

An Oracle White Paper  
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## Oracle Application Express 5.0 Overview

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## Introduction

Oracle Application Express (Oracle APEX) is Oracle's primary tool for developing Web applications with SQL and PL/SQL. Using only a web browser, you can develop and deploy professional Web-based applications for desktops and mobile devices. Oracle Application Express is a fully supported, no cost option of the Oracle Database, and is installed by default in all editions of the Oracle Database.

Oracle Application Express is a database-centric development tool that allows you to build a vast array of applications. Within minutes, you can easily convert a spreadsheet to a multi-user, Web-based application. On the other end of the spectrum, you can build very large, complex, and multi-lingual applications. Oracle Application Express runs within the Oracle Database which allows your applications to scale to meet your largest user communities. This white paper provides an overview of the major components and features of Oracle Application Express. It describes how easily and quickly you can build beautiful, secure, and scalable Web applications for desktops and mobile devices by utilizing the built-in features of Oracle Application Express.

## Oracle Application Express Architecture Overview

Oracle Application Express utilizes a simple architecture where pages are dynamically generated using metadata stored within the Oracle Database. There is no code generation or file based compilation. Once fully installed and configured, the Uniform Resource Locator (URL) will be defined for both developers and end users to access Oracle Application Express. Users require only a Web browser to build, develop, and deploy Oracle Application Express applications. No additional client software is required.

When developers create, modify, or delete components, their changes are saved directly into the metadata tables which hold the application definitions. The developer can then run the application and review the enhancements immediately. The developer toolbar, displayed in the runtime application, allows the developer to quickly navigate back into the development environment to make additional enhancements as required. This ability to rapidly iterate an application greatly enhances developer productivity.

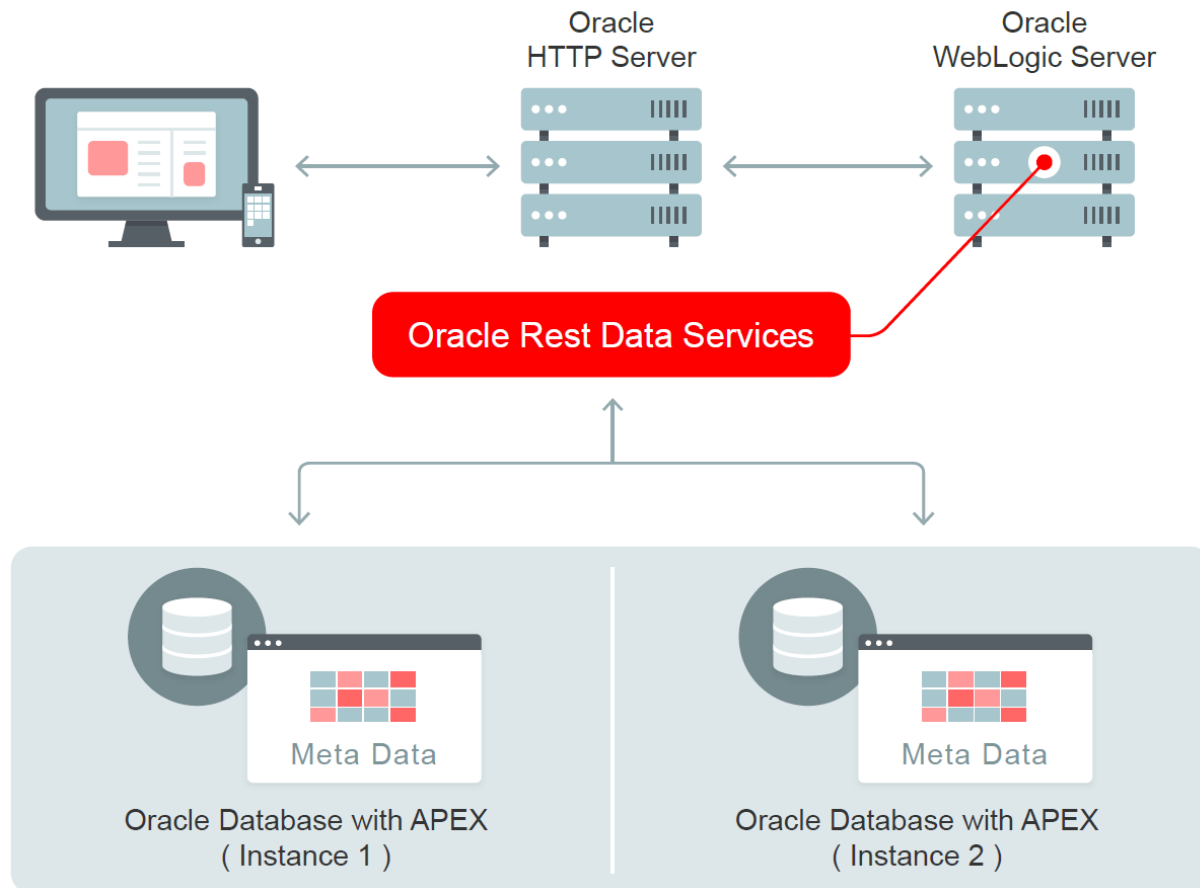
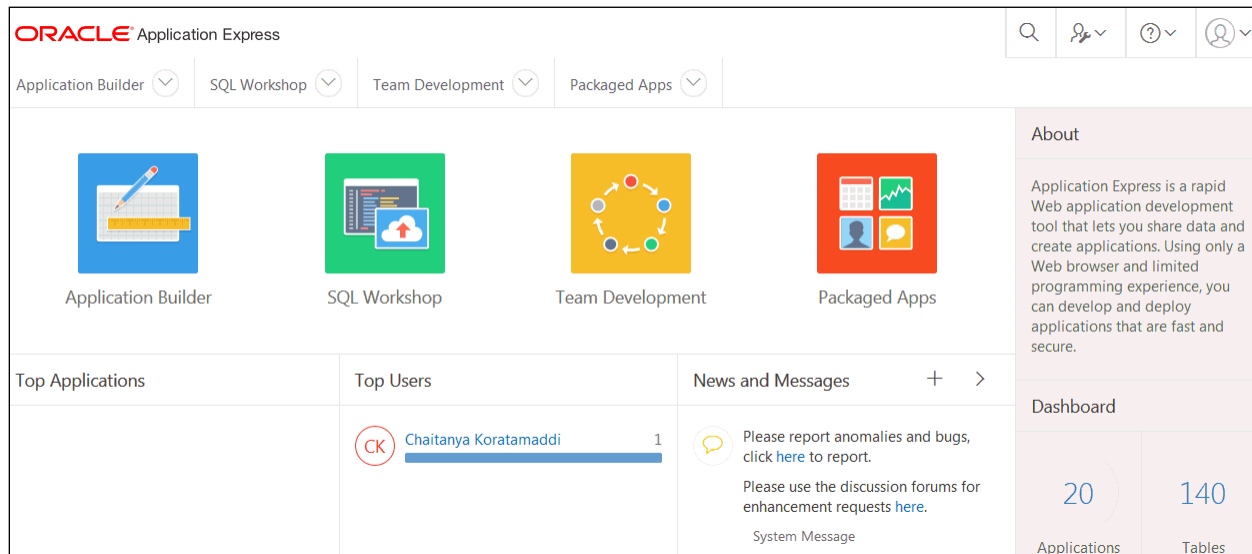


Figure 1: Sample Application Express Architecture

The Oracle Application Express architecture requires some form of Web server to proxy requests between a client Web browser and the Oracle Application Express engine. The Web server options include:

- Oracle REST Data Services:** Oracle REST Data Services (ORDS) is a Java based, free tool that is fully supported when used with Oracle WebLogic Server, Oracle Glassfish Server, and Apache Tomcat. Oracle REST Data Services is part of the reference architecture used to operate the Oracle Database Cloud Service.  
**Note:** There are licensing costs associated with Oracle WebLogic Server. Oracle Glassfish Community edition is a no cost option.
- Embedded PL/SQL Gateway:** The Embedded PL/SQL Gateway (EPG) runs in the Oracle XML DB Protocol Server within the Oracle Database and includes the core features of `mod_plsql`. Licensing for the Embedded PL/SQL Gateway is included with the Oracle Database license.
- Oracle HTTP Server:** The Oracle HTTP Server (Apache) with `mod_plsql` plugin can be placed on the same physical machine as the database, or on a separate physical machine.  
**Note:** `mod_plsql` is deprecated as of Oracle HTTP Server 12c (12.1.3). For more information, please see My Oracle Support Note 1576588.1. Oracle recommends using Oracle REST Data Services instead.

## Oracle Application Express Major Components



**Figure 2: Application Express Development Home Page**

### Application Builder

Application developers use Application Builder to build the pages that make up an Oracle Application Express application. Application developers use wizards to declaratively assemble applications organized by pages. By using the Application Builder, you create both database applications and Websheet applications using the Create Application Wizard. Database applications include both desktop and mobile applications. Websheet applications are similar to WIKIs and suited for community contributions. While database applications are primarily developed by application developers, Websheet applications are often created by end users with no development experience.

### SQL Workshop

The SQL Workshop provides tools to view and manage database objects and data.

- Object Browser enables you to use a tree control to view database object properties and create new database objects.
- The SQL Commands tool enables you to enter ad-hoc SQL
- Query Builder enables you to create join queries using drag and drop
- SQL Scripts enables you to store and run scripts
- Restful Services enables the declarative specification of RESTful services used to access the database

### Team Development

Team development facilitates the management of the application development process. Use this tool to track features, To Do tasks, milestones, and bugs. Use Feedback to capture user feedback and then categorize user comments as features, To Do tasks, and bugs.

### Packaged Applications

Packaged applications are a suite of business productivity applications, easily installed with only a few clicks. These solutions can be readily used as production applications to improve business processes and are fully supported by Oracle. Packaged Applications also include a collection of sample applications which demonstrate some of the major features of Oracle Application Express.

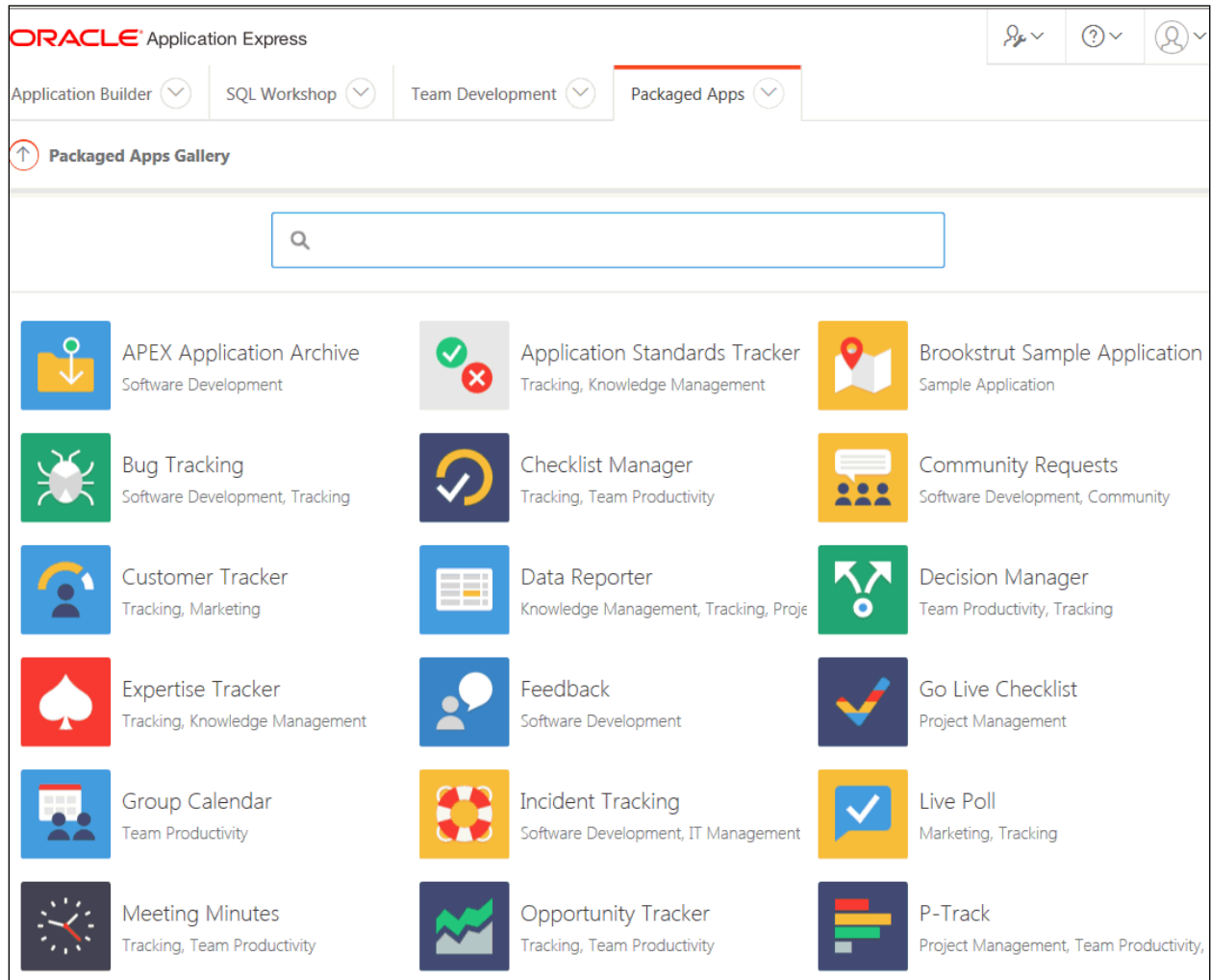
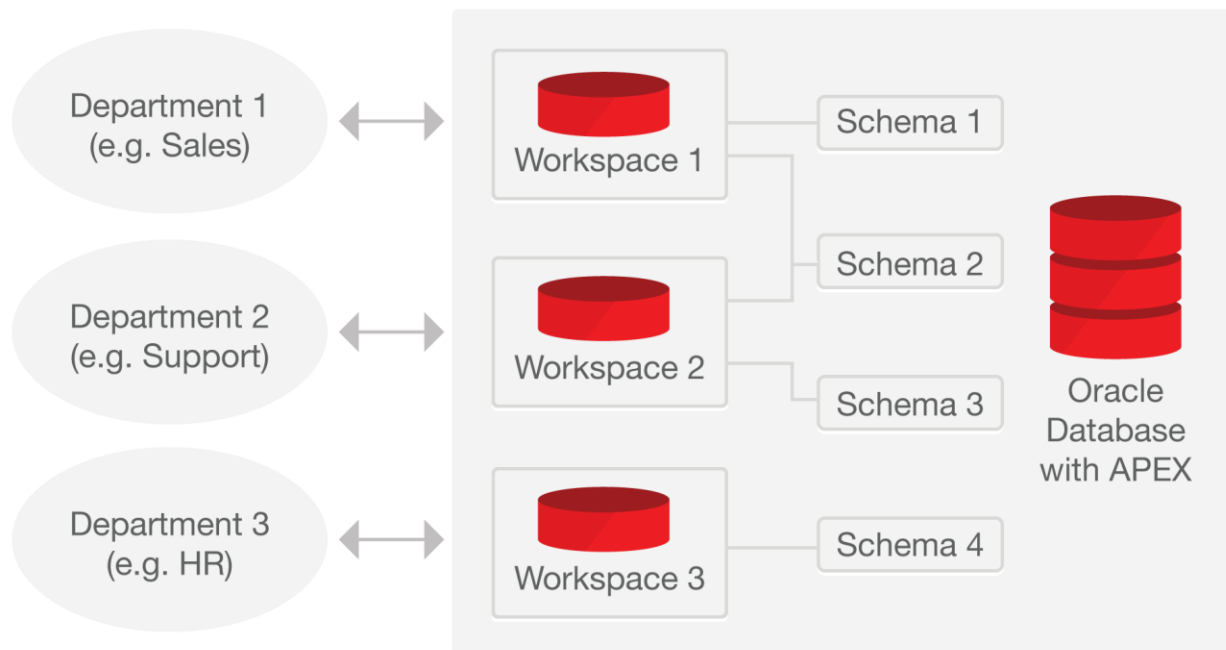


Figure 3: Packaged Apps Gallery

## The Complete Modern Web Application Development Solution

### Single Database Instance Serving Multiple Departments

Oracle Application Express enables a single database to host large number of applications and users. Developers work in a dedicated work area called a workspace to develop applications against one or more schemas. This flexible architecture enables a single database instance to act as a Platform as a Service (PaaS), providing a hosted Intranet capability within the organization, or hosted Internet service. It is common for workspaces to be defined for separate departments within an organization so that each department can develop their own database objects and applications independently.



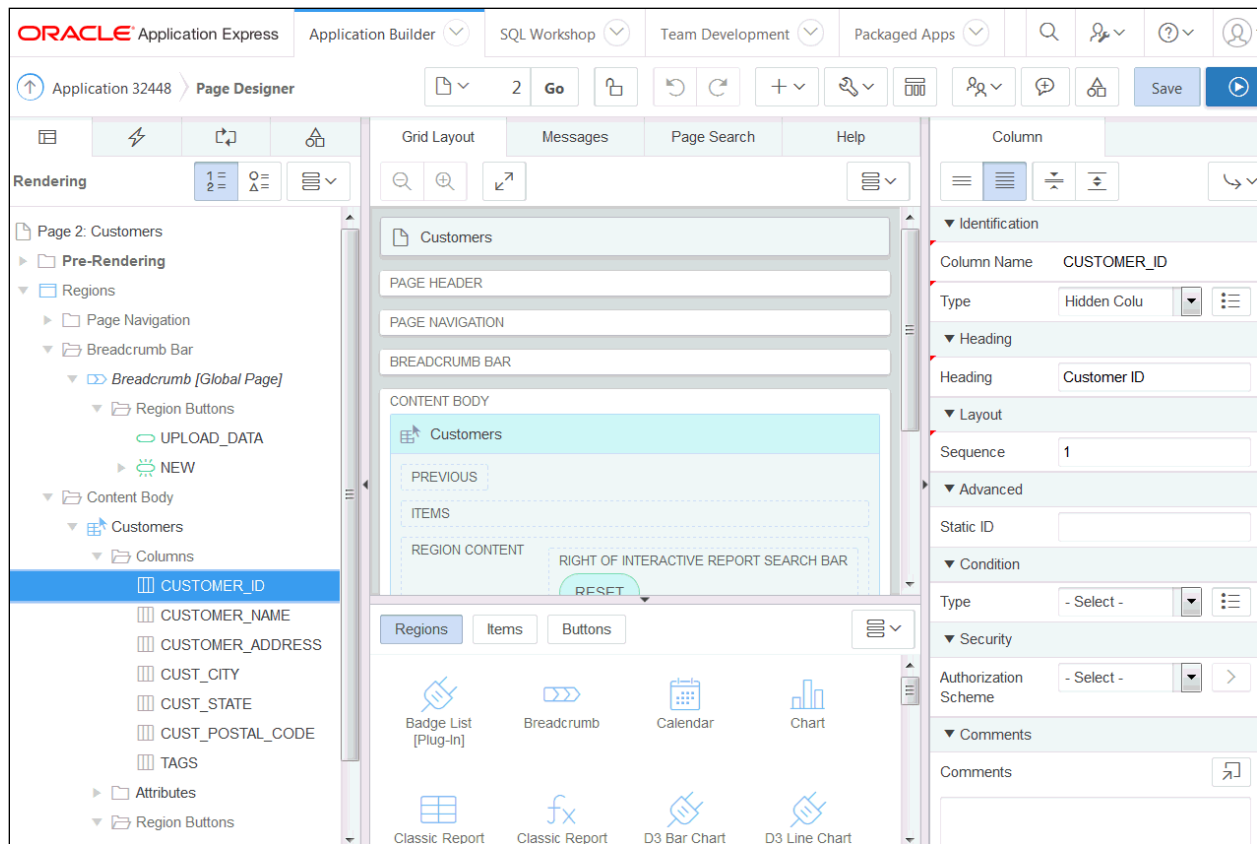
**Figure 4: Single Oracle Database serving multiple departments**

Given that Oracle Application Express runs everywhere and anywhere the Oracle Database runs, you have a great deal of flexibility in development and deployment. All you need to do is simply provide the appropriate URL to developers so that they access the Application Builder using a browser. Once you are done with developing the application on your desktop or on cloud, you export the application. You can then import this application into any other Oracle database where you have the same version or later version of Oracle Application Express installed. You can deploy your application on hosted instance, or on cloud for example, Oracle Database Cloud Service. You can seamlessly move your applications between environments within your corporate network and public clouds.

### Page Designer

Oracle Application Express includes, Page Designer, a revolutionary browser-based IDE designed to greatly improve developer's productivity, allowing you to very quickly enhance and maintain pages within Application Express.





**Figure 5: Manage application pages using Page Designer**

### Cohesive User Experience

There is no context-switching when modifying multiple components. To make changes, you need not drill into component pages. All modifications occur within Page Designer, where you can undo and redo changes as necessary, before saving and running your page.

### Better Visual Representation

With the Page Designer, you gain an immediate understanding of how your regions and items are laid out within the Grid Layout. Changes to components on a page are immediately reflected across the Tree and Grid Layout. Additionally, errors and warnings display immediately.

### Intuitive Drag and Drop

Page Designer provides an entirely new way to develop pages. In the Grid Layout pane, you can drag new components from the Component Gallery, or move and copy existing components around. In the Rendering pane, you can drag to move and copy multiple components at a time.

### Enhanced Code Editor

A new code editor provides SQL and PL/SQL validation with inline errors, auto completion, syntax highlighting, search and replace with regex support, complete with undo and redo support. Developers can even specify their preferences for tabs, indentation, and color scheme.

### Universal Theme

Oracle Application Express provides responsive user interface themes that enable you to build applications that can scale to any screen size. The new Universal Theme - 42 is an example of a responsive user interface theme. Developers can use this theme to build applications that work well on a variety of different screen sizes.

Responsive design enables you to design web pages so that the layout fits the available space regardless of the device on which the page displays (for example, a desktop computer, laptop computer, tablet, or smartphone). By implementing a responsive design, the user gets the full experience on larger screens. On smart phones and tablets, the layout will adjust to the size of the specific device. During this resizing process, elements shift position, re-size, or become hidden. The goal of responsive design is to present all essential content in a user friendly way for all possible screen sizes.

The Universal Theme is a new application user interface that does away with excessive templates and supports effortless customizations with Template Options, Theme Styles, and Theme Roller. The Universal Theme empowers application developers to build modern, responsive, sophisticated, accessible applications without requiring expert knowledge of HTML, CSS, or JavaScript.

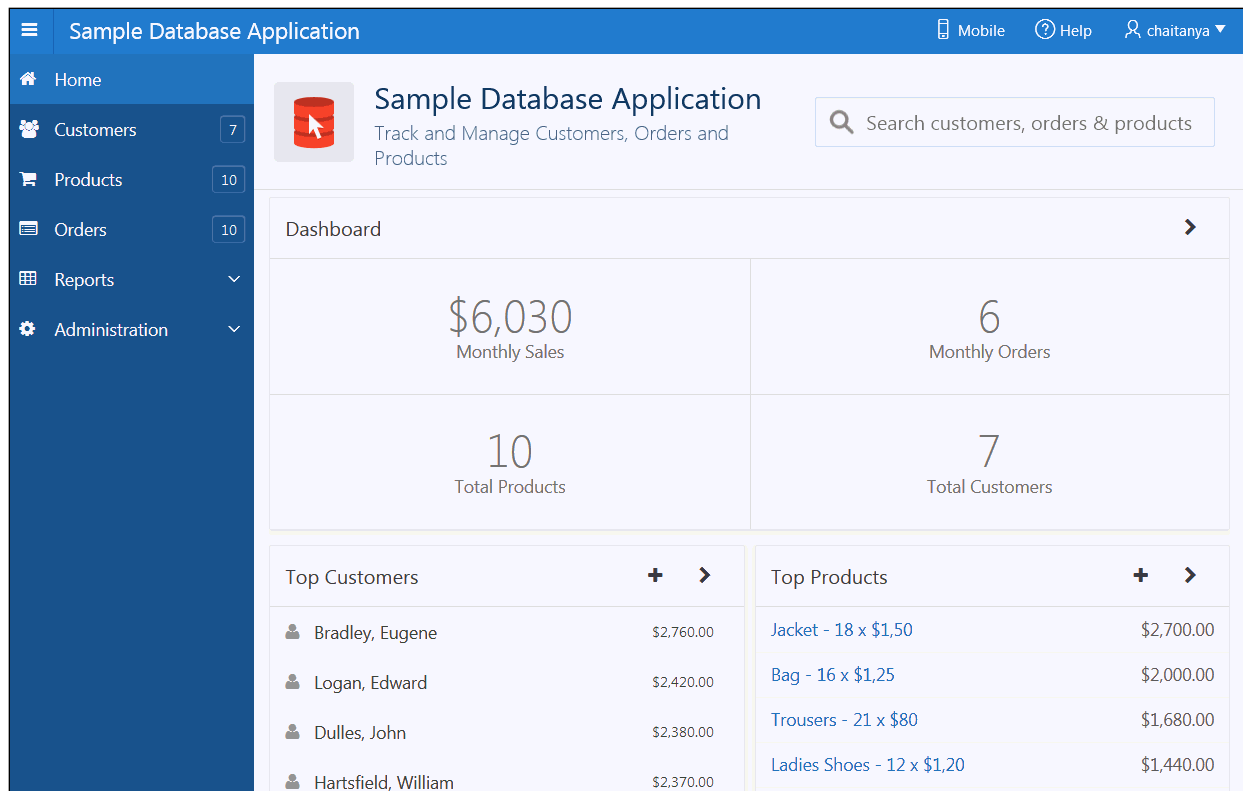


Figure 6: Sample page built with the Universal Theme

#### Template Options

You can easily customize the way buttons, regions, lists, and other template-based components appear. Using template options, you can display a single component in several different ways, without needing to have a specific template for each display characteristic. Universal Theme enables developers to use fewer templates but build far more versatile applications.

#### Theme Roller

Using Theme Roller, you can easily customize the look and feel of your application. You can adjust a number of style attributes and review changes applied to your application in real time. When you are satisfied with the result, you can then save those changes as a Theme Style directly to your application.

#### Absolutely Responsive

Using Universal Theme, you can build fully responsive applications that work flawlessly across a variety of screen sizes and form factors. Universal Theme includes key enhancements such as enabling complex form layouts and using flexible grids.

**Accessible**

Universal Theme delivers the most accessible user interface for applications built with Application Express. Theme Roller can be used to build accessible Theme Styles and includes built-in WCAG 2.0 color-contrast checking.

**Declarative Mobile Web Application Development**

Oracle Application Express allows you to declaratively define and develop mobile pages and applications. To support mobile Web application development, Oracle Application Express incorporates jQuery Mobile. jQuery Mobile-based web pages use a lightweight framework that enables you to create compact and minimalistic web sites that include only a few images and CSS files. Using jQuery Mobile, these applications can run on any mobile operating systems, such as iOS, Android, Blackberry, and Windows Mobile.

jQuery Mobile supports mobile device-specific events, such as orientation change and touch events. You can also change the look and feel of jQuery Mobile-based applications by modifying the CSS using tools such as jQuery ThemeRoller.

In your mobile Web applications, you can build reports that display all of your data on any mobile device, by using reflow table or column toggle. Reflow table wraps each column or changes to displaying multiple lines on very small screens. Column toggle allows you to specify the most important columns, and those which will be hidden as necessary on smaller screens.

Customer Name	Order Total
Dulles, John	\$2,380.00
Hartsfield, William	\$1,640.00
Hartsfield, William	\$730.00
Logan, Edward	\$1,515.00
Logan, Edward	\$905.00
OHare, Frank	\$1,060.00
LaGuardia, Fiorello	\$1,090.00
Lambert, Albert	\$950.00
Bradley, Eugene	\$1,890.00
Bradley, Eugene	\$870.00

**Figure 7: Mobile Column-Toggle Report**

### Powerful Reporting

In Oracle Application Express, developers can quickly create reports as the formatted result of a SQL query. Application Builder includes many built-in wizards that enable you to generate reports. The available report options differ depending on the selected user interface, such as Desktop or Mobile.

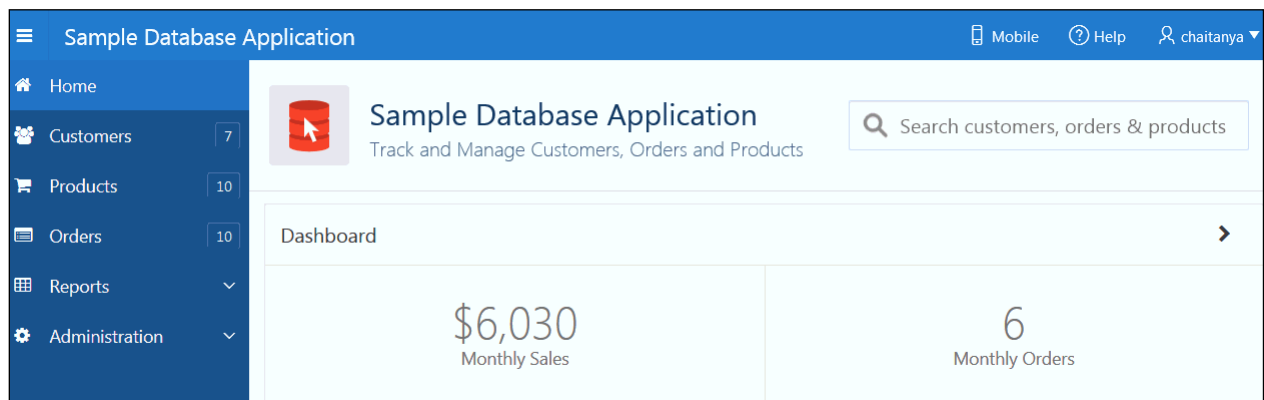
For desktop user interfaces you can build two primary types of reports: an Interactive Report and a Classic Report. When viewing an interactive report, end users can customize how and what data displays. By default, interactive reports include a search bar, an Actions menu, column heading menus, and Edit icons in the first column of each row. Using options on the Actions menu, users can alter the report layout by hiding or exposing specific columns and applying filters, highlighting, and sorting. They can also define breaks, aggregations, charts, group bys, and add their own computations. Once customized, the report can be saved as either a private or public report. In contrast, with the exception of sorting and simple filtering, end users cannot customize a classic report.

You can now easily create multiple interactive reports on a single page, and gain insights into your data like never before. End users can also define a pivot report at runtime, which is similar to defining a group report.

### Building and Customizing a Calendar with Drag and Drop

Oracle Application Express provides a built-in wizard to let you build calendars with monthly, weekly, daily, and list views. Once you specify the table on which the calendar is based, you can create drill-down links to information stored in specific columns and enable drag and drop capability. The calendar is based on the popular FullCalendar library, which is easy to customize and supports drag and drop, time-based events, and is even responsive.

### Navigation Lists



**Figure 8: Sample Application List Navigation**

You can now use the same type of navigation list for your applications that Application Builder has used for years. In Oracle Application Express, older themes provide navigation support through the creation of tabs. Newer themes, such as Universal Theme - 42, provide navigation support through the creation of navigation menu lists. Navigation menu lists support the creation of hierarchical sub-menus. Navigation Menus can be positioned to the top or side of your pages, and can be rendered based on any List template, enabling nested navigation items, keyboard support, and greater accessibility.

**Note:** Developers can switch from a theme using tabs to a theme using navigation menus if the existing application used one level of tabs. If an existing application uses two levels of tabs, you must convert it to one level tabs before changing the theme.

## Benefits of Application Express

### 100% Browser-based Development

To perform application development using Oracle Application Express, you do not need to install any client software. All you need is a simple browser, which you use to access the Application Builder to declaratively develop, deploy and run applications. End users also only require a browser, the URL for the application, and their user credentials.

### Rapid Application Development

Using Oracle Application Express, you can develop web-based, database-centric applications that are reliable and fast, as well as secure and scalable. It has a user-friendly interface, which enables you to create and deploy applications in a short span of time. You can use the available themes and templates to provide a consistent look-and-feel across your web pages.

### Declarative Programming

Oracle Application Express uses a declarative framework for web application development. This means that you specify what to do rather than how to do it. No code is generated or compiled. You interact with wizards and property sheets to define and enhance your application.

### Short Learning Curve

Oracle Application Express enables organizations to capitalize on their existing investment in SQL and PL/SQL skills. Few programming skills are required, and anyone can quickly learn to develop applications. With Oracle Application Express, applications are built faster, with fewer developers.

### Simple self-contained Architecture

Oracle Application Express can be installed on a single workstation, or on a server that can support multiple developers. An administrator centrally manages and administers the development environment and creates a shared workspace in a single installation. The definition of an entire application can be easily packaged and exported for deployment and installation into another Oracle Application Express instance.

### Mobile Application Development

Oracle Application Express allows you to build not just desktop applications but also declaratively define and develop mobile pages and applications. To support mobile application development, Oracle Application Express incorporates jQuery Mobile.

## Getting Started

It's very easy to get started with learning and using Oracle Application Express. Oracle provides a free hosted service at <http://apex.oracle.com>. This service is for demonstration purposes only. Storing of production or sensitive data is prohibited on this instance. For production applications you can install Application Express on-premise or sign up for the [Oracle Database Cloud Service](#).

You can download the latest Oracle Application Express software from our OTN downloads page at <http://www.oracle.com/technetwork/developer-tools/apex/downloads/index.html>

To learn more about Oracle Application Express, free tutorials, videos, white papers and other collateral, see our OTN page at <http://www.oracle.com/technetwork/developer-tools/apex/overview/index.html>

## Summary

Oracle Application Express (APEX) is the native Web application development framework for the Oracle Database. Oracle Application Express is a standard component of the Oracle Database and enables you to create database-centric Web applications that are reliable, scalable, and secure. This paper covered how easy it is to use Oracle Application Express to build modern Web applications for desktop and mobile devices.

Oracle Application Express key features include:

- 100% browser-based development
- Declarative framework for rapid application definition, maintenance, and enhancements
- Desktop and mobile Web application development made easier and faster
- Fully supported with any supported Oracle Database version
- Leverages SQL and PL/SQL skills and build applications that are reliable, scalable, and secure
- Improve developer productivity by using Page Designer
- Develop beautiful and responsive applications by using Universal Theme
- Seamlessly move applications between environments within your corporate network and public clouds





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