

# Oracle Application Express 4.2

## New Features

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### Introduction

Oracle Application Express, commonly referred to as APEX, is a robust rapid application development tool that has been included with the Oracle Database for more than 8 years. APEX gives developers the ability to create applications in minutes. Once development is complete, the applications are instantly available, allowing for a process of iterative development where developers work with business users to quickly create and refine applications to achieve business goals.

The process of application creation with Oracle Application Express can take advantage of a wealth of wizards, which simplify and accelerate development. APEX applications can be extended to meet specific business needs with PL/SQL on the server side and JavaScript, HTML and CSS on the client side, so the range of functionality that can be implemented is virtually unlimited. APEX provides extremely high levels of productivity for creating standard applications and the ability to create sophisticated mission critical applications as well. With more than 250,000 APEX developers across the world there are thousands of APEX applications in production scaling to support large user communities and millions of page views a day for some individual applications.

Oracle's most recent release of Oracle Application Express 4.2 is known as the "mobile release". With Oracle Application Express 4.2, APEX has evolved into a modern and productive mobile development platform. Using the same declarative wizards and development techniques APEX customers have been using for years, it is now possible to build applications that are optimized for mobile devices like smartphones and tablets. These applications can take advantage of device specific capabilities such as responding to touch events, orientation change, rendering form elements using the device's native controls and displaying an appropriate keypad based on context, e.g. a numeric keypad for numbers, special characters for email address and URL and a phone dial pad for phone numbers. APEX 4.2 also introduces new region types, such as a mobile-specific list view, which provides drill down capabilities and advanced formatting options targeted at smaller screens. As an alternative to the built-in Flash charts, APEX 4.2 now provides HTML5 charting capabilities.

In addition to the mobile development capabilities, APEX 4.2 has been enhanced to be the underlying infrastructure of the Oracle Cloud Database service and many enhancements were driven by the development of the Oracle Cloud, including tighter security, enhancements to the APEX Listener, RESTful Web Services and the inclusion of a suite of Business Productivity applications and sample applications. Rounding out this newest release of Oracle Application Express is a modernized user interface, several new themes, a new grid layout, enhanced data loading capabilities and support for partitioning of APEX runtime tables.

## Mobile

When building mobile applications developers have a choice of building native mobile apps, which are specific to certain platform or building mobile web apps, i.e. web applications that run within a mobile web browser, such as Safari on iOS or Chrome on Android. There are use cases when building native applications is beneficial and there are use cases when mobile web apps are a more suitable choice. Some of the benefits of using native apps are better performance and access to more device specific features and APIs, while mobile web apps have the advantage of having to be built only once, using standard, cross-platform HTML, CSS and JavaScript.

For projects where the decision has been made to build a mobile web app, developers have to also consider whether to build responsive web pages, i.e. web pages that uses CSS and media queries to scale and re-arrange content to optimally fit the available screen size or to build separate desktop and mobile pages using mobile JavaScript frameworks such as jQuery Mobile. Using a mobile JavaScript framework provides easy access to many device specific features, such as APIs to respond to touch events, orientation change and the use of device specific native controls. Those types of frameworks allow for building more native-like user experiences and provide faster performance thanks to smaller file sizes. As a general rule of thumb, it makes sense to use responsive techniques to build Marketing-oriented and Content-oriented sites while the use of dedicated mobile pages is typically better suited for productivity applications, data entry forms and monitoring tools.



**Figure 1: Desktop and Mobile User Interfaces**

Oracle Application Express 4.2 supports both: building pages using responsive design and developing dedicated mobile pages using jQuery Mobile. Sharing the same base libraries (jQuery and jQuery UI) that were already included with APEX in previous releases, including the jQuery Mobile library added only a minimal amount of additional code to download into the browser, and jQuery Mobile being almost entirely HTML5 driven made it very easy to build new themes and templates without having to add a large amounts of new custom JavaScript code. Applications in APEX 4.2 can be built for Desktop, Mobile, or both. The user interface of a page determines what theme and set of templates is used when rendering a page.

## User Interfaces

APEX renders pages by merging HTML templates with content from the Oracle database. Each page uses several different types of templates. Starting with the page template, region templates down to templates used for reports, labels and buttons. The templates that are associated with an application are organized as a user interface theme and APEX allows for switching from one theme to another, which essentially replaces all templates of the current theme with the templates of the new theme. In previous releases APEX would only allow one active theme for an application. With APEX 4.2 this has been extended to allow for multiple themes, with each theme associated with one user interface type. A user interface describes the target platform for a page. APEX 4.2 ships with built-in support for desktop user interfaces and mobile user interfaces. Thus each application can have up to two user interfaces, one for desktop and one for mobile. Each page of an application is associated with one user interface, so the templates available to be used on that page are limited to the templates of the corresponding user interface theme.

User interfaces allow for having applications that have both mobile pages and desktop pages. This makes it possible to share common components, like authentication schemes, application items processes, access to session state, etc. across all pages. The user interface attributes define which user interface is to be used as the default user interface when the application is first loaded into the browser. Alternatively it is also possible to enable auto-detection, so that depending on the device used, the user is taken to the appropriate login and home pages - if defined. The user interface of an application can be selected by the developer in the create application wizard. Existing applications that have only one user interface can be extended to include additional user interfaces. New user interfaces can be added on the application attributes page or the create theme wizard. When a new user interface is added, the developer first selects the user interface type and then selects a theme from a list of available themes for the user interface. Adding a user interface also creates a corresponding login page and a global page for content that is shared across all pages associated with the same user interface.

## Global Page

Content that is defined on a global page, such as regions, items and buttons, is included on all pages that share a user interface with the global page. In previous versions of Application Express this global page was called page 0. With the support for multiple user interfaces, a single page 0 was no longer practical, so it is now possible to define one global page for each user interface. This global page can have any arbitrary page number, i.e. the page number does not necessarily have to be 0.

## Responsive Web Design

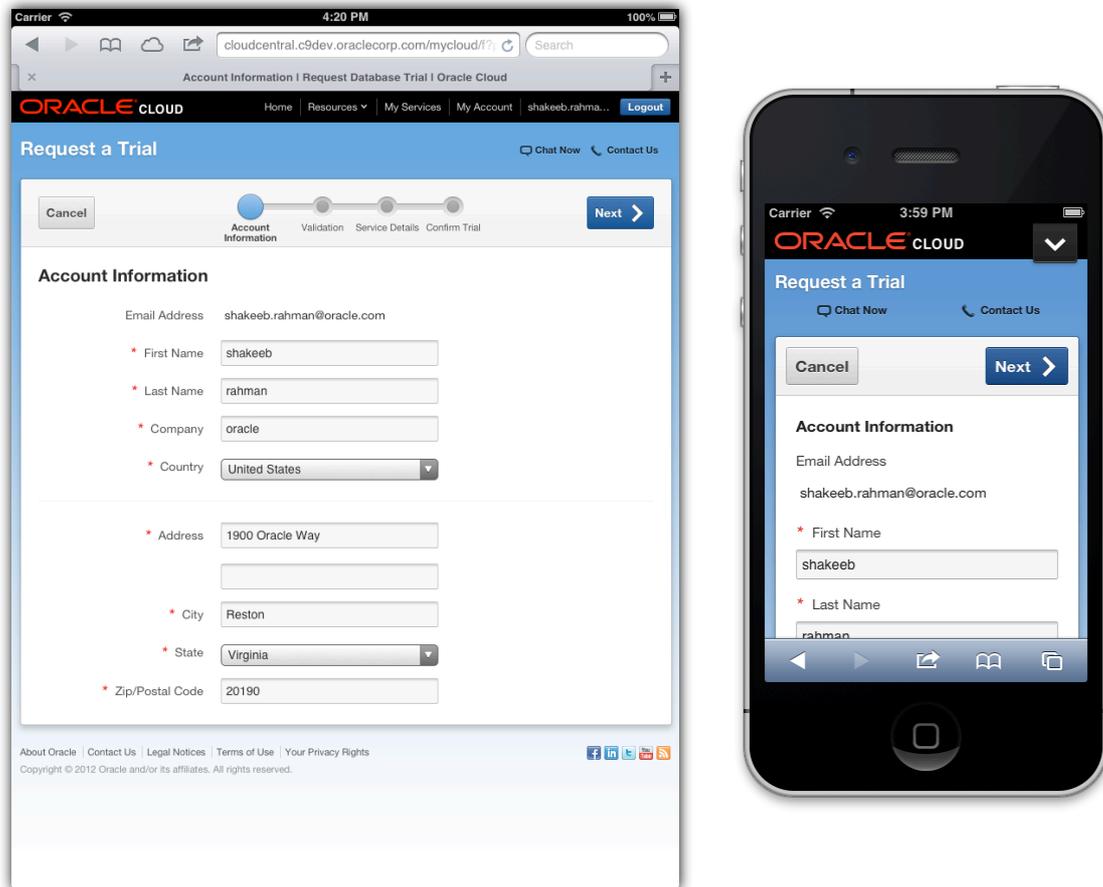
Responsive Web Design is an approach to web design in which the designer strives to provide an optimal viewing experience across a wide range of devices, including different sized Desktop monitors, laptops, tablets and smart phones. Responsive web pages allow for easy reading and navigation with a minimum of resizing, panning and scrolling.

Responsive Web Design uses CSS3 to define styles based on conditions such as screen size or resolution:

```
@media screen and (min-width: 320px) and (max-width: 479px) {...}
```

Using multiple CSS media queries allows to target “cut off points” and appropriately adjust UI for given screen size, e.g. Mobile Portrait, Mobile Landscape, Tablet Portrait, Tablet Landscape, etc.

APEX 4.2 introduces grid layout as a declarative way to layout regions and items on a page. This makes it possible to do complex layouts without manual CSS overrides and media queries can then easily shift or reposition these components. The new APEX grid layout is compatible with popular grid frameworks such as twitter bootstrap, 960 gs, etc.



**Figure 2: Responsive Web Design**

The new theme 25 is a fully responsive theme, it uses a custom flexible grid that is up to 2560px wide and includes support for Mobile, Tablet and Desktop. Theme 25 includes icon-based buttons, using one regular sprite and a high-res sprite for Retina displays. Using frameworks such as Modernizr and Respond.js ensures cross browser support and compatibility with older versions of Internet Explorer.

### **HTML5 Charts**

APEX 4.2 introduces HTML5 charts. The cross-browser and cross-platform charting solution is intended for everybody who deals with creation of dashboard, reporting, analytics, statistical, financial or any other data visualization solutions. Based on an upgraded Anychart 6.0 charting engine, it is now possible to have several of the charts types that were available in earlier releases of APEX to be rendered in HTML5 rather than Adobe Flash, thus allowing those charts to be displayed on mobile devices that do not support Flash or no longer support Flash. When creating new charts, developers have a choice of creating the chart as Flash-preferred or HTML5-only. Flash-preferred charts are rendered as Flash charts when Flash is available and otherwise fall back to HTML5. HTML5-only charts are always rendered in HTML5 format. Existing charts can be upgraded to support Flash-preferred and HTML5.

## HTML5 Item Types

APEX 4.2 adds new item types specifically for mobile and updates some existing items types with mobile specific enhancements. As with other jQuery Mobile and HTML5 components, there's a fallback rendering built-in for devices that can't display certain controls.

- Select lists have been extended to show lists of values using the device's native LOV control for LOV with up to 10 values. LOVs with more than 10 values are rendered as popup dialogs
- A new HTML5 date picker allows users to edit date values using a native calendar control.
- A slider control allows for setting a value based on moving a slider across a range of values
- The Yes / No control is a touch-friendly alternative to checkboxes used to turn attributes on or off
- Text fields now include a number of subtypes that prompt the mobile device to display a keyboard layout specific to the subtype, e.g. the email subtype includes "@" and "." alongside the regular non-numeric characters on the keyboard, the URL subtype shows a ".com" instead and the phone subtype display a numeric phone keypad.

## RESTful Web Services

REST, the commonly used name for a set of architectural principals officially known as Representational State Transfer, has become a standard for defining Web services on the Web, based in large part on its simplicity when compared with two other widely used architectures, SOAP and WSDL-based services. REST is widely used by a variety of Web service providers, including Google, Facebook and Yahoo, as the way to expose their own services.

RESTful Web Services have three main characteristics:

- The services use HTTP methods explicitly
- The services are accessible through Uniform Resource Identifiers (URIs) and
- The services are stateless

Oracle Application Express 4.2 used with the APEX Listener allows access to data within a particular workspace through RESTful Web Services. The APEX SQL Workshop includes a RESTful Web Service wizard, which makes it easy to create RESTful Web Services for use by applications that reside outside an APEX instance.

There are three levels of organization used for defining RESTful Web Services:

- The RESTful Service Module is used to group Services and to implement some types of RESTful security. The definition of Modules is arbitrary and should be used to group Services, which will commonly be used together. All export and import of Services is done at the Module level.
- A template is identified by a unique URI, which is comprised of portions also based on the Database Cloud Service and the Module.
- A handler is based on a specific HTTP method, such as GET, POST, PUT or DELETE. Only one handler for each HTTP method for each template is available.

When creating a RESTful Web Service, the key attribute of the Service is the Source Type. This Source Type indicates the way the code used to produce the values returned from a RESTful Web Service is defined. There are two basic categories of Source Types – SQL and PL/SQL, and a total of 5 distinct Source Types.

- The Query, Query One Row, Feed and Media Resource Source Types use SQL to define the information returned for a RESTful Web Service call.
- The PL/SQL Source Type allows the use of PL/SQL code to create and return data from a RESTful Web Service call. The PL/SQL within this Source Type is essentially an anonymous PL/SQL block. The PL/SQL Source Type can be used to implement SQL DML, extended logic or to format and return data in a specific way.

An Oracle Database Cloud Service is based on a single schema, and all RESTful Web Services, which access data in this schema, are run as the owner of the schema. Without security limitations, all RESTful Web Services are public, which means that anyone who has the URL of the RESTful Web Service call can use the call

There are four ways access to RESTful Web Services can be limited:

- Based on the origin of the RESTful Web Service, when accessing the Service from a browser
- Based on the application using the RESTful Web Service
- Based on the application and the identity of the user calling the RESTful Web Service
- Based on logic implemented in the RESTful Web Service call itself

Any combination of these four approaches can be used in implementing security on RESTful Web Services, including using none of them for a public Web Service.

### **APEX Listener 2.0**

The Oracle Application Express architecture requires some form of Web server to proxy requests between a Web browser and the Oracle Application Express engine. In addition to Oracle HTTP Server/mod\_plsql and the XDB HTTP protocol server/embedded PL/SQL gateway the Oracle APEX Listener can be used for this purpose.

The Oracle APEX Listener 2.0 introduces the following enhancements over previous versions:

- Added support for multiple database connections
- Changed configuration file structure to support multiple databases
- Added command line facility for configuring Oracle Application Express Listener
- Moved storage of RESTful Services to the Oracle Application Express Schema
- Design and creation of RESTful Services is now done using Oracle Application Express
- Graphical administration of Oracle APEX Listener is now done using Oracle SQL Developer
- RESTful Services are now protected via the OAuth2 Protocol

## **Packaged Applications**

Oracle Application Express 4.2 includes a set of business productivity applications and sample applications, which can be installed with just a few clicks. These applications are full production applications designed to provide real functionality, such as project management, shared calendars and shared checklist management.

All of these applications can be configured to use APEX authentication, Oracle Single-Sign on or tap into the user identity pool for the Database Cloud Service, so users do not have to be defined and maintained for each individual application. All of these applications share the same privilege levels of administrator, developer and user, which grant differential access to functionality and features. All of these applications can be installed or removed through the same simple administrative interface.

All included applications can be unlocked so that developers can gain access to the underlying code. While unlocked packaged applications are no longer supported by Oracle, having access to the implementation details provides a great resource for learning about common best practices and UI patterns as well as APEX application and database design.

## **Security**

Oracle Application Express 4.2 includes a number of security enhancements:

- It is now possible - via the Instance Administration - to require all outbound requests to be over HTTPS, this includes regions of type URL and Web Service requests
- Outbound HTTP(s) requests can now also be required to use an instance-wide proxy
- Enhanced input validation allows declarative control over which character can be entered into session state. For page items it is now possible to define a list of restricted characters, either by picking the white-list option, allowing a-Z, 0-9 and whitespace or by picking one of the black-list options, preventing different sets of special characters from being submitted into session state.
- Log switch allows for configuring different levels of log data retention. The access log, activity log, debug messages and the external click count log can now each be configured with their own number of days until a log switch occurs.

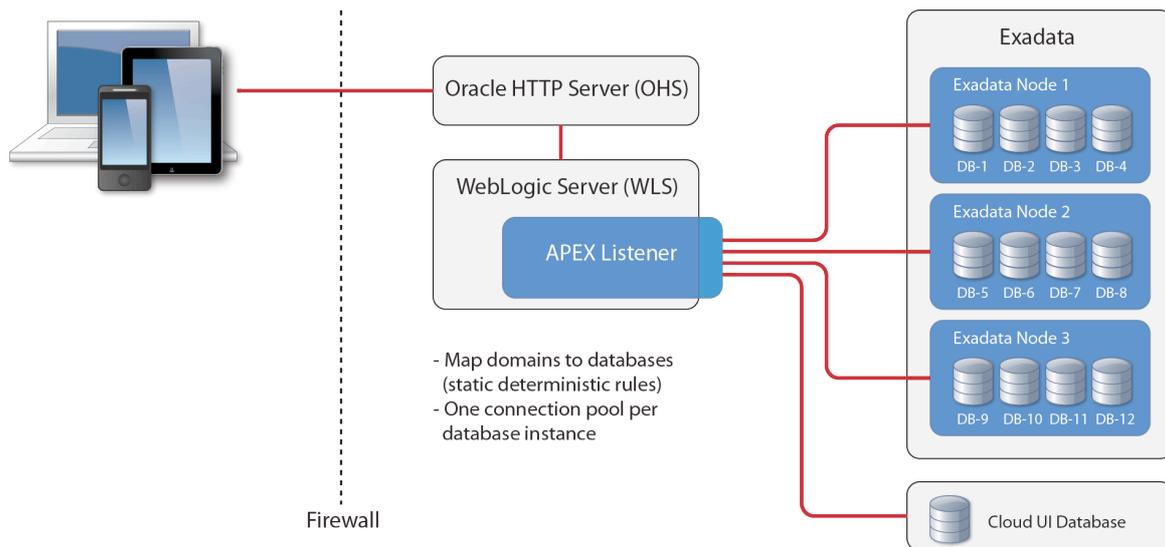
## **Functional Improvements**

In addition to the new features and enhancements discussed above, Oracle Application Express 4.2 includes numerous smaller features and feature enhancements, including:

- Supported method to partition APEX runtime tables (session data, activity logs and indexes)
- Read-only attribute for Pages and Regions
- Interactive Report and Websheet enhancements
- New CKEditor, jQuery and AnyGantt charts versions
- Item limit per page raised to 200
- Publish Translations from command-line

## Oracle Database Cloud

Oracle Application Express is available as part of the Oracle Database and as a stand-alone download on the Oracle Technology Network. As an alternative to on-premise installations, Oracle Application Express is also available as a hosted service as part of the Oracle Cloud. The Oracle Database Cloud Service provides the robustness and power of the Oracle Database in the Cloud. With the Oracle Database Cloud Service, customers get the Oracle Database, RESTful Web Service based access to their data, Oracle Application Express and a platform for deploying packaged business applications, complete with integrated security and database access.



**Figure 3: Oracle Database Cloud Service**

The Oracle Database Cloud Service enables businesses to reap all the benefits of Platform as a Service including subscription-based, self-service access to reliable, scalable, and elastic cloud environments. Businesses can move applications and data seamlessly from the Oracle Cloud to other clouds or on-premise.

### About the Author

Marc Sewtz is a Senior Software Development Manager at Oracle Corporation in New York. With over sixteen years of industry experience, Marc previously held roles in Consulting, Sales and Product Development and now manages a global team of Software Developers and Product Managers in the Oracle Application Express (APEX) development team, part of the Oracle Database Tools group. Marc and his team are responsible for features such as the development of Mobile Web Applications with APEX, Reporting and Charting, Tabular Forms, Oracle Forms to APEX conversion and integration with Oracle Business Intelligence Publisher. Marc has a Master's degree in computer science from the University of Applied Sciences in Wedel, Germany.

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