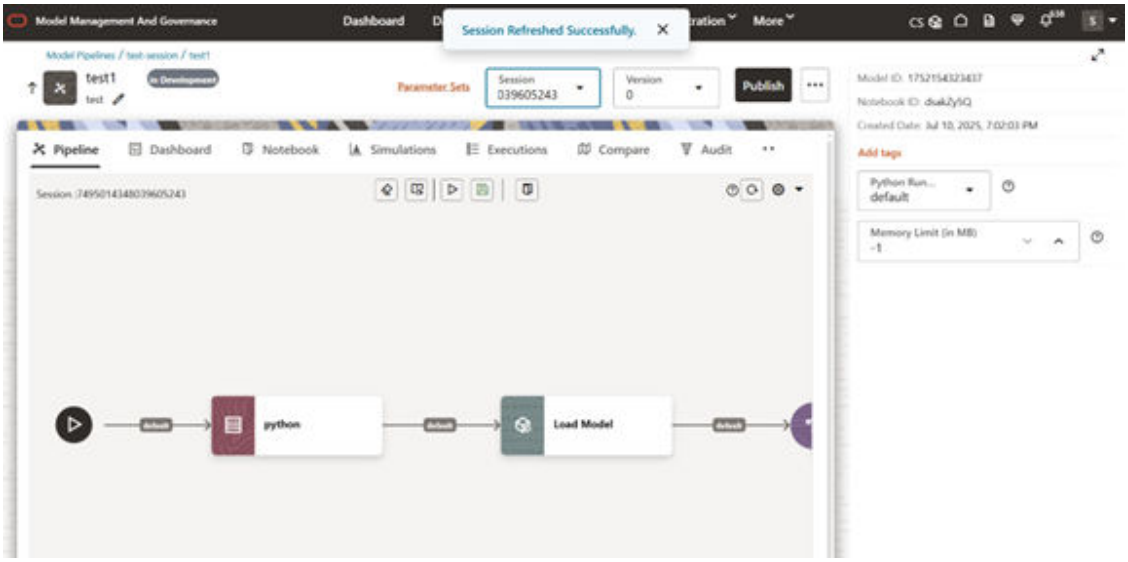


Figure 11-118 Refreshing a Session



Switching Between Notebook and Pipeline

Once a session is selected, you can move between Notebook and Pipeline tabs while keeping outputs in sync.

Figure 11-119 Switching between Notebook and Pipeline

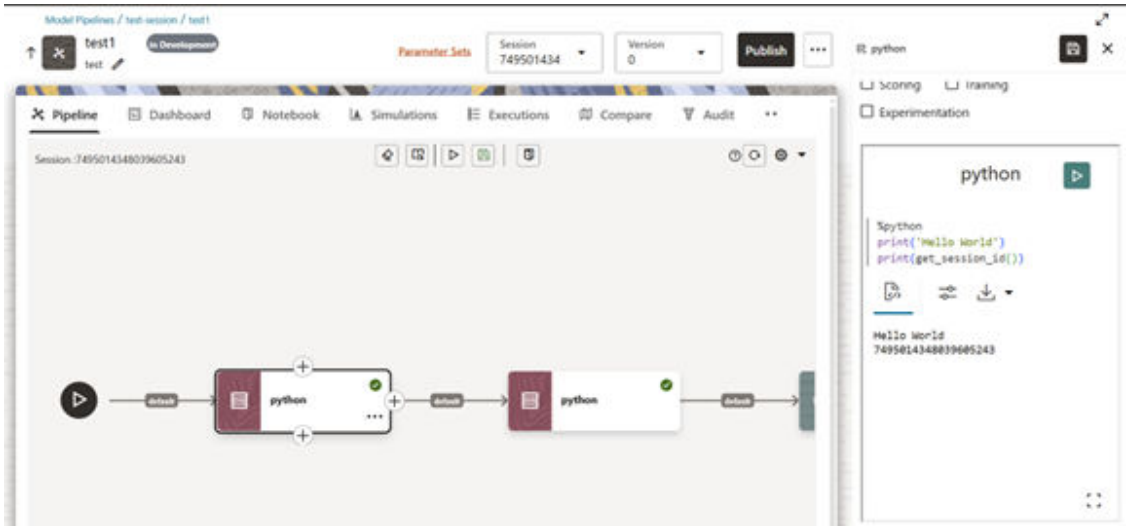
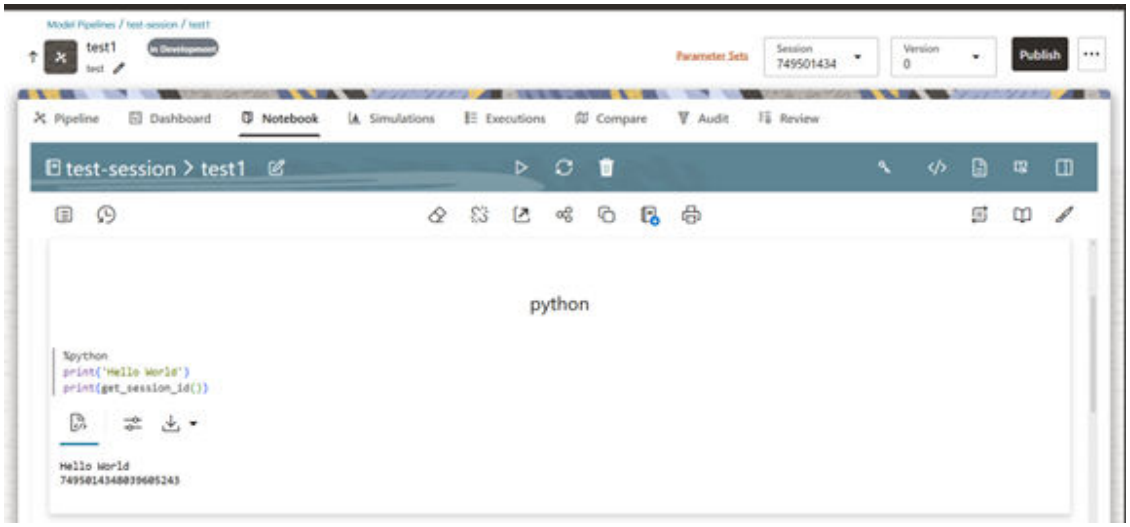


Figure 11-120 Notebook screen



Graphs

The Graph Pipeline feature enables you to transform data in relational tables into a graph.

This feature uses the latest technology to harness the power of Graph Analytics to give Financial Institutions the ability to monitor the data financial institutions effectively. The data is organized as nodes, edges, and properties (property data is stored on the nodes or edges). The results of analytics algorithms are stored as transient properties of nodes and edges in the Graph.

Users can harness the power of Graph Analytics using our in-built in-memory Oracle Graph Analytics Engine (PGX).

The Graph Pipeline functionality allows users to define graphs easily, attach underlying data, and match pipelines to populate data in the graph.

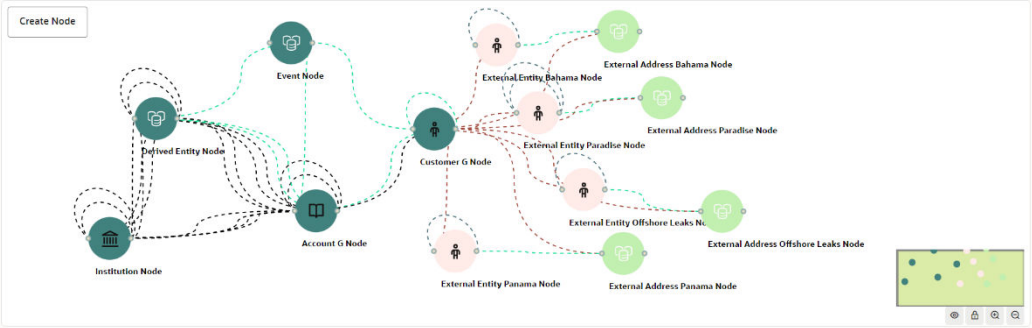
The Graph Pipeline functionality allows users to quickly create and configure a graph for use in advanced analytics. It can also manage and schedule the tasks required to run populate the graph on a periodic basis.

The Graph Pipeline functionality allows you to:

- Creating Graph Model from their existing relational data model
- Configuring the Graph Model through Pipeline UI
- Creating and Scheduling the data pipeline and matching (creation of similarity relationships) for created Graph Model
- Adding new sources and contextualizing the links quickly
- Standardizing the data before pushing it to Graph Model
- Using the following data source for Graph Model:
  - Oracle
  - File System (CSV)
- Using BD data source definitions for pre-seeded Workspace
- Using pre-configured Financial Crime Graph Model pipelines
- Using pre-seeded mappings of Graph Model properties with BD Data source properties
- Scheduling to create Graph by running pre-configured batches
- Blending data and getting insights from data quickly
- Load data into elastic search indexes so matching and entity resolution can occur in the graph
- Define matching rules for the generation of similarity edges in the graph.

An example of a preconfigured Financial Crime Graph Model with Nodes and Edges is provided here.

Figure 11-121 Example of Graph Model



The Graph Model defines the nodes and the relationship between them:

- **Node**: Represents a single entity with its attributes. The entity can be a single table or combination of tables merged on some common feature, it could be from a file, or any generalized component of multiple substructures merged for a specific reason/objective. For example, Customer.

  A customer could be a single entity.

Customer, Salesperson, Manager, and so could be individual entities that can be structured together as a “Person” entity with a set of attributes persisted across individual entities.

- **Edge**: A connector between nodes or the same Node itself. Each edge can have a set of attributes associated with it. These edges will map to 'join' between two entities that could be direct or transitive.
- **Modeler Attributes**: Properties of the Node/Edge, and these are mandatory inputs. For example:

  A Customer Node will have properties like Customer ID, Name, Age, Gender, etc.

  A Transaction edge will have properties like Transaction ID, Date, Amount, From/To account, etc.

See the Adding a Graph Pipeline section for creating Graph, Nodes, Edges, and Scheduling.

Accessing the Graph Summary Page

The Graph Summary page gives access to the various graph pipeline functions such as create, view and delete.

To access the Graph Summary page, follow these steps:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click the **Graphs** icon.

   This displays the graph pipeline in a tabular format.

   The following table provides descriptions for the fields and icons on the Graph Summary page.

Table 11-26 Graph Summary Details

Field or Icon	Description
Search	The field to search for a graph pipeline. Enter specific terms in the field for which you want to search, and press Enter on the keyboard to display the results.
Name	The name of the graph pipeline.
Number of Nodes	The number of nodes present in the graph pipeline.
Number of Edges	The number of edges present in the graph pipeline.
Owner	The owner of the graph pipeline.
Created Date	The date on which the graph pipeline was created.
Delete	Click to delete multiple graph pipelines.
Add	Click to create a new graph pipeline. See Adding a Graph Pipeline section.
Action	Click **Action** icon to View/Edit/Delete/Download functions on the selected graph pipeline.

> **Note**
>
> The user is now able to execute/schedule a batch with SYSDATE-X days functionality.

Adding a Graph Pipeline

To add a graph pipeline:

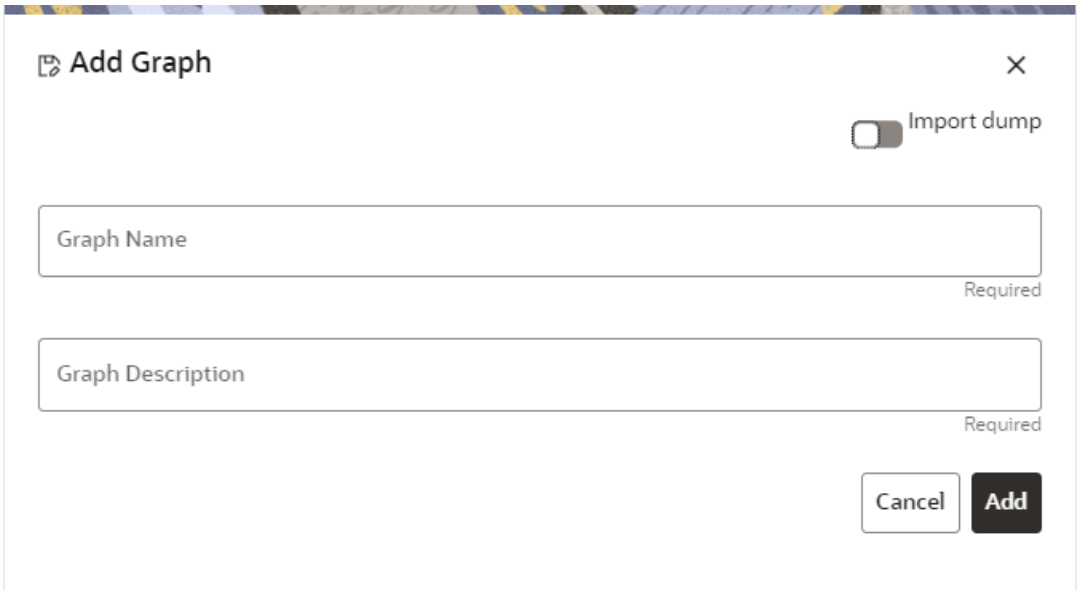
1. Navigate to Graph Summary page.

   This page displays the graph summary records in a table.

2. Click **Add**.

   The **Add Graph**pop-up window is displayed. Figure: Add Graph window.

Figure 11-122 Add Graph window



3. In the **Graph Name** field, enter a name for the graph. The name must be unique to a particular workspace.

4. In the **Graph Description**field, enter the description for the graph and click Add.

   OR

   You can import an existing Graph. Use the toggle button to select **Import Dump**.

   The following page is displayed.

   Browse the file and click **Import**. Once the Import is successful, the Graph Model page is displayed.

   The Maximum Age of Old session for a graph is 7 days by default. The Maximum age of old session of 7 days specifies that graph would be retained for a period of 7 days. You can modify the description and Max Age of Old session by clicking on the **Setting** icon. If you want the batch to be created in read-only mode for scheduler screen, enable the option.

5. Click **Save**.

The user session of the Graph Pipeline will get refreshed after the set timeline.

6. You can perform the following:
   a. Create a Node
   b. Create an Edge
   c. Toggle drawing which will enable or disable the user from dragging components
   d. Zoom In and Zoom Out

Create a Node

To create a Node:

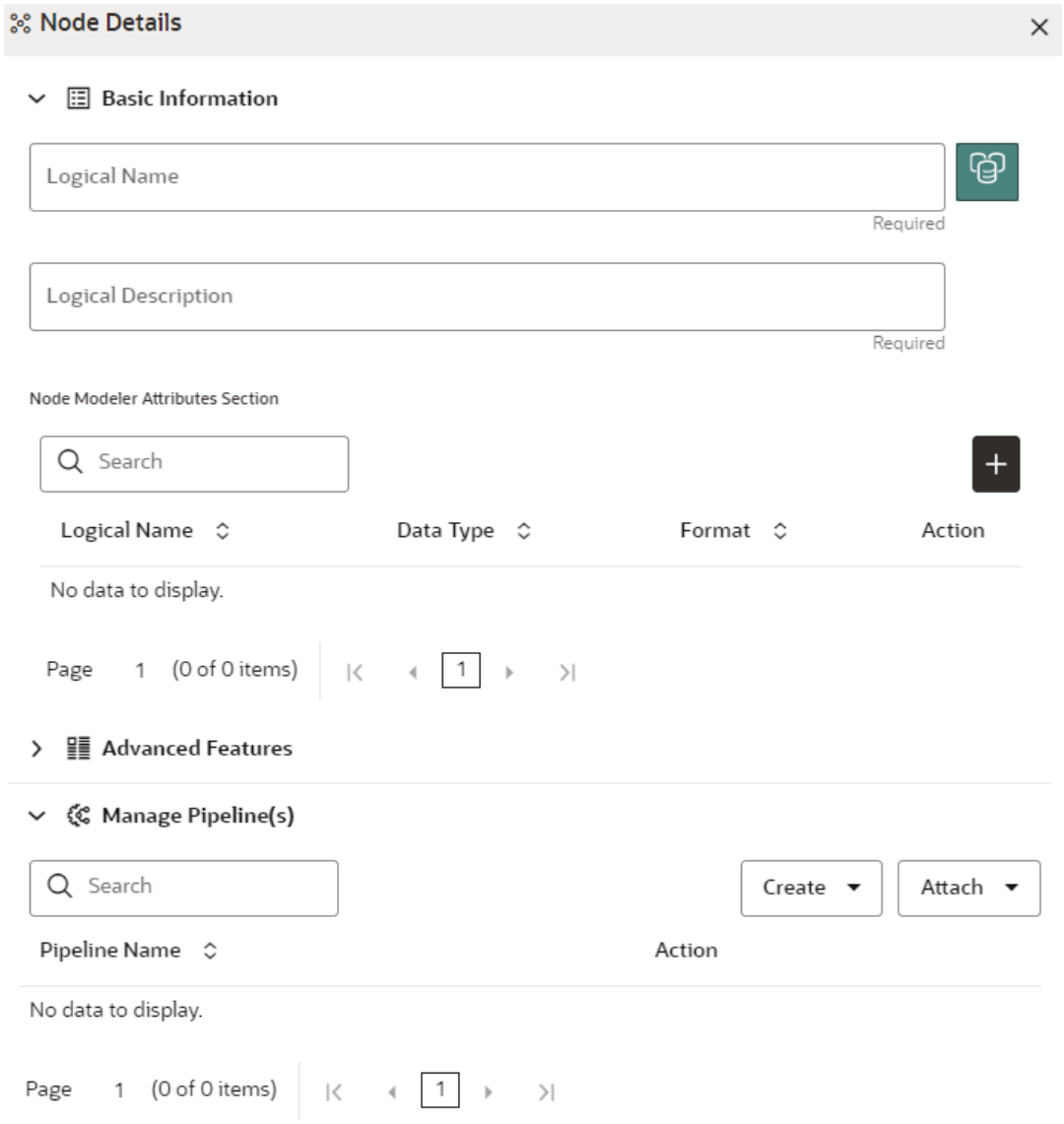
1. In the Graph Model page, click Create Node.

   OR

   Select the graph for which you want to create a Node, click on the Action button, and select the **Edit** option. In the Graph Model page, click **Create Node**.

   The **Node Details** screen is displayed.

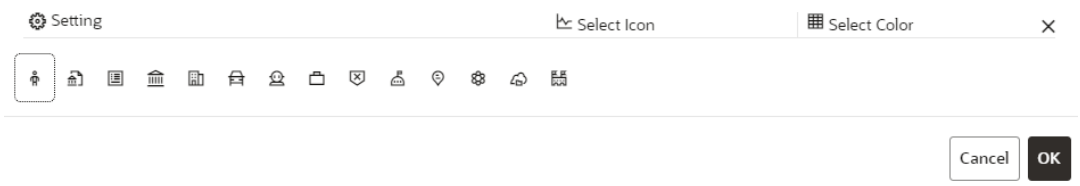
Figure 11-123 Node Details



2. In the **Logical Name** field, enter a name for the Node or click **Setting** .

   The Setting pop-up window is displayed.

Figure 11-124 Setting



3. Select the required representation from the above Node icon.

   For example: Person, Institution, Account etc.

   Hover over the icon to view the definition of the node.

4. Based on your selection, the related Nodes are displayed. Select the Node, and you can choose the required color for the Node using the **Select Color** option.
5. The selected Node is displayed on the graph. To add attributes to the Node, click **Add** .

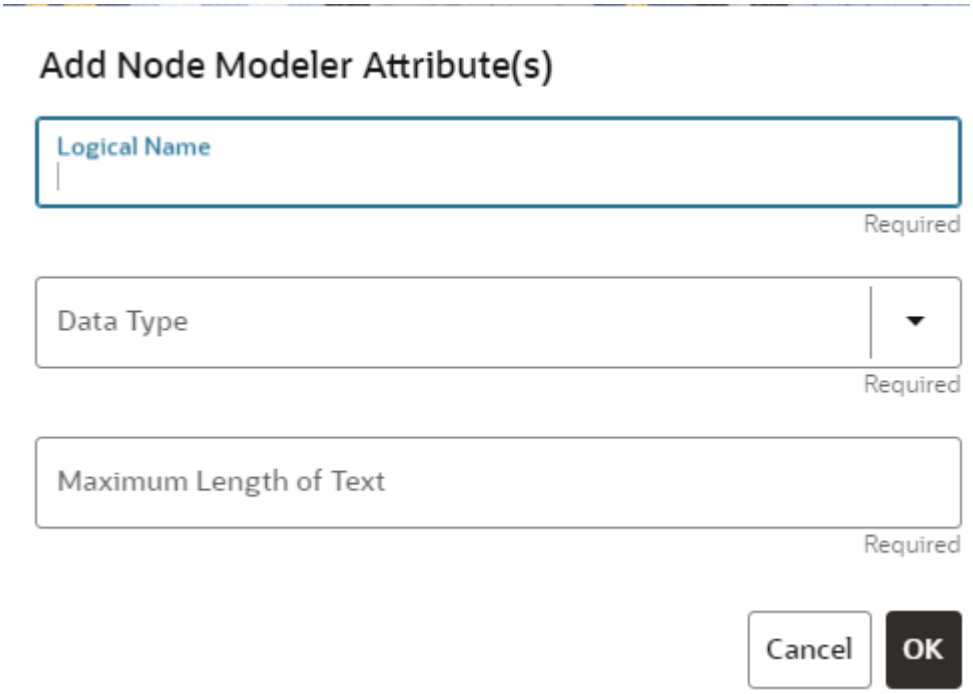
   Modeler attributes are the properties of Node/Edge, and these are mandatory inputs.

   For Example:

   Customer Node will have properties like Customer ID, Name, Age, Gender, etc.

   The **Add Node Modeler Attribute(s)**screen is displayed.

Figure 11-125 Add Node Modeler Attribute(s) screen



6. In the **Logical Name** field, enter the logical name for the modeler attribute.

   This field is mandatory.
7. Select the data type based on your requirements in the **Data Type** field drop-down.

   The available data types are Text, Number, and Date. This field is mandatory.

   Based on the data type selection, the following input field is displayed.

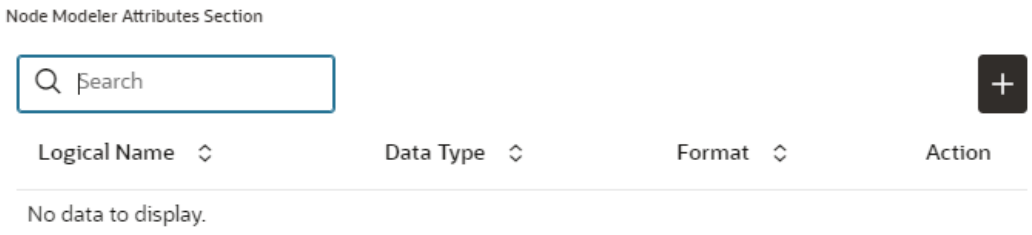
   For example, the **Maximum Length** of Text field is displayed if the data type is selected as Text.

> **Note**
>
> Ensure the Maximum Length attribute is set to at least the field's length from which the data is to be populated.

8. Enter the data and click **OK**.

   The Node attributes are displayed on the Node Details page.

Figure 11-126 Search



You can add any number of modeler attributes based on your requirements by clicking on the Add icon.

9. Under the **Advanced Features** group, select the modeler attribute from the Column Identifier drop-down. All the created modeler attributes are displayed in this list.

Figure 11-127 Advanced Features

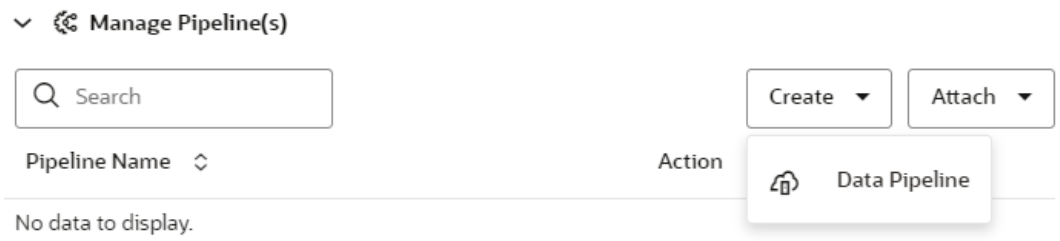
Under the **Manage Pipeline(s)** group, you can either create a new data pipeline or attach the existing pipeline.

The application uses data pipelines to prepare filtered data which can be used to create and run scenarios. Data pipelines prepare data by selecting and joining data sources to create virtual data tables, adding derived attributes to data, running derivations on the data to determine the risk associated with the entity, and so on.

> **Note**
>
> The newly created data pipeline is not automatically added to the Node. You must attach the pipeline using the **Attach** drop-down option.

The selected data pipeline is displayed under the Manage Pipeline(s).

Figure 11-128 Manage Pipeline(s)



10. Click **Create** drop-down and select **Data Pipeline**.

    The **Create Pipeline** window is displayed.

Figure 11-129 Create Pipeline

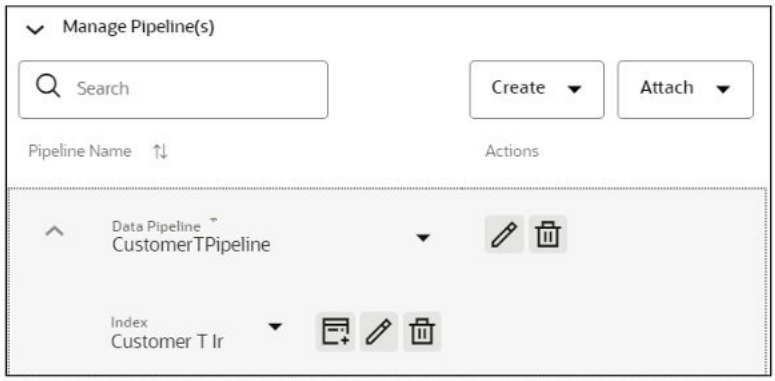
11. Select the **Create New Data Pipeline** option and then click **Ok**.

    The Pipeline Designer page is displayed.

    - To create a data pipeline, see the Managing Data Pipeline section.
      OR
    - To clone from an existing data pipeline, see the Cloning from an Existing Data Pipeline section.

> **Note**
>
> The Persist of the Data pipeline of the corresponding node should be defined with the prescript. See the Prescript Condition section for more details.

Figure 11-130 Create an Index

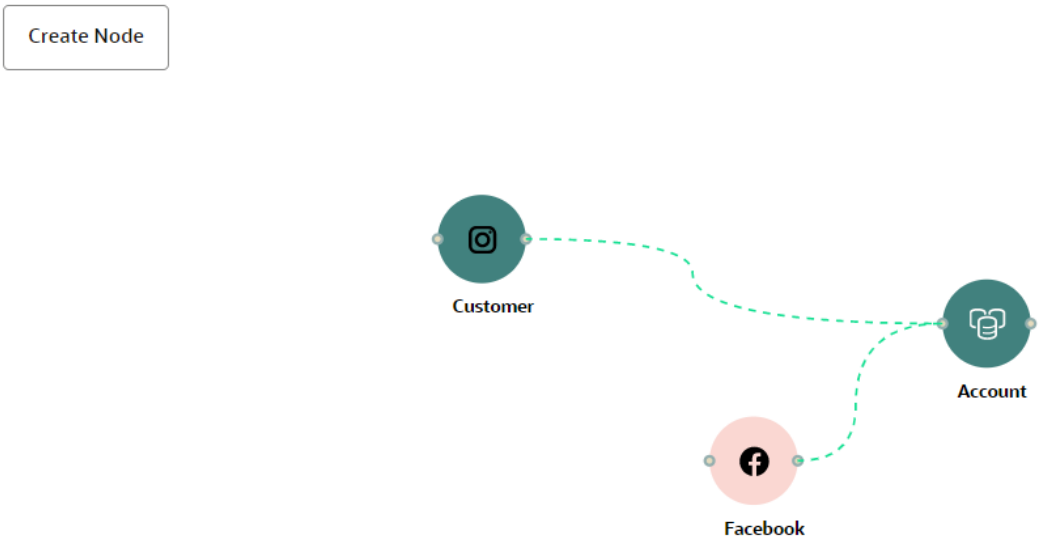


- To define an index for the data pipeline, see the Defining an Index section.

12. By clicking on the **Attach** drop-down, you can add any number of data pipelines to the Node-based on your requirements.
13. Click **OK**.

    The Node is created with pipeline Facebook and an account attached to it as shown in the below example.

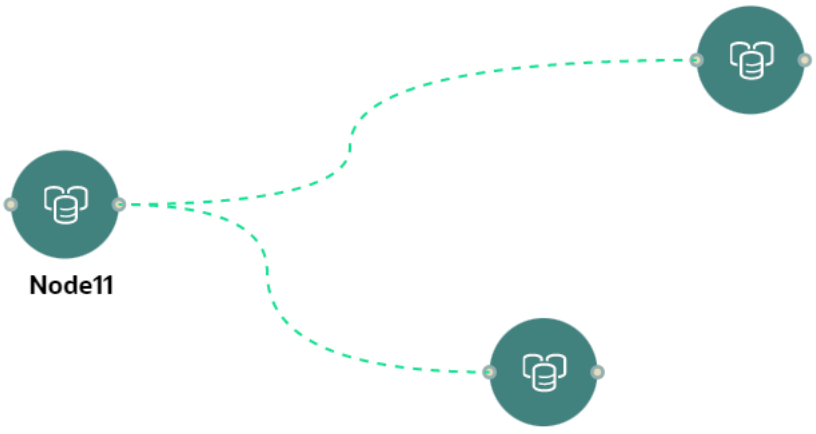
Figure 11-131 Graph with Node and Edge



Create an Edge

An Edge can be used to connect two different nodes or connect to itself. When compared to nodes, edges also capture the basic information like name, description, attributes to an edge, and possible pipelines that can be attached to an edge.

Figure 11-132 Edge

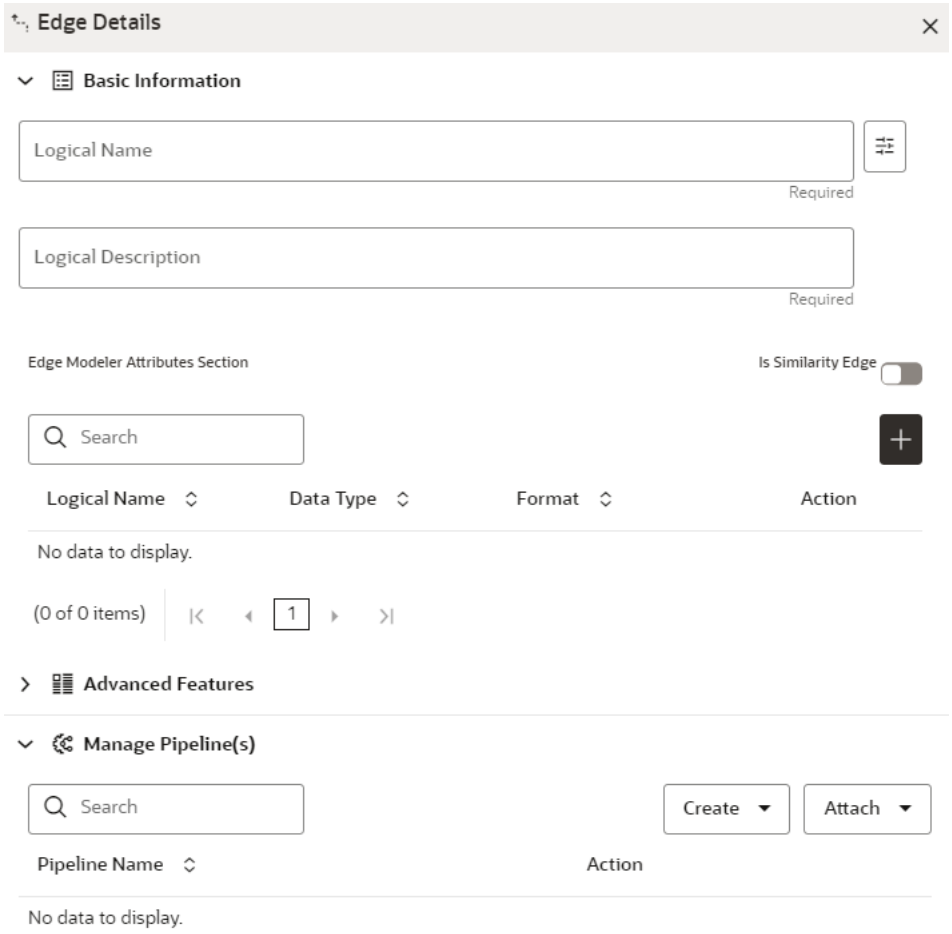


To create an edge, perform these steps:

1. Hover on the Node to create a relationship between them.

   The **Edge Details**screen is displayed.

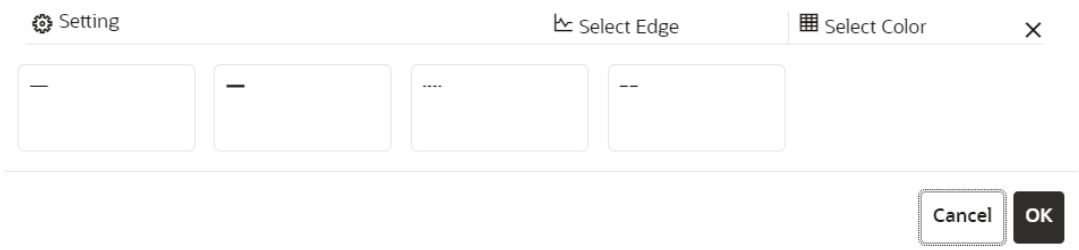
Figure 11-133 Edge Details



2. In the **Logical Name** field, enter the Node's name or click the **Setting** icon.

   The **Setting** pop-up window is displayed.

Figure 11-134 Setting



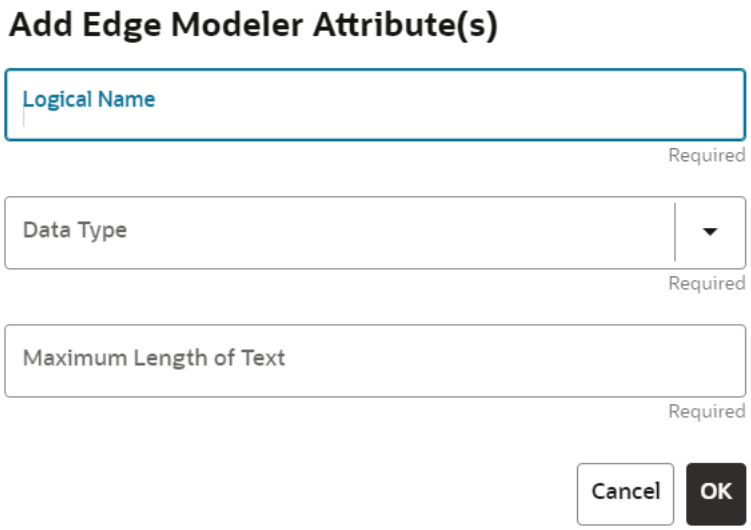
3. Select the required edge from the options displayed and choose the required color for the edge using the **Select Color** option.

4. Click **OK**.

   The selected edge is displayed on the graph pipeline.

5. To add attributes to the edge, click the **Add** icon.

Figure 11-135 Add Edge Modeler Attribute(s) screen



   The **Add Edge Modeler Attribute(s)** screen is displayed.

6. In the **Logical Name** field, enter the logical name for the edge attribute.

   This field is mandatory.

7. In the **Data Type** drop-down, select the data type based on your requirements.

   The available data types are Text, Number, and Date. This field is mandatory.

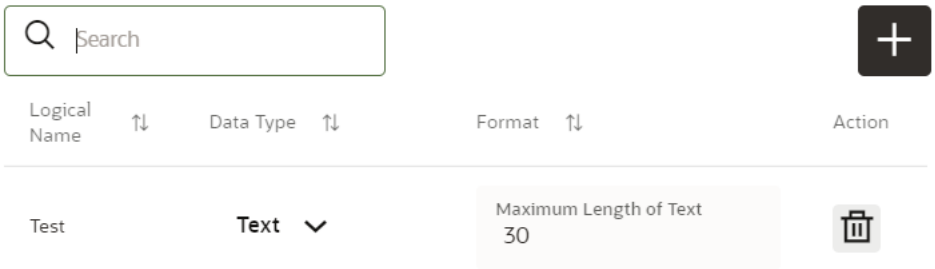
   Based on the data type selection, the following input field is displayed.

   For example, the **Maximum Length of Text** field is displayed if the data type is selected as **Text**.

8. Enter the data and click **Ok**.

   The edge attribute is displayed on the **Edge Details** page.

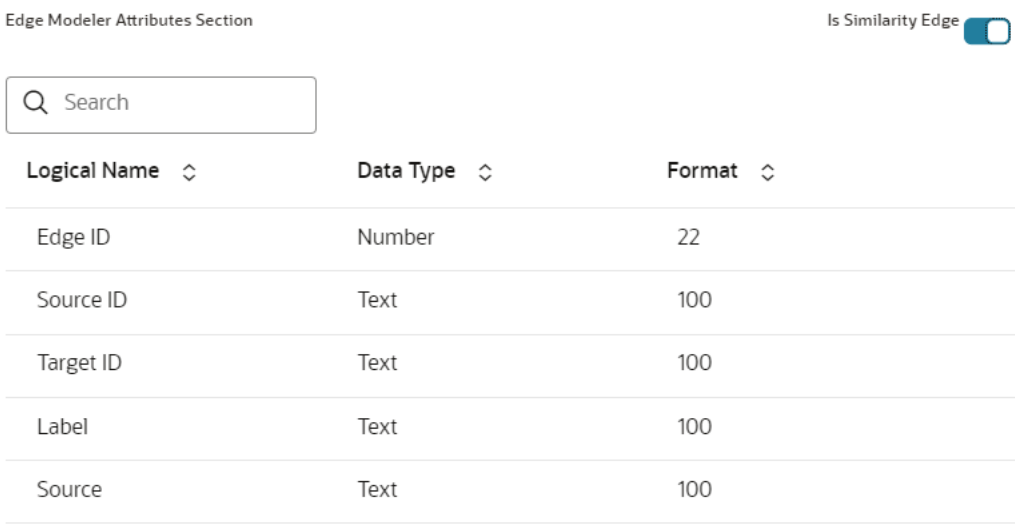
Figure 11-136 Search



By clicking on the **Add** icon, you can add any number of edge attributes based on your requirements.

OR

Figure 11-137 Edge Details



Click the **Is Similarity Edge** toggle button the **Edge Modeler Attributes** section to add the pre-defined set of attributes available in the edge.

Similarity Edgesin the graph are created by Match Rules. If the edge is defined using Match Rule (under Manage Pipeline, by selecting Match Rule from drop down), the toggle button should be enabled to make it a Similarity Edge.

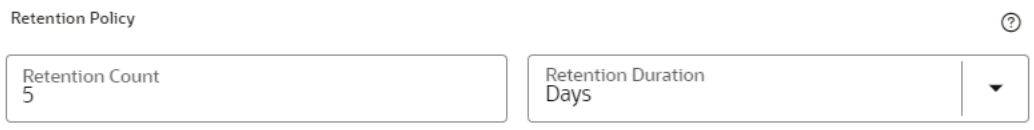
9. Under the **Advanced Features** group, you can specify the Edge Retention Policy.

   For example, An Edge Retention Policy of 7 Days specifies that the current edge would be retained in the physicalized Graph for a period of 7 Days.

10. Enter the retention count and select the retention duration from the drop-down.

    The available retention durations are Days, Weeks, and Months.

Figure 11-138 Retention Durations tab



11. Enable the **Pluggable Attribute**, then the corresponding drop-down will contain the list of attributes of the Edge.

    Pluggable edges are those edges whose data can be directly plugged in to the graph. In Financial Crime and Compliance domain, Transaction is a pluggable edge, which is generally large and is difficult to find out difference/ delta between two subsequent loads. Hence, it's data is provided for a range of dates which can be directly plugged in to the PGX memory while refreshing the graph.

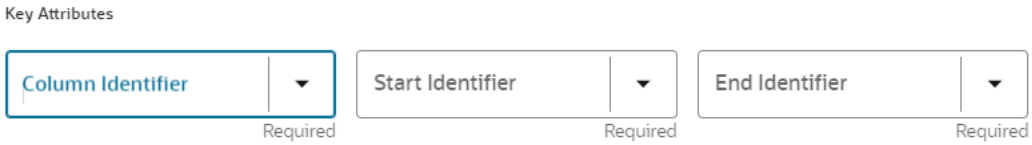
Any pluggable edge should have an identifier attribute, which is of “Date” data type. Figure: Pluggable Attribute.

Figure 11-139 Pluggable Attribute

12. Under the **Key Attributes** field, select the Column, Start, and End identifier from the respective Identifier drop-down. Without these attributes, an edge cannot be created.

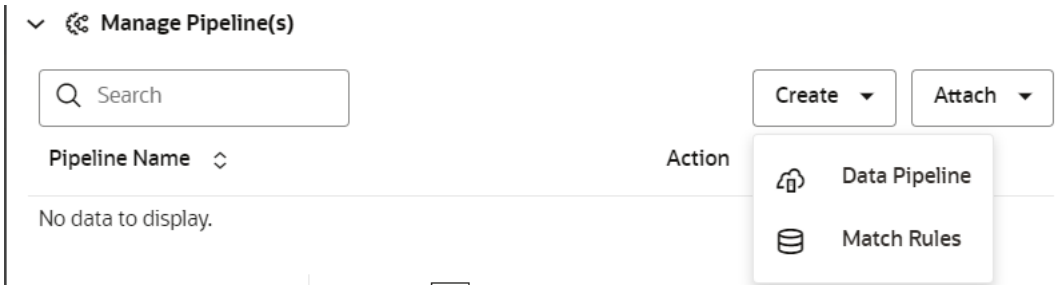
    All the created edge attributes are displayed under this drop-down.

Figure 11-140 Key Attributes



13. Under the **Manage Pipeline(s)** group, you can either create a new data pipeline if the edge is coming from source data and Match Rules, if a similarity edge is to be created between nodes or attach the existing pipeline and Match Rules.

Figure 11-141 Manage Pipeline(s) for Edge



14. Click **Create** drop-down and then select the Data Pipeline.

    The **Create Pipeline** window is displayed.

Figure 11-142 Create Pipeline

15. Select the **Create New Data Pipeline** option and then click **OK**.

    The Pipeline Designer page is displayed.

    - To create a data pipeline, see the Creating a New Data Pipeline section.
      OR
    - To clone from an existing data pipeline, see the Cloning from an Existing Data Pipeline section.

    > **Note**
    >
    > Define persist of the Data pipeline of the corresponding edge with the prescript. See the Prescript Condition section for more details.

16. Click **Create** drop-down and then select the **Match Rules** from the Manage Pipeline(s) group.

    The **Create Pipeline** window is displayed.

Figure 11-143 Create Pipeline

17. Select the **Create New Match Rule** option and then click **Ok**.

    The Create Match Ruleset window is displayed

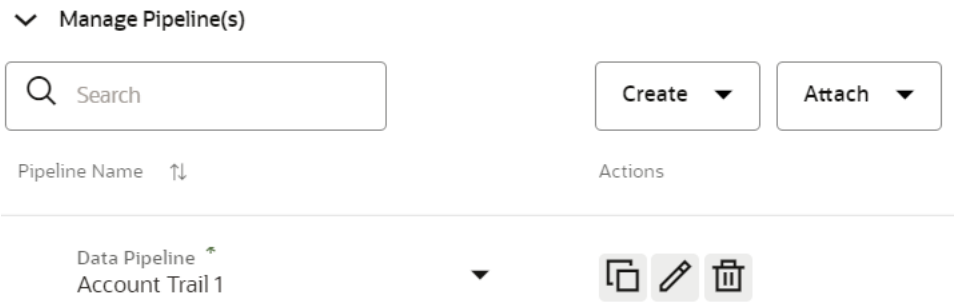
    - To create a Match Rule, see the Creating Match Ruleset section.
      OR
    - To clone from an existing match rule, see the Cloning Ruleset (Match) section.

    > **Note**
    >
    > The newly created data pipeline and match rule are not automatically added to the edge. You must attach using the Attach drop-down option.

    By clicking on the **Attach** drop-down, you can add any number of data pipelines/match rules to the Node-based on your requirements.

    The selected data pipeline/match rule is displayed.

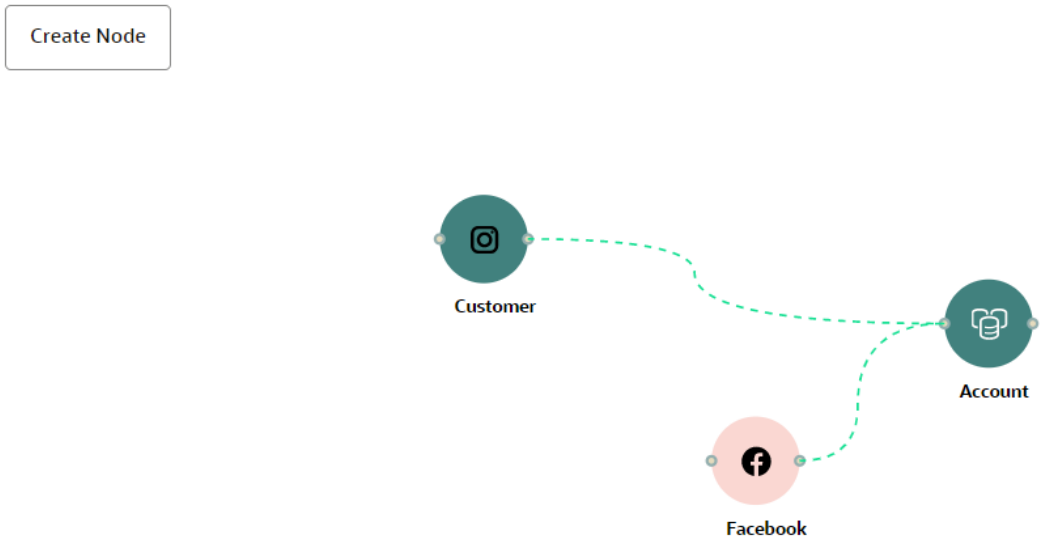
Figure 11-144 Create Pipeline



18. Click **OK**.

    An Edge is created between the Customer, Facebook, and Account as shown in the below example.

Figure 11-145 Graph page



Zoom In and Zoom Out

You can zoom in or zoom out of the graph pipeline and view the data pipelines using the diagram present in the bottom right corner of the page.

Edit a Graph Pipeline

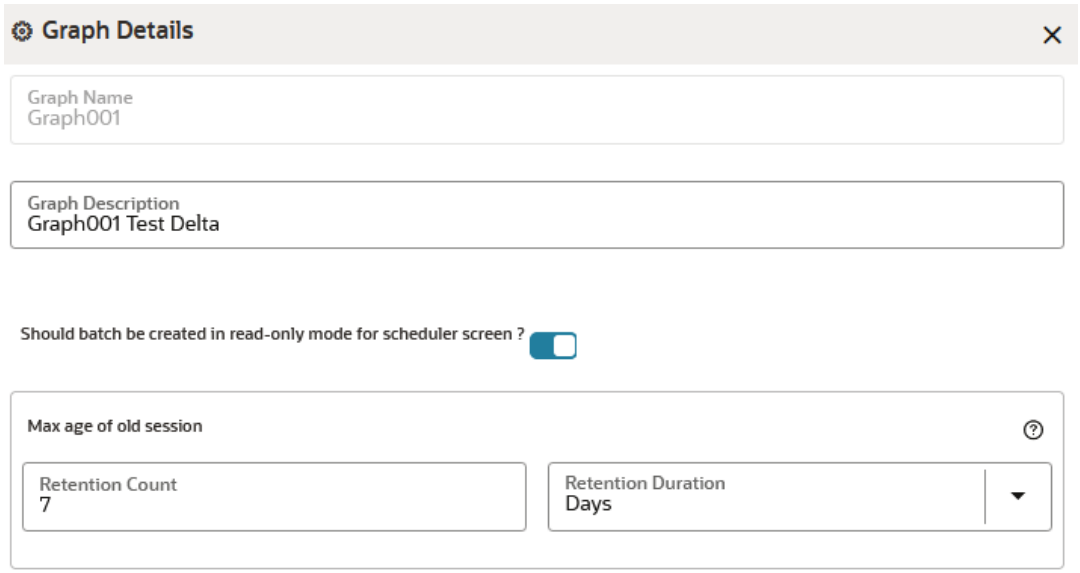
To edit a graph pipeline, perform these steps.

1. In the **Graph Summary**page, select the graph pipeline you want to edit, click the Action icon, and select **Edit**.
2. In the **Graph Name**field, modify the graph pipeline name.

   The name must be unique to a particular workspace.
3. Click the **Setting** icon.
4. In the **Graph Description**field, enter the description for the graph pipeline and click **Save**.

The following page is displayed.

Figure 11-146 Graph page



The Maximum Age of Old session for a graph is 7 days by default. The Maximum age of old session of 7 days specifies that graph would be retained for a period of 7 days. You can modify the description and Max Age of Old session by clicking on the **Setting** icon. If you want the batch to be created in read-only mode for scheduler screen, enable the option.

5. Click **Save**.

   The user session of the Graph Pipeline will get refreshed after the set timeline.

Delete a Graph Pipeline

To delete a graph pipeline:

- On the **Graph Summary**page, select the graph pipeline you want to delete, click the **Action**icon, and select **Delete**.

  To delete multiple graph pipelines, select the graph pipelines which you want to delete and click **Delete** icon in the Header.

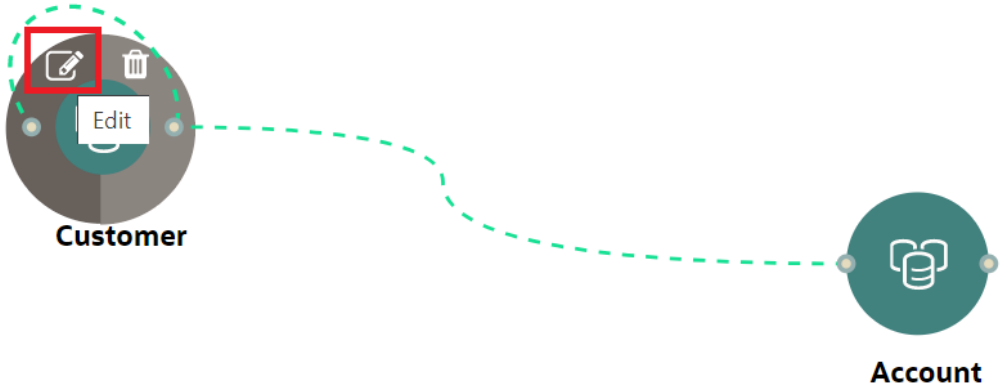
Edit a Node

To edit a node, perform these steps.

1. On the **Graph Summary** page, select the graph pipeline you want to edit, click the **Action** icon, and select **Edit**.
2. Hover over the graph pipeline and click **Edit** icon.

   The **Node Details**page is displayed.

Figure 11-147 Node Details page



3. Perform the steps from 3 to 12 in the Creating a Node section.

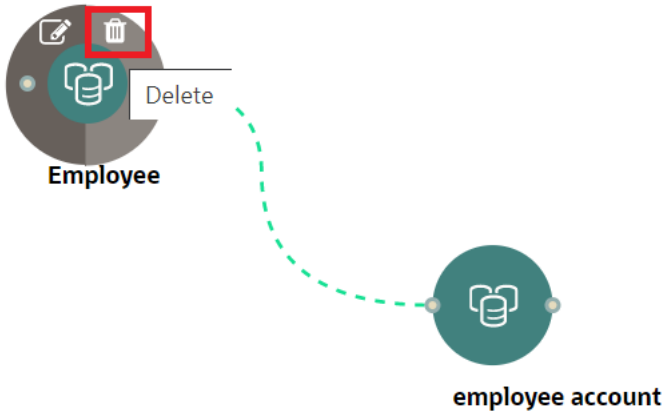
> **Note**
>
> If you delete any attribute in the Node Modeler Attribute section of the Node Details page, you must delete the same attribute in the match rule details.
> For example:
>
> If the edge has two match rules and one is attached, and another match rule is not attached to the edge details. You need to remove attributes in both math rules for this case. To remove the deleted attribute from the Node Details page in the unattached match rule, perform the following:
>
> a. Navigate to **Edge Details > Manage Pipeline(s) > Attach**. Attach the new match rule, which is not attached to the node details.
> b. Click **Edit** and delete the attribute in the Ruleset Details, which is removed from the Node Details page.
> c. Click **Save**. The attribute is removed.
> d. Click **Delete** in Manage Pipeline(s) of the Edge Details page to remove the attached match rule.
> e. After saving in the Edge Details page, navigate to the Node Details page and delete the attribute again.
> f. Click **OK**. The attribute is removed from the node.

Delete a Node

To delete a node:

1. On the **Graph Summary** page, select the graph pipeline you want to edit, click the **Action**icon, and select **Edit**.
2. Hover over the graph pipeline and click **Delete**icon.

Figure 11-148 Delete Node



A confirmation dialog is displayed.

3. Click **Delete**.

   The Node is deleted.

Schedule Details

> **Note**
>
> Currently, when you execute a Graph pipeline for the first time and navigates to the "Monitor Batch" screen, two "run ids" are generated for that batch.

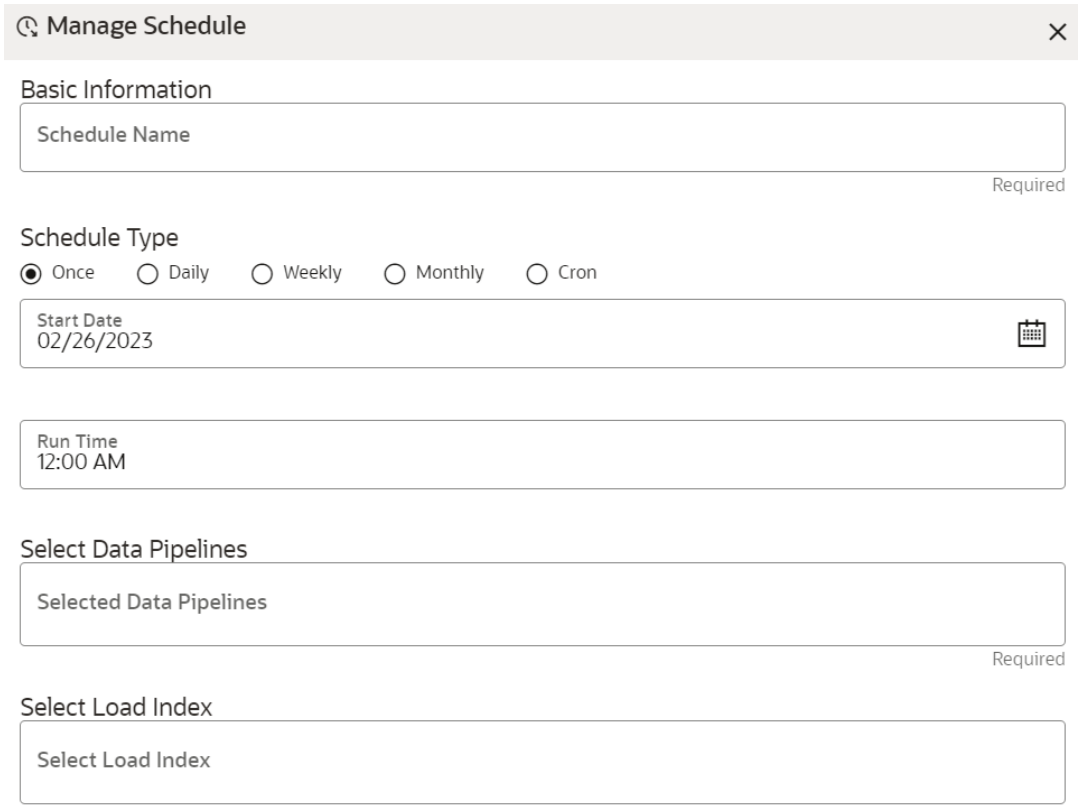
To create a Graph Refresh Schedule:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click the **Graphs** icon.

   This displays the graph pipeline in a table.
3. Click on the graph for which you want to create refresh schedule.
   - The Graph Model page is displayed.
4. Navigate to **Schedule Details** page and click **Add Schedule**.

   The **Manage Schedule** screen is displayed.

Figure 11-149 Manage Schedule screen



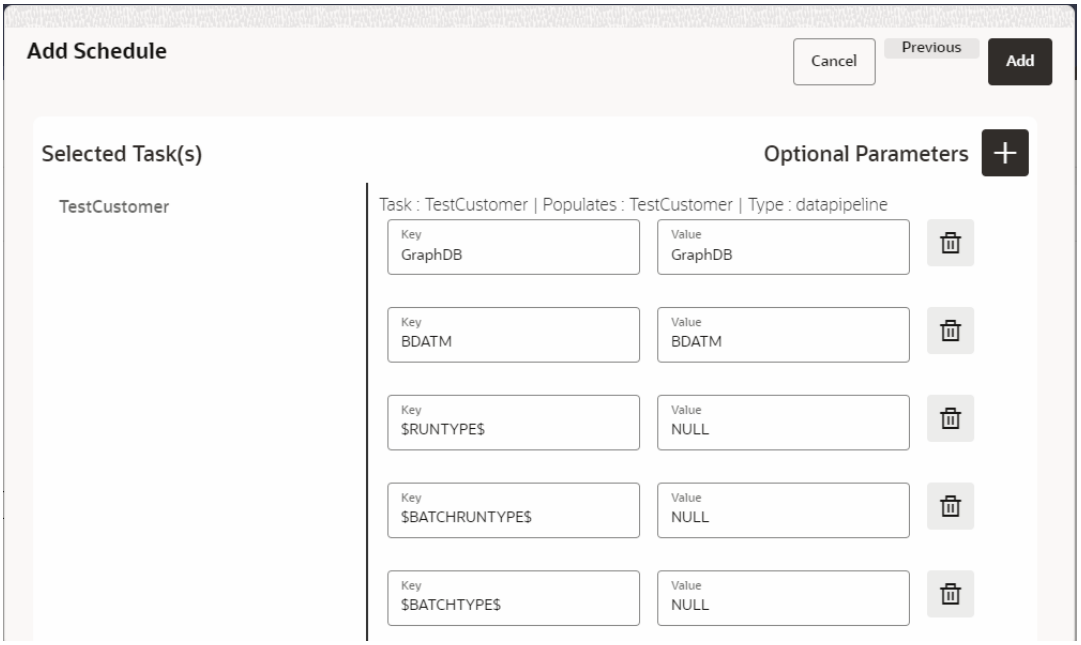
5. In the **Schedule Name**, enter the desired name.
6. Select the **Schedule Type** from the options.

   Based on the schedule type, the following input field is displayed.

> **Note**
>
> For more details and expressions of schedule type, click the **help** icon.

7. Click inside the **Select Task** field and select the tasks. You can select multiple tasks.
8. Click **Next** and add the values for the selected task, and the values are mandatory fields.

Figure 11-150 Add Optional Parameters



9. Click the **+** icon to add optional parameters for the selected task.

   For the Pre-configured Data pipeline, respective Key fields will be displayed. You can configure the respective key-value in the Value field as required and specified in the following table:

Table 11-27 Optional Parameters for Data Pipeline

Name	Description	Default Value
$GRAPH_SCHEMA	Oracle wallet alias of graph schema. Navigate to <OFS_COMPLIANCE_STUDIO >/wallet/ tnsnames.ora and check the Graph Schema alias name. For example, graph_schema_alias	
$BD_SCHEMA	Oracle wallet alias of BD schema. Navigate to <OFS_COMPLIANCE_STUDIO >/wallet/ tnsnames.ora and check the BD Schema alias name. For example, bd_schema_alias	
$RUNTYPE$	Indicates Run type. It can be either a production batch or a test batch. If it is a production batch, set it as PROD and TEST for the test batch.	PROD

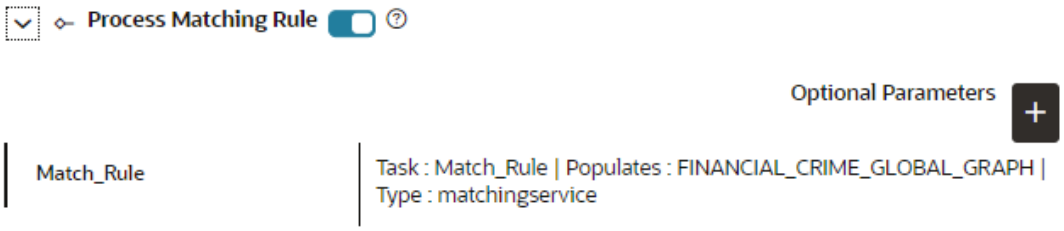
Table 11-27 (Cont.) Optional Parameters for Data Pipeline

Name	Description	Default Value
$batchRunType$	Indicates Batch Run type. It can be either run or re-run. If it needs to execute once, set it as RUN and RE-RUN for re-executing after failure.	RUN
$BATCHTYPE$	Indicates the batch type. It should be DATA for the data pipeline task.	DATA
$JOBNAME$	Name of the data pipeline to be executed.	

10. To add Match Rules, enable the Process Matching Rule option and click + icon to add optional parameters.

    For more information on Match Rule, see the Creating Match Ruleset section.

Figure 11-151 Process Matching Rule



For the Pre-configured Match Rules, respective Key fields will be displayed. You can configure the respective key-value in the Value field as required and specified in the following table:

Table 11-28 Optional Parameter for Match Rules

Name	Description	Default Value
datasource	Oracle wallet alias of graph schema. Navigate to <OFS_COMPLIANCE_STUDIO >/wallet/ tnsnames.ora and check the Graph Schema alias name. For example, graph_schema_alias	-
loadType	Execution Load Type. Available types are full and delta. In this release, only the full mode is supported.	full
processingGroupName	Logical processing group name for the batch. You should set it as MAN.	MAN

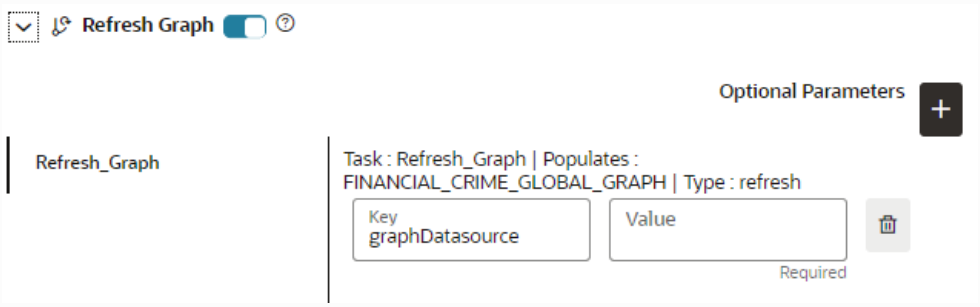
Table 11-28 (Cont.) Optional Parameter for Match Rules

Name	Description	Default Value
basedOnPipelineId	Match rules can be executed based on pipeline Ids or ruleset Ids. The value should be true while running from the Graph.	true
runSkey	A numeric value indicates the runskey of the execution.	100
runType	Indicates matching job that can be executed as part of graph or Entity Resolution. It should be set as Graph.	graph

11. Enable the **Refresh Graph** option and click **Add** to refresh the Graph to add optional parameters.

> **Note**
>
> The Key and Value parameters are not required.

Figure 11-152 Refresh Graph



> **Note**
>
> If you do not enable the Refresh Graph option, the pipeline will add nodes and edges to the Graph Schema but does not load into PGX.

> **Note**
>
> The user is now able to execute/schedule a batch with SYSDATE-X days functionality.

Audit History

At any time, you can audit the Graphs from the Audit History page. This page provides the events on the Graph. This shows the information such as, when the Graph was created, who created the Graph and its status, and so on.

The sequence of actions performed on the Graph is listed in the table view and the timeline view (graphical representation).

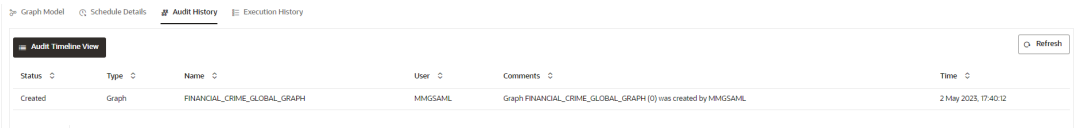
To view the audit history of the Graph, follow these steps:

1. Click **Launch Workspace** next to corresponding Workspace to Launch Workspace to display the **MMG Dashboard** window with application configuration and model creation menu.
2. Click the **Graphs**icon.

   This displays the graph pipeline in a table.
3. Click on the graph for which you want to view the audit history.

   The **Graph Model**page is displayed.
4. Navigate to **Audit History** page to view the details.

Figure 11-153 Audit History



Click for **Audit Timeline View** for Timeline View and **Audit Table View** to switch to the regular view. Click to **Refresh**to refresh the Audit History.

Figure 11-154 Audit History window Timeline View with Horizontal Time Axis

Execution History

To view the Graph Execution History:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click the **Graphs** icon.

   This displays the graph pipeline in a table.

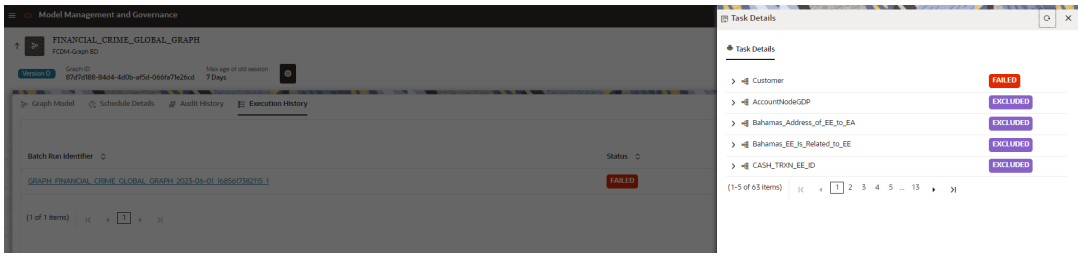
3. Click on the graph for which you want to view the execution history.

   The **Graph Model** page is displayed.

4. Navigate to **Execution History** page to view the details.

   This window displays the details such as Batch Run Identifier, Status, Start and end time of the execution. Click on the Batch Run Identifier to view the individual task details.

Figure 11-155 Execution History page



Analyses

You can analyse, search, add, and delete a notebook from this page.

> **Note**
>
> In the current release, features such as Edit, Clone, and Credential version are not supported.

To analyse the Graph:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. In the Mega menu, click **Modeling > Graphs**.

   This displays the graph pipeline in a table.

3. Click on the graph for which you want to view the execution history.

   The **Graph Model** page is displayed.

4. Navigate to **Analyses** page to view the details.

12

Orchestration

Orchestration covers the following:

- **Scheduler Dashboard**: Get an overview of the scheduled tasks and processes.
- **Define Batch**: Manage and configure batch definitions.
- **Define Tasks**: Create tasks, configure parameters, and set execution dependencies within a batch process.
- **Schedule Batch**: Set execution schedules for your batch processes.
- **Monitor Batch**: Track and monitor batch process executions.

Scheduler Service

The Scheduler Service automates the running of models in the Compliance Studio application.

The Scheduler Service contains a graphical user interface and a single control point for defining and monitoring background executions.

The Scheduler Service is a service in the Infrastructure system that automates behind-the-scenes work that is necessary to sustain various enterprise applications and functionalities. This automation helps the applications to control unattended background jobs.

The Scheduler Service contains a graphical user interface and a single point of control for the definition and monitoring of background executions.

Following are the concepts or terminologies in the Scheduler Service:

- **Batch**: Date and time-based execution of the background tasks based on a defined period during which the resources were available for batch processing.
- **Job**: A batch job is a piece of a program meant to meet specific and business-critical functions. The program is a RESTful API used in a batch.
- **Job Dependency**: When the batch job is submitted, it is moved to the job queue until the system is ready to process. The system process the job based on chronological order or priority in case if more jobs are required to be executed in the job queue.
- **Schedule**: Batch jobs are used to automate the tasks that require to be performed on a regular basis but don’t necessarily need to occur during the day or have an employee interacted with the system are batch schedule. Jobs that happen on a regular basis are incorporated into batch schedules.

API Endpoints for Export/Import Scheduler Objects

Header Parameters for each API:

- ofs_tenant_id - Tenant ID of the Application
- ofs_service_ID - Service ID of the Application
- ofs_workspace_ID - Workspace ID of the Application

- ofs_remote_user - Used ID of the User. This parameter should be mapped to proper function.
- Content-Type: application/JSON

1. Batch Export API:
   HTTP Method - GET

   URL - /v1/rest/batch/:code
2. Batch Import API:
   HTTP Method - POST

   URL - /v1/rest/batch

   Request Body:

   ```
   {
   "objectcode": "<<BATCH_NAME>>",
   "objecttype": "BATCH",
   "objectsubtype": "",
   "overwrite": "Y",
   "objectdefinition":""
   }
   ```
3. Batch Group Export API:
   HTTP Method - GET

   URL - v1/rest/batchgroup/:code
4. Batch Group Import API
   HTTP Method:

   POST URL- /v1/rest/BatchGroup

   Request Body:

   ```
   {
   "objectcode": "<<BATCHGROUP_NAME>>",
   "objecttype": "BATCHGROUP",
   "objectsubtype": "",
   "overwrite": "Y",
   "objectdefinition":""
   }
   ```
5. Schedule Export API:
   HTTP Method- GET

   URL- v1/rest/schedule/:code
6. Schedule Import API HTTP Method - POST URL - /v1/rest/schedule
   Request Body:

   ```
   {
   "objectcode": "<<SCHEDULE_ID>>",
   "objecttype": "SCHEDULE",
   ```

```
"objectsubtype": "",
"overwrite": "Y",
"objectdefinition":""
}
```

> **Note**
>
> 1. OverWrite flag can be **Y** or **N**
> 2. Objectdefinition will be obtained in export API same need to be paste during import in request body
> 3. In Schedule Export API code it is Schedule ID.
> 4. During import of schedule dependent batch or if BatchGroup is not migrated, the user have to use batch and BatchGroup import API to migrate updated definition in the Target environment.

Batch Import Export Utility

This utility is used to export and import batch objects like batch, batchgroups and schedules. This script works in two modes Export and Import. The first parameter of the script decides which mode it is. The Export mode requires exactly five parameters, while the Import mode requires seven parameters. Sequence of the parameters is mentioned below:

For Batch Export:

./batch_export_import_utility.sh EXPORT WORKSPACE LOGIN_USER OBJECT_CODE OBJECT_TYPE

For Batch Import:

./batch_export_import_utility.sh IMPORT WORKSPACE LOGIN_USER OBJECT_CODE OBJECT_TYPE OVERWRITE FILE_NAME

Table 12-1 Parameter Description

Parameter	Description	Example
WORKSPACE	Workspace from which/into which the batch object must be exported/imported.	CS
LOGIN_USER	Any valid user which has access to the system.	SAUSER
OBJECT_CODE	Code of the batch object being exported/imported. If object is of schedule type, please use schedule id instead of code.	BATCH_1
OBJECT_TYPE	Type of the object. e.g., batch, batchgroup, schedule. Must be given in lowercase.	batch
OVERWRITE	'Y' if you want to overwrite existing object while importing, 'N' if you don’t want to.	Y/N

Table 12-1 (Cont.) Parameter Description

Parameter	Description	Example
FILE_NAME	The format is <workspace>/<object_type>/<object_code>	CS_batch_BATCH_1

Scheduler Service Dashboard

1. Click **Launch Workspace** next to corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. In the LHS menu, click **Scheduler Service**.

   This displays the executed runs in a table.

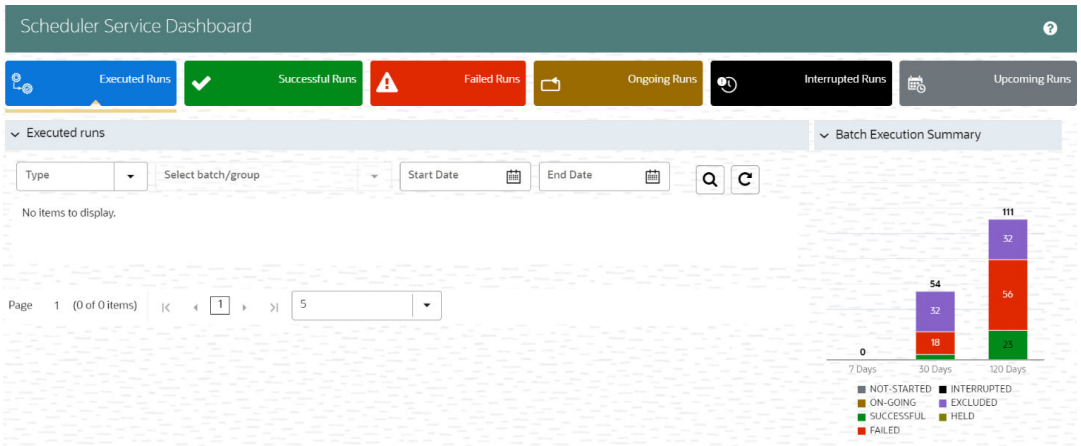
   To view the demonstration of the Dashboard window, see the Scheduler Service Introduction video.

   In the Scheduler Service window, you can view the following details:

   - The Executed Runs, Successful Runs, Failed Runs, Ongoing Runs, Interrupted Runs, and Upcoming Runs tabs. You can click the tabs to view the details of the Batches based on their status. For example, click **Ongoing Runs** to view the details of the batches that are currently running.
   - The Batches that were executed within the last 7 or 30 days contain details such as Batch Name, Batch Run ID, and Run Time. Click **30 days** to view the batches that were executed within the last 30 days.
   - The **Batch Execution Summary** pane displays the count of total batches executed that were executed within the last 7 days, 30 days, and 120 days. Additionally, you can see the separate count of successful batches, failed batches, interrupted batches, on-going batches, and the batches which are yet to start, by hovering your mouse over the batches.

   You can filter the executed runs based on Batch type, Batch/ group, start date and end date by selecting the corresponding options.

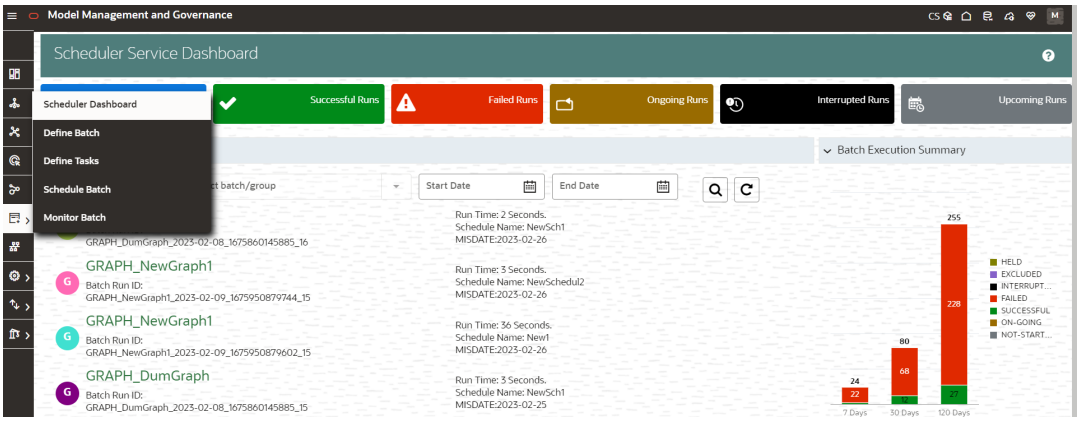
Figure 12-1 Scheduler Service Dashboard



On the **Scheduler Service** window, you can see:

- Menu Navigation: Shows the menu options available in Scheduler Service.
- Quick Actions: Quick actions can be performed by using the buttons in this section.
- User Details: View the logged in user's details, help, and set your profile preferences.

Figure 12-2 Header Details



On the left side of the window, click the **Scheduler Service** icon to see available options in the Scheduler Service.

Configure Batch and Batch Groups

This section describes about Configure Batch and Batch Groups.

Create a Batch

The **Define Batch** window displays the details of an existing batches such as Batch ID, Batch Name, Batch Description, Last Modified By and Last Modified Date. You can create, edit, copy, and delete batches. You can also create a Batch Group, a list of batches that you have selected and grouped, and execute it.

To create a new batch and schedule and monitor the batch that you create:

1. Click **Define Batch** from the Header in the Dashboard window. After selecting the batch, click corresponding to the batch to proceed to create or edit tasks.
2. In the Define Batch window, click **Add**.

   The **Create a New Batch** window is displayed.
3. Specify the details as described in the following table.

Table 12-2 Fields in the Create a New Batch window and their Description

Field	Description
Batch Name	The Batch Name is generated based on the values provided by you. **NOTE**: • The Batch Name should be unique across the Information Domain. • The Batch Name must be alphanumeric and should not start with a number. • The Batch Name should not exceed 60 characters in length. • The Batch Name should not contain any special characters except "_".
Batch Description	Enter a description for the Batch based on the Batch Name. **NOTE**: The Batch description should be alphanumeric. The allowed special characters are: and <blank space>, along with spaces and alpha-numeric. It should not exceed 200 characters in length.
Service URL Name/ Service URL Notify on Mail	• Select the Service URL name from the drop-down list, if it is available. The Service URL is displayed in the Service URL field. • To add a new service URL, enter a name to identify it in the Service URL Name field and enter the proper URL in the Service URL field. You can give partial URL here and the remaining URL in the Task Service URL. Choose this option to notify by an e-mail the batch execution status depending on the property selected. E-mail for the email notification is fetched from the IDCS configuration for the logged-in user. **NOTE**: E-mail is a mandatory field in IDCS. The BATCH_NOTIFY_FUNCT function has to be enabled to access this feature. If it is not available for the logged-in user, this field is grayed out. – Every Time: An e-mail is triggered irrespective of the batch status. – Never: No e-mail will be triggered. – On Error only: An e-mail is triggered only when the batch execution has failed/Error. – On Interrupt only: An e-mail is triggered if the batch is successfully interrupted. **NOTE**: **Never** is the default option.

4. Click **Save**.

   The new Batch is created and displayed in the **Define Batch**window.

Manage Batch

You can manage a batch by editing, copying, or delete them as required.

- **Edit**: Use the **Edit Batch** icon to edit the Batch Description, Service URL Name, Service URL. You can also add a new batch parameter. You cannot edit seeded batches.
- **Copy**: Use the **Copy Batch** option to copy a Batch that you want to clone or create instances in the system from the **Define Batch** window.

- **Delete**: Use the **Delete** icon to delete a Batch that is no longer required in the system. You cannot delete seeded batches.

Create a Batch Group

You can create a new batch group in the Define Batch window and schedule and monitor the batch group that you created.

To create a new Batch Group:

1. In the **Define Batch** window, click **Add**.

   The **Create a New Batch** window is displayed.
2. Select **Batch Group** option.
3. Specify the following fields:
   - Name
   - Description
   - Add Batches: This is a multi-select field. You can select the batches that you want to add to the group using this field.
   - Notify on mail

   > **Note**
   >
   > The Add Batches is a multi-select field, you can select the batches that you want to add to the group using this field.

   Choose the desired option to notify by an e-mail the batch execution status depending on the property selected. E-mail for the email notification is fetched from the IDCS configuration for the logged in user.

   > **Note**
   >
   > E-mail is a mandatory field in IDCS.

   The BATCH_NOTIFY_FUNCT function must be enabled to access this feature.

   If it is not available for the logged in user, this field is grayed out.
   - Every Time: An e-mail is triggered irrespective of the batch status.
   - Never: No e-mail will be triggered.
   - On Error only: An e-mail is triggered only when the batch execution has failed/Error.
   - On Interrupt only: An e-mail is triggered if the batch is successfully interrupted.

   > **Note**
   >
   > Never is the default option.
4. Click **Save**.

   The new Batch Group is created and displayed in the **Define Batch** window.

Manage Batch Group

You can manage a batch group by editing, copying, or delete them as required.

- **Edit**: Use the edit icon to edit the Batch Group name, Added Batches, and Batch Group Description.
- **Copy**: Use the copy option to copy a batch group that you want to clone or create instances in the system.
- **Delete**: Use the delete icon to delete a batch group that is no longer required in the system.

Define Batch

The Define Batch window displays the details of all existing Batch like Batch ID, Batch Name, Batch Description, Last Modified By and Last Modified Date. This window allows you to create a new, edit, copy, and delete the batches. You can also create a Batch Group and execute the Batch Group which has the list of batches that you have selected and grouped.

To navigate to the Define Batch window, click Define Batch option from the Header in the Dashboard window. After selecting the batch, you can select the **Monitor** icon corresponding to the batch to proceed to create or edit tasks.

Batch

Batch is a process of execution of the Date and time-based background tasks based on a defined period during which the resources were available for batch processing.

Edit a Batch

The **Edit Batch** option allows you to edit the Batch details such as Batch Description, Service URL Name and Service URL and also add a new Batch Parameter.

> **Note**
>
> Seeded batches cannot be edited.

To modify a Batch, perform the following steps:

1. In the Define Batch window, click **Edit** corresponding to the Batch you want to modify.

   The **Edit Batch** window is displayed.
2. Modify the required Batch details.

   For more information, see Create a Batch section.
3. Click **Save**.

   The edited batch is saved and displayed in the Define Batch window.

Copy a Batch

The **Copy Batch** option allows you to copy a Batch that you want to clone or create instances in the system from the **Define Batch** window.

To copy a Batch, perform the following steps:

1. In the **Define Batch** window, click **Copy Batch** corresponding to the Batch that you want to copy.

   The **Copy Batch** window is displayed.
2. Specify the Batch details as you want to clone and copy the existing batch.

   For more information, see Create a Batch section.
3. Click **Save**.

   The copied batch is saved and displayed in the **Define Batch** window.

Delete a Batch

The Delete Batch option allows you to delete a Batch that are no longer required in the system from the Define Batch window.

> **Note**
>
> Seeded batches cannot be deleted.

To delete a Batch, perform the following steps:

1. From the **Define Batch** window, click **Delete** corresponding to the Batch you want to delete.
2. Click **OK** in the confirmation dialog to confirm deletion.

   If the batch has any active schedules a warning is displayed.

   Upon confirmation, all schedules of the batch are also deleted.

Batch Group

Batch Group is a process of grouping the batches that are required to be execute together for execution of the Date and time-based background tasks based on a defined period during which the resources were available for batch processing.

Edit a Batch Group

The **Edit Batch Group** option allows you to edit the Batch Group details such as Batch Group name, Added Batches, and Batch Group Description.

To modify a Batch Group, perform the following steps:

1. In the **Define Batch** window, click **Batch Group** option to list the batch groups.
2. Click **Edit** corresponding to the Batch Group you want to modify.

   The **Edit Batch** window is displayed.
3. Modify the required Batch Group details.

   For more information, see Create a Batch Group section.
4. Click **Save**.

   The edited batch group is saved and displayed in the **Define Batch** window.

Copy a Batch Group

The **Copy Batch** option allows you to copy a Batch that you want to clone or create instances in the system from the Define Batch window.

To copy a Batch Group, perform the following steps:

1. In the **Define Batch** window, click Batch Group option to list the batch groups.
2. Click **Copy Batch** corresponding to the Batch Group that you want to copy.

   The Copy Batch window is displayed.
3. Specify the Batch Details as you want to clone and copy the existing batch.

   For more information, see Create a Batch Group section.
4. Click **Save**.

   The copied batch group is saved and displayed in the **Define Batch** window.

Delete a Batch Group

The **Delete Batch** option allows you to delete a Batch that are no longer required in the system from the **Define Batch** window.

To delete a Batch Group, perform the following steps:

1. From the **Define Batch** window, click **Batch Group** option to list the batch groups.
2. Click **Delete** corresponding to the Batch Group you want to delete.
3. Click **OK** in the confirmation dialog to confirm deletion.

Define Tasks

The **Define Tasks** window displays the list of tasks associated with a specific Batch definition. You can create new tasks, edit the existing tasks or delete unwanted tasks. Additionally, you can specify task precedence for each task in Task Precedence window and click the Schedule icon to Schedule the batch.

The **Define Tasks** window allows you to perform the following task operations for your batch and batch group:

- Batch
- Batch Group

Batch

Batch is a process of execution of the Date and time-based background tasks based on a defined period during which the resources were available for batch processing. You can perform the following operation for the batch based on the task.

- Add a Task
- Modify a Task
- Define Task Precedence
- Delete a Task

Modify a Task

Modifying a task option allows you to modify the details of existing tasks of a Batch definition such as Task Description, Task Type, Batch Service URL and Task Service URL. You can also add a new task parameter and enable or disable already existing task parameters.

To modify a Task, perform the following steps:

1. From the **Define Task** window, select the Batch whose task details you want to modify, from the **Select** drop-down list.
2. Click **Edit** corresponding to the Task whose details you want to modify.

   The **Edit Task** window is displayed.
3. Modify the required Task Details.

   For more information, see Add a Task section.
4. Click **Save**.

Delete a Task

You can remove a task from a Batch definition which are no longer required in the system by deleting it from the **Define Task** window.

To delete a Task, perform the following steps:

1. From the **Define Task** window, select the Batch whose task details you want to delete from the **Select** drop-down list.
2. Click **Delete** corresponding to the Task you want to delete.
3. Click **OK** in the confirmation dialog to confirm deletion.

Batch Group

Batch Group is a process of grouping the batches that are required to be execute together for execution of the Date and time-based background tasks based on a defined period during which the resources were available for batch processing. You can perform the following operation for the batch based on the task.

- Define Task Precedence

Define Task Precedence

Task Precedence indicates the execution-flow of a Batch. Task Precedence value facilitates you to determine the order in which the specific Tasks of a Batch are executed.

For example, consider a Batch consisting of 4 Task. The first 3 Task does not have a precedence defined and hence will be executed simultaneously during the Batch execution. But, Task 4 has a precedence value as task 1 which indicates that, Task 4 is executed only after Task 1 has been successfully executed.

You can set Task precedence between Tasks or define to run a Task after a set of other tasks. However, multiple tasks can be executed simultaneously, and cyclical execution of tasks is not permitted. If the precedence for a Task is not set, the Task is executed immediately on Batch execution.

To define the task precedence in the Define Task window, perform the following steps:

1. Click the **Menu** button corresponding to the task for which you want to add precedence task.

The **Task Precedence Mapping** window is displayed.

The Task Precedence option is disabled if a batch has only one task associated.

a. Select the batch that you want to execute before the current task, from the Available Tasks pane and click **Move**. You can press Ctrl key for multiple selections.

b. To select all the listed batches, click **Move All**.

c. To remove a batch, select the task from the Selected Tasks pane and click **Remove**.

d. To remove all the selected batches, click **Remove All**.

2. Click **Save** to update Task Precedence in the batches.

3. Click **Preview** to view the Precedence information.

Configure Tasks

The **Define Tasks** window displays the list of tasks associated with a specific Batch definition. You can create new tasks, edit existing tasks, or delete unwanted tasks. Additionally, you can specify task precedence for each task in the Task Precedence window and schedule the batch.

Use the **Define Tasks** window to perform task operations for your batch and batch group.

Add Task to a Batch or Batch Group

You can add new tasks to a selected Batch or Batch Group definition.

To add new task:

1. Click **Define Tasks** from the Header panel.

   The **Define Task** window is displayed.

2. Select the Batch or Batch Group for which you want to add new task from the Select drop-down list.

3. Click **Add**.

   The **Create a New Task** window is displayed.

   When creating a task, there are multiple types of components to choose from:

   Model

   - **Model**: Select the Model of selected Objective. It can be any specific model of Objective or All models of Objective. If the ALL_CHAMPION is selected here, then Objectives with no Champion Model is skipped, and the Objectives with Champion Models gets executed. If CHAMPION is selected, and no Champion is present, then Model Execution gets fail.
   - **Objective**: Select the Object which you want to use for execution. For more information, see the Create Objective (Folders) section. The Sub Objective is displayed with path. For example, if Test1 is Objective and Test11 is Sub Objective, and you want to use Test11 Objective for execution, then select this field as Test1/Test11.
   - **Link Types**: You can set this parameter to **Yes** or **No**. If Synchronous Execution is set to **Yes**, then execution will wait for the notebook execution status. If Synchronous Execution is set to **No**, then execution will not wait for the notebook execution status, it will trigger the notebook and update task status as successful in batch monitor.
   - **Synchronous Executions**: You can set this parameter to **Yes** or **No**. If Synchronous Execution is set to **Yes**, then execution will wait for the notebook execution status. If

Synchronous Execution is set to **No**, then execution will not wait for the notebook execution status, it will trigger the notebook and update task status as successful in batch monitor.

- **Optional Parameters**: This is used pass the parameters dynamically.

Populate Workspace

- **Global Filter**: Provided input will be applied as a data filter on all the tables selected for data sourcing.
- **Table Filter**: Users can provide data filters individually on the tables here. Please note that you may provide multiple table names for the same SQL filter. Global Filters will not be applicable for those tables on which filters have been applied individually. In case the same table name is provided in more than one rows here, the filter condition will be generated as a conjunction of all the provided filters.
- **Additional Parameters**: Additional parameters include source/target pre-scripts, fetch size, and commit size to optimize data processing and control execution behavior.

4. Enter the details as given here:

Table 12-3 Fields in the Create a New Task window and their Description

Field	Description
Task Name	Enter the task name. **NOTE:** • The Task Name must be alphanumeric and should not start with a number. • The Task Name should not exceed 60 characters in length. • The Task Name should not contain any special characters except underscore (_).
Task Description	• Enter the task description along with spaces and alpha-numeric. No special characters are allowed in Task Description. • Words like Select From or Delete From should not be entered in the Description.
Task Type	Select the task type from the drop-down list: **Rest**: Used to invoke RESTful APIs. Only POST method is supported commonly used to trigger downstream services (For example: models, graphs and so on) or workflows. **Executable**: Used to run shell scripts (.sh) or other system-level executables.
Batch Service URL	Select the required Batch Service URL from the drop-down list. This can be blank, and you can provide the full URL in the Task Service URL field. **WORKSPACE_URL**: Seeded batch URL base endpoint of the batch service responsible for managing and orchestrating batch or batch group executions related to workspace APIs. **MMG_SERVICE_URL**: Seeded batch URL base endpoint of the batch service responsible for managing and orchestrating batch or batch group executions related to MMG APIs (For example: Model Execution). **CS_SERVICE_URL**: Seeded batch URL base endpoint of the batch service responsible for managing and orchestrating Batch or Batch Group executions related to CS APIs.

Table 12-3 (Cont.) Fields in the Create a New Task window and their Description

Field	Description
Component	These are preceded metadata types, which can be executed through Scheduler. The user is allowed to select the required components with regards to the select Bacth URL, or the user can create their own CUSTOM URLs by selecting the CUSTOM component.
Task Service URL	Enter task service URL if it is different from Batch or Batch Group Service URL. **Batch URL**: This is the base endpoint of the batch service responsible for managing and orchestrating batch or batch group executions. Users can append the task end points in the Define Task. There is nothing as Batch group service URL. **Task Service URL**: This is the endpoint for executing individual tasks (For example, REST calls). Users can either provide an end point path to be appended to the Batch URL provided in the batch definition or specify a full REST URL for independent execution.

5. From the Task Parameters pane, click **Add** to add a new Task Parameter. By default, all Batch level parameters are added and enabled as task parameters. To disable, deselect the check box corresponding to the task parameter ( )
   a. Enter the Parameter name in the **Param Name** field.
   b. Enter the Parameter value in the **Param Value** field.
   You can delete a parameter by clicking **Delete** corresponding to the parameter.
6. Click **Save**.

> **Note**
>
> **Header Parameter**: This parameters are passed in the request header of the execution API to provide metadata like workspace, service ID and so on.

Manage Tasks

You can manage tasks by modifying or deleting tasks and also define task precedence.

- **Modify**: Use the edit icon to modify details of existing tasks of a Batch definition such as Task Description, Task Type, Batch Service URL, and Task Service URL. You can also add a new task parameter and enable or disable existing task parameters.
- **Delete**: Use the delete icon to remove a task from a Batch definition from the Define Task window.
- **Define Task Precedence**: Task Precedence specifies the execution-flow of a Batch. Task Precedence value facilitates you to determine the order in which the tasks of a Batch are executed.

For example, consider a Batch consisting of 4 tasks. The first 3 tasks do not have a precedence defined and hence will be executed simultaneously during the Batch execution. But, task 4 has a precedence value as task 1 which indicates that, task 4 is executed only after task 1 has been successfully executed.

You can set Task precedence between Tasks or define to run a Task after a set of other tasks. However, multiple tasks can be executed simultaneously; cyclical execution of tasks is not permitted. If the precedence for a task is not set, the task is executed immediately on execution of the Batch.

To define the task precedence in the Define Task window:

1. Click **Menu** button corresponding to the task for which you want to add a precedence task.

   The **Task Precedence Mapping** window is displayed.

   > **Note**
   >
   > The Task Precedence option is disabled if a batch has only one task associated.
   >
   > a. Select one or multiple tasks you want to execute before the current task, from the **Available Tasks** pane and click >. Press Ctrl key to select multiple items.

2. Click **Save**.
3. Click **Preview** to view the precedence information.

Define Task Precedence

Task Precedence specifies the execution-flow of a Batch. Task Precedence value facilitates you to determine the order in which the specific Tasks of a Batch are executed.

For example, consider a Batch consisting of 4 Task. The first 3 Task does not have a precedence defined and hence will be executed simultaneously during the Batch execution. But, Task 4 has a precedence value as task 1 which indicates that, Task 4 is executed only after Task 1 has been successfully executed.

You can set Task precedence between Tasks or define to run a Task after a set of other tasks. However, multiple tasks can be executed simultaneously, and cyclical execution of tasks is not permitted. If the precedence for a Task is not set, the Task is executed immediately on Batch execution.

To define the task precedence in the Define Task window:

1. Click the **Menu** button corresponding to the task for which you want to add precedence task.

   The **Task Precedence Mapping** window is displayed.

   > **Note**
   >
   > The Task Precedence option is disabled if a batch has only one task associated.

   a. Select the Task you want to execute before the current task, from the **Available Tasks** pane and click **Move**. You can press Ctrl key for multiple selections.
   b. To select all the listed Tasks, click **Move All**.
   c. To remove a Task, select the task from the Selected Tasks pane and click **Remove**.
   d. To remove all the selected Tasks, click **Remove All**.

2. Click **Save** to update Task Precedence.
3. Click **Preview** to view the Precedence information.

Exclude or Include Tasks

You can exclude tasks or include the excluded tasks during Batch Group Execution. The excluded task components are therefore executed in the normal process assuming that the excluded task have completed execution.

To exclude/include tasks, perform the following steps:

1. In the **Schedule Batch** window, click **Exclude Tasks**.

   The **Select Tasks** window is displayed.

2. To exclude tasks:

   a. Select the required task from the **Included Tasks** list and click **Move**. You can press Ctrl key for multiple selections.

   b. To exclude all tasks, click **Move All**.

3. To include the excluded tasks:

   a. Select the required task from the **Excluded Tasks** list and click **Remove**. You can press Ctrl key for multiple selections.

   b. To include all excluded tasks, click **Remove All**.

4. Click **Save**.

Schedule Batch or Batch Group

Use the *Schedule Batch / Batch Group* feature to run, schedule, re-start, re-run batches in the Scheduler Service. After you upload the data in the required format into Object Storage, you must load the data into the system using the Scheduler Service. You can schedule them to run in a required pattern and view the run time status of the scheduled services using the Monitor Batch feature.

You can perform operations on batches and batch groups. Information in the following sections is applicable to both batches and batch groups. Where there are unique instructions for batches or batch groups, they are called out clearly.

Execute a Batch/Batch Group

Use the Execute batch option to run a batch/batch group instantaneously.

To execute a batch:

1. Click **Schedule Batch**from the Header panel.

   The **Schedule**window is displayed.

2. Select the Batch Name from the **Select Name** drop down menu.

   For example, AMLDataLoad.

   You can preview the schedule of a Batch/Batch Group by clicking on Preview button.

3. Click **Execute**.

   The Execution Status Dialog Box is displayed with the Batch executed successfully message.

   This indicates the unique identification reference number for the batch and date of the batch execution.

4. In the **Execution Status** Dialog Box, click **Monitor** to monitor the batch.
5. If you want to exclude/include some tasks, click **Exclude Tasks**.

   For more information, see Exclude/Include Tasks section.
6. If you want to hold/release some tasks, click **Hold Tasks**.

   For more information, see Hold/Release Tasks section.
7. If you want to edit the dynamic parameters of the batch, click **Edit Dynamic Parameters** .

   For more information, see Edit Dynamic Parameters section.

Schedule a Batch/Batch Group

You can schedule a Batch to run just for Once, Daily, Weekly, Monthly or a Cron Expression for scheduling the batches. You can also have a user defined schedule to schedule and run a batch/batch group.

Schedule Once

To schedule a Batch to run once:

1. Click **Schedule Batch** from the Header panel.

   The **Schedule Batch** window is displayed.
2. In the Schedule Batch window, click **Once**.
3. Select the Batch or Batch Name you want to schedule for once from the **Select** list.
4. Enter a **Schedule Name**.
5. Click the date and time picker icons and select the date and time when you want to run the batch.
6. Click **Schedule**.

Schedule Daily

To schedule a Batch to run daily:

1. In the **Schedule Batch** window, click **Daily**.
2. Select the Batch or Batch Name you want to schedule daily from the **Select** list.
3. Enter a **Schedule Name**.
4. Click the date and time picker icons and select the date and time when you want to run the batch.
5. Click **Schedule**.

Schedule Weekly

To schedule a Batch to run weekly:

1. In the **Schedule Batch** window, click **Weekly**.
2. Select the batch or batch name you want to schedule weekly from the **Select** list.
3. Enter a **Schedule** Name.
4. Click the date and time picker icons to select the start date, end date, and time when you want to run the batch.

5. Select the days of the week when you want to run the batch from the **Select Days of the Week** list.
6. Click **Schedule**.

Schedule Monthly

To schedule a Batch to run monthly:

1. In the **Schedule Batch**window, click **Monthly**.
2. Select the Batch or Batch Name you want to schedule monthly from the Select list.
3. Enter a **Schedule** Name.
4. Click the date and time picker icons to select the start date, end date, and time when you want to run the batch.
5. Select the days of the week when you want to run the batch from the **Select Days of the Week** list.
6. Click **Schedule**.

Schedule Cron Expression

To run a Batch in a user-defined schedule, you can have custom schedule with the help of Cron Expression. A Cron Expression is a string comprised of 6 or 7 fields separated by white space. Fields can contain any of the allowed values, along with various combinations of the allowed special characters for that field. For more information, click the information icon.

To create a customized schedule for a batch using a Cron Expression:

1. In the **Schedule Batch**window, click **Cron Expression**.
2. Select the batch or batch name you want to schedule from the Select list.
3. Enter a **Schedule Name**.
4. Enter the Cron Expression for your schedule. For more information about the Cron Expression, click the **Information**icon.
5. Click **Schedule**.

Pause a Batch

You can pause a batch that has been executed. User can click on pause button and can pause schedule for between scheduled dates. Time is not supported for pause activity, if any schedule is paused for current date, it will be paused immediately. If pause start date is passed, user cannot change pause start date, rest fields can be manipulated and will be valid one minute before end of day.

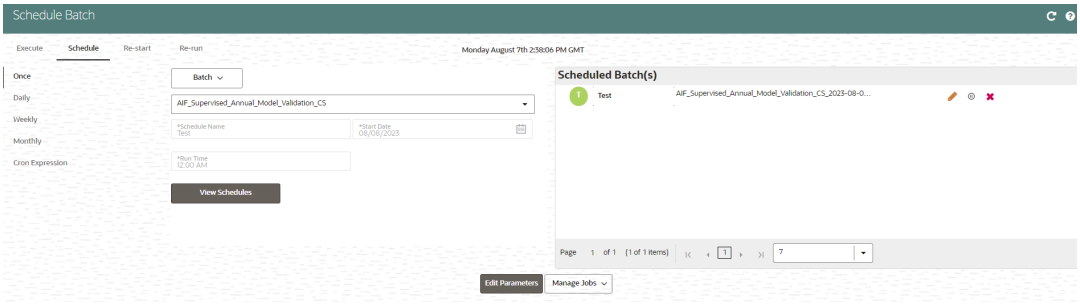
If pause is expired, user cannot edit and delete but will be shown in UI.

To pause a batch:

1. From the Header panel, click **Schedule Batch** and then click the **Schedule** tab.
2. Select the batch you want to pause from the list.
3. For the batch you have selected to pause, select the scheduling type (Once, Daily, Weekly, Monthly, or Cron Expression).
4. Click **View Schedules**.

   The scheduled batches are displayed on the right pane.

Figure 12-3 Scheduled Batches



5. Click the pause icon for the batch you want to pause.
6. In the **Manage Pause** screen, click **Add Pause**.
7. Select the **Pause Start** and **End Date**, add comments if required, and click +.

   The Pausing schedule appears in the Pause Summary.
8. Repeat the steps if you want to add multiple pausing schedules for the same batch.

Re-start a Batch/Batch Group

You can restart a Batch which has not been executed successfully or which has been explicitly interrupted, or cancelled, or put on hold during the execution process. By restarting a Batch, you can continue Batch execution directly from the point of interruption or failure and complete executing the remaining tasks.

To re-start a batch:

1. Click **Schedule Batch**from the Header panel.

   The **Schedule** window is displayed.
2. From the **Schedule** window, select **Re-start** tab.
3. Select the Batch Group you want to re-start from the Select Name drop down menu.
4. Select the Batch Run ID.
5. Click **Re-start**.

Re-run a Batch/Batch Group

You can re-run a Batch which has previously been executed. Rerun Batch facilitates you to run the Batch irrespective of the previous execution state. A new Batch Run ID is generated during the Rerun process and the Batch is executed as similar to the new Batch Run.

To re-run a batch:

1. Click **Schedule Batch** from the Header panel.

   The **Schedule Batch** window is displayed.
2. In the **Schedule Batch** window, select **Re-run** tab.
3. Select the Batch or Batch Name you want to re-run from the **Select Name** list.
4. Select the **Batch Run ID**.
5. Click **Re-run**.

Edit Dynamic Parameters

Dynamic Parameters facilitate modification of dynamic parameters for the batch. You can change the param value and save the changes to the batch. The **Edit Dynamic Parameters** option is available in all the tab in the *Schedule Batch* window.

To edit the dynamic parameters for a batch/batch group:

1. In the **Schedule Batch** window, click **Edit Dynamic Parameters**.
2. In the **Edit Dynamic Params** window, modify the values as required.
3. Use the **SYSDATE-x** option to reference relative dates execute or schedule a batch. In the **Edit Dynamic Parameter** window, enter a value, for example; *SYSDATE-2*, to represent two days before the execution date/time. You must ensure that the value for *x* is a non-negative integer
4. Click **Save**.

   The modified parameters are applied to the Batch.

Task Definitions of a Batch/Batch Group

You can modify the task definition state in the Batch Execution window to exclude or hold the defined task in a Batch from execution. The excluded tasks are therefore assumed to have completed execution and get excluded during the Batch Run.

While executing or scheduling a batch group from the Schedule Batch window, you can:

- Exclude a task or include the excluded task.
- Hold a task or release the held task.

Exclude or Include Tasks

You can exclude tasks or include the excluded tasks during Batch/Batch Group Execution. The excluded task components are executed in the normal process assuming that the excluded tasks have completed execution.

To exclude/include tasks:

1. In the **Schedule Batch** window, click **Exclude Tasks**.

   The **Select Tasks** window is displayed.
2. To exclude tasks:
   a. Select one or multiple tasks from the Included Tasks list and click > or >> respectively. Press the Ctrl key and click to select multiple items.
3. To include the excluded tasks:
   a. Select one or multiple tasks from the **Excluded Tasks** list and click < or << respectively. Press the Ctrl key and click to select multiple items.
4. Click **Save**.

Hold or Release Tasks

You can hold tasks or release the held tasks during Batch Group Execution. The tasks which are on hold along with the defined components are skipped during execution. However, at least one task should be available in a Batch without being held or excluded for Batch execution.

To hold/release tasks:

1. In the **Schedule Batch** window, click **Hold Tasks**.

   The **Select Tasks** window is displayed.
2. To hold tasks:
   a. Select the required task from the **Released Tasks** list and click **Move**. You can press Ctrl key for multiple selections.
   b. To hold all tasks, click **Move All**.
3. To release held tasks:
   a. Select the required task from the **Held Tasks** list and click **Remove**. You can press Ctrl key for multiple selections.
   b. To release all held tasks, click **Remove All**.
4. Click **Save**.

Pre-Conditions for a Batch Group

You can schedule the batches and set the pre-conditions within a Batch group with frequency as Weekly, Monthly, or based on an Interval for scheduling the batches. The batch that satisfies the configured pre-conditions are executed as part of the schedule.

> **Note**
>
> Pre-Conditions can only be applied when using the Schedule option in the Schedule Batch window.

Weekly

To set the pre-conditions to the batches in a batch group weekly, perform the following steps:

1. In the **Schedule Batch** window, you can select either Once, Daily,Weekly, Monthly, or Cron Expression option based on the schedule that you want to run the batch group.
2. Select the Batch Group you want from the Select drop down menu.
3. Enter a Schedule Name.
4. Specify the other details displayed when you are selecting Once, Daily,Weekly, Monthly, or Cron Expression.
5. Click Pre-Conditions.
6. In the Pre-Conditions window, specify the Batch from the drop down and from the Frequency drop down and select Weekly.
7. Select the days from the Select Days drop down that you want to schedule the batch run within the selected week.
8. Click **Add** to add the specified entry.

   > **Note**
   >
   > Pre-Conditions can be added only to one batch at a time.

9. Click **Save**.
   The batch is executed based on the configured pre-conditions.

Monthly

To set the pre-conditions to the batches in a batch group monthly, perform the following steps:

1. In the **Schedule Batch** window, you can select either Once, Daily,Weekly, Monthly, or Cron Expression option based on the schedule that you want to run the batch group.
2. Select the Batch Group you want from the Select drop down menu.
3. Enter a Schedule Name.
4. Specify the other details displayed when you are selecting Once, Daily,Weekly, Monthly, or Cron Expression.
5. Click Pre-Conditions.
6. In the Pre-Conditions window, specify the Batch from the drop down and from the Frequency drop down and select Monthly.
7. Select the days from the Select Days drop down that you want to schedule the batch run within the selected week.
8. Click **Add** to add the specified entry.

> **Note**
>
> Pre-Conditions can be added only to one batch at a time.

9. Click **Save**.
   The batch is executed based on the configured pre-conditions.

Interval

To set the pre-conditions to the batches in a batch group based on an interval, perform the following steps:

1. In the **Schedule Batch** window, you can select either Once, Daily,Weekly, Monthly, or Cron Expression option based on the schedule that you want to run the batch group.
2. Select the Batch Group you want from the Select drop down menu.
3. Enter a Schedule Name.
4. Specify the other details displayed when you are selecting Once, Daily,Weekly, Monthly, or Cron Expression.
5. Click Pre-Conditions.
6. In the Pre-Conditions window, specify the Batch from the drop down and from the Frequency drop down and select Interval.
7. Select the interval from the Custom Recurrence (Repeat every) Days drop down that you want to schedule the batch run within the selected week.

> **Note**
>
> The Custom Recurrence can be set maximum to 60 days.

8. Click **Add** to add the specified entry.

> **Note**
>
> Pre-Conditions can be added only to one batch at a time.

9. Click **Save**.
10. The batch is executed based on the configured pre-conditions.

Edit Dynamic Parameters

Dynamic Parameters facilitates you to the modify the dynamic parameters for the batch. You can change the param value from the Edit Dynamic Params window and save the changes to the Batch. The Edit Dynamic Parameters option is available in all the tab in the **Schedule Batch** window.

To edit the dynamic parameters for a batch group, perform the following steps:

1. In the **Schedule Batch** window, click **Edit Dynamic Parameters**.

   The **Edit Dynamic Params**window is displayed.
2. In the **Edit Dynamic Params** window, modify the values as required.
3. Click **Save**.

   The modified parameters are applied to the Batch.

Accessing Scheduler Optional Parameters Inside Studio Paragraphs

The Scheduler Service automates the running of models in the application. The Scheduler Service contains a graphical user interface and a single control point for defining and monitoring background executions.

For more details on the Scheduler Service, see Scheduler Service section.

To access the optional parameters passed from the Scheduler during execution of any models, run the following script:

```
To print
print('BATCHRUNID value is : ${$BATCHRUNID$}')
print('TASKID value is : ${$TASKID$}')
print('FICMISDATE value is : ${$FICMISDATE$}')
```

To access the optional parameters passed during execution of any models, run the following scripts:

```
%python
print('threshold value is : ${threshold}')
```

> **Note**
>
> Threshold is the optional parameter passed during the model execution.

From scheduler task/edit dynamic parameters, the aprameter set to a model can be passed in optional parameter textbox as parameterSets=Set1 where parameterSets is the key for paramter sets and Set1 is the actual set value.

From EICS it is as below:

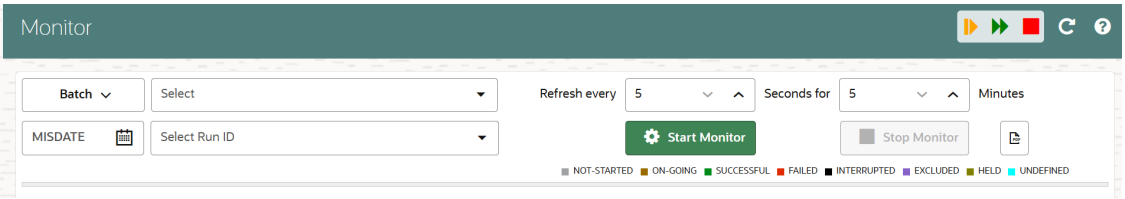
```
./EICSchedulerService.sh -o 1 -u mmgadmin -w CS -c ofsauser -s secret -x 232 -
b BatchModel -t rest -v '{"batchParams":
{"$FICMISDATE$":"2021-11-30","$BATCHRUNID$":"BATCHRUNID"},"taskRuntimeParams":
{"Task1":{"optionalparams":"parameterSets=Set1"},"Task2":
{"optionalparams":"parameterSets=Set2"}}
```

Monitor Batch or Batch Groups

Use the Monitor Batch feature to view the status of executed batch/batch group along with the task's details. You can track the issues if any, on regular intervals and ensure smoother batch/ batch group execution. A visual representation as well as tabular view of the status of each task in the batch/batch group is available.

You can monitor operations for batches and batch groups using the Monitor Batch feature.

Figure 12-4 Monitor Batch

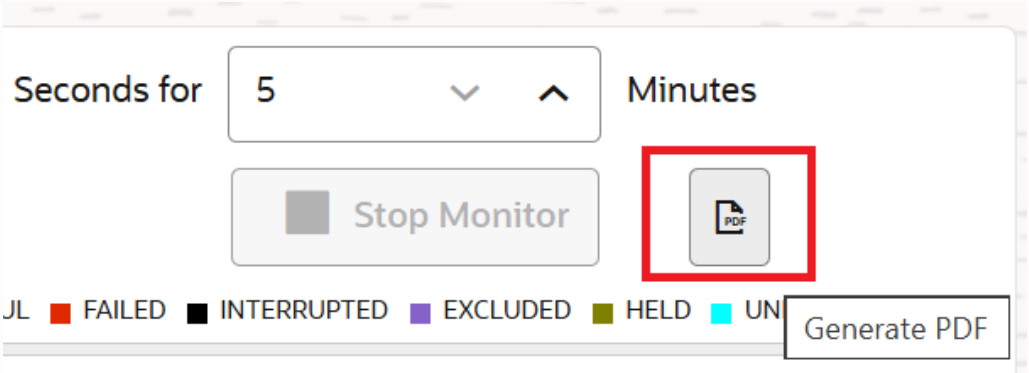


To monitor a batch/batch group:

1. Click **Monitor Batch** from the Header panel.
   The **Monitor** window is displayed.
2. Select the batch/batch group from the **Select** drop-down and then select the **Batch Run ID** from the **Run ID** list.
3. Click **Start Monitor**.
   The result is displayed in **Visualization** and **List View** tabs.
   - On the Visualization tab are charts and in List View are details in a tabular format with the following details:
     a. i. Batch Status: Displays the batch status—NOT-STARTED, ON-GOING, SUCCESSFUL, FAILED, INTERRUPTED, EXCLUDED, HELD, and UNDEFINED.
     b. Batch Start Time: The batch start time.
     c. Batch End Time: The batch end time.
     d. Task Details: Mouseover the task to display task status and additional details.
     e. More Information: The message returned by the Rest Service.
4. Select **Stop Monitor** if you wish to stop monitoring. You can also specify the Start and Stop Monitor options along with refresh interval by providing the Refresh every seconds and minutes information.

> **Note**
>
> - You can select the refresh interval and the duration of the auto refresh. The default refresh interval is 5 seconds and default duration 5 minutes. That is, data is refreshed every 5 seconds for the next 5 minutes.
> - The interval input range must be between 5 to 60 seconds and the duration input range between 5 to 180 minutes.
> - You can use the **Stop Monitor** button to stop the auto refresh.

5. To restart, rerun, or interrupt the monitoring, select the **Restart**, **Rerun**, or **Interrupt** buttons, respectively.
6. To view log information, click the log icon in the **List View** tab.
   The **Log Viewer** window appears displaying the log details.
7. Click the Download icon to download the log, or click the close icon to close the log viewer.

> **Note**
>
> On the **Batch Monitor** screen, click **Download PDF** to generate and download a PDF report for the selected batch run.
>
> **Figure 12-5 Generate PDF Icon**
>
> 
>
>
> The PDF report is also saved in the `<ftpsharepath>/printservice/pdfs/scheduler/<DATE>/` path, where `<ftpsharepath>` is the FTP share path that was configured during the installation.

Batch Group

Batch Group is a process of grouping the batches that are required to be execute together for execution of the Date and time-based background tasks based on a defined period during which the resources were available for batch processing.

To monitor a batch group:

1. Click **Monitor Batch** from the Header panel.

   The **Monitor** window is displayed.

2. Select the **Batch Group from the Select** drop-down and then select the **Batch Run ID from the Run ID** drop-down.
3. Click **Start Monitor**.

   The result is displayed in Visualization and List View tabs. Details of these tabs are as follows:

   - The Visualization tab displays the details in the form of a chart represented with the following details:
     - Batch Status: Displays the batch status, the different batch status are NOT-STARTED, ON-GOING, SUCCESSFUL, FAILED, INTERRUPTED, EXCLUDED, HELD, and UNDEFINED.
     - Batch Start Time: Displays the batch start time details.
     - Batch End Time: Displays the batch end time details.
     - Batch Details: Mouseover the task to display its status and details.
   - The **List View** tab displays the details in a tabular form with the following details:
     - Batch Status: Displays the batch status, the different batch status are NOT-STARTED, ON-GOING, SUCCESSFUL, FAILED, INTERRUPTED, EXCLUDED, HELD, and UNDEFINED.
     - Batch Start Time: Displays the batch start time details.
     - Batch End Time: Displays the batch end time details.
     - Batch Details: Mouseover the task to display its status and details.
     - More Information: The message returned by the Rest Service.
4. If you wish to stop the monitoring, select Stop Monitor. You can also specify the Start and Stop Monitor options along with refresh interval in the Refresh every seconds and minutes fields.

   > **Note**
   >
   > - You can select the refresh interval and the duration for the auto refresh. The refresh interval is defaulted to 5 seconds and duration is defaulted to 5 minutes. That is the refresh happens every 5 seconds for next 5 minutes.
   > - Range of interval input must be between 5 to 60 seconds and range of duration.
   > - Input should be between 5 to 180 minutes.
   > - You can use the Stop Monitor button to stop the auto refresh.

5. To restart the Batch Group, select **Restart**.
6. To rerun the Batch Group, select **Rerun**.
7. To interrupt the Batch Group, select **Interrupt**.

   To view the log information about the batch group, click **View Log** in the **List View**tab.

Scheduler Configuration

Scheduler Configuration UI allows you to manage the scheduler service configuration parameters.It also allows you to map specific user to batch and batchgroups for email notifications.

To access the Scheduler Configuration UI in the Scheduler Service page, follow these steps:

1. Go to the Home page of the application.
2. Navigate to **Batch Administration** in the left Navigation pane.
3. Under **Batch Administration**, click on **Scheduler Configuration**.

> **Note**
>
> Ensure you have the BATCH_ADMIN function code to access the Scheduler Configuration page.

Batch to User Configuration

Batch to User Configuration menu allows you to map users to specific batch/batch group processes.This assignment ensures that emails are sent only to the specific users associated with each batch.

To access the Batch to User Configuration page, select **Batch to User Configuration** in the Scheduler Configuration UI.

> **Note**
>
> Click the **eye** icon on the **Batch to User Configuration** tile to view the page.

To search for a specific batch/batch group, enter the keywords in the Search field and click **Search**. You can search based on Batch Name, Batch Code, and Batch type.

> **Note**
>
> The system automatically sends an email to all users mapped to the BATCH_NOTIFY_FUNT function and BATCH_NOTIFY_ROLE role. If a batch/batch group is mapped to a user (and their email ID), the batch email notifications will be sent only to that configured batch user. If no batch-to-user configuration is provided or updated, email notifications will be sent to users with the above function and role.

Perform the following steps to add specific user(s) to the batch/batch group:

1. In Batch to User Configuration menu, click **Add** to add new batch/batch groups.
2. Select the batch type from the dropdown menu.
3. Select the required batch/batch group from the dropdown menu.
4. Select the required users from the dropdown menu.
5. Click **Create**, the *Batch User mapping is created successfully* message is displayed.

Action menu

Batch to user mapping configuration page lists all the batch/batch groups which are mapped to specific user(s).

1. Select the desired batch/batch group from the Batch to user mapping configuration page. Click **Action Menu** to view, modify, or delete batch/batch groups.
   a. **View**
   Clicking **View** allows users to see detailed information on the batch/batch group user mapping.
   b. **Edit**
   Edit the batch/batch group to user mapping configuration.You can either update the user details or remove the user.
   c. **Delete**
   The **Delete** option allows you to remove the user to batch/batch group mapping from the system.

General Configuration

The **General Configuration menu** allows you to configure the parameters related to a scheduler service.

1. Under **Scheduler Configuration** menu, select **General Configuration**.

> **Note**
>
> Click the **eye** icon on the **General Configuration** tile to view the page.

2. In Scheduler Service General Configuration Screen, click **Edit** to modify the configuration settings.
3. Modify the required details, refer to the **General configuration parameters** table below.

Table 12-4 General configuration parameters

Parameter	Description	Default Value
Enable/disable general email notification	Enable/disable general email notifications to automatically alert users when a batch job is successful, failed, or is interrupted.	Enable
Enable/disable in-app notification	Enable/disable in-app notifications to alert users within the application when a batch job is successful, failed, or is interrupted.	Enable

Table 12-4 (Cont.) General configuration parameters

Parameter	Description	Default Value
Enable/disable notification for threshold email	Enable/disable email notifications triggered when a batch execution exceeds its expected execution time threshold. For example, if a batch typically completes in 1 hour but now takes longer, an email is sent as its taking longer than expected time to complete.	Enable
Threshold email time notification percentage criteria	Defines the additional execution time (in percentage) allowed beyond the last successful batch completion time before sending a threshold notification email. For example: If a batch previously completed successfully in 1 hour and the threshold is set to 20%, a threshold notification will be triggered if the batch exceeds 1 hour and 12 minutes (i.e., 60 minutes + 20%). If multiple notifications are allowed (as per the Threshold email Notify Limit), the time for subsequent notifications will be calculated from the last notification time, adding the same threshold percentage again. For instance, the next notification would be triggered after 20% of 72 minutes (i.e., 86.4 minutes), and so on.	20
Threshold email Notify Limit	Defines the maximum number of email notifications that can be sent when a batch exceeds its execution time threshold during a single run. **Note** If general email notification is disabled and only if the threshold email notification is enabled, scheduler sends only the threshold email.	5

Table 12-4 (Cont.) General configuration parameters

Parameter	Description	Default Value
Batch to User mapping upper limit	Specifies the maximum number of users that can be mapped to a batch/batch group.You can configure a maximum of five user mappings per batch or batch group.	10

4. Click **Save** to save the modified configurations.
OR

   Click **Cancel** to discard the changes and revert to the previous settings.

External Interface Component Scheduler Service

Use the **EICSchedulerService.sh** utility located in the `<installed path> mmg-home/bin` folder to perform basic scheduler operations.

Prerequisites:

- Ensure public and private keys are present in the conf folder and the corresponding path is present in `application.properties` of `mmg UI service`.
- You should be aware of the clientId/secret which will be used for basic authentication. (Currently, these values are stored in `application.properties` as `token.clientid` and token.secret).

Table 12-5 List of possible flagged arguments to be passed while executing EICSchedulerService.sh

Flag	Description	Comments
-o	Operation Type: The operation the user wants to perform.	A mandatory argument for all type of requests. Possible Values are: 1 – To trigger an object 2 – To get the current status of a run. 3 – To re-start an execution. 4 – To re-run an execution. 5 – To interrupt an execution.
-u	ofs_remote_user	A mandatory argument for all the type of requests
-w	Workspace Id	A mandatory argument for all the type of requests
-c	Client Id for authentication	A mandatory argument for all the type of requests Currently, in mmg-ui application.properties the parameter token.clientid is set to ofsauser

Table 12-5 (Cont.) List of possible flagged arguments to be passed while executing EICSchedulerService.sh

Flag	Description	Comments
-s	Client Secret for authentication	A mandatory argument for all the type of requests Currently, in mmg-ui application.properties the parameter token.secret is set to secret
-b	Object Name	Batch or Batch Group Name.
-t	Object Type	For Batch, it is set to rest and for Batch Group, it is set to group.
-r	Batch Execution Id	Execution ID of the Batch or Batch Group.
-x	External Unique Id	The unique ID for every execution. Mandatory for execute and rerun operations.
-i	Included Jobs	In case of trigger, included jobs can be provided as comma separated values using this flag.
-e	Excluded Jobs	In case of trigger, excluded jobs can be provided as comma separated values using this flag.
-h	Held Jobs	In case of trigger, held jobs can be provided as comma separated values using this flag.
-v	Dynamic parameter list	This is an optional parameter to support passing of dynamic runtime parameters for Batch/ Task.

Table 12-6 List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
Trigger	• **Execute batch "batch1":** – **Syntax:** `./EICSchedulerService.sh -o 1 –u <ofs_remote_user> -w <Workspace Id> -c <Client Id for authentication>`	To execute a batch or a batch group	-4	Invalid arguments passed in request/not enough params in Request body
			-5	Invalid Request Headers
			-9	Duplicate External Unique Id
			-3	Batch or Batchgroup does not exist.
			-6	No executable job is present. Batch with no task.

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	-s < Client Secret for authentication > -x < External Unique Id > -b < Object Name > -t < Object Type> – **Example:** ./EICSchedulerService.sh -o 1 -u scheduser -w WS1 -c ofsauser -s secret -x batch1_1001 -b batch1 -t rests • **Execute batch "batch1" with the Dynamic Parameter list** – **Syntax:** ./EICSchedulerService.sh -o 1 –u < ofs_remote_user > -w < Workspace Id > -c < Client Id for authentication > -s <		0	Batch or BatchGroup execution is success

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	Client Secret for authentication > -x < External Unique Id > -b < Object Name > -t < Object Type> -v <Dynamic Runtime parameter list> – **Example:** ./EICSchedulerService.sh -o 1 -u mmgadmin -w CS -c ofsauser -s secret -x 232 -b BatchModel -t rest -v '{"batchParams":{"$FICMISDATE$":"2021-11-30","$BATCHRUNID$":"BATCHRUNID","param_1":"qwert","param_2":"abcde"},"taskRuntimeParams":{"Task1":{"p1":"1		-1	Batch or BatchGroup execution is failed.

Table 12-6 (Cont.) List of possible exit codes returned by “EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	1102","p 2":"2220 2","abc" :"123342 ","extra P":"wert 2y"},"Ta sk2": {"abc":" 1233","p 3":"3333 ","extP2 ":"0983" }}}' **Note** The Task/Batchparameters should be et			

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	heactualparameterkey. • **Execute batch "batch1" with "task1" and "task2" included:** – **Syntax:** ./EICSchedulerService.sh -o 1 –u <ofs_remote_user> -w <Workspace Id > -c <Client Id for authentication > -s <Client Secret for authentication > -x <External Unique Id > -b < Object			

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	Name > -t < Object Type> -I < Included Jobs with comma separated values> – **Example:** ./EICSchedulerService.sh -o 1 -u scheduser -w WS1 -c ofsauser -s secret -x batch1_1001 -b batch1 -t rest -i task1,task2 • **Execute batch "batch1" with "task1" as excluded and "task2" as held:** – **Syntax:** ./EICSchedulerService.sh -o 1 –u < ofs_remote_user > -w < Workspace Id > -c < Client Id for authentication >			

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	-s < Client Secret for authentication > -x < External Unique Id > -b < Object Name > -t < Object Type> -e < Excluded Jobs> -h < Held Jobs> – **Example:** ./EICSchedulerService.sh -o 1 -u scheduser -w WS1 -c ofsauser -s secret -x batch1_1001 -b batch1 -t rest -e task1 -h task2			
Status	• **Get status of execution having runid = MMG_R1_2022-09-07_1662557327886_1:** – **Syntax:** ./EICSchedulerService.sh -o 2–u < ofs_remote_user	To check the status	-3	Batch or Batchgroup Run Id does not exist.
			-4	Invalid arguments passed in request/not enough params in Request body
			-5	Invalid Request Headers
			0	Batch or batchgroup status is success

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	> -w < Workspace Id > -c < Client Id for authentication > -s < Client Secret for authentication > -r < Batch Execution Id> – **Example:** ./EICSchedulerService.sh -o 2 -u scheduser -w WS1 -c ofsauser -s secret -r MMG_R1_2022-09-07_1662557327886_1		-1	Batch or batchgroup status is failed or API failed internally to return valid response status code.
			-2	Batch or batchgroup status is interrupted.
			1	Batch or batchgroup status is not started.
			2	Batch or batchgroup status is ongoing.
			5	Batch or batchgroup status is held.
Restart	• **Restart execution for batch "MMG_R1" having runid = MMG_R1_2022-09-07_1662557327886_1:** – **Syntax:** ./EICSchedulerService.sh -o 3–u < ofs_remote_user > -w <	To restart failed execution	-4	Invalid arguments passed in request/not enough params in Request body
			-5	Invalid Request Headers
			-3	Batch or Batchgroup Run Id does not exist.
			-6	No executable job is present. Batch with no task.
			0	Batch or BatchGroup restart is success

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	Workspace Id > -c < Client Id for authentication > -s < Client Secret for authentication > -b < Object Name> -r < Batch Execution Id> – **Example:** ./EICSchedulerService.sh -o 3 -u scheduser -w WS1 -c ofsauser -s secret -b MMG_R1 -r MMG_R1_2022-09-07_1662557327886_1		-1	Batch or BatchGroup restart is failed.
Rerun	• **Rerun execution for batch "batch1" having runid = batch1 -r batch1_2022-09-01_16620110655557_1:** – **Syntax:** ./EICSchedulerService.sh -o 4–u < ofs_remo	To rerun the batch execution	-4	Invalid arguments passed in request/not enough params in Request body
			-5	Invalid Request Headers
			-3	Batch or BatchgroupId or Run Id does not exist.
			0	Batch or BatchGroup rerun is success

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	te_user > -w < Workspace Id > -c < Client Id for authentication > -s < Client Secret for authentication > -x < External Unique Id > -b < Object Name> -r < Batch Execution Id> – **Example:** ./EICSchedulerService.sh -o 4 -u scheduser -w WS1 -c ofsauser -s secret -x batch1_1002 -b batch1 -r batch1_2022-09-01_1662011065557_1		-1	Batch or BatchGroup rerun is failed.
			-9	Duplicate External Unique Id
Interrupt	• **Interrupt execution for batch "batch1" having runid = batch1_2022-**	To Interrupt the ongoing execution	-3	Batch or Batchgroup Run Id does not exist.
			-4	Invalid arguments passed in request/not enough params in Request body

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description
	09-07_166253 0601924_1: – **Syntax:** `./EICSchedulerService.sh -o 5–u < ofs_remote_user > -w < Workspace Id > -c < Client Id for authentication > -s < Client Secret for authentication > -b < Object Name> -r < Batch Execution Id>` – **Example:** `./EICSchedulerService.sh -o 5 -u scheduser -w WS1 -c ofsauser -s secret -b batch1 -r batch1_2022-09-07_1662530601924_1`		-5	Invalid Request Headers
			0	Batch or BatchGroup interrupt is success
			-1	Batch or BatchGroup interrupt is failed
			-7	Batch or BatchGroup status is not ongoing or already interrupted.

Table 12-6 (Cont.) List of possible exit codes returned by "EICSchedulerService.sh

API	Syntax	Description	Status Code	Code Description

> **Note**
>
> - The status code **-10** can be a general code if the scheduler service APIs are unreachabale.
> - On successful request for execute/rerun, the batchrunid corresponding to external unique id will be stored in the AAICL_SS_EXT_BATCH_RUN_ID_MAPPING table.
> - External Unique ID is required only in case of execute/rerun request.
> - Invalid UserID status for EICSchedulerService.sh Utility
>
> If the EICSchedulerService.sh utility fails with status as -5, then its due to invalid user. The error can be observed in the mmg-service.logs.

Batch Utilities

A new utility, `batch_export_import_utility.sh`, to export and import batch/batchgroups/schedules is introduced in the following path: `OFS_MMG/bin/batch_export_import_utility.sh`.

The `# FTPSHARE` value in the utility must be manually updated before triggering the utility file.

The `# Export` value can be triggered by using the following command:

```
## ./batch_export_import_utility.sh EXPORT <workspace> <mmguser> <batchcode> batch/schedule/batchgroup ##
```

For example: `./batch_export_import_utility.sh EXPORT CS mmgadmin BatchRest batch`

The `# Import` value can be triggered by using the following command:

```
##./batch_export_import_utility.sh IMPORT <workspace> <mmguser> <batchcode> batch/schedule/batchgroup <OVERWRITE_flag> <filename without .txt extension>
```

For example: `./batch_export_import_utility.sh IMPORT DEMO7 mmgadmin BatchRest batch N CS_batch_BatchRest`

Scheduler Configuration / Admin User Interface

The Scheduler Configuration / Admin User Interface (UI) is used to manage the scheduler notification settings and to configure email notification recipients for specific batches or batch groups.

Access Control

To access the Scheduler Configuration/Admin UI , you must have the **BATCH_ADMIN** role. By default, the **BATCH_ADMIN** role is mapped to the seeded user group **SCHEDULERADMIN**.

From the Orchestration page, navigate to the Scheduler Configuration/Admin UI.

Scheduler Configuration/Admin UI Features

The Scheduler Configuration/Admin UI provides the following functionalities:

- **General Configuration** (system-level configuration parameters)
- **Batch/Batch Group to User Mapping** (workspace-level email mapping)
- **Batch/Batch Group to User Mapping** (workspace-level)

You can use this page to map specific users to a batch or batch group for email notifications. This configuration is workspace-specific.

Access the Batch/Batch Group to User Mapping

In the Scheduler Configuration/Admin UI, select **Batch to User Configuration**. Click the **Eye** icon adjacent to the Batch to User Configuration tile (if applicable) to open the page.

Search

To search for a batch or batch group, enter the desired keywords in the **Search** field and then click **Search**. This feature enables you to search by the batch name, batch code, and batch type.

Add a Mapping

Perform the following steps to add a mapping:

1. Click **Add**.
2. Select the batch type.
3. Select the required batch or batch group.
4. Select the required user(s).
5. Click **Create**.
   A message appears informing you that indicating that the mapping was successfully created.

Manage Existing Mappings (Action menu)

The **Batch to User Mapping** page lists all the batch or batch groups that are mapped to user(s). Use the **Action** menu to:

- **View:** This displays mapping details.
- **Edit:** Updates the mapped user list (add/remove users).
- **Delete:** Removes the batch/batch group to user mapping.
- Email notification behavior (mapping vs default recipients)

The system can send notifications to default recipients based on the configured notification role/function. If a batch/batch group is explicitly mapped to a user(s), notifications for that batch/batch group are sent only to the mapped user(s). If no batch-to-user mapping is configured for a batch/batch group, notifications are sent to the default recipients.

General Configuration (system-level)

Use this page to update scheduler service configuration parameters. General Configuration values are system-level; a change made in one workspace is reflected across all workspaces.

Access General Configuration:

Perform the following steps to access the general configuration page:

1. In the Scheduler Configuration/Admin UI, select **General Configuration**.
2. Click the **Eye** icon on the **General Configuration** tile (if applicable) to open the page.
3. Update configuration values.
4. Click **Edit**.
5. Modify the required configuration values.
6. Click **Save** to apply the changes.
   OR

   Click **Cancel** to discard changes and revert to the previous values.

> **Note**
>
> - Batch/Batch Group to User Mapping is workspace-specific.
> - General Configuration is system-level and is effective across all workspaces.
> - Access to this page requires the **BATCH_ADMIN** role (seeded through the **SCHEDULERADMIN** group by default).

13
More

More feature covers:

- **Export Objects**: Utilize Object Migration feature to efficiently export and save objects.
- **Import Objects**: Import previously exported objects into the system.
- **Model Actions**: Review and approve model deployments in bulk.
- **Audit Trail**: Monitor all system activities and changes.
- **Data Pipelines**: Create and manage data pipelines for efficient data flow and processing.

Object Migration

Object Migration is the process of migrating or moving objects between environments.

You may want to migrate objects for reasons such as managing global deployments on multiple environments or creating multiple environments so that you can separate the development, testing, and production processes.

Prerequisites to Migrating Objects

In order to migrate objects, users must be mapped to the **Object Migration Admin Group**.

> ⓘ **Note**
>
> Identity Administrator Group users cannot migrate objects if they are not mapped to the **Object Migration Admin Group**.

Migration Object Types

You can migrate (import/export) the following object types by clicking the Object Migration icon on the left menu.

- **Schedule**: Provides the instruction to schedule the execution of defined processes. When a schedule is migrated, the associated batch is also migrated.
- **Batch**: A group of jobs that are scheduled to automatically execute at a preset interval of time without any user intervention. When a batch is migrated, the batch and the associated pipeline information are also migrated.
- **Batch Group**: A set of individual batches are consolidated to form a single Batch Group. When you migrate a batch group all the batches, tasks, and pipeline information associated with that batch group are also migrated.
- **Pipeline**: A pipeline is an embedded data processing engine that filters, transforms, and migrates data on-the-fly. Pipelines consist of a set of data processing elements called widgets connected in series, where the output of one widget is the input to the next element.

- **Threshold**: The threshold limit associated with values of set variables for scenarios in FCCM Cloud Service. These threshold values are set when scenarios are created or installed and can be changed, if required.
- **Job**: Jobs provide a set of instructions to execute Workflow Pipelines, based on the set threshold values.
- **PMF Process**: PMF Processes are defined to sequence the Workflow Pipelines, the applications, and to design the artifacts that participate in the pipelines, to implement the pipelines. When exporting a PMF Process, dependent metadata such as data fields, transition rules associated with the PMF process are taken care of.
- **Roles**: Roles are used to map functions to a defined set of groups to ensure user access system security.
- **Groups**: Groups are used to map Roles. Specific User Groups can perform only a set of functions associated with that group.

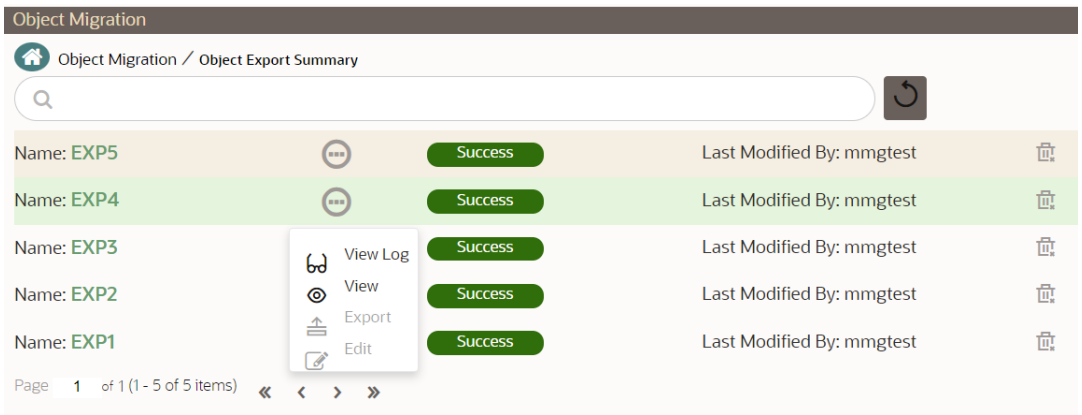
Export Objects

To access the Object Export Summary page:

1. Click **Launch Workspace** next to corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click the **Object Migration** icon and select **Export Objects**.

   The Object Export Summary page containing the records is displayed with the following details.

Figure 13-1 Object Export Summary page



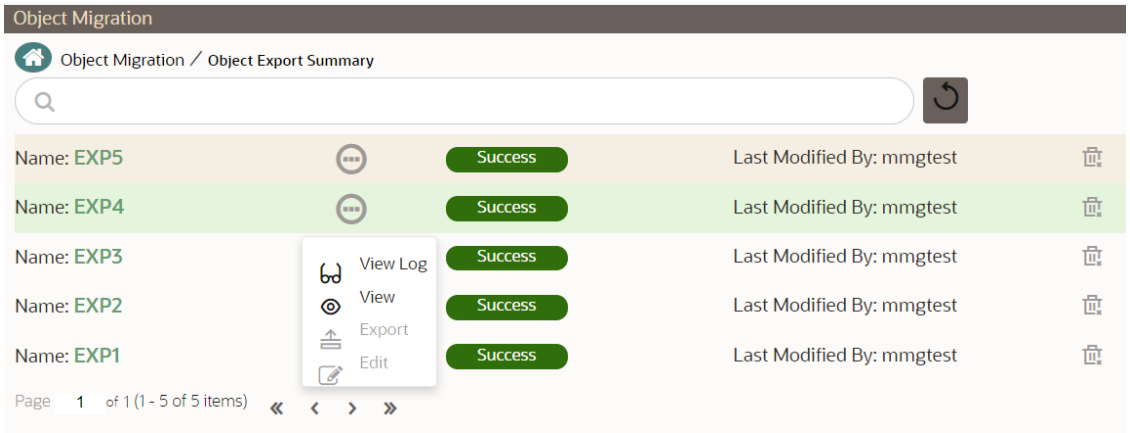
- **Name**: The unique migration name assigned to the collection when the migration definition was created.
- **Object Migration Status**: The migration status of the record corresponding to the specified Definition Name. The three migration status values are as follows:
  - **Success** - Set to Success, when the object export is completed successfully.
  - **Saved** - Set to Saved, when the migration definition is ready for export and needs to import.
  - **Failed** - Set to failed, when the migration definition is not exported successfully.

- **Last Modified By**: The ID of the Last Modified by user who has modified the record.

Search Objects to Export

To search for a specific migration definition, type the first few letters of the user name that you want to search in the **Search** box and click the **Search** icon.

Figure 13-2 Search Objects to Export



Use the controls at the bottom of the page, to set the number of entries displayed per page and to navigate between pages.

Create Migration Export Object Definitions

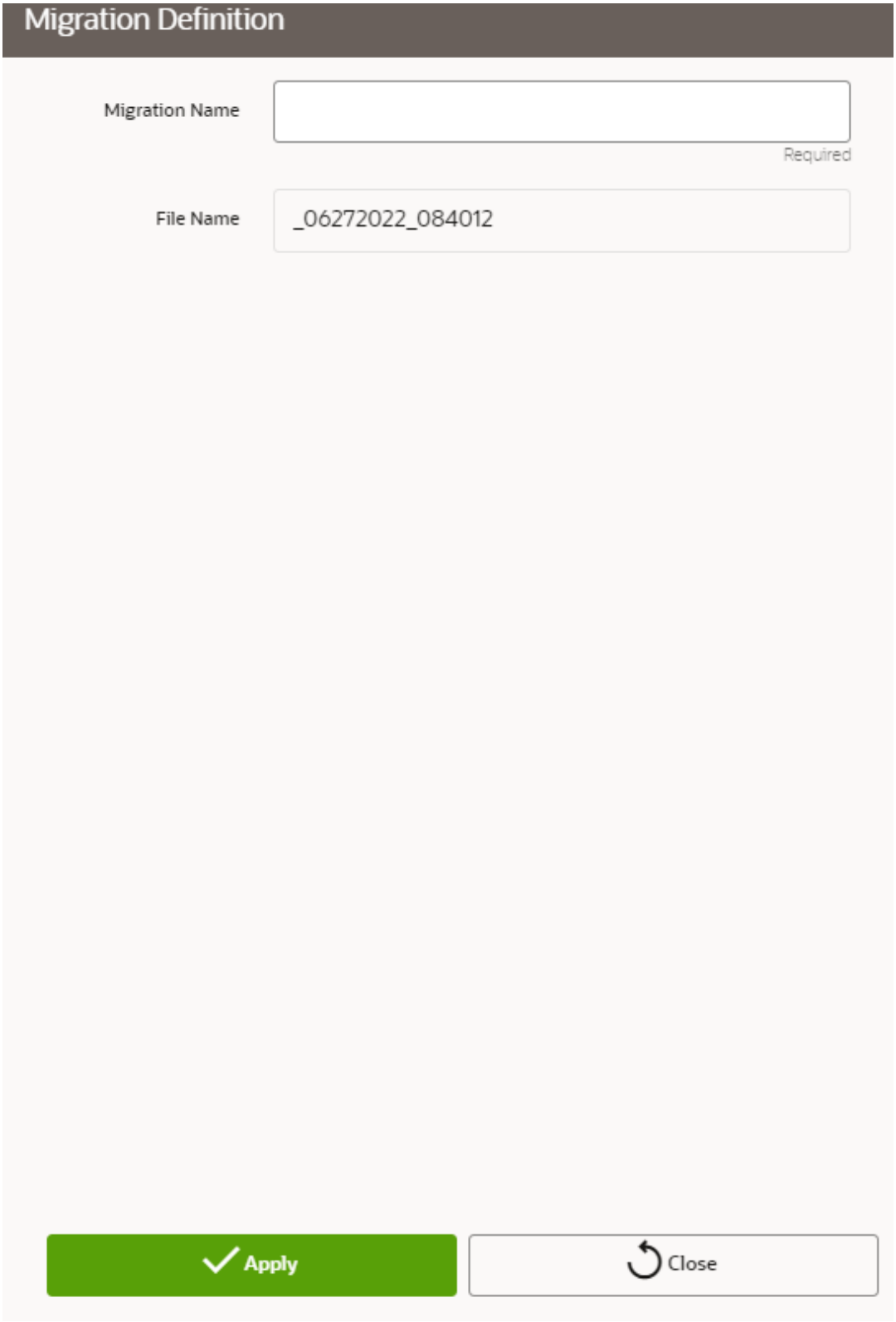
You can create Migration Export object definitions for the following object types.

- Batch Group
- Threshold
- PMF Process
- Batch
- Pipeline
- Schedule
- Job

To create a definition for export of objects to be migrated, do as follows:

1. Click **Add** in the **Object Export Summary** page to display the **Migration Definition** window.

Figure 13-3 Migration Definition window



2. In the **Migration Definition** window, enter the details for the following:
   - **Migration Name**: Enter the code of the export of objects to be migrated definition. This is a unique identifier.

- **File Name**: The system auto-creates the file name of the objects that can be used to export the definition in the following format:
  - **For Business Objects**: Migration Name_BO_Time Stamp (MMDDYYY HHMMSS)
  - **For Identity Objects**: Migration Name_IDM_Time Stamp (MMDDYYY HHMMYY)

3. Click **Apply** to save the details.

   The Object Selection Page is displayed.

4. In the Object Selection page, select the required Object Type from the Object Types drop-down list. The object types listed for the System Configuration tab are, Schedule, Batch group, Batch, Pipeline, Threshold, Job and PMF process. For more information about the object types, refer Migration Object Types.

   You can also enter the first few letters in Search to add a particular object from a selected Object type.

   The list of objects is displayed.

5. Select the objects to be added to the Migrate Definition.

   The selected objects are added to the respective object type branch.

6. Click **Save**to create the Migrate Definition.

   A confirmation message is displayed, when the definition is saved successfully.

   The new migration definition is listed in the Object Export Summary page and the status is set to Saved.

> **Note**
>
> If the migration definition object is not created successfully and the status is set to Failed. Contact My Oracle Support of more information.

View Migration Objects to be Exported

You can view and edit the migration objects from the **Object Export Summary** page.

To view the list of migration export objects associated with a migration definition, highlight the migration definition and click **Menu**button.

You can:

Table 13-1 View Migration Export Objects

Field	Description
View Log	View the migration log details of the selected Migration Definition. For more information, refer to View Log of Migration Export Objects.
View	View the Object Details for a specific Migration Definition. Click an object to view more details. For more information, refer to Viewing Export Migration Object Details.

Table 13-1 (Cont.) View Migration Export Objects

Field	Description
Export	Click Export to initiate Object Migration (Export) for a specific Migration Definition. When the migration is completed, the status will change from Saved to Success. For more information, refer to Exporting Migration Objects.
Edit	Click Edit to view and edit the objects linked to a Migration Definition. For more information, refer to Editing Migration Export Definitions.

View Log of Migration Objects Exported

To view the log details of object with migration status Success or Failed, follow these steps. The view log facilitates you to view the log information of the definition for export of objects to be migrated with its status.

1. Highlight the migration definition and click Menu button and select View Log.

   The View Log page is displayed.

   The status of the export migration is displayed with the following details.

Table 13-2 View Log of Migration Export Objects

Field	Description
Object Migration ID	The migration ID associated with the export object.
Object Type	The object type of the export object.
Object Code	The object code associated with the export object.
Creation Date	The date of creation of the export object.
Created By	The User Id of the User who created the export object.
Status	The migration status of the export object. • Success - Indicates that the export migration was completed successfully. • Failed - Indicates that the export migration did not complete

> **Note**
>
> The View Log page for a migration object with status Saved will be empty.

2. Click **OK** to close the window.

View Details of Exported Migration Objects

To view the list of objects added to a specific Migration Definition:

1. Highlight the migration definition and click **Menu** button and select **View**.

   The list of migration objects added to the definition is displayed.

2. Double-click an object to view the object attribute details.

Export Migration Objects

To export the list of objects added to a specific Migration Definition:

- Highlight the migration definition and click **Menu** button and select **Export**.

  The status is indicated as either Success or Failed.

> **Note**
>
> Use Object Migration (export) to export a set of objects within the same setup or across different setups.

Edit Exported Migration Definitions

You can edit the migration export objects that are not exported and their status is Saved or Failed. If the object is already exported and the status is set to Success, you cannot edit the object details.

To edit a record of the definition of export of objects to be migrated, follow these steps. You can add more objects to export or remove existing objects.

1. Highlight the migration definition and click **Menu** button and select **Edit**.

   The Object Selection window is displayed.

2. Update the required details.

3. In the Object Selection window, select the required Object Type from the Object Types drop-down list.

   The object types listed for the System Configuration tab are, Batch_Group, PMF_Process, Batch and Schedule. For more information about the object types, refer Migration Object Types. You can also enter the first few letters in Search to add a particular object from a selected Object type.

   The list of objects is displayed.

4. Select the objects to be added to the Migrate Definition or to be deleted from the Migration Definition.

   The selected objects are added/deleted to the respective object type branch.

5. Click **Save** to edit the Migrate Definition.

   A confirmation message is displayed, when the definition is saved successfully.

   The edited migration definition is listed in the Object Export Summary page and the status is set to Saved.

6. Click **Save** to update the changes.

Delete Exported Migration Definitions

You can only delete records in the Saved or Failed state; records in Success state cannot be deleted.

To delete a migrate export object definition, highlight the record to be deleted and click the delete button. Click Yes to confirm and proceed with the deletion.

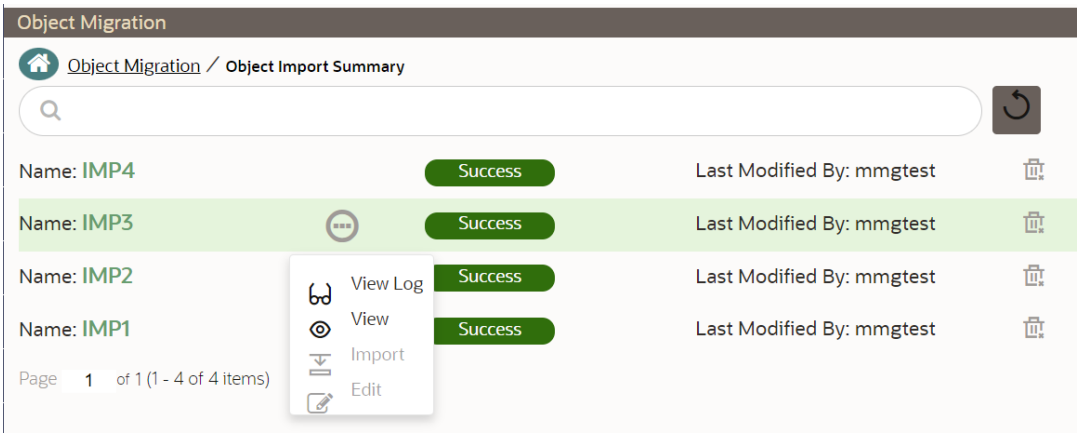
Import Objects

To access the Object, Import Summary page:

1. Click **Launch Workspace** next to corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click the **Object Migration** icon and select **Import Objects**.

   The Object Import Summary page containing the records is displayed with the following details.

Figure 13-4 Object Import Summary page

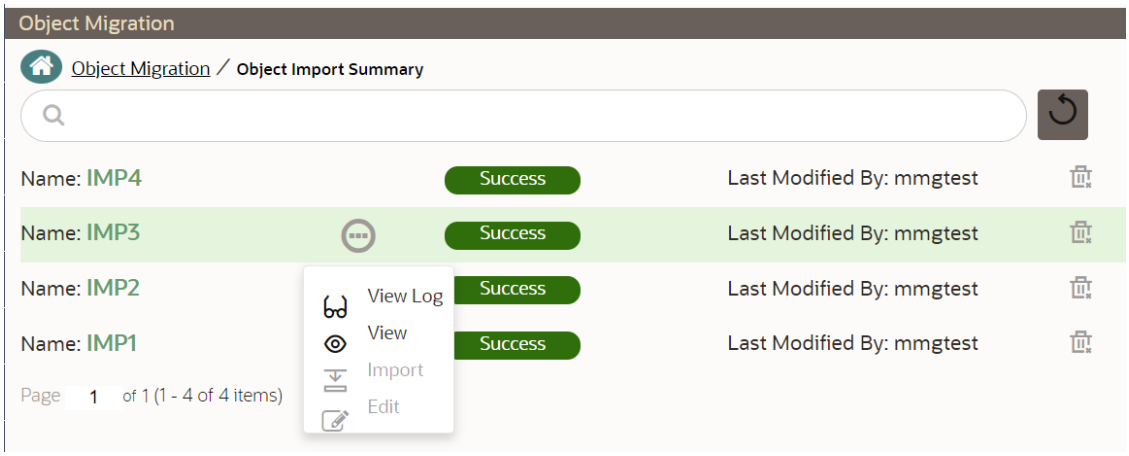


- **Name**: The unique migration name assigned to the collection when the migration definition was created.
- **Object Migration Status**: The migration status of the record corresponding to the specified Definition Name. The three migration status values are as follows:
  - **Success** - Set to Success, when the object import is completed successfully.
  - **Saved** - Set to Saved, when the migration definition is ready for import and needs to import.
  - **Failed** - Set to failed, when the migration definition is not imported successfully.
- **Last Modified By**: The ID of the Last Modified by user who has modified the record.

Search Objects to Import

To search for a specific migration definition, type the first few letters of the user name that you want to search in the **Search**box and click search icon. The search results display the names that consist of your search string.

Figure 13-5 Object Migration



At the bottom of the page, you have controls to navigate the search entries and also specify the number of entries available on a single page.

Create Import Object Definitions for Migrations

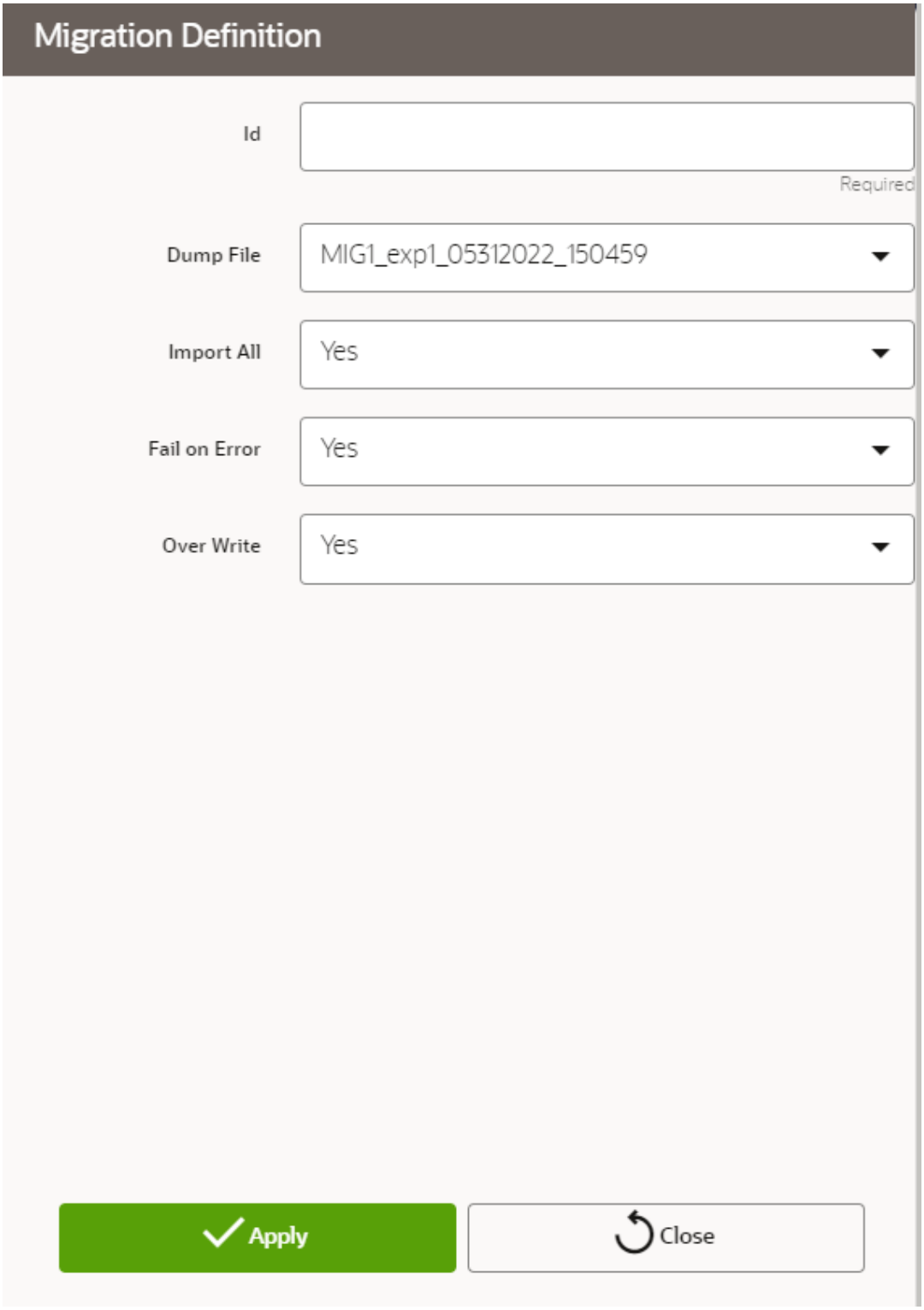
You can create Import Object definitions for migration for the following object types.

- Batch Group
- Threshold
- PMF Process
- Batch
- Pipeline
- Schedule
- Job

To create a definition for import of objects to be migrated, do as follows:

1. Click **Add** in the **Object Import Summary**page to display the **Migration Definition window**.

Figure 13-6 Migration Definition window



2. In the **Migration Definition window**, enter the details for the following:
   - **ID**: Enter a valid name for the new migration import definition. This is a unique identifier.
   - **Dump File**: Select the dump file to be utilized for creating the Migration Import Definition.

3. **Import All**: Select an option to import the nodes that are associated with the selected object type.

   You can edit this option if required, in the **Object Selection**page.

Figure 13-7 Object Selection page

   - **Yes** - Imports all the nodes that are included in the dump file.
   - **No** - Imports only those nodes that you can select in the Object Selection page.

4. **Fail on Error**: Select an option to proceed with the definition creation in case of an error.

   You can edit this option if required, in the **Object Selection**page.

   - **Yes** - Stops the creation process, if error is generated.
   - **No** - Creates the import definition even when error is generated. The node with the error is not included in the object creation.

5. **Overwrite**: Select an option to overwrite the existing definition file.

   You can edit this option if required, in the **Object Selection**page.

   - **Yes** - Replaces the existing Import definition.
   - **No** - Creates a new Import definition.

6. Click **Apply** to save the details.

   The **Object Selection** page is displayed.

7. In the **Object Selection** page, click **Add Members**, to add objects associated with specific object types.

8. In the **Object Selection** page, select the required **Object Type** from the **Object Types** drop-down list.

   The object types listed are, Schedule, Batch group, Batch, Pipeline, Threshold, Job and PMF process. For more information about the object types, refer Migration Object Types.

   You can also enter the first few letters in **Search** to add a particular object from a selected Object type.

   The list of objects is displayed.

9. Select the objects to be added to the Migrate Definition.

   You can select the objects only if you select **No** for **Import All**.

   The selected objects are added to the respective object type branch.

10. Click **Save** to create the Migrate Definition.

    A confirmation message is displayed, when the definition is saved successfully. The new migration definition is listed in the Object Import Summary page and the status is set to **Saved**.

> **Note**
>
> If the migration definition object is not created successfully and the status is set to **Failed**, contact My Oracle Support of more information.

View Migration Objects to be Imported

You can view and edit the migration objects from the Object Import Summary Page.

To view the list of imported migration objects associated with a migration definition, highlight the migration definition and click **Menu**button.

The following options are displayed.

Table 13-3 Viewing Migration Import Objects

Field	Description
View Log	View the migration log details of the selected Migration Definition. For more information, refer to View Log of Migration Import Objects.
View	View the Object Details for a specific Migration Definition. Click an object to view more details. For more information, refer to Viewing Import Migration Object Details.
Export	Click **Export** to initiate Object Migration (Import) for a specific Migration Definition. When the migration is completed, the status will change from Saved to Success. For more information, refer to Importing Migration Objects.
Edit	Click **Edit** to view and edit the objects linked to a Migration Definition. For more information, refer to Editing Migration Import Definitions.

View Log of Migration Objects Imported

To view the log information of a record of the definition for import of objects to be migrated, follow these steps. The view log facilitates you to view the log information of the definition for import of objects to be migrated with its status.

1. Highlight the migration definition and click **Menu** button and select **View Log**.

   The **View Log** page is displayed.

   The export migration status with the following details is displayed.

Table 13-4 View Log of Migration Import Objects

Field	Description
Object Migration ID	The migration ID associated with the export object.

Table 13-4 (Cont.) View Log of Migration Import Objects

Field	Description
Object Type	The object type of the export object.
Object Code	The object code associated with the export object.
Creation Date	The date of creation of the export object.
Created By	The User Id of the User who created the export object.
Status	The migration status of the export object. • Success - Indicates that the export migration was completed successfully. • Failed - Indicates that the export migration did not complete

> **Note**
>
> The View Log Page for a migration object with status Saved will be empty

2. Click **OK** to close the window.

View Details of Imported Migration Objects

To view the list of objects added to a specific Migration Definition:

1. Highlight the migration definition and click **Menu**button and select **View**.

   The list of migration objects added to the definition is displayed.

2. Double-click an object to view the object attribute details.

Import Migration Objects

To export the list of objects added to a specific Migration Definition:

- Highlight the migration definition and click **Menu**button and select **Export**.

  After you export, the following types of status are displayed:

  - **Success**- When the object is migrated successfully.
  - **Failed**- When the object migration didn't complete.

> **Note**
>
> Object Migration (export) facilitates you to export a set of objects within the same setup or across different setups.

> **Note**
>
> Currently, if the user give production workspace a name during the import, the utility migrates the dump to the production workspace as well. This should be restricted, as the models in sandbox may or may not be promoted and the invalid status will be shown in the production.

Edit Imported Migration Definitions

You can edit the migration export objects that are not exported and their status is Saved or Failed. If the object is already exported and the status is set to Success, you cannot edit the object details.

To edit a record of the definition of export of objects to be migrated, follow these steps. You can add more objects to export or remove existing objects.

1. Highlight the migration definition and click **Menu** button and select **Edit**.

   The **Object Selection** window is displayed.
2. Update the required details.
3. In the **Object Selection** window, select the required **Object Type** from the **Object Types**drop-down list.

   The object types listed for the System Configuration tab are, Batch_Group, PMF_Process, Batch and Schedule. For more information about the object types, refer Migration Object Types.

   You can also enter the first few letters in **Search** to add a particular object from a selected Object type.

   The list of objects is displayed.
4. Select the objects to be added to the Migrate Definition or to be deleted from the Migration Definition.

   The selected objects are added/deleted to the respective object type branch.
5. Click **Save** to edit the Migrate Definition.

   A confirmation message is displayed, when the definition is saved successfully.

   The edited migration definition is listed in the Object Export Summary page and the status is set to Saved.
6. Click **Save** to update the changes.

Delete Imported Migration Object Definitions

You can delete only a record that is set to Saved or Failed status and not a record that is in Success status.

To delete a migrate export object definition:

1. Highlight the record to be deleted and click the **Delete**button.
2. Click **Yes**to confirm and proceed with the deletion.

Prerequisites to Migrate Objects

In order to migrate the objects, the users must be mapped to the **Object Migration Admin Group**.

> **Note**
>
> The Identity Administrator Group Users cannot migrate objects if they are not mapped to the **Object Migration Admin Group**.

Migration Object Types

You can migrate (import/export) the following Object Types by clicking the Object Migration icon on the left menu.

- Schedule
- Batch
- Batch Group
- Pipeline
- Threshold
- Job
- PMF_Process
- Roles
- Groups

Schedule

Schedule provides the instruction to schedule the execution of defined processes. When a schedule is migrated, the associated batch is also migrated.

Batch

A batch is a group of jobs that are scheduled to automatically execute at a preset interval of time, without any user's intervention. When a batch is migrated, the batch and the associated pipeline information are also migrated.

Batch Group

A set of individual batches are consolidated to form a single Batch Group. When we migrate a Batch Group all the batches, tasks and pipeline information associated with that Batch Group are also migrated.

Pipeline

A pipeline is an embedded data processing engine that runs inside the application to filter, transform, and migrate data on-the-fly. Pipelines are a set of data processing elements called widgets connected in series, where the output of one widget is the input to the next element.

Threshold

The threshold limit associated with set variables values for scenarios in FCCM Cloud Service. These threshold values are set when scenarios are created or installed and can be changed, if required.

Job

Jobs provide set of instructions to execute Workflow Pipelines, based on the set threshold values

PMF_Process

PMF_Processes are defined to sequence the Workflow Pipelines the applications, and to design the artifacts that participate in the Pipelines, to implement the Pipelines. Export of PMF_Process will take care of dependent metadata, such as data fields, transition rules associated to the PMF process, that are defined in PMF.

Roles

Roles are used to map functions to a defined set of groups to ensure user access system security.

Groups

Groups are used to map Roles. Specific User Groups can perform only set of functions associated with that group.

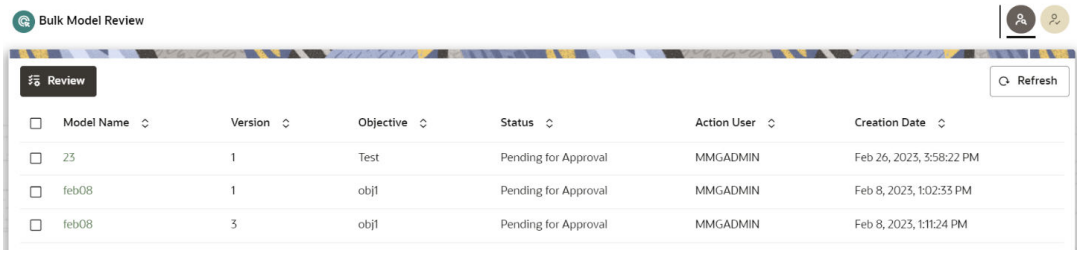
Model Actions

The Model Actions window allows you to view the list of models for which the Workflow action has been taken which requires review or approve across the workspace.

For example, when any Model User sends and Model for review or approval, the user receives the bulk Models in Model Actions window for review or approval. This helps when lot of models are received for review before deployment or some actions need to be performed on many models, such as making multiple models champion locally or globally, and so on.

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. Click Model Actions to view the list models pending an action such as approval.

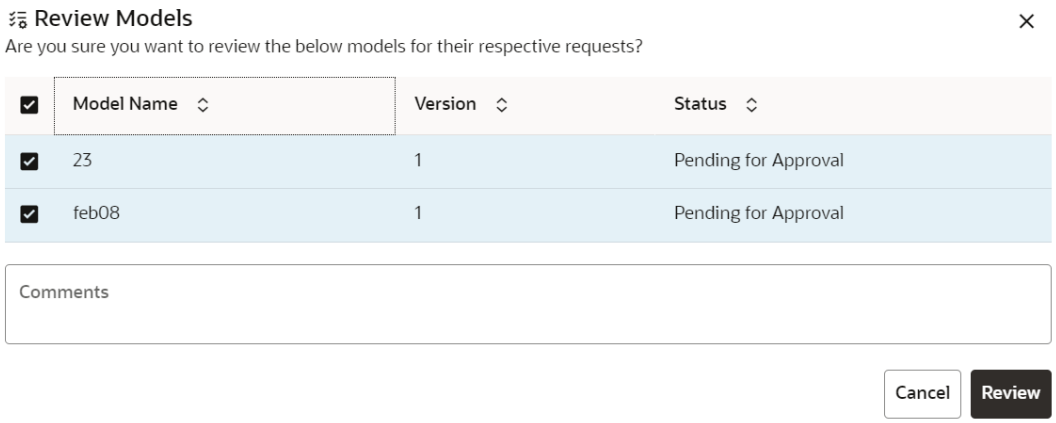
Figure 13-8 Review Models screen



If you are a reviewer, Review Models screen is displayed and if you are an approver, Approve Models screen is displayed. This can be toggled in the header of the screen using Reviewer and Approver icon.

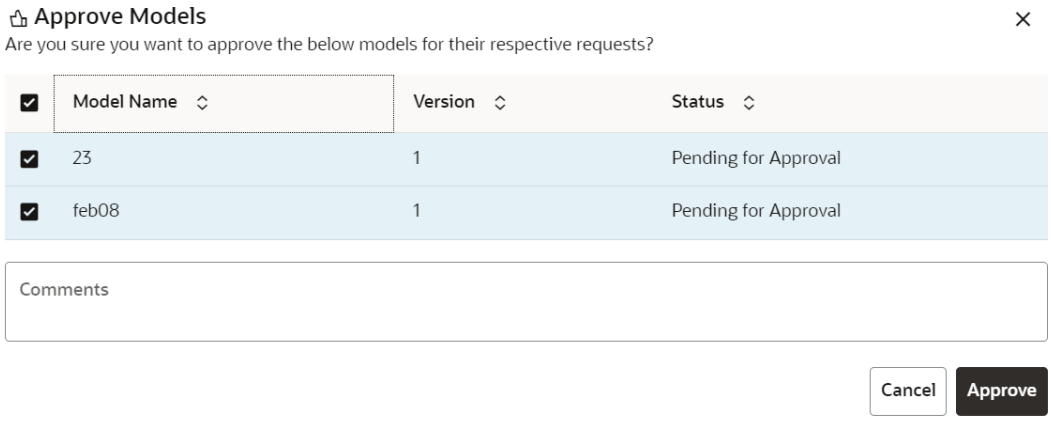
3. To review the model, follow these steps:
   a. Select the Model using the corresponding check box and click **Review**.
   b. Enter **Comments**, if any, and click **Review**.

Figure 13-9 Review Models window



4. To approve or reject the models, follow these steps:
   a. Select the Model using the corresponding check box and click **Approve** or **Reject**.
   b. Enter the comments in Comments field of the **Approve Models** window or **Reject Models** window and click **Approve** or **Reject**.

Figure 13-10 Approve Models screen



Audit Trail

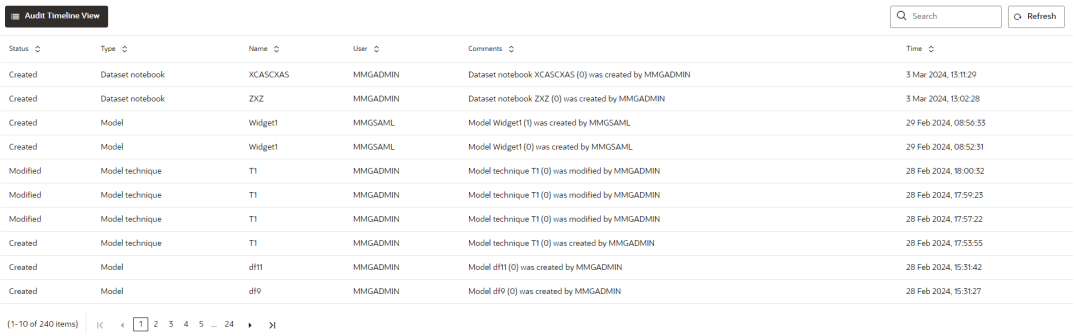
At any time, you can audit the models from the Audit Trail window. The Audit Trail window provides the complete details of model. This shows the information such as, when Model was created, who created the Model, workflow of Model, when this Model became champion or deployed, and so on.

The sequence of actions performed in the model lifecycle is listed in the table view and the timeline view (graphical representation).

To audit models:

1. Click **Launch Workspace** next to the corresponding Workspace to display the **Dashboard** window with application configuration and model creation menu.
2. In the Mega menu, click **More > Audit Trail** to view the time of the various actions performed on the model in the **Audit Trail** window.

Figure 13-11 Audit Trail window

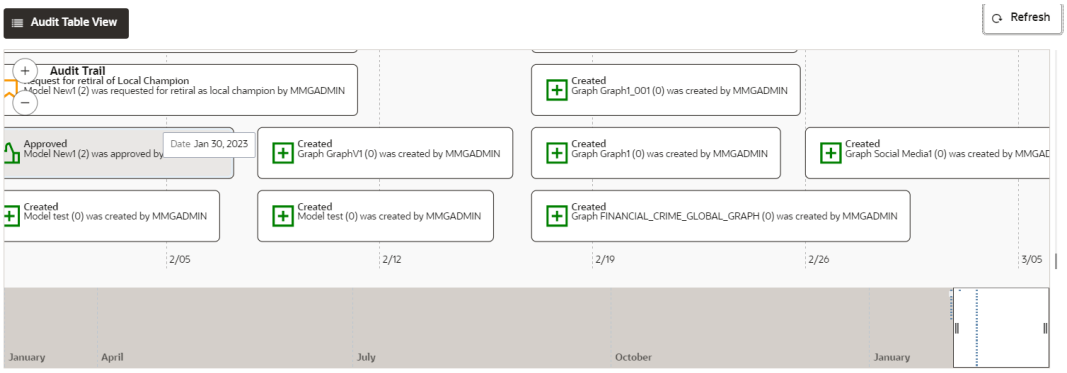


3. Click for Timeline View.

   Click to switch to the regular view. Click to refresh the Audit Trail window.

   You can search the models by entering the name in the search box.

Figure 13-12 Audit Trail Window Timeline View with Horizontal Time Axis



A

APIs for Model Pipelines

All the listed APIs/Functions can be utilized by users in Model Pipelines.

Table A-1 Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
Set User	Set the user for a session	-	%python from mmg.constants import * user = "SAUSER" set_user(user)	user - username to be set	8.1.1
Get User	Get the user that has been set	Set User	%python from mmg.constants import * get_user()	-	8.1.1
Attach Workspace	Attach the workspace for a session	-	%python from mmg.workspace import attach_workspace workspace = "CS" attach_workspace(workspace)	workspace- workspace to be attached	8.1.1
Get Workspace	Get the workspace that has been attached	Attach Workspace	%python from mmg.workspace import get_workspace get_workspace()		8.1.1
List Workspaces	Lists all workspaces available to a user	Set User	%python from mmg.workspace import list_workspaces list_workspaces()		8.1.1

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
Check AIF	Check if AIF is set or not	Set User	%python from mmg.workspace import check_aif check_aif()		8.1.1
List All Data Sources	List all data sources available in a workspace for a set user. The default workspace chosen is the one that is attached.	Set User, Attach Workspace	%python from mmg.workspace import list_datasources list_datasources(order=None)	order - None ensures that all the data sources will be listed for the attached workspace	8.1.1
List All Data Sources of Workspace	List all Data Sources of a specific Workspace that is not the attached workspace for a set user.	Set User	%python from mmg.workspace import list_datasources workspace="HELLO NEW" list_datasources(workspace,order=None)	workspace - Name of workspace for which data sources should be listed order - None ensures that ALL data sources will be listed for that workspace	8.1.1
Fetch First Order Data Source	This method will fetch the data source related to attached workspace with default order 1.	Set User, Attach Workspace	%python from mmg.workspace import list_datasources list_datasources()	order - 1 by default, if not specified	8.1.1
Fetch First Order Data Source of Workspace	This method will fetch the data source with default order 1 related to specified workspace.	Set User	%python from mmg.workspace import list_datasources workspace="CS" list_datasources(workspace)	workspace - Name of workspace for which data source should be listed order- 1 by default if not specified	8.1.1

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
Fetch Nth Order Data Source	This method will fetch the data source related to attached workspace with given order	Set User, Attach Workspace	%python from mmg.workspace import list_datasources list_datasources(order=2)	order - Order of data source to be fetched	8.1.1
Fetch Nth Order Data Source of Workspace	This method will fetch the data source with given order related to specified workspace.	Set User	%python from mmg.workspace import list_datasources workspace="CS" list_datasources(workspace,order=2)	workspace - Name of workspace for which data source should be listed order = Order of data source to be fetched	8.1.1

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version

Get Connection Object	Returns an Oracle DB / SQLAlchemy connection object for the data source of order 1 in the attached workspace.	Set User, Attach Workspace	Python:
			`from mmg.workspace import get_conn`
			`conn = get_conn()`
			`# conn = get_conn(conn_type=None)`
			`import oracledb`
			`if not isinstance(conn, oracledb.Connection):`
			`print("Not Conn Object")`
			`print(conn)`
					8.1.2.0

Note

If conn_type is None or or

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				acldb(ornotspecified), theAPIreturnsanoracldb.Conn	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				`ectionbydefault.Ifconn_type="sqlalchemy",theAPIcrea`	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				t e s a c o n n e c t i o n o b j e c t b y u s i n g c r e a t e _ e n g i n e ( ) f r o m S Q L A l c	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				h e m y .	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version

Get Connection Object To Specific Data Source	Returns an Oracle DB / SQLAlchemy connection object to the specified data source (by name).	Set User	Python:
			`from mmg.workspace import get_conn`
			`datasource = "DS"`
			`conn = get_conn(datasource, conn_type=None)`
			`import oracledb`
			`if not isinstance(conn, oracledb.Connection):`
			`print("Not Conn Object")`
			`print(conn)`
			datasource = Name of the datasource for which the connection object must be returned.
				datasource - Name of datasource for which the connection object has to be returned	8.1.2.0

Note

If conn_type i

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				s N o n e o r o r a c l e d b (o r n o t s p e c i f i e d) , t h e A P I r e t u r n s a n o r a c	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				`ledb.Connectionbydefault.Ifconn_type="sqlalchemy",`	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				the API creates a connection object by using create_engine()	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				fromSQLAlchemy.	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version

Get Connection Object To Data Source Using Order	Returns an Oracle DB / SQLAlchemy connection object to the data source of the specified order in the attached workspace.	Set User, Attach Workspace	Python:
			`from mmg.workspace import get_conn`
			`datasource = 2`
			`conn = get_conn(datasource, conn_type=None)`
			`import oracledb`
			`if not isinstance(conn, oracledb.Connection):`
			`print("Not Conn Object")`
			`print(conn)`
			datasource = Order number of the datasource in the attached workspace for which the connection object must be returned.
				datasource - Order number of datasource in attached workspace for which the connection object has to be returned	8.1.2.0

Note

If conn_ty

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				pisNoneororacledb(ornotspecified), theAPIreturnsano	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				`racledb.Connectionbydefault.Ifconn_type="sqlalchem`	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				y", the API creates a connection object by using create_engi	

Table A-1 (Cont.) Python Paragraph Scripting

API Type	Functionality	Prerequisite	Notebook Execution Script	Notebook Script Input	Minimum Supported Version
				ne()fromSQLAlchemy.	
Test Connection Object	This script can be used to test the connection object to data source	Get Connection Object OR Get Connection Object To Specific Data Source OR Get Connection Object To Data Source Using Order	%python query="SELECT table_name FROM user_tables" cur = conn.cursor() cur.execute(query) print(cur.fetchall()) if cur: cur.close()		8.1.2.0

> **Note**
>
> The property RESTRICT_UNMAPPED_DATASTORES_ACCESS has been introduced in the NEXTGENEMF_CONFIG table to control datastore access within notebook sessions. By default, this property is set to false, which means access to all datastores is allowed. If a user wants to restrict access so that only the datastores attached to the current workspace are accessible, the value of this property must be set to true. When enabled, the get_conn() OR get_connection() method will only allow connections to those datastores that are mapped to the same workspace as the notebook session. This restriction is effective only when the session-mode in the application.yml file is configured as NOTEBOOK_USER. The property accepts only two values: true or false.

Table A-2 PYTHON LINEPARSER APIs (for MMG version 8.1.0)

API Type	Functionality	Notebook Execution Script	Note
Attach Workspace	Attach the workspace for a session	%python mmg.attachWorkspace(workspace) #eg-mmg.attachWorkspace("CS")	workspace - workspace to be attached (String) Sets 'mmg' python variable which contains the information about the attached workspace. Output- Print a boolean in one line on the status of workspace attachment and another line of boolean on status of AIF enabled and attached.
List Workspaces	Lists all workspaces available to a user	%python mmg.listWorkspaces()	Sets 'ofs_wsList' python variable which is the list of all available workspaces. Output- Print the list of workspaces.
Check AIF	Check if AIF is set or not	%python print(aif__isAttached)	Output- Boolean on the status of AIF.
Get Connection Object	Returns cx_Oracle Connection Object	%python mmg.getConnection(schema_name) #eg-mmg.getConnection("OFSAA")	schema_name = name of the schema for which connection is required (String). Sets 'conn' python variable which is the cx_Oracle connection object to be used for firing queries.
Publish	Fetch and sets the Notebook JSON dump	%python mmg.publish()	Sets 'emf_para' python variable which is the JSON dump for the notebook component. Output- Print the set 'emf_para' value.
Register	Register the Notebook	%python mmg.register(register) #eg-mmg.register({"modelname":"model1",\ #"modeldescription":"Model description"}) #eg-mmg.register(emf_para) {After doing mmg.publish()}	register - JSON Stringify object for RegisterNotebookBean Object. Sets 'publishedNotebookId' python variable which is the studio notebook id for the published version. Output- Prints the published notebook id.

Table A-2 (Cont.) PYTHON LINEPARSER APIs (for MMG version 8.1.0)

API Type	Functionality	Notebook Execution Script	Note
Load Flat File	-	%python mmg.loadFlatFile() #eg- mmg.loadFlatFile() Incomplete	
Profile Data	-	%python mmg.profileData(code,title) #eg- mmg.profileData(ABC,XYZ)	

Table A-3 MMG Library Python APIs

Index	API Type	Functionality	Prerequisite	Notebook Execution Script
1	Set User	Set the user for a session		`%python from mmg.constants import * user = "SAUSER" set_user(user)`
2	Get User	Get the user that has been set	Set User	`%python from mmg.constants import * get_user()`
3	Attach Workspace	Attach the workspace for a session		`%python from mmg.workspace import attach_workspace workspace = "CS" attach_workspace(workspace)`
4	Get Workspace	Get the workspace that has been attached	Attach Workspace	`%python from mmg.workspace import get_workspace get_workspace()`
5	Get Base URL	Get MMG Studio Service Base URL		`%python from mmg.constants import * get_mmg_studio_service_url()`
6	List Workspaces	Lists all workspaces available to a user	Set User	`%python from mmg.workspace import list_workspaces list_workspaces()`

Table A-3 (Cont.) MMG Library Python APIs

Index	API Type	Functionality	Prerequisite	Notebook Execution Script
7	Check AIF	Check if AIF is set or not	Set User	`%python from mmg.workspace import check_aif check_aif()`
8	List All Data Sources	List all data sources available in a workspace for a set user. The default workspace chosen is the one that is attached.	Set User, Attach Workspace	`%python from mmg.workspace import list_datasources list_datasources(order=None)`
9	List All Data Sources of Workspace	List All Data Sources of a specific Workspace that is not the attached workspace for a set user	Set User	`%python from mmg.workspace import list_datasources workspace="HELLO NEW" list_datasources(workspace,order=None)`
10	Fetch First Order Data Source	This method will fetch the data source related to attached workspace with default order 1	Set User, Attach Workspace	`%python from mmg.workspace import list_datasources list_datasources()`
11	Fetch First Order Data Source of Workspace	This method will fetch the data source with default order 1 related to specified workspace	Set User	`%python from mmg.workspace import list_datasources workspace="CS" list_datasources(workspace)`
12	Fetch Nth Order Data Source	This method will fetch the data source related to attached workspace with given order	Set User, Attach Workspace	`%python from mmg.workspace import list_datasources list_datasources(order=2)`

Table A-3 (Cont.) MMG Library Python APIs

Index	API Type	Functionality	Prerequisite	Notebook Execution Script
13	Fetch Nth Order Data Source of Workspace	This method will fetch the data source with given order related to specified workspace	Set User	`%python from mmg.workspace import list_datasources workspace="CS" list_datasources(workspace,order=2)`
14	Get Connection Object	Returns Oracle/ SQL Alchemy Connection Object to Data Source of order 1 in attached workspace	Set User, Attach Workspace	`%python import cx_Oracle from mmg.workspace import get_connection conn=get_connection() if not isinstance(conn,cx_Oracle.connect): print("Not Conn Object") print(conn)`
15	Get Connection Object To Specific Data Source	Returns Oracle/ SQL Alchemy Connection Object to specified Data Source	Set User	`%python import cx_Oracle from mmg.workspace import get_connection datasource="DS" conn=get_connection(datasource, conn_type=None) if not isinstance(conn,cx_Oracle.connect): print("Not Conn Object") print(conn)`

Table A-3 (Cont.) MMG Library Python APIs

Index	API Type	Functionality	Prerequisite	Notebook Execution Script
16	Get Connection Object To Data Source Using Order	Returns Oracle/ SQL Alchemy Connection Object to Data Source of specified order in attached workspace	Set User, Attach Workspace	`%python import cx_Oracle from mmg.workspace import get_connection datasource=2 conn=get_connection(datasource, conn_type=None) if not isinstance(conn,cx_Oracle.connect): print("Not Conn Object") print(conn)`
17	Get Connection Object	Returns Oracle/ SQL Alchemy Connection Object to Data Source of order 1 in attached workspace	Set User, Attach Workspace	`%python import oracledb from mmg.workspace import get_conn conn=get_conn() if not isinstance(conn,oracledb.Connection): print("Not Conn Object") print(conn)`
18	Get Connection Object To Specific Data Source	Returns Oracle/ SQL Alchemy Connection Object to specified Data Source	Set User	`%python import oracledb from mmg.workspace import get_conn datasource="DS" conn=get_conn(datasource, conn_type=None) if not isinstance(conn,oracledb.Connection): print("Not Conn Object") print(conn)`

Table A-3 (Cont.) MMG Library Python APIs

Index	API Type	Functionality	Prerequisite	Notebook Execution Script
19	Get Connection Object To Data Source Using Order	Returns Oracle/ SQL Alchemy Connection Object to Data Source of specified order in attached workspace	Set User, Attach Workspace	`%python import oracledb from mmg.workspace import get_conn datasource=2 conn=get_conn(datasource, conn_type=None) if not isinstance(conn,oracledb.Connection): print("Not Conn Object") print(conn)`
20	Get Objective Hierarchy	Returns the complete objective hierarchy including pipeline name		`%python print(objectiveId)`
21	Fetch FTPSHARE Path	Get complete ftpshare path on the server		`%python from mmg.datasets import fetch_ftpshare fetch_ftpshare()`
22	Get Pipeline Name	Get the Pipeline Name to which the current notebook is attached	Attach Workspace	`%python from mmg.constants import get_pipeline_name get_pipeline_name()`
23	Get Pipeline ID	Get ID of Pipeline to which the current notebook is attached	Attach Workspace	`%python from mmg.constants import get_pipeline_id get_pipeline_id()`
24	Get Pipeline Version	Get version of Pipeline to which the current notebook is attached	Attach Workspace	`%python from mmg.constants import get_pipeline_version get_pipeline_version()`

Table A-3 (Cont.) MMG Library Python APIs

Index	API Type	Functionality	Prerequisite	Notebook Execution Script
25	Get MISDATE	Return MISDATE from pipeline execution if set otherwise takes default value provided	Attach Workspace	`%python misdate=ds.date_picker(name='$FICMISDATE$',format='yyyy-MM-dd', default_value='2000-01-01', label='FICMISDATE') print(misdate)`
26	Get BATCHRUNID	Returns BATCHRUNID if set from pipeline, otherwise takes default value		`%python batchrunid=ds.textbox(name='$BATCHRUNID$',default_value='Batch_auto',label='BATCHRUNID') print(batchrunid)`
27	Get TASKID	Returns TASKID if set from pipeline, otherwise takes default value		`%python taskid=ds.textbox(name='$TASKID$',default_value='task1',label='TASKID') print(taskid)`

Miscellaneous Helper Python Scripts

Table A-4 Miscellaneous Helper Python Scripts

Index	Name	Description	Prerequisite	Script
1	Create Connection Object Using Wallet Alias	This script can be used to test the connection to any Oracle database using wallet alias. Make sure to close connection object after use.		`%python wallet_alias = "WALLET_ALIAS_NAME" import oracledb oracledb.init_oracle_client() conn = oracledb.connect(dsn=wallet_alias`

Table A-4 (Cont.) Miscellaneous Helper Python Scripts

Index	Name	Description	Prerequisite	Script
2	Test Connection Object	This script can be used to test the connection object to data source	Get Connection Object OR Get Connection Object To Specific Data Source OR Get Connection Object To Data Source Using Order	`%python query="SELECT table_name FROM user_tables" cur = conn.cursor() cur.execute(query) print(cur.fetchall()) if cur: cur.close()`
3	Close Connection Object		Connection Object should be created using any of the above methods	`%python query="SELECT table_name FROM user_tables" cur = conn.cursor() cur.execute(query) print(cur.fetchall()) if cur: cur.close()`
4	Close Cursor		Cursor Object should be created using any of the above methods	`%python if cur: cur.close()`
5	Check environment variables	For example: Check wallet alias value of MMG_LIB_WALLET_ALIAS		`%python import os print(os.environ['MMG_LIB_WALLET_ALIAS'])`

Table A-4 (Cont.) Miscellaneous Helper Python Scripts

Index	Name	Description	Prerequisite	Script
6	Save Dataframe to a File	Save dataframe to a file stored on server		`%python from mmg.datasets import fetch_ftpshare, save_dataframe from mmg.workspace import get_workspace from mmg.constants import get_pipeline_version misdate=ds.date_picker(name='$FICMISDATE$', format='yyyy-MM-dd', default_value='2000-01-01', label='FICMISDATE') batchrunid=ds.textbox(name='$BATCHRUNID$', default_value='Batch_auto', label='BATCHRUNID') taskid=ds.textbox(name='$TASKID$', default_value='task1', label='TASKID') filename="df.csv" filepath=fetch_ftpshare() + "/mmg/" + get_workspace() + "/pipelines/" + objectiveId + "/" + get_pipeline_version() + "/output/" + misdate + "/" + batchrunid + "/" + taskid + "/" + filename res=save_dataframe(df,filepath`

Table A-4 (Cont.) Miscellaneous Helper Python Scripts

Index	Name	Description	Prerequisite	Script
				) message=res["messages"] if res["status"]=="ERROR": raise Exception(message) else: print(message)

Python Linepraser APIs (for MMG version 8.1.0)

Table A-5 Python Linepraser APIs (for MMG version 8.1.0)

Index	API Type	Functionality	Notebook Execution Script	Note
1	Attach Workspace	Attach the workspace for a session	%python mmg.attachWorkspace(workspace) #eg- mmg.attachWorkspace("CS")	workspace = workspace to be attached (String) Sets 'mmg' python variable which contains the information about the attached workspace Output- Print a boolean in one line on the status of workspace attachment and another line of boolean on status of AIFenabled and attached
2	List Workspaces	Lists all workspaces available to a user	%python mmg.listWorkspaces()	Sets 'ofs_wsList' python variable which is the list of all available workspaces Output- Print the list of workspaces
3	Check AIF	Check if AIF is set or not	%python print(aif__isAttached)	Output- Boolean on the status of AIF

Table A-5 (Cont.) Python Linepraser APIs (for MMG version 8.1.0)

Index	API Type	Functionality	Notebook Execution Script	Note
4	Get Connection Object	Returns cx_Oracle Connection Object	`%python mmg.getConnection(schema_name) #eg- mmg.getConnection("OFSAA")`	schema_name = Name of the schema for which connection is required (String) Sets 'conn' python variable which is the cx_Oracle connection object to be used for firing queries
5	Publish	Fetch and sets the Notebook JSON dump	`%python mmg.publish()`	Sets 'emf_para' python variable which is the JSON dump for the notebook component Output- Print the set 'emf_para' value
6	Register	Register the Notebook	`%python mmg.register(register) #eg- mmg.register({"modelname":"model1",\ # "modeldescription":"Model description"}) #eg- mmg.register(emf_para) {After doing mmg.publish()}`	register = JSON Stringify object for RegisterNotebookBean Object Sets 'publishedNotebookId' python variable which is the studio notebook id for the published version. Output- Prints the published notebook ID
7	Load Flat File	`%python mmg.loadFlatFile() #eg- mmg.loadFlatFile() Incomplete`		
8	Profile Data		`%python mmg.profileData(code,title) #eg- mmg.profileData(ABC,XYZ)`	code = title =

B

Public APIs for Scheduler Operations

Public APIs for Scheduler Operations

The following APIs are exposed for the Scheduler Operations.

> **Note**
>
> 1. All the below APIs are POST requests.
> 2. All the APIs accept below values in request header:
>   - ofs_tenant_id - Optional
>   - ofs_service_id - Optional
>   - ofs_workspace_id - Respective workspace id where the batch needs to be created
>   - ofs_remote_user – MMG login user The ofs_workspace_id and ofs_remote_user are mandatory fields.

Base URL: `http(s)://<MMG_Service_HostName>:<MMG-Service_Port>/<CONETXTNAME>/`

Table B-1 APIs for Scheduler Operations

Functionality	API	Sample Request JSON	Sample Response JSON	Comments

Execute Immediate	rest-api/v1/external/trigger	{
		"batchName": "batch1",
		"batchType": "rest",
		"includedTasks" :"task1,task2",
		"excludedTasks" :"task1,task2",
		"heldTasks":"task1,task2"
		}
			{
			"severity": "info",
			"summary": "Object triggered successfully with Run Id:
			batch1_2022-08-17_1660721567845_1",
			"batchRunId": "batch1_2022-08-17_1660721567845_1",
			"details": "Object triggered successfully.",
			"status": "success",
			"statusCode": "0"
			}
				• The includedTasks/ excludedTasks/ heldTasks are options keys.
				• The batchType will be “group” for batch group execution.

Table B-1 (Cont.) APIs for Scheduler Operations

Functionality	API	Sample Request JSON	Sample Response JSON	Comments
Execution Status	rest-api/v1/external/status	{ "batchRunId": "batch1_2022-08-17_1660721567845_1", "tasks": ["task1","task2"] }	{ "severity": "info", "batchRunId": "batch1_2022-08-17_1660721567845_1", "taskStatusList": [{ "taskCode": "task1", "taskStatus": "SUCCESSFUL", "statusCode": "0" }, { "taskCode": "task2", "taskStatus": "EXCLUDED", "statusCode": "4" }], "batchStatusCode": "0", "batchList": [], "batchStatus": "SUCCESSFUL", "status": "success", "statusCode": "0" }	• “tasks” is options key. If not passed, then response will contain status all the tasks inside a batch.
Rerun	rest-api/v1/external/rerun	{ "batchName": "batchgroup1", "batchRunId": "batchgroup1_2022-08-17_1660720814942_1" }	{ "severity": "info", "summary": "Object triggered successfully for rerun with Run Id: batchgroup1_2022-08-17_1660730049819_1", "batchRunId": "batchgroup1_2022-08-17_1660730049819_1", "details": "Object triggered successfully.", "status": "success", "statusCode": "0" }	

Table B-1 (Cont.) APIs for Scheduler Operations

Functionality	API	Sample Request JSON	Sample Response JSON	Comments

Restart	rest-api/v1/external/restart	{
		"batchName": "MMG_R1",
		"batchRunId": "MMG_R1_2022-07-15_1657867378160_1"
		}
			{
			"severity": "info",
			"summary": "Object triggered successfully for restart with Run Id: MMG_R1_2022-07-15_1657867378160_1",
			"batchRunId": "MMG_R1_2022-07-15_1657867378160_1",
			"details": "Object triggered successfully.",
			"status": "success",
			"statusCode": "0"
			}	

Interrupt	rest-api/v1/external/interrupt	{
		"batchName": "B2001",
		"batchRunId": "B2001_2022-05-22_1653222717896_1"
		}
			{
			"summary": "Execution interrupted successfully for Run Id: B2001_2022-05-30_1653233511394_1",
			"severity": "info",
			"batchRunId": "B2001_2022-05-30_1653233511394_1",
			"details": "Execution interrupted successfully.",
			"statusCode": "0",
			"status": "success"
			}	

Table B-2 Failed Response Body

Failed Sample Response JSON	Description

Batch Status Failed	{
	"severity": "info",
	"batchRunId": "BT-BI-EXCHG_RATES_EOD_2022-05-27_1653662703599_1",
	"batchStatusCode": "-1",
	"batchList": [],
	"batchStatus": "FAILED",
	"statusCode": "0",
	"status": "success"
	}

Table B-2 (Cont.) Failed Response Body

Failed Sample Response JSON	Description

Object Not found	{
	"severity": "error",
	"summary": "Object does not exist.",
	"details": "Object does not exist.",
	"error": {
	"errorCode": "OBJECT_NOT_EXIST",
	"errorMsg": "Object does not exist."
	},
	"statusCode": "-3",
	"status": "failed"
	}

Table B-3 Status Codes in the Response Body

Status Code	Description
0	Success
1	Not Started
2	Ongoing
4	Excluded
5	Held
-1	Failure
-2	Interrupted
-3	Object does not exist
-4	Invalid arguments passed in request/not enough parameters in the Request body
-5	Invalid request headers/request headers missing
-6	No executable job is present
-7	Job is already interrupted