

Information Integration

Chapter 2. Federated Databases (REST & Web Model)

SIA & SDBIS



Web Model: Web Views and REST Views

Oracle APEX Platform and ORDS Services

Case Study (Review)

- Data Sources
 - SQL: Oracle DB Database 12c/18c/19c/21c,
 - SQL: PostgreSQL 9/10/12,
 - CSV/XLSx: Local FileSystem, Virtual File System (FTP)
 - XML: Local FileSystem or (Web)REST Data Services
 - JSON: Local FileSystem or (Web)REST Data Services
- Data source Access Model
 - External Tables
 - Remote Views
 - SQL Remote Views
 - XML Remote Views
 - REST Remote Views
 - Local Tables (ETL)
- Integration Model
 - Consolidation Views
 - Analytical Views
- Web Model:
 - ORDS REST Views,
 - APEX Reports and Charts

2.2 Architecture and components FDB

- 2.2.1 Federated Database System Concept
- 2.2.2 Data Source Model and Access Components
- 2.2.3 Integration and Analytical Model
- **2.2.4 Integration Web Model**

2.2.4 Integration Web Model with Oracle ORDS & APEX

- 1. Installation of Oracle ORDS and APEX (on ORDS Platform)
 - Install and config ORDS
 - Enable APEX on ORDS-Service as Web Listener.
- 2. REST Data Service Model with ORDS
 - Create REST Services (ORDS) from Oracle Database
 - REST Data Views with ORDS Services
 - Create REST Data Services with APEX
 - REST Data Services with SQL Queries.
- 3. Web Model with Oracle APEX
 - Reporting Pages for Analytical Views
 - Interactive Reports
 - Chart Reports.

1. Installation of ORDS Platform and APEX Environment

- ORDS Platform is the APEX runtime.
- If only the REST Services were needed then:
 - (1a) Install and configure ORDS Platform (standalone mode)
- If both APEX and ORDS services are needed then:
 - (1b) Install and configure APEX into Oracle Database
 - (1a) Install and configure ORDS Platform (standalone mode)
 - (1c) Run APEX on ORDS Platform (standalone mode)



(1a) Install and configure **ORDS** platform

- a1) Create/define ORDS HOME directory, e.g. %ORDS_HOME% could be D:\ORDS
- a2) Create/define ORDS configuration directory, e.g. D:\ORDS\config
- a3) Download **Oracle REST Data services** (aka **ORDS**) kit from [OTN-link](#) and unzip the file into %ORDS_HOME%:
- a4) **First install** and run **ords** app from ORDS_HOME/bin and follow command line instructions:
 - Change current directory to %ORDS_HOME% directory:
 - CD %ORDS_HOME%/bin (replace %ORDS_HOME% with actual ORDS path)
 - ords --config %ORDS_HOME%/config install
 - e.g.: ords --config ../config install
- a5) **Launch** ORDS runtime in standalone mode:
 - **ords --config %ORDS_HOME%/config serve**
 - e.g. **ords --config ../config config**

ORDS Interactive Install Log (1)

Oracle REST Data Services - Interactive Install

Enter a number to select the database connection type to use

[1] Basic (host name, port, service name)

[2] TNS (TNS alias, TNS directory)

[3] Custom database URL

Choose [1]:

Enter the database host name [**localhost**]:

Enter the database listen port [**1521**]:

Enter the database service name [**XEPDB1**]:

Provide database user name with administrator privileges.

Enter the administrator username: **SYS**

Enter the database **password** for SYS AS SYSDBA:

ORDS Interactive Install Log (2)

Retrieving information.

Enter a number to update the value or select option A to Accept and Continue

[1] Connection Type: Basic

[2] Basic Connection: **HOST=localhost PORT=1521 SERVICE_NAME=XEPDB1**

Administrator User: SYS AS SYSDBA

[3] Database password for ORDS runtime user (ORDS_PUBLIC_USER): <generate>

[4] Additional Feature: Database Actions

[5] Configure and start ORDS in Standalone Mode: Yes

[6] Protocol: **HTTP**

[7] HTTP Port: **8080**

[8] APEX static resources location:

[A] Accept and Continue - Create configuration and Upgrade ORDS in the database

[Q] Quit - Do not proceed. No changes

Choose [A]: A

Install and configure ORDS platform: DEBUG

- Optional - IF the ORDS installation fail or some other problems:
 - to re-configure server
 - `ords --config %ORDS_HOME%/config config`
 - e.g. `ords --config ../config config`
 - to run a second installation - if the first install will fail
 - Uninstall:
 - `ords --config %ORDS_HOME%/config uninstall`
 - Re-install:
 - `ords --config %ORDS_HOME%/config install`
- Finally re-launch ORDS runtime in standalone mode:
 - `ords --config %ORDS_HOME%/config serve`
 - e.g. `ords --config ../config config`

(1b) Install and configure **APEX** into the Oracle Database

- b1) Download APEX from [OTN Link](#)
- b2) Unzip APEX kit into a dedicated folder (e.g D:\) so that %APEX_HOME% could be D:\apex
 - (the apex-latest.zip contains an internal *apex folder*)
- b3) Run installation procedure scripts:
 - CD %APEX_HOME% - replace APEX_HOME with the actual apex path.
 - Run apex installation SQL scripts from SQLPLUS /nolog.

(1b) Install and configure **APEX** into Oracle Database

- b3) Run installation procedure scripts from SQLPLUS
 - 1) Connect to SQLPLUS
 - sqlplus /nolog
 - connect sys as sysdba
 - (for Oracle CDB context switch to a PDB)
 - **ALTER SESSION SET container = XEPDB1;**
 - 2) Run installation script
 - **@apexins** SYSAUX SYSAUX TEMP /i/
 - 3) Set APEX admin account credentials
 - **@apxchpwd**
 - Username(default): ADMIN
 - 4) Unlock and update Oracle **APEX_PUBLIC_USER** use account:
 - ALTER USER APEX_PUBLIC_USER ACCOUNT UNLOCK;

(1b) Install and configure **APEX** into Oracle Database

- b3) Run installation procedure scripts from SQLPLUS
 - 5) Enable **APEX REST services** for ORDS integration (to enable REST data schema and/or structure from APEX REST module) by running the @apex_rest_config script
 - Run @**apex_rest_config**
 - **6) Set APEX static resource directory (with images) for ORDS integration**
 - Open and edit ORDS platform configuration file
%ORDS_HOME%/config/global/**settings.xml**
 - Add the following configuration line (replace %APEX_HOME% with actual apex directory, e.g. D:\apex):
 - **<entry key="standalone.static.path">%APEX_HOME%/images/</entry>**

(1c) Run Oracle **APEX** on ORDS Platform

- Launch **ORDS platform** in standalone mode:
 - `ords --config %ORDS_HOME%/config serve`
 - e.g.: `ords --config ../config config`
 - ORDS path (from generic URL <http://localhost:8080/ords/>)
 - http://localhost:8080/ords/_/landing
- **APEX URLs** from ORDS (default port: 8080):
 - <http://localhost:8080/ords/apex>
 - http://localhost:8080/ords/apex_admin
- See 3.1 section (from this tutorial) to configure an Workspace and a developer APEX user to access APEX development mode.

Problems with installation and configuration of ORDS and APEX

- **ORDS Platform** Installation “problematic” steps:
 - Setup configuration location [Enter the location to store configuration data]
 - [%ORDS_HOME%]\config
 - If the installation home is in a CDB Context (Container Database Context is default for 18c, 19c, 21c) then ORDS must be installed in a pluggable-database and not in the main container, then in the step:
 - **Enter the Database Service Name**: enter PDB container name (e.g. XEPDB1)
 - APEX URL from ORDS (default port: 8080):
 - <http://localhost:8080/ords/apex>

[Installation Guide Latest](#)



Problems with installation and configuration of ORDS and APEX

- APEX Installation problems

- If the installation home is in a CDB Context (Container Database Context is default for 18c, 19c, 21c) then APEX (and ORDS) must be installed in a pluggable-database and not in the main container: launch SQL*PLUS with SYS user and switch to a pluggable db:

```
sqlplus /nolog
connect sys as sysdba
ALTER SESSION SET container = XEPDB1;
```

- Check Oracle Service ORCL (Oracle Instance) to be started in OS Services console.

[Installation Guide Latest](#)



Problems with installation and configuration of ORDS and APEX

- APEX on ORDS Installation problems

- Remember APEX user password
- Check APEX users - check if status is OPEN and not expired:
 - APEX_PUBLIC_USER
 - ALTER USER APEX_PUBLIC_USER ACCOUNT UNLOCK;
 - ALTER USER APEX_PUBLIC_USER ACCOUNT IDENTIFIED BY *new_password*;
 - APEX_REST_PUBLIC_USER
 - ORDS_PUBLIC_USER
- Check configuration file: %ORDS_HOME%/config/global/**settings.xml**
 - <entry key="standalone.http.port">8080</entry>
 - <entry key="standalone.context.path">/ords</entry>
 - <entry key="standalone.static.path">%APEX_HOME%/images/</entry>

2. WEB REST Data Service Model with ORDS

- Oracle REST Data Services (ORDS) for Oracle Database
 - REST Data Views with ORDS Services
 - REST Data Services with APEX (first see section 3.1)
 - REST Data Services with SQL Queries



Create REST Services from Oracle Database (ORDS)

- Oracle REST Services (ORDS) into Oracle Database: publishing REST Data Views with ORDS Services
 - Enable REST services for Oracle schema with `ORDS.ENABLE_SCHEMA`
 - Enable SQL-Table/View as REST-Resource with `ORDS.ENABLE_OBJECT`



Publish SQL-View as REST Resource

STEP_1: http://localhost:8080/ords/fdbo/invoices_agg/

```
BEGIN
    ORDS.ENABLE_SCHEMA(p_enabled => FALSE);
    ORDS.drop_rest_for_schema();
    commit;
END;
/
```

```
BEGIN
    ORDS.ENABLE_SCHEMA(p_enabled => TRUE,
        p_schema => 'FDBO',
        p_url_mapping_type => 'BASE_PATH',
        p_url_mapping_pattern => 'fdbbo',
        p_auto_rest_auth => FALSE);

    commit;

END;
/
```

Publish SQL.View as REST Resource

STEP_2: http://localhost:8080/ords/fdbo/invoices_agg/

```
BEGIN
```

```
ORDS.ENABLE_OBJECT(p_enabled => TRUE,  
                    p_schema => 'FDBO',  
                    p_object => 'INVOICES_AGG_VIEW',  
                    p_object_type => 'VIEW',  
                    p_object_alias => 'invoices_agg',  
                    p_auto_rest_auth => FALSE);
```

```
commit;
```

```
END;
```

```
/
```



URL(endpoint) for a RESTful Resource

- ORDS base URL
 - `http://localhost:8080/ords`
- Schema context
 - `/fdbo`
- Object alias
 - `/invoices_agg`

`http://localhost:8080/ords/fdbo/invoices_agg/`



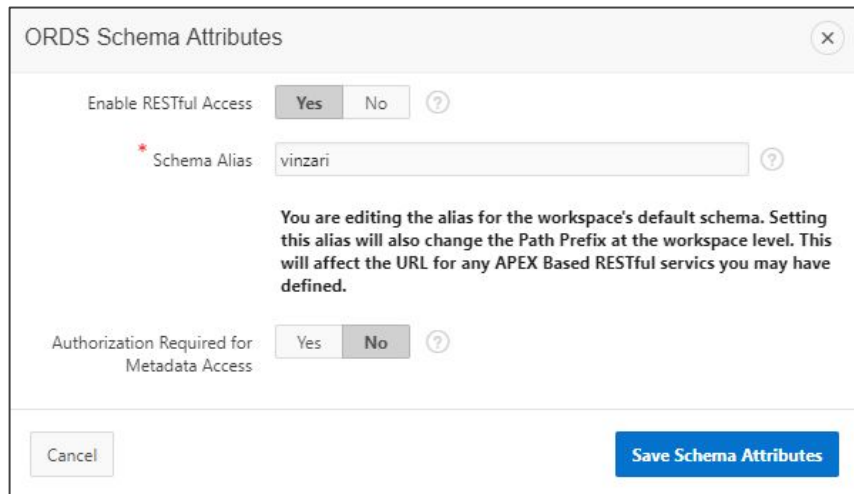
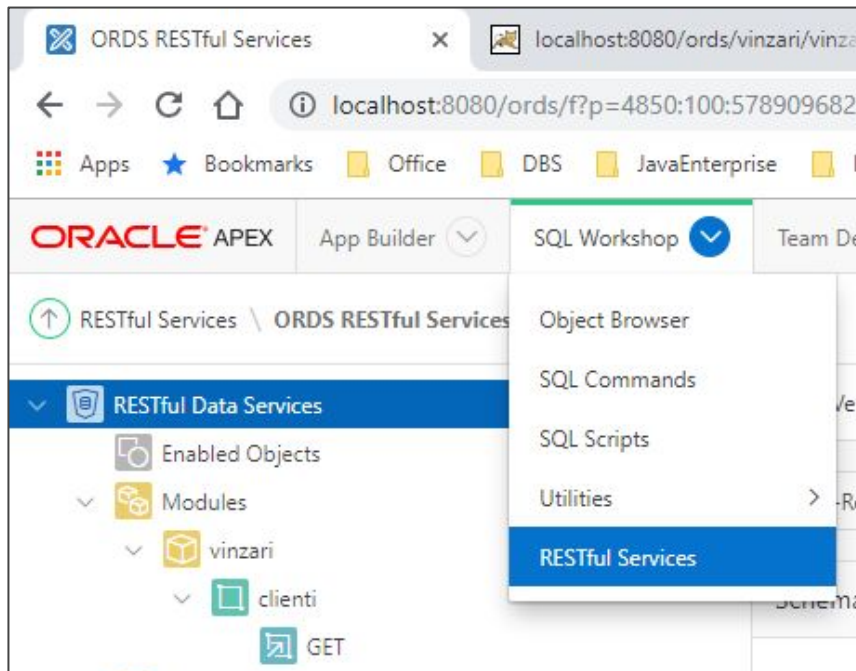
Create REST Data Services from APEX

- Enable Restful Services
- Create REST Data Services with APEX from (local) SQL-Queries
- (Optional) REST Enabled SQL option of APEX



APEX Restful Services

- Enable APEX support from APEX SQL Workshop module and RESTful Services Option



APEX Restful Services

RESTful Services \ ORDS RESTful Services \ Modules \ **Module Definition** Schema VINZARI

RESTful Data Services

- Enabled Objects
- Modules**
 - vinzari
 - Privileges
 - Roles

ORDS Module Definition Cancel Create Module

* Module Name

* Base Path

* Is Published Yes No ?

* Pagination Size ?

Origins Allowed

Comments

Step_1: Create Module definition

ORDS Module Definition

*

Module Name

datasources

?

*


Base Path

/ds/

?

Full URL

http://localhost:8080/ords/fdbo/ds/



*

Is Published

Yes

No

?

*

Pagination Size


25

?

Origins Allowed

?

Comments



Step_2: Create Template definition

ORDS Template Definition

RESTful Service Module

datasources

Module Base Path

/ds/

*

URI Template

?

Full URL

http://localhost:8080/ords/fdbo/ds//customers



*

Priority

?

*

HTTP Entity Tag Type

?

Comments

Step_3: Create Handler definition with Source Type Query

ORDS Handler Definition

RESTful Service Module

datasources

Module Base Path

/ds/

URI Template

/customers

Full URL

http://localhost:8080/ords/fdbo/ds//customers

* Method

GET

* Source Type

Query

Format

JSON

Pagination Size


Comments

Source

1

`select * from customers_view`

Step_3: Access REST Data Services URL

ORDS Handler Definition	
RESTful Service Module	datasources
Module Base Path	/ds/
URI Template	/customers
Full URL	http://localhost:8080/ords/fdbo/ds//customers 



CASE STUDY: Oracle REST Data Services

Case Study: Oracle REST Data Services Configuration from SQL Developer

- SQL Script Examples:
 - [32_FDBO_REST_WebViews.sql](#)



3. Oracle APEX Web Model

- Workspace management in Admin Mode
- Create Starter Web Application in Development Mode
- Analytical Reports with Interactive Grids
- Analytical Charts



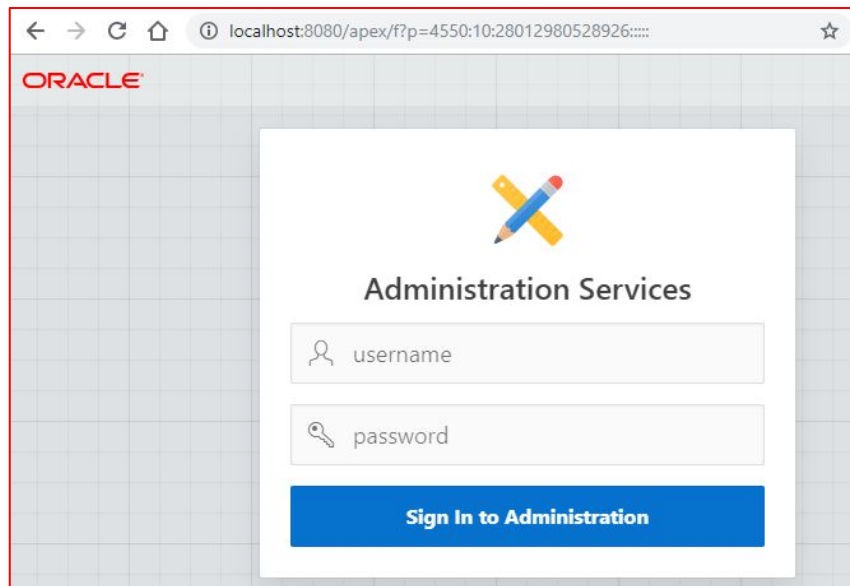
3.1 Workspace management in Admin Mode

- Prerequisites
 - Existing database schema: FDBO



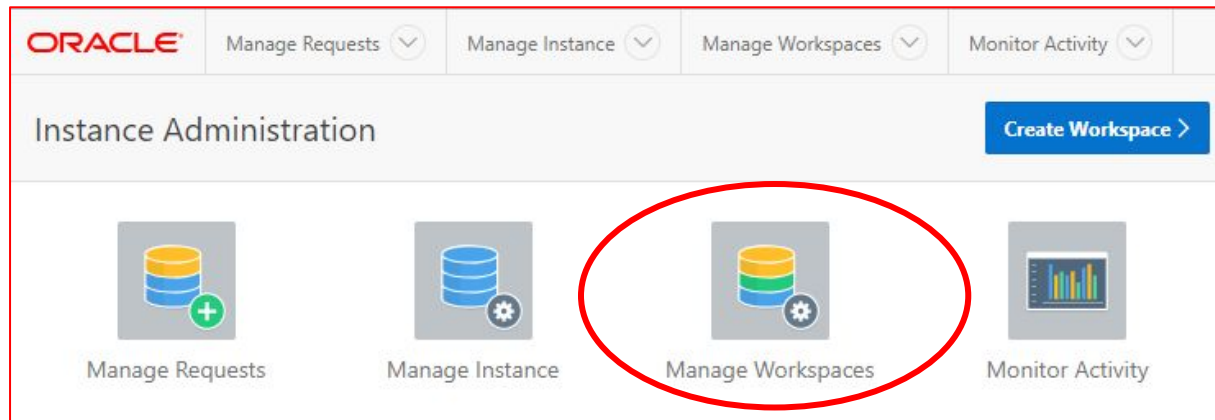
ADMIN Mode: Instance Administration

- Login page from URL: http://localhost:8080/apex/apex_admin requires:
 - administration account username: admin;
 - password settled with *apxchpwd* script (see previous slides).



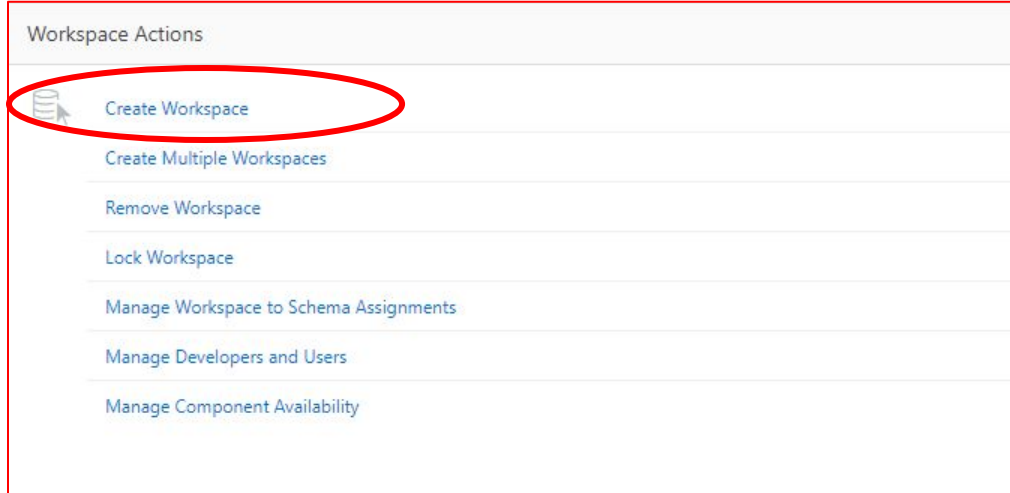
Apex Instance Administration

- The necessary settings in order to activate the “Development Mode” will be made from *Manage Workspace* option.



Apex Instance Administration

- From *Manage Workspace* page the *Create Workspace* flow has to be started.



Apex Instance Administration

- The assisted process flow (working as an wizard) will guide you through a sequence of steps.
- *The first step* requires the name for the new development workspace.

The screenshot shows the 'Create Workspace' wizard interface. At the top, there is a breadcrumb trail: 'Manage Workspaces > Create Workspace'. The main title is 'Create Workspace'. Below the title is a progress bar with four steps; the first step, 'Identify Workspace', is highlighted with a blue dot. The form contains three fields: 'Workspace Name' (required, indicated by an asterisk) with the value 'development', 'Workspace ID', and 'Workspace Description' (a text area). Each field has a help icon (question mark). At the bottom left is a 'Cancel' button, and at the bottom right is a 'Next >' button. Below the form, there is a 'Tasks' section with a link 'Create Multiple Workspaces'.

Manage Workspaces > Create Workspace

Create Workspace

Identify Workspace

* Workspace Name ?

Workspace ID ?

Workspace Description

Tasks

[Create Multiple Workspaces](#)

Cancel Next >

Create Workspace Workflow

Step-by-step Sequence

Step #	Parameter (field)	Value
Step 1 <i>Identify workspace</i>	Workspace name	<i>fdbo</i>
Step 2 <i>Identify schema</i>	Re-use existing schema?	<i>Yes</i>
	Schema name	<i>fdbo</i>
Step 3 <i>Identify administrator</i>	Administrator username	<i>developer</i>
	Administrator password	<i>*****</i>
	Email	<i>developer@org.com</i>
Step 4 <i>Confirm request</i>	Create Workspace	<i>action</i>

3.2 Create Starter Web Application in Development Mode

- Prerequisites
 - Existing database schema: FDBO
 - Existing workspace: FDBO
 - Existing admin/dev user in workspace: developer

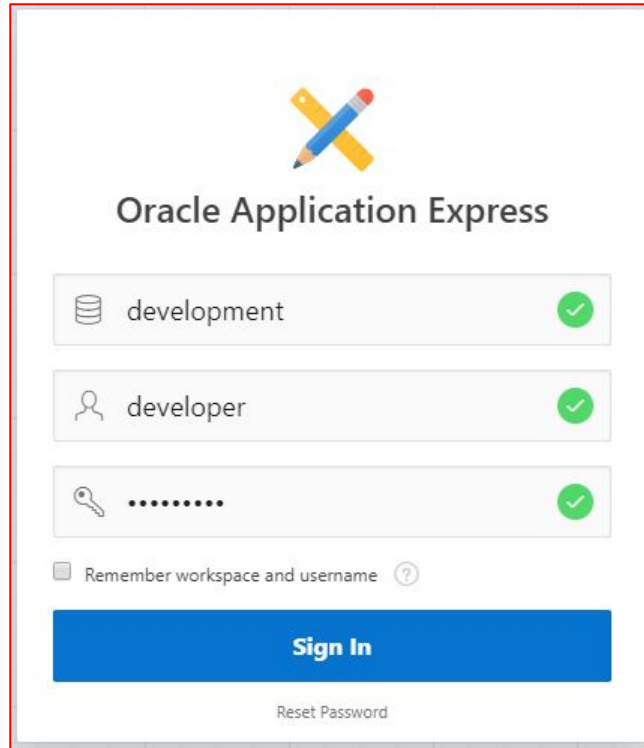


APEX Development Mode

- The home page [<http://localhost:8080/apex>] accessible from web browser starts with a login dialog where has to be entered:
 - Development workspace name: *fdbo*
 - Development workspace username: *developer*
 - Developer user password: *developer*



<http://localhost:8080/apex>



The image shows the Oracle Application Express (APEX) login page. At the top, there is a logo consisting of two crossed pencils, one yellow and one blue. Below the logo, the text "Oracle Application Express" is displayed. The login form contains three input fields: the first is labeled "development" with a database icon and a green checkmark; the second is labeled "developer" with a person icon and a green checkmark; the third is a password field with a key icon, masked dots, and a green checkmark. Below these fields is a checkbox labeled "Remember workspace and username" with a question mark icon. A large blue "Sign In" button is positioned below the checkbox. At the bottom, there is a link for "Reset Password".

Oracle Application Express

development ✓

developer ✓

..... ✓

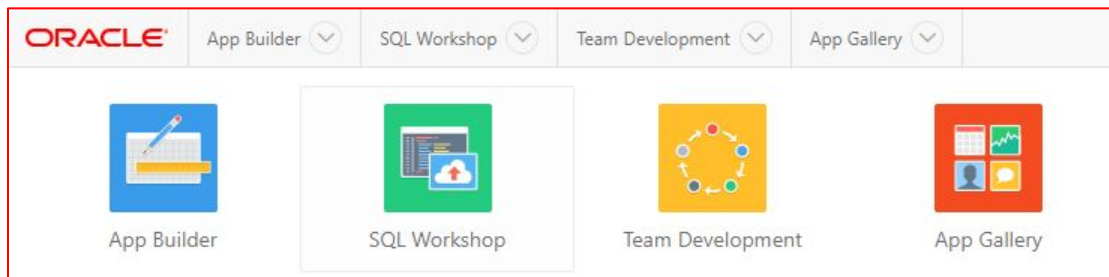
☐ Remember workspace and username ?

Sign In

[Reset Password](#)

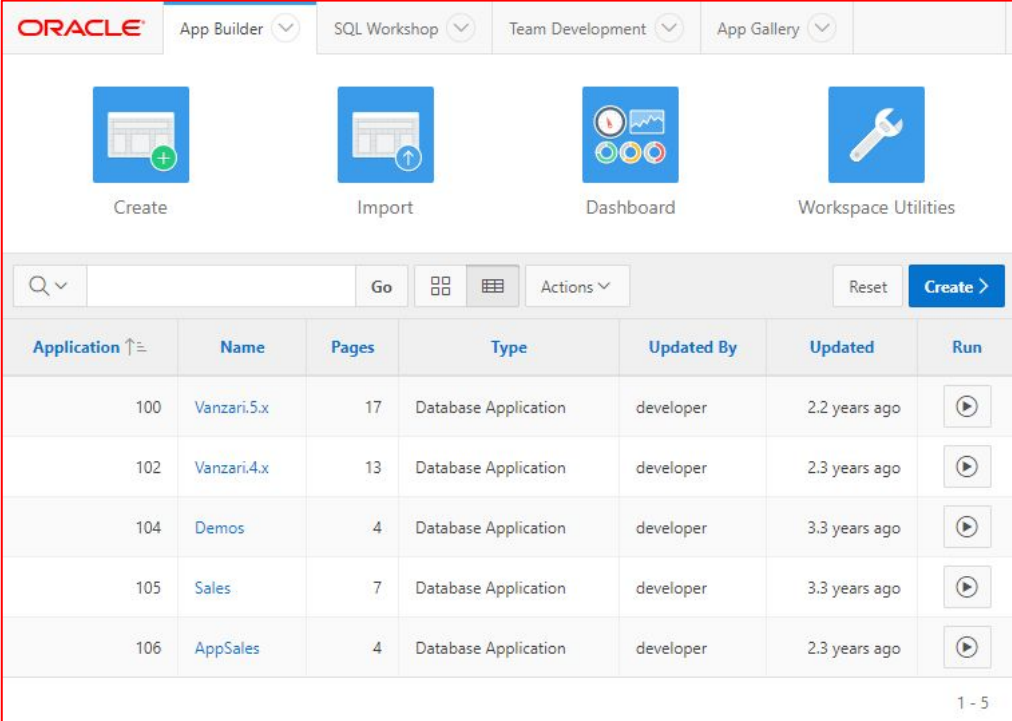
Apex Development

- The starting page for *developer* user (which also owns the administrator role of the workspace) will display several sections (and menus) for: APEX-apps creation, database SQL object creation, teamwork coordination and APEX-apps administration.
- **Application Builder** module allows the access to the actual declarative and visual development environment.



Apex Development

- *Create* button of the Application Builder will start the creational flow guided by the corresponding wizard through the step-by-step sequence that will finally conclude with the first application containing the default login and start pages.



The screenshot displays the Oracle APEX Application Builder interface. At the top, there are navigation tabs: ORACLE, App Builder (selected), SQL Workshop, Team Development, and App Gallery. Below the tabs, there are four main action buttons: Create (with a plus icon), Import (with an up arrow icon), Dashboard (with a gauge icon), and Workspace Utilities (with a wrench icon). Below these buttons is a search bar with a magnifying glass icon, a 'Go' button, and a grid/list toggle. To the right of the search bar are 'Reset' and 'Create >' buttons. Below the search bar is a table listing existing applications.

Application ↑	Name	Pages	Type	Updated By	Updated	Run
100	Vanzari.5.x	17	Database Application	developer	2.2 years ago	
102	Vanzari.4.x	13	Database Application	developer	2.3 years ago	
104	Demos	4	Database Application	developer	3.3 years ago	
105	Sales	7	Database Application	developer	3.3 years ago	
106	AppSales	4	Database Application	developer	2.3 years ago	

1 - 5

3.3 APEX Analytical Reports

- Prerequisites
 - Existing database schema: FDBO
 - Existing workspace: FDBO
 - Existing admin/dev user in workspace: developer
 - Existing starter application.
- APEX Region Types useful for analytical applications:
 - Classic Report
 - Interactive Report (legacy)
 - **Interactive Grid.**



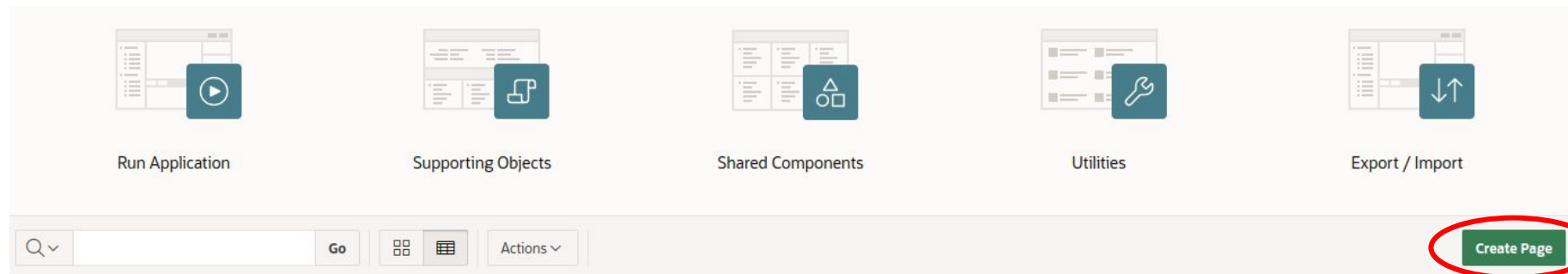
APEX Web Model

- Define and Analytical Application with:
 - Integration/consolidation view reports
 - OLAP Dimensional view reports
 - OLAP Factual view reports
 - Analytical Pages
 - OLAP Aggregation View Reports
 - Other Analytical Query Reports and charts.



Create AR Page: Interactive Grid Container

- Create New Page:
 - From APEX Application Builder
 - Select <Create Page> Action (button).

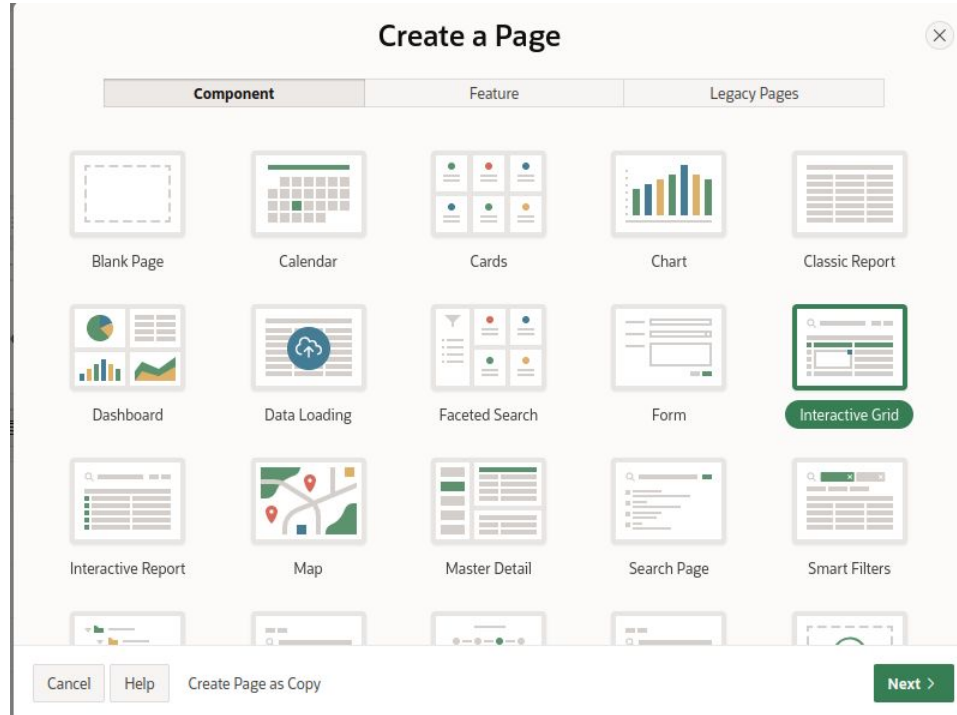


Create Page with Interactive Grid Workflow

Step-by-step Sequence

Step #	Parameter (field)	Value
Step 1 <i>Select Page/Region Type</i>	Component	<i>Interactive Grid</i>
Step 2 <i>Create Interactive Grid</i>	Page Definition: Name	<i>OLAP_FACTS_SALES_AMOUNT_WebView</i>
	Data Source: Source Type	<i>SQL Query</i>
	Data Source: Enter SQL SELECT Statement	<i>SELECT CUST_ID, PRODUCT_CODE, INVOICE_DATE, SALES_AMOUNT FROM OLAP_FACTS_SALES_AMOUNT</i>
	Navigation: Parent Navigation Menu Entry	<i>Integration Web Views</i>
Step 4 <i>Confirm request</i>	Create Page	<i>Action <Create Page></i>

Step 1: Select Page/Region Type



Step 2: Create Interactive Grid

Create Interactive Grid

Page Definition

* Page Number

14

* Name

OLAP_FACTS_SALES_AMOUNT_WebVie

Page Mode

Normal

Modal Dialog

Include Form Page

Data Source

Data Source

Local Database

REST Enabled SQL Service

REST Data Source

Source Type

Table

SQL Query

* Enter a SQL SELECT statement

1

SELECT CUST_ID, PRODUCT_CODE, INVOICE_DATE, SALES_AMOUNT

2

FROM OLAP_FACTS_SALES_AMOUNT

<

Cancel

Create Page

Step 2: Create Interactive Grid

Create Interactive Grid

Editing Enabled ☐

Navigation

Use Breadcrumb ☒

Breadcrumb Parent Entry

Use Navigation ☒

Navigation Preference

Create a new entry

Parent Navigation Menu Entry

- No parent selected -

- No parent selected -

Home

Data Sources WebViews

... (PRODUCTS_WebVIEW)

Integration WebViews

... (Customer-Locations Dimension WebView)

... (Consolidated Sales WebView)

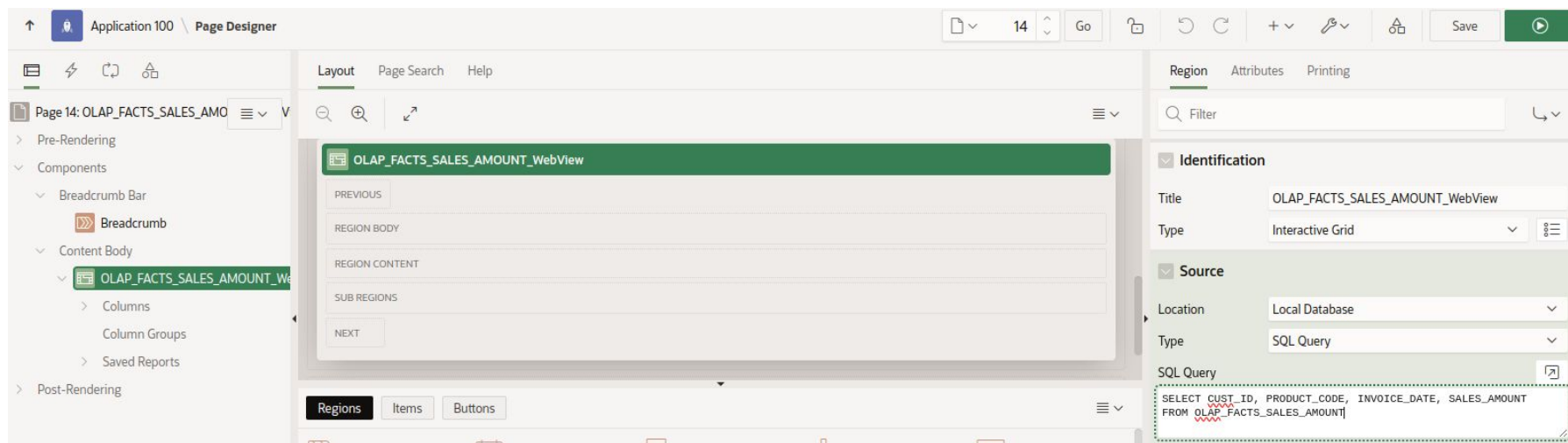
Analytical WebViews

Icon

< Cancel

Create Page

Interactive Grid Page Designer



Interactive Grid Page Runtime

FDBO.OLAP.WebApp

fdbo

Home

Data Sources WebViews

Integration WebViews

Customer-Locations Dimension ...

Consolidated Sales WebView

OLAP_FACTS_SALES_AMOUNT_...

Analytical WebViews

OLAP_FACTS_SALES_AMOUNT_WebView

Search: All Text Columns

Go

Actions

Reset

Cust Id	Product Code	Invoice Date	Sales Amount
1001	3001	7/1/2023	11935
1001	3003	7/1/2023	17050
1001	3005	7/1/2023	72600
1002	3002	7/7/2023	330
1002	3004	7/7/2023	275
1001	3004	7/1/2023	1650
Total 6			

3.4 APEX Analytical Charts

- Prerequisites
 - Existing database schema: FDBO
 - Existing workspace: FDBO
 - Existing admin/dev user in workspace: developer
 - Existing starter application.
- APEX Region Types for analytical applications:
 - Chart.

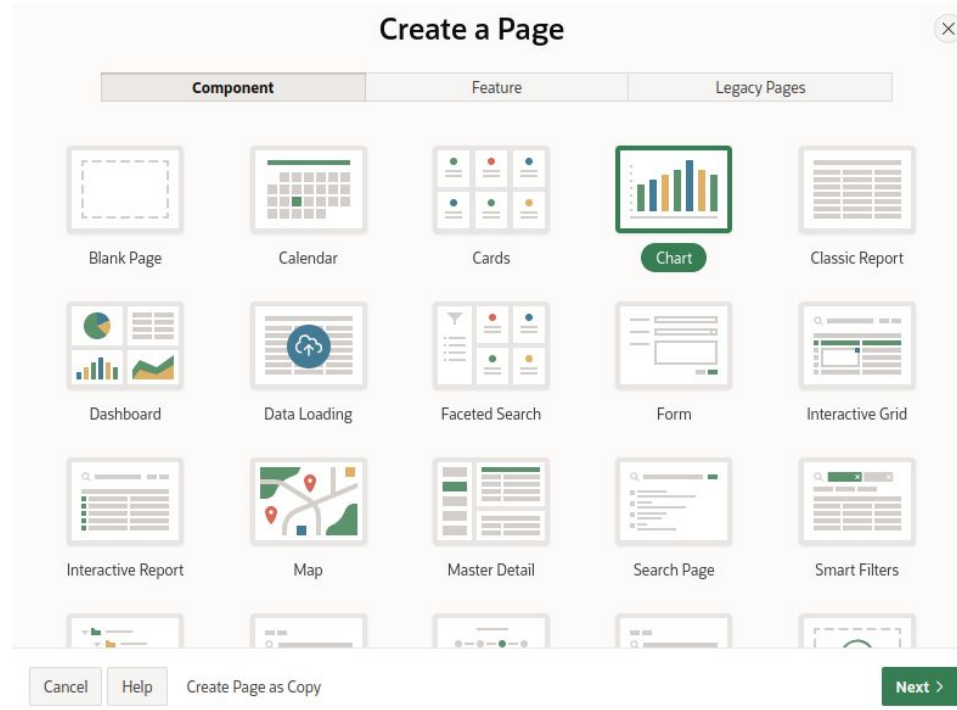


Create Page with Chart Workflow

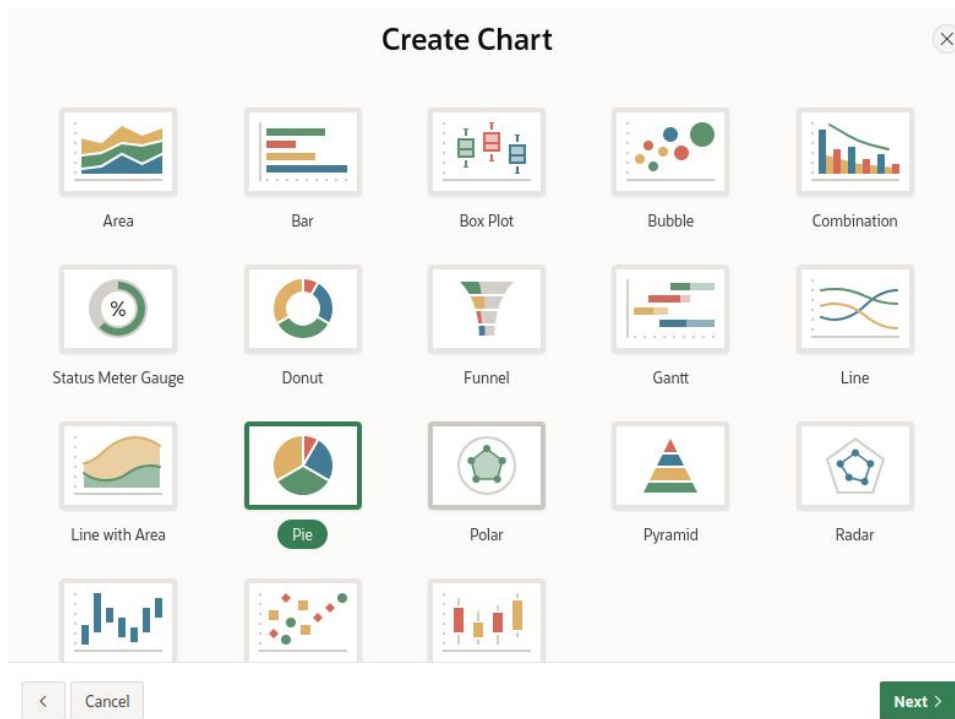
Step-by-step Sequence

Step #	Parameter (field)	Value
Step 1 <i>Select Page/Region Type</i>	Component	<i>Chart</i>
Step 2 <i>Create Chart</i>	(Select Chart Type)	<i>Pie</i>
	Page Definition: Name	<i>SALES_CTG_PROD_ChartWebView</i>
	Data Source: Source Type	<i>SQL Query</i>
	Data Source: Enter SQL SELECT Statement	<i>SELECT prod_name, sales_amount FROM OLAP_VIEW_SALES_CTG_PROD WHERE prod_name NOT LIKE 'subtotal%' AND prod_name <> ''</i>
	Navigation: Parent Navigation Menu Entry	<i>Analytical Web Views</i>
Step 4 <i>Confirm request</i>	Create Page	<i>Action <Create Page></i>

Step 1: Select Page/Region Type



Step 2: Create Chart: Select Chart Type



Step 2: Create Chart: Name and Data Source

Create Chart

Page Definition

* Page Number

16

* Name

SALES_CTG_PROD_ChartWebView

Page Mode

Normal

Modal Dialog

Data Source

Data Source

Local Database

REST Enabled SQL Service

REST Data Source

Source Type

Table

SQL Query

* Enter a SQL SELECT statement

A::

1

SELECT prod_name, sales_amount

2

FROM OLAP_VIEW_SALES_CTG_PROD

3

WHERE prod_name NOT LIKE 'subtotal%'

4

AND prod_name <> ' '

<

Cancel

Next >

Chart Page Designer

The screenshot displays the 'Chart Page Designer' interface for 'Application 100 \ Page Designer'. The main workspace shows a page layout for 'Page 16: SALES_CTG_PROD_ChartW' with a title bar 'SALES_CTG_PROD_ChartWebView'. The layout includes a 'PAGE HEADER', 'PAGE NAVIGATION', 'BREADCRUMB BAR', 'REGION BODY', and 'REGION CONTENT'. The 'BREADCRUMB BAR' contains a 'Breadcrumb' component. The 'REGION CONTENT' area is currently empty. The left sidebar shows the 'Components' tree with 'Pre-Rendering', 'Components', 'Content Body', and 'Post-Rendering'. Under 'Components', there is a 'Breadcrumb Bar' containing a 'Breadcrumb' component, and a 'SALES_CTG_PROD_ChartWebView' component containing a 'Series' component. The 'Series' component is highlighted with a green dashed border. The right sidebar shows the 'Series' configuration panel with the following settings:

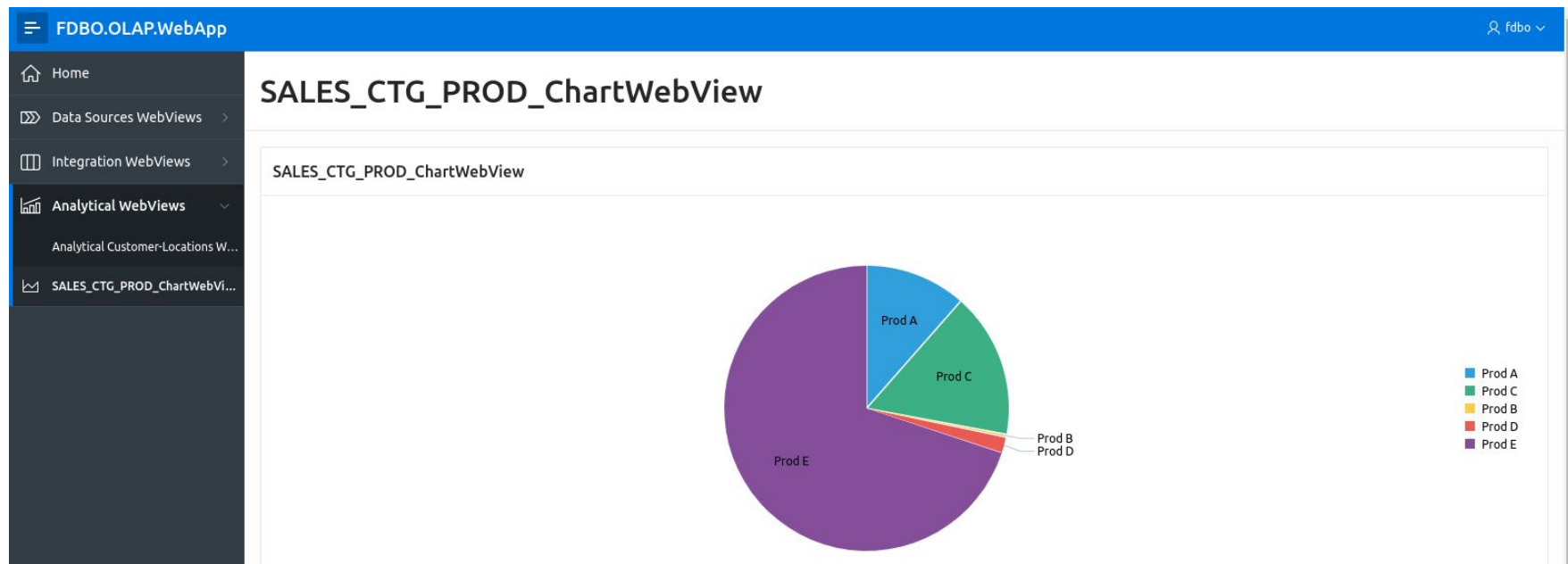
- Identification**: Name: Series 1
- Execution**: Sequence: 10
- Source**: Location: Local Database, Type: SQL Query

The 'SQL Query' field contains the following query:

```
SELECT prod_name, sales_amount
FROM OLAP_VIEW_SALES_CTG_PROD
WHERE prod_name NOT LIKE 'subtotal%'
AND prod_name <> ' '
```

At the bottom of the interface, there is a 'Regions' tab and a 'Items' tab. The 'Regions' tab is active, showing a grid of components: Breadcrumb, Calendar, Cards, Chart, Classic Report, Column Toggle Report, Dynamic Content, Faceted Search, Form, and Help Text.

Chart Page Runtime



CASE STUDY: APEX

Analytical Web View

Case Study: Oracle APEX Web Application Configuration from SQL Developer

- APEX workspace and application exported:
 - 32_WebApp.FDBO.OLAP_wks_ful.sql
 - 32_WebApp.FDBO.OLAP_f101.sql



Documentations

Oracle APEX Tutorials (advanced)

- Development Workflow: resource: see [OracleAPEX-2-BaseWorkflows.PDF](#) and [OracleAPEX-3-AdvancedWorkflows.PDF](#) documents, pay attention to:
 - Creation flow of STARTER App: default home page - *slide 9* from [OracleAPEX-2-BaseWorkflows.PDF](#)
 - Structure of Initial Navigational System - *slide 15* from [OracleAPEX-2-BaseWorkflows.PDF](#)
 - Report Creation Stage - *slide 13* from [OracleAPEX-2-BaseWorkflows.PDF](#)
 - Regions in APEX page REPORTS - *slide 31* from [OracleAPEX-2-BaseWorkflows.PDF](#)
 - Visual Chart Creation Workflow - *slide 30* from [OracleAPEX-3-AdvancedWorkflows](#)



Online Docs for Oracle APEX and ORDS

- APEX Web Reporting Pages for Analytical Views
 - Install APEX platform into Oracle Database
 - [APEX Installation Guide](#)
 - Uninstall apex: [link_1](#), [link_2](#)
 - Interactive Reports
 - [Tutorial Oracle APEX Interactive Reports](#)
 - Chart Reports
 - [Tutorial Oracle APEX Charts](#)
- REST Data Views with ORDS Services
 - Install Oracle REST Services (ORDS) into Oracle Database
 - [ORDS Installation Guide](#)
 - Create REST Data Services with Oracle APEX
 - [Tutorial APEX-REST Oracle Technology Network](#)

Book Refs [Oracle APEX and ORDS]

- Edward Sciore, *Understanding Oracle APEX 20 Application Development: Think Like an Application Express Developer*, Apress, 2020
- Patrick Cimolini, *Oracle Application Express by Design*, Apress, 2017
- John Scott et al., *Expert Oracle Application Express*, Apress, 2015
- Francis Mignault, Luc Demanche, *Oracle Application Express Administration: For DBAs and Developers*, Apress, 2016



Other online Refs

[Oracle REST Data Services ORDS]

- <https://blogs.oracle.com/apex/creating-a-crud-form-on-a-rest-service-with-apex-181>
- https://www.oracle.com/webfolder/technetwork/tutorials/obe/db/apex/r51/restful_web_services/restful_web_services.htm
- <https://www.oracle.com/technetwork/developer-tools/apex/downloads/index.html>
- <https://docs.oracle.com/database/apex-18.2/HTMIG/toc.htm>
- https://docs.oracle.com/cd/E56351_01/doc.30/e87809/getting-started-with-RESTful-services.htm#AELIG90198
- <https://blogs.oracle.com/apex/application-express-early-adopter:-rest-enabled-sql>
- <https://blogs.oracle.com/apex/application-express-early-adopter:-rest-enabled-sql>
- <https://oracle-base.com/articles/misc/oracle-rest-data-services-ords-rest-enabled-sql#enable-rest-enabled-sql>

Deploy APEX and ORDS platform on Tomcat Web Server

- Run APEX on ORDS Platform with Tomcat 9 Web Server
 - Download and Apache Tomcat Web Server from [apache-url](#) - use 64-bit Windows version (or 32-bit according with your Windows System version).
 - Install Tomcat Server: unzip downloaded kit-file into a hosting folder %TOMCAT_HOME% (e.g D:\ApacheTomcat)
 - Copy **ords.war** file *after ORDS installation and configuration procedure (1b)*:
 - From %ORDS_HOME% folder
 - To %TOMCAT_HOME%\webapps
 - Copy **images** folder
 - From %APACHE_HOME% folder
 - To %TOMCAT_HOME%\webapps
 - Rename folder as **i**
 - Start tomcat server by %TOMCAT_HOME%\bin\startup.bat script
 - Access APEX login page from <http://localhost:8080/ords> URL
- Installation procedure Documentation:
 - [ORDS Installation Docs](#) and [Oracle APEX Docs](#)