



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

Demo/Workshop

Daniel Ivanescu

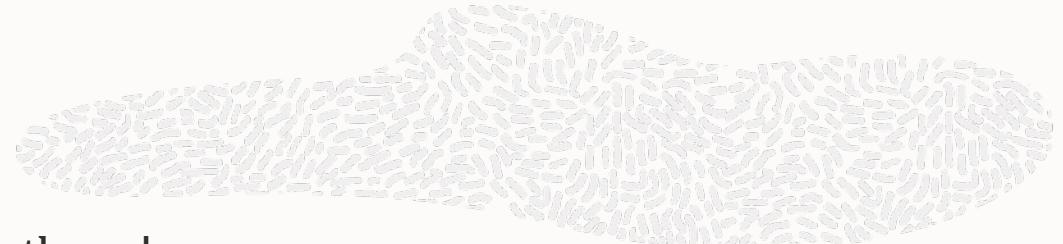
Principal Cloud Specialist Engineer
Technology Solutions & Cloud Engineering
June 10th, 2020



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Workshop Goals



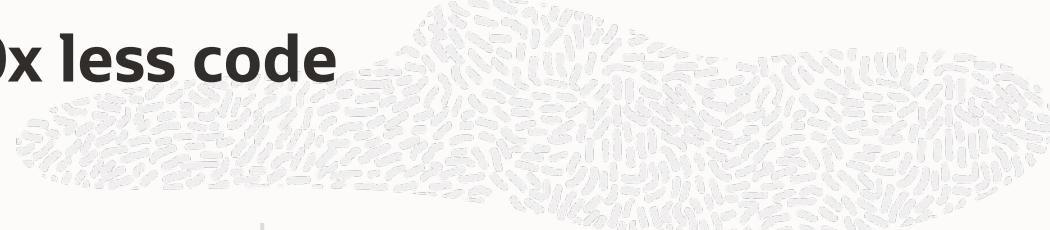
- Explore why using Oracle Application Express can greatly enhance your organization's digital journey
- Get started with Oracle Application Express in the cloud on Autonomous Database
- Integrate Oracle Machine Learning models in decision making by applying predictions to data in a visual way
- Integrate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

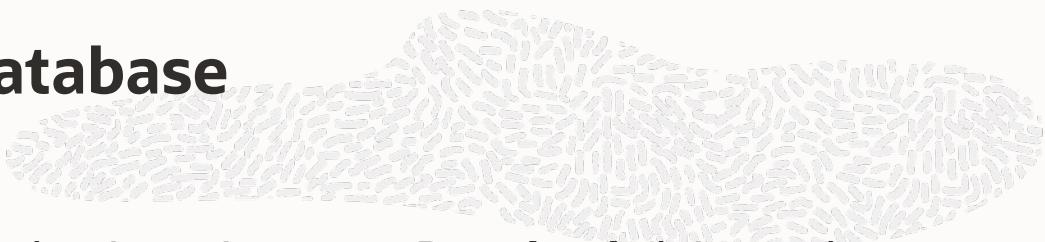
Use it everywhere

- 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.

Overview » Autonomous Database » Autonomous Database Details

Database Name: meetup Workload Type: Transaction Processing
Compartment: danieldev (root)
OCID: ...vytrog Created: Wed, Jun 9, 2021, 09:04:45 UTC
OCPU Count: 1
Auto Scaling: Disabled
Storage: 20 GB
License Type: License included
Database Version: 21c
Lifecycle State: Available
Instance Type: Free [Upgrade to Paid](#)
Mode: Read/Write

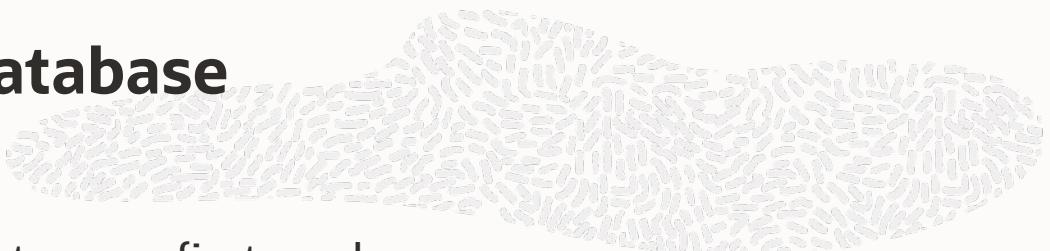
APEX Instance
Instance Name: [meetup](#)

APEX Application Development » APEX Instances » APEX Instance Details

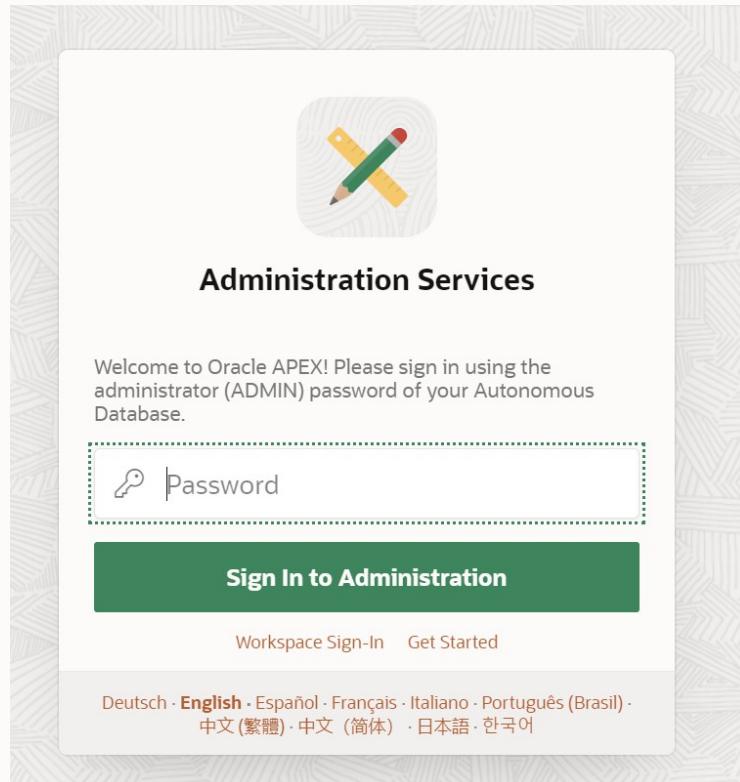
OCID: ...vytrog Compartment: danieldev (root)
Created: Wed, Jun 9, 2021, 09:04:45 UTC
APEX Version: 20.2.0.0.20
ORDS Version: 21.1.1.116.2032

Launch APEX Launch Database Actions View Database Details Add Tags

Get started with APEX on Autonomous Database

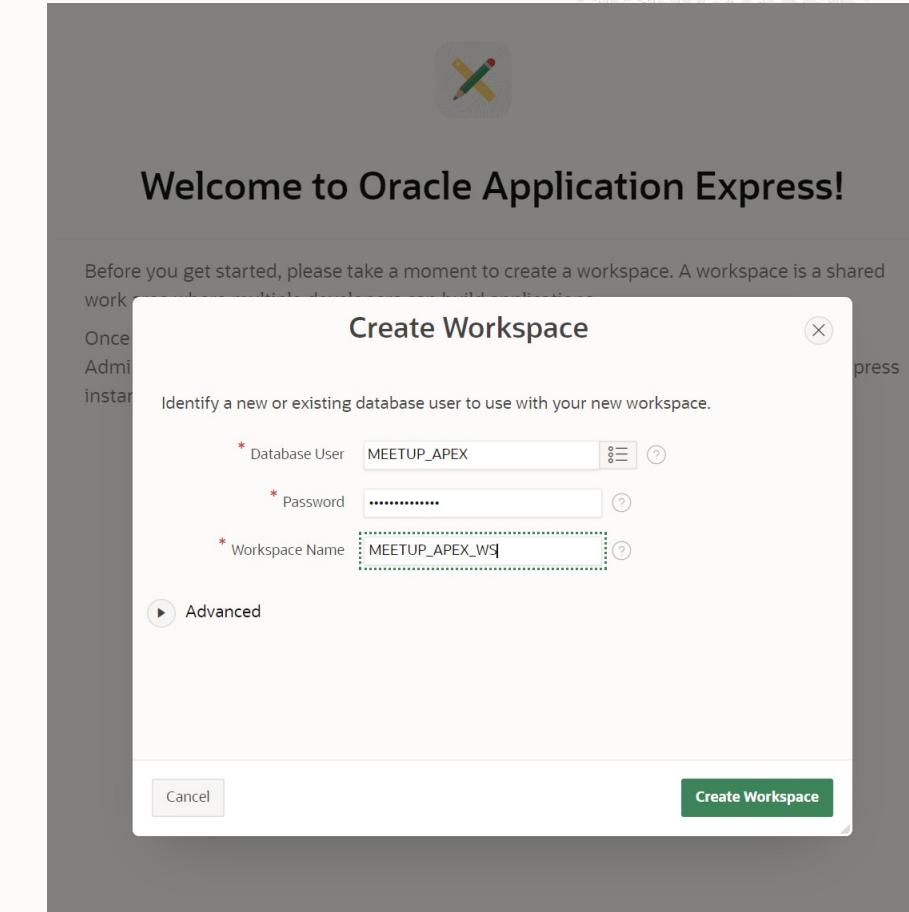


- Log in to the Apex administration workspace with your database “Admin” user password
- Create your first workspace



Get started with APEX on Autonomous Database

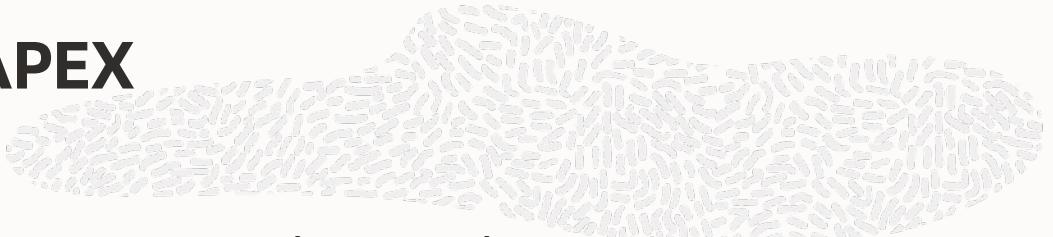
- Fill in your new workspace details
- Name your database user **MEETUP_APEX**
this is important for the next steps.
- Name your workspace **MEETUP_APEX_WS**
- Apex will create a new database user/schema with this username and password.
- Applications from the APEX workspace MEETUP_APEX_WS will have 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.



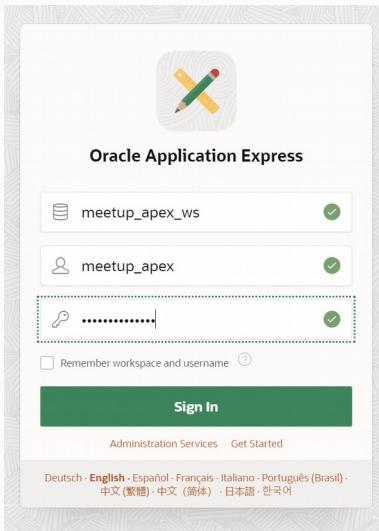
Integrate Oracle Machine Learning models in business decision making

Continue your journey with OML from lab 2

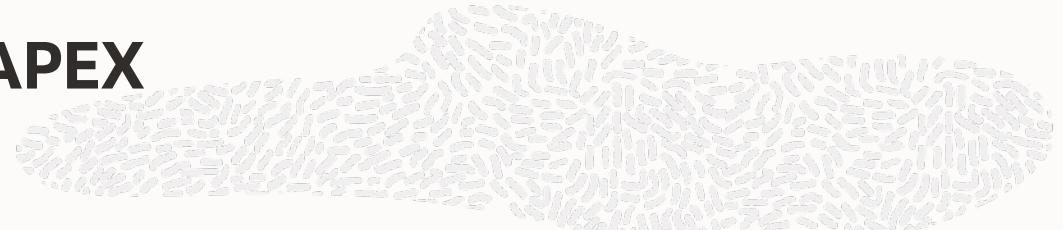
Integrate Oracle Machine Learning with APEX



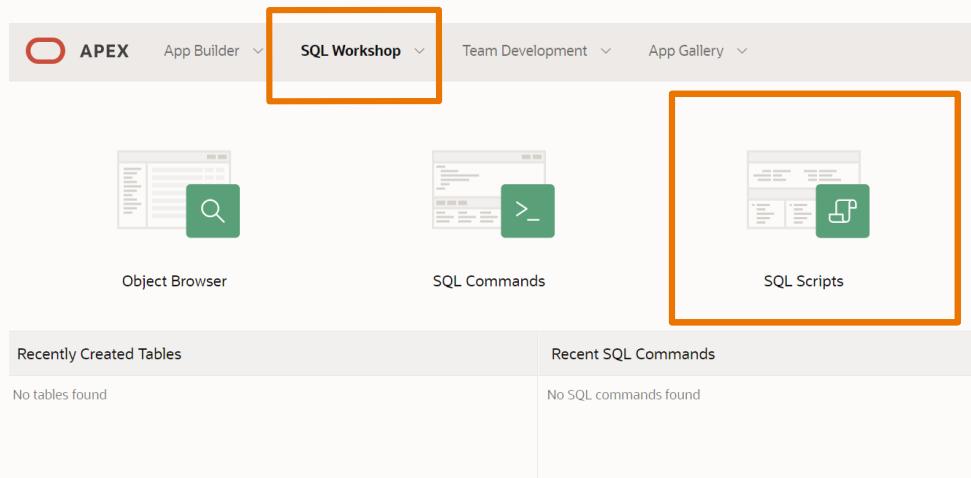
- Let's set up supporting objects and our sample apex application
- Log in to **MEETUP_APEX_WS** workspace with **MEETUP_APEX** user and password
- In a separate tab, open the [arduino lab github](#)
- Download supporting scripts for lab3:
 - [1_apex_oml_datamodel.sql](#)
 - [2_APEX_OML.pks.sql](#)
 - [3_APEX_OML.pkb.sql](#)
 - [4_apex_application_f100.sql](#)
- Notice the number in each script name denotes the order of execution



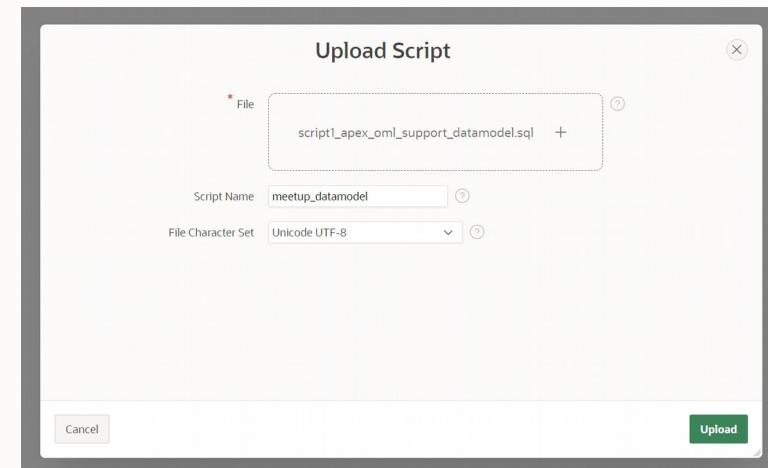
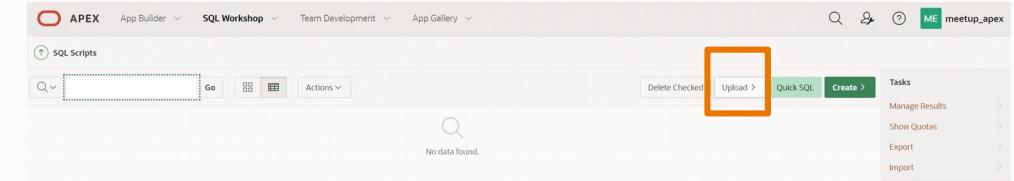
Integrate Oracle Machine Learning with APEX



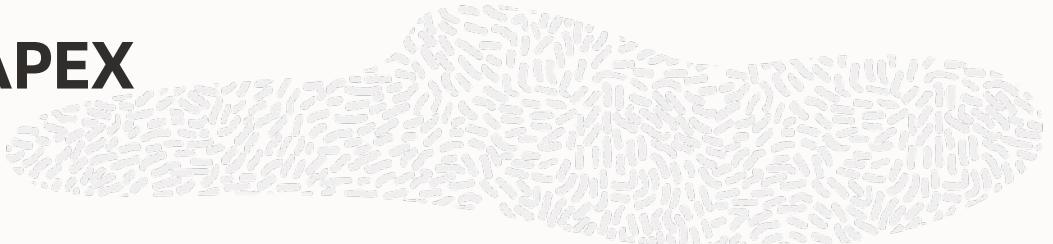
- Navigate to **SQL WORKSHOP** and **SQL SCRIPTS**.



- 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.

The screenshot shows the Oracle APEX interface with the SQL Workshop tab selected. The main area displays a report titled "SQL Scripts". The report includes columns for Edit, Owner, Name, Created, Updated By, Updated, Bytes, Results, and Run. The "Run" column contains a play icon. A red box highlights the play icon for the script named "1_apex_oml_datamodel". A context menu is open over this row, with the "Run" option highlighted by a red box. The menu also includes "Manage Results", "Show Quotas", "Export", and "Import".

Edit	Owner	Name	Created	Updated By	Updated	Bytes	Results	Run
<input type="checkbox"/>	MEETUP_APEX	3_apex_oml_pk	9 seconds ago	MEETUP_APEX	9 seconds ago	9,101	0	(play icon)
<input type="checkbox"/>	MEETUP_APEX	2_apex_oml_pk	34 seconds ago	MEETUP_APEX	34 seconds ago	7,557	0	(play icon)
<input type="checkbox"/>	MEETUP_APEX	1_apex_oml_datamodel	51 seconds ago	MEETUP_APEX	51 seconds ago	1,092	0	(play icon)

The screenshot shows a confirmation dialog titled "Run Script". It contains the following text: "You have requested to run the following script. Please confirm your request." Below this is a table with the following data:

Script Name	1_apex_oml_datamodel
Created	on 06/09/2021 10:39:23 AM by MEETUP_APEX
Updated	on 06/09/2021 10:39:23 AM by MEETUP_APEX
Number of Statements	4
Script Size in Bytes	1,092

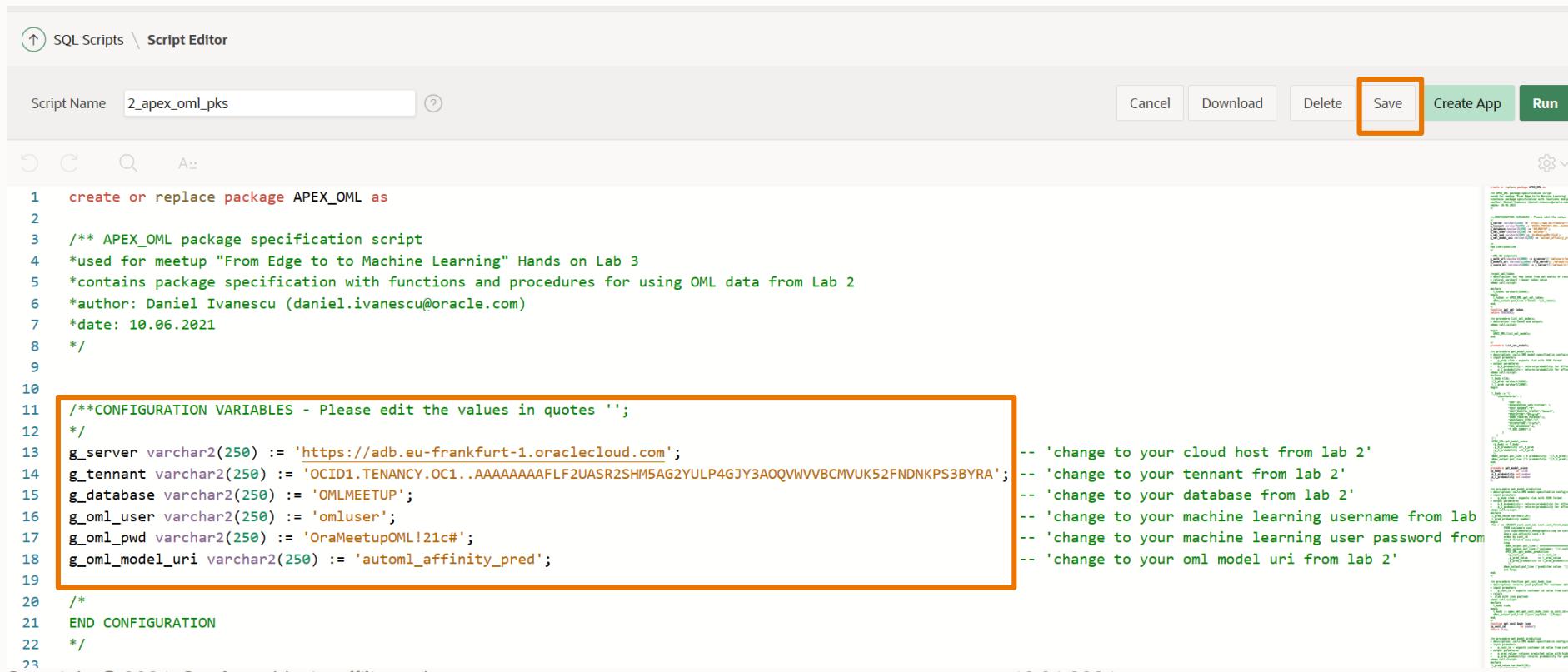
At the bottom right are two buttons: "Cancel" and "Run Now".

Integrate Oracle Machine Learning with APEX



- **Edit script 2_apex_oml_pk. (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.



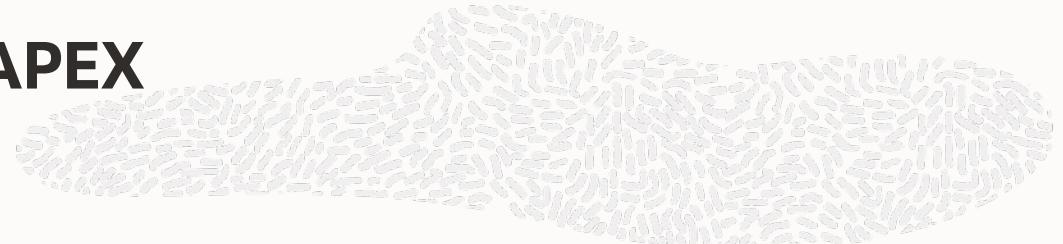
```
SQL Scripts \ Script Editor

Script Name 2_apex_oml_pk
Cancel Download Delete Save Create App Run

1  create or replace package APEX_OML as
2
3  /** APEX_OML package specification script
4  *used for meetup "From Edge to to Machine Learning" Hands on Lab 3
5  *contains package specification with functions and procedures for using OML data from Lab 2
6  *author: Daniel Ivanescu (daniel.ivanescu@oracle.com)
7  *date: 10.06.2021
8  */
9
10
11  /**CONFIGURATION VARIABLES - Please edit the values in quotes ''';
12  */
13  g_server varchar2(250) := 'https://adb.eu-frankfurt-1.oraclecloud.com';
14  g_tenant varchar2(250) := 'OCID1.TENANCY.OC1..AAAAAAAFLF2UASR2SHM5AG2YULP4GJY3AOQVWVVBCMVUK52FNDNKPS3BYRA';
15  g_database varchar2(250) := 'OMLMEETUP';
16  g_oml_user varchar2(250) := 'omluser';
17  g_oml_pwd varchar2(250) := 'OraMeetupOML121c#';
18  g_oml_model_uri varchar2(250) := 'automl_affinity_pred';
19
20  /*
21  END CONFIGURATION
22  */
```

-- 'change to your cloud host from lab 2'
-- 'change to your tenant from lab 2'
-- 'change to your database from lab 2'
-- 'change to your machine learning username from lab 2'
-- 'change to your machine learning user password from lab 2'
-- 'change to your oml model uri from lab 2'

Integrate Oracle Machine Learning with APEX



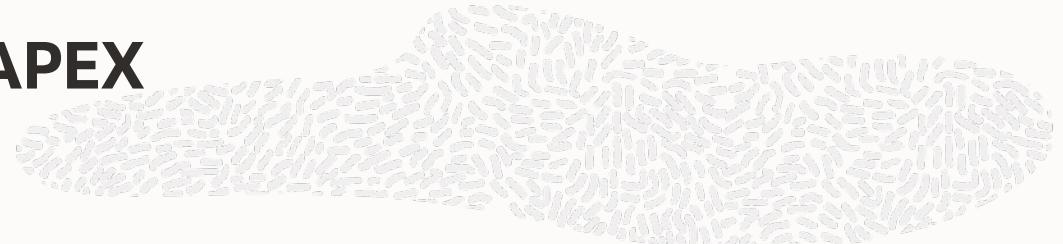
- Sample OML instance configuration:

```
g_server = 'https://adb.eu-frankfurt-1.oraclecloud.com'  
g_tenant = 'OCID1.TENANCY.OC1..AAAAAAAFLF2UASR2SHM5AG2YULP4GJY3AOQVWVVBCMVUK52FNDNKPS3BYRA'  
g_database = 'meetup'  
g_oml_user = 'omluser'  
g_oml_pwd = 'omluser_password'  
g_oml_model_uri = 'automl_affinity_pred'
```

- Run script **2_apex_oml_pk**
- Run script **3_apex_oml_pk** without any changes

Actions	Name	Owner	Created	Updated By	Updated	Bytes	Results	Run
<input type="checkbox"/>	3_apex_oml_pk	MEETUP_APEX	9 seconds ago	MEETUP_APEX	9 seconds ago	9,101	0	
<input type="checkbox"/>	2_apex_oml_pk	MEETUP_APEX	34 seconds ago	MEETUP_APEX	34 seconds ago	7,557	0	
<input type="checkbox"/>	1_apex_oml_datamodel	MEETUP_APEX	51 seconds ago	MEETUP_APEX	51 seconds ago	1,092	0	

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

The screenshot shows the Oracle APEX SQL Workshop interface. The top navigation bar includes links for APEX, App Builder, SQL Workshop (which is selected), Team Development, and App Gallery. On the far right, there are search, filter, and help icons, along with a schema dropdown set to 'MEETUP_'. The main workspace is titled 'SQL Commands' and contains a code editor with the following PL/SQL block:

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

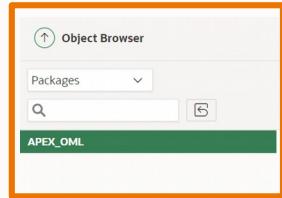
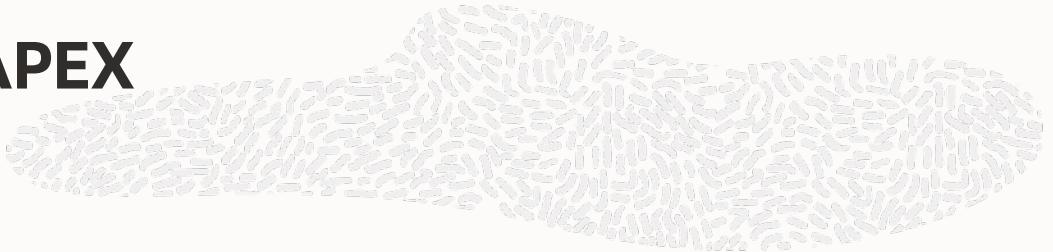
Below the code editor is a results panel. The 'Results' tab is active, showing the output of the executed statement:

```
modelId: ce7582d5-0f93-4340-9c30-2c0343d4e6d9
modelName: autoML_affinity_pred
version: 1.0

Statement processed.
```

At the bottom of the results panel, it indicates the execution time: 13.49 seconds.

Integrate Oracle Machine Learning with APEX

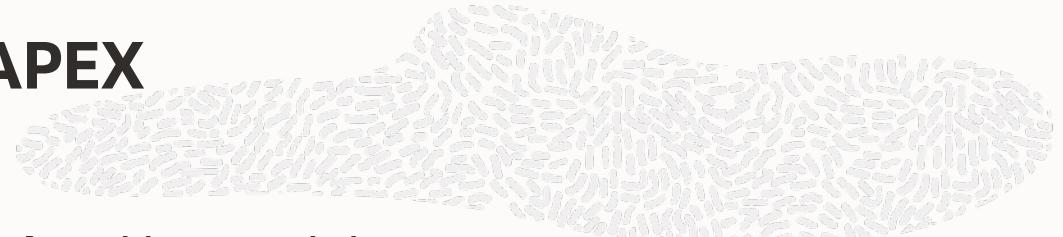


The screenshot shows the Oracle SQL Workshop interface. In the top left, the 'Object Browser' is open, with 'Packages' selected. Below it, a search bar contains 'APEX_OML'. The main panel displays a PL/SQL procedure named 'list_oml_models'. The code uses APEX_WEB_SERVICE to make a REST call to a service, parses the JSON response with apex_json, and prints model parameters. The code is annotated with line numbers from 56 to 94.

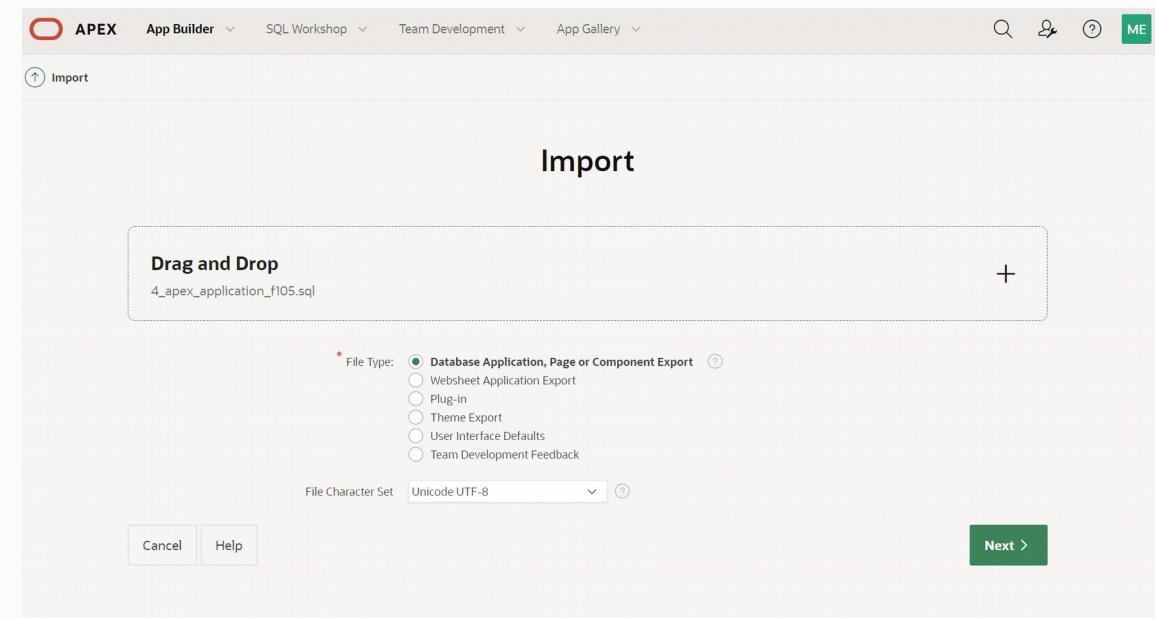
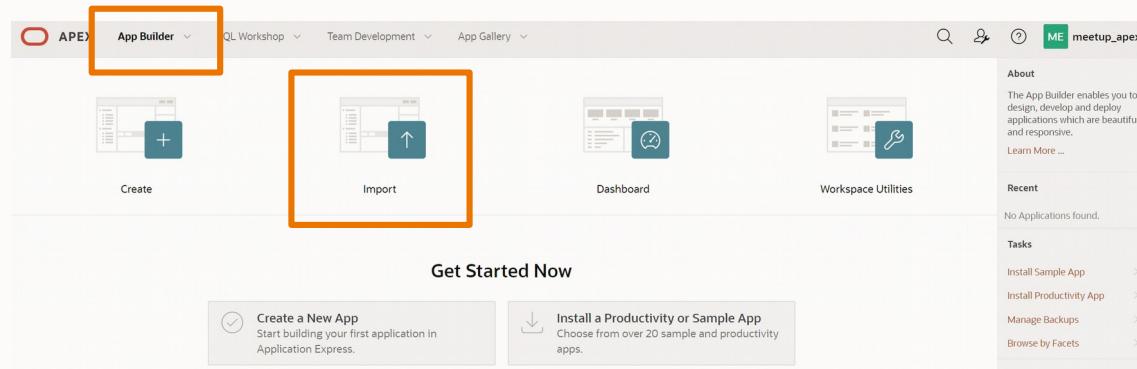
```
56
57
58 procedure list_oml_models
59 is
60   l_token varchar2(32000);
61   l_body clob;
62   l_response clob;
63   l_result varchar2(32000);
64   resp_json apex_json.t_values;
65   l_model_count number;
66   l_model_param varchar2(2000);
67 begin
68   -- get token
69   l_token := APEX_OML.get_oml_token;
70   -- prepare rest call
71   APEX_WEB_SERVICE.g_request_headers.delete();
72   APEX_WEB_SERVICE.g_request_headers(1).name := 'Content-Type';
73   APEX_WEB_SERVICE.g_request_headers(1).value := 'application/json';
74   APEX_WEB_SERVICE.g_request_headers(2).name := 'Authorization';
75   APEX_WEB_SERVICE.g_request_headers(2).value := 'Bearer ' || l_token;
76   -- make rest call
77   l_response:=APEX_WEB_SERVICE.MAKE_REST_REQUEST(
78     p_url          => g_models_url,
79     p_http_method  => 'GET'
80   );
81   -- parse rest response and print model parameters
82   apex_json.parse(resp_json, l_response);
83   l_model_count := apex_json.GET_COUNT (p_path=>'items',p_values=>resp_json);
84   for i in 1..l_model_count
85   loop
86     l_model_param := apex_json.GET_VARCHAR2 (p_path=>'items[%d].modelId',p0=> i,p_values=>resp_json);
87     dbms_output.put_line ('modelId: '||l_model_param);
88     l_model_param := apex_json.GET_VARCHAR2 (p_path=>'items[%d].modelName',p0=> i,p_values=>resp_json);
89     dbms_output.put_line ('modelName: '||l_model_param);
90     l_model_param := apex_json.GET_VARCHAR2 (p_path=>'items[%d].version',p0=> i,p_values=>resp_json);
91     dbms_output.put_line ('version: '||l_model_param);
92   end loop;
93   end list_oml_models;
94
```

- 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 webservicce 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**

Install Database Application

When you install an application having the same ID as an existing application in the current workspace, the existing application is deleted and then replaced by the new application. If you attempt to install an application having the same ID as an existing application in a different workspace, a benign error message displays. If you are importing a Application Express application, the installation wizard will allow you to install supporting objects.

Current Workspace: MEETUP_APEX_WS [?](#)

Export File Workspace ID: 9639908387860335 [?](#)

Export File Application ID: 105 [?](#)

Export File Version: 2020.10.01 [?](#)

Export File Parsing Schema: MEETUP_APEX [?](#)

Application Origin: This application was exported from another workspace. [?](#)

* Parsing Schema: MEETUP_APEX [?](#)

* Build Status: Run and Build Application [?](#)

* Install As Application: Auto Assign New Application ID Reuse Application ID 105 From Export File Change Application ID

> Tasks

[Cancel](#) [Install Application](#)

APEX App Builder SQL Workshop Team Development App Gallery

Export Repository \ Install

✓ Application Installed

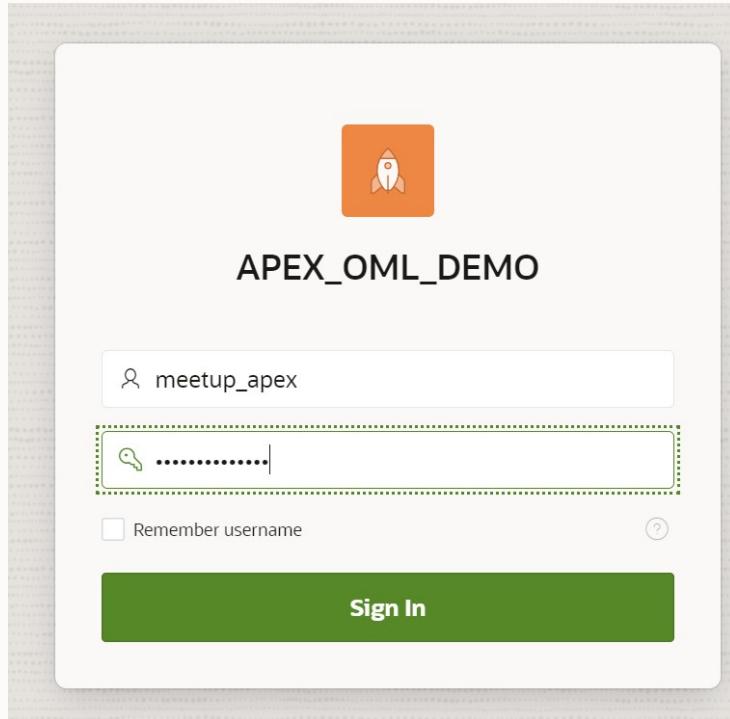
Application 100 successfully installed.
Your imported file is located in the [Export Repository](#). Unless you plan to install it again, you should remove it.

Upgrade Application Edit Application [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

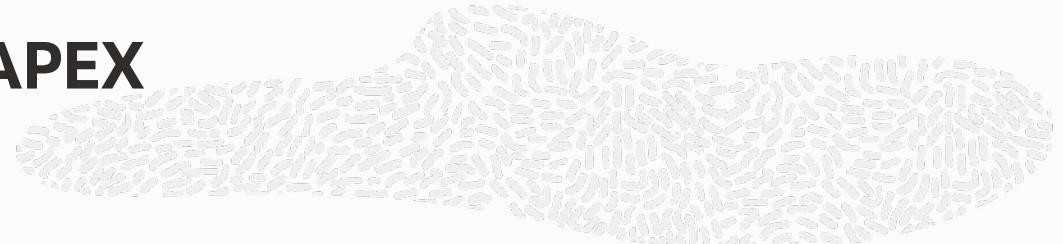


Oracle APEX on Autonomous DB with OML

Get started with :

- Oracle cloud free tier
www.oracle.com/cloud/free
- Oracle Autonomous Database
www.oracle.com/autonomous-database
- Oracle Apex
apex.oracle.com
- Oracle machine learning
www.oracle.com/data-science/machine-learning/

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.

The screenshot shows a web application interface for 'APEX_OML_DEMO'. The top navigation bar has a search field 'meetup_apex'. The left sidebar contains links for 'Home', 'Customers OML', and 'Try OML model' (which is highlighted in green). The main content area has a title 'Try Affinity Card prediction OML model via rest'. It includes a dropdown menu 'Choose customer' set to 'Cole Desai', a button 'Generate oml input', and a code editor showing JSON input:

```
Omni input json
{
  "inputRecords": [
    {
      "AGE": 56,
      "BOOKKEEPING_APPLICATION": 1,
      "CUST_GENDER": "F",
      "CUST_MARITAL_STATUS": "Divorc.",
      "EDUCATION": "Assoc-A",
      "HOME_THEATER_PACKAGE": 1,
      "HOUSEHOLD_SIZE": 2,
      "OCCUPATION": "Cleric",
      "YRS_RESIDENCE": 2,
      "Y_BOX_GAMES": 0
    }
  ]
}
```

Below the input is a 'Get Prediction' button. The results section shows two probability outputs:

Interest	Probability (%)
0 interest in Affinity card	95.5587 %
1 interest in Affinity card	4.4613 %

The bottom of the page shows a footer with 'Release 1.0' and various navigation links: Home, Application 100, Edit Page 3, Session, View Debug, Debug, Page Info, Quick Edit, Theme Roller, and a help icon.

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.

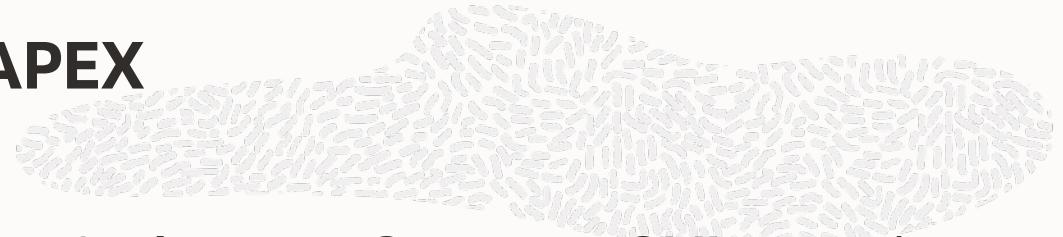
The screenshot shows the Oracle Application Express Page Designer interface. On the left, the navigation pane shows 'Processes' expanded, with 'Get_json' selected. The main area displays the 'Process' configuration for 'Get_json', which is an 'Execute Code' process. The 'Source' section shows the following PL/SQL code:

```
begin
:p3_JSON_BODY := APEX_OML.get_cust_body_json
(p_cust_id => :P3_CUST_ID);
end;
```

- 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
```

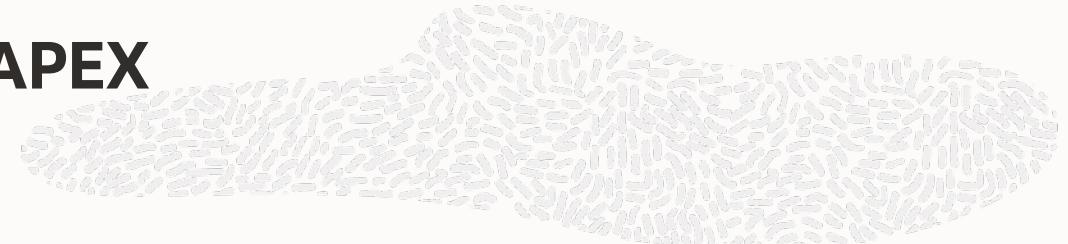
Integrate Oracle Machine Learning with APEX



- 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.

Cust Id	Cust Name	Affinity Card	Prediction	Action
100001	Nicholas Prabu	0		
100002	Kaitlyn Conway	0		
100003	Adriana Shea	0		
100004	Hunter Dowd	0		
100006	Jayden Linoff	0		
100007	Hankil Nicholo	0		
100008	Noah Dosi	0		

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.

Cust Id	Cust Name	Affinity Card	Prediction	Action
100001	Nicholas Prabu	0	0	No action
100002	Kaitlyn Conway	0	1	Push
100003	Adriana Shea	0	0	No action
100004	Hunter Dowd			No action
100006	Jayden Linoff			No action
100007	Hankil Nicholo			No action
100008	Noah Dosi			No action
100010	Brianna Waite			No action
100011	Connor Desai			No action
100015	Hunter Campbell			Push
100014	Dakota Jenson			No action
100015	Uma Linoff			No action
100016	Taylor Wilbur			No action
100017	Adriana Carbery			No action
100018	Nicholas Cackett			No action
100020	Hunter Linoff			No action

Integrate Oracle Machine Learning with APEX



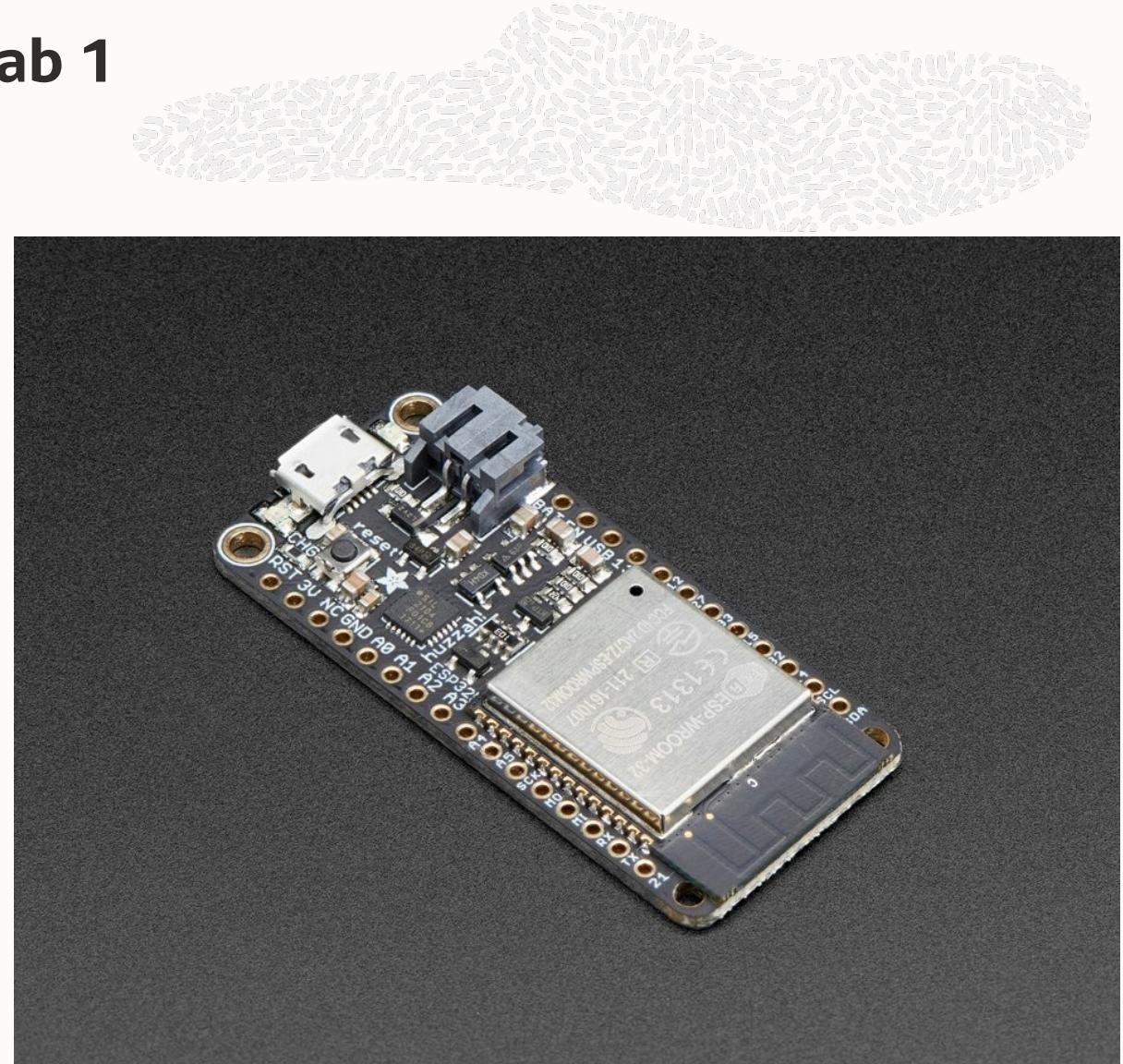
- You can build Oracle Machine Learning Notebooks with SQL and PL/SQL instead of python. This technique is very well described by our colleague Evgeny in the following blog posts :
 - <https://blogs.oracle.com/imc/more-value-for-your-apex-application-with-oracle-machine-learning-in-autonomous-databases-part-1>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

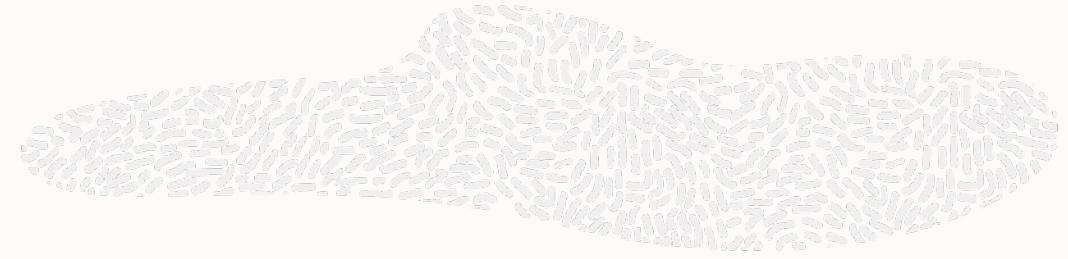
```
create or replace procedure iot_data_fetch
is
  l_clob clob;
  l_batch_id number;
begin
  l_clob := APEX_WEB_SERVICE.MAKE_REST_REQUEST(
    p_url          => 'https://tn1tv18ynzxub:8080/api/v1/sensordata',
    p_http_method  => 'GET',
    p_username      => 'sensordata',
    p_password      => ''
  );

```



The screenshot shows the Oracle Database SQL Workshop interface. The top navigation bar includes 'APEX', 'App Builder', 'SQL Workshop', 'Team Development', and other options. The main area is titled 'SQL Commands' with 'Schema' set to 'MEETUP_APEX'. The language is set to 'SQL' and rows are set to 10. A toolbar with various icons is visible above the command input field. The command input field contains the PL/SQL code for creating a procedure named 'iot_data_fetch'. Below the input field, the 'Results' tab is selected, showing the output: 'Statement processed.' and '0.69 seconds'.

Integrate Arduino sensor data



Object Browser

Procedures

IOT_DATA_FETCH

Code Dependencies Errors REST

Save & Compile Download Source Drop

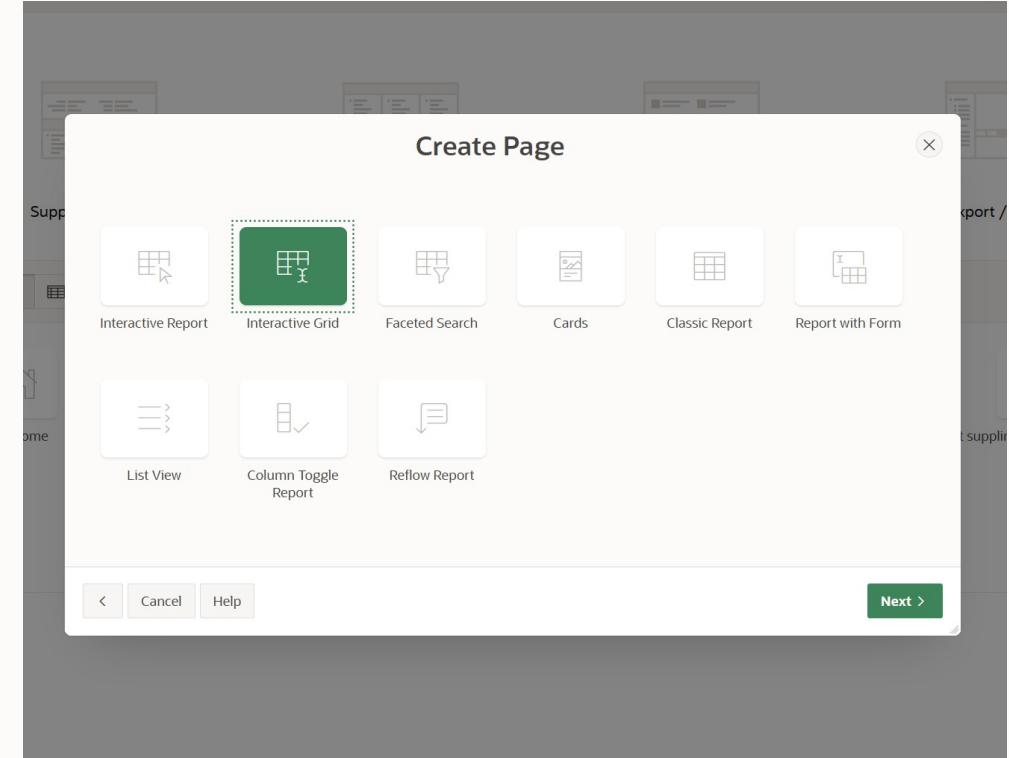
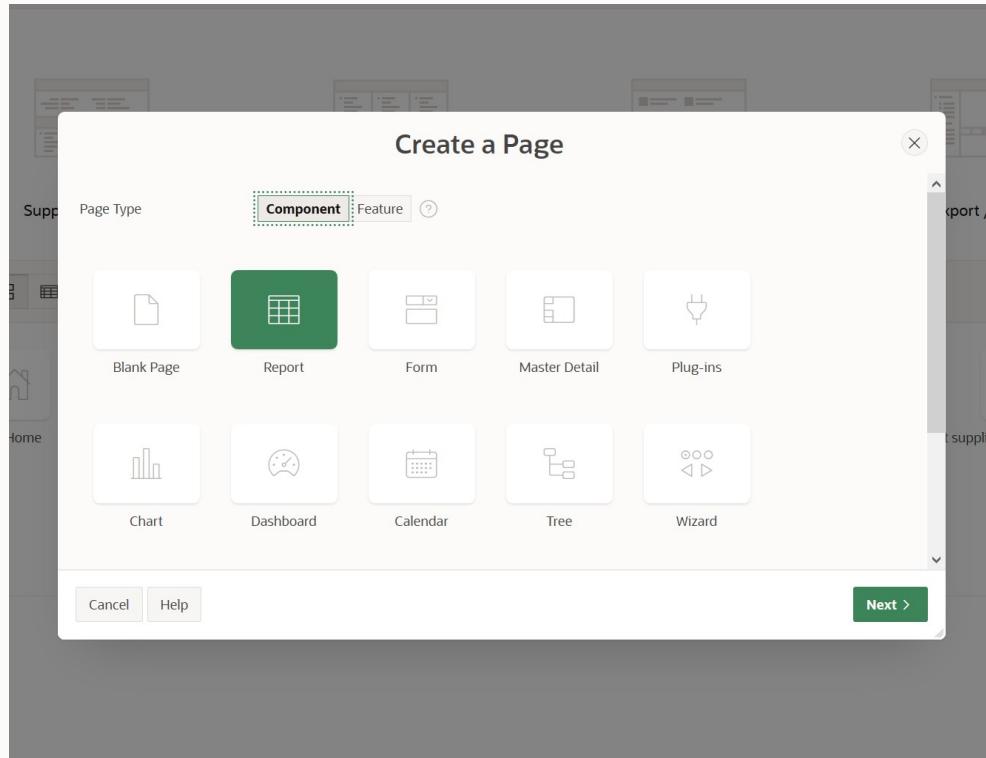
1 create or replace procedure iot_data_fetch
2 is
3 l_clob clob;
4 l_batch_id number;
5 begin
6
7 l_clob := APEX_WEB_SERVICE.MAKE_REST_REQUEST(
8 p_url => 'https://tnitv18ynzxub5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensorapi/soda/latest/iot'
9 ,p_http_method => 'GET'
10 ,p_username => 'sensordata'
11 ,p_password => 'TheSims2IKEA#'
12);
13 insert into iot_raw (json_document) values (l_clob) returning batch_id into l_batch_id;
14
15
16 insert into iot_parsed (batch_id,id,last_modified,created_on,object_name,tempmc,pres,hum,airq)
17 SELECT 1_batch_id as batch_id
18 ,jt.id
19 ,jt.last_modified
20 ,jt.created_on
21 ,jt.object_name
22 ,jt.TempMC
23 ,jt.Pres
24 ,jt.Hum
25 ,jt.AirQ
26 FROM iot_raw,
27 JSON_TABLE(json_document, '\$.items[*]'
28 COLUMNS (id varchar2(255) PATH '\$.id',
29 last_modified timestamp PATH '\$.lastModified',
30 created_on timestamp PATH '\$.created',
31 object_name varchar2(255) PATH '\$.value.objectname',
32 TempMC integer PATH '\$.value.sensordata[0].sensorvalue',
33 Pres integer PATH '\$.value.sensordata[1].sensorvalue',
34 Hum integer PATH '\$.value.sensordata[2].sensorvalue',
35 AirQ integer PATH '\$.value.sensordata[3].sensorvalue'
36)
37)
38 AS jt
39 where iot_raw.batch_id = l_batch_id;
40
41
42 end iot_data_fetch;
43

- 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

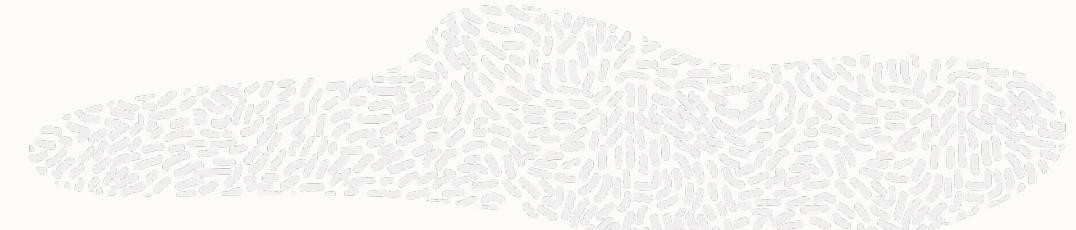


- Let's make our sensor data available in APEX. Navigate to Application builder> app 100
- Click **Create page**. On the 1st step, choose **Report** and on the 2nd step choose **Interactive Grid**.



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.

Create Interactive Grid

Page Attributes

Type: **Interactive Grid**

* Page Number: **9**

* Page Name: **IOT sensor data**

Page Mode: **Normal** Modal Dialog

Breadcrumb: - do not use breadcrumbs on page -

Next >

Create Interactive Grid

Navigation Menu

Navigation Preference:

- Do not associate this page with a navigation menu entry
- Create a new navigation menu entry
- Identify an existing navigation menu entry for this page

* New Navigation Menu Entry: **IOT sensor data**

Parent Navigation Menu Entry: **- No parent selected -**

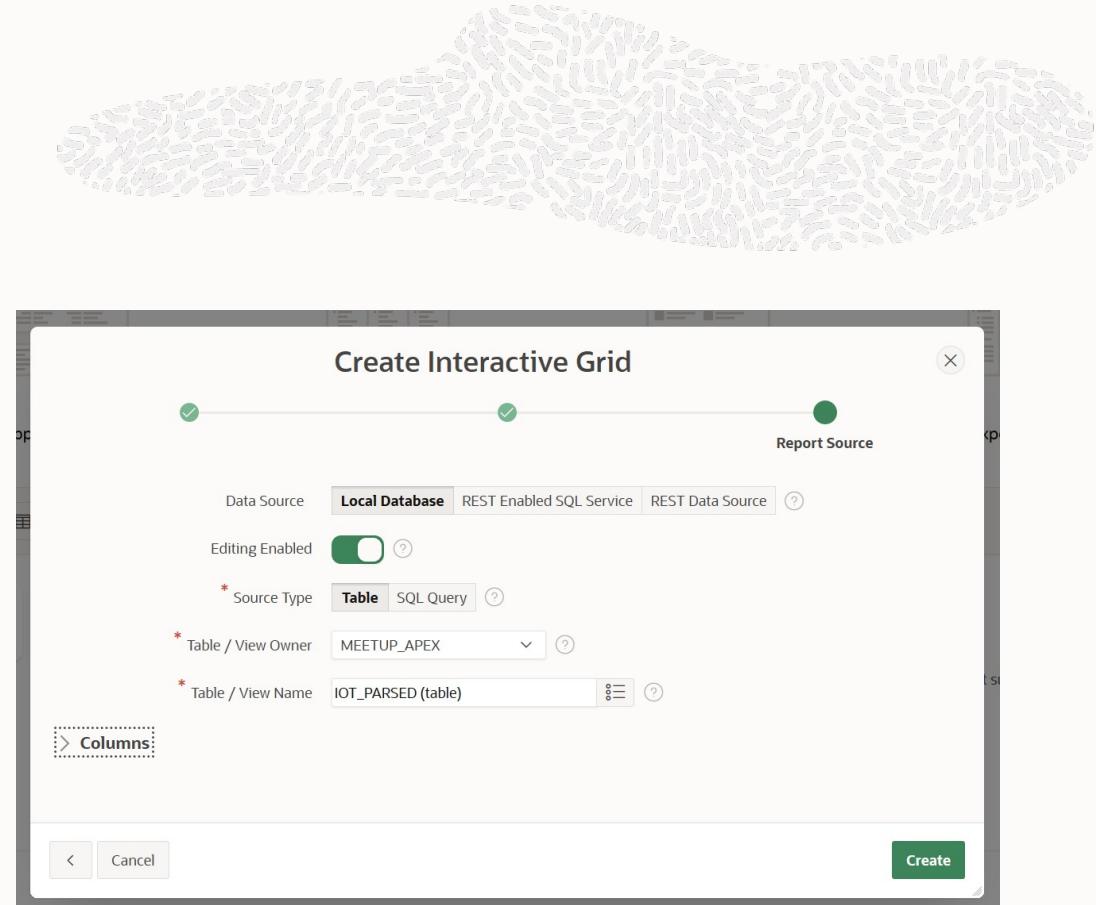
- Home
- Customers OML
- Try OML model

Next >

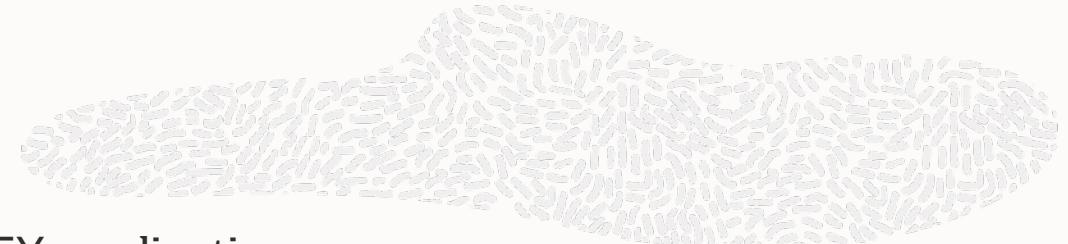
The 'Create Interactive Grid' dialog is shown again, but the focus is on the 'Navigation Menu' section. The 'Create a new navigation menu entry' option is selected. A new menu entry named 'IOT sensor data' is specified. The 'Parent Navigation Menu Entry' dropdown is set to '- No parent selected -' and lists other available menu items: 'Home', 'Customers OML', and 'Try OML model'.

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
<input checked="" type="checkbox"/>	1	00012D66F5A44C2...	6/4/2021	6/4/2021	ESP32:9C80D2AB62...	31227	900	26	132545	
<input type="checkbox"/>	1	000248F4283E4276...	6/7/2021	6/7/2021	ESP32:9C80D2AB62...	32041	1013	38	142506	
<input type="checkbox"/>	1	0003006478BA4BB...	6/4/2021	6/4/2021	ESP32:9C80D2AB62...	31224	1017	26	131501	
<input type="checkbox"/>	1	00034F29C2AD4CD...	6/7/2021	6/7/2021	ESP32:9C80D2AB62...	29976	1013	42	126324	
<input type="checkbox"/>	1	0003B900397D4E9...	5/31/2021	5/31/2021	ESP32:9C80D2AB62...	26420	1013	45	94458	
<input type="checkbox"/>	1	0005CD953A92408...	6/6/2021	6/6/2021	ESP32:9C80D2AB62...	32303	1013	35	107039	
<input type="checkbox"/>	1	000939F0C286402...	6/1/2021	6/1/2021	ESP32:9C80D2AB62...	26453	1021	35	78988	
<input type="checkbox"/>	1	00099AADBAAF432...	6/7/2021	6/7/2021	ESP32:9C80D2AB62...	31621	1013	39	131087	
<input type="checkbox"/>	1	000B0E7E80B345B...	6/1/2021	6/1/2021	ESP32:9C80D2AB62...	28261	1014	25	116127	
<input type="checkbox"/>	1	000C0C97E24A47...	6/16/2021	6/16/2021	ESP32:9C80D2AB62...	23604	889	24	110641	

Oracle Apex look and feel

Apex is responsive by design and highly customizable



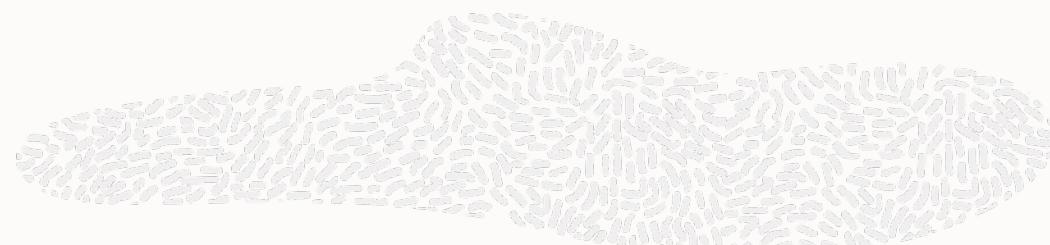
Responsive APEX

- 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.

The screenshot displays two views of an Oracle Apex application, labeled "APEX_OML_DEMO". The top view is a mobile device interface (iPhone X/XS) with a resolution of 375 x 812 and no throttling applied. The bottom view is a desktop browser interface (iPad) with a resolution of 1024 x 768 and a DPR of 2. Both screens show a search bar, a sidebar with filters for "Affinity Card" (0 results) and "Action" (No action, Push, Mention), and a main table titled "Total Row Count 3,428". The table lists customer data with columns: Cust Id, Cust Name, Affinity Card, Prediction, and Action. The desktop view includes developer tools at the bottom, such as Home, Application 100, Edit Page 2, Session, View Debug, Debug, Page Info, Quick Edit, Theme Roller, and Push.

Cust Id	Cust Name	Affinity Card	Prediction	Action
100001	Nicholas Prabu	0	0	No action
100002	Kaitlyn Conway	0	1	Push
100003	Adriana Shea	0	0	No action
100004	Hunter Dowd	0	0	No action
100006	Jayden Linoff	0	0	No action
100007	Hankil Nicholo	0	0	No action
100008	Noah Dosi	0	0	No action
100010	Brianna Waite	0	0	No action
100011	Connor Desai	0	0	No action
100013	Hunter Campbell	0	0	No action
100014	Dakota Jenson	0	0	No action
100015	Uma Linoff	0	0	No action
100016	Taylor Wilbur	0	0	No action
100017	Adriana Carbery	0	0	No action
100018	Nicholas Cackett	0	0	No action
100020	Hunter Linoff	0	1	Push
100021	Cole Cackett	0	1	Push

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

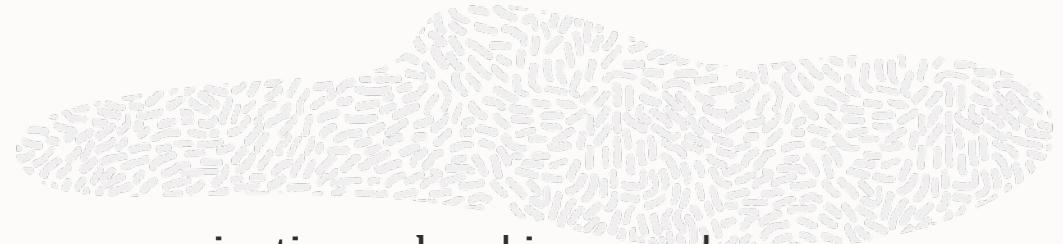
The image displays four side-by-side screenshots of an APEX application named "APEX_OML_DEMO". The application shows a list of customer data with columns for Cust Id, Name, and Action. Each row has a small icon indicating the action type: No action (2,767), Push (384), or Mention (277).

- Dark Theme:** The top navigation bar is dark blue, and the developer toolbar at the bottom is also dark.
- Light Theme:** The top navigation bar is white with a light gray border, and the developer toolbar at the bottom is light gray.
- Redwood Theme (Left):** The top navigation bar is red, and the developer toolbar at the bottom is light gray.
- Redwood Theme (Right):** The top navigation bar is red, and the developer toolbar at the bottom is dark gray.

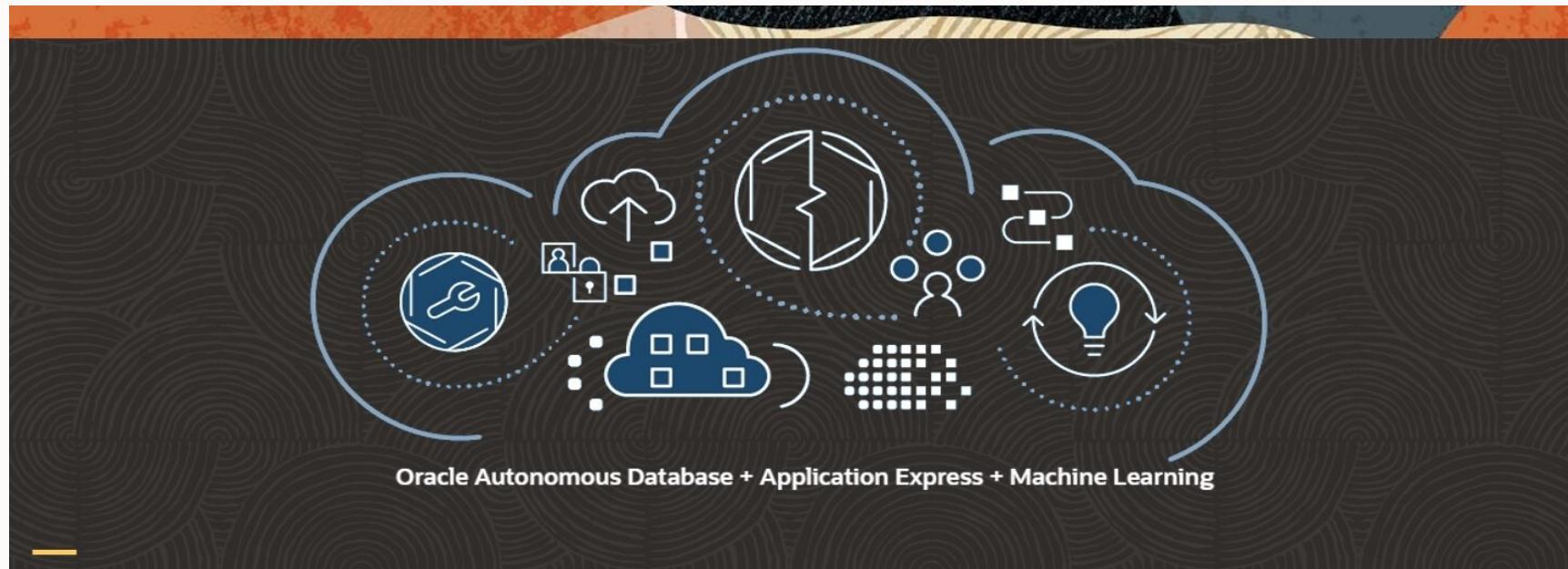
Developer Toolbar (Bottom Right):

- Theme Roller:** A sidebar with "Theme Style" set to "Logo". It includes a "Style" dropdown set to "Vita - Red" and a "Global Colors" section.
- Buttons:** Buttons for "Set as Current" and "Save As".

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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