



Cloud Pak for Data
Version 2.5 or higher
Tutorial – Mortgage

Contents

1.	Prerequisites	5
2.	Setting up database and sample data.....	5
3.	Access Credentials	6
3.1.	Access credential for Db2 database.....	6
3.2.	Sign in to Cloud Pak for Data web console as Administrator.....	6
4.	Create Connection	7
4.2.	Navigate to Connections	7
4.3.	Add connection	7
5.	Discover Assets	8
5.1.	Navigate to discover assets	8
6.	Add users	11
7.	Implement Business Glossary.....	13
7.1.	Download Business Glossaries.....	13
7.2.	Import Categories	14
7.2.	Import Terms	15
7.3.	Create a policy	16
7.4.	Create a rule	16
7.5.	Add rule to metadata.....	17
8.	Access data as a Data Scientist	19
8.1.	Create analytic project.....	19
8.2.	Assets from Glossary	19
8.3.	Check Asset Details	21
8.4.	Enterprise search	21
10.	Navigate to data catalog.....	25
11.	Data Virtualization	27
11.1.	Adding a new data source for Db2	27
11.5.	Add virtual table to catalog	29
11.6.	Publish virtualized table.....	29
11.7.	Access information for virtual table	30
11.8.	Deliver Dataset	30
12.	Build Model	33
12.1.	Navigate to analytics project	33

12.2. Create deployment space	33
12.3. Create notebook	34
12.4. Review and run notebook.....	34
12.5. Test the model.....	36

Cloud Pak for Data is a single end to end platform for data management, governance and data science analytics. It provides a one stop shop for data scientists, data engineer and data stewards to collaborate on the platform to acquire, govern and extract best insights from the data in the least amount of time.

In this demo, user will use a set of a fictitious mortgage data that available in Db2 database on a docker image. User will perform following tasks to predict if a prospective customer may default on their mortgage.

- Create connection from Cloud Pak for Data to Db2 database on cloud
- Discover Db2 assets from Cloud Pak for Data
- Transform the Db2 data using Data Virtualization
- Build a simple machine learning model for prediction

1. Prerequisites

- Access to an operational Cloud Pak for Data (v.2.5 or higher) Instance
- Install Git on the machine that you will use for the tutorial

2. Setting up database and sample data

Log in to the cluster where Cloud Pak for Data is deployed or log in to a Linux-based system (RedHat or Ubuntu) that can access the cluster over your network.

From your home directory, clone the tutorial sample files:

```
git clone https://github.com/IBM-ICP4D/icp4d-tutorials.git
```

Change to the tutorials directory:

```
cd icp4d-tutorials/tutorials/
```

The sample data-loading utility, load_samples.sh, provides an easy way to host a Db2 server and load it with sample data.

Run the following command to view the list of sample data that is provided in the load_samples.sh utility:

```
./load_samples.sh -l
```

Run the following command to load the sample data into a Db2 database:

```
./load_samples.sh -t mortgage-002
```

After the loading process completes, an instance of Db2 is hosted on your cluster as a Docker container.

3. Access Credentials

To work through the tutorial, you need access a Db2 database.

3.1. Access credential for Db2 database

For this tutorial you need JDBC connection to access to a Db2 database that hosted locally on Cloud Pak for Data. Following are JDBC connection credential for Db2:

JDBC Host name	<Same IP address as your web console>
Port number	50000
Database name	MORTGAGE
User ID	db2inst1
Password	password
Db2	Version 11.1
JDBC connection string	jdbc:db2://<same IP as Web Console>:50000/MORTGAGE

3.2. Sign into Cloud Pak for Data web console as Administrator

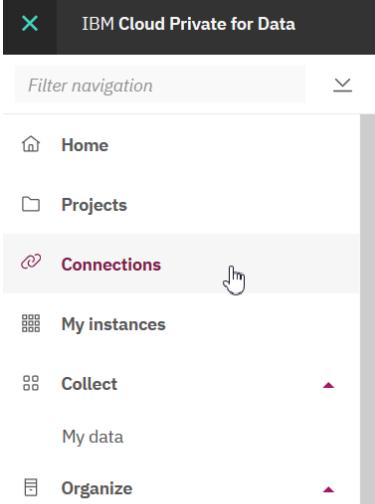
You should have an operational Cloud Pak for Data Instance. Use latest version of Firefox or Google Chrome browser to access the Cloud Pak for Data web console. Starting from here all instruction need to execute on Cloud Pak for Data web console only. You need to login as admin who has administrator privileges.

Sign in  Username <input type="text" value="admin"/> PASSWORD <input type="password" value="*****"/> <input type="button" value="Sign In"/>	<p>Sigh into the Cloud Pak for Data web console as user ‘admin’ and password is ‘password’.</p>
--	---

4. Create Connection

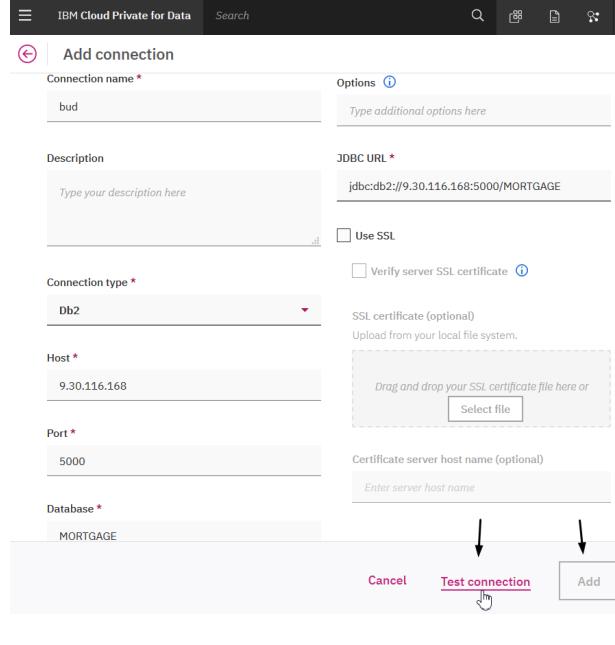
Create a connection to the data source for Db2 database.

4.2. Navigate to Connections



On the left pane choose **Connections**. Next, on the **Data Connections** window click on the  icon.

4.3. Add connection



Fill out the **Add Connection** information according to the information provided in step 3.1. Access credential for DB2. Credential used in following step is just an example.

1. For **Choose connection** use the drop-down menu and select ‘Db2’.
2. Use ‘Bud’ as the **Connection name**
3. Use IP of the cluster node (where DB2 database) as **Host**
4. **Port** is ‘50000’
5. **Database is** ‘MORTGAGE’
6. **Username** is ‘db2inst1’ and **Password** is ‘password’.

Next click on **Test Connection**, once it successful click on **Save Connection**.

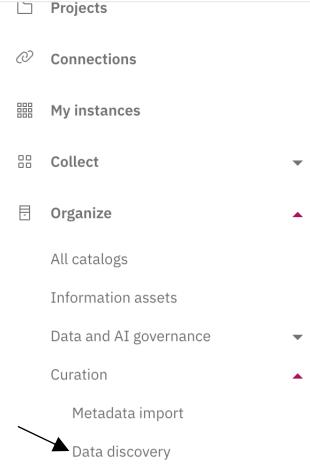


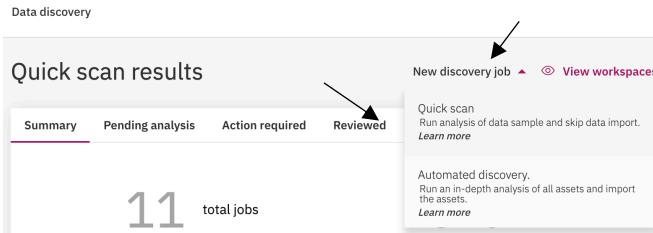
Success The test connection was successful. Click **Add** to save the connection information.

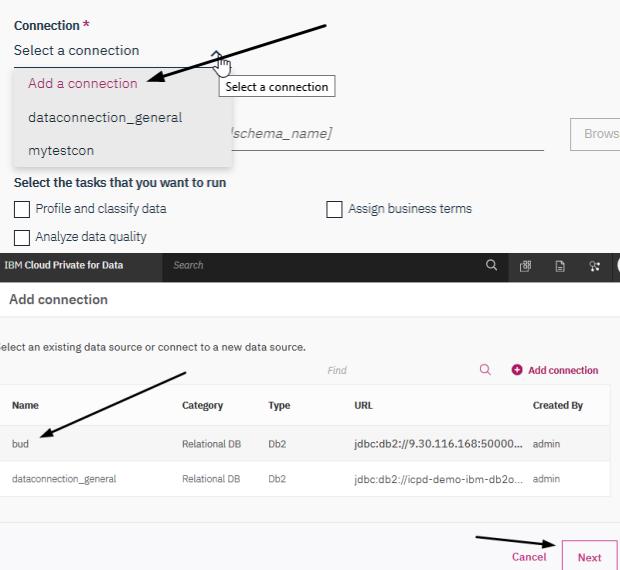
5. Discover Assets

Use the data source created above discover all data assets from Db2 database.

5.1. Navigate to discover assets

	<p>From Organize option on the left pane, choose Curation > Data discovery.</p>
---	--

	<p>To select discover job</p> <p>Navigate to New discover job > Quick scan</p>
--	--

	<p>To discover assets</p> <ol style="list-style-type: none"> 1. Click on Add a connection 2. Choose the connection named bud that you created previously, click Next
---	---

Quick scan job

Connection * bud

Discovery root ⓘ schema[MORTGAGE|DB2INST1]

Discovery options

- Analyze columns
- Analyze data quality
- Assign terms
- Use machine learning to assign terms
- Use data sampling

The maximum number of records included in the data set sample: 1000

Workspace * ⓘ Mortgage

3. Choose the connection named **bud** that you created previously.
4. Select **Discover root** as **MORTGAGE > DB2INST1**
5. Check necessary **Discover options**
6. Click on **Add a workspace** under Workspace and named it as **Mortgage**. Click **Create**.
7. Click on **Discover**

It may take few minutes to complete.

Click on **Quick scan results** > **Action required** > **View results** or **View workspaces** to explore the discover assets.

Quick scan results

New discovery job ⓘ View workspaces ⓘ View automated discovery results

Summary	Pending analysis	Action required	Reviewed													
Status <ul style="list-style-type: none"> <input checked="" type="radio"/> All jobs pending analysis <input type="radio"/> Analyzing <input type="radio"/> In queue for analysis 	Pause View results	1 item selected (select up to 15) Cancel														
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Job ID</th> <th style="text-align: left;">Data assets</th> <th style="text-align: left;">Connection</th> <th style="text-align: left;">Started by</th> <th style="text-align: left;">Processing time</th> <th style="text-align: left;">Status</th> <th style="text-align: left;">Status updated</th> </tr> </thead> <tbody> <tr> <td>qs_1571071613091</td> <td>-</td> <td>bud</td> <td>admin</td> <td>2 minutes 15 seconds</td> <td>Analyzing</td> <td>-</td> </tr> </tbody> </table>	Job ID	Data assets	Connection	Started by	Processing time	Status	Status updated	qs_1571071613091	-	bud	admin	2 minutes 15 seconds	Analyzing	-	
Job ID	Data assets	Connection	Started by	Processing time	Status	Status updated										
qs_1571071613091	-	bud	admin	2 minutes 15 seconds	Analyzing	-										

Results f qs_1571071613091

Explore assets

Business term assignment		Data class assignment	
Assigned	100	Assigned	70.37
Suggested		Suggested	51.85
Unassigned		Unassigned	29.63

Review the discovery results using **Explore assets** tab

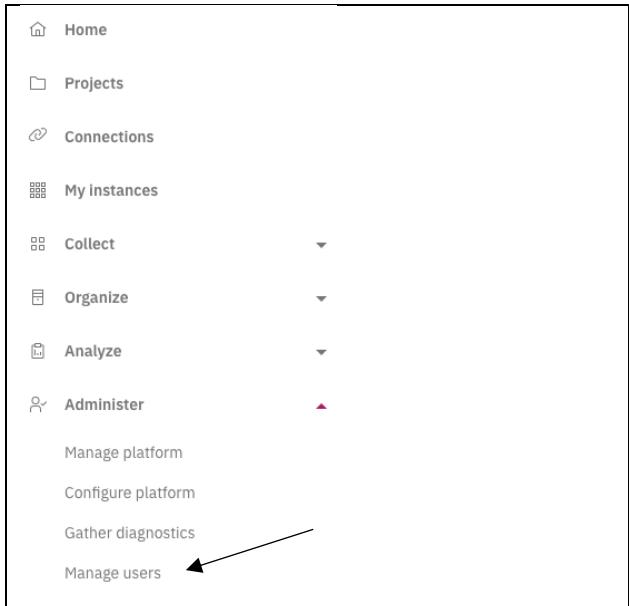
<p>Asset type</p> <ul style="list-style-type: none"> <input type="radio"/> File <input type="radio"/> Schema <input checked="" type="radio"/> Table <input checked="" type="radio"/> Column <p>Filters</p> <p>Labels</p> <p>No filters of this type</p> <p>Tables 3 X</p> <p><input checked="" type="checkbox"/> 3 tables selected</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> MORTGAGE_CUSTOMER <input checked="" type="checkbox"/> MORTGAGE_PROPERTY <input checked="" type="checkbox"/> MORTGAGE_DEFAULT <input type="checkbox"/> MORTGAGE_JOIN <p>Clear Apply</p>	<p>Discovered columns (27)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Column name</th> <th>Identity</th> <th>Quality</th> <th>Assigned business term</th> <th>Suggested business term</th> <th>Assigned data class</th> <th>Suggested data class</th> <th>Business term actions</th> </tr> </thead> <tbody> <tr><td>APPLIED_ONLINE</td><td>MORTGAGE_JOIN</td><td>100%</td><td>-</td><td>-</td><td>Indicator 100%</td><td>-</td><td></td></tr> <tr><td>APPLIED_ONLINE</td><td>MORTGAGE_CUSTOMER</td><td>100%</td><td>-</td><td>-</td><td>Indicator 100%</td><td>-</td><td></td></tr> <tr><td>CARD_DEBT</td><td>MORTGAGE_CUSTOMER</td><td>96%</td><td>-</td><td>-</td><td>-</td><td>US Zip Code 2%</td><td></td></tr> <tr><td>CARD_DEBT</td><td>MORTGAGE_JOIN</td><td>96%</td><td>-</td><td>-</td><td>-</td><td>US Zip Code 4%</td><td></td></tr> <tr><td>CURRENT_LOANS</td><td>MORTGAGE_JOIN</td><td>100%</td><td>-</td><td>-</td><td>Boolean 100%</td><td>Indicator 100%</td><td></td></tr> <tr><td>CURRENT_LOANS</td><td>MORTGAGE_CUSTOMER</td><td>100%</td><td>-</td><td>-</td><td>Boolean 100%</td><td>Indicator 100%</td><td></td></tr> <tr><td>ID</td><td>MORTGAGE_DEFAULT</td><td>100%</td><td>-</td><td>-</td><td>Identifier 100%</td><td>-</td><td></td></tr> <tr><td>ID</td><td>MORTGAGE_CUSTOMER</td><td>100%</td><td>-</td><td>-</td><td>Identifier 100%</td><td>-</td><td></td></tr> <tr><td>ID</td><td>MORTGAGE_PROPERTY</td><td>100%</td><td>-</td><td>-</td><td>Identifier 100%</td><td>-</td><td></td></tr> </tbody> </table> <p>Items per page: 10 1–10 of 27 items</p> <p>1 of 3 pages </p>	Column name	Identity	Quality	Assigned business term	Suggested business term	Assigned data class	Suggested data class	Business term actions	APPLIED_ONLINE	MORTGAGE_JOIN	100%	-	-	Indicator 100%	-		APPLIED_ONLINE	MORTGAGE_CUSTOMER	100%	-	-	Indicator 100%	-		CARD_DEBT	MORTGAGE_CUSTOMER	96%	-	-	-	US Zip Code 2%		CARD_DEBT	MORTGAGE_JOIN	96%	-	-	-	US Zip Code 4%		CURRENT_LOANS	MORTGAGE_JOIN	100%	-	-	Boolean 100%	Indicator 100%		CURRENT_LOANS	MORTGAGE_CUSTOMER	100%	-	-	Boolean 100%	Indicator 100%		ID	MORTGAGE_DEFAULT	100%	-	-	Identifier 100%	-		ID	MORTGAGE_CUSTOMER	100%	-	-	Identifier 100%	-		ID	MORTGAGE_PROPERTY	100%	-	-	Identifier 100%	-		<p>Review assets for proper business glossary assignment, if needed you can adjust them.</p> <p>Select Asset type as “Column”</p> <p>Filters necessary tables using checkbox</p> <p>Click on Apply</p>
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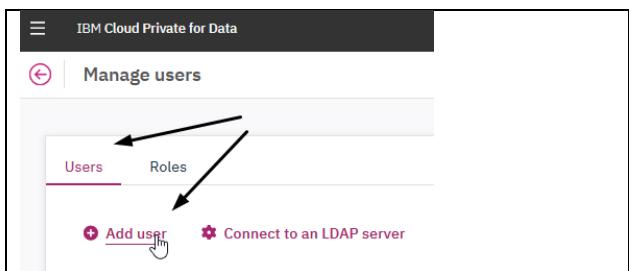
<p>Asset type</p> <ul style="list-style-type: none"> <input type="radio"/> File <input type="radio"/> Schema <input checked="" type="radio"/> Table <input type="radio"/> Column <p>Filters</p> <p>Schemas</p> <p><input type="checkbox"/> DB2INST1</p> <p>Status</p>	<p>Approve results Reject results Audit assets</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Table name</th> <th>Identity</th> <th>Quality</th> <th>Schema name</th> <th>Discovery root</th> <th>Status</th> </tr> </thead> <tbody> <tr><td><input checked="" type="checkbox"/> MORTGAGE_CUSTOMER</td><td>MORTGAGE_CUSTOMER_qs_1573834179481</td><td>100%</td><td>DB2INST1</td><td>schema[MORTGAGE DB:</td><td>Ready for review</td></tr> <tr><td><input checked="" type="checkbox"/> MORTGAGE_DEFAULT</td><td>MORTGAGE_DEFAULT_qs_1573834179481</td><td>100%</td><td>DB2INST1</td><td>schema[MORTGAGE DB:</td><td>Ready for review</td></tr> <tr><td><input type="checkbox"/> MORTGAGE_JOIN</td><td>MORTGAGE_JOIN_qs_1573834179481</td><td>100%</td><td>DB2INST1</td><td>schema[MORTGAGE DB:</td><td>Ready for review</td></tr> <tr><td><input checked="" type="checkbox"/> MORTGAGE_PROPERTY</td><td>MORTGAGE_PROPERTY_qs_1573834179481</td><td>100%</td><td>DB2INST1</td><td>schema[MORTGAGE DB:</td><td>Ready for review</td></tr> </tbody> </table>	Table name	Identity	Quality	Schema name	Discovery root	Status	<input checked="" type="checkbox"/> MORTGAGE_CUSTOMER	MORTGAGE_CUSTOMER_qs_1573834179481	100%	DB2INST1	schema[MORTGAGE DB:	Ready for review	<input checked="" type="checkbox"/> MORTGAGE_DEFAULT	MORTGAGE_DEFAULT_qs_1573834179481	100%	DB2INST1	schema[MORTGAGE DB:	Ready for review	<input type="checkbox"/> MORTGAGE_JOIN	MORTGAGE_JOIN_qs_1573834179481	100%	DB2INST1	schema[MORTGAGE DB:	Ready for review	<input checked="" type="checkbox"/> MORTGAGE_PROPERTY	MORTGAGE_PROPERTY_qs_1573834179481	100%	DB2INST1	schema[MORTGAGE DB:	Ready for review	<p>Change Asset type as “Table”</p> <p>Select all Mortgage related tables</p> <p>Click on Approve results</p>
Table name	Identity	Quality	Schema name	Discovery root	Status																											
<input checked="" type="checkbox"/> MORTGAGE_CUSTOMER	MORTGAGE_CUSTOMER_qs_1573834179481	100%	DB2INST1	schema[MORTGAGE DB:	Ready for review																											
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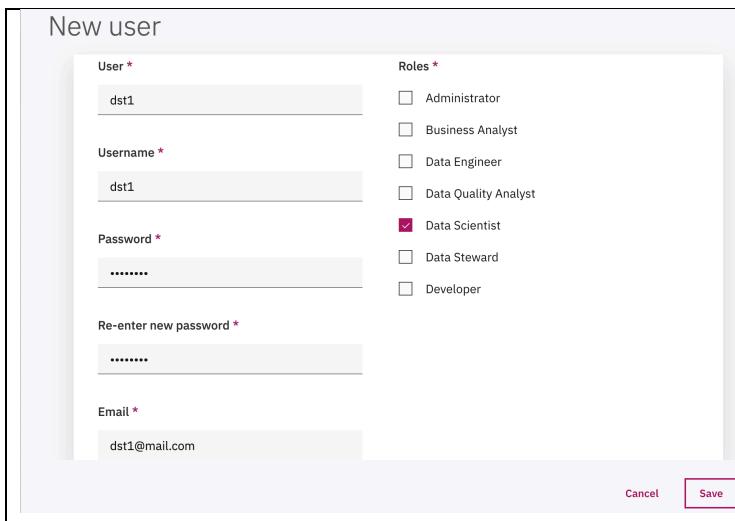
<p>Approve assets</p> <p>The selected assets will be added to the catalog so that other users can access them.</p> <p>The analysis results for these assets will not be included in the catalog until you publish them.</p> <p>The analysis results will be loaded to the workspace that you selected when you started the new discovery job. In the workspace, you can run further analysis, edit the results, or publish them.</p> <p>Selected assets</p> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> <input checked="" type="checkbox"/> MORTGAGE_CUSTOMER <input checked="" type="checkbox"/> MORTGAGE_DEFAULT <input checked="" type="checkbox"/> MORTGAGE_PROPERTY </div>	<p>Click on Approve assets</p>
---	---------------------------------------

6. Add users

Create users with different roles.

 <ul style="list-style-type: none"> Home Projects Connections My instances Collect Organize Analyze Administer <ul style="list-style-type: none"> Manage platform Configure platform Gather diagnostics Manage users 	<p>From Administer option on the left pane, choose Manage users.</p>
--	---

 <p>IBM Cloud Private for Data</p> <p>Manage users</p> <p>Users Roles</p> <p>Add user Connect to an LDAP server</p>	<p>Switch tab to ‘Users’ and click on ‘Add user’</p>
---	--

 <p>New user</p> <p>User * dst1</p> <p>Username * dst1</p> <p>Password * *****</p> <p>Re-enter new password * *****</p> <p>Email * dst1@mail.com</p> <p>Roles *</p> <ul style="list-style-type: none"> <input type="checkbox"/> Administrator <input type="checkbox"/> Business Analyst <input type="checkbox"/> Data Engineer <input type="checkbox"/> Data Quality Analyst <input checked="" type="checkbox"/> Data Scientist <input type="checkbox"/> Data Steward <input type="checkbox"/> Developer <p>Cancel Save</p>	<p>Fill out Add User information for a data scientist</p> <ol style="list-style-type: none"> 1. User as dst1 2. Username is dst1 3. Use a valid email address 4. Set Password as dst1 5. Chose the user roles as Data Scientist <p>Click on Save to confirm the add user</p>
---	---

Follow same steps in Add User section (above) and two more account. Create **deng1** for Data Engineer and **dstw1** a data steward.

User	Role	Password
• deng1	Data Engineer	deng1
• dstw1	Data Stewards	dstw1

The screenshot shows the 'Manage users' page in the IBM Cloud Private for Data interface. A success message 'Successfully updated user "dstw1"' is displayed. The user list table shows three entries: 'admin' (Approved, Status: Approved), 'deng1' (Approved, Status: Approved), and 'dstw1' (Approved, Status: Approved). The right sidebar shows a user profile for 'admin' with options like 'Profile and settings', 'Getting Started', 'About', and 'Logout'. A cursor is hovering over the 'Logout' button.

Log out from user **admin**

7. Implement Business Glossary

Cloud Pak for Data enables you to structure your enterprise information in a logical way, discover relationships between assets, and keep your data always up-to-date. You can import existing glossary with categories, terms, information governance policies and rules.

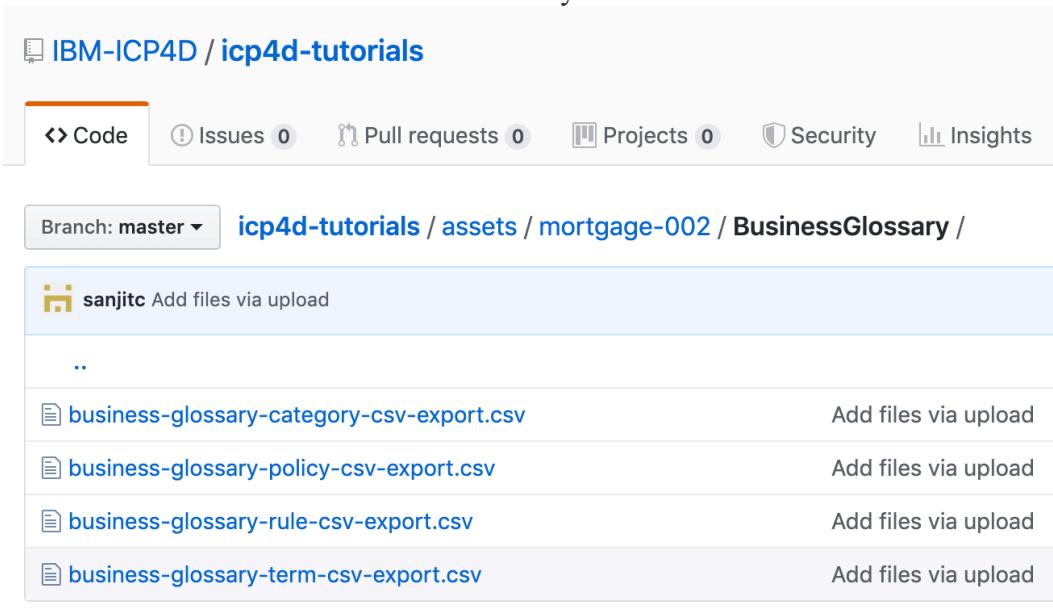
	<p>Sigh into the Cloud Pak for Data web console as user ‘dstw1’ and password is ‘dstw1’ that you created earlier.</p>
---	---

7.1. Download Business Glossaries

First download business glossaries from the GIT to your local machine.

Go to: <https://github.com/IBM-ICP4D/icp4d-tutorials/tree/master/assets/mortgage-002/BusinessGlossary>

Download all four CSV files and save them locally.

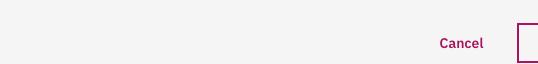


Branch: master **icp4d-tutorials / assets / mortgage-002 / BusinessGlossary**

- sanjtc** Add files via upload
- ..
- business-glossary-category-csv-export.csv** Add files via upload
- business-glossary-policy-csv-export.csv** Add files via upload
- business-glossary-rule-csv-export.csv** Add files via upload
- business-glossary-term-csv-export.csv** Add files via upload

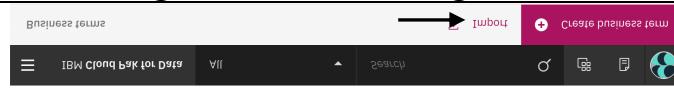
7.2. Import Categories

Sequence is important when importing business glossaries. Make sure import categories before do the terms.

<p>Choose Organize > Data and AI governance > Categories from the left pane.</p> 	
	<p>Click on Import to import the CSV file contains category information that you downloaded from Git.</p>
 <p>Choose file</p> <p>Must be a CSV file.</p> <p>business-glossary-category-csv-export.csv</p> <p>The CSV file must conform to the template for importing governance artifacts. Learn more</p>	<p>Choose the CSV file location</p> <p>Click Next</p>
 <p>Next</p> <p>Cancel</p> <p>Choose file Set merging Import</p> <p>Select merge option</p> <ul style="list-style-type: none"> <input checked="" type="radio"/> Replace all values Imported values in the CSV file replace existing values in the catalog. <input type="radio"/> Replace with defined values Imported CSV values that are not empty replace existing values in the catalog. <input type="radio"/> Replace empty values Imported values in the CSV file replace only empty values in the catalog. 	<p>Select merge option as Replace all values</p> <p>Click Import</p>

7.2. Import Terms

Choose **Organize > Data and AI governance > Business terms** from the left pane.



Click on **Import** to import the CSV file contains term information that you downloaded from Git.

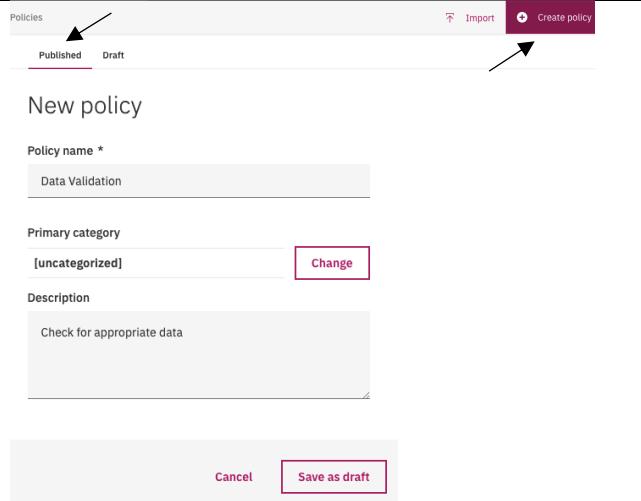
<p>The screenshot shows the first step of the import wizard: 'Choose file'. It has three circular steps: 'Choose file' (with a red circle), 'Set merging' (empty), and 'Import' (empty). Below the steps, the text 'Choose file' is displayed. A red box highlights the file 'business-glossary-term-csv-export.csv' in a list. A note below says: 'The CSV file must conform to the template for importing governance artifacts.' and a 'Learn more' link.</p>	<p>Choose the CSV file location</p> <p>Click Next</p>
<p>The screenshot shows the second step of the import wizard: 'Select merge option'. It has three circular steps: 'Choose file' (with a red circle), 'Set merging' (with a red circle), and 'Import' (empty). Below the steps, the text 'Select merge option' is displayed. There are three radio buttons: <ul style="list-style-type: none"> Replace all values: Imported values in the CSV file replace existing values in the catalog. Replace with defined values: Imported CSV values that are not empty replace existing values in the catalog. Replace empty values: Imported values in the CSV file replace only empty values in the catalog. A red box highlights the 'Import' button at the bottom.</p>	<p>Select merge option as Replace all values</p> <p>Click Import</p> <p>Review each imported business terms and then publish</p>

7.3. Create a policy

Create governance policies and rules for the entire organization to ensure clarity and compatibility among departments, projects, or products.

Choose **Organize > Data and AI governance > Policy** from the left pane

Select **Published** tab and click on **Create Policy**

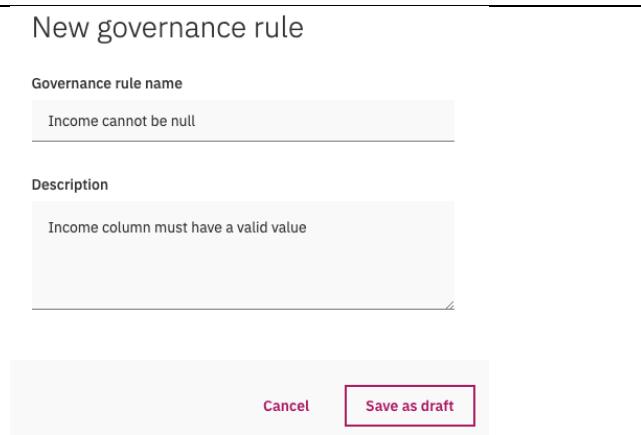
	<p>On the New policy window create a policy with following information and click on Save as draft:</p> <p>Name: Data Validation Description: Check for appropriate data</p> <p>It will take few minutes to appear under list of available policies.</p> <p>Once the new policy available let's publish it.</p>
---	---

7.4. Create a rule

Choose **Organize > Data and AI governance > Rule** from the left pane

Select **Published** tab and click on **Create Rule**

Choose **Governance rule**

	<p>On the New governance rule window create a rule with following information and click on Save as draft:</p> <p>Name: Income cannot be null Description: Income column must have a valid value</p> <p>It will take few minutes to appear under list of available rules.</p>
---	---

	<p>Click on Add policy under Parent policies to assign the Data Validation rule to it.</p>
---	---

7.5. Add rule to metadata

Click on the enterprise search, Search for ‘mortgage_customer’ and hit enter
From the search results select table ‘mortgage_customer’

Click on **Details** tab at the top

On Database Table Details window choose **Database Columns** from left

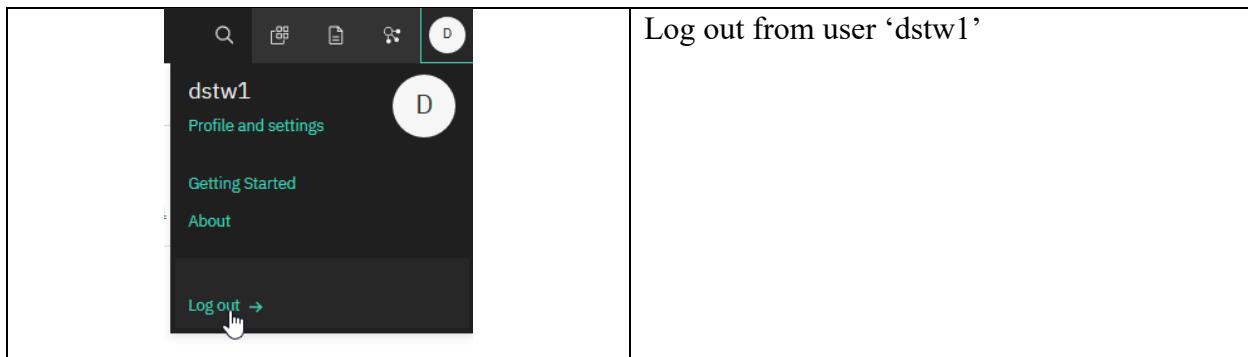
Select INCOME column

Next click on icon (right top corner) and choose Edit

Scroll down to **Implement Rules** section

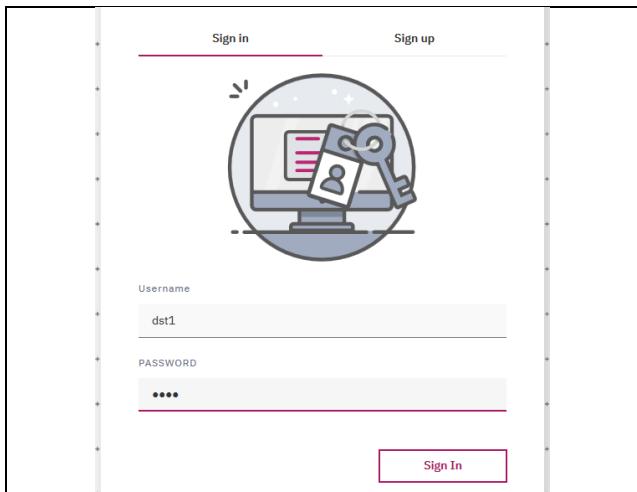
Search and select the rule **Income cannot be null** that you created earlier.

Click on **Save**



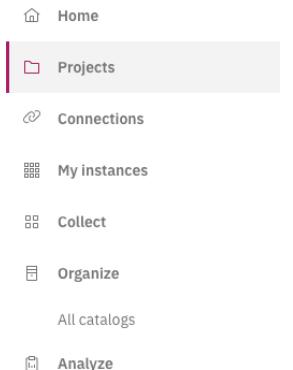
8. Access data as a Data Scientist

Explore the data require for build a model



Sigh in to the Cloud Pak for Data web console as user ‘dst1’ and password is ‘dst1’ that you created earlier.

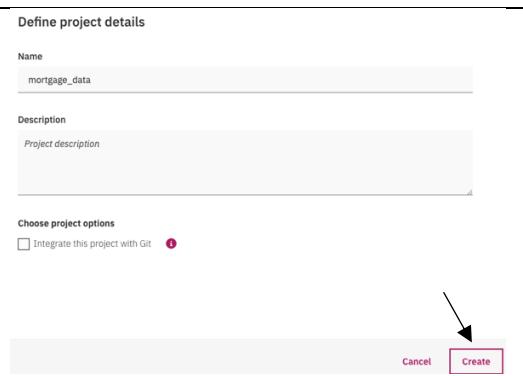
8.1. Create analytic project



Create a new analytical project by ‘Projects’ from right pane.

Click on the  icon

Select **Create an empty project**



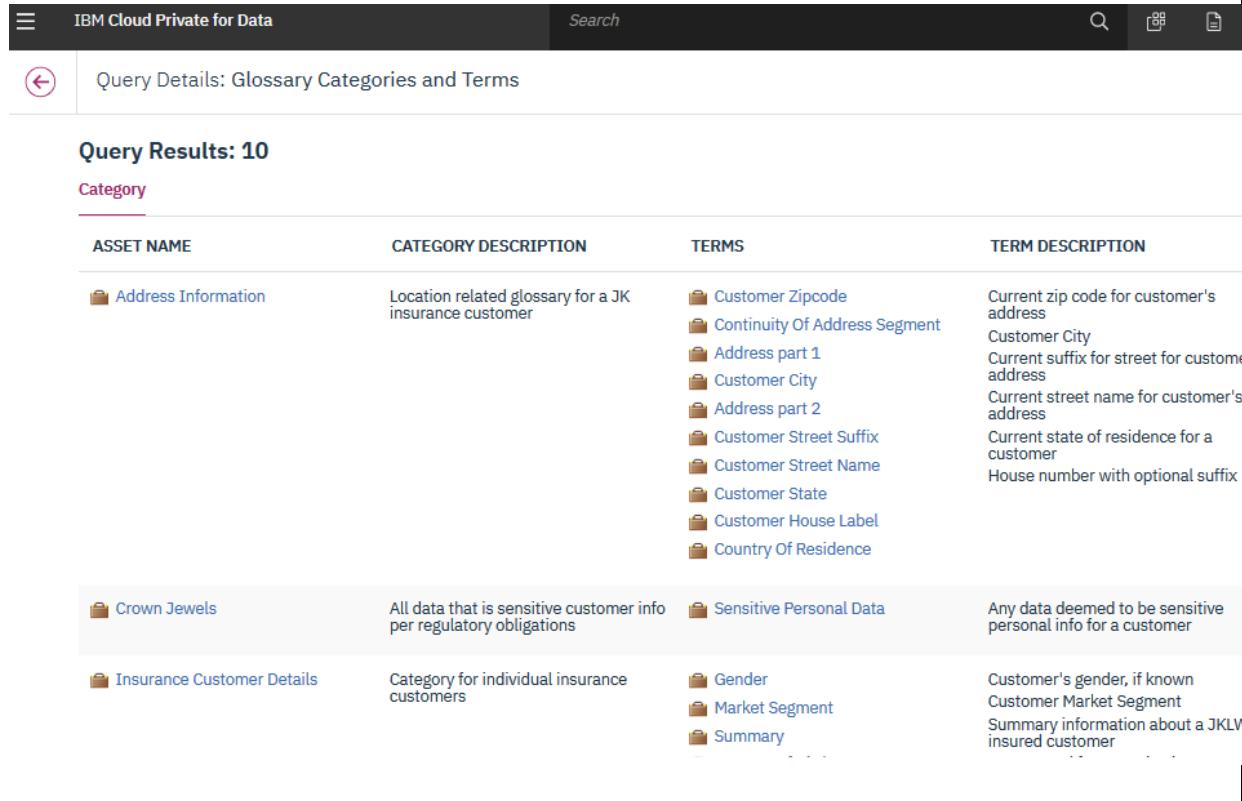
Provide a project name and click **Create**

8.2. Assets from Glossary

Let’s look for mortgage related terms in glossary to get an idea about different data assets available on the system.

Choose **Organize** from the left pane, select **Data Catalog -> Queries -> Glossary Categories and Terms**.

You should have all mortgage related information as follows. Click on each **ASSET NAME**, **TERMS** for additional information. The **TERM DESCRIPTION** provides a basic information about each term.



The screenshot shows the 'IBM Cloud Private for Data' interface with the 'Data Catalog' selected. Under 'Queries', the 'Glossary Categories and Terms' page is displayed. The title bar says 'Query Details: Glossary Categories and Terms'. Below it, the heading 'Query Results: 10' is followed by a table with four columns: ASSET NAME, CATEGORY DESCRIPTION, TERMS, and TERM DESCRIPTION. The table lists three categories: 'Address Information', 'Crown Jewels', and 'Insurance Customer Details', each with its respective description, terms, and term descriptions.

ASSET NAME	CATEGORY DESCRIPTION	TERMS	TERM DESCRIPTION
Address Information	Location related glossary for a JK insurance customer	Customer Zipcode Continuity Of Address Segment Address part 1 Customer City Address part 2 Customer Street Suffix Customer Street Name Customer State Customer House Label Country Of Residence	Current zip code for customer's address Customer City Current suffix for street for customer address Current street name for customer's address Current state of residence for a customer House number with optional suffix
Crown Jewels	All data that is sensitive customer info per regulatory obligations	Sensitive Personal Data	Any data deemed to be sensitive personal info for a customer
Insurance Customer Details	Category for individual insurance customers	Gender Market Segment Summary	Customer's gender, if known Customer Market Segment Summary information about a JKLV insured customer

For example, click on ASSET NAME **Customer**

8.3. Check Asset Details

Go through each item related to mortgage in glossary to have better idea about data you need for your project.

	<p>The asset Customer shows different terms associated with it.</p> <p>Check each Terms for additional information.</p>
--	---

8.4. Enterprise search

	<p>Click on the enterprise search</p>
	<p>Search for ‘mortgage’ and hit enter</p>

MORTGAGE_PROPERTY

MORTGAGE_PROPERTY
Database Table
idbc:db2://9.30.116.168:50000 /MORTGAGE db2 > DB2INST1

★★★★★ 0 Ratings None Quality score

Description

Select your rating: ★★★★★

New Comment:

All Comments (0)

Choose the **mortgage_property** table and click on **Relationship Graph** to see details about the table.

Click on the '+' next to **Database Column** to expand list of columns in the table.

Same way you can view other mortgage related tables.

39 Search Results Filter

- mortgage_property** 67% RELEVANCY TABLE
- mortgage_default** 67% RELEVANCY TABLE
- mortgage_customer** 67% RELEVANCY TABLE
- mortgage customer** 67% RELEVANCY TERM
- mortgage_join** 65% RELEVANCY TABLE
- mortgage_default** 64% RELEVANCY COLUMN

Go back to the enterprise **Search Result**

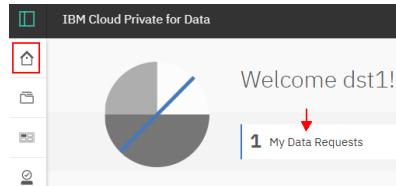
The enterprise search will return all objects that mentioned word mortgage but as a data scientist you don't have access to any of those objects.

Click on the **New Data Request** on top right corner for request access to mortgage related datasets.

Fill up the **New Data Request** form with detail information as much possible, so a data engineer can provide accurate dataset. Click Confirm and then Submit request.

At this point you need to wait for data engineer to address the data request.

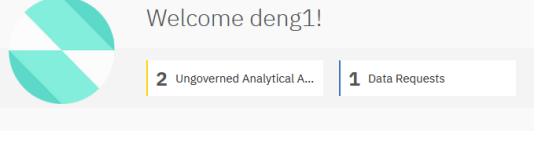
You can go to the home page by clicking on icon from left pane and check the status of the data request.



Sign out from user **dst1**

9. Review data request

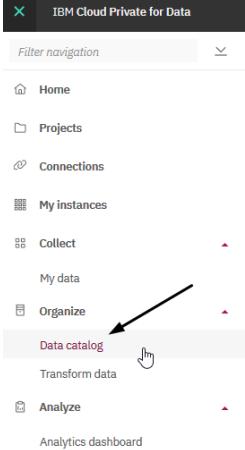
	Sigh in to the Cloud Pak for Data web console as user ‘deng1’ and password is ‘deng1’ that you created earlier.
---	---

	<p>After sing in Click on Go to your home page</p> <p>Check the Data Request tab on the home page.</p>
---	---

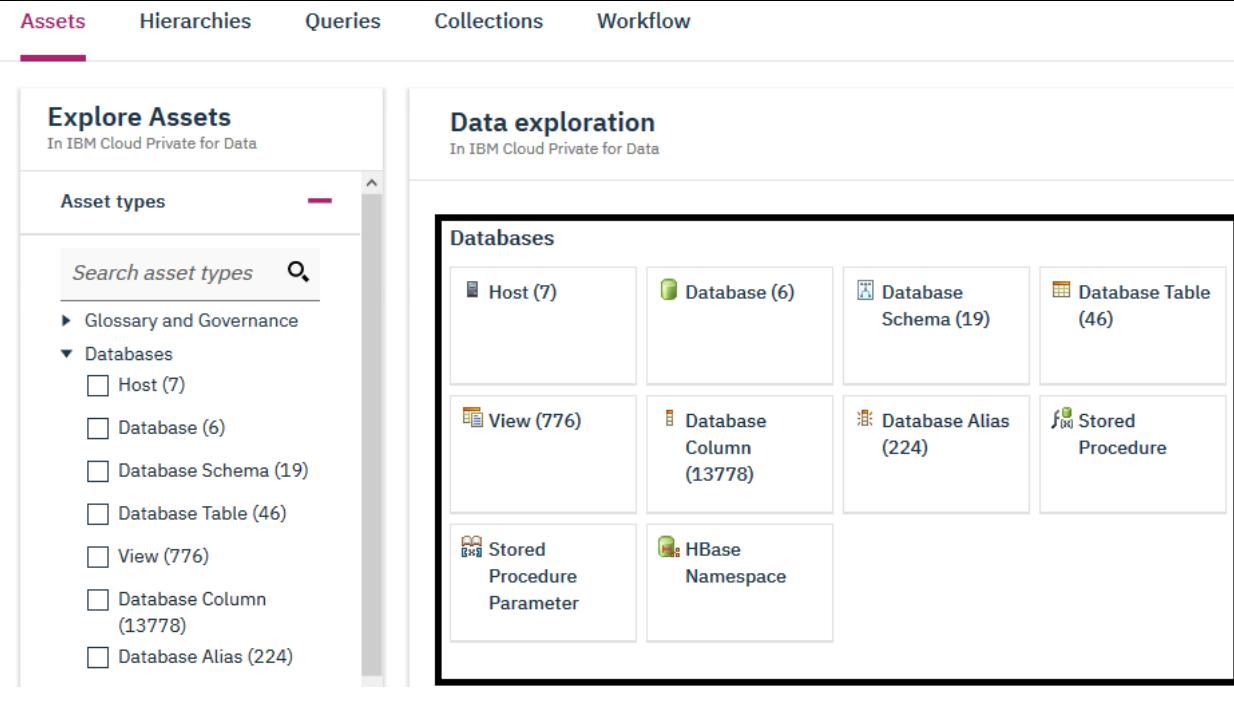
<p>Click on the new data request that submitted by data scientist earlier for review. After reviewing the request click on Action in top right corner and select assign to me.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>ID</th> <th>Name</th> <th>Status</th> <th>Requested by</th> <th>Assigned to</th> <th>Priority</th> <th>Last updated</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Mortgage_Data_Access</td> <td>Claimed</td> <td>dst1</td> <td>deng1</td> <td>Medium</td> <td>3 Jun 2019, 8:15 PM</td> </tr> <tr> <td>2</td> <td>Mortgage_Data_Access_Request</td> <td>Claimed</td> <td>dst1</td> <td>deng1</td> <td>Medium</td> <td>3 Jun 2019, 8:41 PM</td> </tr> <tr> <td>3</td> <td>Mortgage_Data_request1</td> <td>Claimed</td> <td>dst1</td> <td>deng1</td> <td>High</td> <td>3 Jun 2019, 8:39 PM</td> </tr> <tr> <td>4</td> <td>CustData</td> <td>New</td> <td>admin</td> <td>Unassigned</td> <td>High</td> <td>4 Jun 2019, 9:03 AM</td> </tr> </tbody> </table> <div style="text-align: center; margin-top: 10px;"> </div> <div style="text-align: center; margin-top: 10px;"> <p>Action ▾</p> <p>Transform data</p> <p>Assign to me</p> </div>							ID	Name	Status	Requested by	Assigned to	Priority	Last updated	1	Mortgage_Data_Access	Claimed	dst1	deng1	Medium	3 Jun 2019, 8:15 PM	2	Mortgage_Data_Access_Request	Claimed	dst1	deng1	Medium	3 Jun 2019, 8:41 PM	3	Mortgage_Data_request1	Claimed	dst1	deng1	High	3 Jun 2019, 8:39 PM	4	CustData	New	admin	Unassigned	High	4 Jun 2019, 9:03 AM
ID	Name	Status	Requested by	Assigned to	Priority	Last updated																																			
1	Mortgage_Data_Access	Claimed	dst1	deng1	Medium	3 Jun 2019, 8:15 PM																																			
2	Mortgage_Data_Access_Request	Claimed	dst1	deng1	Medium	3 Jun 2019, 8:41 PM																																			
3	Mortgage_Data_request1	Claimed	dst1	deng1	High	3 Jun 2019, 8:39 PM																																			
4	CustData	New	admin	Unassigned	High	4 Jun 2019, 9:03 AM																																			

10. Navigate to data catalog

Once discover assets process completed. All database objects automatically cataloged in Cloud Pak for Data. You can review those database object in the catalog.

	<p>Next go back to Organize option on the left pane and choose Data catalog.</p>
---	--

At this point Cloud Pak for Data should displays all the database objects. You can click each individual object under **Databases** to explore the catalog generated from discover asset previously. Click on the **Database Table** to check tables discovered from Db2. Take a look into the database named **mortgage**.


--

Under the **Database Tables** you can see ‘MORTGAGE_CUSTOMER’, ‘MORTGAGE_DEFAULT’ and ‘MORTGAGE_PROPERTY’ tables, cataloged from Db2 database.

Filter results

[Clear all filters](#)

Asset types (1)

Search asset types

- ▶ Glossary and Governance
- ▼ Databases (1)
 - Host
 - Database
 - Database Schema
 - Database Table (46)
 - View
 - Database Column
 - Database Alias
 - Stored Procedure
 - Stored Procedure Parameter
 - HBase Namespace
- ▶ Data Files

All results

46 results

No items selected

<input type="checkbox"/>	/MORTGAGE » db2 » SYSTOOLS	Modified by InformationServerSystemUser on Jun 3, 2019, 6:52 PM
<input type="checkbox"/>	HMON_COLLECTION	Modified by InformationServerSystemUser on Jun 4, 2019, 11:30 AM
<input type="checkbox"/>	idbc:db2://10.208.125.125:50000 /MORTGAGE	Created by admin on Jun 3, 2019, 6:34 PM
<input type="checkbox"/>	/bisqal » db2 » USER999	Modified by InformationServerSystemUser on Jun 3, 2019, 6:34 PM
<input type="checkbox"/>	MONGO_MORTGAGE_PROPERTY	Created by admin on Jun 4, 2019, 11:28 AM
<input type="checkbox"/>	idbc:db2://dv-server.zen.svc.cluster.local:32051 /bisqal	» db2 » USER999
<input type="checkbox"/>	/MORTGAGE	» DB2INST1

11. Data Virtualization

Context: Data virtualization (DV) integrates data sources across multiple types and locations and turns it into one logical data view. In this case, you have data across three different tables. Creating a virtual table you can quickly view data from different tables.

11.1. Adding a new data source for Db2

Context: DV supports many relational and non-relational data sources (as well as files that reside on a local disk or network file system) that you can add to your data source ecosystem. After a data source has been added, any user that has virtualize permission can create virtual tables. DV agents connect to relational data sources using JDBC protocol. In this tutorial you will add a data source for Db2 database.

Define a data connection to Db2. Use your existing Db2 database connection for Db2 data source.

1. Go to **Collect > Virtualized data > Menu > Data sources**
2. Click **Add > New data source > Add connection**
3. Select **Db2** that you created earlier and click **Next**

11.3. Select tables for virtualization

Context: the most common mechanism for virtualizing data is to create a "view" or virtual table. Virtual tables can be full or segment of data from one or more tables. You can then run queries against the resulting virtual table.

- Click **Collect > Virtualized data > Menu > Virtualize**
- Select tables **MORTGAGE_CUSTOMER**, **MORTGAGE_PROPERTY** and **MORTGAGE_DEFAULT** from **MORTGAGE** database, then click **Add to cart**
- Click **View cart**
- Click **Next**

Table	Schemas	Database
MORTGAGE_JOIN	DB2INST1	MORTGAGE
MORTGAGE_CUST...	DB2INST1	MORTGAGE
MORTGAGE_DEFA...	DB2INST1	MORTGAGE
MORTGAGE_PROP...	DB2INST1	MORTGAGE

<ul style="list-style-type: none"> • Select Neither • Uncheck the box for Submit to catalog • Click Virtualize to complete the process 	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Table</th> <th>Schema</th> <th>Source schema</th> <th>Host/Database</th> <th>Grouped tables</th> </tr> </thead> <tbody> <tr> <td>MORTGAGE_CUSTOMER</td> <td>USER999</td> <td>X ▾</td> <td>DB2INST1</td> <td>169.46.33.180:MORTGAGE</td> </tr> <tr> <td>MORTGAGE_DEFAULT</td> <td>USER999</td> <td>X ▾</td> <td>DB2INST1</td> <td>169.46.33.180:MORTGAGE</td> </tr> <tr> <td>MORTGAGE_PROPERTY</td> <td>USER999</td> <td>X ▾</td> <td>DB2INST1</td> <td>169.46.33.180:MORTGAGE</td> </tr> </tbody> </table>	Table	Schema	Source schema	Host/Database	Grouped tables	MORTGAGE_CUSTOMER	USER999	X ▾	DB2INST1	169.46.33.180:MORTGAGE	MORTGAGE_DEFAULT	USER999	X ▾	DB2INST1	169.46.33.180:MORTGAGE	MORTGAGE_PROPERTY	USER999	X ▾	DB2INST1	169.46.33.180:MORTGAGE
Table	Schema	Source schema	Host/Database	Grouped tables																	
MORTGAGE_CUSTOMER	USER999	X ▾	DB2INST1	169.46.33.180:MORTGAGE																	
MORTGAGE_DEFAULT	USER999	X ▾	DB2INST1	169.46.33.180:MORTGAGE																	
MORTGAGE_PROPERTY	USER999	X ▾	DB2INST1	169.46.33.180:MORTGAGE																	

11.4. Creating virtual table

You can create a new virtual table based on existing tables under **My data** section. You can use “drag and drop” or write your own SQL to create the view.

- Click **Collect > Virtualized data > Menu > SQL editor** to access the editor.
- Copy the following SQL statement and paste it on the editor
- Click on **Run all**

```
CREATE VIEW MORTGAGE_JOIN_VIEW
AS
SELECT A.ID, INCOME, APPLIED_ONLINE, RESIDENCE, YRS_CURRENT_ADD,
       YRS_CURRENT_EMP, NO_OF_CARDS, CARD_DEBT, CURRENT_LOANS,
       LOAN_AMOUNT, SALE_PRICE, LOCATION, MORTGAGE_DEFAULT
FROM   MORTGAGE_CUSTOMER A,
       MORTGAGE_PROPERTY B,
       MORTGAGE_DEFAULT C
WHERE  A.ID = B.ID
AND    A.ID = C.ID;
```

<pre>Menu ▾ SQL editor * Untitled - 1</pre>

- Click **Collect > Virtualized data > Menu > My virtualized data** to access the virtual table MORTGAGE_JOIN_VIEW
- Check the box associated with MORTGAGE_JOIN_VIEW

- Click on the table actions menu
- Select **Manage access** option
- On grant access window select All data virtualization users
- Click **Continue**

Grant access to

All data virtualization users

Specific users

Users Roles

Search

Revoke Grant access

<input type="checkbox"/>	Name	Username	Role	User ID	Access level

11.5. Add virtual table to catalog

Once you create a virtual table, you can add it to the catalog, making it easily searchable.

- Click **Collect > Virtualized data > Menu > My data** to find the virtual table just created.
- Mark the checkbox associated with virtual table
- Choose **Submit to catalog** from table action
- Click on **Confirm**

Menu | My virtualized data

Find

Assign Join view Add table

Total tables: 23 Access to some tables is restricted by policies.

	Table	Schema	Created on
<input checked="" type="checkbox"/>	MORTGAGE_JOIN_VIEW	USER999	18 Oct 2019 20:17:28
<input type="checkbox"/>	V2	USER999	18 Oct 2019 20:09:27
<input type="checkbox"/>	V1	USER999	18 Oct 2019 20:08:40
<input type="checkbox"/>	MORTGAGE_PROPERTY	USER999	18 Oct 2019 20:08:40

11.6. Publish virtualized table

A data steward needs approve the published request before the asset is added to the enterprise data catalog. You signed in as user ‘admin’, it should allow to publish the virtual table.

Pending Publish to Catalog Requests

Search

Name	Type	Project	Owner	Date Updated	Status
> USER999.MORTGAGE_JOIN_VIEW	view	-	admin	21 October 2019, 2:49PM	Pending
> USER999.Currency USER999.Country	table	-	admin	17 October 2019, 8:40AM	Pending

access the **Home** page

- Click on **Pending Publish to Catalog Requests**

- Click on icon on left for virtual table **MORTGAGE_JOIN_VIEW** that you created
- Click on **Approve**

11.7. Access information for virtual table

To access virtual table from external application, you need the JDBC connection information. Click on **Collect > Virtualized data > Menu > Add-on settings** to find out access information. You will use this information later in the building model section.

The screenshot shows the 'Add-on settings' page under the 'Menu' dropdown. The 'Access information' section displays the following details:

User ID	user999	
Password	
JDBC connection URL	jdbc:db2://dv-server.zen.svc.cluster.local:32051/...	

11.8. Deliver Dataset

The screenshot shows the home page of IBM Cloud Private for Data. The left sidebar includes navigation items: Home (highlighted), Projects, Connections, My instances, and Collect. The main area features a pie chart and the text "Welcome deng1!". A "Data Requests" card indicates 1 request.

Go to the home page by clicking on icon from left pane and check the data request tab.

Click on the data request for update that submitted by data scientist earlier.

Data requests + Add new data request

	Name	ID	Status	Last Updated
1	Mortgage_Data_Access	2	New	27 Mar 2019, 11:15 AM

Click on the **Source** and fill out all the necessary information. This information will be picked up by the data scientist later.

Add the **remote data** set information that you created during data transformation. In this case remote data set is MORTGAGE_JOIN_VIEW. Use the **Access information** from the **Add-on settings** information from DV.

New data request

Source

Data source name
mortgage_join

DB2

Username
db2inst1

Password
.....

JDBC URL
169.45.83.218

+ Add new dataset

	Remote data set name	Description	Schema	Table
1	mortgage_join		db2inst1	mortage_join

Click on the data request and change the status to **Deliver**.

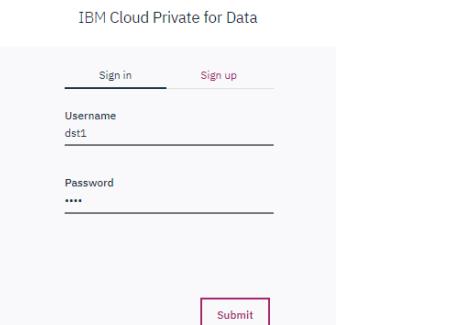
NAME	ID	STATUS	REQUESTED BY	ACCEPTED BY	LAST UPDATED	ACTIONS
mortgagedata1	7	Delivered	dst1	deng1	6 Aug 2018, 12:55 PM	
Mortgage_Data_Access	9	Accepted	dst1	deng1	15 Aug 2018, 1:17 AM	

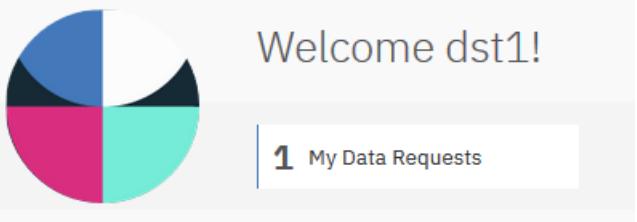
The screenshot shows the IBM Cloud Private for Data dashboard. At the top right, there is a user profile menu with the text "Signed in as: deng1". Below this, there are links for "Getting Started", "Settings", and "Sign Out". A red box highlights the "Sign Out" link. To the left of the menu, there is a circular profile picture with a large teal X over it. On the far left, there is a vertical sidebar with icons for Home, Data Requests, and Settings. The main area of the dashboard displays a "Welcome deng1" message and a "Data Requests" section showing 2 items.

Sign out from user **deng1**

12. Build Model

With Cloud Pak for Data, you can collaborate with other team members on analytic projects to create visualizations and machine learning models with data from your enterprise. In this step you will build a simple model to predict the possibilities of mortgage default by customer. The object of this model is to show the functionality of Cloud Pak for Data, not the prediction accuracy. One can use lot more data and build a complex algorithm to get better accuracy.

 <p>The form shows the 'IBM Cloud Private for Data' sign-in page. It has fields for 'Username' (dst1) and 'Password' (****), with 'Sign in' and 'Sign up' buttons at the top. A 'Submit' button is at the bottom.</p>	<p>Sign in to the Cloud Pak for Data web console as user 'dst1' and password is 'dst1' that you created earlier.</p>
--	--

 <p>The dashboard features a pie chart and the text 'Welcome dst1!' above a 'My Data Requests' section.</p>	<p>At this point data engineer deliver the data set for the data you requested. You can go to the home page by clicking on  icon from left pane</p>
---	---

12.1. Navigate to analytics project

Select **Projects** option from the left pane and click on the analytics project 'mortgage_data' that you created earlier.

12.2. Create deployment space

Create a separate deployment space for your project 'mortgage_data'.

<p>Choose : My Projects > mortgage_data > Settings > Associate a deployment space > New</p> <p>Connect to a deployment space</p> <p>New Existing</p>		<p>Name new deployment space as 'MortgageDeploymntSpace'</p>
<p>Name</p> <p>MortgageDeploymentSpace</p>		<p>Click on Associate</p>
<p>Description (Optional)</p> <p>Description of deployment space</p>		
<p>Cancel Associate</p>		

12.3. Create notebook

Create a notebook from a predefined Jupyter notebook that available on Github.

- Go to : My Projects > **mortgage_data** > Add to project
- Chose asset type as Notebook
- The new notebook needs to create from URL
- Name the notebook as **MortgageNotebook**
- Use notebook URL as <https://github.com/IBM-ICP4D/icp4d-tutorials/blob/master/assets/mortgage-002/MortgageNotebook.V25.jupyter-py36.ipynb>
- Click on **Create Notebook**

The screenshot shows the 'Add Notebook' dialog box. At the top, there's a breadcrumb navigation: 'My Projects > mortgage_data > Add Notebook'. Below that is a title 'New notebook' with tabs for 'Blank', 'From file', and 'From URL', where 'From URL' is selected. The main area has fields for 'Name' (set to 'MortgageNotebook') and 'Description (optional)' (with placeholder text 'Type your Description here'). There's also a 'Select runtime' dropdown set to 'Default Python 3.6 (1 vCPU and 2 GB RAM)'. A 'Notebook URL' field contains the URL: 'https://github.com/IBM-ICP4D/icp4d-tutorials/blob/master/assets/mortgage-002/MortgageNotebook.V25'. At the bottom right are 'Cancel' and 'Create Notebook' buttons, with 'Create Notebook' being highlighted.

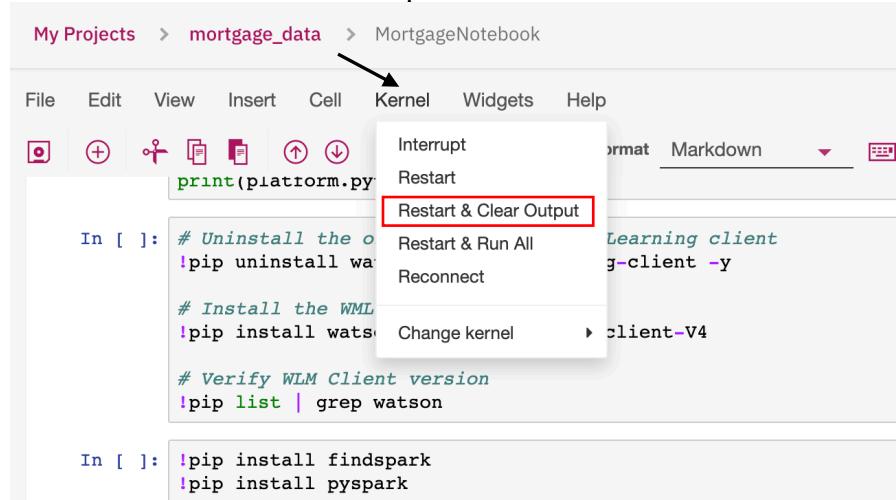
12.4. Review and run notebook

The majority of the code in the notebook is standard open source code that's used for various steps in the predictive analytics process.

Switch to edit mode by clicking on icon from top of the screen.

Do not run all cells at once. Follow the instruction below to run the notebook.

Run the **Step 1: Install** section first. Once all package installed make sure restart the Python kernel before move on next step.



The screenshot shows a Jupyter Notebook interface with the following details:

- Path:** My Projects > mortgage_data > MortgageNotebook
- Kernel Menu:** The 'Kernel' menu is open, showing options like Interrupt, Restart, and a submenu with 'Restart & Clear Output' (which is highlighted with a red box).
- Code Cells:**
 - In []:** print(platform.py)
 - In []:** # Uninstall the old WLM Client
!pip uninstall watson
 - In []:** # Install the WML Client
!pip install wats
 - In []:** # Verify WLM Client version
!pip list | grep watson
 - In []:** !pip install findspark
 - In []:** !pip install pyspark

Action: restart the kernel!

Go the **Step 2: Authenticate** section and update the **url**, **username** and **password** fields with your CPD UI console details and access credential.

Step 2: Authenticate

```
[ ]: WML_CREDENTIALS = {
    "instance_id": "openshift",
    "url" : "https://zen-cpd-zen.apps.testcluster.demo.ibmcloud.com",
    "username": "admin",
    "password": "passw0rd",
    "version": "2.5.0"
}
```

In the next notebook cell, update the **dsn_url**, **dsn_uid** and **dsn_pwd** values with the information available from **Collect > Virtualized data > Menu > Add-on settings**.

```
[ ]: #Enter the values for your database connection found under data virtualization
dsn_url = "jdbc:db2://dv-server.zen.svc.cluster.local:32051/bigsql" # e.g.
dsn_uid = "user1022" # e.g.
dsn_pwd = "sw?#@LT_674MfPI5" # e.g.
```

Run all cells between step 2 and 6.

On **Step 7: Set default space**, run the first cell and find out the **GUID** for space name **MortgageDeploymentSpace**.

On the next cell replaced the **GUID** with one that you found above.

```
In [ ]: # Example: client.set.default_space('b49e13e8-ec68-408d-84a1-957e28c154b1')
client.set.default_space('GUID')
```

Run through remaining cells, so that it generates and deployed the model.

Before exit, save the notebook .

12.5. Test the model

Go to: Analyze > Analytics deployment to access deployed model

Select the **MortgageDeploymentSpace** from the list of analytic deployment space

Click on the **MORTGAGE PREDICTION MODEL**

Choose the **MORTGAGE PREDICTION** model

Click on **Test** tab

The screenshot shows the 'Analytics deployment spaces' interface. The path is: Analytics deployment spaces > MortgageDeploymentSpace > MORTGAGE PREDICTION MODEL > MORTGAGE PREDICTION. The title is 'ONLINE MORTGAGE PREDICTION'. The 'Test' tab is selected. On the left, there's a 'Enter input data' section with a 'Body' area containing a placeholder 'Paste the request payload here' and a 'Predict' button. On the right, there's a 'Result' area which is currently empty. Above the result area is a red circle with a white 'X'. To the right of the result area is a sidebar with the following details:

- MORTGAGE PREDICTION** (status: Deployed)
- Created: Nov 07, 2019 11:48 PM
- Updated: Nov 08, 2019 06:21 PM
- Deployment ID: b7a58231-fd99-4d9f-a760-7d81... (with a copy icon)
- Software: /v4/runtimes/spark-mllib_2.3
- Description: No description provided
- Associated asset**: MODEL MORTGAGE PREDICTION M...
- Model ID: 4809b65e-9cab-4870-b93c-7444... (with a copy icon)

```
{
  "input_data": [
    {
      "fields": [
        "INCOME",
        "APPLIED_ONLINE",
        "RESIDENCE",
        "YRS_CURRENT_ADD",
        "YRS_CURRENT_EMP",
        "NO_OF_CARDS",
        "CARD_DEBT",
        "CURRENT_LOANS",
        "LOAN_AMOUNT",
        "SALE_PRICE",
        "LOCATION"
      ],
      "values": [
        [
          43151,
          "N",
          "P",
          6,
          9,
          1,
          750,
          1,
          8600,
          320000,
          110
        ]
      ]
    }
  ]
}
```

Copy this sample data and paste it on the **Enter input data** box.

Click on **Predict**

According on input values, model will predict and displays the result.

The screenshot shows the Cloud Pak for Data interface with the following details:

- Page Title:** Analytics deployment spaces > MortgageDeploymentSpace > MORTGAGE PREDICTION MODEL > MORTGAGE PREDICTION
- Section:** ONLINE MORTGAGE PREDICTION
- Buttons:** API reference (disabled), Test (selected).
- Form:** Enter input data
 - Body:** A code editor containing the JSON input data provided in the previous code block.
 - Predict:** A button to trigger the prediction.
- Result:** A code editor showing the predicted output JSON.
- Model Summary:**
 - MORTGAGE PREDICTION** (Deployed)
 - Created:** Nov 07, 2019 11:48 PM
 - Updated:** Nov 08, 2019 06:32 PM
 - Deployment ID:** b7a58231-fd99-4d9f-a760-7d81...
 - Software:** /v4/runtimes/spark-mllib_2.3
 - Description:** No description provided
 - Associated asset:** MODEL MORTGAGE PREDICTION M...
 - Model ID:** 4809b65e-9cab-4870-b93c-7444...