ORACLE

Oracle Application Express (APEX) Integrate OracleML and IOT via Rest

Demo/Workshop

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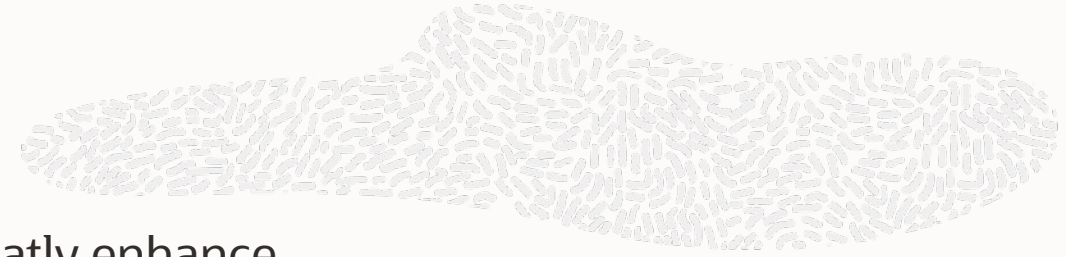
Workshop Goals



- Explore why using Oracle Application Express can greatly enhance your organization's digital journey
- Get started with Oracle Application Express in the cloud on Autonomous Database
- Integrate Oracle Machine Learning models in decision making by applying predictions to data in a visual way
- Integrate IOT sensor data with Oracle Application Express and REST

Oracle Application Express (APEX)

"Oracle Application Express (APEX) is a low-code development platform that enables you to build scalable, secure enterprise apps, with world-class features, that can be deployed anywhere"

Build enterprise apps 20x faster with 100x less code

Low-code & fast development

- Speed up development by coding only what matters
- Comprehensive set of UI components for data entry, advanced reporting, charts and graphs
- Gentle learning curve with low-code
- Built-in session debugging, data modeling and SQL development features

Enterprise features

- Secure out of the box with modern access control methods, server-side session management and tampering protection
- Aggregate data from everywhere with built-in web service support and security
- Globalization features and translations and region based formatting

Modern look and feel

- Responsive UI with Apex Universal theme for a great experience across all devices
- Easy customization with one click theme roller, built-in CSS styles and icon library
- Pixel perfect apps with CSS overwrites, component templates options and multiple page layouts

Simplify maintenance and access to great features in the cloud

Apex on Autonomous Database

- Simplified deployment with the ADB, APEX and ORDS bundle
- Reduce maintenance overhead with automatic patching and updates
- On-demand scaling capabilities for peak workloads
- Easy access to great Oracle cloud features like Oracle Machine Learning

Great community and support

- No license: free to learn and use with your Oracle DB
- Leverage the knowledge of an enthusiastic developer community. Take advantage of community plugins and extensions
- Oracle Support and specialists available anytime
- Find out more on apex.oracle.com, apex.world and #orclapex on twitter

Use it everywhere

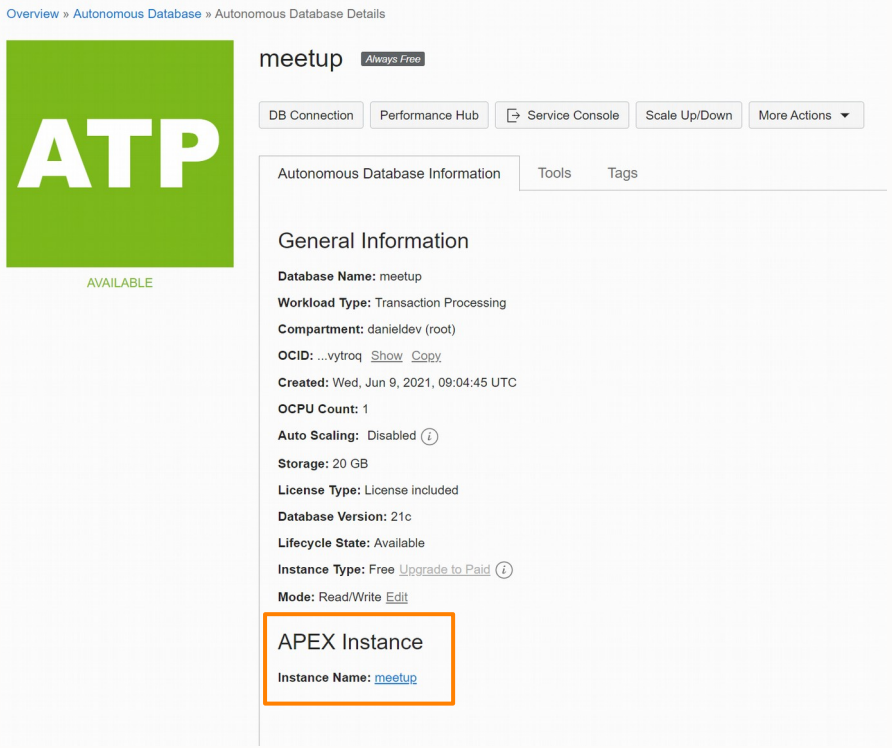
- Replace excel today with quick low-code APEX
- Replace old forms solutions with modern APEX ones
- Rapid development for proof of concepts and idea exploration
- Develop complete solutions to handle all your business needs

Let’s get started with APEX in the cloud

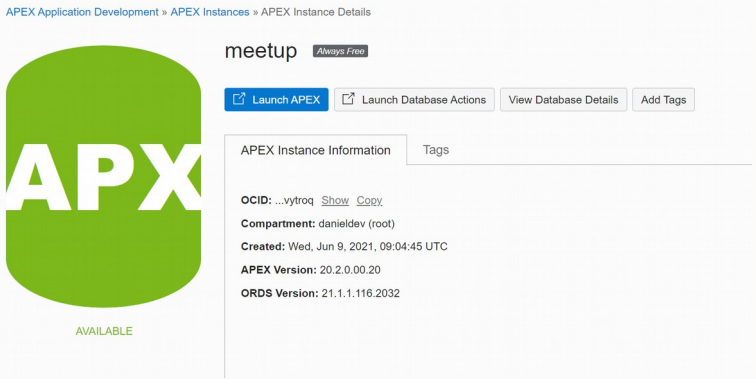
Set-up Apex on your autonomous database

Get started with APEX on Autonomous Database

- Log in to your autonomous Database and click on the **Instance Name** under “APEX Instance”

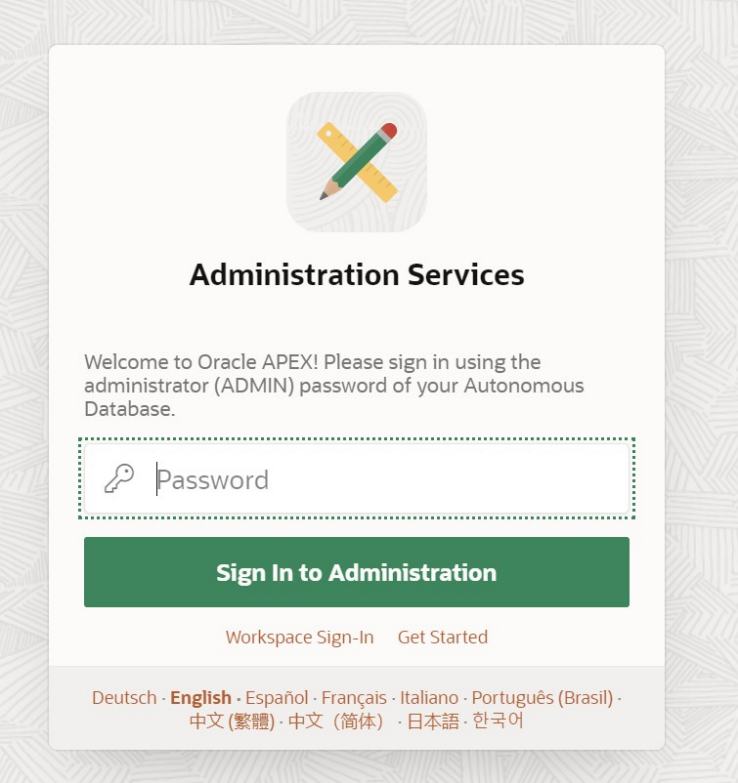


- In the Apex Instance Details, click Launch APEX.

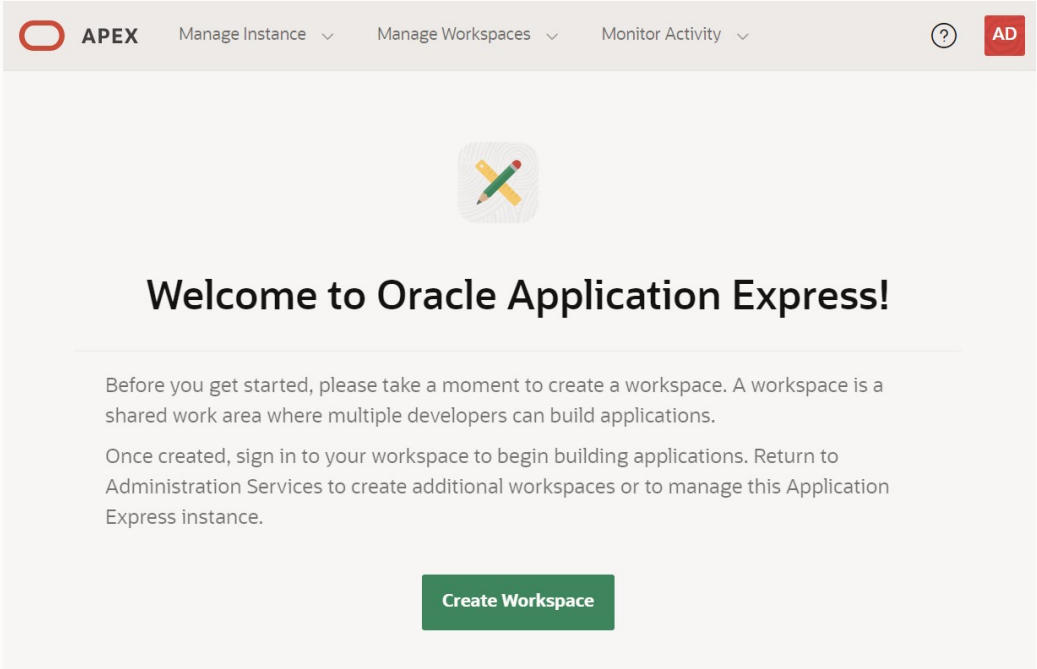


Get started with APEX on Autonomous Database

- Log in to the Apex administration workspace with your database “Admin” user password

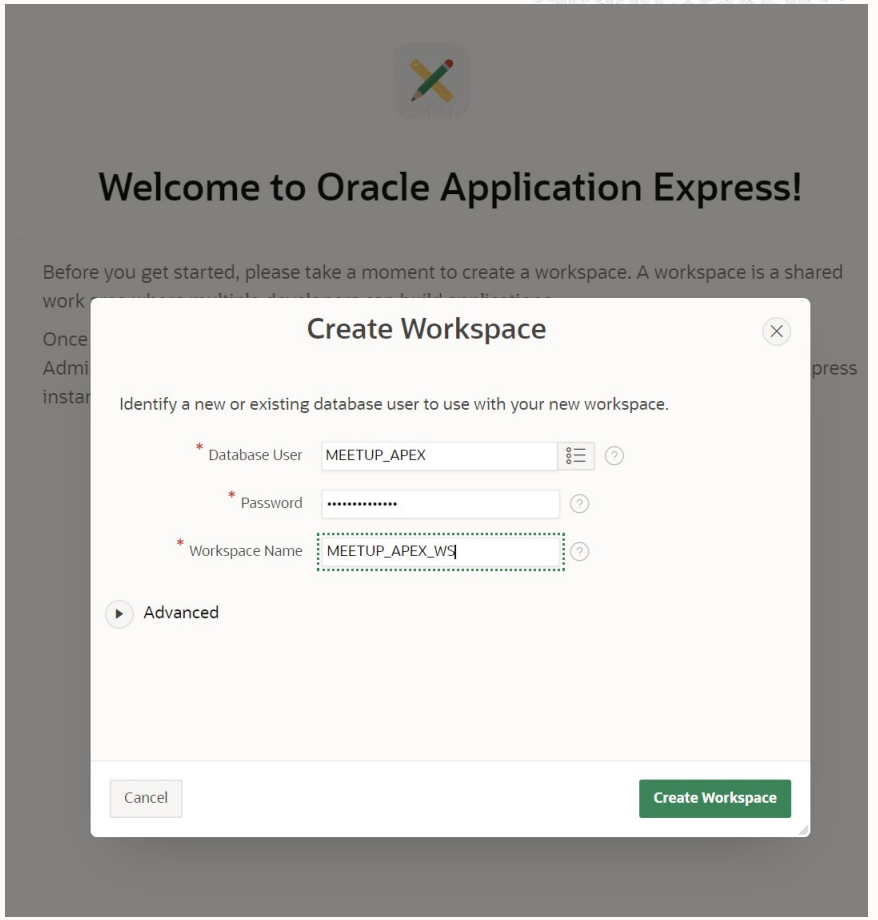


- Create your first workspace



Get started with APEX on Autonomous Database

- Fill in your new workspace details
- Name your database user **MEETUP_APEX** this is important for the next steps.
- Name your workspace **MEETUP_APEX_WS**
- Apex will create a new database user/schema with this username and password.
- Applications from the APEX workspace MEETUP_APEX_WS will have access to procedures and data saved in the“MEETUP_APEX” database schema
- Log-out from the top-right, red and white AD letters menu drop-down.

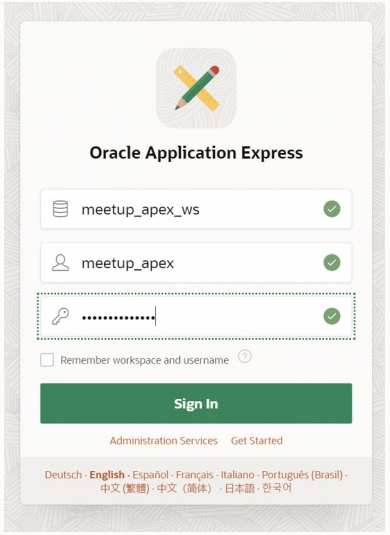


Integrate Oracle Machine Learning models in business decision making

Continue your journey with OML from lab 2

Integrate Oracle Machine Learning with APEX

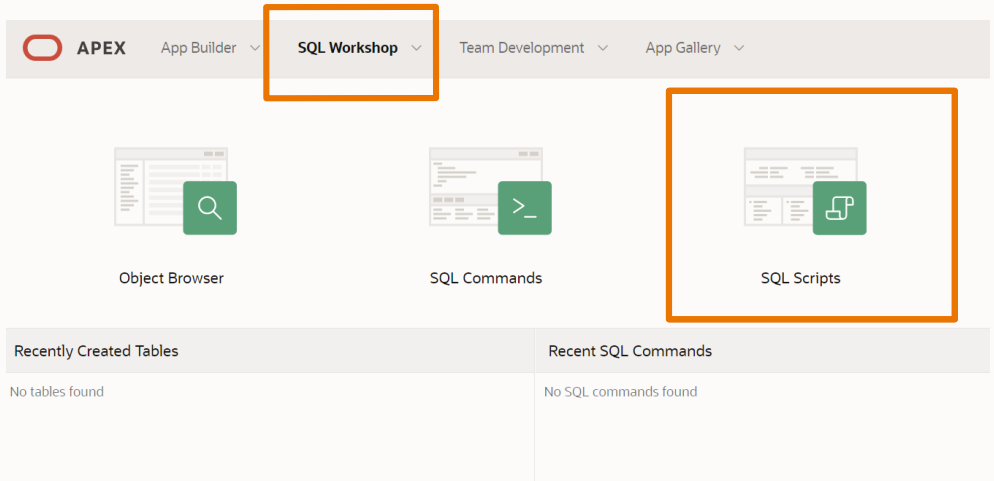
- Let's set up supporting objects and our sample apex application
- Log in to **MEETUP_APEX_WS** workspace with **MEETUP_APEX** user and password



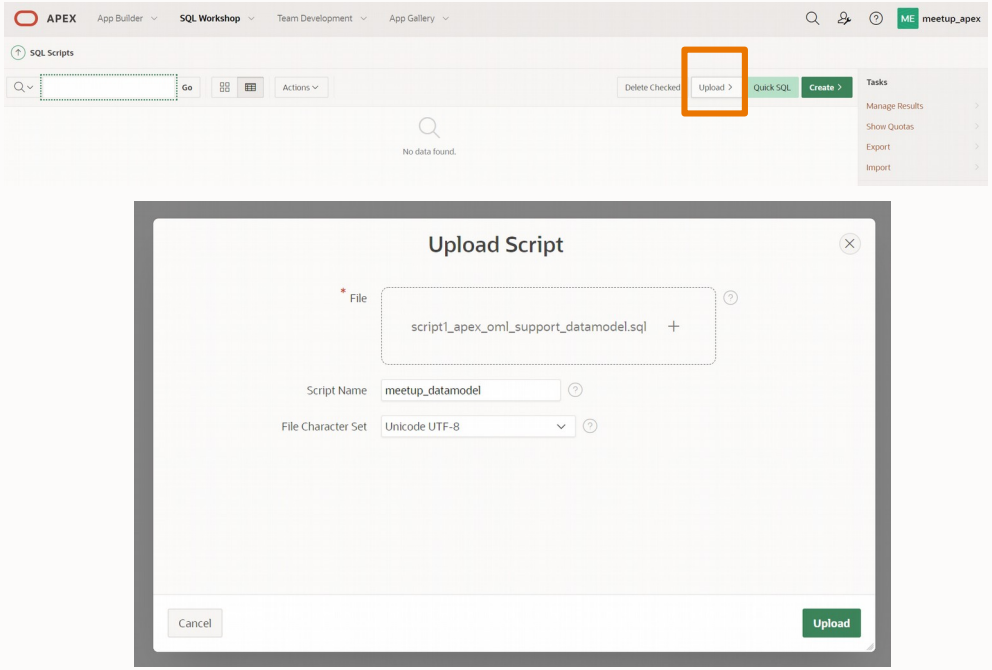
- In a separate tab, open the arduino lab github
- Download supporting scripts for lab3:
  - 1_apex_oml_datamodel.sql
  - 2_APEX_OML.pks.sql
  - 3_APEX_OML.pkb.sql
  - 4_apex_application_f100.sql
- Notice the number in each script name denotes the order of execution

Integrate Oracle Machine Learning with APEX

- Navigate to **SQL WORKSHOP** and **SQL SCRIPTS.**

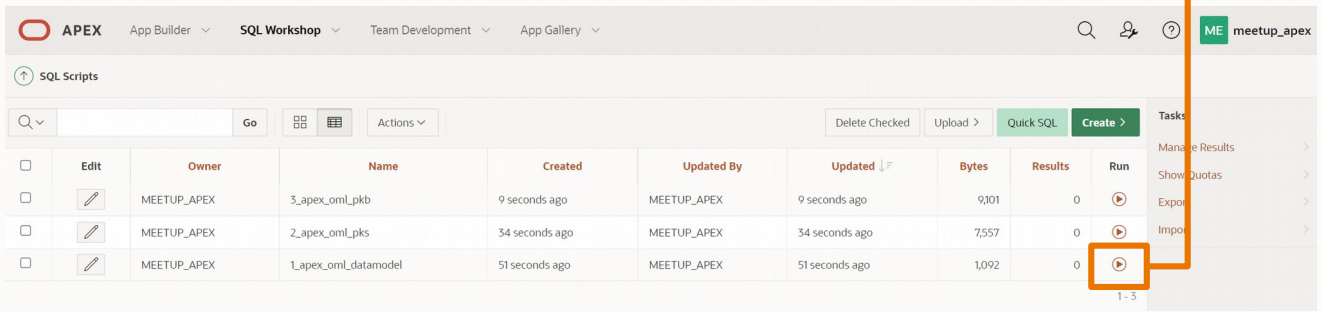


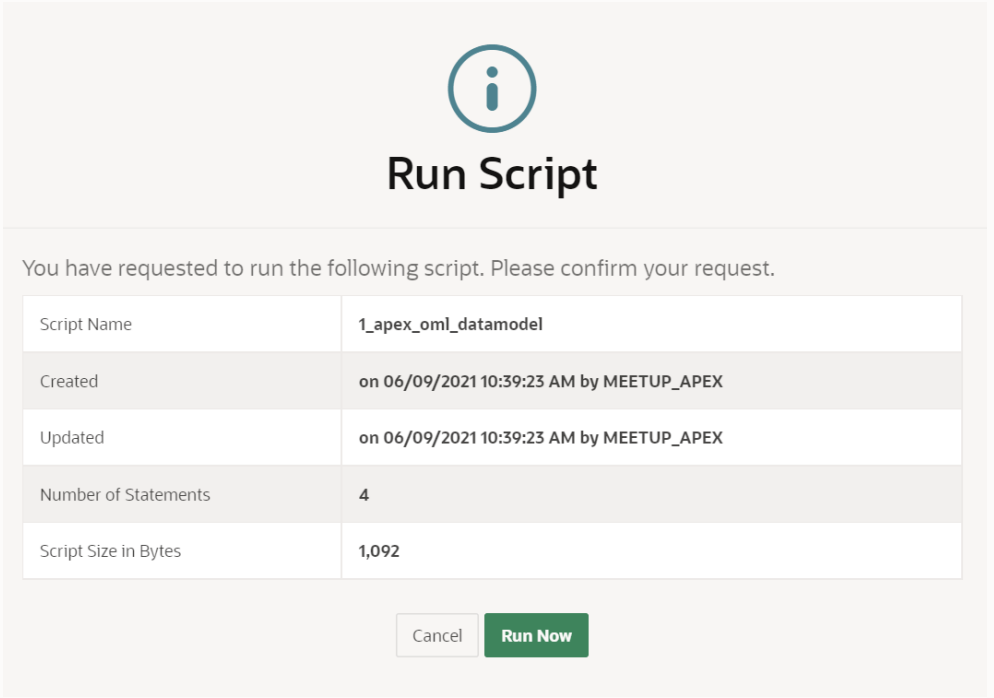
- Click **Upload** to load scripts 1,2,3.
- Leave the script name blank as it will be autocompleted by APEX on upload.



Integrate Oracle Machine Learning with APEX

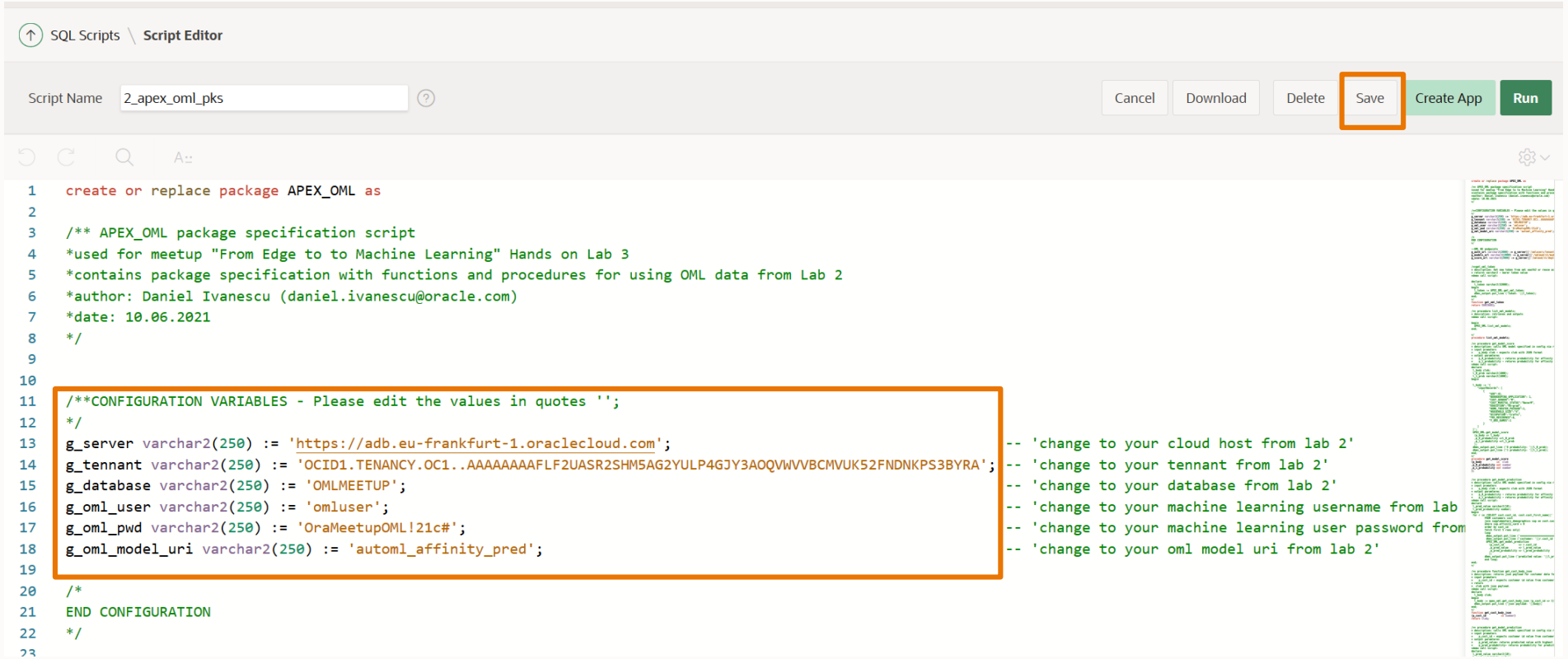
- You should have 3 scripts loaded.
- You can review the scripts content by clicking edit.
- Run script **1_apex_oml_datamodel**
- Click the Run button in edit mode or the play icon in the Run column in SQL Scripts report to execute the script.
- Follow the wizard steps and return to **SQL Scripts** after upload.





Integrate Oracle Machine Learning with APEX

- **Edit** script **2_apex_oml_pks. (Optional)**
  Fill in your OML instance and model details from lab2. You can easily find them in your Postman environment setup. If you don't have details from lab2, leave the configuration variables as they are. There is a shared OML instance set up for this lab. Save your changes.

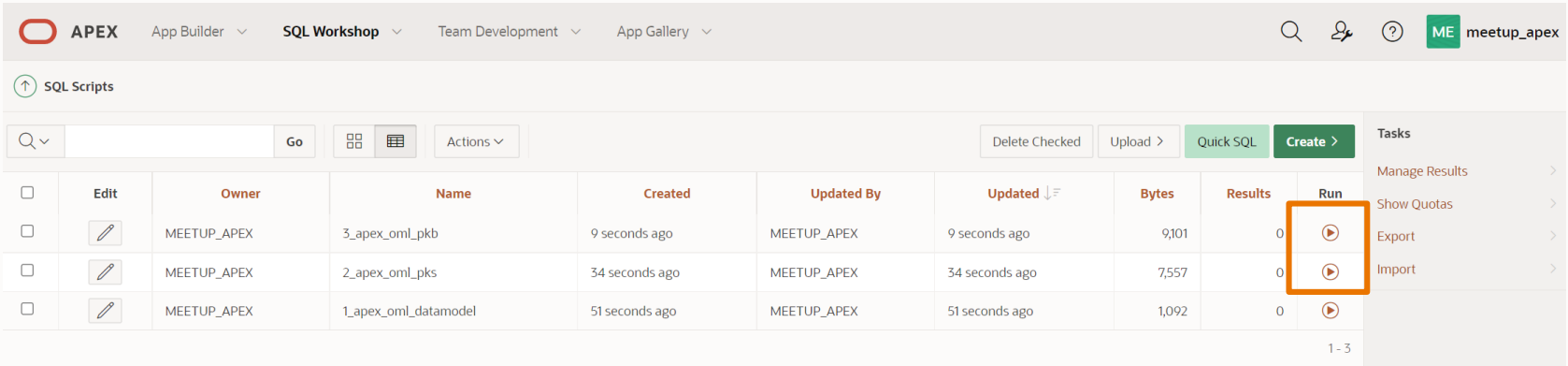


Integrate Oracle Machine Learning with APEX

- Sample OML instance configuration:

  g_server = 'https://adb.eu-frankfurt-1.oraclecloud.com'
  g_tennant = 'OCID1.TENANCY.OC1..AAAAAAAAFLF2UASR2SHM5AG2YULP4GJY3AOQVWVVBCMVUK52FNDNKPS3BYRA'
  g_database = 'meetup'
  g_oml_user = 'omluser'
  g_oml_pwd = 'omluser_password'
  g_oml_model_uri = 'automl_affinity_pred'

- Run script 2_apex_oml_pks
- Run script 3_apex_oml_pkb without any changes

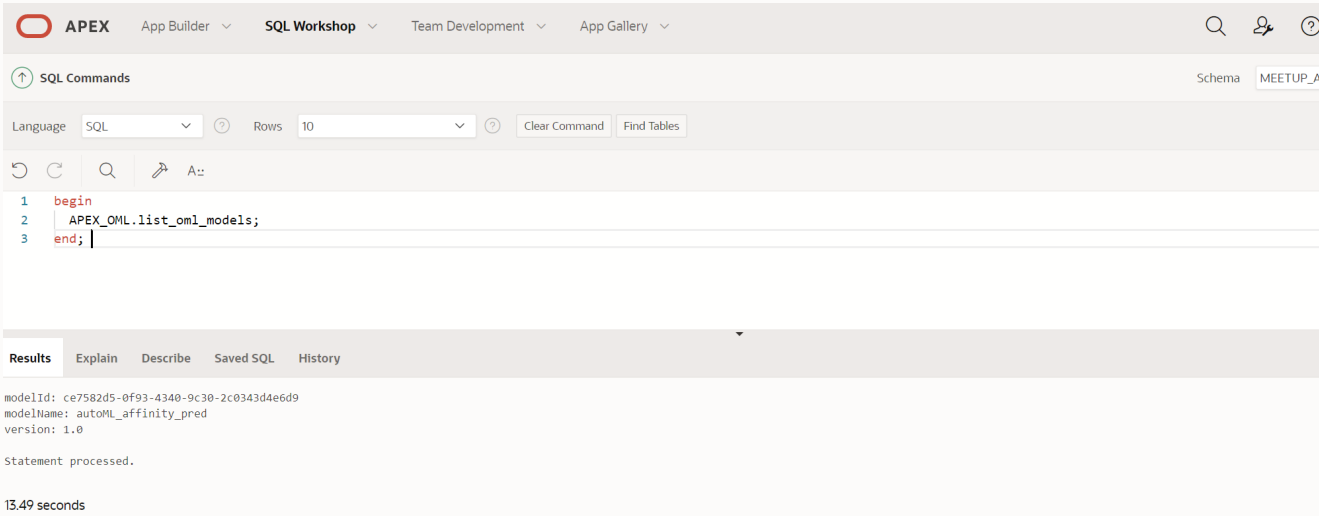


Integrate Oracle Machine Learning with APEX

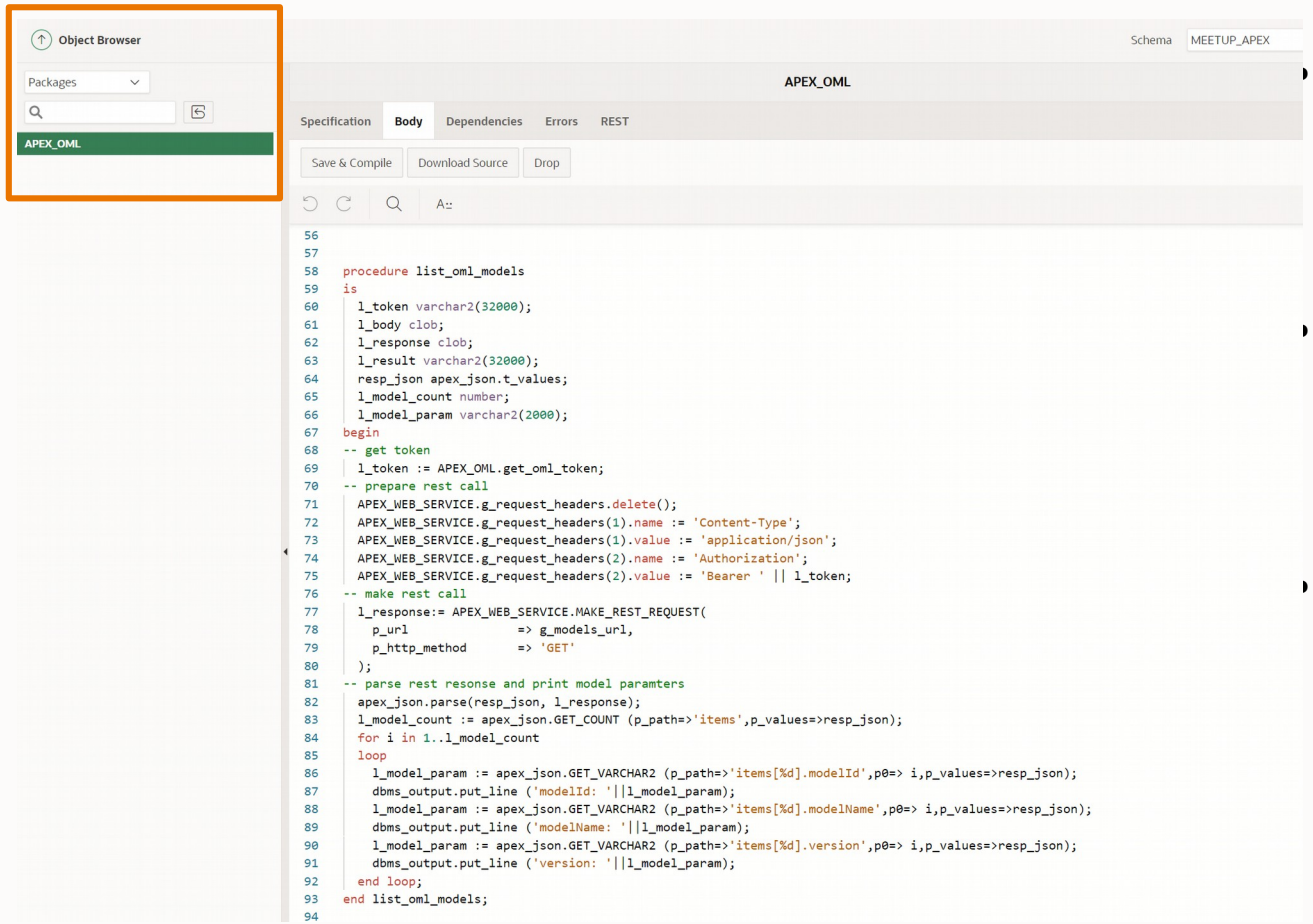
- We can now test out supporting objects and Oracle Machine Learning web services
- Navigate to SQL Workshop > **SQL Commands**
- In the worksheet area add the following code:

```
begin
  APEX_OML.list_oml_models;
end;
```

- Click **Run** in top-right corner to execute your code
- You should see your model from lab 2 in the results section



Integrate Oracle Machine Learning with APEX



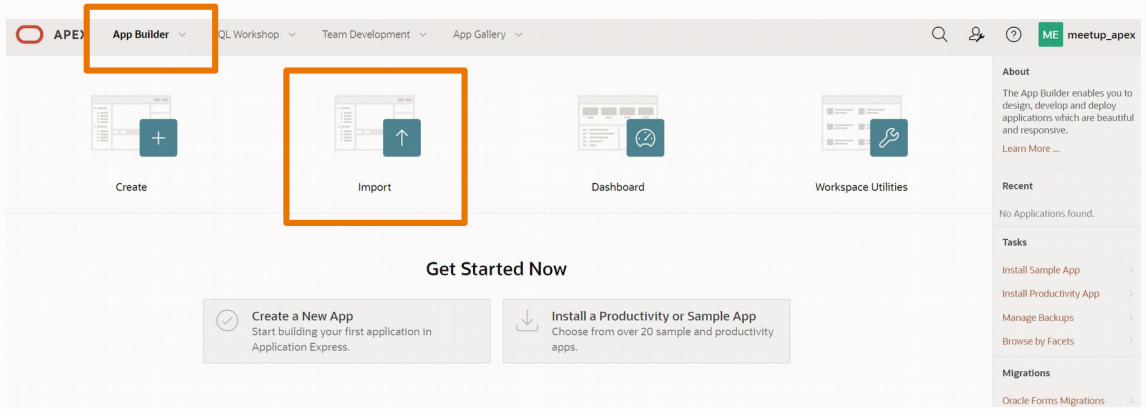
We can review our code in SQL Workshop> Object browser> **Packages** > **APEX_OML**> **body.** Scroll down or search for procedure list_oml_models.

APEX_WEB_SERVICE. MAKE_REST_REQUEST makes calling the REST api easy, while APEX_WEB_SERVICE.g_request_headers handles the api's security token.

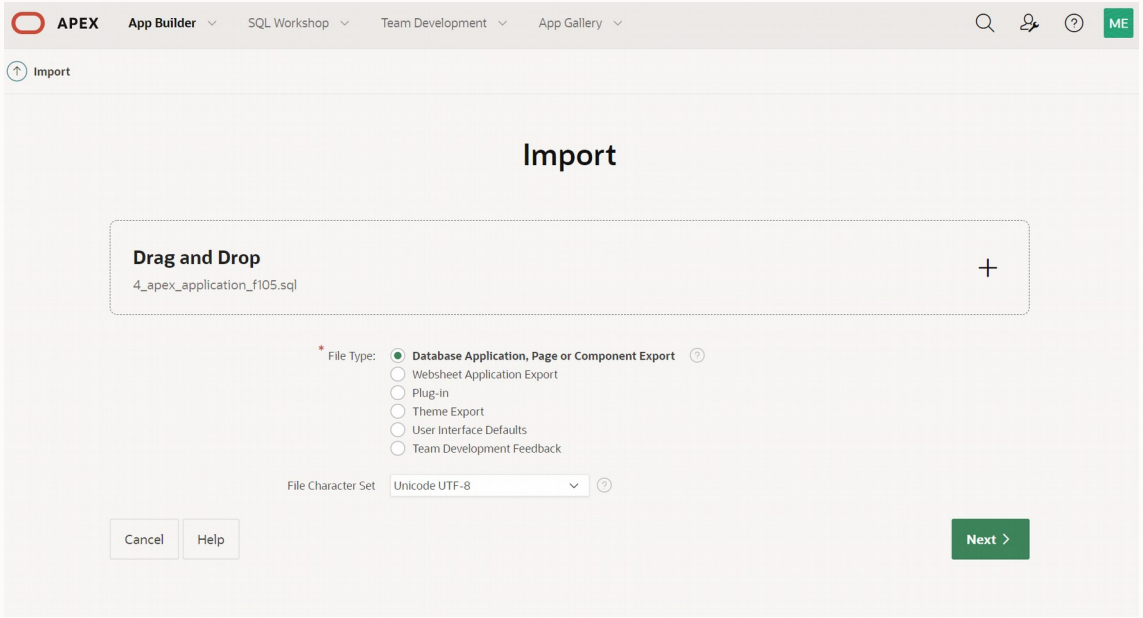
We're using the APEX_JSON package to parse our webserivce data (apex_json.parse), count the array elements(apex_json.get_count) and retrieve the values we need with correct datatype (apex_json.get_varchar2).

Integrate Oracle Machine Learning with APEX

- We are now ready to import our apex application
- Navigate to **App Builder**
- Click **Import**

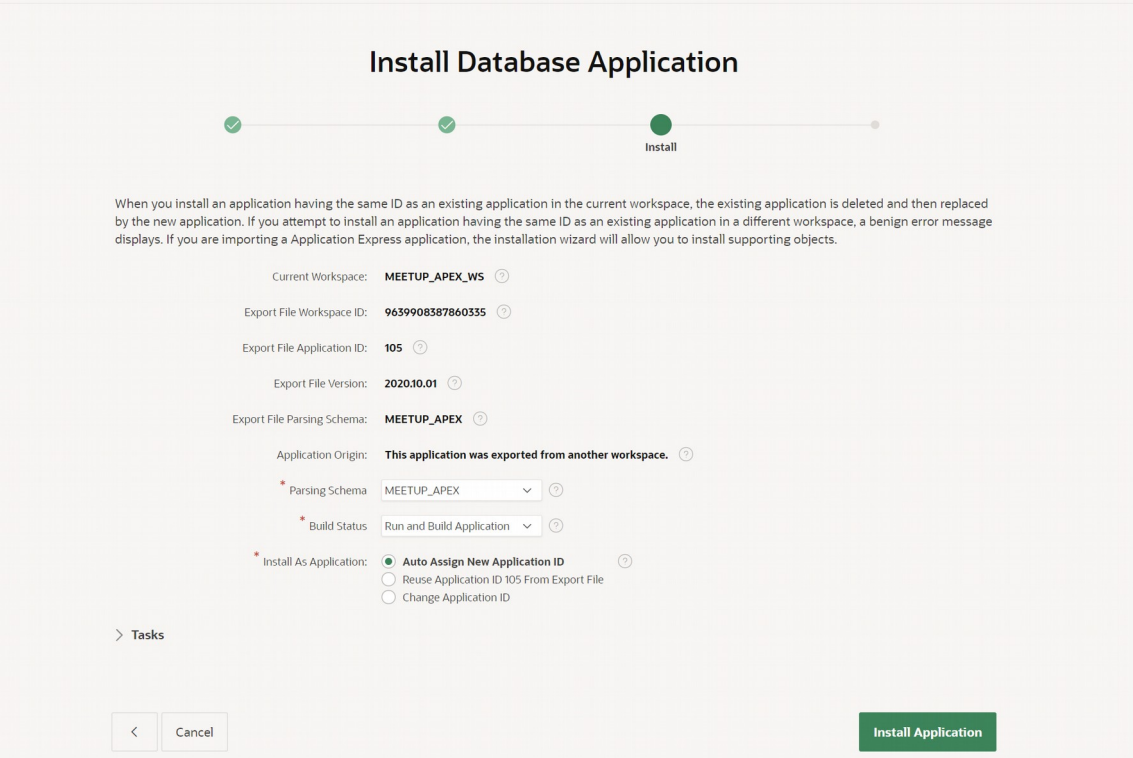


- Select/drag and drop script **4_apex_application_f105.sql**
- Click **next** on step 1 and 2 in the import wizard.

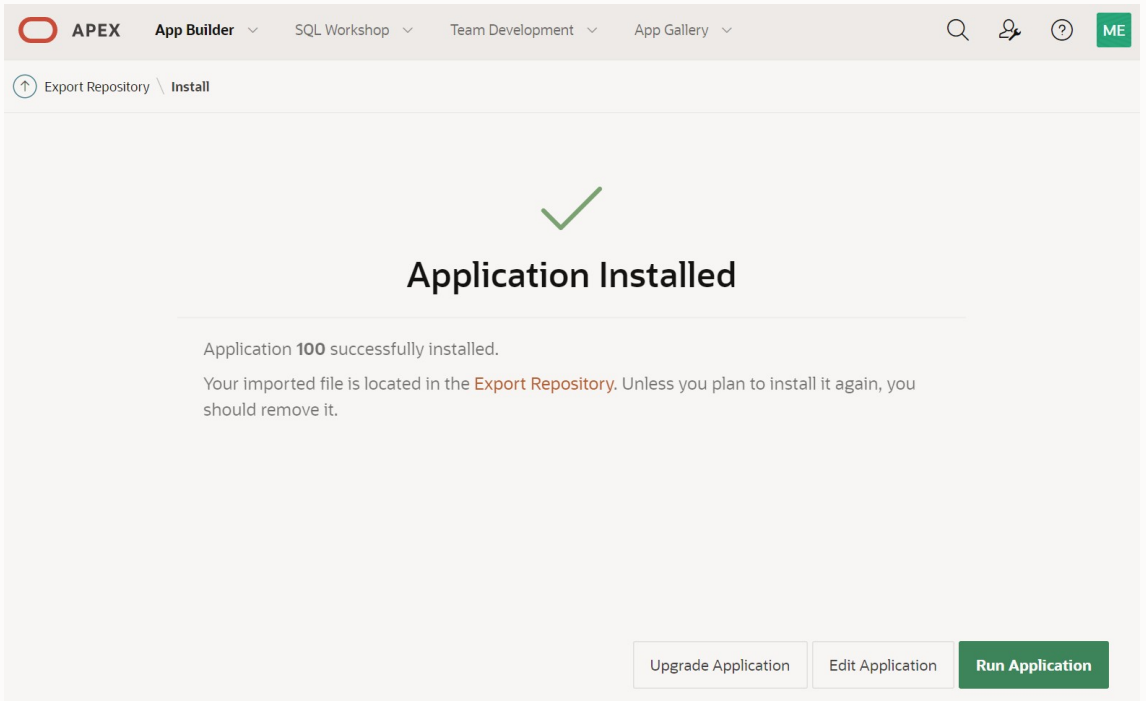


Integrate Oracle Machine Learning with APEX

- Double-check that parsing schema is **MEETUP_APEX** and click **Install Application**.

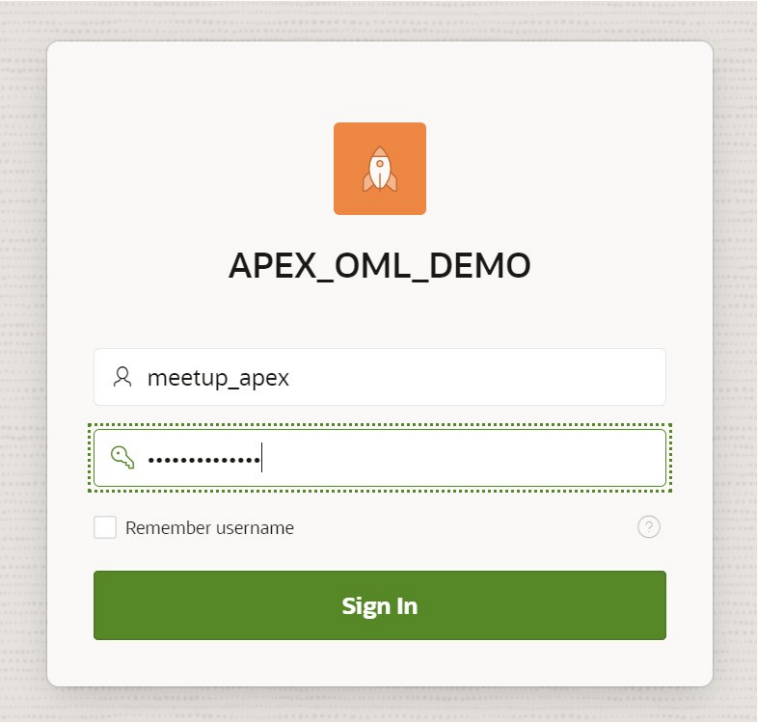


- The application should install as Application 100.
- Click **Run application**

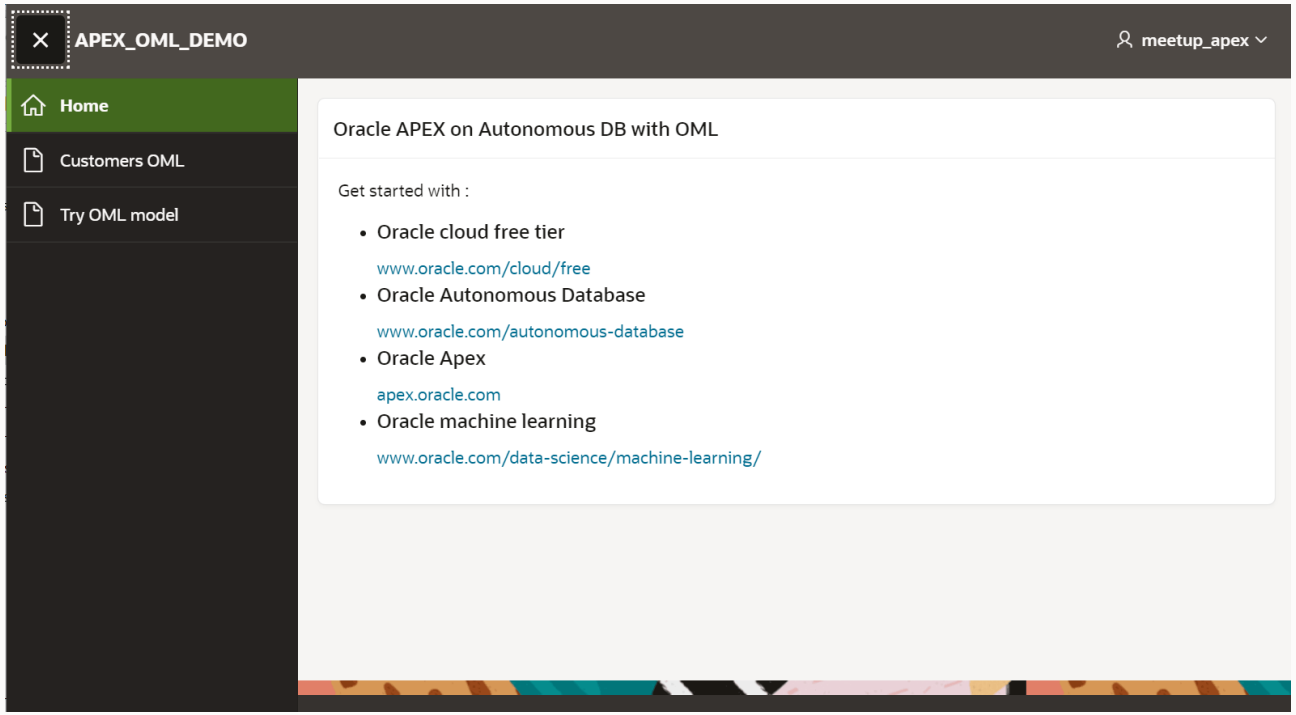


Integrate Oracle Machine Learning with APEX

- Log in to the application workspace with your apex user “meetup_apex” and password

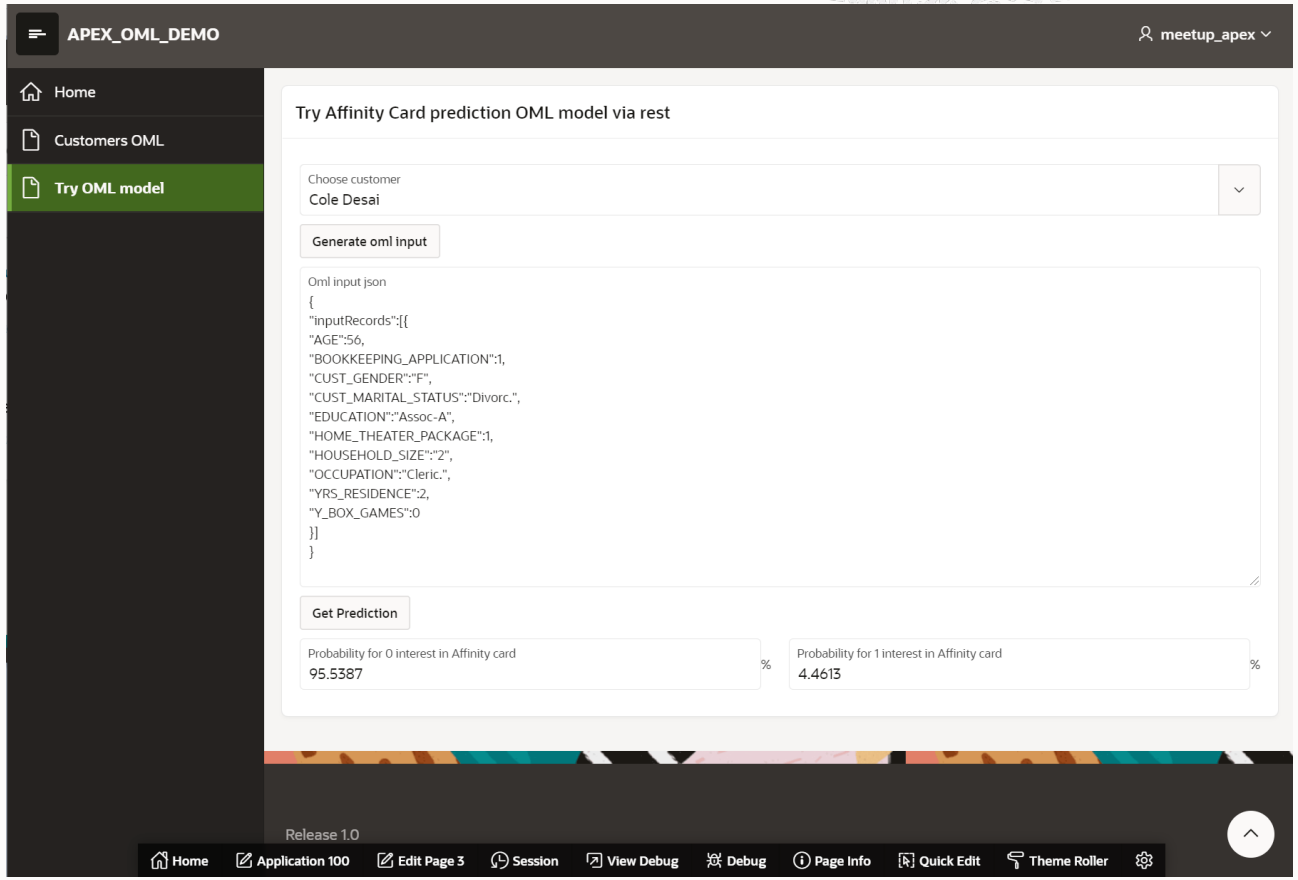


- Welcome to the APEX_OML_DEMO app
- Navigate to “**Try OML model**” from the left side menu



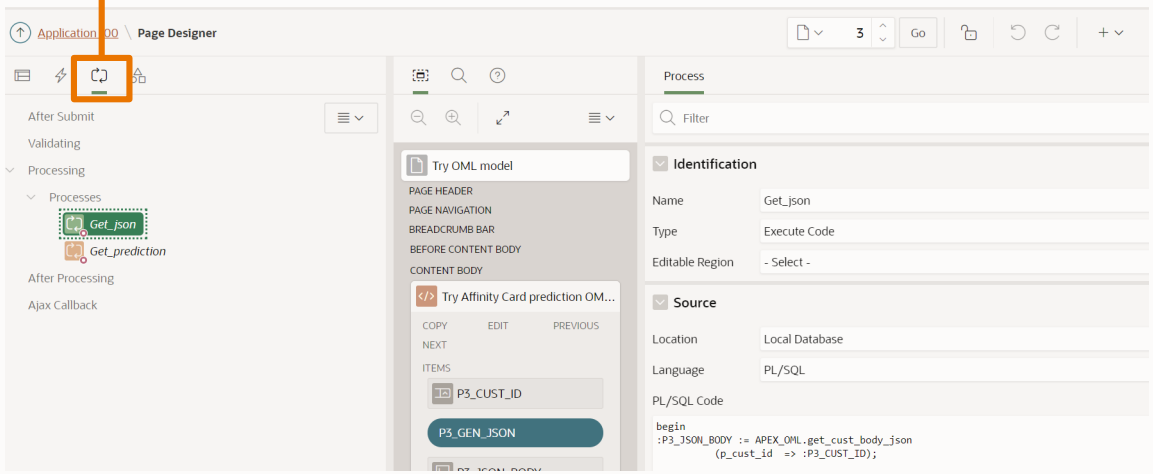
Integrate Oracle Machine Learning with APEX

- Script **1_apex_oml_datamodel** created a local copy of the *sh.customer* and *sh.supplimentary_demographics* tables we used to train our model in lab 2.
- Let's now use the model to see Affinity card predictions. Possible values are "0" and "1"
- Choose a customer from the list.
- Click **Generate oml input** to get a json payload with the customer's details
- Click **Get Prediction** to send our json payload to OML via REST and get our prediction score
- Do this for several customers and also try to change the json payload values to see different predictions.



Integrate Oracle Machine Learning with APEX

- We can review our application code in the page editor(edit page 3- bottom developer toolbar) > Processes button> Get_json and Get_prediction.
- UI coding is minimal, calling our APEX_OML custom pl/sql package to populate our page items.

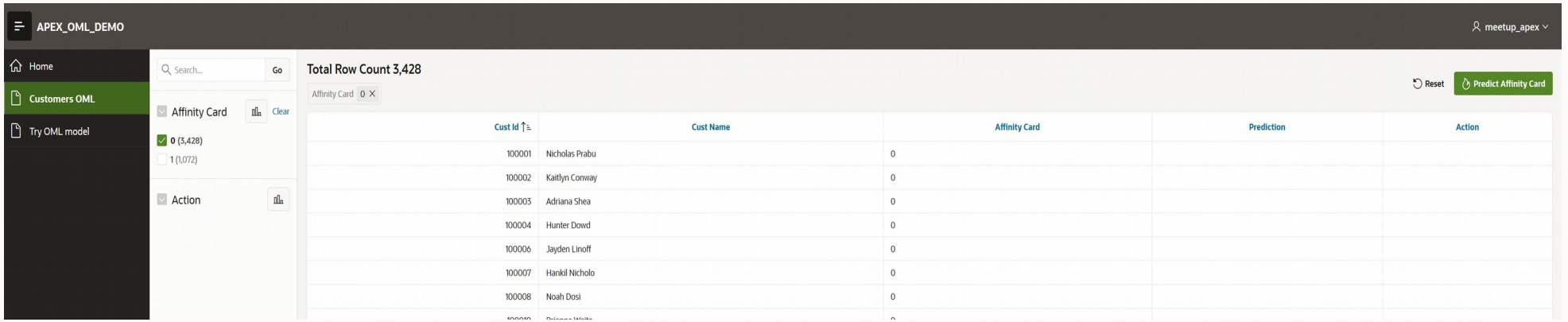


- In SQL Workshop> Object Browser> Packages> APEX_OML > Body, review the function get_cust_body_json
- we leverage Oracle SQL's JSON_OBJECT and JSON_ARRAYAGG to generate our json from stored table data

```
SELECT json_object ('inputRecords' value
                    JSON_ARRAYAGG(
                       JSON_OBJECT('AGE' VALUE (to_char(sysdate,'YYYY')-cust_year_of_birth),
                                   'BOOKKEEPING_APPLICATION' VALUE BOOKKEEPING_APPLICATION,
                                   'CUST_GENDER' VALUE CUST_GENDER,
                                   'CUST_MARITAL_STATUS' value CUST_MARITAL_STATUS,
                                   'EDUCATION' value EDUCATION,
                                   'HOME_THEATER_PACKAGE' value HOME_THEATER_PACKAGE,
                                   'HOUSEHOLD_SIZE' value HOUSEHOLD_SIZE,
                                   'OCCUPATION' value OCCUPATION,
                                   'YRS_RESIDENCE' value YRS_RESIDENCE,
                                   'Y_BOX_GAMES' value Y_BOX_GAMES)
                       )
                    returning clob
                     ) as cust_json
    FROM customers cust
    left join supplementary_demographics sup on cust.cust_id = sup.cust_id
    where cust.cust_id =  p_cust_id
```

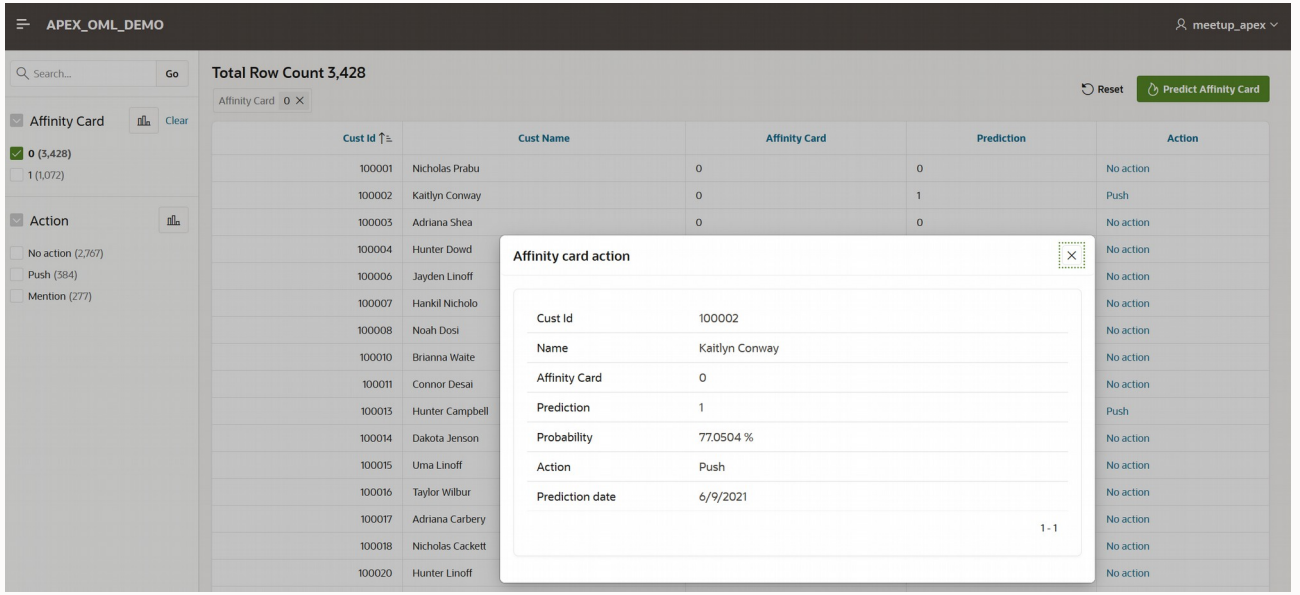
Integrate Oracle Machine Learning with APEX

- Navigate to App Builder > APEX_OML_DEMO app > Run Application > **Customers OML** using the side menu
- We'll use our OML model to determine if case workers should use time convincing customers to sign up for Affinity cards.
- Select customers with Affinity card "**0**" in the facet search.
- Click **Predict Affinity Card** in the top-right corner.
- We'll be running these 3,428 customers through our OML model via REST. It may take a few minutes to get the predictions back.



Integrate Oracle Machine Learning with APEX

- Let's review the results.
- Action column will say "Push" for predicted value '1' with a probability chance higher than 75%
- We'll see "Mention" for predicted value "1" with a probability chance between 50% and 75%
- All other cases will have "No action"
- We're using machine learning to instruct our fictional case workers on which fictional customers to approach and allocate time to convince them to sign up for our affinity cards.
- This page is also a nice example of the Facet search APEX reporting component. Action facets on the left side are now populated to provide at a glance statistics based on new information. Click the little chart icon for a graphic representation.



Integrate Oracle Machine Learning with APEX

- You can build Oracle Machine Learning Notebooks with SQL and PL/SQL instead of python.
  This is technique is very well described by our colleague Evgeny in the following blog posts :
  - https://blogs.oracle.com/imc/more-value-for-your-apex-application-with-oracle-machine-learning-in-autonomous-databases-part-1
  - https://blogs.oracle.com/imc/more-value-for-your-apex-application-with-oracle-machine-learning-in-autonomous-databases-part-2

- Challenge:
  - Replicate our results with this technique.
  - Or apply it to test machine learning with your Arduino sensor data from lab1.
    Let's see how to access the sensor data in APEX in the next section.

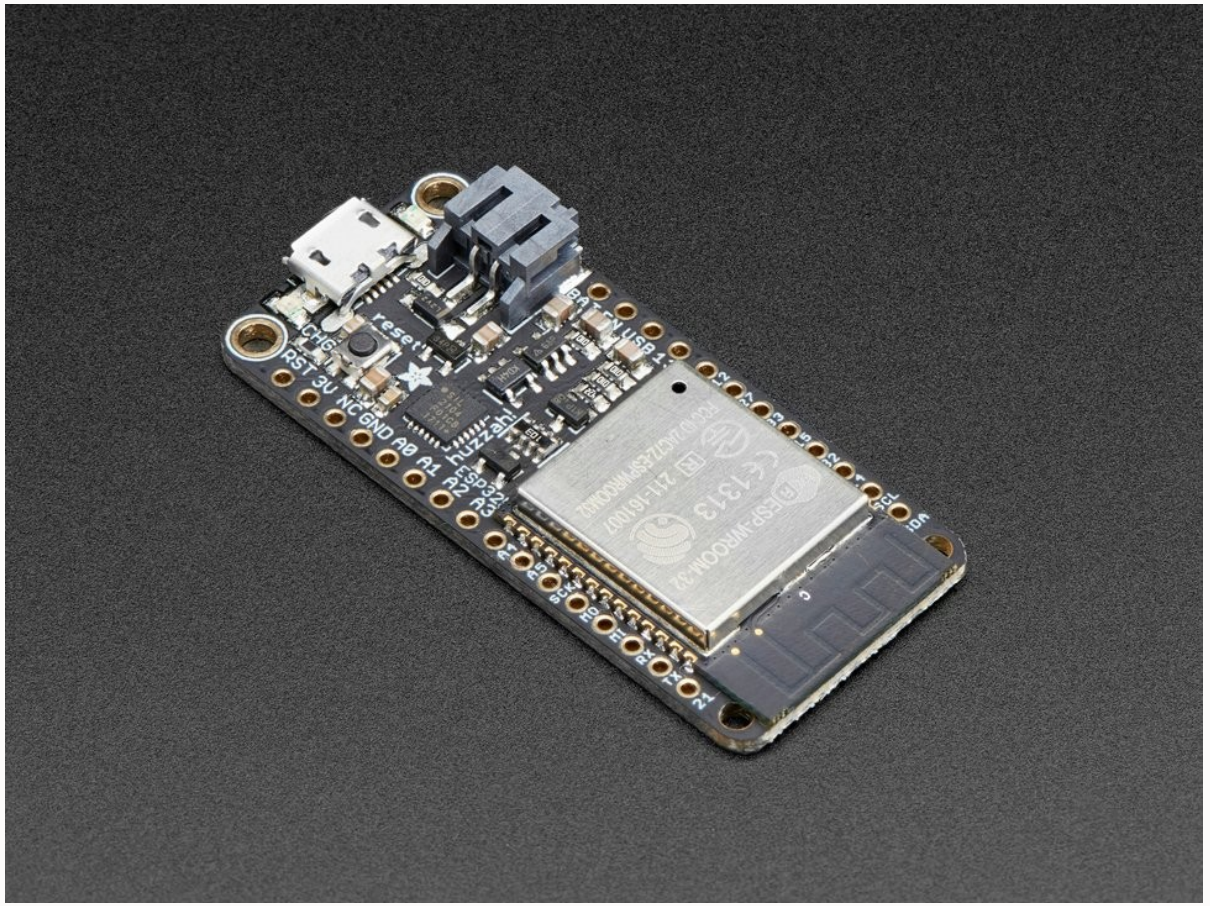
- Good luck!

Integrate IOT sensor data with Oracle Application Express and REST

Consume your Arduino sensor data from lab 1

Integrate Arduino sensor data from lab 1

- Let's further enhance our application to include the Arduino sensor data from lab 1.
- We'll need additional scripts from arduino lab github
- Download scripts:
  - 5_apex_iot_datamodel
  - 6_iot_data_fetch.sql
- Navigate to SQL Workshop > SQL Scripts and upload these scripts as before.
- Script 6 will try to call a shared SODA REST API with Arduino sensor data set up for this lab replicating data from lab 1



Integrate Arduino sensor data

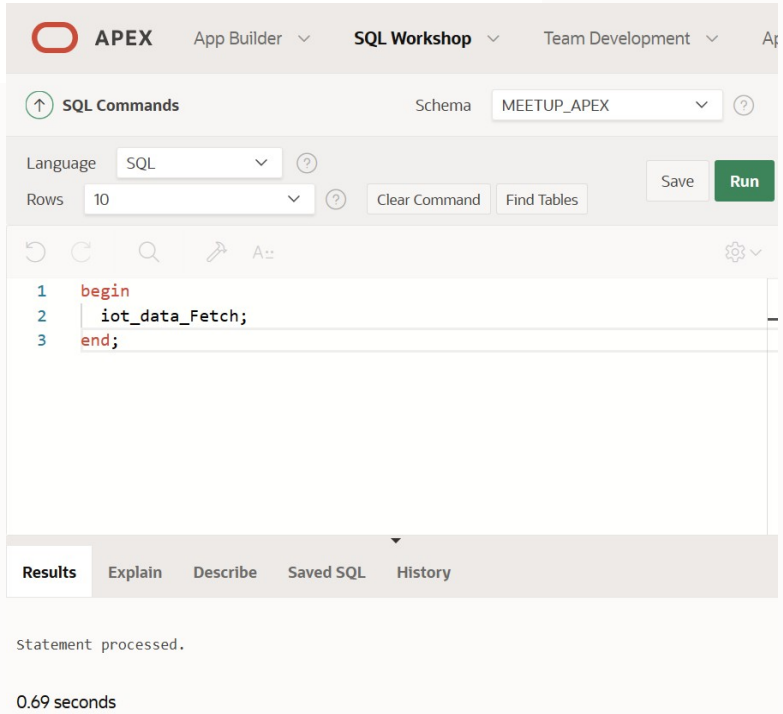
- (**Optional**) If you have webservice details for your Arduino data, edit script 6 REST api call: APEX_WEB_SERVICE. MAKE_REST_REQUEST (p_url= ‘’, p_user =’’, p_password=’’)
- **Run** scripts 5 and 6.
- Navigate to SQL Workshop > SQL Commands to test our code.
- **Run** the following code:

```
begin
  iot_data_Fetch;
end;
```

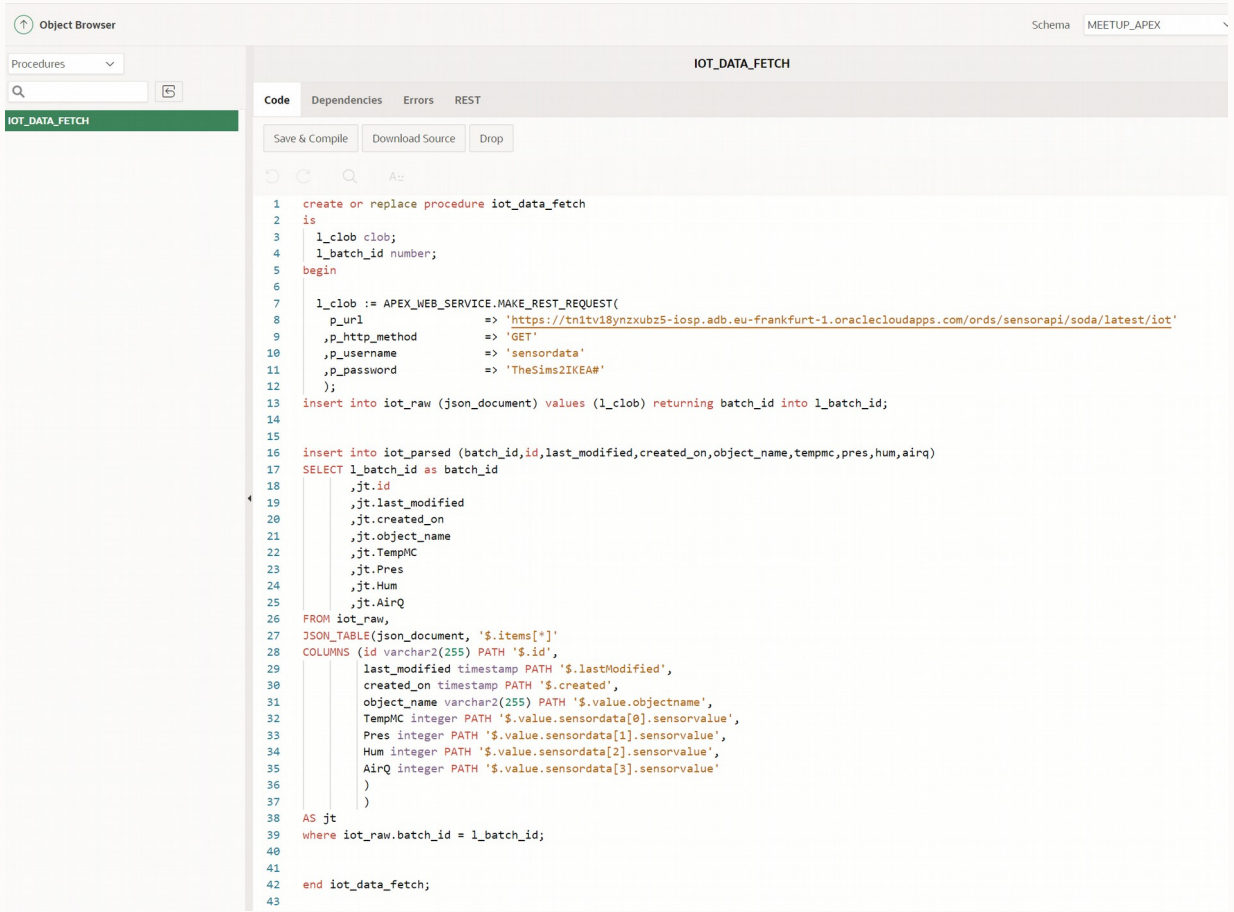
- This will populate sensor data in the table iot_parsed from our api.

```
create or replace procedure iot_data_fetch
is
  l_clob clob;
  l_batch_id number;
begin

  l_clob := APEX_WEB_SERVICE.MAKE_REST_REQUEST(
    p_url                  => 'https://tn1tv18ynzxub
   ,p_http_method          => 'GET'
   ,p_username             => 'sensordata'
   ,p_password
   );
```



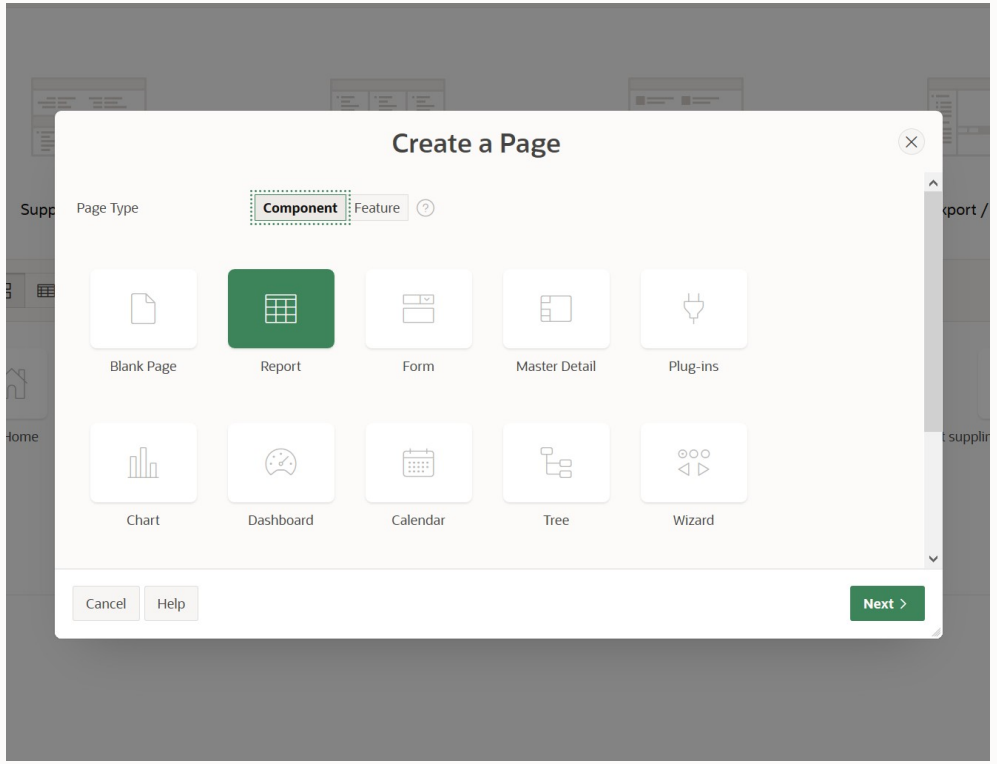
Integrate Arduino sensor data

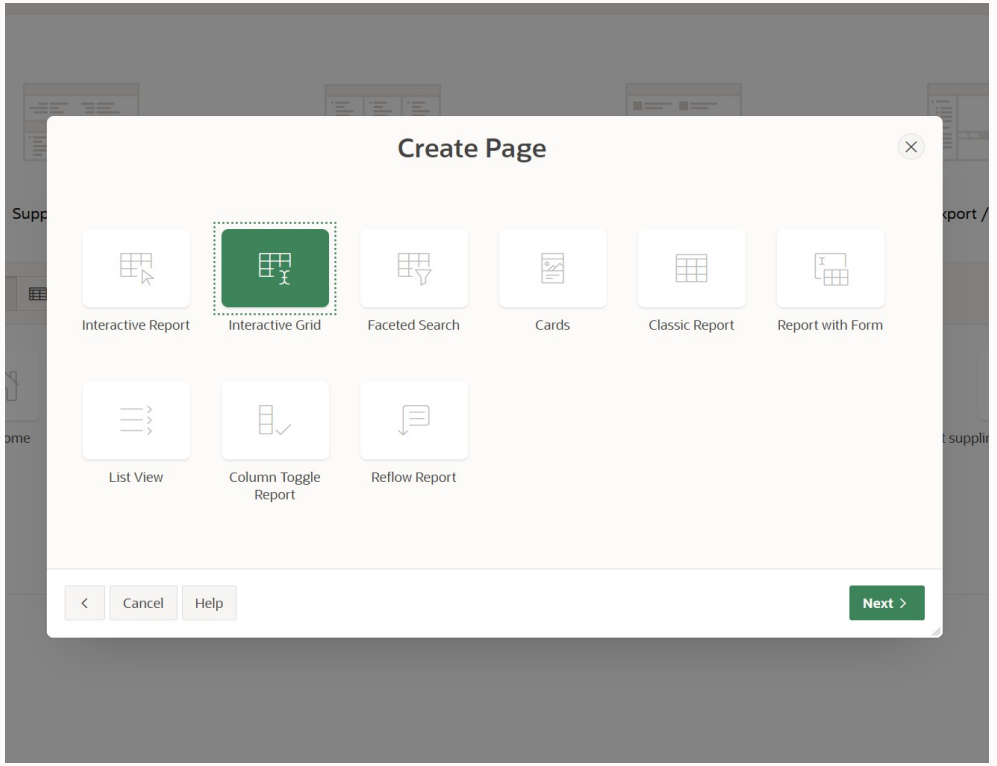


- We can review our code in SQL Workshop > Object browser > Procedures > IOT_DATA_FETCH
- We're using APEX_WEB_SERVICE.MAKE_REST_REQUEST to access our Sensor data with basic authentication
- To parse the retrieved json content we're using a Oracle SQL feature called JSON_TABLE that allows us to fetch all the values we need in one query.
- APEX extends the already powerful data management feature set of the Oracle DB giving us more flexibility

Integrate Arduino sensor data

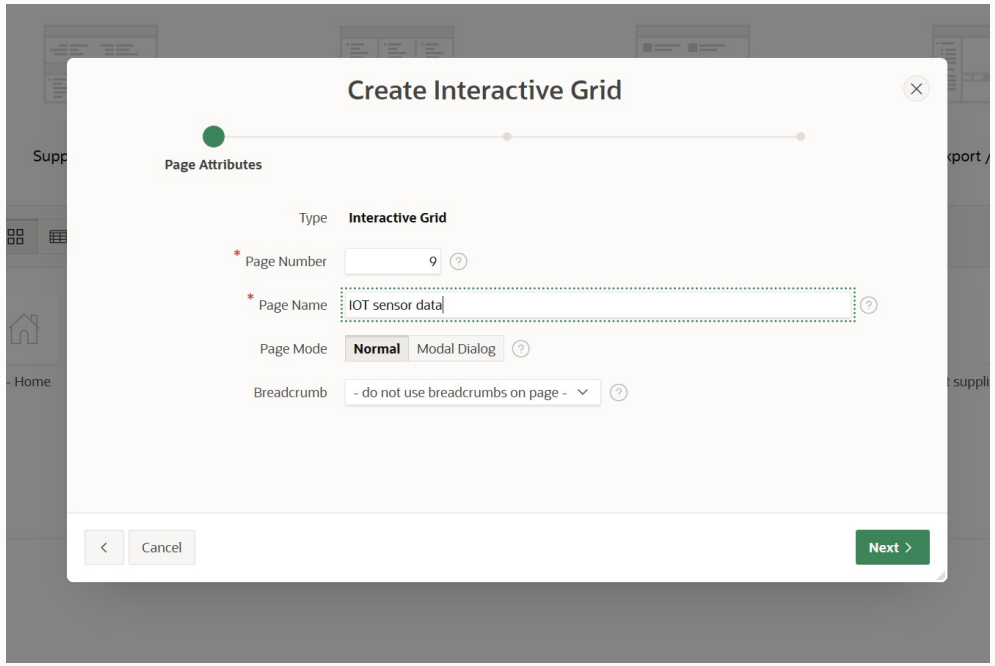
- Let's make our sensor data available in APEX. Navigate to Application builder> app 100
- Click **Create page**. On the 1st step, choose **Report** and on the 2nd step choose **Interactive Grid**.



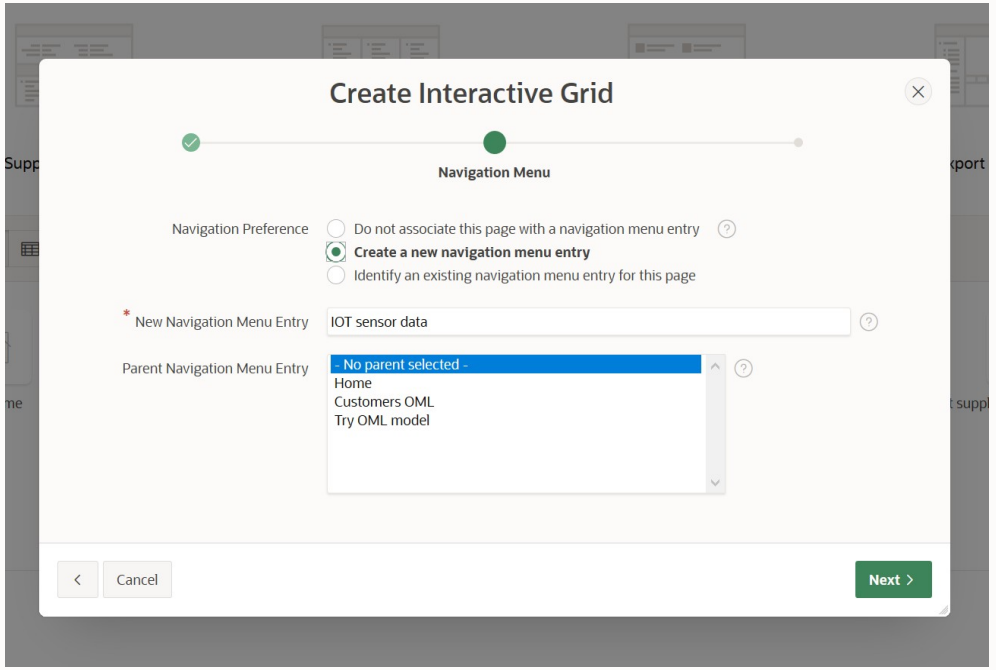


Integrate Arduino sensor data

- Fill in page name and click next.
- Page number can be left the suggested value

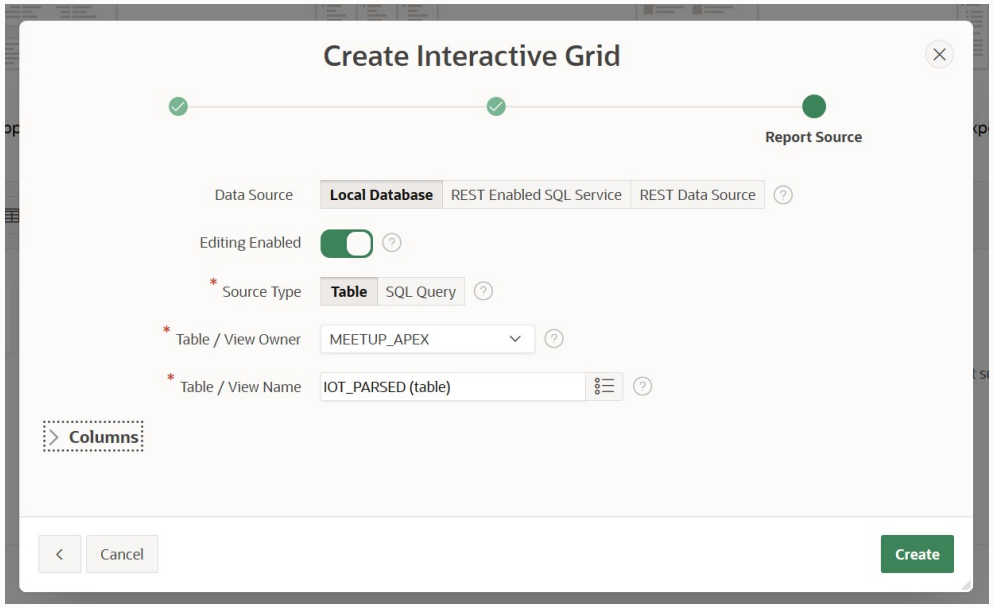


- Choose Navigation preference: Create a new navigation menu entry
- Fill in the name for the navigation menu entry.



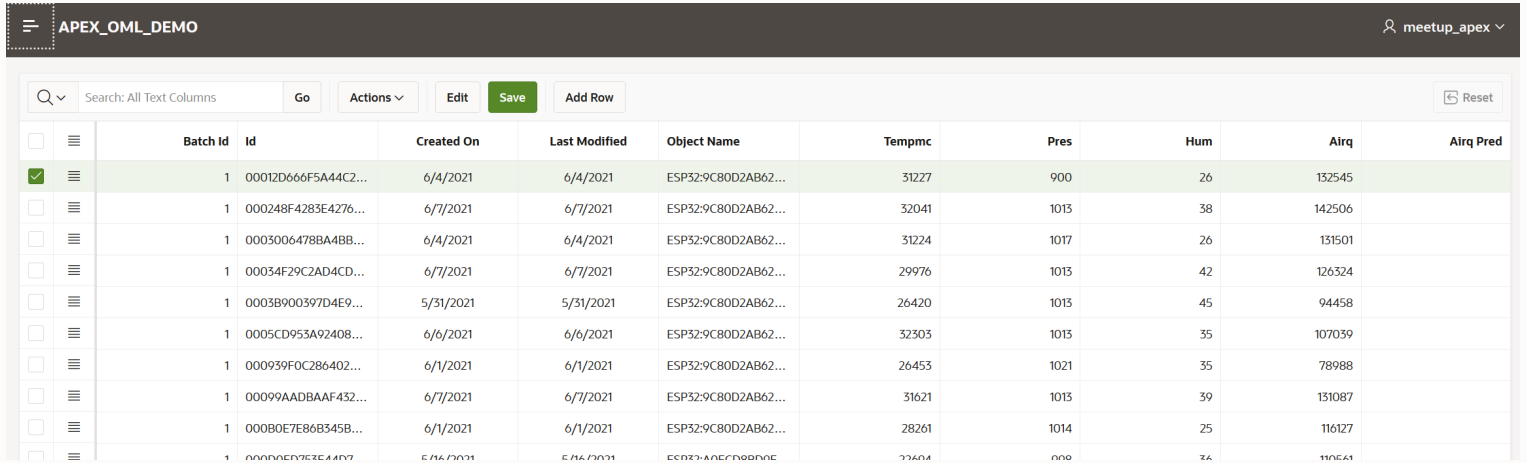
Integrate Arduino sensor data

- **Enable editing** by switching the toggle item.
- In the field **Table/View** name
  - Click the right side pop-up search
  - Select the table **iot_parsed**
- Click **Create** to generate the page.
- Click the **Run** button on the top right corner of the page to see your Arduino data



Integrate Arduino sensor data

- Arduino sensor data can now be reviewed in your APEX application.
- The interactive grid report allows data editing in an excel/google sheets like UI.
- Feel free to explore the Actions available for this type of APEX component
- Notice the empty Airq_pred column
- Challenge: try to use OML to predict Air quality based on the other sensor data and compare with measured data. Use the knowledge you've acquired in these labs.
- Good luck !



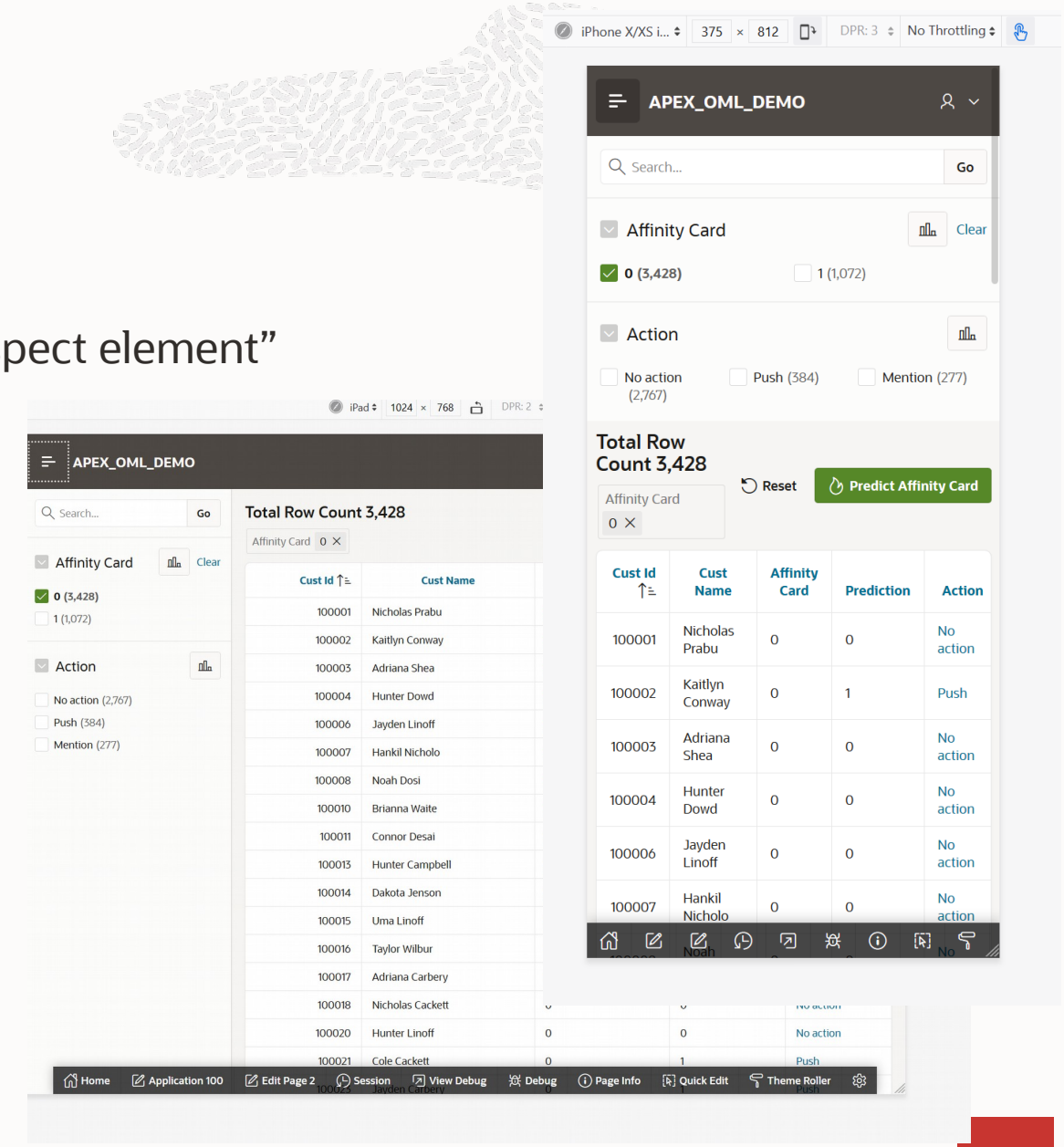
Batch Id	Id	Created On	Last Modified	Object Name	Tempmc	Pres	Hum	Airq	Airq Pred
1	00012D666F5A44C2...	6/4/2021	6/4/2021	ESP32:9C80D2AB62...	31227	900	26	132545	
1	000248F4283E4276...	6/7/2021	6/7/2021	ESP32:9C80D2AB62...	32041	1013	38	142506	
1	0003006478BA4BB...	6/4/2021	6/4/2021	ESP32:9C80D2AB62...	31224	1017	26	131501	
1	00034F29C2AD4CD...	6/7/2021	6/7/2021	ESP32:9C80D2AB62...	29976	1013	42	126324	
1	0003B900397D4E9...	5/31/2021	5/31/2021	ESP32:9C80D2AB62...	26420	1013	45	94458	
1	0005CD953A92408...	6/6/2021	6/6/2021	ESP32:9C80D2AB62...	32303	1013	35	107039	
1	000939F0C286402...	6/1/2021	6/1/2021	ESP32:9C80D2AB62...	26453	1021	35	78988	
1	00099AADBAAF432...	6/7/2021	6/7/2021	ESP32:9C80D2AB62...	31621	1013	39	131087	
1	000B0E7E86B345B...	6/1/2021	6/1/2021	ESP32:9C80D2AB62...	28261	1014	25	116127	

Oracle Apex look and feel

Apex is responsive by design and highly customizable

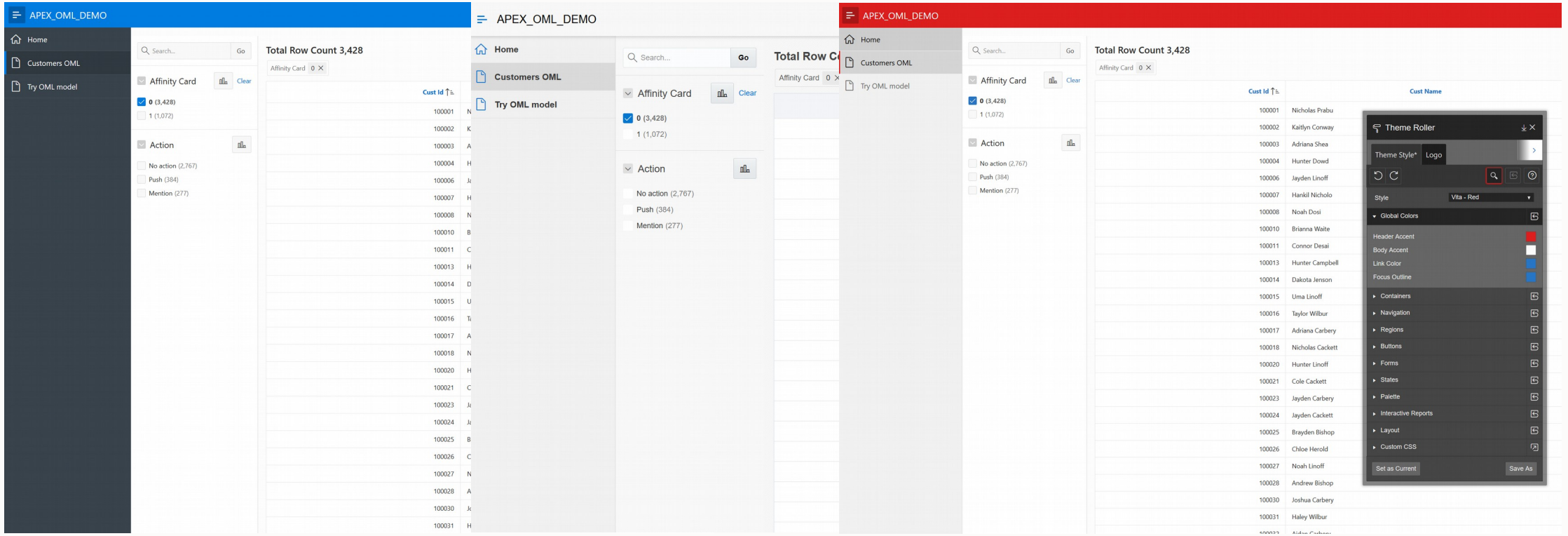
Responsive APEX

- Let's try the app on Mobile or Tablet
- Right click in the browser and select "Inspect/Inspect element"
- Turn on responsive browser mode by pressing CTRL+SHIFT+M or finding the icon on the browser developer utilities
- Try Ipad or Iphone/Galaxy layout and see how the templates change for mobile use.



Pixel-perfect APEX

- Let's change the look of our app
- Click on theme roller in the developer toolbar at the bottom.
- Try the different theme styles Redwood, Vista, Vita



Closing remarks

- Oracle Application Express the ideal tool to enhance your organizations cloud journey by providing easy access to a ecosystem of powerful features.
- Shift your IT departments focus from software configuration and maintenance to rapid development and solving business needs with Apex on Autonomous Database
- Continue your Oracle hands-on learning journey with Oracle Live labs

Our mission is to help people see data in new ways, discover insights, unlock endless possibilities.

Thank you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