

# Oracle Application Server 10g R3 (10.1.3.1) New Features Overview

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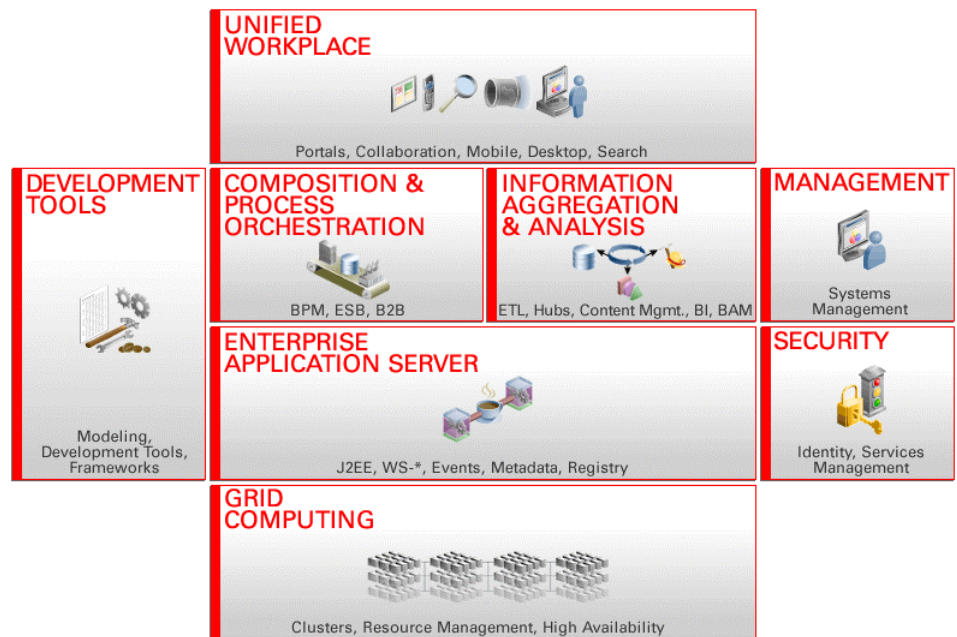
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Oracle Application Server 10gR3 is a significant new release of the Service-Oriented Architecture facilities provided by Oracle Fusion Middleware.

## 1.0 INTRODUCTION

Oracle Application Server 10g R3 (10.1.3.1) is a significant new release of the core service-oriented architecture platform underlying Oracle Fusion Middleware. It is designed to provide a standards-based, mission critical platform for organizations deploying service oriented architectures.

Beyond the core enterprise application server outlined in this paper, key components of the broader Oracle Fusion Middleware platform will be included in Oracle Application Server 10g R3. These include Oracle Business Rules, Oracle BPEL Process Manager, Oracle Web Services Manager, Oracle Enterprise Service Bus, Oracle Identity Management and Oracle Application Server Service Registry. Figure 1 provides an overview of Oracle Fusion Middleware.



**Figure 1: Oracle Fusion Middleware**

Central to the success of this baseline infrastructure is unparalleled support for key standards used in service-oriented architecture – the Java 2 Enterprise Edition (J2EE) 1.4 component model and Web services. The underlying Enterprise Application Server engine for this infrastructure is the Oracle Containers for J2EE 10g R3 (OC4J). OC4J has a proven background of being lightweight, easy-to-use and highly productive for developers and continues to lead industry benchmarks for performance and cost-effectiveness.

**Oracle Application Server 10gR3 has several new features:**

- **Comprehensive J2EE 1.4 support**
- **Enhanced Web Services Support**
- **Enhanced Messaging, Transaction Management, and Security Features**
- **Enhanced Web Services Registry**
- **Enhanced clustering and Grid Computing facilities**
- **Enhanced Systems Monitoring, and Management**
- **Enhanced support for standards - EJB 3.0, Java Server Faces, J2EE 1.4, Java 1.5.**
- **New Business Rules Engine**
- **Enhanced Features for ESB, BPEL Process Manager, Web Services Manager, and Identity Management**

The release of Oracle Application Server 10g R3 is driven by six major design themes

1. Deep J2EE 1.4 standards support to enable a portable and interoperable foundation for service oriented architecture.
2. Hardened infrastructure designed for industry leading performance, reliability, availability and scalability for new applications and those connecting to heterogeneous backend infrastructures.
3. Simplified operational and administrative capabilities designed to administratively grow from single node to large-scale distributed deployments.
4. Deep adoption of next generation enterprise Web services programming and management infrastructure to underpin loosely coupled service- oriented applications.
5. Innovation in core middleware infrastructure by providing next generation advances such as a full implementation of Enterprise Java Beans 3.0 from Java Platform Enterprise Edition 5.0, JavaServer Faces, a native business rules engine and object-to-XML tooling for service-oriented application development.
6. Deep integration of higher-level Oracle Fusion Middleware components on this runtime architecture including Oracle Business Rules, Oracle BPEL Process Manager, Oracle Web Services Manager, Oracle Enterprise Service Bus, Oracle Identity Management and Oracle Application Server Service Registry.

Pervasive throughout the design themes of Oracle Application Server 10g R3 is an underlying philosophy to make the environment simple, open and easy-to-use within heterogeneous middleware infrastructures while staying true to its heritage of being the industry’s most hardened infrastructure for mission critical application deployments.

**2.0 STANDARDS SUPPORT: J2EE INFRASTRUCTURE**

In order to maximize productivity and reduce risk in usage of middleware infrastructure, deep adoption of standards is key. Oracle Application Server 10g R3 is certified to be a fully J2EE 1.4 compatible container that runs on a standard file based J2SE 5.0 Java Virtual Machine and provides complete support for the key development paradigms of JavaServer Pages (JSP), Servlets, Enterprise JavaBeans (EJB), Java Message Service, J2EE Connector Architecture, Web services and all the underlying J2EE services for deployment, management transactions and security.

Table 1 outlines the primary J2EE 1.4 and Web services standards Oracle Application Server 10g R3 supports.

JavaServer Pages (JSP)	2.0
Servlets	2.4
Java Server Faces	1.1

Enterprise JavaBeans (EJB)	3.0
Java Management Extensions (JMX)	1.2
JMX Remote Access API	JSR-160
J2EE Management	1.0 (JSR-77)
J2EE Application Deployment	1.1 (JSR-88)
Java Transaction API (JTA)	1.0
Java Message Service (JMS)	1.1
Java Naming and Directory Interface	1.2
Java Mail	1.2
Java Database Connectivity (JDBC)	3.0
Java Authentication & Authorization Service	1.0
J2EE Connector Architecture	1.5
Enterprise Web Services	1.1 (JSR-921)
Web Services Metadata	1.0 (JSR-181)
Java API for XML-Based RPC (JAX-RPC)	1.1
SOAP with Attachments API for Java (SAAJ)	1.2
Java API for XML Processing (JAXP)	1.2
Java API for XML Registries (JAXR)	1.0.5
Java API for Rules Engines	JSR-94
Common Annotations for the Java Platform	JSR-250

**Table 1: Oracle Application Server 10g R3 Standards Support**

Oracle Application Server 10g R3 retains its extremely lightweight footprint – requiring approximately 69 MB disk to install - even with significant new native capabilities including pre-configured console for management, rules management engine and message routing services. The result is that it is fast to install – typically taking less than 15 minutes – and it is very easy to use with built-in management console. Because it is written in Java it is available on 32-bit and 64-bit versions of standard operating systems and JDKs on a wide range of hardware platforms including Linux, Solaris, HP-UX, AIX, and Windows NT/2000/2003.

## 2.1 Presentation Tier – Java Server Pages and JavaServer Faces

Oracle Application Server 10g R3 provides a JSP translator and runtime engine compliant with version 2.0 of Sun’s JavaServer Pages specification working hand-in-hand with the Servlet 2.4 compliant runtime.

Built on top of this foundation runtime environment, Oracle Application Server 10g R3 has comprehensive support for JavaServer Faces (JSF). JavaServer Faces is a new, highly productive standard Java framework for building Web applications. It simplifies development by providing a component-centric approach to developing Java Web user interfaces.

One of the most compelling aspects of JSF's user interface component technology is its pluggable rendering capability. JSF UI Components have the ability to render themselves differently depending on the client type viewing the component.

**Oracle Application Server 10gR3 provides comprehensive support for**

- **Java Server Pages 2.0**
- **Servlet 2.4**
- **Java Server Faces**

Oracle has been instrumental in leading the adoption of JavaServer Faces not only by being committed to the Java Specification Requests 127 and 252 but by actively participating in the popular open source community MyFaces to facilitate adoption of that framework and further by working within the Eclipse community to drive the creation of an open source JavaServer Faces design time environment.

These efforts are complemented by Oracle's work within Oracle JDeveloper where Oracle pioneered one of the industry's first JSF design times and has developed a rich family of JSF components called ADF Faces. Extensive information and tutorials on JSF is available at <http://otn.oracle.com/jsf>.

With the annotation-driven development model being used extensively within the EJB 3.0 specification and more generally across the entire Java Enterprise Edition 5.0 specification, the OC4J Web container supports the use of annotations within web application code. This enables Web developers to benefit from the same sort of productivity benefits EJB developers are experiencing through being able to specify resource dependencies that the container should automatically populate when applications are loaded.

## **2.2 Business Tier – Enterprise Java Beans**

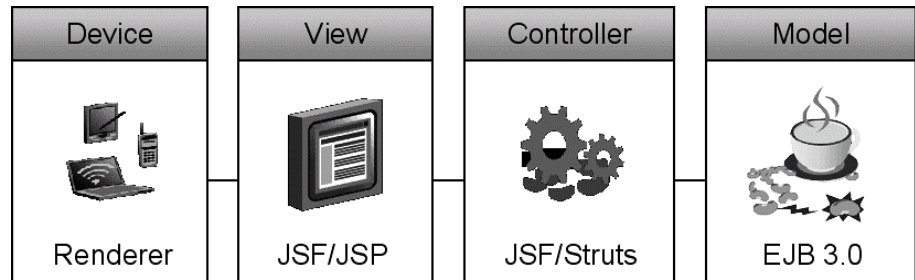
Oracle Application 10.1.3.1 provides full support for the EJB 3.0 specification out-of-the-box. EJB 3.0 greatly simplifies the programming model for EJB and standardizes the persistence model for the Java platform. The EJB 3.0 implementation in Oracle Application Server 10g R3 gives Java developers the opportunity to begin exploring the capabilities of EJB 3.0 by building and deploying applications, in readiness for the full production release for which there are plans to support the finalized EJB 3.0 specification.

As with the presentation tier with JSF, Oracle has made a large commitment to both the industry and its product offering to drive forward the next generation standard EJB 3.0 by working in four different areas:

1. Being the first commercial J2EE Server to provide a complete implementation of the EJB 3.0 specification to lead the adoption of this important new development paradigm.
2. Contributing its EJB 3.0 implementation to be the reference implementation for the Java EE 5.0 platform to ensure widespread adoption by J2EE vendors. Oracle is the co-specification lead for EJB 3.0 in the Java Community Process.
3. Contributing Oracle TopLink Essentials as the reference implementation of the Java Persistence API (JPA) to Project GlassFish, Sun's open source implementation of the Sun Java System Application Server software.
3. Leading the EJB 3.0 persistence project in Eclipse to ensure an open source design time for EJB 3.0 application development.

Oracle is making this investment, similar to its work with JavaServer Faces, because of clear evidence that these new programming models radically simplify Java application development, significantly increase productivity and ultimately reduce the monetary and time investment necessary to deliver enterprise quality applications on the J2EE platform. Extensive information and tutorials on EJB 3.0 is available at <http://otn.oracle.com/ejb3>.

The new application development model recommended by Oracle based on EJB 3.0 and JSF is illustrated in Figure 2.



**Figure 2: JSF and EJB 3.0 Development Model**

In, Oracle Application Server 10gR3, Toplink has many new features

- **Container Managed Persistence**
- **Object-Relational and Object-XML Mapping**
- **Support for Virtual Private Database and Stored Functions**
- **JMX-based Management**
- **Comprehensive EJB 3.0 Support**

## 2.3 Persistence - TopLink

### 2.3.1 Oracle TopLink

Oracle TopLink is fully integrated into the Oracle Application Server 10g R3 infrastructure. Oracle TopLink is an advanced, object-persistence and object-transformation framework that provides development tools and runtime capabilities that reduce development and maintenance efforts and increase enterprise application functionality.

TopLink is designed for use with a wide range of Java 2 Enterprise Edition (J2EE) and Java application architectures:

- **Relational** - for transactional persistence of Java objects to a relational database accessed using Java Database Connectivity (JDBC) drivers.
- **Object-Relational** - for transactional persistence of Java objects to special purpose structured data source representations optimized for storage in object-relational databases such as Oracle Database.
- **Enterprise Information Service (EIS)** - for transactional persistence of Java objects to a non-relational data source - accessed using a J2EE Connector Architecture (J2CA) adapter and any supported EIS record type, including indexed, mapped, or XML.
- **XML** - for non-transactional, non-persistent (in-memory) conversion between Java objects and XML Schema Document (XSD) based XML documents using Java Architecture for XML Binding (JAXB).



Oracle TopLink 10g R3 has tighter Oracle Application Server integration with support for CTS 1.4 compliant EJB CMP, JMX based management framework, standard logging framework and security policies. It leverages the Oracle Database with support for Virtual Private Database, XML DB XMLType, flashback, and stored functions. Oracle TopLink also includes major enhancements in the TopLink Workbench, caching, clustering and transaction areas. Finally, Oracle TopLink 10.1.3 continues its broad support for non-Oracle Application Servers.

### 2.3.2 EJB 3.0 Persistence

Oracle TopLink is the foundation of Oracle's EJB 3.0 persistence engine and the source of the EJB 3.0 Persistence Reference Information for the Java EE 5.0 platform. In EJB 3.0, the specification, a lightweight persistence model based on plain old Java objects (POJOs) replace the previous entity bean style significantly simplifying the effort necessary to persist Java application data. Making migration to EJB 3.0 persistence within Oracle Application Server 10g R3 even easier is the tight relationship between TopLink and EJB 3.0.

### 2.3.3 Object-XML

Oracle TopLink 10.1.3 introduces a major new set of functionality around object to XML mapping with JAXB. With Oracle TopLink 10.1.3 developers can go well beyond what can be done with JAXB including support for mapping existing Java objects to XML. The TopLink Workbench can be used to create and customize these Java object to XML mappings. TopLink also provides developers complete flexibility with the analogous-to-object-relational ability to control how their object model is mapped to an XML schema.

One of the key advantages of TopLink's object to XML capabilities is that the mapping information is stored externally and does not require any changes to the Java classes or XML schema. This means that developers can map domain objects to more than one schema or if the underlying schema changes developers can simply update the mapping metadata instead of modifying domain classes.

## Oracle Application Server 10gR3 has

many Oracle Application Server 10gR3 ha

- many Data Source enhancements:
  - Rationalization of managed and non-Managed Data Sources
  - Optimized Connection Cache
  - Support for Oracle 9.2, 10.1, 10.2 Databases including RAC

## 2.4 Data Sources and Transactions

### 2.4.1 Data Sources

A continued area of large engineering investment in Oracle Application Server 10g R3 has been data sources, particularly in the area of simplification and hardening of the underlying infrastructure. In the area of simplification, Oracle Application Server 10g R3 has focused on rationalizing the categorization of data sources to the following:

- *Managed data sources:* A managed data source is an Oracle Containers for J2EE provided data source implementation that acts as a wrapper to a JDBC driver or data source. Oracle Containers for J2EE provides critical system

infrastructure, such as global transaction management, connection caching, dynamic configuration via JMX, and error handling, for managed data sources.

- *Native data sources:* A native data source is a DataSource implementation from JDBCdriver vendors such as Oracle and DataDirect. Native data sources are not wrapped by Oracle Containers for J2EE.

In the area of hardening, data sources in Oracle Application Server 10g R3 comes with a new connection caching mechanism that leverages all the new Implicit Connection Cache features in Oracle Database 10g JDBC. Some of the advantages associated with the new connection caching include:

- Driver independence
- Compliance to JDBC 3.0 standard
- Transparent access to the connection cache
- Multiple users and passwords per cache
- Connection recycling and refresh of stale connections
- Attribute-based search for connections
- Multiple cache enabled DataSource
- Connection cache callback mechanism
- Integrated support for RAC fast connection failover

Data sources in Oracle Application Server 10g R3 are now managed dynamically using JMX and do not require restart of Oracle Containers for J2EE for any changes in the data sources.

#### **2.4.2 Transactions**

Oracle Application Server 10g R3 introduces a enhanced middle tier transaction coordinator that supports all XA-compatible resources, not just those from Oracle including third party databases like IBM DB2, Microsoft SQL Server and JMS providers like WebSphere MQ, Tibco and Sonic. In addition, full transaction propagation between Oracle Containers for J2EE processes is supported over ORMI enabling OC4J instances to participate in distributed transactions.

#### **2.5 Java 2 Connector Architecture**

In a significant upgrade for application integrators working with enterprise information systems (EIS), Oracle Application Server 10g R3 provides a complete implementation of version 1.5 J2EE Connector Architecture. This includes full support of quality of service system level contracts including lifecycle management, security management, work unit management, message inflow and transaction inflow. New in J2CA 1.5 is a standardized approach for inbound and outbound communication enabling external EIS to both initiate activities back into the container as well as to receive, as previously, input from the container.

Oracle Application Server 10gR3 has many security enhancements:

- **Native support for Active Directory and any LDAP Store**
- **Security Context Propagation**
- **JACC Support**
- **Comprehensive Web Service Security Infrastructure including XMLDigSig; XMLEncryption; Security Tokens; and SAML Support**

## 2.6 Security

### 2.6.1 Core Container

Oracle Application Server 10g R3 provides a number of enhancements to the base security infrastructure as part of J2EE 1.4 compliance as well as new capabilities for enterprise deployments. These include:

- Native support for 3<sup>rd</sup> party LDAP servers including Active Directory and Sun Java System Application Server (formerly known as iPlanet).
- Security context propagation, also known as subject propagation, between Oracle Containers for J2EE instances.
- JACC Support - This feature implements JSR-115 (Java Authorization Contract for Containers).
- Support for Oracle CoreID 10.1.2.

### 2.6.2 WS-Security for Authentication, Integrity and Confidentiality

Oracle Application Server 10g R3 provides a comprehensive WS-Security implementation for authentication, confidentiality with encryption and integrity with digital signatures as described below:

- *XML Digital Signatures*: Message integrity addresses how to use digital signatures to ensure that SOAP messages are not tampered with during transmission. Oracle Application Server uses XML Digital Signatures to ensure message integrity.
- *XML Encryption*: Message confidentiality addresses how to use encryption to keep portions of a SOAP message confidential. Oracle Application Server uses XML Encryption to ensure message confidentiality.
- *Security Tokens*: Message authentication provides a means for associating an identity with a message. For example, this could be a digital certificate or a username token. Oracle Application Server uses WS-Security SecurityTokens to provide message authentication capabilities.
- *SAML*: Support SAML token profile as an authentication mechanism within WS-Security. This feature enables customers to use standards based authentication and to propagate the identity from one web service to another Web service in a standard interoperable way.

Figure 3 provides an overview of the Oracle Application Server Web Services WS-Security configuration model, showing how the WS-Security capabilities are configured independent of the Web service endpoints.

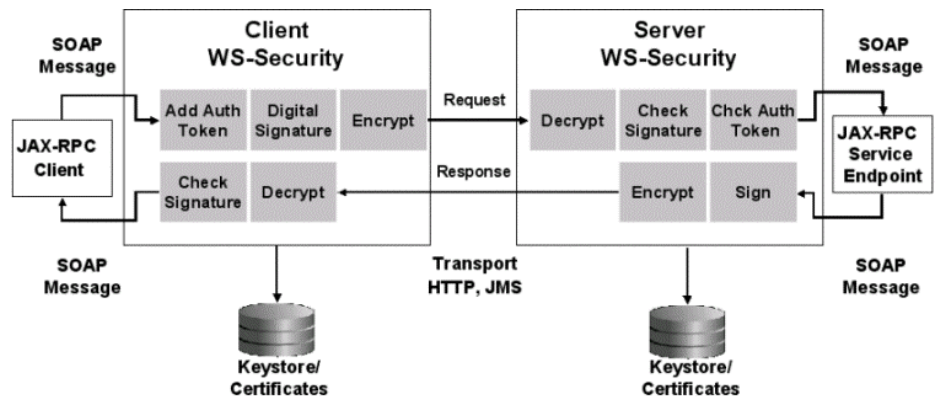


Figure 3: Oracle Application Server Web Services Security Implementation

## 2.7 Scheduler

Oracle Application Server 10g R3 introduces a new scheduling engine as part of the Application Server. Oracle Containers for J2EE Job Scheduler enables J2EE clients to submit asynchronous, autonomous background jobs to be run in Oracle Containers for J2EE (OC4J). Some major features of this component are:

- Temporal- and trigger-based jobs
- Automatic retry of failed jobs
- Job blackout windows
- Java Management Extensions (JMX) MBeans for monitoring and administering Oracle Containers for J2EE Job Scheduler
- Configurable logging of various system, error, and warning messages
- API for submitting, controlling, and monitoring jobs
- API-level Java Transaction API (JTA) support for job submission and control

## 2.8 Class Loading

In Oracle Application Server 10g R3, the class loading framework has been extensively re-architected offering a more flexible set of options for controlling and configuring how Oracle Application Server provides resources to deployed applications. Inherent in the new framework is the notion of a shared-library, which represents a set of code-sources (JAR files), which, in turn, can be reached by a class loader.

With the new class loading framework, a clear and clean separation is made between the shared libraries that Oracle Application Server itself depends on to operate, and the additional shared libraries which applications may install and use. This new class loading framework underlies the increased ease of use customers will experience with testing and certifying third party commercial and open source products on the runtime environment.

## 2.9 Open Source Runtime Integration

Open source frameworks and software has rapidly become fundamental to many organizations' development projects. In reaction to this Oracle has invested heavily

**With Oracle Application Server 10gR3, Oracle has tested and certified a variety of popular Open Source technologies on its Application Server including**

- **Spring**
- **Apache Struts**
- **Apache Axis**
- **Apache MyFaces**
- **Tapestry**
- **Ant**
- **Hibernate**
- **Log4J**

in certifying key popular open source software frameworks, libraries and products on Oracle Application Server 10g R3 . A short list of some key open source projects that will be formally certified on Oracle Application Server 10g R3 include:

- Spring
- Apache Struts
- Apache Axis
- Apache MyFaces
- Tapestry
- Ant
- Hibernate
- Log4J

Oracle has clearly done more within the open source community with leadership roles in the JSF, BPEL and EJB 3.0 Persistence projects in Eclipse, building Oracle Containers for J2EE JSR 88 deployment in Eclipse and the aforementioned EJB 3.0 Reference Implementation contribution to Project Glassfish. These prominent and significant resource commitments represent a strong interest in contributing resources and software to the open source community.

**Oracle JDeveloper 10gR3 introduces a large number of new features:**

- **J2SE 5.0 Support**
- **J2EE 1.4 Support**
- **40+ New Refactoring Actions**
- **Enhanced Look and Feel**
- **Significant Usability Improvements**
- **New Database Development Features**
- **Enhanced Application Development Framework**

## **3.0 DEVELOPMENT TOOLS**

### **3.1 Oracle JDeveloper 10.1.3**

Oracle JDeveloper 10g is a J2EE development environment with end-to-end support for modeling, developing, debugging, and deploying applications and Web services. Oracle JDeveloper 10g R3 will ship coincident with Oracle Application Server 10g R3

#### **3.1.1 Core IDE**

Oracle JDeveloper 10g R3 introduces a brand new look and feel containing many usability enhancements with respect to windows management include drag and drop feedback, fast maximize and restore capabilities, title bars as tabs and editor window splitting. JDeveloper also introduces enhancements in the area of files and project management such as dynamic projects, working sets, shareable and user-local properties and library management that simplifies team development environment.

#### **3.1.2 Java Coding and Re-Factoring**

The new re-factoring framework allows for more powerful and faster re-factoring with over 40 re-factoring actions. This new framework allows optional searching/refactoring in non-Java files, for example the struts-config.xml file, and in comments and strings in Java source files. New Java code navigations include the ability to navigate using Find Usages, the Hierarchy Browser, Implemented and Overridden margin markers, as well as easy navigation between members.

Code assist functionality helps developer identify problematic areas in their code and automatically offers fixes when possible. Features such as dynamic code templates, keyboard shortcuts, code folding, import assistance, and file overview margin speed up coding tasks and simplify interaction with large chunks of code.

### **3.1.3 J2SE 5.0 Support**

Complementing the Oracle Application Server 10g R3 support, Oracle JDeveloper 10g offers complete support for J2SE 5.0. Not only can the new J2SE be used for compiling, running, debugging, and profiling Java projects, but the IDE also provides tools to assist with the new coding constructs introduced in J2SE 5.0. For example, the Structure Pane, Code Insight, and the Code Editor have all been updated to work with metadata annotations, generics, auto-boxing, var args, and more. IDE features like code templates and re-factoring have been enhanced to take advantage of the new J2SE features.

### **3.1.4 J2EE 1.4 Support**

Oracle JDeveloper 10g R3 supports development of the various J2EE artifacts using the J2EE 1.4 specifications. Interactive dialogs simplify the development of EJB 2.1. Visual development is provided for JSP 2.0 and Servlets 2.4 with support for new features such as coda and prelude creation. JDeveloper also supports development for the upcoming EJB 3.0 API.

This new release of JDeveloper supports J2EE 1.4 compliant Web services runtime in Oracle Application Server 10g R3 with the ability to create JAX-RPC clients and services as well as use Web Services Metadata for Web services publishing. It also includes new wizards for WS-Security, WS-Reliability, and WS-Management, allowing users to set security, quality of service, and logging properties for Web services before deployment.

### **3.1.5 JavaServer Faces Development**

Oracle JDeveloper provides a visual JavaServer Faces (JSF) development environment as well as an extensive library of JSF components - Oracle ADF Faces. In addition to drag-and-drop support for user interface components and faces navigation, developers have access to the JSF source code at all times.

Oracle JDeveloper offers live rendering in the visual editor for JSF components provided by the JSF Reference Implementation (RI), as well as custom components such as ADF Faces, MyFaces and other third party JSF components.

In addition Oracle JDeveloper now offers a visual page flow modeler for the JSF controller, similar to the one offered for the Struts controller in previous versions, and additional dialogs to help edit the jsf-config.xml file.

### **3.1.6 Open Source Design Time Integration**

Oracle JDeveloper 10g R3 enhances its support for open source and provides

**Oracle JDeveloper 10gR3 enhances support for Open Source tools including ANT, JUnit, CVS, Struts, XDoclet, SubVersion, and PVCS.**

easier integrations with Ant, JUnit, CVS, Struts, and Xdoclet. Oracle JDeveloper is expected to provide a reference implementation of JSR-198 once it is finalized, thus enabling integration with any tool supporting this specification.

**Oracle ADF 10gR3 has many new capabilities including support for Java Server Faces, Enterprise Java Beans 3.0, Visual and Declarative Page Design, and JSR-227 based Declarative Data Binding.**

### **3.1.7 Oracle Application Development Framework**

Oracle Application Development Framework (Oracle ADF) simplifies J2EE development by minimizing the need to write code that implements design patterns and application infrastructure. Recognizing that having a set of runtime services is not enough, Oracle ADF is also focused on the development experience providing a visual and declarative approach to J2EE development.

The new release of Oracle ADF includes new support for JSF as the View/Controller layer and EJB 3.0 in the Model layer. Additional improvements include declarative validation definitions for the model layer as well as many enhancements for the visual development experience.

**Oracle Application Server 10gR3 has many new features supporting Eclipse including integration with the Web Tools Project; BPEL and Java Server Faces modeling; and support for Data Tools.**

### **3.2 Eclipse**

Oracle is providing Eclipse support in four major areas:

1. Contributing engineering resources to create a JSF design time in Eclipse.
2. Contributing engineering resources and leading the EJB 3.0 Persistence project in Eclipse.
3. Building a JSR 88 deployment plugin for the Web Tools project to enable easy deployment to Oracle Application Server 10g R3.
4. Contributing engineering resources and leading the BPEL design time project in Eclipse.

The addition of scripting and simple Ant tasks natively part of Oracle Application Server 10g R3 to this investment makes development J2EE and Web service applications for Oracle Application Server 10g R3 in Eclipse a seamless undertaking.

### **3.3 Command Line Tools and Scripting**

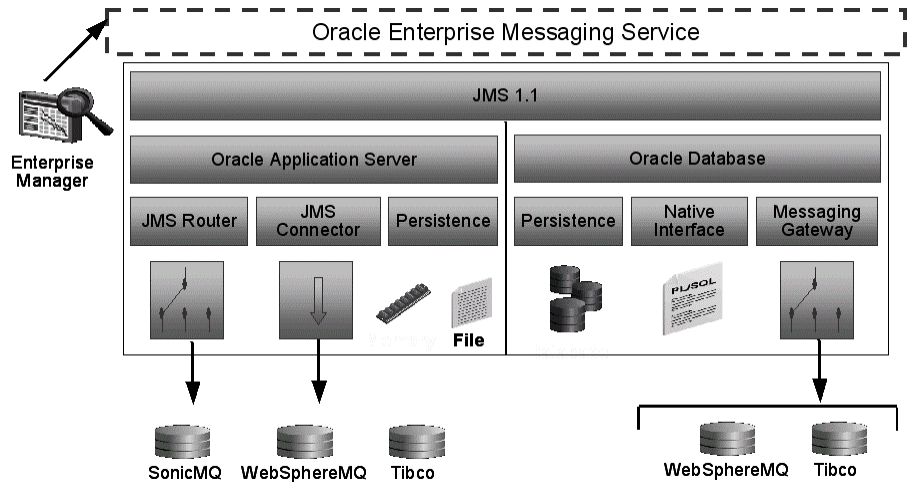
Oracle Application Server 10g R3 continues to provide an extensive list of command line tools to enable scripting of the development and deployment environment. In this release full support for Ant based tasks for JSR 88 deployment and configuration operations, and Web services development has been added to the out-of-the-box experience. Further, support for scripting using popular languages such as Groovy, Beanshell and Jython has been added, enabling the easy scripting of deployment and resource configuration tasks.

**Oracle Application Server 10gR3 introduces significantly enhanced Enterprise Messaging facilities.**

### **4.0 ENTERPRISE MESSAGING SERVICE**

Oracle Application Server 10g R3 introduces the Oracle Enterprise Messaging Service (OEMS). This is the next generation infrastructure based on the JMS 1.1

foundation provided by the Oracle Containers for J2EE. OEMS is built on Java 2 Enterprise Edition (J2EE) standards such as the Java Message Service (JMS) and the J2EE Connector Architecture (JCA) and is designed to reduce the time, cost, and effort required to build message oriented integrated distributed applications. Figure 4 provides a summary of the OEMS environment.



**Figure 4: Oracle Enterprise Messaging Service Architecture**

#### 4.1 Quality of Service

The foundation of OEMS is Oracle Application Server 10g R3 and the Oracle Database 10g platform which offer developers a choice of many different message persistence models.

By implementing a JMS 1.1 compliant interface, OEMS makes the choice configurable when architecting and integrating distributed applications. For a lightweight solution you can choose to persist messages in-memory or to the file system. For a more robust solution, Oracle Streams Advanced Queuing (AQ) in the Oracle Database can be used to store messages.

#### 4.2 Enterprise Messaging Integration

Reducing the complexity and cost of enterprise application integration is a challenge in distributed environments. OEMS provides a standardized means to achieve these goals by connecting your current message based applications with applications deployed onto the Oracle Containers for J2EE. Customers who want to integrate existing messaging systems like WebSphereMQ, Tibco Enterprise JMS, or SonicMQ with an OC4J Message Drive Bean (MDB) can now accomplish this using the JMS Connector, a generic JCA based resource adapter implementation in the Oracle Application Server.



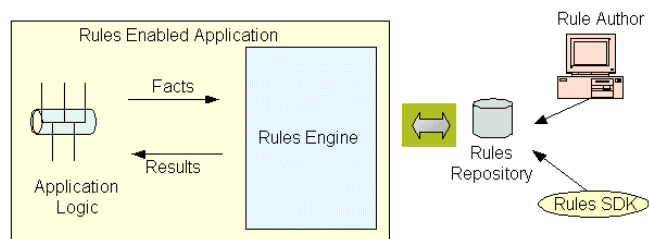
### 4.3 Store and Forward

A distributed messaging environment requires dependable and flexible message delivery between applications residing on local or remote servers. If the server for a message end point is down then the sending server should dependably store messages until the destination server is back up. Furthermore, these architectures often require the flexible integration of dissimilar messaging systems. The built-in JMS Router meets these requirements by providing guaranteed message propagation between the Oracle JMS in-memory and file-based systems to the Oracle JMS database system, WebSphereMQ, Tibco Enterprise JMS, and SonicMQ message systems.

**Oracle Application Server 10gR3 introduces a Business Rules Engine to allow users to declaratively specify Business Rules**

### 5.0 BUSINESS RULES

Oracle Application Server 10g R3 ships Oracle Business Rules natively as part of the runtime. Oracle Business Rules allows application developers to add agility and transparency to their applications by allowing business analysts, without depending on programmers, to directly effect application changes reflecting new business policies. Oracle Business Rules is especially suited to deployment as part of BPEL applications in particular, SOA applications in general and other architectures where agility is important. Figure 5 provides an overview of the Oracle Business Rules engine architecture.



**Figure 5: Oracle Business Rules**

### 6.0 WEB SERVICES

Oracle Application Server 10g R3 Web Services provides a new runtime infrastructure supporting J2EE 1.4 Web services. Figure 6 provides an architectural overview of this new infrastructure. The Web services runtime fully leverages the scalability, reliability and performance characteristics of core Oracle Application Server 10g R3 environment.

In addition to supporting publishing and consuming Java Web services the Oracle Application Server Web Services environment also enables declarative quality of service characteristics on those service endpoints such as WS-Security, WS-Reliability, content based logging and auditing. The Oracle Application Server Web Services 10.1.3 framework is used across the Oracle platform in a variety of component areas such as the Oracle BPEL Process Manager, Oracle Application Development Framework, Enterprise Service Bus and Web Services Manager as

foundation Web services infrastructure in addition to being a standalone developer platform for developing Web services.

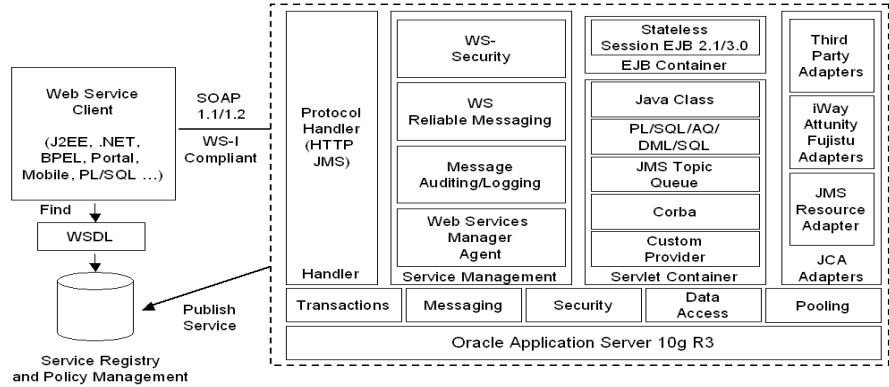


Figure 6: Oracle Application Server 10g R3 (10.1.3.0.0) Web Services Framework

Oracle Application Server 10gR3 introduces a comprehensive Web Services infrastructure:

- Supports publishing and consuming Java Web services
- Declarative quality of service characteristics on service endpoints such as WS-Security, WS-Reliability, content based logging and auditing
- Complete support for WS-I Basic Profile 1.0
- Interoperability with MSFT.NET

## 6.1 J2EE 1.4 Web Services

The J2EE 1.4 specification outlines a family of standards that make up the programming model for portable Web services – Oracle will have a complete implementation of these standards. From a core programming API, this includes the Java API for XML Remote Procedure Calls (JAX-RPC 1.1) and the SOAP Attachment API for Java (SAAJ) 1.2.

Also impacting component developers is the addition of a native mechanism to declare an EJB 2.1 interfaces as Web services. Lastly, Enterprise Web Services 1.1 (also known as JSR 921) defines a portable packaging and deployment model for Web services.

Using this standards based infrastructure the following Java artifacts are publishable as Web services in Oracle Application Server 10g R3 :

- Java classes
- Stateful Java classes
- EJB components
- JMS queues and topics

## 6.2 Web Services Metadata – Annotation Based Web Services

In addition to the fully specified Web services programming API provided by J2EE 1.4, Oracle Application Server Web Services debuts one of the first commercial implementations of Java 5.0 annotation programming for Web services, compliant with Web Services Metadata (JSR 181).

This approach enables a significantly simplified programming model for Web services where developers add simple annotation markup to their Java classes to describe them as Web services. No other configuration is necessary. A sample class annotated for Web services is shown in Listing 1.

```
package sample1;
import javax.jws.WebMethod;
import javax.jws.WebService;

@WebService(
name = "EchoEndpoint",
targetNamespace = http://echo/targetNamespace )
public class Echo {

@WebMethod
public String echoString(String p) {
return "echo" + p; }
}
```

**Listing 1: Annotated Java Class for Web Services**

The annotation approach to programming in Java 5.0 is considered a major step forward in usability and productivity across the entire Java platform. Oracle has taken deliberate steps to ensure this model is available to the developer community as early as possible to ensure developers are able to understand how best to use it in their environments.

### **6.3 Web Services Interoperability (WS-I)**

A significant effort in J2EE 1.4 Web services was ensuring that Web services built with JAX-RPC and SAAJ could easily conform to the WS-I Basic Profile. By conforming to the WS-I Basic profile, a set of best practices defined by Oracle, IBM, Microsoft, Sun and others, developers have a high certainty that their Web services will interoperate across heterogeneous Web services implementations. By default, Web services built with Oracle Application Server 10g R3 Web Services conform to the WS-I Basic Profile 1.1. Further, Oracle has also done the same interoperability certification with its WS-Security implementation conforming to the WS-I Basic Security Profile 1.0.

### **6.4 Web Services Reliable Messaging**

In Oracle Application Server 10g R3, Oracle provides a complete SOAP reliable messaging infrastructure. This reliable messaging implementation is designed to provide architects with a guaranteed message delivery between a Web service client and server ensuring at least once, at most once and exactly once SOAP message delivery. In the current version Oracle Application Server 10g R3, provides an implementation of the OASIS standard WS-Reliability however Oracle is committed to delivering an implementation of WS-ReliableExchange, a reliable messaging variant that has drawn consensus from the major Web services infrastructure vendors Oracle, IBM, BEA and Microsoft when it emerges from the OASIS standards body.

## Oracle Application Server 10gR3

### Web Services Infrastructure supports:

- **WS-I Basic Profile 1.0**
- **WS-Reliability**
- **Database Web Services**
- **Web Services Invocation Framework (WSIF)**
- **REST-style Web Services**

## 6.5 Database Web Services

Oracle Application Server Web Services has supported publishing PL/SQL as Web service since Oracle9iAS Release 2. Oracle Application Server Web Services is also used as the Java runtime in the Oracle Database 10g for call outs to Web services. This support continues going forward but based on the new J2EE 1.4 Web services infrastructure.

In this release Oracle Application Server Web Services will extend its database capabilities and tooling to include the ability to declaratively define the following database artifacts as Web services:

- SQL statements
- DML statements
- AQ queues
- Java classes loaded within the database Java virtual machine

## 6.6 Web Services Invocation Framework Support

Developers often would like to describe resources using WSDL yet not require the abstraction of requiring the invocation model to be XML SOAP message based. The Apache Web Services Invocation Framework (WSIF) provides a general-purpose, extensible mechanism to describe arbitrary programmatic artifacts using WSDL as well as a framework to invoke those programmatic artifacts using their native protocols rather than through SOAP based messaging. Oracle Application Server Web Services provides an implementation of WSIF along with tooling to generate WSIF bindings within standard Java, EJB and PL/SQL Web services. This is designed to work hand in hand with the Oracle BPEL Process Manager which uses both loosely coupled Web services as well as native, high performance, transactional service interfaces based on WSIF bindings.

## 6.7 REST Web Services

In Oracle Application Server 10g R3, ordinary JAX-RPC Web services can be declaratively defined to support both SOAP messages over multiple protocols and additionally what is frequently called a REST style of Web services. REST is an acronym for Representational State Transfer and defines a simplified model for constructing Web services predicated on the basic web infrastructure of HTTP, URIs and simplified data formats of plain old XML (PoX).

Any JAX-RPC or Web Services Metadata Web service built on Oracle Application Server 10g R3 can be simply exposed both as a SOAP Web service or a REST Web service. In the latter case, there is no SOAP wrappers required on the message exchange, simply the XML message content, however, the resulting plain XML messages are still constrained by the message schemas defined in the WSDL. The end result is a highly productive yet radically simplified model for building Web services integrations and applications.

## 6.8 Oracle Application Server Service Registry

Oracle Application Server 10g R3 introduces Oracle Application Server Service Registry based on the UDDI V3 standard. Oracle Application Server Service Registry is a best of breed business service registry enabling SOA governance and lifecycle management.

This new registry provides a configurable, scalable, and secure repository of Web services that can be managed, discovered and governed by Oracle Fusion Middleware. Direct integration is provided with Oracle BPEL PM, Oracle Web Services Manager and Oracle JDeveloper via the interoperable UDDI browsers used in those products.

Key features in this release include:

- **Core Services**  
Support for UDDI V3 standard, including support for subscriptions and notifications for automatic notifications of changes to Web services
- **Information Services**  
Business service data access, including the ability to discover business services based on business and technical classification and without having to understand the underlying UDDI data structure
- **Lifecycle Services**  
Business service discovery, based on the powerful business services browser allowing users to navigate through their business services based on business-relevant classifications
- **Configurable Web-based Business Service Console**  
Customer-defined and configurable, Registry ships with preconfigured User Profiles for different communities, including developers, architects and administrators

Oracle Application Server Control in 10GR3 introduces new features:

- **JSR-77 based Management**
- **JSR-88 based Deployment**
- **Lightweight Console**
- **Role-based Administration**

## 7.0 APPLICATION SERVER CONTROL

Oracle Application Server Control provides management for single node and distributed topologies of Oracle Application Server 10g R3. It is designed to provide comprehensive end-to-end configuration management and real time monitoring for the Oracle Application Server, J2EE applications and applications instrumented with JMX. This new version offers local, remote and role based administration of Oracle Containers for J2EE (OC4J).

This new management framework, based on a high performance J2EE architecture designed to complement the overall architecture of the Oracle Application Server to lower IT management costs and increase operational efficiency for administrative staff.

## 7.1 Lightweight Architecture

Enterprise Manager AS Control has been completely re-architected in 10.1.3. Application Server Control itself is a J2EE application that runs within one of the OC4J containers in the cluster. In small deployments, the OC4J that hosts Application Server Control can also be used to host customer applications. The new architecture also eliminates the need for a separate EM Agent. These footprint and resource reductions yield more system resources for real end user applications and enable administrators to manage and monitor applications with minimal impact.

## 7.2 Standards Based Management

Application Server Control is based on JMX and leverages JSR 77 MBeans provided by the OC4J container for configuration, monitoring and state management. The standards based architecture also supports administration and monitoring via Application Defined MBeans. The new MBean browser provides complete support for JSR 77 as well as Application Defined MBean operations such as viewing MBean attributes values and statistics, MBean method invocation, subscription to JMX notifications, , and state management.

Application Server Control provides JSR 88 support for application deployment. A JSR 88 based deployment wizard simplifies deployment and redeployment of J2EE applications. Task oriented deployment plan editors assist application administrators in assigning or mapping the most common deployment descriptors at deploy time. Finally, a generic deployment plan editor provides access to all deployment descriptors for advanced configuration.

The JNDI browser hierarchically displays the JNDI bindings in the server at a glance, and helps J2EE developers and administrators diagnose and debug application related problems

Lastly, the Web Services administration functionality allows configuration of auditing, logging, security, reliability and Oracle Web Services Manager agents for Web Services deployed in the OC4J containers.

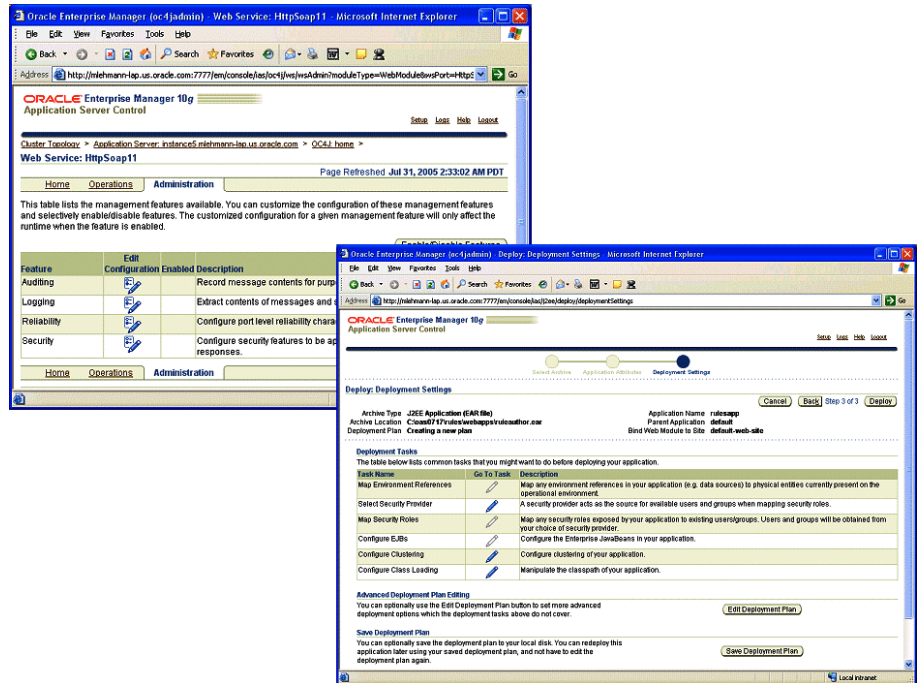


Figure 7: Example Application Server Control Screens

### 7.3 Remote Management

The new lightweight J2EE application and standards based architecture enables Application Server Control to remotely manage OC4J instances. From one console installation, administrators can centrally manage and monitor all OC4J instances in a Oracle Application Server 10g R3 cluster. This, combined with the lightweight architecture, results in more resource-efficient management. Central management of multiple OC4J instances also results insignificant reduction in total cost of ownership. Further, remote management is well integrated with administrative roles to provide a comprehensive cluster management solution.

### 7.4 Role Based Administration

In a typical production data center, administrative operations including configuration, application deployment, application and server instance process control and monitoring are performed by different set of administrators depending upon the data center deployment and security policies. Typically a full administrator would delegate some of these administrative responsibilities to a set of users who would have limited privilege to only carry out selected administrative operations. Application Server Control now allows for three roles for administration:

- Administrator - full administrative privileges
- Application Administrator – privileges to deploy, undeploy, redeploy and manage the state of J2EE applications

- Monitor – viewer (read-only) access to pages in Application Server Control.

These roles are defined as J2EE security roles for the Application Server Control application. Mapping of these J2EE roles to groups in JAAS security providers is provided out of box. Finally, integration of third party security providers with these administrative roles is supported, although such integration will require some manual configuration in your security provider tools.

## 7.5 Topology and Group Management

In an Oracle Application Server 10.1.3 cluster configuration, a set of OC4J instances can be explicitly clustered together to form a management construct called a Group. The Oracle Application Server Control management console allows a number of management and administration operations to be conducted at the Group level including:

- Process Management operations – start/stop/restart
- Deployment operations – deploy/undeploy/redeploy
- Publish and configure shared-libraries
- Configure and test JDBC resources
- Configure and test JMS resources

In addition to the management operations performed in Group-specific administrative pages, Application Server Control enables direct access to management and administration operations that are exposed as JMX operations in a Cluster MBean Browser.

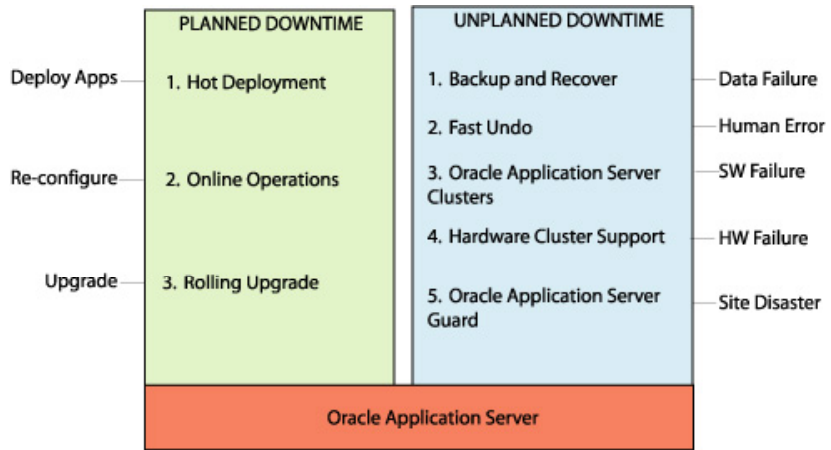
A Group can be specified as the management target for the command line utility provided with Oracle Application Server (`admin_client.jar`) and the pre-packaged Oracle Ant tasks. This provides administrators with the flexibility to choose the tool or tools best suited to perform the required task at hand.

**Oracle Application Server 10gR3 introduces a number of new High Availability Features including enhanced clustering; resource management; dynamic mount point registration; load balancing and failover; Backup and Recovery; and Disaster Recovery**

## 8.0 HIGH AVAILABILITY AND OPERATIONAL CHARACTERISTICS

Oracle Application Server 10g R3 10.1.3 carries forward its rich High Availability features from previous releases designed to reduce both planned and unplanned downtime. As a key value for all those customers who use Oracle Database Server, Oracle Application Server 10g R3 has been integrated with the latest high availability features of Oracle Database 10g and provides the most advanced mechanisms for load balancing and failover between the middle tier and the database of an application. Figure 8 provides a summary of these capabilities.





**Figure 8: End-to-End High Availability in Oracle Application Server 10g R3**

To enable this capability, the core Oracle Application Server 10g R3 consists of an integrated set of components outlined in Table 2.

Component Name	Description
Oracle HTTP Server and mod_oc4j	HTTP Server and router
Oracle Process Management and Notification	Process management
Oracle Containers for J2EE	J2EE containers
Oracle TopLink	Persistence
Oracle Application Server Control	Management and Administration
Backup and Restore	Backup and Restore utility
Disaster Recovery	Disaster Recovery utility
Application Development Framework	Development framework
Oracle Business Rules	Rules engine
Oracle JDeveloper	Released separately from Oracle Application Server 10g R3.

**Table 2: Oracle Application Server 10g R3 Components**

**8.1 State Replication**

Oracle Application Server 10g R3 introduces a new application level clustering model that enables OC4J instances to host both clustered and non-clustered applications simultaneously. For state replication multiple protocols can be used including multi-cast, peer to peer and database backed. This new cluster model

offers more flexible control, better ease of use and increased performance. The cluster settings for an application are fully configurable at deployment time using the Deployment Plan Editor in Application Server Control.

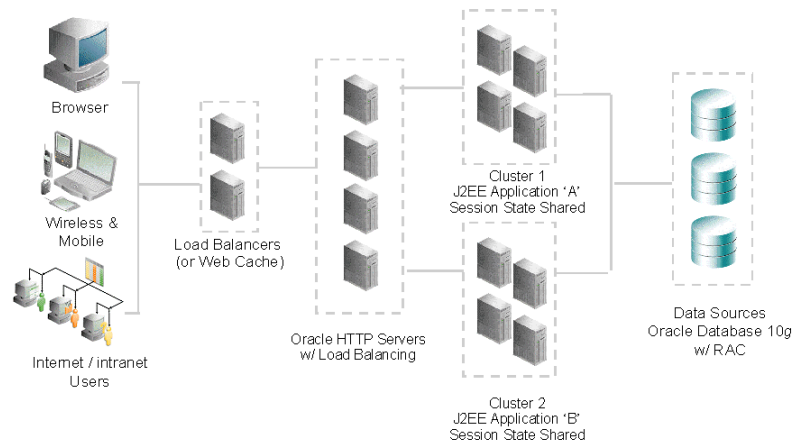
### 8.1 Online Operations

Oracle Application Server 10g R3 extends its previous investment in maintaining zero downtime for configuration changes at runtime by taking advantage of the new JMX infrastructure where configuration operations are all done online without impacting running applications. Unless impacting running applications – where rolling upgrade support provides a managed way to upgrade applications and application configuration – no downtime is required for common configuration operations.

### 8.3 Large Scale Distributed Topologies

Larger deployments of Oracle Application Server 10g R3 typically include clusters of web caches, clusters of HTTP servers, clusters of J2EE servers and clusters of database servers (real application clusters – RAC) – all acting as a logical application server with quality of service unmatched in the industry (see Figure 9). Managing this in a transparent manner where new capacity can be seamlessly added, removed and provisioned through a consolidated management infrastructure continues to be a core design principle in the deployment capabilities capabilities of Oracle Application Server 10g R3.

**Oracle Application Server 10gR3 introduces a number of new High Availability Features including enhanced clustering; resource management; dynamic mount point registration; load balancing and failover; Backup and Recovery; and Disaster Recovery**



**Figure 9: Oracle Application Server 10g R3 Distributed Topology**

In Oracle Application Server 10g R3 a number of capabilities have been added to lower the effort of implementing distributed topologies. These enhancements include:

- *Topology Configuration:* Simplified configuration of connecting Oracle HTTP Server to Oracle Containers for J2EE

- *Dynamic Topologies:* When Oracle Container for J2EE instances are added to application server clusters Oracle HTTP Server (OHS) routing tables are automatically updated.
- *Dynamic Routing Relationships:* The routing relationship between Oracle HTTP Servers and OC4Js is established dynamically. All Oracle HTTP Servers listen for notifications from OC4Js that they have a routing relationship with. Therefore, each of these Oracle HTTP Servers discovers the OC4Js it needs to route to instead of being statically defined in mod\_oc4j configuration file
- *Mount Point Discovery:* When an application is deployed to OC4J it announces itself via the Oracle Naming Service messages that are received by Oracle HTTP Server. The routing table in mod\_oc4j is then updated. No configuration changes (e.g. mount points) are required in mod\_oc4j.conf and processes do not have to be restarted

#### **8.4 Rolling Upgrades**

Oracle Application Server 10g R3 continues its support for rolling upgrades and increases the overall simplicity of this administrative operation by providing the ability to gracefully stop applications on individual Oracle Containers for J2EE and quiesce applications running on specific nodes to enable application and state migration to remaining nodes. It is now a simple operation with one Oracle HTTP Server and two Oracle Containers for J2EE to upgrade running applications with zero application downtime and zero runtime state or transactional lossage.

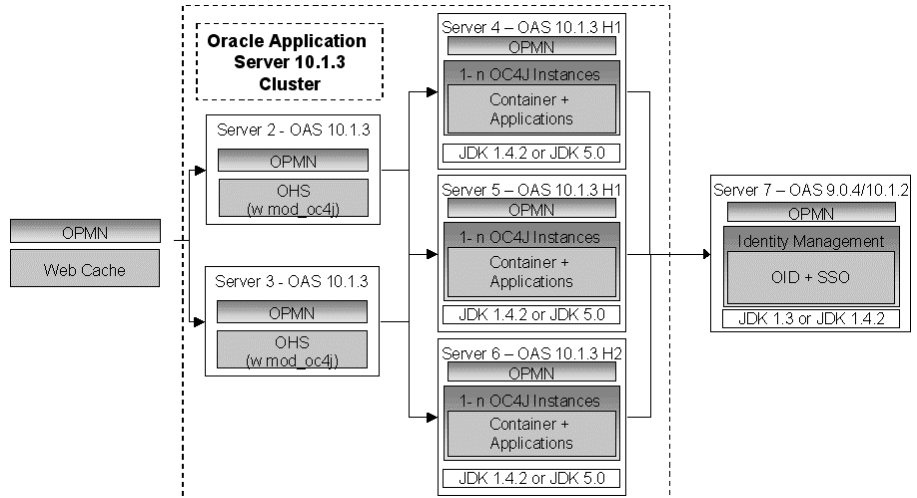
#### **8.5 Interoperable and Integrated Topologies**

Many Oracle Application Server customers have large-scale deployments of Oracle Application Server 10.1.2 infrastructures and wish to take advantage of the latest advances in J2EE 1.4. To facilitate this, Oracle Application Server 10g R3 has been certified to interoperate and plug into existing 10.1.2 topologies to maximize the ability of the Oracle Application Server install base to use the latest capabilities. The following capabilities will be certified with Oracle Application Server 10g R3

- Oracle Web Cache 10.1.2
- Oracle HTTP Server 10.1.2
- Portal Development Kit 10.1.2
- Authentication via Oracle Application Server 9.0.4 and 10.1.2 Internet Directory
- Single Signon via Oracle Application Server 9.0.4 and 10.1.2 Single SignOn
- Oracle CoreID

In addition, Oracle BPEL Process Manager, Oracle Web Services Manager and the Oracle Enterprise Service Bus are now certified with the release of Oracle Application Server 10g R3 (10.1.3.1).

A typical mixed version topology using Oracle Application Server 10g R3 and Oracle Application Server 10.1.2 is represented by Figure 10.



**Figure 10: Oracle Application Server 10g R3 Interoperable Distributed Deployment**

## 9.0 COMPREHENSIVE SOA INFRASTRUCTURE

The latest release of Oracle Application Server is intended to provide a robust environment for building and managing a service-oriented architecture.

Several of the key Oracle Fusion Middleware components that collectively comprise Oracle SOA Suite can be installed into Oracle Application Server with the click of a button. Oracle SOA Suite facilitates the development of enterprise applications as modular business services that can be easily integrated and reused, creating a truly flexible, adaptable IT infrastructure.

These components include:

- Oracle Business Rules, providing flexible event routing and distribution via a high performance rules engine
- Oracle BPEL Process Manager, the first native business process execution language (BPEL) engine for orchestrating services into business processes
- Oracle Enterprise Service Bus, which connects applications via secure and reliable message routing
- Oracle Web Services Manager, providing a central platform for securing and managing services and enforcing policies set on services

When deployed to Oracle Application Server, the management consoles for each of these components can be accessed with the same login used to access the Application Server Control console.

As a complement to the SOA Suite installation, the following companion products are also available for deployment to Oracle Application Server:

- Oracle Service Registry, a UDDI v3-compliant platform for publishing, categorizing and discovering Web services and related resources across the enterprise, is available as a companion product.
- Oracle Business Activity Monitoring, which provides real-time analysis of business events and event patterns through rich monitoring dashboard.
- An enhanced version of JDeveloper that includes utilities for building and deploying BPEL processes and ESB services; EJB 3.0 / JPA 1.0 design-time support; and EJB 3.0 Web services interface creation.

Detailed information on all of these Fusion Middleware Components is available on Oracle Technology Network (OTN).

## **10.0 CONCLUSION**

Oracle Application Server 10g R3 is a major new release of the core infrastructure underlying Oracle Fusion Middleware. Oracle Application Server 10g R3 is the baseline SOA platform upon which the Oracle Fusion Middleware capabilities such as Oracle Business Rules, Oracle BPEL Process Manager, Oracle Web Services Manager, Oracle Enterprise Service Bus, Oracle Identity Management and Oracle Application Server Service Registry will be delivered, enabling organizations to develop, deploy and manage large scale integrated and interoperable service oriented architectures.

**Oracle Application Server 10g R3 (10.1.3.1)**

**New Features Overview**

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