

Oracle Application Express Overview 3.1

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Oracle Application Express Overview

EXECUTIVE OVERVIEW

Oracle Application Express, a feature of Oracle Database 11g, combines rapid web application development with the power of the Oracle Database. Its easy to use browser based application builder enables developers and non-programmers to develop and deploy data driven web applications in very little time. Utilizing Oracle Application Express in your enterprise will help consolidate the management and security of data currently scattered throughout the organization in spreadsheets and personal Databases. At the same time, access to information will be improved by making the data available to anyone with a web browser.

INTRODUCTION

Now that there is a web browser connected to the Internet or Intranet on virtually every desktop, the potential to improve the flow of information in your business is enormous. New applications can be launched and updated without the need to distribute software, everyone has access to the latest information from any computer, and users jump almost seamlessly from one application to another.

The reality is that a large part of this potential has still not been realized. Data collection and sharing is a difficult task, with spreadsheets being traded, merged, and scrubbed. Important data is locked in word processing documents, text files and desktop Databases. Departments and lines of businesses are wasting time attempting to automate simple business processes using tools that are not secure and not designed for enterprise web deployment.

This paper describes the benefits, architecture and features of Oracle Application Express and how it can help you quickly develop web deployed reporting and data entry applications on consolidated data in an Oracle Database.

BENEFITS

Many organizations are wasting valuable time by using spreadsheets and personal Databases to manage information. Although easy to use, these products don't deploy well on the web, they don't handle concurrent updates to data gracefully and they provide little in the way of security. Oracle Application Express offers a new approach to capturing, delivering, and managing information with significant benefits.

Better Access through Consolidation

By consolidating many small workgroup Databases and spreadsheets, into a single Oracle Database, Oracle Application Express provides the following benefits:

- Improved access by delivering data currently locked in spreadsheets and personal Databases to the web, allowing concurrent updates by multiple users as well as providing real time access to a single source of truth for your information.
- Time saved by avoiding the emailing around of spreadsheets as attachments and the merging and scrubbing of multiple copies of data
- Improved security and availability through consolidation of fragmented information into a reliable, secure, scalable Oracle Database, managed by professionals.
- Build applications you never could before – even “quick and dirty” applications are immediately deployed on the web ready for enterprise wide use.

The benefits of consolidation can be achieved without taking away control or flexibility from the developer or end user.

Getting your Information on the Web Minus the Complexities

Data driven web applications are typically built to optimize a business process by streamlining the flow of information in the organization. Unfortunately, building web applications is fraught with repetitive and tedious tasks that don't directly solve the business problem at hand. Rather, these tasks deal with the “plumbing” of the application and can take up the bulk of the development effort. The “plumbing” of an application are those parts that handle low level duties such as:

- Maintaining session state on the inherently stateless HTTP protocol
- Authenticating users and enforcing access control rules
- Ensuring concurrent access to data is properly handled
- Maintaining a consistent user interface throughout an application or across multiple applications
- Ensuring the application runs using the appropriate language and local settings

The people in your organization that are familiar with the business process to be optimized should not be burdened with building the plumbing of a web

application. Oracle Application Express eliminates this burden by including all necessary facilities in every application automatically. This helps the business process experts do what they do best: solve the problem at hand.

Built in Best Practices

Oracle Application Express has built into it established best practices for building web applications. It is these best practices that help avoid common mistakes and improve developer productivity. For example when building a web application, manually a developer may unintentionally scatter logic to handle access control throughout the application, making it difficult to make changes to the underlying rules that govern the access control. Or, when a developer sets out to build an application he may not be aware that some day the application needs to be delivered in more than one language. The framework provided by Application Express's application builder ensures that such mistakes cannot be made. The following best practices are built into Oracle Application Express.

Consistency and standardization in application and page structure

Oracle Application Express uses a pre-defined methodology to render and process pages across the entire application. This speeds up the assembly of pages, but it also makes maintenance easier, since understanding how a page works does not require looking through code or scripts. In Oracle Application Express, a developer can quickly tell what function a page performs and how it works, even if he's never seen the application before.

Separation of user interface, application logic and data access

The way Application Express uses templates for pages, regions, reports, labels and other elements of an application, encourages developers to separate the user interface or the look of the application from its logic and functionality. This has several benefits. First, this separation makes it easier to understand the definition of the application and doesn't require you to sort through pages of HTML code to get to the core of the application. Secondly, maintaining this separation means that you can start on the logic of the application before you decide on the user interface. You can even have another person work on the user interface of the application in parallel. Finally, changing the look of an application only requires changing a few templates rather than every page or component in the application.

Centralized authentication and authorization

Rules governing authentication and authorization are defined centrally and independently from the logic of an application. This ensures that you can change the way the user's identity is verified and established at any point in time during the development of an application without changing its logic. Authorization schemes help you define access control rules in a central place

and associate them with most any element within an application to ensure maximum flexibility in controlling who gets to see what and who gets to perform what function.

Separately stored translatable strings

Oracle Application Express stores the entire definition of an application in the Database. Included in the application definition are translatable text contained in elements such as field labels, region titles, and report column headers. Application Express automatically keeps track of translatable strings throughout the development process and provides a facility for exporting all strings in a single file for translation by a third party.

ARCHITECTURE OVERVIEW

Oracle Application Express consists of a metadata repository that stores the definitions of applications and an engine for the rendering and processing of pages. Additional tasks performed by the engine include:

- session state management
- authentication services
- authorization services
- page flow control
- validations processing

The engine is implemented in PL/SQL and is accessed from a web browser through the Embedded PL/SQL Gateway (see figure 1) or the Oracle HTTP Server (Apache) and mod_plsql (see figure 2).

Applications are rendered in real time from the metadata repository stored in Database tables. Building or extending applications does not cause code to be generated. Rather, metadata is created or modified and stored in Database tables. Whether running the Oracle Application Express development environment or an application built using Oracle Application Express, the process is the same. Browser sends a URL request that is translated into the appropriate Oracle Application Express PL/SQL call. After the Database processes the PL/SQL, the results are relayed back to your browser as HTML.

A unique session state management method ensures minimal CPU resource consumption. Session state is managed in the Database. Each page view results in a new Database session, so when the Oracle Application Express engine is not processing or rendering a page, no Database processing resources are consumed.

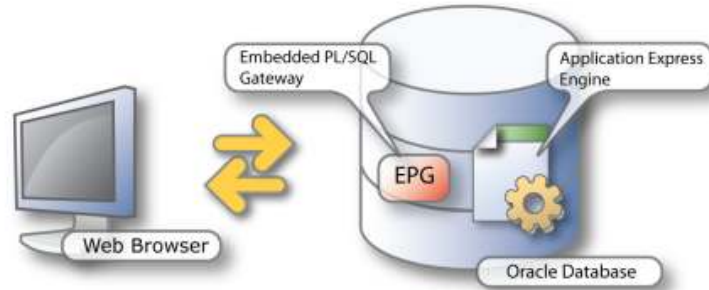


Fig. 1 – Oracle Application Express Architecture: Embedded PL/SQL gateway (Oracle Database 11.1 or higher or Oracle Database 10g XE)

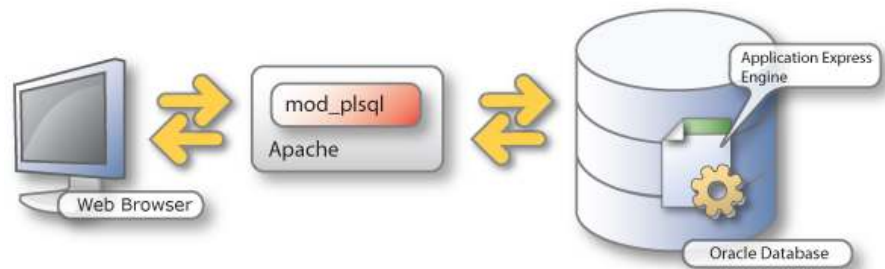


Fig. 2 – Oracle Application Express Architecture: Oracle HTTP Server (Apache) with mod_plsql (Versions prior to Oracle Database 11.1 and an option with 11.1 or higher)

COMPLETE HOSTED SOLUTION

Oracle Application Express turns a single Oracle Database into shared workgroup Database service. This service can be trivially accessed via a browser requiring no software to be installed on the desktop for the developer or the end user.

Workspaces: Sharing a Database

Anyone interested in tracking some data and sharing it with others on the web can sign up for a workspace within Oracle Application Express using a self service signup wizard. A workspace is a virtual private Database that enables multiple users to work within the same Oracle Application Express installation while keeping their objects, data and applications private.

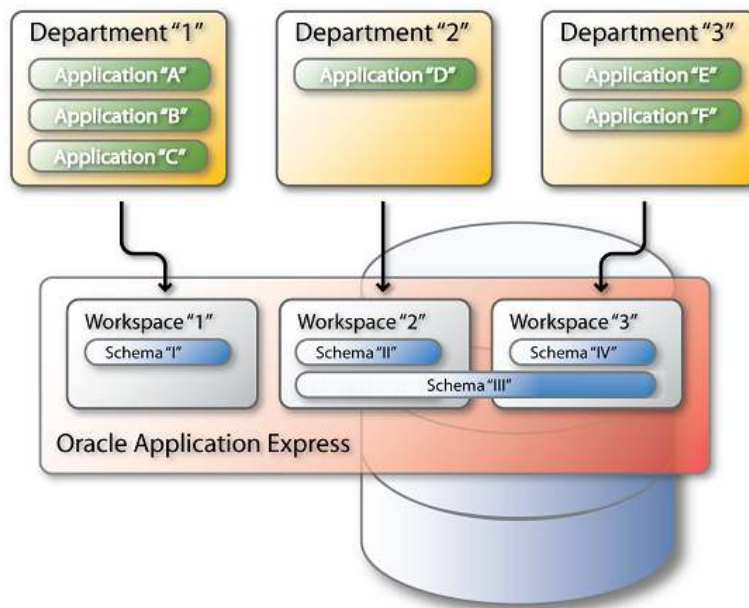


Fig. 3 – Sharing a Database with Workspaces

As illustrated in figure 3, a single Oracle Database can contain multiple Oracle Application Express workspaces (WS1 through WS3), each with access to one or more Database schemas (A through F). Multiple development efforts can therefore occur in the same Database without interfering with each other.

During signup for a workspace, a new schema may be requested or an existing schema with Database objects such as tables, views and stored procedures may be associated with the workspace. Workspace requests are queued for an Oracle Application Express administrator to approve using a web-based interface.

Once logged in to a workspace (see figure 4), a user has access to the following components:

- Application Builder
- SQL Workshop
- Utilities
- Administration
- Migrations
- Workspace schemas
- Links



Fig. 4 – Oracle Application Express welcome page

Application Builder

The Application Builder is optimized for assembling an HTML user interface on top of Database objects such as tables, views and procedures. It provides many wizards to build reporting and data entry applications. More details on its features are discussed just ahead.

SQL Workshop

The SQL Workshop is a tool that enables you to interact with the Database through a web browser. Its features include:

- Viewing Database objects
- Creating Database objects such as tables, views, triggers, and sequences
- Creating, editing and running script files. You can also upload and download scripts from your local file system
- Running SQL commands and anonymous PL/SQL, scripts, and saved queries
- Query Builder to search and filter Database objects, create relationships between objects, view formatted query results, and save queries

Utilities

The Data Workshop helps you import and export structured data into and from Database tables. For example, with the spreadsheet data import wizard you create a Database table and import data from a spreadsheet in a single operation. Other Data Workshop features include:

- Import data from a structured text file, for example comma separated values (CSV) or tab separated values
- Export data from any table with choice of separator
- Generate DDL
- View object reports
- Restore dropped Database objects

Administration

As a workspace administrator, you have control over the environment in which applications are developed and deployed. Workspace administration features include:

- Management of services, including session state, log files, service termination, schema requests, storage requests, schema reports, preferences, and application models
- Management of users and user groups
- Monitoring of end user and developer activity, changes to page views and login attempts

Tasks list on the right displays the links for the following:

- Change your password
- About page that lists basic product information

Migrating Applications

Oracle Application Express Application Migration Workshop (Application Migration) enables you to migrate a Microsoft Access application and generate an Oracle Application Express application from the retrieved objects.

Workspace schemas

The list displays the Database schemas that are associated with, and therefore accessible to, this workspace.

Links

Use this list to access the following Application Express resources:

- Oracle Technology Network
- Discussion Forum
- User's Guide

APPLICATION DEVELOPMENT FEATURES

So far we've learned that Application Express improves development productivity by eliminating the need for you to program the low-level facilities needed to develop and deploy an attractive, sophisticated, and robust data driven web application. In this section we will detail a few important web development features to illustrate this point.

Automatic Session State Management

Oracle Application Express transparently maintains session state in the Database, giving developers the ability to "get" and "set" session state values from any page in their application. Each session is assigned a unique identifier (or session ID) within the Oracle Application Express installation. The Oracle Application Express engine uses this session ID to store and retrieve an application's working set of data (or session state) before and after each page view.

Declarative Data Entry Forms

Through wizards and many pre-built widgets you can quickly build forms to capture data and insert it into, or update the Database. Forms can be enhanced with:

- A wide variety of built in HTML widgets
- Data validations
- Shared list of values
- Field level help
- Pop-Up calendar

Form wizards generate all the data logic needed to perform inserts, updates and deletes. The data logic includes lost update detection to ensure that access by multiple users concurrently doesn't compromise the integrity of the data in the

Database. There is also support for more sophisticated form types such as tabular, multi-row forms, form on a table with report, form on a web-service, form on a SQL Query, master detail forms and Summary page.

The screenshot shows a web form titled "Create/Edit Employee" with a "Cancel" and "Create" button. The form contains the following fields:

- First Name: Peter
- Last Name: Chen
- Email: peter.chen@anycorp.com
- Phone Number: 555-1240-5353
- Hire Date: (empty)
- Job Id: Accountant
- Salary: 100000
- Commission Pct: 5
- Manager Id: Steven King
- Department Id: Accounting

A calendar pop-up window is open, showing January 2007. The calendar grid is as follows:

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

The calendar window has a "Close" button at the bottom.

Fig. 5 – a form created with Application Express

Fully Template Driven User Interface (UI)

Applications built with Oracle Application Express are entirely template driven. Templates are used for almost every element of an application, including: pages, regions, reports, lists, field labels, menus, buttons and pop up list of values. The Application Builder ships with ready-made design themes but also allows you to build your own templates using HTML including custom cascading style sheets (CSS), Javascript and images.

Templates are organized first by type (breadcrumb, button, region, report etc) and then by template classes, identifying the purpose of the each template within that type. Each template type provides a group of standard classes and eight custom classes.

Two new themes are included with this release 3.1 as per the figure below.

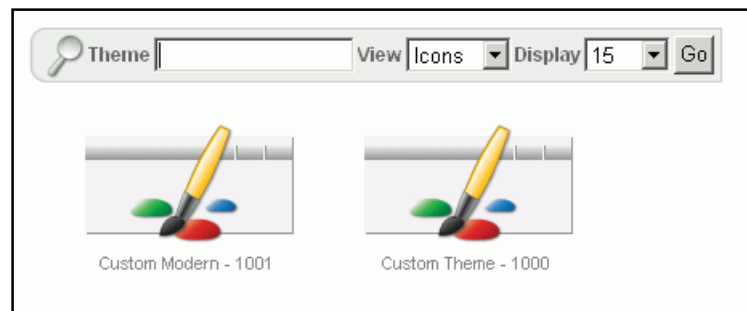




Fig. 6 – Fully template driven application building

Public theme can be created by selecting a theme from within a workspace and application. To edit this theme, create an application based off the theme and then edit the theme within that application. You may now create a new public theme with the updated application theme and add to the theme repository.

Powerful Reporting

Using the application builder, reports can quickly be created as the formatted result of a SQL query. An Easy Report wizard guides the user through building a report without requiring knowledge of SQL.

Features of the reporting engine include

- Controlling Report Layout and Pagination
- Column linking to other reports or charts
- Exporting a report as an XML File or a CSV File
- Define an Updatable Column
- Column Breaks
- Column based sorting
- Controlling when columns display
- Applying HTML based expressions to column values

Department Id	Department Name	Number Of Employees	Manager Name	Location
110	Accounting	2	S. Higgins	United States of America
10	Administration	1	J. Whalen	United States of America
40	Human Resources	1	S. Mavris	United Kingdom
80	Sales	34	J. Russell	United Kingdom
90	Executive	3	S. King	United States of America
70	Public Relations	1	H. Baer	Germany
20	Marketing	2	M. Hartstein	Canada
100	Finance	6	N. Greenberg	United States of America
30	Purchasing	6	D. Raphaely	United States of America
60	IT	5	A. Hunold	United States of America

CSV | PDF

row(s) 1 - 10 of 11 [Next](#)

Fig. 7 – a Report created with Application Express

Interactive Reporting

The Interactive Reporting Region is an innovative new technology implementation that allows end users to customize reports. This reduces development time and effort while simultaneously enhancing application functionality. This dynamic reporting region allows users to:

- Customize the layout of the data by choosing the columns they wish to view/ display
- Applying filters
- Enabling highlighting and sorting
- Define breaks, aggregations, different charts, and their own computations
- Create multiple variations of the report and save them as named reports or Output to comma delimited files or Print them to PDF, Word, Excel documents



Fig. 8 – Interactive Report created with Application Express

PDF Printing and BI Publisher Integration

Reports can also be exported to a PDF, Word, Excel, or HTML Document. Once a reports server has been configured and the definition details entered into Application Express, any report region can easily be output as a printable report, including customizable report attributes and automatic page numbering. With PDF printing declarative interface you can define a range of attributes associated with the output document e.g., you can set the report Page size, Background color, add a page header etc. Using Oracle Business Intelligence (BI) Publisher as the reports server, “high fidelity” reports can be incorporated, as shown in figure 8. BI Publisher provides a MS Word plug-in to develop complex report templates, which can incorporate multiple tables (e.g. master – detail), charts, and other parameters passed from Application Express. These report templates can then be loaded into Application Express and accessed via a URL, and called from a button or link.

New enhancements to PDF Reporting include:

- Multiple Source Queries
- Choose Document format on the fly
- Generate a PDF report and access it as a BLOB variable
- Improved data source support for Word Plug-in

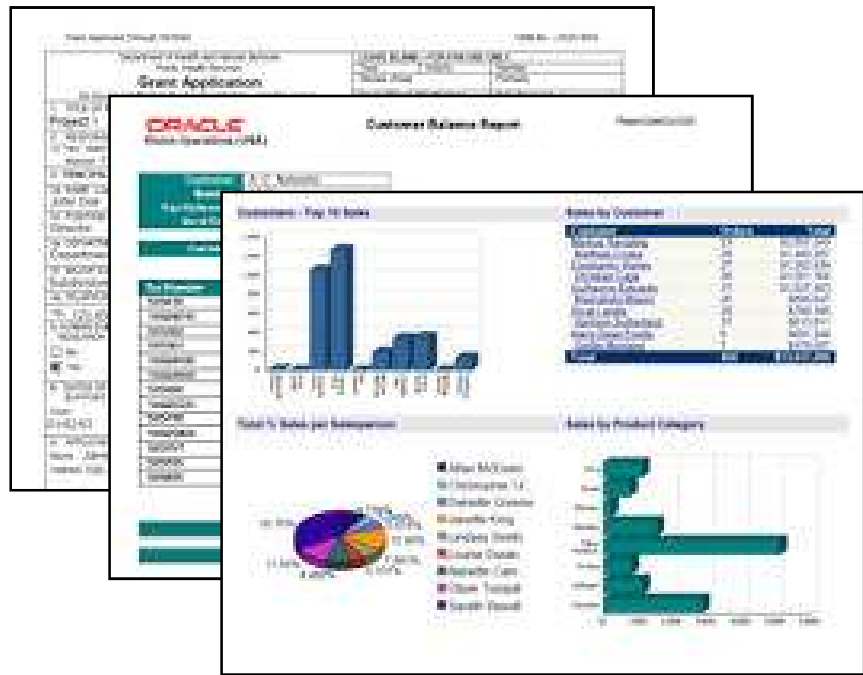


Fig. 9 – “High Fidelity” reports created with Application Express and BI Publisher

Fully Extensible with PL/ SQL, JavaScript and AJAX

Application Express offers quick development of Database centric web applications through wizards and pre built components. However, the simplicity of the tool does not compromise flexibility needed to extend the functionality of an application with custom PL/SQL or Javascript. When appropriate, the application builder lets you provide custom logic in the form of a few lines of PL/SQL or Javascript or a call to an existing PL/SQL procedure or function or Javascript function in an existing Javascript library. For example, Application Express provides built in declarative validations but also allows you to create your own Javascript based validations. Asynchronous Javascript and XML (AJAX) can easily be incorporated to perform actions between the client and the webserver. This provides the ability to further improve the user interface to meet demanding business requirements and increase customer usability and satisfaction. The new AJAX capabilities include AJAX Pagination and AJAX calendar. The javascript libraries include:

- Improved Page Load Time
- Suppress JavaScript & CSS
- Javascript functions and objects available on every page
- Build and leverage Custom Web 2.0 capabilities
- Documented Javascript API's

Charting

Three types of charts are provided in the Application Builder. The first type is based on Flash Charting and provides multiple bar, line, and pie charts together with various attributes and features such as asynchronous updates. Declarative controls are provided for a number of display attributes including animations, coloring, labeling, and legends. The second type is based on HTML and gif images and provides vertical and horizontal bar charts. The third type of chart is based on Scalable Vector Graphics (SVG), an XML-based language for Web graphics, and provides bar, line and pie charts.

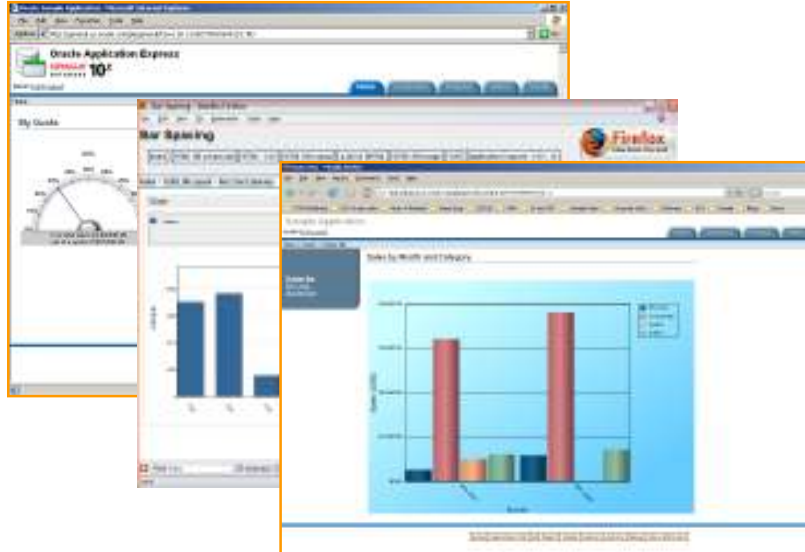


Fig. 10 – Charts created with Application Express Web Services Integration

Applications developed in Oracle Application Express may incorporate calls to external web services using SOAP. The web service response can be transformed using an XSL style sheet and incorporated in a page, or the result may simply be stored in session state. This feature provides a powerful way to integrate with logic or processes running on external servers.

Built in File Upload Capability

The Application Builder includes a “File Browse...” widget for building applications-- such as document --libraries that require the end user to upload documents and other files. Uploaded files are automatically stored in the Database and can easily be incorporated in a report for downloading.

Email Notifications

Many applications require notifications in the form of an Email message to be sent when a particular business event occurs, for example when a manager

approves a purchase order request. Application Express includes an API based on the Database's supplied UTL_SMTP package that makes sending email from your application easy. These emails can also include attachments.

Flexible Authentication

An authentication scheme is a method that will verify a user's identity and then inform the Oracle Application Express engine that it has succeeded and pass along the relevant username. That username may come from a login page inside an Oracle Application Express application or an external login page, as is the case when using Oracle Application Server Single Sign-On for example.

Oracle Application Express applications allow for the authentication scheme to be changed at any time. This gives the developer the flexibility to change to authentication based on LDAP (Lightweight Directory Access Protocol) or Oracle Application Server single Sign-On, for example, without changing any application logic.

Improved Security

Now included is a new Hidden and Protected item type which simplifies the developer's task of protecting item session state. Also, built-in page process types (DML Operations) – enhanced to negate possible SQL injection attacks.

Reusable Access Control Rules

Access control rules called authorization schemes can be defined centrally and reused by applying them to elements within an application. For example, authorization schemes can control access to a single field or button all the way up to an entire application.

Authorization schemes can be defined using declarative instructions such as 'the value of variable X must be Y' or can be more complex and query the Database or perform search in an LDAP directory.

Runtime Only Installation

Scripts provided with the installer allow you to switch between the 'Full Development' or 'Runtime' version of Oracle Application Express. When the 'Runtime Only' script has been run there will be no separate Administration User Interface. Only packages necessary to run applications are created. The APEX_INSTANCE_ADMIN Package provides utilities to enable management of this environment. You must connect to SQL*Plus to get and set the instance "Attributes" and "Settings". This involves better security because of the following reasons:

- Fewer points of entry for hackers/malicious user
- Run applications with minimal Database privileges
- Disallows developers from accidentally modifying or deleting data or pages from a Runtime Environment
- Ideal for production and testing instances

CONCLUSION

Scattering valuable information throughout the organization in spreadsheets and personal Databases breaks the flow of information and creates undue exposure to risk of security breaches. Oracle Application Express's unique architecture allows you to consolidate and secure your data while improving access by delivering it to a web browser.

Oracle Application Express's application builder provides a rich set of features optimized for web development so that even those with limited development experience can build and deploy a data-driven web application.



Oracle Application Express Overview

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