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Hands-on Lab: Building an Application is as Simple as “ABC” in Cloud Pak for Data

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1. Introduction to the Demo Challenge:

TravelBid is an e-commerce startup providing discounted hotel rates and rental car reservations. TravelBid has a bulk of hotel and rental car vendors, from which they fulfill travel reservations for their clients.

The company is looking for a data & analytics platform that can help them easily implement an e-commerce system using different vendor databases, depending on the hotel or rental car reservation.

TravelBid needs an application interface that allows customers to name their price for hotel rooms and car rentals and returns a list of matches within their price range.

2. Prerequisites

- IBM Cloud Pak for Data instance is already installed and available
- Relational databases (such as Db2 and Mongo) already created and available
- Previously created business glossary and governance policies. Download it from: <https://drive.google.com/file/d/1oNQKyu7kDVP65ToPKmFqFRcPyNiSi4KS/view?usp=sharing>
- Previously created analytics project. Download it from: <https://drive.google.com/file/d/12z0VzLAWPT6JgePvfOsAcNUHpg9eQTTp/view?usp=sharing>

3. Access Credentials

To work through the lab, you need access a Db2 and Mortgage databases.

3.1. Access credential for Db2 database

You need JDBC connections to access to Db2 and MongoDB database, which hosted locally on Cloud Pak for Data.

Following is the JDBC connection credential for Db2:

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

JDBC connection credential for Mongo:

JDBC Host name	<Same IP address as your web console>
Port number	27017
Database name	icpd_mongo
User ID	mongodbuser
Password	password
Mongo	Version 4.0.12
JDBC connection string	jdbc:mongo://<same IP as Web Console>:27017/databaseName=icpd_mongo

3.2. Setting up the databases and sample tables

- Log in to the cluster where ICP for Data is deployed.
- From your home directory, clone the tutorial sample files:

```
git clone https://github.com/sanjitc/TravelBid.git
```
- Change to the tutorials directory:


```
cd TravelBid/tutorials
```
- Run the following command to load the sample data into a Db2 database:

```
./load_samples.sh -t db2-travel-001
```
- Run the following command to load the sample data into an Informix database:

```
./load_samples.sh -t mongo-travel-001
```
- After the data loading process completes, instance of Db2 and MongoDB are hosted on your cluster as a Docker container.

3.2. Sign in to 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.

<div><div>Sign in</div><div>Sign up</div></div> <div></div> <div><div>Username</div><div>admin</div></div> <div><div>PASSWORD</div><div>••••••••</div></div> <div><div>Sign In</div></div>	<p>Sign into the Cloud Pak for Data web console:</p> <p>username: admin password: password</p>
---	--


4. Collect

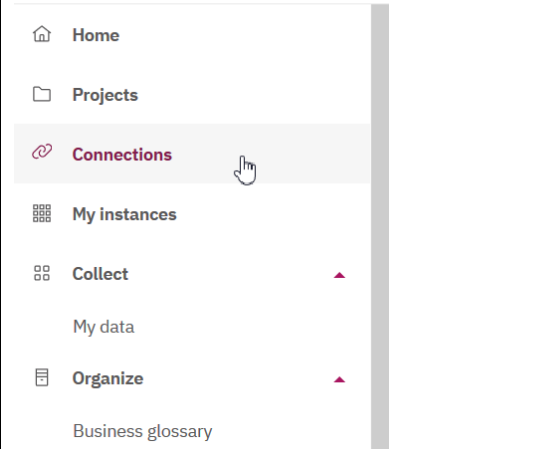
Cloud Pak for data allows you to collect data regardless of where it resides.

In this stage of the lab you'll use integrated connectors to connect to the travel's data sources. After you are connected, you can easily discover data and select the data that you need to analyze.

4.1. Connect to your data source

You will create a JDBC connection to the Db2 database where rental car related data is stored. Connecting to a database is relatively easy - you need only the JDBC link, the username, and password. You'll enter connection details, such as the name of the host where the Db2 database is located, and the credentials to access the database.

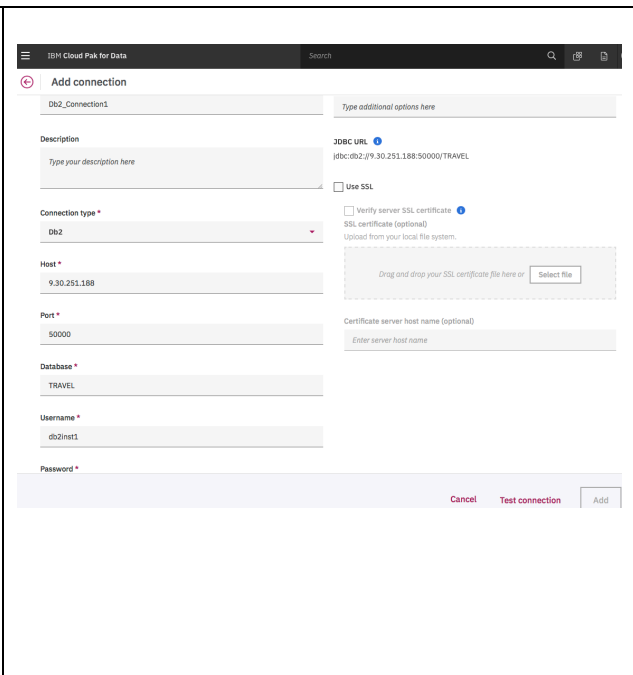
- On the left side navigation pane, click **Connections**.
- Use Next, on the **Data Connections** window, click the “Add connection” icon.




4.2. Add connection for Db2 Database

Fill out the **Add Connection** information according to the information provided in step 3.1 (pg7). Access credential for DB2. Credential used in following step is just an example.

- For **Choose connection** use the drop-down menu and select 'Db2'.
- Use Db2_Connection# as the **Name**.
(Replace # with a unique number)
- Host** is the IP of the master 1 node
- Port** is 50000
- Database** TRAVEL
- Username** is 'db2inst1' and **Password** is 'password'.
- Click on **Test Connection**, once it successful click on **Save**.



4.3. Add connection for Mongo Database

Create a JDBC connection to the MongoDB database where hotel-related data is stored. You need only the JDBC link, the username, and password to connect to a MongoDB database.

Fill out the **Add Connection** information according to the information provided in step 3.1 (pg7). Access credential for MongoDB. Credential used in following step is just an example.

- For **Choose connection** use the drop-down menu and select 'Mongo.
- Use 'Mongo_Local#' as the **Name**
- **Host** is the IP of the master 1 node
- **Port** is 27017
- **Database** icpd_mongo
- **Username** is 'mongodbus' and **Password** is 'password'.

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

Replace # with a unique number

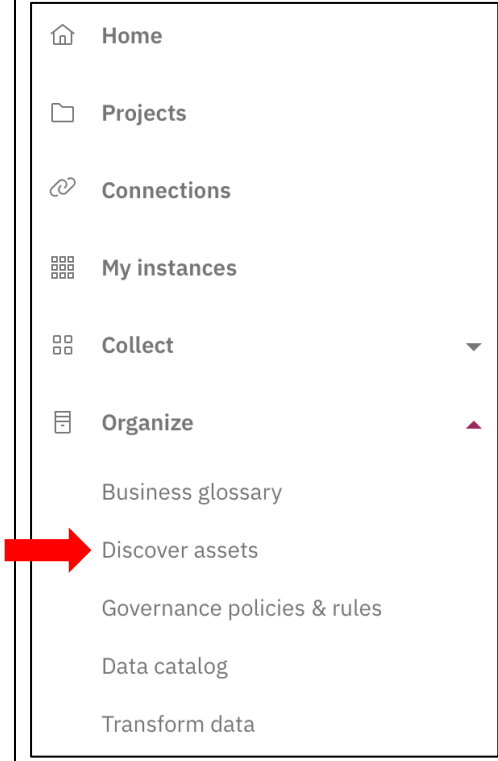
The screenshot shows a web form titled 'Mongo-Connection1' with a subtitle 'Type additional options here'. The form contains several fields: 'Description' (placeholder: 'Type your description here'), 'JDBC URL' (value: 'jdbc:ibm.mongodb://169.62.109.12:27017;databaseName=icpd_mongo'), 'Use SSL' (checkbox, unchecked), 'Verify server SSL certificate' (checkbox, unchecked), 'SSL certificate (optional)' (text input), 'Upload from your local file system' (button: 'Select file'), 'Host' (value: '169.62.109.12'), 'Port' (value: '27017'), 'Certificate server host name (optional)' (text input, placeholder: 'Enter server host name'), 'Database' (value: 'icpd_mongo'), 'Username' (value: 'mongodbus'), and 'Password' (text input). At the bottom right, there are three buttons: 'Cancel', 'Test connection', and 'Save'.

5. Discover Assets

The discover assets enables you to catalog data from sources to make it easier to search for, govern, and analyze. Use the data source created above to discover all data assets from Db2 and MongoDB databases.

5.1. Navigate through discover Db2 assets

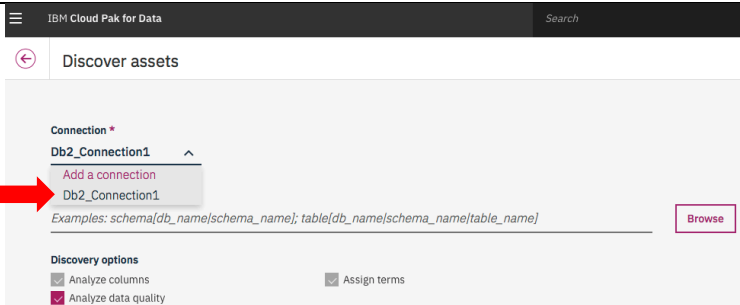
From **Organize** option on the left pane, choose **Discover assets**



- Home
- Projects
- Connections
- My instances
- Collect
- Organize
 - Business glossary
 - Discover assets
 - Governance policies & rules
 - Data catalog
 - Transform data

To discover assets:

1. Add a connection
2. Choose the connection named **Db2_Connection#** that you created previously, click **Next**



IBM Cloud Pak for Data

Discover assets

Connection *

Db2_Connection1

Add a connection

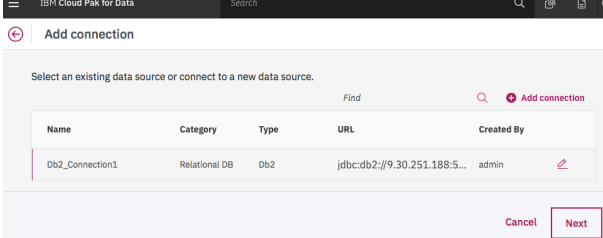
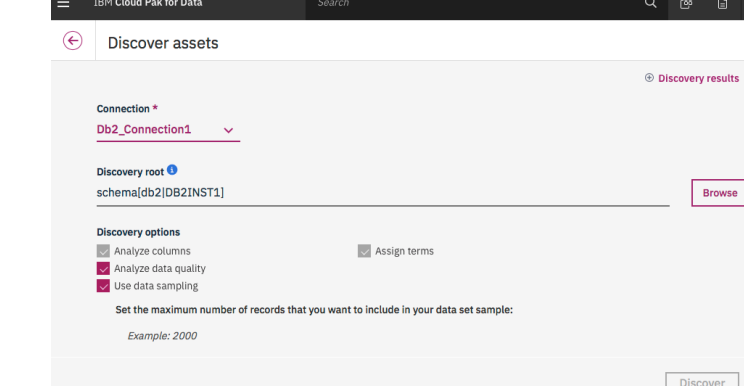
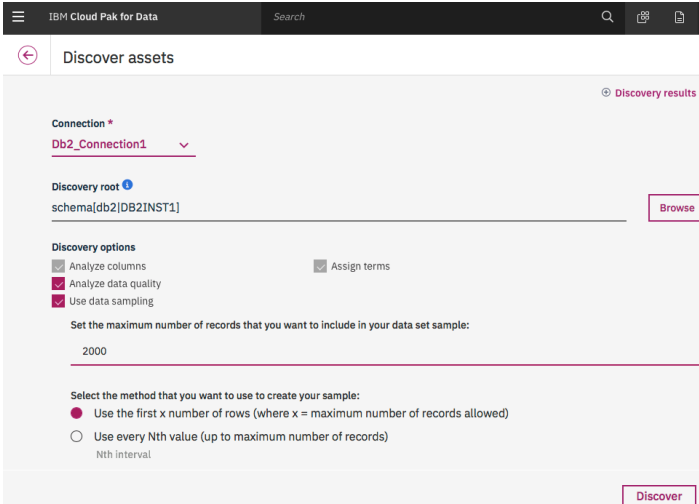
Db2_Connection1

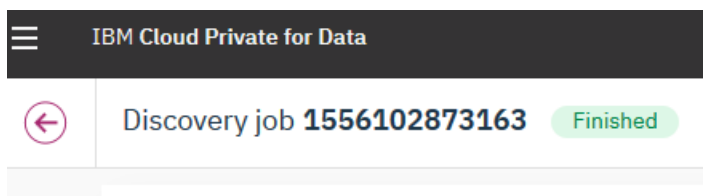
Examples: schema[db_name/schema_name]; table[db_name/schema_name/table_name]

Browse

Discovery options

- Analyze columns
- Analyze data quality
- Assign terms

<p>3. Add the Db2_Connection# connection</p> <p>Replace # with a unique number</p>	
<p>4. Click on Browse and select 'DB2INT1' schema for discover assets</p>	
<p>5. Check all Discovery options.</p> <p>6. Set sample dataset as 2000.</p> <p>7. Click on Discover</p> <p>It may take few minutes to complete. Click refresh to get latest status of the discovery job. Wait till discovery job is finished.</p> <p>**Don't forget to document your feedback at https://pollev.com/turtles**</p>	



5.2. Navigate through discover MongoDB assets

As you discovered Db2 assets in above step, you can also discover assets from MongoDB. Choose the connection named **Mongo_Connection#** (Replace # with a unique number) that you created earlier. For discover roots select **ICPD_MONGO** as the schema.

Discover assets

⊕ Discovery results

Connection *

Mongo-Connection1 ▾

Discovery root ⓘ

schema[ibm|ICPD_MONGO]

Browse

Discovery options

- ☒ Analyze columns ☒ Assign terms
- ☒ Analyze data quality
- ☒ Use data sampling

Set the maximum number of records that you want to include in your data set sample:

2000

Select the method that you want to use to create your sample:

- ☒ Use the first x number of rows (where x = maximum number of records allowed)
- ☐ Use every Nth value (up to maximum number of records)

Nth interval

Example: 1000

- ☐ Use a random sampling

Seed

Percentage

Example: 1234

Example: 10

Discover

6. Data Dictionary

Context: A data dictionary contains a business glossary with terms and categories, and information governance policies and rules to ensure data compliance with business objectives. The business glossary is a catalog of assets that defines the character of an enterprise to form a logical structure of your data. Information governance is a quality control discipline for managing, using, improving, and protecting organizational information.

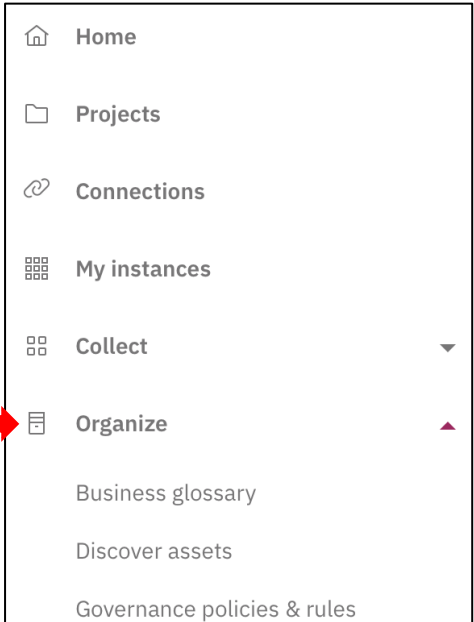
In Cloud Pak for Data you can manually create terms and categories, information governance policies and rules. You can also import glossaries with existing terms, categories, information governance policies and rules. In this lab we will import business glossary and information governance assets related to the travel application.

6.1. Download Glossary

Use the web browser to download the XML file previously created, that contains all business glossary and information governance assets.

- Go to <https://drive.google.com/file/d/1oNQKyU7kDVP65ToPKmFqFRcPyNiSi4KS/view?usp=sharing>
- Click on the **Download** button.

6.2. Import Glossary

<p>1. Go to Organize, and select either Business glossary, or Governance policies & rules.</p> <p>2. Depending on what view you opened, click one of the following buttons:</p> <ul style="list-style-type: none">○ Import Categories○ Import Terms○ Import Rules○ Import Policies <p>The same Import Assets wizard opens, regardless of which button you click.</p>	 <ul style="list-style-type: none">HomeProjectsConnectionsMy instancesCollectOrganizeBusiness glossaryDiscover assetsGovernance policies & rules
---	---

<ul style="list-style-type: none"> • Select the XML file type • Click Next 	<div> <div>Import glossary assets</div> <div> <div>Import glossary assets</div> <div>Import glossary assets such as terms, rules and policies.</div> </div> <div> <div> <div>Select file type</div> <div>Set import options</div> <div>Select file</div> <div>Import summary</div> </div> <div> <div>Select a file type for import</div> <div> <div>Select one of the file types</div> <div> <input type="radio"/> CSV <input checked="" type="radio"/> XML </div> </div> </div> <div> <div>Back</div> <div>Next</div> </div> </div> </div>
<ul style="list-style-type: none"> • Choose Ignore the imported asset and keep the existing asset method to resolve conflict • Click Next 	<div> <div>Import glossary assets</div> <div> <div>Import glossary assets</div> <div>Import glossary assets such as terms, rules and policies.</div> </div> <div> <div> <div>Select file type</div> <div>Set import options</div> <div>Select file</div> <div>Import summary</div> </div> <div> <div>Select import options</div> <div> <div>Choose a method to resolve conflicts during the import</div> <div> <input checked="" type="radio"/> Ignore the imported asset and keep the existing asset <input type="radio"/> Overwrite the existing asset with the imported asset <input type="radio"/> Merge the imported asset with the existing asset, and ignore any imported attributes that cannot be merged </div> </div> </div> <div> <div>Back</div> <div>Next</div> </div> </div> </div>
<ul style="list-style-type: none"> • Browse the XML file to import that you download previously • Click Import • Once import complete, it shows import summary of glossary assets 	<div> <div>Import glossary assets</div> <div> <div>Import glossary assets</div> <div>Import glossary assets such as terms, rules and policies.</div> </div> <div> <div> <div>Select file type</div> <div>Set import options</div> <div>Select file</div> <div>Import summary</div> </div> <div> <div>Select file</div> <div> <div>Select the file that you want to import</div> <div>Browse</div> </div> </div> </div> <div> <div>Back</div> <div>Import</div> </div> </div>

7. Analytics Project


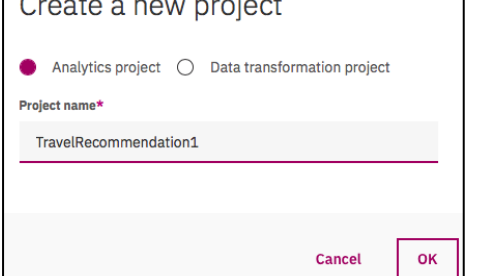
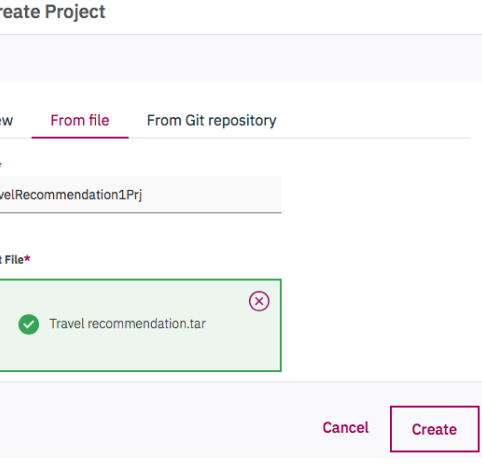
Context: an analytics project is a collection of assets you use to achieve a particular analysis goal. These project assets can include: notebooks, RStudio files, models, data assets, scripts etc. With CPD, you can collaborate with other team members on analytic projects to create machine learning models and visualizations with data from your enterprise. This lab uses preconfigured RStudio scripts that you can use to build a Shiny application.

7.1. Download Analytic Project files

Use the web browser to download the ZGIP file which contains a previously created analytic project file with notebooks and RStudio files.

- Go to <https://drive.google.com/file/d/12z0VzLAWPT6JgePvfOsAcNUHpg9eQTTp/view?usp=sharing>
- Click on the **Download** button

7.2. Create An Analytics Project

<p>Click on “Folder icon” for Projects on left pane and select New project</p>	
<ul style="list-style-type: none">• Select Analytics project• Type TravelRecommendation#Prj for project name and click OK• Replace # with a unique number	
<ul style="list-style-type: none">• Select create project From file• Browse the analytic project zip file to import that you download earlier.• Click Create• (It may take few minutes) <p>**Some go wrong? Something not make sense? Something you like? Document your feedback at https://pollev.com/turtles**</p>	

8. 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 two data sources: Db2 and MongoDB. Creating connections to your data sources enables you to quickly view data from across your organization.

8.1. 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 two data sources, one for Db2 and other one for MongoDB.

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-Connection#** that you created earlier and click **Next**

8.2. Adding a new data source for MongoDB

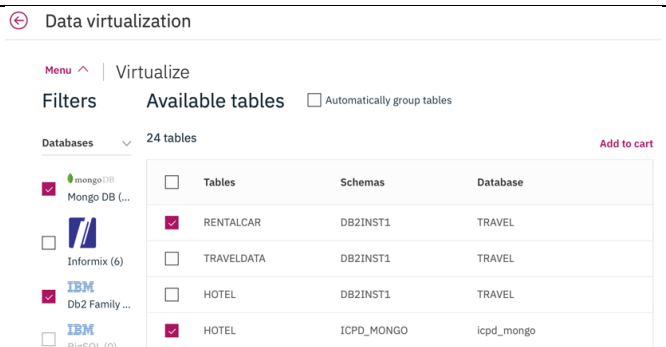
Similar as Db2, define a data connection to MongoDB. Use your existing MongoDB database connection for MongoDB data source.

4. Go to **Collect > Virtualized data > Menu > Data sources**
5. Click **Add > New data source > Add connection**
6. Select **Mongo-Connection#** that you created earlier and click **Next**

8.3. 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 **RENTALCAR** from **TRAVEL** database and **HOTEL** from **ICPD_MONGO** database, then click **Add to cart**
- Click **View cart**
- Click **Next**



- Select **Neither**
- Uncheck the box for **Submit to catalog**
- Click **Virtualize** to complete the process

Review cart and virtualize tables

☐ Submit to catalog | Cancel Virtualize

Assign to (all tables will be assigned to the same project or data request)

☐ Data request ⓘ
 ☐ Project ⓘ
 ☒ Neither

Table name	Schema	Source schema	Hosts	Source	Grouped tables
RENTALCAR	USER999 ×	DB2INST1	169.62.109.12	TRAVEL	1
HOTEL	USER999 ×	ICPD_MONGO	169.62.109.12	icpd_mongo	1

8.4. 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.

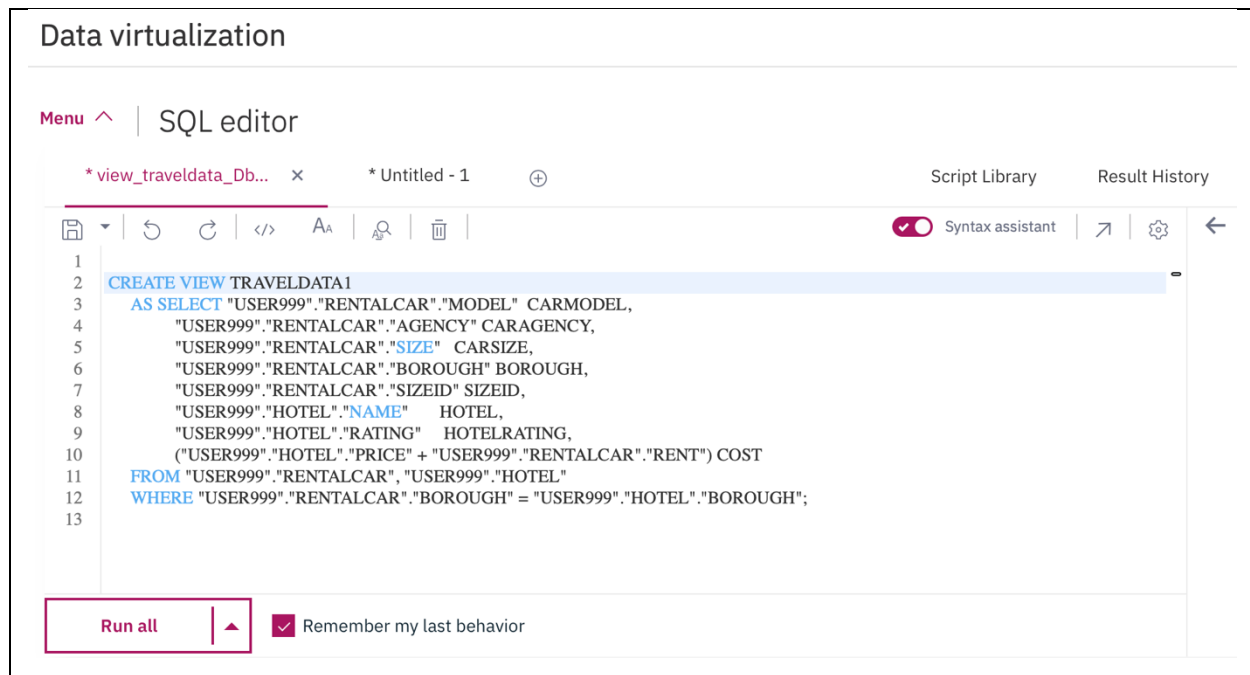
- Click **Collect > Virtualized data > Menu > SQL editor** to access the editor.
- Copy the following SQL statement and paste it on the editor
- **Replace # with a unique number** for TRAVELDATA# (on the 1st line)
- Click on **Run all**

(If you are login as a different user than admin, you need to change the schema according in the SQL.)

```

CREATE VIEW TRAVELDATA#
AS SELECT "USER999"."RENTALCAR"."MODEL"  CARMODEL,
        "USER999"."RENTALCAR"."AGENCY"  CARAGENCY,
        "USER999"."RENTALCAR"."SIZE"    CARSIZE,
        "USER999"."RENTALCAR"."BOROUGH" BOROUGH,
        "USER999"."RENTALCAR"."SIZEID"  SIZEID,
        "USER999"."HOTEL"."NAME"         HOTEL,
        "USER999"."HOTEL"."RATING"       HOTELRATING,
        ("USER999"."HOTEL"."PRICE" + "USER999"."RENTALCAR"."RENT") COST
FROM "USER999"."RENTALCAR", "USER999"."HOTEL"
WHERE "USER999"."RENTALCAR"."BOROUGH" = "USER999"."HOTEL"."BOROUGH";

```



8.5. 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
- Chose **Submit to catalog** from table action
- Click on **Confirm**

Data virtualization

Menu ^ | My data

Find Assign Join view Add table or file

Table	Schema	Created on	
<input type="checkbox"/> TRAVELDATA	USER999	Oct 9, 2019 2:02:49 PM	
<input checked="" type="checkbox"/> TRAVELDATA1	USER999	Oct 9, 2019 1:37:19 PM	...



8.6. 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.TRAVELDATA1	view	-	admin	9 October 2019, 12:07PM	Pending
> USER999.1HOTEL USER999.1RENTALCAR	table	-	admin	9 October 2019, 11:52AM	Pending
> USER999.Hotels3_csv	table	-	admin	27 September 2019, 2:37PM	Pending





- Click on  access the **Home** page
- Click on **Pending Publish to Catalog Requests**
- Click on  icon on left for virtual table **TRAVELDATA#** that you created
- Click on **Approve**

8.7. Access information for virtual table

To access virtual table from external application, you need the JDBC connection information. Click on **Collect > Virtualized data > Menu > Service details** to find out access information. You will use this information later in the RStudio.

Virtualized data
Virtualize
SQL editor
Data sources
Manage users
Connection details
About

Access information

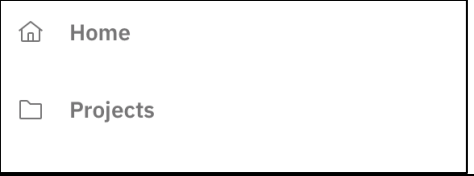
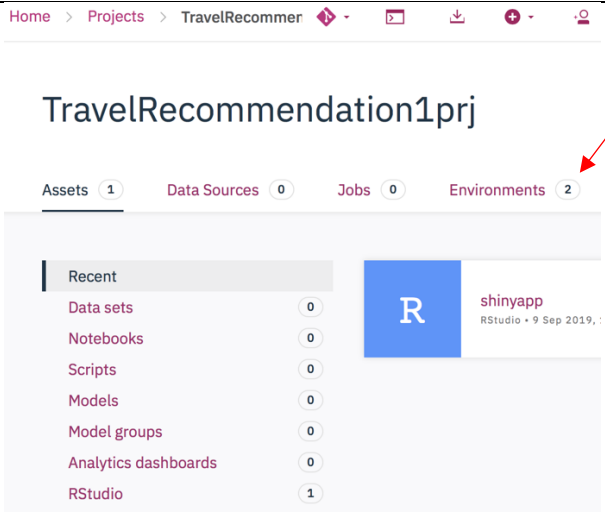

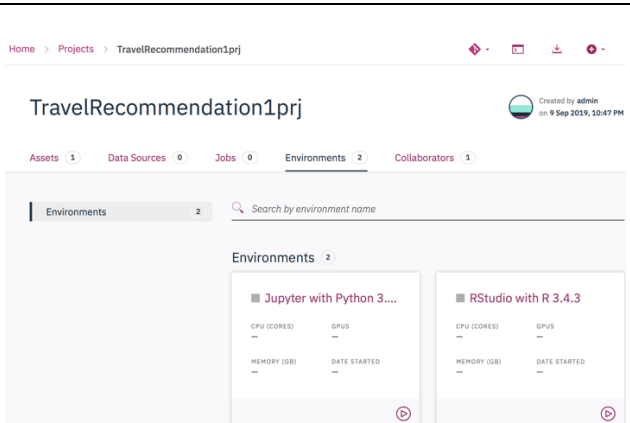
Username	user999	
Password	myS-u#C-5#TE419e	 
JDBC connection URL	jdbc:db2://dv-server.zen.svc.cluster...	

9. RStudio

Context: R is a popular statistical analysis and machine-learning package that enables data management and includes tests, models, analyses, and graphics, and enables data management. RStudio provides an IDE for working with R. This feature is available only if your administrator configures the RStudio Server add-on. For this lab RStudio Server add-on is already installed.

9.1. Enable RStudio Environment

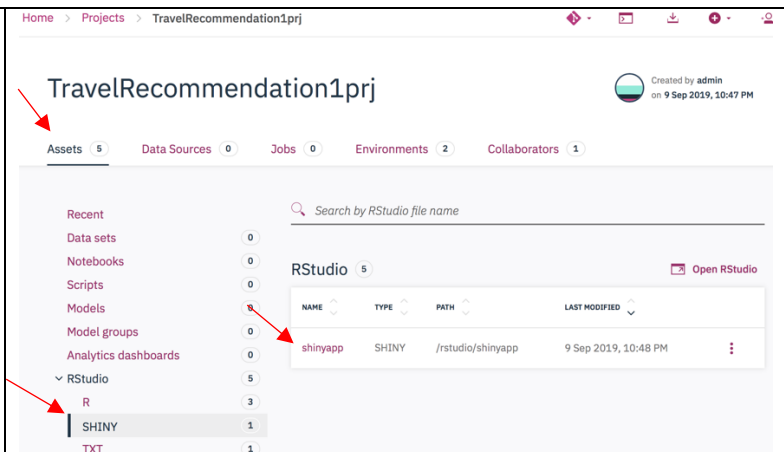
By default, CPD includes Jupyter Notebook Server with Python 3.6. As you need other development environment you can optionally install and enable other development environments. In this lab you need enable the RStudio Server for your analytic project.

<ul style="list-style-type: none">Click on “Folder icon” for Projects on left pane and select your existing TravelRecommendation#Prj project (Replace # with a unique number)	
<ul style="list-style-type: none">Once inside your project, select Environments tab	
<ul style="list-style-type: none">If the RStudio is not already started, used the  icon on the RStudio with R 3.4.x environment tile to start the environment.	

9.2. Access RStudio Assets

Once RStudio environment started, you can have access to all RStudio assets associated to the analytic project. There are some R scripts and previously build Shiny package added to the project. You will use the Shiny package called **shinyapp** in this lab.

- Click on **Assets**
- Expand asserts under **RStudio**
- Click on **SHINY** to list the Shiny packages
- Click on **shinyapp** package to open it in RStudio



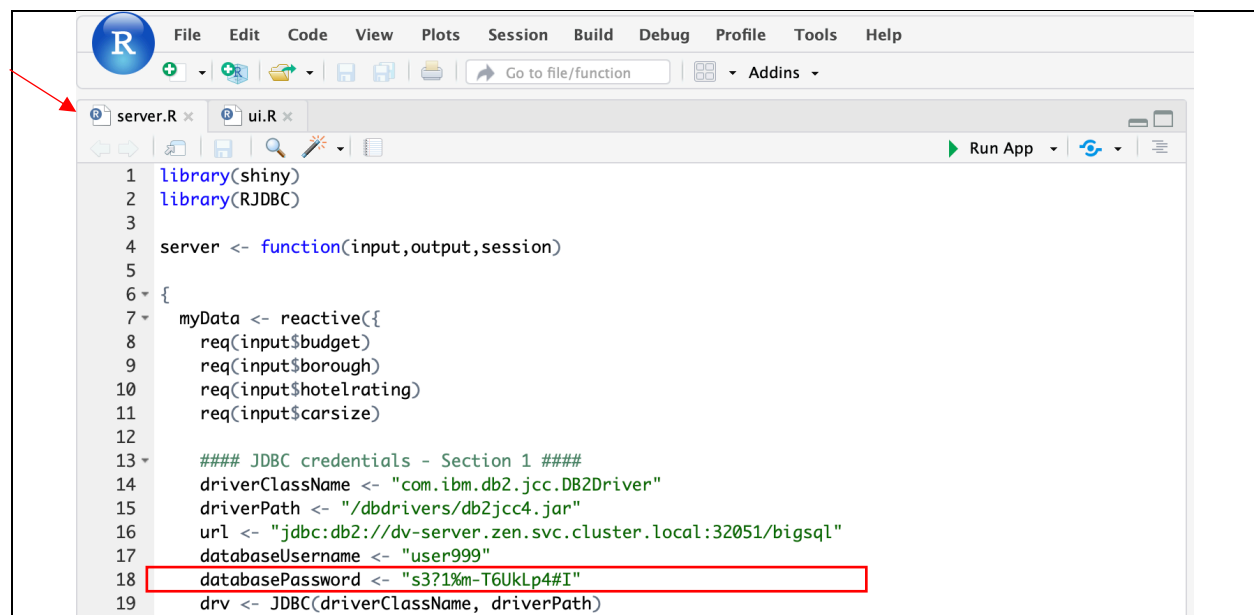
9.3. Shinyapp Package

The shinyapp opened in RStudio IDE. App consists of two R scripts. The **ui.R** use for the frontend application and **server.R** connect use for connecting to database and retrieve the dataset.

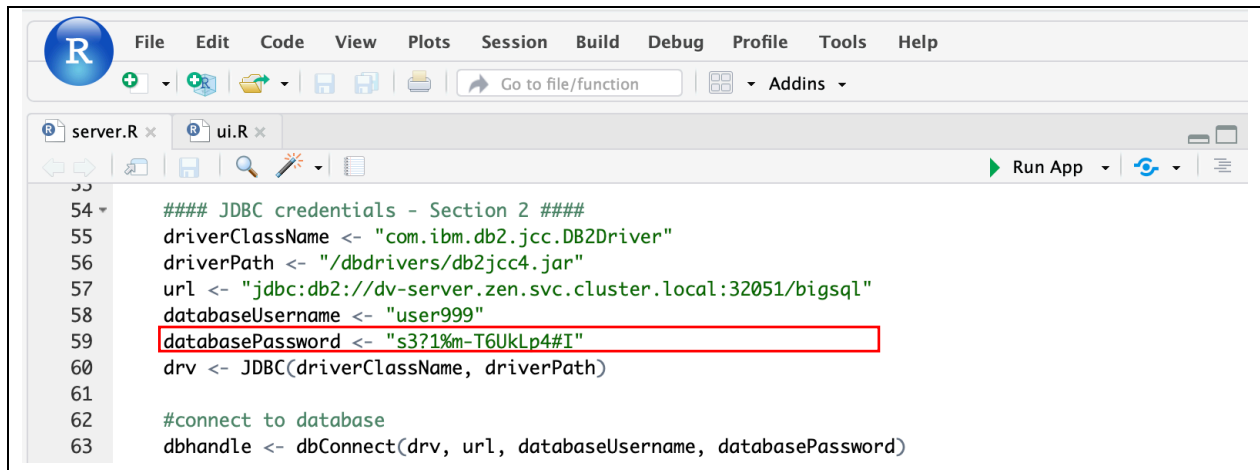
Click on the **server.R** tab to access the associated R code. You need to change the **databasePassword** value with your cluster password. Review step 8.7 to find out the cluster password.

9.4 Update cluster password in Shinyapp

There are two places in the Server.R file where you need to replace this **databasePassword** value.



```
1 library(shiny)
2 library(RJDBC)
3
4 server <- function(input,output,session)
5
6 {
7   myData <- reactive({
8     req(input$budget)
9     req(input$borough)
10    req(input$hotelrating)
11    req(input$carsize)
12
13    #### JDBC credentials - Section 1 ####
14    driverClassName <- "com.ibm.db2.jcc.DB2Driver"
15    driverPath <- "/dbdrivers/db2jcc4.jar"
16    url <- "jdbc:db2://dv-server.zen.svc.cluster.local:32051/bigsql"
17    databaseUsername <- "user999"
18    databasePassword <- "s371%T6UkLp4#I"
19    drv <- JDBC(driverClassName, driverPath)
```



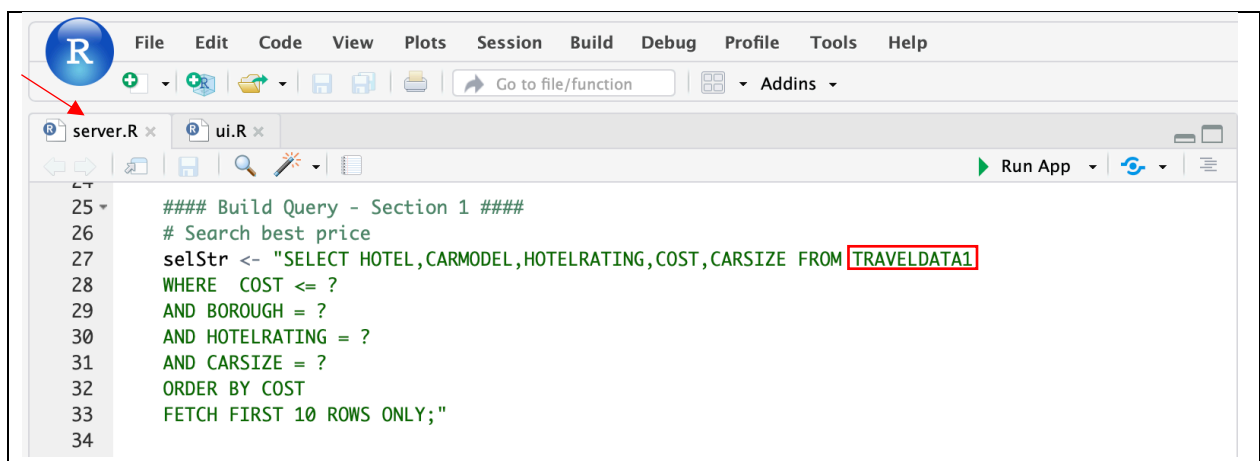
The screenshot shows the RStudio interface with the 'server.R' file open. The code defines JDBC credentials for a DB2 database. The 'databasePassword' line is highlighted with a red box.

```
54 ##### JDBC credentials - Section 2 #####
55 driverClassName <- "com.ibm.db2.jcc.DB2Driver"
56 driverPath <- "/dbdrivers/db2jcc4.jar"
57 url <- "jdbc:db2://dv-server.zen.svc.cluster.local:32051/bigsql"
58 databaseUsername <- "user999"
59 databasePassword <- "s3?1%m-T6UkLp4#I"
60 drv <- JDBC(driverClassName, driverPath)
61
62 #connect to database
63 dbhandle <- dbConnect(drv, url, databaseUsername, databasePassword)
```

Save the server.R file.

9.4. Update virtual table name in Shinyapp

There are two queries in the Server.R file. In these two queries you need to update the virtual table name that you crated in DV.



The screenshot shows the RStudio interface with the 'server.R' file open. The code defines a SQL query. The 'TRAVELDATA1' table name in the query is highlighted with a red box. A red arrow points to the R logo in the top left corner of the RStudio window.

```
25 ##### Build Query - Section 1 #####
26 # Search best price
27 selStr <- "SELECT HOTEL,CARMODEL,HOTELRATING,COST,CARSIZE FROM TRAVELDATA1
28 WHERE COST <= ?
29 AND BOROUGH = ?
30 AND HOTELRATING = ?
31 AND CARSIZE = ?
32 ORDER BY COST
33 FETCH FIRST 10 ROWS ONLY;"
34
```

```

65 ##### Build Query - Section 2 #####
66 # Display best experience
67 selStr1 <- "SELECT HOTEL,CARMODEL,HOTELRATING,COST,CARSIZE
68 FROM USER999.TRAVELDATA1
69 WHERE COST <= ?
70 AND BOROUGH = ?
71 AND HOTELRATING > ?
72 AND SIZEID IN (
73   SELECT USER999.RENTALCAR.SIZEID
74   FROM USER999.RENTALCAR
75   WHERE USER999.RENTALCAR.SIZEID NOT IN (
76     SELECT UNIQUE USER999.RENTALCAR.SIZEID
77     FROM USER999.RENTALCAR
78     WHERE USER999.RENTALCAR.SIZE = ?
79     ORDER BY USER999.RENTALCAR.SIZEID DESC
80   )
81 )
82 ORDER BY COST DESC,SIZEID DESC
83 FETCH FIRST 10 ROWS ONLY;"

```

Save the server.R file.

9.5. Test the Shinyapp



The shinyapp will open the Travel Recommendation application in a new window. The left pane collects input from the user. Depending on the input, the right pane displays suggested hotel and car information.

The user can provide their daily budget for hotel and rental cars. The application also collects information about the place they want to stay, preferred hotel rating and car type.

- Provide a **Price Range** using slider
- Choose **Borough** where you want to stay in New York
- Choose desired **Hotel Rating** from drop down menu
- Similarly select a **Car Type**
- Click **Submit**

Travel Recommendation

Budget

Price Range (\$)

100 318 1,000

Hotels and Rental Cars

Borough

Queens

Hotel Rating

3

Car Type

Economy

Submit

Depending on the input, the application will generate a list of cheapest possible hotel and car combination under Best Price. The Best Experience section show highest comfort hotel and car combination.

Travel Recommendation

Budget

Price Range (\$)

100 318 1,000

Hotels and Rental Cars

Borough

Queens

Hotel Rating

3

Car Type

Economy

Submit

Best Price

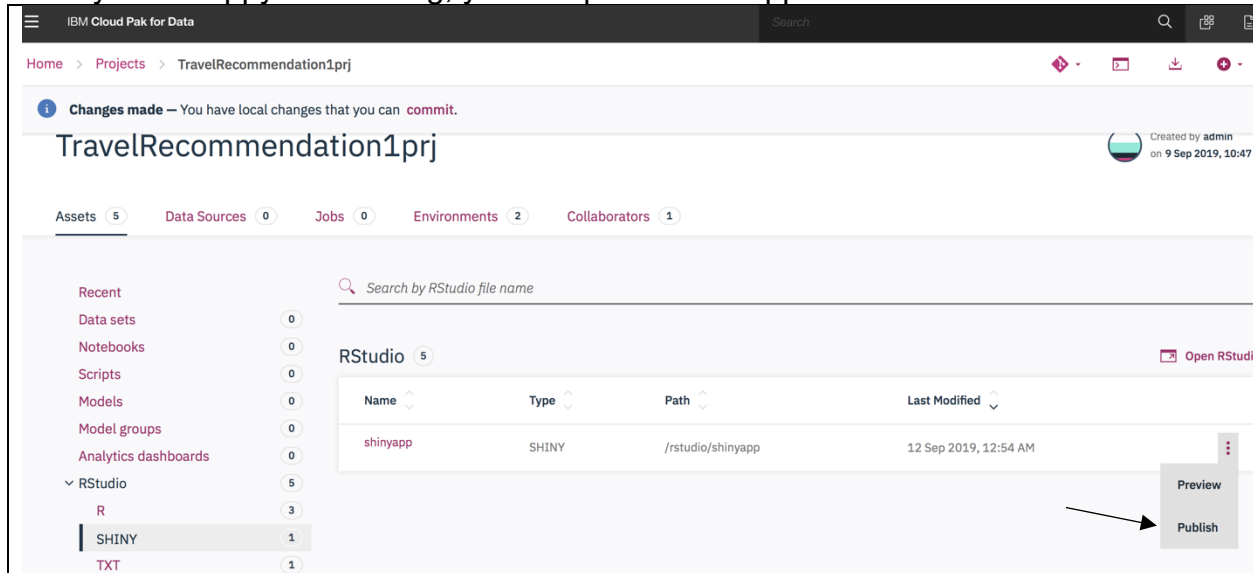
HOTEL	CARMODEL	HOTELRATING	COST	CARSIZE
Flushing Ymca	Chevrolet Aveo	3.00	115.00	Economy
Flushing Ymca	Chevrolet Aveo	3.00	119.00	Economy
Flushing Ymca	Hyundai Accent	3.00	129.00	Economy
Flushing Ymca	Hyundai Accent	3.00	129.00	Economy
Flushing Ymca	Chevrolet Spark	3.00	137.00	Economy
Lexington Inn Queens	Chevrolet Aveo	3.00	146.00	Economy
Lexington Inn Queens	Chevrolet Aveo	3.00	150.00	Economy
Kamway Lodge	Chevrolet Aveo	3.00	153.00	Economy
Kamway Lodge	Chevrolet Aveo	3.00	157.00	Economy
Lexington Inn Queens	Hyundai Accent	3.00	160.00	Economy

Best Experience

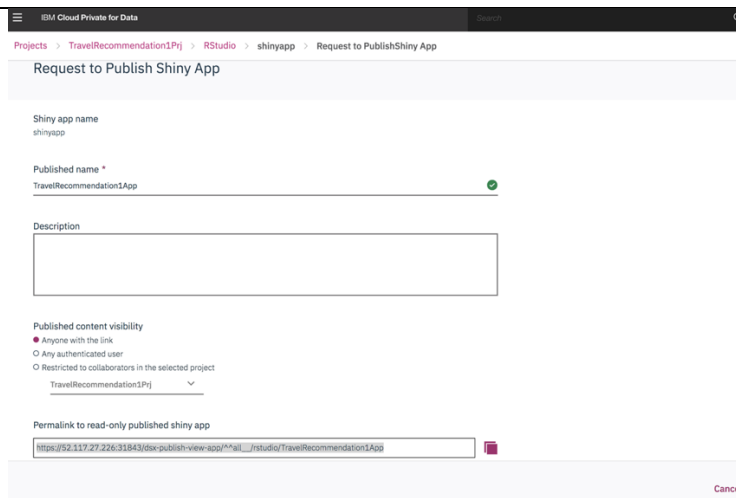
HOTEL	CARMODEL	HOTELRATING	COST	CARSIZE
Hilton Brooklyn Queens	Buick LaCrosse	4.00	318.00	Luxury
Courtyard by Marriott Brooklyn Queens	Toyota Avalon	4.00	318.00	Premium
Hilton Brooklyn Queens	Chevy Tahoe	4.00	318.00	Fullsize SUV
Sleep Inn	Ford Fusion	4.00	317.00	Fullsize
Quality Inn	Ford Fusion	4.00	317.00	Fullsize
Fairfield Inn & Suites Brooklyn Queens/Queensboro Bridge	Chevy Tahoe	4.00	317.00	Fullsize SUV
Hampton Inn Brooklyn - LaGuardia Airport	Dodge Grand Caravan	4.00	317.00	Minivan
Aloft Brooklyn LaGuardia Airport	Hyundai Santa Fe	4.00	317.00	Standard SUV
Holiday Inn - Queens City - Manhattan View	Chevrolet Equinox	4.00	317.00	Standard SUV

9.6. Externalize the application

Once you're happy with testing, you can publish the application.



- Give a unique published name, e.g., TravelRecommendation1prj. System will automatically generate a permalink.
- Click on **Publish**.



Cloud Pak for Data has a built-in web server under Watson Studio. Once the application is ready, you can deploy it on the platform and anyone with the published web link can easily access it on the internet. Access to this app can be governed and managed in CPD.

https://52.117.27.226:31843/dsx-publish-view-app/^^all__/_rstudio/TravelRecommendation1App