Oracle® Fusion Middleware

Developing Resource Adapters for Oracle WebLogic Server

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Preface

This document describes how to develop applications that include Java EE resource adapters and how to deploy them on WebLogic Server.

Audience

This document is written for resource adapter users, deployers, and software developers, and also contains information that is useful for business analysts and system architects who are evaluating WebLogic Server or considering the use of WebLogic Server resource adapters for a particular application.

The topics in this document are relevant during the design and development phases of a software project. The document also includes topics that are useful in solving application problems that are discovered during test and pre-production phases of a project.

This document does not address production phase administration, monitoring, or performance tuning topics. For links to WebLogic Server documentation and resources for these topics, see Related Documentation.

It is assumed that the reader is familiar with Java EE and resource adapter concepts. The foundation document for resource adapter development is the JSR 322: Java EE Connector Architecture 1.7. See http://jcp.org/aboutJava/communityprocess/final/jsr322/index.html. Resource adapter developers should become familiar with the Java EE Connector Architecture 1.7 specification. This document, *Developing Resource Adapters for Oracle WebLogic Server*, emphasizes the value-added features provided by WebLogic Server resource adapters and key information about how to use WebLogic Server features and facilities to get a resource adapter up and running.

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Diversity and Inclusion

Oracle is fully committed to diversity and inclusion. Oracle respects and values having a diverse workforce that increases thought leadership and innovation. As part of our initiative to build a more inclusive culture that positively impacts our employees, customers, and

partners, we are working to remove insensitive terms from our products and documentation. We are also mindful of the necessity to maintain compatibility with our customers' existing technologies and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

Related Documentation

The foundation document for resource adapter development is JSR 322: Java EE Connector Architecture 1.7. *Developing Resource Adapters for Oracle WebLogic Server* document assumes you are familiar with the Java EE Connector Architecture specification, which contains design and development information that is specific to developing WebLogic Server resource adapters.

For comprehensive guidelines for developing, deploying, and monitoring WebLogic Server applications, see the following documents:

- *Developing Applications for Oracle WebLogic Server* is a guide to developing WebLogic Server applications.
- *Deploying Applications to Oracle WebLogic Server* is the primary source of information about deploying WebLogic Server applications.
- *Tuning Performance of Oracle WebLogic Server* contains information on monitoring and improving the performance of WebLogic Server applications.

Examples for the Resource Adapter Developer

In addition to this document, Oracle provides resource adapter examples for software developers. WebLogic Server optionally installs API code examples in the *ORACLE_HOME*`/wlserver/samples/server/examples/src/examples` directory. For more information about the WebLogic Server code examples, see Sample Applications and Code Examples in *Understanding Oracle WebLogic Server*.

The resource adapter example provided with this release of WebLogic Server is compliant with the 1.7 Connector Architecture. Oracle recommends that you examine, run, and understand these resource adapter examples before developing your own resource adapters.

New and Changed WebLogic Server Features

For a comprehensive listing of the new WebLogic Server features introduced in this release, see *What's New in Oracle WebLogic Server12.2.1.4.0*.

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.

Convention	Meaning
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

1

Understanding Resource Adapters

Resource adapters play a central role in the integration and connectivity between enterprise information systems (EIS) and applications deployed on Oracle WebLogic Server by communicating through well-defined contracts that are specified in the Java EE Connector Architecture. This chapter explains resource adapter concepts, and also describes the deployment descriptors that define the structure and runtime behavior of a resource adapter that is deployed on WebLogic Server.

Overview of Resource Adapters

A resource adapter is a system library specific to an Enterprise Information System (EIS) and provides connectivity to an EIS. A resource adapter is analogous to a JDBC driver, which provides connectivity to a database management system. The interface between a resource adapter and the EIS is specific to the underlying EIS; it can be a native interface. The resource adapter plugs into an application server, such as WebLogic Server, and provides seamless connectivity between the EIS, application server, and enterprise application. Multiple resource adapters can plug in to an application server. This capability enables application components deployed on the application server to access the underlying EISes. An application server and an EIS collaborate to keep all system-level mechanisms — transactions, security, and connection management — transparent to the application components. As a result, an application component provider can focus on the development of business and presentation logic for application components and need not get involved in the system-level issues related to EIS integration. This leads to an easier and faster cycle for the development of scalable, secure, and transactional enterprise applications that require connectivity with multiple EISes.

Comparing WebLogic Server and WebLogic Integration Resource Adapters

It is important to note the difference between WebLogic Integration (WLI) resource adapters and WebLogic Server resource adapters. WebLogic Integration resource adapters are written to be specific to WebLogic Server and, in general, are not deployable to other application servers. However, WebLogic Server resource adapters written without WLI extensions are deployable in any Java EE-compliant application server. This document discusses the design and implementation of non-WLI resource adapters.

Inbound, Outbound, and Bidirectional Resource Adapters

WebLogic Server supports three types of resource adapters:

- Outbound resource adapter — Allows an application to connect to an EIS system and perform work. All communication is initiated by the application. In this case, the resource adapter serves as a passive library for connecting to an EIS and executes in the context of the application threads.

Outbound resource adapters based on the Java EE Connector Architecture 1.5 and 1.6 can be configured to have more than one simultaneous outbound connection. You can configure each outbound connection to have its own WebLogic Server-specific authentication and transaction support. See Configuring Outbound Connections.

Outbound resource adapters based on the Java EE Connector Architecture 1.0 are also supported. These resource adapters can have only one outbound connection.

- Inbound resource adapter (1.5 and 1.6 only) — Allows an EIS to call application components and perform work. All communication is initiated by the EIS. The resource adapter may request threads from WebLogic Server or create its own threads; however, this is not the Oracle-recommended approach. Oracle recommends that the resource adapter submit work by way of the WorkManager. See Message and Transactional Inflow.

  > **Note:**
  >
  > The WebLogic Server thin-client JAR also supports the WorkManager contracts and thus can be used by non-managed resource adapters (resource adapters not running in WebLogic Server).

- Bi-directional resource adapter (1.5 and 1.6 only) — Supports both outbound and inbound communication.

Connector Architecture 1.7 Support

WebLogic Server supports the following Java EE Connector Architecture (1.7) features:

- Supports `@AdministeredObjectDefinition/@AdministeredObjectDefinitions` annotations and equivalent deployment descriptors for defining an administered object resource.
- Supports `@ConnectionFactoryDefinition/@ConnectionFactoryDefinitions` and equivalent deployment descriptors for defining a connection factory resource.

Connector Architecture 1.6 Support

The major themes of Connector Architecture 1.6 that are supported in WebLogic Server Full Platform include the following:

- Ease of development features

  Connector Architecture 1.6 adds a number of features to simplify the development process, such as metadata annotations and support for sparse deployment descriptors. Metadata annotations can be embedded within resource adapter class files to specify deployment information, minimizing or even eliminating the need to manually create the `ra.xml` file. See Using Metadata Annotations to Specify Deployment Information.

- Generic work context

  A generic work context is the mechanism used by the resource adapter to propagate contextual information, such as the transaction context and security

context, from the EIS to WebLogic Server during message delivery or submitting a work instance. For more information, see Generic Work Context.

- Security context

  Connector Architecture 1.6 defines a standard, generic security context that leverages the work done in JSR 196: Java Authentication Service Provider Interface for Containers. For more information, see Security Inflow.

- Miscellaneous improvements, including:
  - Integration of JSR 303: Bean Validation
  - Dynamic Reconfigurable Configuration Properties

    This includes the ability to designate specific properties of resource adapter component beans to be dynamically configurable, enabling those properties to be reconfigured at run time without requiring adapter restart or redeployment. See Dynamic Reconfigurable Configuration Properties.
  - The ability for a resource adapter to determine and classify the level of transaction support it can provide at run time. See Specifying and Obtaining Transaction Support Level.
  - Optional distributed `Work` processing, which gives an application server instance's WorkManager the choice to distribute a `Work` instance submitted by a resource adapter to another `WorkManager` residing in a different application server instance.

Comparing 1.0 Resource Adapters to 1.5 and 1.6

WebLogic Server supports resource adapters developed under versions 1.0, 1.5, and 1.6 of the Java EE Connector Architecture. Java EE Connector Architecture 1.0 restricts resource adapter communication to a single external system using one-way outbound communication. Java EE Connector Architecture 1.5 lifts this restriction. Other capabilities provided by and for 1.5 and 1.6 resource adapters that do not apply to 1.0 resource adapters include:

- Outbound communication from the application to multiple systems, such as Enterprise Information Systems (EISes) and databases. See Inbound, Outbound, and Bidirectional Resource Adapters.
- Inbound communication from one or more external systems such as an EIS to the resource adapter. See Handling Inbound Messages.
- Transactional inflow to enable a Java EE application server to participate in an XA transaction controlled by an external Transaction Manager by way of a resource adapter. See Transactional Inflow.
- A Work Manager provided by WebLogic Server to enable resource adapters to create threads through `Work` instances. See work-manager.
- A life cycle contract for calling `start()` and `stop()` methods of the resource adapter by the application server. See Programming a Resource Adapter to Perform as a Startup Class.

Another important difference between 1.0 resource adapters and 1.5 and 1.6 resource adapters is regarding connection pools. For 1.5 and 1.6 resource adapters, you do not automatically get one connection pool per connection factory; you must configure a connection instance. You do so by setting the `connection-instance` element in the `weblogic-ra.xml` deployment descriptor.

Although WebLogic Server Full Platform is now compliant with JSR 322: Java EE Connector Architecture 1.6, it continues to fully support versions 1.0 and 1.5. In accordance with Connector Architecture 1.6, WebLogic Server supports schema-based deployment descriptors. Resource adapters that have been developed based on the Java EE Connector Architecture 1.0 use Document Type Definition (DTD)-based deployment descriptors. Resource adapters that are built on DTD-based deployment descriptors are still supported.

This document describes the development and use of 1.6 resource adapters.

Additional Support Provided by the WebLogic Server Connector Container

WebLogic Server provides a number of features in its Connector container that supplement the JSR 322: Java EE Connector Architecture 1.6, including the following:

- Support for JSR 299: Contexts and Dependency Injection for the Java EE Platform (CDI) in embedded and global resource adapters. CDI defines a set of services for using injection to specify dependencies in an application. For more information, see Using Contexts and Dependency Injection in Resource Adapters.
- Additional runtime transaction level specification. WebLogic Server exposes information about the runtime transaction level in the `ConnectorConnectionPoolRuntimeMBean.RuntimeTransactionSupport` MBean attribute and in the WebLogic Server Administration Console. For more information, see Supported Transaction Levels.
- Ability to lookup the `TransactionSynchronizationRegistry` object in JNDI, using the standard name of `java:comp/TransactionSynchronizationRegistry`. Oracle extends support by providing two additional global JNDI names: `javax/transaction/TransactionSynchronizationRegistry` and `weblogic/transaction/TransactionSynchronizationRegistry`. For more information, see `javax.transaction.TransactionSynchronizationRegistry`.
- Management and monitoring of long-running `Work` instances, including the number of current active work requests and the number of completed work requests, which WebLogic Server exposes on the `ConnectorWorkManagerRuntimeMBean` and in the WebLogic Server Administration Console. See Long-Running Work Support.
- Additional support for the `javax.resource.spi.RetryableException` exception by extending it to outbound connection pools. When you try to get a connection from a suspended connection pool, WebLogic Server throws a `RetryableApplicationServerInternalException` that implements the `RetryableException` interface. You can then use the `RetryableException` instance to determine whether the failure is transient.
- Supplemental support for the security context in the WebLogic Server Administration Console by providing a means to create inbound EIS-to-WebLogic principal mappings, which map EIS principals, such as users or groups defined in the EIS security domain, to corresponding principals in the WebLogic domain. For more information, see Inbound Principal Mappings.
- Support for module-level JSR 303: Bean Validation configuration. WebLogic Server extends Java EE 6 by supporting the optional use this bean configuration file to validate a resource adapter module.

- New methods on the `weblogic.connector.extensions.ExtendedBootstrapContext` that:
  - Provide a means for a resource adapter to look up the `Validator` and `ValidatorFactory` instances of its own beans for validation. See Bean Validation.
  - Return the resource adapter's `BeanManager` instance to support CDI injection. See BeanManager, and Using Resource Adapters Deployed as CDI Bean Archives.
- `Work` Name Hint — Names a `Work` instance and is used as part of the thread name assigned to a long-running Work instance. The `nameHint` forms part of the thread name and is used only for long-running work. For more information, see Long-Running Work Support.
- In resource adapters configured with multiple connection pools, the ability to isolate failed connection pools from healthy ones during deployment. This enables you to locate, diagnose, and fix failed connection pools, and then dynamically update the adapter deployment, without redeploying the resource adapter.

  The ability to detect outbound connection pool failures is available through the health monitoring feature, which is extended to resource adapters. You can access the health state of a resource adapter deployment using WLST or the WebLogic Server Administration Console. For more information, see Monitoring Resource Adapter Health, and Deploying a Resource Adapter Configured with Multiple Outbound Connection Pools .

Java EE Connector Architecture

The Java EE Connector Architecture defines a standard architecture for connecting the Java EE platform to heterogeneous Enterprise Information Systems (EISes), such as Enterprise Resource Planning (ERP) systems, mainframe transaction processing (TP), and database systems.

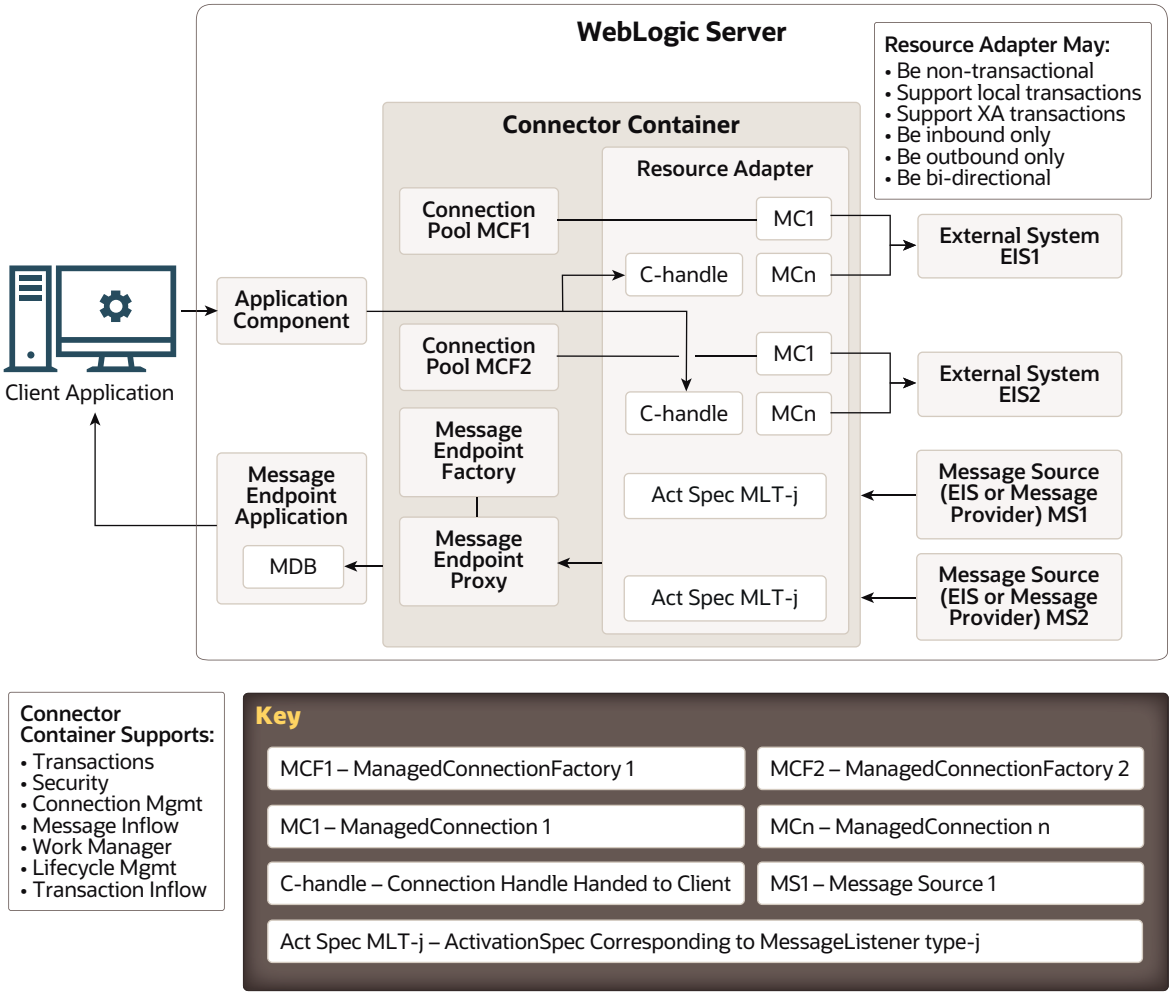
The resource adapter serves as a protocol adapter that allows any arbitrary EIS communication protocol to be used for connectivity. An application server vendor extends its system once to support the Java EE Connector Architecture and is then assured of seamless connectivity to multiple EISes. Likewise, an EIS vendor provides one standard resource adapter that can plug in to any application server that supports the Java EE Connector Architecture.

See Resource Adapters and Contracts in *Java Platform, Enterprise Edition: The Java EE Tutorial*.

Java EE Architecture Diagram and Components

Figure 1-1 and the discussion that follows describe a WebLogic Server implementation of Connector Architecture 1.6.

Figure 1-1 Connector Architecture Overview



The connector architecture shown in Figure 1-1 demonstrates a bi-directional resource adapter. The following components are used in outbound connection operations:

- A client application that connects to WebLogic Server, but also needs to interact with the EIS.
- An application component (an EJB or servlet) that the client application uses to submit outbound requests to the EIS through the resource adapter
- The WebLogic Server Connector container in which the resource adapter is deployed. The container in this example holds the following:
  - A deployed resource adapter that provides bi-directional (inbound and outbound) communication to and from the EIS.
  - One or more connection pools maintained by the container for the management of outbound managed connections for a given `ManagedConnectionFactory` (in this case, MCF-2 - there may be more corresponding to different types of connections to a single EIS or even different EISes)
  - Multiple managed connections (MC1, MCn), which are objects representing the outbound physical connections from the resource adapter to the EIS.

  - Connection handles (C-handle) returned to the application component from the connection factory of the resource adapter and used by the application component for communicating with the EIS.

The following components are used for inbound connection operations:

- One or more external message sources (MS1, MS2), which could be an Enterprise Information System (EIS) or Message Provider, and which send messages inbound to WebLogic Server.
- One or more ActivationSpecs (Act Spec), each of which corresponds to a single MessageListener type (MLT-i).
- A `MessageEndpointFactory` created by the EJB container and used by the resource adapter for inbound messaging to create proxies to `MessageEndpoint` instances (MDB instances from the MDB pool).
- A message endpoint application (a message-driven bean (MDB) and possibly other Java EE components) that receives and handles inbound messages from the EIS through the resource adapter.

System-Level Contracts

To achieve a standard system-level pluggability between WebLogic Server and an EIS, WebLogic Server has implemented the standard set of system-level contracts defined by the Java EE Connector Architecture. These contracts consist of SPI classes and interfaces that are required to be implemented in the application server and the EIS, so that the two systems can work cooperatively. The EIS side of these system-level contracts are implemented in the resource adapter's Java classes. The following standard contracts are supported:

- Connection management contract — Enables WebLogic Server to pool connections to an underlying EIS and enables application components to connect to an EIS. Also allows efficient use of connection resources through resource sharing and provides controls for associating and disassociating connection handles with EIS connections.
- Transaction management contract — A contract between the transaction manager and an EIS that supports transactional access to EIS resource managers. Enables WebLogic Server to use its transaction manager to manage transactions across multiple resource managers.
- Transaction inflow contract — Allows a resource adapter to propagate an imported transaction to WebLogic Server. Allows a resource adapter to flow-in transaction completion and crash recovery calls initiated by an EIS. Transaction inflow involves the use of an external transaction manager to coordinate transactions.
- Security contract — Extends the connection management contract by providing secure access to an EIS and support for a secure application environment that reduces security threats to the EIS and protects valuable information resources managed by the EIS.
- Life cycle management contract — Enables WebLogic Server to manage the life cycle of a resource adapter. This allows bootstrapping a resource adapter instance during its deployment or application server startup, and notification to the resource adapter instance when it is undeployed or when the application server is being shut down.
- Work management contract — Allows a resource adapter to do work (monitor network endpoints, call application components, and so on) by submitting `Work` instances to WebLogic Server for execution.
- Generic work context contract — Enables a resource adapter to control the contexts in which the Work instances that it submits are executed by the WorkManager in WebLogic

Server. A generic work context mechanism also enables WebLogic Server to support new message inflow and delivery schemes, providing the resource adapter with a robust contextual Work execution environment that includes the ability to manage concurrent activity.

The generic work context contract standardizes the transaction context and the security context. JSR 322: Java EE Connector Architecture 1.6 defines this contract between the resource adapter and the application server in detail, including interfaces and classes, the thread model, rules for verifying and establishing contexts, error handling, event notifications, and so on.

- Message inflow contract — Allows a resource adapter to asynchronously or synchronously deliver messages to message endpoints residing in WebLogic Server independent of the specific messaging style, messaging semantics, and messaging infrastructure used to deliver messages. Also serves as the standard message provider pluggability contract that enables a wide range of message providers (Java Message Service, Java API for XML Messaging, and so on) to be plugged into WebLogic Server through a resource adapter.

These system-level contracts are described in detail in JSR 322: Java EE Connector Architecture 1.6.

Resource Adapter Deployment Descriptors

The structure of a resource adapter and its runtime behavior are defined in deployment descriptors. Programmers create the deployment descriptors during the packaging process, and these become part of the application deployment when the application is compiled.

WebLogic Server resource adapters have two deployment descriptors, each of which has its own XML schema:

- `ra.xml` — The standard Java EE deployment descriptor. All resource adapters must be specified in an `ra.xml` deployment descriptor file. The schema for `ra.xml` is `http://xmlns.jcp.org/xml/ns/javaee/connector_1_7.xsd`.

  > **Note:**
  >
  > Connector Architecture 1.6 introduces metadata annotations, which allow you to specify deployment information in resource adapter class files, thereby minimizing or eliminating the need to manually create the deployment descriptor file `ra.xml`.

- `weblogic-ra.xml` — This WebLogic Server-specific deployment descriptor contains elements related to WebLogic Server features such as transaction management, connection management, and security. This file is required for the resource adapter to be deployed to WebLogic Server. The schema for the `weblogic-ra.xml` deployment descriptor file is `http://xmlns.oracle.com/weblogic/weblogic-connector/1.5/weblogic-connector.xsd`. For a reference to the `weblogic-ra.xml` deployment descriptor, see weblogic-ra.xml Schema.

2

Creating and Configuring Resource Adapters

To create and configure a WebLogic Server resource adapter and prepare it for deployment, you perform several tasks that include creating the resource adapter classes and configuring the deployment descriptors, and may also include specifying metadata annotations, preparing the bean validation configuration file, setting up health status monitoring of standalone and embedded resource adapters, and more.

Creating and Configuring Resource Adapters: Main Steps

To create a new WebLogic resource adapter, you must create the classes for the particular resource adapter, write the resource adapter's deployment descriptors, and then package everything into an archive file to be deployed to WebLogic Server.

The following are the main steps for creating a resource adapter:

1. Write the Java code for the various classes required by resource adapter (`ConnectionFactory`, `Connection`, and so on) in accordance with JSR 322: Java EE Connector Architecture 1.7. These classes will be specified in the `ra.xml` file. For example:

```
<managedconnectionfactory-class>
com.sun.connector.blackbox.LocalTxManagedConnectionFactory
</managedconnectionfactory-class>

<connectionfactory-interface>
javax.sql.DataSource
</connectionfactory-interface>

<connectionfactory-impl-class>
com.sun.connector.blackbox.JdbcDataSource
</connectionfactory-impl-class>

<connection-interface>
java.sql.Connection
</connection-interface>

<connection-impl-class>
```

```
com.sun.connector.blackbox.JdbcConnection
</connection-impl-class>
```

For 1.6 adapters, you can embed metadata annotations in the resource adapter class files to specify deployment information, eliminating the need to create the `ra.xml` file manually. For more information, see Configuring the ra.xml File.

> **Note:**
>
> The WebLogic Server implementation of Connector Architecture 1.6 includes support for Contexts and Dependency Injection. This support has implications on the set of annotations that may be used in resource adapter component beans, which are beans that define special components managed by the Connector container and that have a special life cycle. For more information, see

For more information about programming resource adapters, see Programming Tasks.

2. Compile the Java code for the interfaces and implementation into class files, using a standard compiler.
3. Create the resource adapter's deployment descriptors. A WebLogic resource adapter uses two deployment descriptor files:
   - `ra.xml` describes the resource adapter-related attributes type and its deployment properties using the standard XML schema specified by the Java EE Connector Architecture specification.

     > **Note:**
     >
     > Java EE Connector Architecture 1.6 no longer requires the `ra.xml` file to be created manually. Instead, deployment information can be specified in metadata annotations. See Configuring the ra.xml File.

   - `weblogic-ra.xml` adds additional WebLogic Server-specific deployment information, including connection and connection pool properties, security identities, Work Manager properties, and logging.

   For detailed information about creating WebLogic Server-specific deployment descriptors for resource adapters, refer to Configuring the weblogic-ra.xml File, and weblogic-ra.xml Schema.
4. Package the Java classes into a Java archive (JAR) file with a `.rar` extension.

   Create a staging directory anywhere on your hard drive. Place the JAR file in the staging directory and the deployment descriptors in a subdirectory called `META-INF`.

   Then create the resource adapter archive by executing a `jar` command similar to the following in the staging directory:

   ```
   jar cvf myRAR.rar *
   ```

Optionally, you can include the Bean Validation configuration file, `META-INF/validation.xml`, inside the JAR file. WebLogic Server uses the Bean Validation configuration file to validate the resource adapter module.

5. Deploy the resource adapter archive (RAR) file on WebLogic Server in a test environment and test it.

   During testing, you may need to edit the resource adapter deployment descriptors. You can do this using the WebLogic Server Administration Console or manually using an XML editor or a text editor. For more information about editing deployment descriptors, see Configuring the weblogic-ra.xml File, and Configure resource adapter properties in the *Oracle WebLogic Server Administration Console Online Help*. See also weblogic-ra.xml Schema, for detailed information on the elements in the deployment descriptor.

6. Deploy the RAR resource adapter archive file on WebLogic Server or include it in an enterprise archive (EAR) file to be deployed as part of an enterprise application.

   For information about these steps, see Packaging and Deploying Resource Adapters. See also *Deploying Applications to Oracle WebLogic Server* for detailed information about deploying components and applications in general.

Modifying an Existing Resource Adapter

If you already have a resource adapter that is packaged in a RAR file, you can modify it for deployment to WebLogic Server. This task involves adding the `weblogic-ra.xml` deployment descriptor and repackaging the resource adapter.
The follow example shows the steps for modifying an existing resource adapter packaged in a RAR file named `blackbox-notx.rar`.

1. Create a temporary directory anywhere on your hard drive to stage the resource adapter:

   ```
   mkdir c:/stagedir
   ```

2. Extract the contents of the resource adapter archive:

   ```
   cd c:/stagedir
   jar xf blackbox-notx.rar
   ```

   The staging directory should now contain the following:

   - A JAR file containing Java classes that implement the resource adapter
   - A META-INF directory containing the Manifest.mf and ra.xml files

   Execute these commands to see these files:

   ```
   c:/stagedir> ls
      blackbox-notx.rar
      META-INF
   c:/stagedir> ls META-INF
      Manifest.mf
      ra.xml
   ```

3. Create the `weblogic-ra.xml` file. This file is the WebLogic-specific deployment descriptor for resource adapters. In this file, you specify parameters for connection factories, connection pools, and security settings.

   For more information, see Configuring the weblogic-ra.xml File, and also refer to weblogic-ra.xml Schema, for information on the XML schema that applies to `weblogic-ra.xml`.

4. Copy the `weblogic-ra.xml` file into the temporary directory's `META-INF` subdirectory. The `META-INF` directory is located in the temporary directory where you extracted the RAR file or in the directory containing a resource adapter in exploded directory format. Use the following command:

```
cp weblogic-ra.xml c:/stagedir/META-INF
c:/stagedir> ls META-INF
   Manifest.mf
   ra.xml
   weblogic-ra.xml
```

5. Create the resource adapter archive:

```
jar cvf blackbox-notx.rar -C c:/stagedir
```

6. Deploy the resource adapter to WebLogic Server. For more information about packaging and deploying the resource adapter, see Packaging and Deploying Resource Adapters, and *Deploying Applications to Oracle WebLogic Server*.

Configuring the ra.xml File

All resource adapters must be specified in an `ra.xml` deployment descriptor file. For 1.0 or 1.5 resource adapters, you must create this file manually. If you are creating a 1.6 resource adapter, you can optionally specify metadata annotations in the resource adapter classes, eliminating the need to create the `ra.xml` file manually. The following sections explain how to configure the `ra.xml` file:

- Creating the ra.xml File Manually
- Using Metadata Annotations to Specify Deployment Information
- Resource Adapter XML Schema Definitions

For more information about creating a `ra.xml` file, you can also refer to JSR 322: Java EE Connector Architecture 1.6.

Creating the ra.xml File Manually

If your resource adapter does not already contain a `ra.xml` file, and you are creating a resource adapter, you must manually create or edit an existing one to set the necessary deployment properties for the resource adapter. You can use a text editor or XML editor to edit the properties.

Using Metadata Annotations to Specify Deployment Information

The Java EE Connector Architecture 1.6 no longer requires you to manually create a `ra.xml` file. Instead, metadata annotations can be included in resource adapter classes to provide the same functions that are specified in the `ra.xml` file.

If you choose to specify all deployment information in a `ra.xml` file, the Java EE Connector Architecture 1.6 includes the `metadata-complete` element, which you include in the `ra.xml` file and set to `true`. Setting the `metadata-complete` element to `true` causes all metadata annotations included in the resource adapter classes to be ignored. If the `metadata-complete` element is not specified, or is set to `false`, WebLogic Server merges the information specified in the annotations with the information specified in the `ra.xml` file at run time, and uses this merged information to deploy and manage the resource adapter.

For more information about deployment descriptors and annotations, see Chapter 18, Metadata Annotations, of JSR 322: Java EE Connector Architecture 1.6. See also Metadata Annotations in *Java Platform, Enterprise Edition: The Java EE Tutorial*.

Resource Adapter XML Schema Definitions

The Java EE Connector Architecture 1.6 introduces changes to the `ra.xml` file schema, primarily to support ease-of-development features such as metadata annotations. For details about schema definition changes, see Section 20.7, Resource Adapter XML Schema Definition, in JSR 322: Java EE Connector Architecture 1.6.

The schema for the `ra-xml` file for 1.0 and 1.5 resource adapters is `http://java.sun.com/xml/ns/j2ee/connector_1_5.xsd`. For 1.6 and 1.7 adapters, the schema is at `http://www.oracle.com/webfolder/technetwork/jsc/xml/ns/javaee/index.html`.

Configuring the weblogic-ra.xml File

In addition to supporting features of the standard resource adapter configuration `ra.xml` file, WebLogic Server defines an additional deployment descriptor file, `weblogic-ra.xml`. This file contains parameters that are specific to configuring and deploying resource adapters in WebLogic Server. This functionality is consistent with the equivalent `weblogic-*.xml` extensions for EJBs and Web applications in WebLogic Server, which also add WebLogic-specific deployment descriptors to the deployable archive. The basic RAR or deployment directory can be deployed to WebLogic Server without a `weblogic-ra.xml` file. If a resource adapter is deployed in WebLogic Server without a weblogic-ra.xml file, a template `weblogic-ra.xml` file populated with default element values is automatically added to the resource adapter archive. However, this automatically generated `weblogic-ra.xml` file is not persisted to the RAR; the RAR remains unchanged.
The following summarizes the most significant features you can configure in the `weblogic-ra.xml` deployment descriptor file.

- Descriptive text about the connection factory.
- JNDI name bound to a connection factory. (Resource adapters developed based on JSR 322: Java EE Connector Architecture 1.6 are bound in the JNDI as objects independently of their `ConnectionFactory` objects.)
- Reference to a separately deployed connection factory that contains resource adapter components that can be shared with the current resource adapter.
- Connection pool parameters that set the following behavior:
  - Initial number of `ManagedConnections` that WebLogic Server attempts to allocate at deployment time.
  - Maximum number of `ManagedConnections` that WebLogic Server allows to be allocated at any one time.
  - Number of `ManagedConnections` that WebLogic Server attempts to allocate when filling a request for a new connection.
  - Whether WebLogic Server attempts to reclaim unused `ManagedConnections` to save system resources.
  - The time WebLogic Server waits between attempts to reclaim unused `ManagedConnections`.

- Logging properties to configure WebLogic Server logging for the `ManagedConnectionFactory` or `ManagedConnection`.
- Transaction support levels (XA, local, or no transaction support).
- Principal names to use as security identities.

For detailed information about configuring the `weblogic-ra.xml` deployment descriptor file, see the reference information in weblogic-ra.xml Schema. See also the configuration information in the following sections:

- Connection Management
- Transaction Management
- Message and Transactional Inflow
- Security

Editing Resource Adapter Deployment Descriptors

To define or make changes to the XML descriptors used in the WebLogic Server resource adapter archive, you must define or edit the XML elements in the `weblogic-ra.xml` and `ra.xml` deployment descriptor files. You can edit the deployment descriptor files with any plain text editor. However, to avoid introducing errors, use a tool designed for XML editing.You can also edit most elements of the files using the WebLogic Server Administration Console.

Editing Considerations

To edit XML elements manually:

- If you use an ASCII text editor, make sure that it does not reformat the XML or insert additional characters that could invalidate the file.
- Use the correct case for file and directory names, even if your operating system ignores the case.
- To use the default value for an optional element, you can either omit the entire element definition or specify a blank value. For example: `<max-config-property></max-config-property>`

Schema Header Information

When editing or creating XML deployment files, it is critical to include the correct schema header for each deployment file. The header refers to the location and version of the schema for the deployment descriptor.

Although this header references an external URL at `xmlns.jcp.org`, WebLogic Server contains its own copy of the schema, so your host server need not have access to the Internet. However, you must still include this `<?xml version...>` element in your `ra.xml` file, and have it reference the external URL because the version of the schema contained in this element is used to identify the version of this deployment descriptor.

Table 2-1 shows the entire schema headers for the `ra.xml` and `weblogic-ra.xml` files.

Table 2-1 Schema Header

XML File	Schema Header
ra.xml	<?xml version="1.0" encoding="UTF-8"?> <connector xmlns="http://xmlns.jcp.org/xml/ns/javaee" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/javaee/ connector_1_7.xsd" version="1.7">
weblogic-ra.xml	<?xml version = "1.5"> <weblogic-connector xmlns="http://xmlns.oracle.com/ weblogic/weblogic-connector">

XML files with incorrect header information may yield error messages similar to the following, when used with a utility that parses the XML (such as `ejbc`):

```
SAXException: This document may not have the identifier 'identifier_name'
```

Conforming Deployment Descriptor Files to Schema

The contents and arrangement of elements in your deployment descriptor files must conform to the schema for each file you use. The following links provide the public schema locations for deployment descriptor files used with WebLogic Server:

- `connector_1_7.xsd` contains the schema for the standard `ra.xml` deployment file, required for all resource adapters. This schema is maintained as part of JSR 322: Java EE Connector Architecture 1.7 and is located at `http://www.oracle.com/webfolder/technetwork/jsc/xml/ns/javaee/index.html#7`.
- `weblogic-ra.xsd` contains the schema used for creating `weblogic-ra.xml`, which defines resource adapter properties used for deployment to WebLogic Server. This schema is located at `http://xmlns.oracle.com/weblogic/weblogic-connector/1.5/weblogic-connector.xsd`.

> **Note:**
>
> Your browser might not display the contents of files having the `.xsd` extension. In that case, to view the schema contents in your browser, save the links as text files and view them with a text editor.

Dynamic Descriptor Updates: Console Configuration Tabs

You can use the WebLogic Server Administration Console to view, modify, and (when necessary) persist deployment descriptor elements. Some descriptor element changes take place dynamically at run time without requiring the resource adapter to be redeployed. Other descriptor elements require redeployment after changes are made. To use the WebLogic

Server Administration Console to configure a resource adapter, open Deployments and click the name of the deployed resource adapter. Use the Configuration tab to change the configuration of the resource adapter and the other tabs to control, test, or monitor the resource adapter.

For information about using the WebLogic Server Administration Console, see Configure resource adapter properties in the *Oracle WebLogic Server Administration Console Online Help*.

Dynamic Reconfigurable Configuration Properties

Dynamic reconfigurable configuration properties are described in Section 5.3.7.6 of JSR 322: Java EE Connector Architecture 1.6. For 1.6 resource adapters, WebLogic Server supports dynamic reconfigurable configuration properties for the following adapter component beans:

- `ResourceAdapter` beans
- `ManagedConnectionFactory` beans
- Administered object beans

At run time, after you update the dynamically configurable properties on any of these adapter component beans, you must update the adapter to put changes into effect. Updating the adapter is a relatively lightweight operation during which WebLogic Server modifies the run-time bean instances without interfering with active connection pools or admin objects that do not have configuration updates. You do not need to update the adapter immediately. However, changes to properties on adapter component beans do not go into effect unless the beans are dynamically updated or the resource adapter is restarted.

The resource adapter should be designed carefully with regard to support for dynamic changes to its properties during run time. Depending on the services provided by the resource adapter, it might be critically important that some properties should never be reconfigured when the adapter is running; for example, the listen address and port number of a resource adapter used for the EIS connection (any reconfiguration of those properties should require the adapter to be shut down and restarted). WebLogic Server does not impose any requirements on an adapter component bean with regard to whether specific properties may or may not be designated as dynamically reconfigurable. It is entirely for the adapter developer to decide which adapter component beans support dynamic update and which do not.

Dynamic Configuration Parameters

For 1.6 adapters, WebLogic Server supports dynamic update on properties of `Resource Adapter`, `ManagedConnectionFactory`, and admin object beans. Using the WebLogic Server Administration Console, you can modify the following configuration parameters on those beans dynamically, without requiring the resource adapter to be redeployed:

- Edit the adapter JNDI name
- Create and delete outbound connection pools
- Edit the connection pool JNDI name
- Create and delete admin objects
- Edit admin object JNDI names

Dynamic Pool Parameters

Using the WebLogic Server Administration Console, you can modify the following `weblogic-ra.xml` pool parameters dynamically, without requiring the resource adapter to be redeployed:

- `initial-capacity`
- `max-capacity`
- `capacity-increment`
- `shrink-frequency-seconds`
- `highest-num-waiters`
- `highest-num-unavailable`
- `connection-creation-retry-frequency-seconds`
- `connection-reserve-timeout-seconds`
- `test-frequency-seconds`

Dynamic Logging Parameters

Using the WebLogic Server Administration Console, you can modify the following `weblogic-ra.xml` logging parameters dynamically, without requiring the resource adapter to be redeployed:

- `log-filename`
- `file-count`
- `file-size-limit`
- `log-file-rotation-dir`
- `rotation-time`
- `file-time-span`

Automatic Generation of the weblogic-ra.xml File

A resource adapter archive (RAR) deployed on WebLogic Server must include a `weblogic-ra.xml` deployment descriptor file in addition to the `ra.xml` deployment descriptor file specified in JSR 322: Java EE Connector Architecture 1.6.

If a resource adapter is deployed in WebLogic Server without a `weblogic-ra.xml` file, a template `weblogic-ra.xml` file populated with default element values is automatically added to the resource adapter archive. However, this automatically generated `weblogic-ra.xml` file is not persisted to the RAR; the RAR remains unchanged. WebLogic Server instead generates internal data structures that correspond to default information in the `weblogic-ra.xml` file.

For a 1.0 resource adapter that is a single connection factory definition, the JNDI name will be `eis/`*`ModuleName`*. For example, if the RAR is named `MySpecialRA.rar`, the JNDI name of the connection factory will be `eis/MySpecialRA`.

For a 1.5 resource adapter with a `ResourceAdapter` bean class specified, the JNDI name of the bean would be `MySpecialRA`. Each connection factory would also have a corresponding instance created with a JNDI name of `eis/`*`ModuleName`*, `eis/`*`ModuleName_1`*, `eis/`*`ModuleName_2`*, and so on.

(Deprecated) Configuring the Link-Ref Mechanism

The Link-Ref mechanism was introduced in the 8.1 release of WebLogic Server to enable the deployment of a single base adapter whose code could be shared by multiple logical adapters with various configuration properties. For 1.5 resource adapters in the current release, the Link-Ref mechanism is deprecated and is replaced by the new Java EE libraries feature. However, the Link-Ref mechanism is still supported in this release for 1.0 resource adapters. For more information on Java EE libraries, see Creating Shared Java EE Libraries and Optional Packages in *Developing Applications for Oracle WebLogic Server*. To use the Link-Ref mechanism, use the `ra-link-ref` element in your resource adapter's `weblogic-ra.xml` file.

The deprecated and optional `ra-link-ref` element allows you to associate multiple deployed resource adapters with a single deployed resource adapter. In other words, it allows you to link (reuse) resources already configured in a base resource adapter to another resource adapter, modifying only a subset of attributes. The `ra-link-ref` element enables you to avoid - where possible - duplicating resources (such as classes, JARs, image files, and so on). Any values defined in the base resource adapter deployment are inherited by the linked resource adapter, unless otherwise specified in the `ra-link-ref` element.

If you use the optional `ra-link-ref` element, you must provide either *all* or *none* of the values in the `pool-params` element. The `pool-params` element values are not partially inherited by the linked resource adapter from the base resource adapter.

Do one of the following:

- Assign the `max-capacity` element the value of `0` (zero). This allows the linked resource adapter to inherit its `pool-params` element values from the base resource adapter.
- Assign the `max-capacity` element any value other than `0` (zero). The linked resource adapter will inherit no values from the base resource adapter. If you choose this option, you must specify *all* of the `pool-params` element values for the linked resource adapter.

For further instructions on editing the `weblogic-ra.xml` file, see weblogic-ra.xml Schema.

Bean Validation Configuration File

In its support of JSR 303: Bean Validation, WebLogic Server extends Java EE 6 by providing a module-level bean validation configuration file. WebLogic Server supports the optional use of this file to validate a resource adapter module. The JSR 303: Bean Validation specification is available at https://jcp.org/en/jsr/detail?id=303.
The bean validation configuration file can be specified for a resource adapter module regardless of whether the resource adapter is deployed independently (as a standalone RAR) or as part of an enterprise application (EAR). If no bean validation configuration file is specified for an adapter module, WebLogic Server uses a default bean validation configuration to validate the resource adapter module.

The bean validation configuration file is named `validation.xml` and is included among the deployment descriptors in the `META-INF` subdirectory of the RAR.

For more information about bean validation, see Bean Validation.

Long-Running Work Support

Section 11.7 of the Java EE Connector Architecture 1.6 specification defines two standard **hints** to control the quality-of-service (QoS) characteristics afforded to it by the `WorkManager`. These hints are:

- `Work` Name Hint — Names a `Work` instance and is used as part of the thread name assigned to a long-running Work instance.
- Long-running `Work` instance Hint — Performs the same function as the WebLogic Server extension annotation @LongRunning, which allows you to schedule a `Work` instance in a separate thread and that also facilitates the control and monitoring capabilities of long-running Work instances.

  WebLogic Server allows you to configure a limit on the number of long-running `Work` instances that can be submitted by a resource adapter to be executed concurrently. The default limit is 10. You can change the limit to higher value, but you need to exercise care not to overburden system resources.

  This limit can be specified either by using the `max-concurrent-long-running-requests` element in the `weblogic-ra.xml` file or by setting `ConnectorWorkManagerRuntimeMBean.ActiveLongRunningRequests` attribute, which is exposed in the WebLogic Server Administration Console. The `ConnectorWorkManagerRuntimeMBean` includes getter and setter methods on the `ActiveLongRunningRequests` and `CompletedLongRunningRequests` attributes that allow you to configure and monitor information about long-running `Work` instances.

For more information, see Configuring and Managing Long-Running Work.

Tooling Support

WebLogic Server supports two tools, `weblogic.appmerge` and `appc`, which you can use to help with resource adapter development and deployment.

- `weblogic.appmerge`

  Performs validation checks metadata annotations. When used with the `-writeInferredDescriptors` option, `weblogic.appmerge` generates a merged `ra.xml` that combines deployment information specified in annotations with the contents of any pre-existing `ra.xml` file.

> **Note:**
>
> After you run the `weblogic.appmerge` tool, make sure the `metadata-complete` element in the merged `ra.xml` is set to `true`. This prevents the deployer from processing annotations again, which improves overall deployment performance and reduces deployment time.

See Using weblogic.appmerge to Merge Libraries in *Developing Applications for Oracle WebLogic Server*.

- `appc`

  Performs extensive validation checks on annotations, bean classes, `ra.xml`, `weblogic-ra.xml`, and the resource adapter deployment plan (`weblogic.appmerge` validates annotations only).

  The `appc` tool also:

  – Provides extensive reports that include both warnings and errors.

  – Is particularly useful for validating a resource adapter and ensuring that its configuration is correct without having to deploy it.

  See appc Reference in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

Monitoring Resource Adapter Health

WebLogic Server provides the ability to monitor the health status of standalone and embedded resource adapters. By default if a standalone or embedded resource adapter has a deployment error, the entire deployment of the adapter fails with a health status of HEALTH_FAILED. However, if the resource adapter includes multiple outbound connection pools and its deploy-as-a-whole flag is set to `false`, the adapter deployment can succeed even if one or more outbound connection pool failures occur. You can use the health monitoring feature to detect connection pool failures and repair them without needing to redeploy the adapter.
The following sections explain how resource adapter health status monitoring is available in WebLogic Server:

- Obtaining Resource Adapter Health State
- Deployment Requirements for Monitoring Health

Obtaining Resource Adapter Health State

To support health monitoring in both standalone and embedded resource adapters, WebLogic Server provides the following MBean attributes, whose values can be obtained using the WebLogic Server Administration Console, WLST, or JMX:

- `ConnectorComponentRuntimeMBean.HealthState` — Returns the overall health state of either a standalone or embedded resource adapter. If an outbound connection pool has a deployment failure, the health state of the resource adapter is HEALTH_CRITICAL.
- `ApplicationRuntimeMBean.OverallHealthState` — Returns the aggregated health state of the application, including that of the embedded components that report health. If an embedded resource adapter contains a failed outbound connection pool, the health state of that connection pool is reflected in the overall health of the application.
- `ConnectorConnectionPoolRuntimeMBean.HealthState` — Returns health state of the individual outbound connection pool in a resource adapter.

Deployment Requirements for Monitoring Health

To deploy a resource adapter that is configured with multiple outbound connection pools so that a failed connection pool does not cause the whole adapter deployment to fail, you must set the `deploy-as-a-whole` element in the `weblogic-ra.xml` file to `false`. (By default, this element is set to `true`.) For information about setting this deployment option, see Deploying a Resource Adapter Configured with Multiple Outbound Connection Pools .

3
Programming Tasks

When you implement a WebLogic Server resource adapter, you must include a specific set Java classes that are required by the Java EE Connector Architecture. Optionally, you can create the resource adapter so that it can perform as a startup class. You should also understand how to suspend and resume resource adapter activity and also how to use the `ExtendedBootstrapContext` class.

Required Classes for Resource Adapters

In accordance with Java Connector Architecture, a resource adapter must include a specific set of classes, and which must be specified in the `ra.xml` deployment descriptor file.

A resource adapter requires the following Java classes:

- `ManagedConnectionFactory`
- `ConnectionFactory` interface
- `ConnectionFactory` implementation
- `Connection` interface
- `Connection` implementation

You must specify these classes in the `ra.xml` file. For example:

```
<managedconnectionfactory-class>
com.sun.connector.blackbox.LocalTxManagedConnectionFactory
</managedconnectionfactory-class>

<connectionfactory-interface>
javax.sql.DataSource
</connectionfactory-interface>

<connectionfactory-impl-class>
com.sun.connector.blackbox.JdbcDataSource
</connectionfactory-impl-class>

<connection-interface>
java.sql.Connection
</connection-interface>

<connection-impl-class>
```

```
com.sun.connector.blackbox.JdbcConnection
</connection-impl-class>
```

In addition, if the resource adapter supports inbound messaging, the resource adapter will require an `ActivationSpec` class for each supported inbound message type. See Message and Transactional Inflow.

The specifics of these resource adapter classes depend on the nature of the resource adapter you are developing.

Generic Work Context

Connector Architecture 1.6 defines the generic work context, which is a mechanism for a resource adapter to propagate contextual information from an EIS to WebLogic Server during message delivery or when submitting a Work instance. The generic work context comprises a set of classes, interfaces, and methods, and also includes new schema elements supported in WebLogic Server.
The following sections describe these entities added to support the generic work context:

- Interfaces, Classes, and Methods Added to Support the Generic Work Context
- Deployment Descriptor Element Added to Support the Generic Work Context

Interfaces, Classes, and Methods Added to Support the Generic Work Context

The following interfaces are added to support the generic work context:

Table 3-1 Interfaces

Interface	Description
`javax.resource.spi.work.WorkContext`	Serves as a standard mechanism for a resource adapter to propagate an imported context from an EIS to an application server.
`javax.resource.spi.work.WorkContextLifecycleListener`	Models the various events that occur during the processing of the `WorkContext`s associated with a `Work` instance. This interface may be implemented by a `WorkContext` instance to receive notifications from the `WorkManager` when the `WorkContext` is set as the execution context of the `Work` instance it is associated with.
`javax.resource.spi.work.WorkContextProvider`	Specifies the methods a `Work` instance uses to associate a `List` of `WorkContext` instances to be set when the `Work` instance gets executed by a `WorkManager`.

The following class is added to support the generic work context:

Table 3-2 Classes

Class	Description
`javax.resource.spi.work.WorkContextErrorCodes`	Models the possible error conditions that might occur during associating a `WorkContext` with a `Work` instance.

The following method is added to `BootstrapContext` interface to support the generic work context:

Table 3-3 Methods

Method	Description
`isContextSupported`	A resource adapter can check an application server's support for a particular `WorkContext` type through this method. This mechanism enables a resource adapter developer to dynamically change the `WorkContext`s submitted with a `Work` instance based on the support provided by the application server.

Deployment Descriptor Element Added to Support the Generic Work Context

To support the generic work context, the `required-work-context` element is added to the `ra.xml` file schema to represent a `WorkContext` class that is required by the resource adapter for WebLogic Server to support. For each `WorkContext` class that is required, an individual `required-work-context` element is specified.

Note that the `@Connector` metadata annotation can be used in a resource adapter source file to specify this deployment descriptor information. See Section 18.4, @Connector, in JSR 322: Java EE Connector Architecture 1.6.

Programming a Resource Adapter to Perform as a Startup Class

As an alternative to using a WebLogic Server startup class, you can implement a simple resource adapter to perform as a startup class.

The following sections describe programming a resource adapter to perform as a startup class:

- Minimum Content of a Resource Adapter
- Submitting a Work Instance
- Retrying a Work Submission

Minimum Content of a Resource Adapter

As an alternative to using a WebLogic Server startup class, you can program a resource adapter with a minimal resource adapter class that implements `javax.resource.ResourceAdapter`, which defines a `start()` and `stop()` method.

> **Note:**
>
> Because of the definition of the ResourceAdapter interface, you must also define the `endpointActivation()`, `Deactivation()` and `getXAResource()` methods.

When the resource adapter is deployed, the `start()` method is invoked. When it is undeployed, the `stop()` method is invoked. Any work that the resource adapter initiates can be performed in the `start()` method as with a WebLogic Server startup class.

Example 3-1 shows a resource adapter having a minimum resource adapter class. It is the absolute minimum resource adapter that you can develop (other than removing the `println` statements). In this example, the only work performed by the `start()` method is to print a message to `stdout` (standard out).

Example 3-1 Minimum Resource Adapter

```
import javax.resource.spi.ResourceAdapter;
import javax.resource.spi.endpoint.MessageEndpointFactory;
import javax.resource.spi.ActivationSpec;
import javax.resource.ResourceException;
import javax.transaction.xa.XAResource;
import javax.resource.NotSupportedException;
import javax.resource.spi.BootstrapContext;
/**
* This resource adapter is the absolute minimal resource adapter that anyone can
build (other than removing the println's.)
*/
public class ResourceAdapterImpl implements ResourceAdapter
{
   public void start( BootstrapContext bsCtx )
   {
      System.out.println( "ResourceAdapterImpl started" );
   }
   public void stop()
   {
      System.out.println( "ResourceAdapterImpl stopped" );
   }
   public void endpointActivation(MessageEndpointFactory messageendpointfactory,
ActivationSpec activationspec)
      throws ResourceException
   {
      throw new NotSupportedException();
   }
   public void endpointDeactivation(MessageEndpointFactory
messageendpointfactory, ActivationSpec activationspec)
   {
   }
   public XAResource[] getXAResources(ActivationSpec aactivationspec[])
      throws ResourceException
   {
      throw new NotSupportedException();
   }
}
```

Submitting a Work Instance

Because resource adapters have access to the Work Manager through the `BootstrapContext` in the `start()` method, they should submit `Work` instances instead of using direct thread management. This enables WebLogic Server to manage threads effectively through its self-tuning Work Manager.

Once a Work instance is submitted for execution, the `start()` method should return promptly so as not to interfere with the full deployment of the resource adapter. Thus, a `scheduleWork()` or `startWork()` method should be invoked on the Work Manager rather than the `doWork()` method.

Example 3-2 shows resource adapter that submits work instances to the Work Manager. The resource adapter starts some work in the `start()` method, thus serving as a Java EE-compliant startup class.

Example 3-2 Resource Adapter Using the Work Manager and Submitting Work Instances

```
import javax.resource.NotSupportedException;
import javax.resource.ResourceException;
import javax.resource.spi.ActivationSpec;
import javax.resource.spi.BootstrapContext;
import javax.resource.spi.ResourceAdapter;
import javax.resource.spi.endpoint.MessageEndpointFactory;
import javax.resource.spi.work.Work;
import javax.resource.spi.work.WorkException;
import javax.resource.spi.work.WorkManager;
import javax.transaction.xa.XAResource;
/**
* This Resource Adapter starts some work in the start() method,
* thus serving as a Java EE compliant "startup class"
*/
public class ResourceAdapterWorker implements ResourceAdapter
{
   private WorkManager wm;
   private MyWork someWork;
   public void start( BootstrapContext bsCtx )
   {
      System.out.println( "ResourceAdapterWorker started" );
      wm = bsCtx.getWorkManager();
      try
      {
         someWork = new MyWork();
         wm.startWork( someWork );
      }
      catch (WorkException ex)
      {
         System.err.println( "Unable to start work: " + ex );
      }
   }
   public void stop()
   {
   // stop work that was started in the start() method
   someWork.release();
      System.out.println( "ResourceAdapterImpl stopped" );
   }
   public void endpointActivation(MessageEndpointFactory messageendpointfactory,
             ActivationSpec activationspec)
```

```
      throws ResourceException
   {
      throw new NotSupportedException();
   }
   public void endpointDeactivation(MessageEndpointFactory
            messageendpointfactory, ActivationSpec activationspec)
   {
   }
   public XAResource[] getXAResources(ActivationSpec activationspec[])
      throws ResourceException
   {
      throw new NotSupportedException();
   }
   // Work class
   private class MyWork implements Work
   {
      private boolean isRunning;
      public void run()
      {
         isRunning = true;
         while (isRunning)
         {
         // do a unit of work (e.g. listen on a socket, wait for an inbound msg,
         // check the status of something)
         System.out.println( "Doing some work" );
         // perhaps wait some amount of time or for some event
         try
         {
            Thread.sleep( 60000 ); // wait a minute
         }
         catch (InterruptedException ex)
         {}
      }
   }
   public void release()
   {
         // signal the run() loop to stop
         isRunning = false;
      }
   }
}
```

Retrying a Work Submission

There are instances in which the submission of a `Work` instance by a resource adapter can experience a transient failure. For example, JSR 322: Java EE Connector Architecture 1.6 describes how you can use the optional `startTimeout` parameter in a WorkManager interface implementation to specify a time interval within which the execution of the Work instance must start. If a Work submission times out, a work submission failure occurs and a WorkRejectedException is generated.

JSR 322: Java EE Connector Architecture 1.6 states that the application server throws out a RetryableWorkRejectedException when it determines that the failure of a `Work` submission may due to transient causes. When it receives a RetryableWorkRejectedException, the resource adapter may retry submitting the `Work` instance. WebLogic Server supports the RetryableWorkRejectedException in the following transient failure situations:

- The `Work` instance was submitted to a suspended Work Manager.

- The `Work` submission has timed out.

> **Note:**
>
> WebLogic Server extends retryable exception support to outbound connection pools if a connection instance attempts to connect to a suspended connection pool. For more information, see Retrying a Connection Attempt.

Suspending and Resuming Resource Adapter Activity

You can program your resource adapter to use the `suspend()` method, which provides custom behavior for suspending activity. For example, using the `suspend()` method, you can queue up all incoming messages while allowing in-flight transactions to complete, or you can notify the Enterprise Information System (EIS) that reception of messages is temporarily blocked.
You then invoke the `resume()` method to signal that the inbound queue be drained and messages be delivered, or notify the EIS that message receipt was re-enabled. Basically, the `resume()` method allows the resource adapter to continue normal operations.

You initiate the `suspend()` and `resume()` methods by making a call on the resource adapter runtime MBeans programmatically, using WebLogic Scripting Tool, or from the WebLogic Server Administration Console. See Start and stop a resource adapter in the *Oracle WebLogic Server Administration Console Online Help* for more information.

The `Suspendable.supportsSuspend()` method determines whether a resource adapter supports a particular type of suspension. The `Suspendable.isSuspended()` method determines whether or not a resource adapter is presently suspended.

A resource adapter that supports `suspend()`, `resume()`, or production redeployment must implement the `Suspendable` interface to inform WebLogic Server that these operations are supported. These operations are invoked by WebLogic Server when the following occurs:

- Suspend is called by the `suspend()` method on the connector component MBean.
- The production redeployment sequence of calls is invoked (when a new version of the application is deployed that contains the resource adapter). See Suspendable Interface and Production Redeployment.

Example 3-3 contains the `Suspendable` interface for resource adapters:

Example 3-3 Suspendable Interface

```
package weblogic.connector.extensions;
import java.util.Properties;
import javax.resource.ResourceException;
import javax.resource.spi.ResourceAdapter;
/**
* Suspendable may be implemented by a ResourceAdapter JavaBean if it
* supports suspend, resume or side-by-side versioning
* @author Copyright (c) 2002 by BEA Systems, Inc. All Rights Reserved.
* @since November 14, 2003
*/
public interface Suspendable
{
/**
```

```
* Used to indicate that inbound communication is to be suspended/resumed
*/
int INBOUND = 1;
/**
* Used to indicate that outbound communication is to be suspended/resumed
*/
int OUTBOUND = 2;
/**
* Used to indicate that submission of Work is to be suspended/resumed
*/
int WORK = 4;
/**
* Used to indicate that INBOUND, OUTBOUND & WORK are to be suspended/resumed
*/
int ALL = 7;
/**
* May be used to indicate a suspend() operation
*/
int SUSPEND = 1;
/**
* May be used to indicate a resume() operation
*/
int RESUME = 2;
/**
* Request to suspend the activity specified. The properties may be null or
* specified according to RA-specific needs
* @param type An int from 1 to 7 specifying the type of suspension being
* requested (i.e. Suspendable.INBOUND, .OUTBOUND, .WORK or the sum of one
* or more of these, or the value Suspendable.ALL )
* @param props Optional Properties (or null) to be used for ResourceAdapter
* specific purposes
* @exception ResourceException If the resource adapter can't complete the
* request
*/
void suspend( int type, Properties props ) throws ResourceException;
/**
* Request to resume the activity specified. The Properties may be null or
* specified according to RA-specific needs
*
* @param type An int from 1 to 7 specifying the type of resume being
* requested (i.e. Suspendable.INBOUND, .OUTBOUND, .WORK or the sum of
* one or more of these, or the value Suspendable.ALL )
* @param props Optional Properties (or null) to be used for ResourceAdapter
* specific purposes
* @exception ResourceException If the resource adapter can't complete the
* request
*/
void resume( int type, Properties props ) throws ResourceException;
/**
*
* @param type An int from 1 to 7 specifying the type of suspend this inquiry
* is about (i.e. Suspendable.INBOUND, .OUTBOUND, .WORK or the sum of
* one or more of these, or the value Suspendable.ALL )
* @return true iff the specified type of suspend is supported
*/
boolean supportsSuspend( int type );
/**
*
* Used to determine whether the specified type of activity is
* currently suspended.
*
```

```
* @param type An int from 1 to 7 specifying the type of activity
* requested (i.e. Suspendable.INBOUND, .OUTBOUND, .WORK or the sum of
* one or more of these, or the value Suspendable.ALL )
* @return true iff the specified type of activity is suspened by this
* resource adapter
*/
boolean isSuspended( int type );
/**
* Used to determine if this resource adapter supports the init() method used for
* resource adapter versioning (side-by-side deployment)
*
* @return true iff this resource adapter supports the init() method
*/
boolean supportsInit();
/**
* Used to determine if this resource adapter supports the startVersioning()
* method used for
* resource adapter versioning (side-by-side deployment)
*
* @return true iff this resource adapter supports the startVersioning() method
*/
boolean supportsVersioning();
/**
* Used by WLS to indicate to the current version of this resource adapter that
* a new version of the resource adapter is being deployed. This method can
* be used by the old RA to communicate with the new RA and migrate services
* from the old to the new.
* After being called, the ResourceAdapter is responsible for notifying the
* Connector container via the ExtendedBootstrapContext.complete() method, that
* it is safe to be undeployed.
*
* @param ra The new ResourceAdapter JavaBean
* @param props Properties associated with the versioning
* when it can be undeployed
* @exception ResourceException If something goes wrong
*/
void startVersioning( ResourceAdapter ra,
Properties props ) throws ResourceException;
/**
* Used by WLS to inform a ResourceAdapter that it is a new version of an already
* deployed resource adapter. This method is called prior to start() so that
* the new resource adapter may coordinate its startup with the resource adapter
* it is replacing.
* @param ra The old version of the resource adapter that is currently running
* @param props Properties associated with the versioning operation
* @exception ResourceException If the init() fails.
*/
void init( ResourceAdapter ra, Properties props ) throws ResourceException;
}
```

Extended BootstrapContext

WebLogic Server extends the Java EE Connector Architecture 1.6 specification by providing the `weblogic.connector.extensions.ExtendedBootstrapContext` interface, which your resource adapter can implement to obtain access to additional WebLogic Server-specific diagnostics capabilities and that also support Contexts and Dependency Injection (CDI).

If, when a resource adapter is deployed, it has a resource adapter JavaBean specified in the `resource-adapter-class` element of its `ra.xml` descriptor, the WebLogic Server connector

container calls the `start()` method on the resource adapter bean as required by JSR 322: Java EE Connector Architecture 1.6. The resource adapter code can use the `BootstrapContext` object that is passed in by the `start()` method to:

- Obtain a `WorkManager` object for submitting `Work` instances
- Create a `Timer`
- Obtain an `XATerminator` for use in transaction inflow

These capabilities are all prescribed by Connector Architecture 1.6.

In addition to implementing the required `javax.resource.spi.BootstrapContext`, the `BootstrapContext` object passed to the resource adapter `start()` method also implements `weblogic.connector.extensions.ExtendedBootstrapContext`, which gives the resource adapter access to some additional WebLogic Server-specific extensions that enhance diagnostic capabilities and that also support Contexts and Dependency Injection (CDI). These extensions are described in the following sections:

- Diagnostic Context ID
- Dye Bits
- Callback Capabilities
- Bean Validation
- BeanManager

Diagnostic Context ID

In the WebLogic Server Diagnostic Framework, a thread may have an associated *diagnostic context*. A request on the thread carries its diagnostic context throughout its lifetime, as it proceeds along its path of execution. The `ExtendedBootstrapContext` allows the resource adapter developer to set a diagnostic context *payload* consisting of a String that can be used, for example, to trace the execution of a request from an EIS all the way to a message endpoint.

This capability can serve a variety of diagnostic purposes. For example, you can set the String to the client ID or session ID on an inbound message from an EIS. During message dispatch, various diagnostics can be gathered to show the request flow through the system. As you develop your resource adapter classes, you can make use of the `setDiagnosticContextID()` and `getDiagnosticContextID()` methods for this purpose.

Note the following regarding the contents of the diagnostic context payload:

- The payload can be viewed by other code in the same execution context, and it can also flow out of the process along with the `Work` instance. Therefore, you should ensure that the application does not include any sensitive data in the payload that, for example, could be returned by the `getDiagnosticContextID()` method.
- The payload can be overwritten by other code in the same execution context. Therefore, the application must never have a dependency on a specific context ID being available in the payload. In addition, the application should also verify that the context ID in the payload matches what is expected before using it.

For more information about the diagnostic context, see *Configuring and Using the Diagnostics Framework for Oracle WebLogic Server*.

Dye Bits

The WebLogic Server diagnostic framework also provides the ability to *dye* a request. The `ExtendedBootstrapContext` allows you to set and retrieve four dye bits on the current thread for whatever diagnostic purpose the resource adapter developer chooses. For example, you might set priority of a request using the dye bits. For more information about request dyeing, see *Configuring and Using the Diagnostics Framework for Oracle WebLogic Server*.

Callback Capabilities

You can use the `ExtendedBootstrapContext.complete()` method as a callback to the connector container. See Redeploying Applications in a Production Environment in *Deploying Applications to Oracle WebLogic Server*.

Bean Validation

In its support of JSR 303: Bean Validation, WebLogic Server extends Java EE 6 by providing a module-level bean validation configuration file, which WebLogic Server uses to validate the resource adapter module.

There are circumstances in which you might want a resource adapter to perform validation on other bean instances that are managed by that resource adapter. Because a resource adapter does not have its own JNDI namespace, it cannot look up its own `Validator` and `ValidatorFactory` instances using JNDI. Instead, the resource adapter can inject those beans using CDI, or use the following methods on the `ExtendedBootstrapContext` interface to obtain instances of those beans:

- `getValidator()`
- `getValidatorFactory()`

BeanManager

To support JSR 299: Contexts and Dependency Injection for the Java EE Platform (CDI), WebLogic Server implements the `getBeanManager` method on the `ExtendedBootstrapContext` interface. A resource adapter can invoke this method to obtain its own `BeanManager` instance and perform CDI-style injection of managed beans inside the resource adapter.

> **Note:**
>
> Note the following restrictions:
>
> - The use of a resource adapter's `BeanManager` instance by a separate, caller thread is not supported.
> - You cannot use a `BeanManager` instance to manage the life cycle of resource adapter component beans.

For more information about using the `getBeanManager` method on the `ExtendedBootstrapContext` interface to use CDI, see Using Contexts and Dependency Injection in Resource Adapters.

Administered Object Uniqueness

Connector Architecture 1.6 allows a resource adapter to have multiple administered object classes that implement the same interface. However, there must be no more than one administered object definition with the same interface and class name combination (see Section 20.4.1, Resource Adapter Provider in JSR 322: Java EE Connector Architecture 1.6). The `adminobject-type-uniqueness` constraint has been added to the schema definition for the `ra.xml` file to define the `adminobject-interface` and `adminobject-class` combination.
In previous releases of WebLogic Server, the mapping of an admin object group defined in `weblogic-ra.xml` to the corresponding admin object defined in `ra.xml` was based on the admin object interface only. However, to support multiple admin object classes that have the same interface, WebLogic Server includes the optional `admin-object-class` sub-element of the `admin-object-group` element in `weblogic-ra.xml`. You can use the `admin-object-class` sub-element to define an admin object interface and class combination that WebLogic Server is able to map to the corresponding admin object defined in `ra.xml`.

When mapping an admin object group, WebLogic Server uses the following rules, which also ensure backward compatibility with 1.0 and 1.5 adapters:

- If the admin object group defined in `weblogic-ra.xml` includes both an admin object interface and class, WebLogic Server attempts to match that interface and class to the corresponding admin object definition in `ra.xml`.
- If the admin object group defined in `weblogic-ra.xml` includes only one admin object interface, and more than one matching admin object interface is defined in `ra.xml`, WebLogic Server generates an error.
- If the admin object group defined in `weblogic-ra.xml` includes only one admin object interface, and only one matching admin object interface is defined in `ra.xml`, that specific admin object interface is used.

4

Using Contexts and Dependency Injection in Resource Adapters

WebLogic Server provides full support for JSR 299: Contexts and Dependency Injection for the Java EE Platform (CDI) in its implementation of Connector Architecture 1.7.

Overview

The CDI specification defines a set of services for using injection to specify dependencies in an application. CDI provides contextual life cycle management of beans, type-safe injection points, a loosely coupled event framework, loosely coupled interceptors and decorators, alternative implementations of beans, bean navigation through the Unified Expression Language (EL), and a service provider interface (SPI) that enables CDI extensions to support third-party frameworks or future Java EE components.
CDI support in the WebLogic Server implementation of Connector Architecture 1.7 is based on the following related specifications:

- JSR 299: Contexts and Dependency Injection for the Java EE Platform (`http://www.jcp.org/en/jsr/summary?id=299`)
- JSR 330: Dependency Injection for Java (`http://jcp.org/en/jsr/summary?id=330`)

For additional general information about CDI, see:

- Using Contexts and Dependency Injection for the Java EE Platform in *Developing Applications for Oracle WebLogic Server*
- Introduction to Contexts and Dependency Injection for Java EE in *Java Platform, Enterprise Edition: The Java EE Tutorial*.

Resource Adapter Bean Discovery

A resource adapter RAR is a bean archive if it has a bean archive descriptor file, `beans.xml`, in its `META-INF` directory. If a resource adapter RAR is a bean archive, then all JARs must conform to the CDI 1.1 standard. See Using CDI With JCA Technology in *Developing Applications for Oracle WebLogic Server*.
When an application is deployed as a resource adapter RAR bean archive, the WebLogic Server Connector container searches the following for beans and bean references:

- The resource adapter RAR

- All classes packaged directly inside the resource adapter RAR
- Every bean archive referenced by the adapter RAR

Obtaining Contextual References to Resource Adapter Beans

A resource adapter is different from a Web application or an EJB in that a resource adapter does not have its own JNDI namespace. That is, a resource adapter module does not have a `java:comp`, `java:module`, or `java:app` namespace. Therefore, it is not possible to bind a named managed bean to a resource adapter's JNDI namespace, and it is also not possible to perform a lookup (as specified in the Java EE 6 Managed Beans Specification) from a resource adapter's JNDI namespace or to use the Java EE 6 `@Resource` annotation to inject a predefined bean.
However, WebLogic Server provides the `ExtendedBootstrapContext.getBeanManager()` method. A resource adapter can invoke the `getBeanManager` method to expose the `BeanManager` instance of its adapter module.

Invoking Resource Adapter Beans From Other Application Types

The WebLogic Server Connector container does not support injecting CDI bean classes contained in a resource adapter RAR bean archive into other Web applications or EJBs. WebLogic Server support is limited to permitting CDI beans within an adapter RAR bean archive to be used or invoked by other caller Web applications or EJBs, provided that those CDI beans are not client proxies.

Using Resource Adapters Deployed as CDI Bean Archives

If the resource adapter is deployed as a CDI bean archive, the WebLogic Server Connector container provides support for several CDI features within the resource adapter itself. This support includes:

- The ability to discover managed beans, decorators, interceptors, events, and so on, that are inside the deployed resource adapter
- Support for third-party portable extensions, as defined in Portable Extensions of Chapter 11 in JSR 299: Contexts and Dependency Injection for the Java EE Platform
- Support for the CDI features that are exposed by the `BeanManager`
- Support for bean instantiation, injection, decorators, interceptors, events, and so on, for managed beans inside the resource adapter

Note the following:

- A resource adapter's `BeanManager` instance is exposed by the `getBeanManager` method on the `ExtendedBootstrapContext` object.
- WebLogic Server supports the use of an adapter's `BeanManager` only in the adapter's own thread. An adapter's `BeanManager` cannot be used in another application's thread.

- The WebLogic Server Connector container supports the injection of built-in `BeanManager` bean types that are inside the resource adapter module; for example, injecting into the `ResourceAdapter` bean.
- The use of the `Resource` injection annotation on a resource adapter's managed beans is not supported.

BeanManager Support

A resource adapter's `BeanManager` can be used in either of the following situations:

- During the adapter deployment process, such as when the `ResourceAdapter.start` method is invoked
- Inside the `Work.run` method, which is scheduled by the resource adapter's `WorkManager` instance

The WebLogic Server Connector container supports the injection of built-in `BeanManager` bean types in the resource adapter module. However, the use of a resource adapter's `BeanManager` instance by a caller thread is not supported.

Injection Points

The WebLogic Server Connector container supports injection points for the following beans within a resource adapter deployed as a CDI bean archive:

- The following built-in beans, which JSR 299: Contexts and Dependency Injection for the Java EE Platform requires to be provided in a Java EE container:
  - `UserTransaction` — Provided by WebLogic JTA.
  - `Principal` — The caller principal set by the WebLogic Server Connector container. Its value is the current principal on the thread at the time this instance is used, not when it was injected.
  - `ValidationFactory` — The `ValidationFactory` instance of the resource adapter module itself and that is also accessible from the `ExtendedBootstrapContext.getValidatorFactory` method.
  - `Validator` — The `Validator` instance of the resource adapter module itself and that is also accessible from the `ExtendedBootstrapContext.getValidator` method.
- The `BeanManager` instance, as defined in Section 11.3 of JSR 299: Contexts and Dependency Injection for the Java EE Platform, of the resource adapter module itself that is accessible from the `ExtendedBootstrapContext.getBeanManager` method.
- Any managed bean that conforms to JSR 299: Contexts and Dependency Injection for the Java EE Platform and the Java EE 6 Managed Beans Specification, which is a part of JSR 316: Java Platform, Enterprise Edition 6 (Java EE 6) Specification.
- Any special Connector Architecture 1.7 built-in beans of the following types that are part of the current resource adapter module:
  - `javax.resource.spi.ResourceAdapter` allowing injection of a reference to the current resource adapter bean, which always refers to either: the `ResourceAdapter` bean instance of the current adapter module; or `null` if no `ResourceAdapter` bean is defined for the current resource adapter module.

  - `javax.resource.spi.BootstrapContext` or `weblogic.connector.extensions.ExtendedBootstrapContext` allowing injection of a reference to either: the current resource adapter's `BootstrapContext` bean instance; or `null` if no `ResourceAdapter` bean is defined for the current resource adapter module. This bean type is also available from a parameter in an invocation of the `ResourceAdapter.start(BootstrapContext ctx)` method.
  - `javax.resource.spi.work.WorkManager` allowing injection of a reference to either: the current resource adapter's `WorkManager` instance, which is available also from the `BootstrapContext.getWorkManager()` method; or `null` if no `ResourceAdapter` bean is defined for the current resource adapter module.
  - `javax.resource.spi.XATerminator` allowing injection of a reference to either: the current resource adapter's `XATerminator` instance, which is also available from the `BootstrapContext.getXATerminator` method; or `null` if no `ResourceAdapter` bean is defined for the current resource adapter module.
  - `javax.transaction.TransactionSynchronizationRegistry` allowing injection of a reference to the JTA `TransactionSynchronizationRegistry` instance, which is also available also from the `BootstrapContext.getTransactionSynchronizationRegistry` method.

Using CDI with Resource Adapter Component Beans

WebLogic Server supports four types of beans called **resource adapter component beans**, which define special components managed by the WebLogic Server Connector container. Resource adapter component beans are POJOs (Plain Old Java Objects), but are created and managed by the resource adapter container and have a special life cycle.

The adapter component bean types are:

- `ResourceAdapter` bean — Resource adapter class that implements `javax.resource.spi.ResourceAdapter` interface, which contains operations for life cycle management and message endpoint setup.
- `ManagedConnectionFactory` bean — JavaBean class that implements the `javax.resource.spi.ManagedConnectionFactory` interface and is a factory of both ManagedConnection and EIS-specific connection factory instances. This interface supports connection pooling by providing methods for matching and creation of a ManagedConnection instance.
- `ActivationSpec` bean — JavaBean class that implements the `javax.resource.spi.ActivationSpec` interface and that holds the activation configuration information for a message endpoint.
- Administered objects, or admin objects — Optional set of JavaBean classes that represent objects specific to a messaging style or message provider.

The following metadata annotations may be used within resource adapter component beans:

- @Connector
- @Activation
- @ConnectionDefinition

- @ConnectionDefinitions
- @AdministeredObject

> **Note:**
>
> The preceding annotations are new in Connector Architecture 1.7 and are recommended for use instead of the corresponding `ra.xml` elements.

The following sections include important information about the programming requirements for resource adapter component beans:

- Resource Adapter Component Beans Must Not Be Managed Beans
- Using Dependency Injection

For information about setting dynamically configurable properties on resource adapter component beans, see Dynamic Reconfigurable Configuration Properties.

Resource Adapter Component Beans Must Not Be Managed Beans

Resource adapter component beans must not be managed beans. However, the WebLogic Server Connector container does support CDI injection of managed beans, as defined in JSR 299: Contexts and Dependency Injection for the Java EE Platform, into a resource adapter component bean. WebLogic Server also supports the `PostConstruct` and `PreDestroy` annotations in adapter component beans as well.

> **Note:**
>
> Note the following:
>
> - The WebLogic Server Connector container does not support managed beans that conform to the Java EE 6 Managed Beans Specification, which is a part of JSR 316: Java Platform, Enterprise Edition 6 (Java EE 6) Specification.
> - For information about designing a managed bean that meets the conditions required by JSR 299, see About Managed Beans in *The Java EE 6 Tutorial*.

To ensure that a resource adapter component bean is not treated as a managed bean, WebLogic Server will fail to deploy the adapter if any of the following class-level annotations are used within an adapter component bean:

- The `javax.annotation.ManagedBean` annotation
- Any scope annotation
- Any qualifier annotation
- Any stereotype annotation
- `javax.inject.Named` annotation
- `javax.enterprise.inject.Alternative` annotation
- `javax.enterprise.inject.Specializes` annotation

- `javax.enterprise.inject.Typed` annotation
- `javax.decorator.Decorator` annotation
- `javax.decorator.Delegate` annotation

Using Dependency Injection

In a resource adapter that is deployed as a CDI bean archive, the WebLogic Server Connector container supports CDI for adapter component beans once they are created and initialized.

To support Dependency Injection for resource adapter component beans, consistent with Section EE.5.20, Support for Dependency Injection (JSR-330) in the Java Platform, Enterprise Edition (Java EE) Specification, Version 6, the WebLogic Connector container does the following when initializing these beans:

1. Initializes the resource adapter component bean configuration properties using values in deployment descriptors.
2. Uses the `PostConstruct` annotation after dependency injection is done to perform any initialization.
3. Performs bean validation, consistent with JSR 303: Bean Validation, and for an `ActivationSpec` bean, invokes the `validate()` method.
4. For a `ResourceAdapter` bean, invokes the `start()` method.
5. Makes all resource adapter component beans available either by binding them to JNDI or exposing them to endpoint applications.

Notes on Injection Usage

Resource adapter component beans cannot be injected into other beans outside of the resource adapter module because they are not standard managed beans. That is, they are not visible outside the resource adapter module in a way that is consistent with JSR 299: Contexts and Dependency Injection for the Java EE Platform. You can design adapter component beans to support injection, but it is important to ensure that they are not treated like managed beans because the notion of request scope or session scope is meaningless in resource adapter component beans.

Injection is supported as follows:

- Field and method injection, but not constructor injection, is supported using the `javax.inject.Inject` annotation.
- Injected Fields, as defined in Section 3.8 of JSR 299: Contexts and Dependency Injection for the Java EE Platform, is supported.
- All injection points listed in Injection Points, are supported, such as `weblogic.transaction.UserTransaction` or `javax.resource.spi.BootstrapContext`.
- The `PostConstruct` and `PreDestroy` injection annotations are supported as follows:
  - For `ResourceAdapter` bean types, the @PostConstruct method is called after the configuration properties are initialized but before the `start()` method is called. In addition, the @PreDestroy method is after the `stop()` method.

  - For other bean types, the @PostConstruct method is called after the configuration properties are initialized but before the bean is bound to JNDI. In addition, the @PreDestroy method is called when the resource adapter is undeployed or when the server is shut down.
  - For all beans, WebLogic Server performs bean validation consistent with its support for JSR 303: Bean Validation and also call the `validate()` method, if applicable, after calling the @PostConstruct method.
- Events, as defined in Chapter 10, Events, in JSR 299: Contexts and Dependency Injection for the Java EE Platform, are supported.
- In releases prior to WebLogic Server 12.2.1, the annotation "@Inject Validator v" injects only the default validator, even if you specify a customized validator as per the specification in CDI 1.0. However, since 12.2.1 release of WebLogic Server, the annotation "@Inject Validator v" injects even the customized validator as per the specification in CDI 1.1.

The `Resource` injection annotation is not supported in a resource adapter module.

Example

The following example shows that during resource adapter deployment, WebLogic Server first instantiates a `MyResourceAdapter` instance consistent with CDI. `MyResourceAdapter` is the `ResourceAdapter` component bean of the resource adapter module shown in this example because it is annotated with the `Connector` annotation. During deployment, WebLogic Server also:

- Instantiates `MyBean` and injects it into the `MyResourceAdapter` instance using the `javax.inject.Inject` annotation.
- Injects the `Validator` instance of this adapter module into the `MyResourceAdapter` instance.
- Injects the `WorkManager` and `UserTransaction` instances of this adapter module into `MyBean`.

```
@Connector
public class MyResourceAdapter implements ResourceAdapter{
     private @Inject MyBean bean;
private @Validator v;

public void start(BootstrapContext ctx){
     v.validate(this, AnotherGroup.class);
     bean.do();
     .
     .
     .
}
     .
     .
     .
}

public class MyBean{
     private String name;
private @WorkManager wm;
private @UserTransaction ut;

public String  getName(){
```

```
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }

    public void do(){
        Work w = …
        wm.scheduleWork(w);
    }
}
```

5

Connection Management

WebLogic Server supports connection management in accordance with Connector Architecture 1.6 and includes support for the connection management contract, a standard model for configuring outbound and inbound connections and connection pooling, support for testing connections, and more.

For more information about the connection management contract, see Chapter 6, Connection Management, of JSR 322: Java EE Connector Architecture 1.6.

Connection Management Contract

The connection management contract is a requirement of Connector Architecture 1.6 and specifies a consistent model for connection management, a set of services that must be provided by the application server to its resource adapters, and more.

The connection management contract between WebLogic Server and a resource adapter:

- Provides a consistent application programming model for connection acquisition for both managed and non-managed (two-tier) applications.
- Enables a resource adapter to provide a connection factory and connection interfaces based on the common client interface (CCI) specific to the type of resource adapter and EIS. This enables JDBC drivers to be aligned with the Java EE Connector Architecture 1.6 with minimum impact on the existing JDBC APIs.
- Enables an application server to provide various services — transactions, security, advanced pooling, error tracing/logging — for its configured set of resource adapters.
- Supports connection pooling.

The resource adapter's side of the connection management contract is embodied in the resource adapter's `Connection`, `ConnectionFactory`, `ManagedConnection`, and `ManagedConnectionFactory` classes.

Connection Factory and Connection

A Java EE application component uses a public interface called a connection factory to access a connection instance, which the component then uses to connect to the underlying EIS. Examples of connections include database connections and JMS (Java Message Service) connections.

A resource adapter provides connection and connection factory interfaces, acting as a connection factory for EIS connections. For example, the `javax.sql.DataSource` and `java.sql.Connection` interfaces are JDBC-based interfaces for connecting to a relational database.

An application looks up a connection factory instance in the Java Naming and Directory Interface (JNDI) namespace and uses it to obtain EIS connections. See Obtaining the ConnectionFactory (Client-JNDI Interaction).

Resource Adapters Bound in JNDI Tree

Version 1.5 and 1.6 resource adapters can be bound in the JNDI tree as independent objects, making them available as system resources in their own right or as message sources for message-driven beans (MDBs). In contrast, version 1.0 resource adapters are identified by their `ConnectionFactory` objects bound in the JNDI tree.

In a version 1.5 or 1.6 resource adapter, at deployment time, the `ResourceAdapter` Bean (if it exists) is bound into the JNDI tree using the value of the jndi-name element, shown in the `weblogic-ra.xml` file. As a result, administrators can view resource adapters as single deployable entities, and they can interact with resource adapter capabilities publicly exposed by the resource adapter provider. For more information, see jndi-name in weblogic-ra.xml Schema.

Obtaining the ConnectionFactory (Client-JNDI Interaction)

The application assembler or component provider configures the Connection Factory requirements for an application component in the application's deployment descriptor. For example:

```
res-ref-name: eis/myEIS
res-type: javax.resource.cci.ConnectionFactory
res-auth: Application or Container
```

The resource adapter deployer provides the configuration information for the resource adapter.

An application looks up a `ConnectionFactory` instance in the Java Naming and Directory Interface (JNDI) namespace and uses it to obtain EIS connections. The following events occur when an application in a managed environment obtains a connection to an EIS instance from a Connection Factory, as specified in the `res-type` variable.

> **Note:**
>
> A managed application environment defines an operational environment for a Java EE-based, multi-tier, Web-enabled application that accesses EISes.

1. The application server uses a configured resource adapter to create physical connections to the underlying EIS.
2. The application component looks up a `ConnectionFactory` instance in the component's environment by using the JNDI interface, as shown in Example 5-1.

3. The application component uses the returned connection to access the underlying EIS.
4. The application component invokes the `getConnection` method on the `ConnectionFactory` to obtain an EIS connection. The returned connection instance represents an application level handle to an underlying physical connection. An application component obtains multiple connections by calling the method `getConnection` on the connection factory multiple times:

   ```
   javax.resource.cci.Connection cx = cxf.getConnection();
   ```

5. After the component finishes with the connection, it closes the connection using the close method on the `Connection` interface:

   ```
   cx.close();
   ```

   If an application component fails to close an allocated connection after its use, that connection is considered an unused connection. The application server manages the cleanup of unused connections.

Example 5-1 JNDI Lookup

```
//obtain the initial JNDI Naming context
Context initctx = new InitialContext();

// perform JNDI lookup to obtain the connection factory
javax.resource.cci.ConnectionFactory cxf =
    (javax.resource.cci.ConnectionFactory)
        initctx.lookup("java:comp/env/eis/MyEIS");
```

The JNDI name passed in the method `NamingContext.lookup` is the same as that specified in the `res-ref-name` element of the deployment descriptor. The JNDI lookup results in an instance of type `java.resource.cci.ConnectionFactory` as specified in the `res-type` element.

Specifying and Obtaining Transaction Support Level

Section 7.13 of JSR 322: Java EE Connector Architecture 1.6 specifies that a resource adapter may determine and classify the level of transaction support it can provide at run time. To have the ability to specify the level of transaction support, a resource adapter's `ManagedConnectionFactory` class must implement the `TransactionSupport` interface. If this interface is not implemented, the Connector container uses the transaction support specified in the merged result of the resource adapter's `ra.xml` file and `Connector` annotations.

JSR 322: Java EE Connector Architecture 1.6 also defines the rules and priorities on the transaction support level determined from the `ra.xml` file, `Connector` annotation, and the `TransactionSupport` interface.

WebLogic Server supplements support for obtaining transaction support level by exposing the following two methods on the `ConnectorConnectionPoolRuntimeMBean`:

- `ConnectorConnectionPoolRuntimeMBean.getRuntimeTransactionSupport()` — Return the real transaction support level in use for this Connector connection pool.

  This value may also be viewed in the WebLogic Server Administration Console in the Resource Adapter: Monitoring: Outbound Connection Pools page.

- `ConnectorConnectionPoolRuntimeMBean.getTransactionSupport()` — Returns the static transaction support level, which is configured either in `ra.xml` or using the @Connector annotation, for the resource adapter for this Connector connection pool.

Specifying an Unshareable ManagedConnectionFactory

In most cases, an adapter's `ManagedConnectionFactory` supports connection sharing, as defined in section 7.9 of JSR 322: Java EE Connector Architecture 1.6. The specification also says that a connection can be made *unshareable* by setting `res-sharing-scope` to `Unshareable` in the caller application's deployment descriptor or annotation.

However, it can be inconvenient to define an unshareable resource reference in the caller application. For example, the caller application may perform a look up to a `ConnectionFactory` pool from WebLogic's global JNDI directly, but the application does not define unshareable resource references to this pool. WebLogic Server treats such use of the pools as shareable by default. As a result, if an adapter does not support connection sharing, the adapter will not work.

To circumvent this problem, WebLogic Server supports the public annotation `weblogic.connector.extensions.Unshareable`. This annotation can be used on a `ManagedConnectionFactory` class if the `ManagedConnectionFactory` does not support sharing. When such an adapter is deployed, WebLogic Server checks the `ManagedConnectionFactory` class and treats the `ManagedConnectionFactory` and related pools as unshareable. If you configure a sharable resource reference to this unshareable pool in a Web application or an Enterprise Java Bean, WebLogic Server issues a warning message—but the Web application or the EJB nevertheless treats the pool as unshareable. There is no need to configure anything in `weblogic-ra.xml` or in the WebLogic Server Administration Console.

If a `ManagedConnectionFactory` is shareable, nothing needs to be changed in the adapter's code. All `ManagedConnectionFactory` instances and pools are considered shareable by default, unless the `ManagedConnectionFactory` contains an `Unshareable` annotation.

Configuring Outbound Connections

Outbound resource adapters based on Connector Architecture 1.6 can be configured to have one or more outbound connections, each having its own WebLogic Server-specific authentication and transaction support. You configure outbound connection properties in the `ra.xml` and `weblogic-ra.xml` deployment descriptor files.

Connection Pool Configuration Levels

You use the `outbound-resource-adapter` element and its subelements in the `weblogic-ra.xml` deployment descriptor to describe the outbound components of a resource adapter.

You can define outbound connection pools at three levels:

- Global - Specify parameters that apply to all outbound connection groups in the resource adapter using the `default-connection-properties` element. See default-connection-properties.
- Group - Specify parameters that apply to all outbound connection instances belonging to a particular connection factory specified in the `ra.xml` deployment descriptor using the `connection-definition-group` element. A one-to-one

correspondence exists from a connection factory in `ra.xml` to a connection definition group in `weblogic-ra.xml`. The properties specified in a group override any parameters specified at the global level. See connection-definition-group.

The `connection-factory-interface` element (a subelement of the `connection-definition-group` element) serves as a required unique element (a key) to each `connection-definition-group`. There must be a one-to-one relationship between the `connection-definition-interface` element in `weblogic-ra.xml` and the `connectiondefinition-interface` element in `ra.xml`.

- Instance - Under each connection definition group, you can specify connection instances using the `connection-instance` element of the `weblogic-ra.xml` deployment descriptor. These correspond to the individual connection pools for the resource adapter. You can use the `connection-properties` subelement to specify properties at the instance level too; properties specified at the instance level override those provided at the group and global levels. See connection-instance.

Retrying a Connection Attempt

If an application component attempts to obtain a connection instance from a connection pool using the `getConnection()` method on the `ConnectionFactory`, but the pool is temporarily suspended, WebLogic Server generates an exception that implements `javax.resource.spi.RetryableException`. The application component can use an instance of `RetryableException` to determine whether the connection failure is transient.

Isolating, Troubleshooting, and Fixing Outbound Connection Pool Failures Without Redeploying the Adapter

By default, if a resource adapter has multiple outbound connection pools, a failure in any one connection pool causes the entire deployment of the resource adapter to fail. However, the deploy-as-a-whole deployment option is available, which you can set to isolate individual outbound connection pool failures from the resource adapter deployment. Using this deployment option enables you to use the adapter health monitoring feature to identify connection pool failures, which you can troubleshoot and repair without the need to redeploy the resource adapter.

For general information about the resource adapter health monitoring features, see Monitoring Resource Adapter Health. For information about setting the `deploy-as-a-whole` element in the `weblogic-ra.xml` file, see the following topics:

- deploy-as-a-whole: Isolating Outbound Connection Pool Failures from the Whole Adapter Deployment
- Deploying a Resource Adapter Configured with Multiple Outbound Connection Pools

The following sections explain how to use the deploy-as-a-whole deployment option and how to diagnose and recover from outbound connection pool failures:

Using the Deploy-As-A-Whole Option

To deploy a resource adapter so that the failure of an individual outbound connection pool does not cause the whole adapter deployment to fail, set the `deploy-as-whole` element of the `weblogic-ra.xml` file to `false` (by default, this element is set to `true`). For details about setting this deployment option, see Deploying a Resource Adapter Configured with Multiple Outbound Connection Pools .

If the deploy-as-a-whole option is set to `false`, note the following:

- If there is no error during deployment, the resource adapter deployment succeeds and is placed in an active state, with a health state of HEALTH_OK.
- If an error occurs when creating or configuring at least one outbound connection pool, the health state of the adapter deployment is set to HEALTH_CRITICAL.
- If any other failure occurs, such as the following, the adapter deployment fails:
  - An error parsing or validating the `ra.xml` file, the `weblogic-ra.xml` file, or the deployment plan.
  - An error occurs when creating or configuring the ResourceAdapter or admin object beans.
  - Any pool-related classes failing to meet basic requirements defined by JSR 322: Java EE Connector Architecture 1.6 that can be detected statically; for example, the adapter's `ManagedConnectionFactory` class not implementing the required standard interface `javax.resource.spi.ManagedConnectionFactory`.

Troubleshooting Failed Connection Pools

If a connection pool is in a HEALTH_CRITICAL state, invoking most methods on the `ConnectorConnectionPoolRuntimeMBean`, such as `testPool`, may simply throw an `IllegalStateException`. You can invoke only the following methods, which provide static information and are not affected by connection pool failures:

- `getKey()`
- `getPoolName()`
- `getState()` (always returns `Shutdown` for failed pools)
- `getHealthState()`
- `getManagedConnectionFactoryClassName()`
- `getMCFClassName()` (same as `getManagedConnectionFactoryClassName()`)
- `getConnectionFactoryClassName()` (returns the ConnectionFactoryName of the connection pool)
- `reset()`
- `forceReset()`

Note the following:

- A resource adapter module's health state may change from HEALTH_OK to HEALTH_CRITICAL after one of the following actions:
  - Performing a dynamic update.
  - Performing either a `reset` or `force reset` of outbound connection pools
  - Stopping then restarting the resource adapter
  - Redeploying the adapter
- If a connection pool is in the HEALTH_CRITICAL state, the `suspend` and `resume` actions on the pool have no effect.

Connection Pool Recovery Steps

Once a connection pool has failed and is in the HEALTH_CRITICAL state, check the failure reason and correct the error. For example, ensure that updated values for the pool's properties are valid and properly assigned.

For most failures that are caused by an incorrect configuration, Oracle recommends taking the following steps:

1. Modify the configuration of each failed pool, if necessary.
2. Save the new configuration to the adapter's deployment plan.
3. Using the updated adapter's deployment plan, perform a dynamic update of the resource adapter.

The preceding steps can recover failed pools without affecting properly functioning and in-use connection pools. During the dynamic update process, all failed connection pools are recreated using the new configuration data, regardless of whether the configuration changes for the pools have been made in the new deployment plan or whether the configuration changes are dynamically updatable. For existing connection pools that are functioning properly, non-dynamic configuration changes are ignored. However, for failed connection pools, the configuration updates go into effect from the dynamic update process.

Other Options for Recovering Failed Connection Pools

As an alternative to performing a dynamic update to recover a failed connection pool, you can try one of the following methods. If the failure is due to causes other than an invalid pool configuration, one of these method might be appropriate:

- Reset or force reset the failed connection pool, as described in Reset a Connection Pool.. Depending on the reason for the failure, these actions may or may not recover the failed pool. However, because no connections with failed pools are active, reset and force reset have the same effect. Note the following:
  - If the pool failure is not caused by an invalid configuration, the pool can potentially be recovered by resetting it, which uses the existing configuration data. For example, if the failure is due to a JNDI conflict, the pool can be recovered if the conflicting object from JNDI tree is removed. Resetting the connection pool would be recommended in this scenario.
  - If the connection pool has failed due to an invalid configuration, resetting the connection pool is not recommended. Resetting uses the existing deployment plan, or existing deployment descriptor information, which contain the invalid configuration data.
- Redeploy the adapter. Note that this action affects all outbound connection pools in the resource adapter, including any that are functioning properly
- Stop and then restart the resource adapter. This action also affects all outbound connection pools in the adapter. This method has drawbacks similar to performing a `reset` or `force reset` action because it also uses the pre-existing configuration data without first performing a dynamic update. In addition, configuration data that has been revised that is not made available by dynamic update is not used. For this reason, stopping and then restarting the resource adapter is not a recommended option for recovering failed connection pools in most cases.

Multiple Outbound Connections Example

Example 5-2 is an example of a `weblogic-ra.xml` deployment descriptor that configures multiple outbound connections:

Example 5-2 weblogic-ra.xml Deployment Descriptor: Multiple Outbound Connections

```
<?xml version="1.0" ?>
<weblogic-connector xmlns="http://xmlns.oracle.com/weblogic/weblogic-connector">
<jndi-name>900eisaNameOfBlackBoxXATx</jndi-name>
   <outbound-resource-adapter>
      <connection-definition-group>
         <connection-factory-interface>javax.sql.DataSource
         </connection-factory-interface>
            <connection-instance>
               <jndi-name>eis/900eisaBlackBoxXATxConnectorJNDINAME1
               </jndi-name>
               <connection-properties>
                  <pool-params>
                     <initial-capacity>2</initial-capacity>
                     <max-capacity>10</max-capacity>
                     <capacity-increment>1</capacity-increment>
                     <shrinking-enabled>true</shrinking-enabled>
                     <shrink-frequency-seconds>60</shrink-frequency-seconds>
                  </pool-params>
                  <properties>
                     <property>
                        <name>ConnectionURL</name>
                        <value>

jdbc:oracle:thin:@bcpdb:1531:bay920;create=true;autocommit=false
                        </value>
                     </property>
                     <property>
                        <name>XADataSourceName</name>
                        <value>OracleXAPool</value>
                     </property>
                     <property>
                        <name>TestClassPath</name>
                        <value>HelloFromsetTestClassPathGoodDay</value>
                     </property>
                     <property>
                        <name>unique_ra_id</name>
                        <value>eisablackbox-xa.oracle.900</value>
                     </property>
                  </properties>
               </connection-properties>
            </connection-instance>
            <connection-instance>
                  <jndi-name>eis/900eisaBlackBoxXATxConnectorJNDINAME2
                  </jndi-name>
                  <connection-properties>
                     <pool-params>
                        <initial-capacity>2</initial-capacity>
                        <max-capacity>10</max-capacity>
                        <capacity-increment>1</capacity-increment>
                        <shrinking-enabled>true</shrinking-enabled>
                        <shrink-frequency-seconds>60
```

```
                        </shrink-frequency-seconds>
                     </pool-params>
                  <properties>
                     <property>
                        <name>ConnectionURL</name>
                        <value>
                  jdbc:oracle:thin:@bcpdb:1531:bay920;create=true;autocommit=false
                        </value>
                     </property>
                     <property>
                        <name>XADataSourceName</name>
                        <value>OracleXAPool</value>
                     </property>
                     <property>
                        <name>TestClassPath</name>
                        <value>HelloFromsetTestClassPathGoodDay</value>
                     </property>
                     <property>
                        <name>unique_ra_id</name>
                        <value>eisablackbox-xa.oracle.900</value>
                     </property>
                  </properties>
               </connection-properties>
            </connection-instance>
         </connection-definition-group>
        <connection-definition-group>
            <connection-factory-interface>javax.sql.DataSourceCopy
            </connection-factory-interface>
            <connection-instance>
               <jndi-name>eis/900eisaBlackBoxXATxConnectorJNDINAME3</jndi-name>
               <connection-properties>
                     <pool-params>
                        <initial-capacity>2</initial-capacity>
                        <max-capacity>10</max-capacity>
                        <capacity-increment>1</capacity-increment>
                        <shrinking-enabled>true</shrinking-enabled>
                        <shrink-frequency-seconds>60</shrink-frequency-seconds>
                     </pool-params>
                     <properties>
                        <property>
                           <name>ConnectionURL</name>

<value>jdbc:oracle:thin:@bcpdb:1531:bay920;create=true;autocommit=false</value>
                        </property>
                        <property>
                           <name>XADataSourceName</name>
                           <value>OracleXAPoolB</value>
                        </property>
                        <property>
                           <name>TestClassPath</name>
                           <value>HelloFromsetTestClassPathGoodDay</value>
                        </property>
                        <property>
                           <name>unique_ra_id</name>
                           <value>eisablackbox-xa-two.oracle.900</value>
                        </property>
                     </properties>
                  </connection-properties>
            </connection-instance>
        </connection-definition-group>
```

```
   </outbound-resource-adapter>
</weblogic-connector>
```

Configuring Inbound Connections

The Java EE Connector Architecture 1.7 permits you to configure a resource adapter to support inbound message connections.

The following are the main steps for configuring an inbound connection:

1. Provide a JNDI name for the resource adapter in the `weblogic-ra.xml` deployment descriptor. See jndi-name in Table A-1
2. Configure a message listener and `ActivationSpec` for each supported inbound message type in the `ra.xml` deployment descriptor. For information about requirements for an `ActivationSpec` class, see Chapter 13, Message Inflow in JSR 322: Java EE Connector Architecture 1.6.
3. Within the packaged enterprise application, include a configured EJB message-driven bean (MDB). In the `resource-adapter-jndi-name` element of the `weblogic-ejb-jar.xml` deployment descriptor, provide the same JNDI name assigned to the resource adapter in the previous step. Setting this value enables the MDB and resource adapter to communicate with each other.
4. Configure the security identity to be used by the resource adapter for inbound connections. When messages are received by the resource adapter, work must be performed under a particular security identity. See Configuring Security Identities for Resource Adapters.
5. Deploy the resource adapter as discussed in *Deploying Applications to Oracle WebLogic Server*.
6. Deploy the MDB. See Deploying MDBs in *Developing Message-Driven Beans for Oracle WebLogic Server* and *Deploying Applications to Oracle WebLogic Server*.

Example 5-3 Example of Configuring an Inbound Connection

```
<inbound-resourceadapter>
   <messageadapter>
      <messagelistener>
         <messagelistener-type>
         weblogic.qa.tests.connector.adapters.flex.InboundMsgListener
         </messagelistener-type>
         <activationspec>
            <activationspec-class>
            weblogic.qa.tests.connector.adapters.flex.ActivationSpecImpl
            </activationspec-class>
         </activationspec>
      </messagelistener>
      <messagelistener>
         <messagelistener-type>
         weblogic.qa.tests.connector.adapters.flex.ServiceRequestMsgListener
         </messagelistener-type>
         <activationspec>
            <activationspec-class>

weblogic.qa.tests.connector.adapters.flex.ServiceRequestActivationSpec
            </activationspec-class>
            </activationspec>
      </messagelistener>
```

```
   </messageadapter>
</inbound-resourceadapter>
```

Example 5-3 shows how an inbound connection with two message listener/activation specs could be configured in the `ra.xml` deployment descriptor:

Configuring Connection Pool Parameters

You configure WebLogic Server resource adapter connection pool parameters in the `weblogic-ra.xml` deployment descriptor.

initial-capacity: Setting the Initial Number of ManagedConnections

Depending on the complexity of the Enterprise Information System (EIS) that the `ManagedConnection` is representing, creating `ManagedConnections` can be expensive. You may decide to populate the connection pool with an initial number of `ManagedConnections` upon startup of WebLogic Server and therefore avoid creating them at run time. You can configure this setting using the `initial-capacity` element in the `weblogic-ra.xml` descriptor file. The default value for this element is `1 ManagedConnection`.

Because no initiating security principal or request context information is known at WebLogic Server startup, a server instance creates initial connections using a security subject by looking up special credential mappings for the initial connection. See Initial Connection: Requires a ManagedConnection from Adapter Without Application's Request .

> **Note:**
>
> WebLogic Server uses `null` as `Subject` if a mapping is not found.

max-capacity: Setting the Maximum Number of ManagedConnections

As more `ManagedConnections` are created, they consume more system resources - such as memory and disk space. Depending on the Enterprise Information System (EIS), this consumption may affect the performance of the overall system. To control the effects of `ManagedConnections` on system resources, you can specify a maximum number of allocated `ManagedConnections` in the `max-capacity` element of the `weblogic-ra.xml` descriptor file.

If a new `ManagedConnection` (or more than one `ManagedConnection` in the case of `capacity-increment` being greater than one) needs to be created during a connection request, WebLogic Server ensures that no more than the maximum number of allowed `ManagedConnections` are created. Requests for newly allocated `ManagedConnections` beyond this limit results in a `ResourceAllocationException` being returned to the caller.

capacity-increment: Controlling the Number of ManagedConnections

In compliance with Connector Architecture 1.6, when an application component requests a connection to an EIS through the resource adapter, WebLogic Server first tries to match the type of connection being requested with an existing and available `ManagedConnection` in the connection pool. However, if a match is not found, a new `ManagedConnection` may be created to satisfy the connection request.

Using the `capacity-increment` element in the `weblogic-ra.xml` descriptor file, you can specify a number of additional `ManagedConnections` to be created automatically when a match is not found. This feature provides give you the flexibility to control connection pool growth over time and the performance hit on the server each time this growth occurs.

shrinking-enabled: Controlling System Resource Usage

Although setting the maximum number of `ManagedConnections` prevents the server from becoming overloaded by more allocated `ManagedConnections` than it can handle, it does not control the efficient amount of system resources needed at any given time. WebLogic Server provides a service that monitors the activity of `ManagedConnections` in the connection pool of a resource adapter. If the usage decreases and remains at this level over a period of time, the size of the connection pool is reduced to the initial capacity or as close to this as possible to adequately satisfy ongoing connection requests.

This system resource usage service is turned on by default. However, to turn off this service, you can set the `shrinking-enabled` element in the `weblogic-ra.xml` descriptor file to `false`.

shrink-frequency-seconds: Setting the Wait Time Between Attempts to Reclaim Unused ManagedConnections

Use the `shrink-frequency-seconds` element in the `weblogic-ra.xml` descriptor file to identify the amount of time (in seconds) the Connection Pool Manager will wait between attempts to reclaim unused `ManagedConnections`. The default value of this element is `900` seconds.

highest-num-waiters: Controlling the Number of Clients Waiting for a Connection

If the maximum number of connections has been reached and there are no available connections, WebLogic Server retries until the call times out. The `highest-num-waiters` element controls the number of clients that can be waiting at any given time for a connection.

highest-num-unavailable: Controlling the Number of Unavailable Connections

When a connection is created and fails, the connection is placed on an unavailable list. WebLogic Server attempts to recreate failed connections on the unavailable list. The `highest-num-unavailable` element controls the number of unavailable connections that can exist on the unavailable list at one time.

connection-creation-retry-frequency-seconds: Recreating Connections

To configure WebLogic Server to attempt to recreate a connection that fails while creating additional `ManagedConnections`, enable the `connection-creation-retry-frequency-seconds` element. By default, this feature is disabled.

match-connections-supported: Matching Connections

A connection request contains parameter information. By default, the connector container calls the `matchManagedConnections()` method on the `ManagedConnectionFactory` to match the available connection in the pool to the parameters in the request. The connection that is successfully matched is returned.

It may be that the `ManagedConnectionFactory` does not support the call to `matchManagedConnections()`. If so, the `matchManagedConnections()` method call throws a `javax.resource.NotSupportedException`. If the exception is caught, the connector container automatically stops calling the `matchManagedConnections()` method on the `ManagedConnectionFactory`.

You can set the `match-connections-supported` element to specify whether the resource adapter supports connection matching. By default, this element is set to true and the `matchManagedConnections()` method is called at least once. If it is set to false, the method call is never made.

If connection matching is not supported, a new resource is created and returned if the maximum number of resources has not been reached; otherwise, the oldest unavailable resource is refreshed and returned.

test-frequency-seconds: Testing the Viability of Connections

The `test-frequency-seconds` element allows you to specify how frequently (in seconds) connections in the pool are tested for viability.

test-connections-on-create: Testing Connections upon Creation

You can set the `test-connections-on-create` element to enable the testing of connections as they are created. The default value is `false`.

test-connections-on-release: Testing Connections upon Release to Connection Pool

You can set the `test-connections-on-release` element to enable the testing of connections as they are released back into the connection pool. The default value is `false`.

test-connections-on-reserve: Testing Connections upon Reservation

You can set the `test-connections-on-reserve` element to enable the testing of connections as they are reserved from the connection pool. The default value is `false`.

deploy-as-a-whole: Isolating Outbound Connection Pool Failures from the Whole Adapter Deployment

You can set the `deploy-as-a-whole` element to determine whether or not the deployment of a resource adapter, which contains multiple outbound connection pools, should fail if a failure occurs in any connection pool. The default value is `true`, which causes the whole resource adapter deployment to fail if any error occurs (not just with connection pools).

Setting this element to `false` enables the resource adapter deployment to succeed as long as at least one outbound connection pool remains healthy, allowing you isolate, diagnose, repair, and dynamically update the resource adapter without the need to redeploy it.

Connection Proxy Wrapper - 1.0 Resource Adapters

The connection proxy wrapper feature is valid only for resource adapters that are created based on the Java EE Connector Architecture 1.0. When a connection request is made, WebLogic Server returns to the client (by way of the resource adapter) a proxy object that wraps the connection object. WebLogic Server uses this proxy to provide the following features:

- Connection leak detection capabilities
- Late XAResource enlistment when a connection request is made before starting a global transaction that uses that connection

Possible ClassCastException

If the connection object returned from a connection request is cast as a `Connection` implementation class (rather than an interface implemented by the `Connection` class), a `ClassCastException` can occur. This exception is caused by one of the following:

- The resource adapter performing the cast
- The client performing the cast during a connection request

An attempt is made by WebLogic Server to detect the `ClassCastException` caused by the resource adapter. If the server detects that this cast is failing, it turns off the proxy wrapper feature and proceeds by returning the unwrapped connection object during a connection request. The server logs a warning message to indicate that proxy generation has been turned off. When this occurs, connection leak detection and late XAResource enlistment features are also turned off.

WebLogic Server attempts to detect the `ClassCastException` by performing a test at resource adapter deployment time by acting as a client using container-managed security. This requires the resource adapter to be deployed with security credentials defined.

If the client is performing the cast and receiving a `ClassCastException`, the client code can be modified, as in the following example.

Assume the client is casting the connection object to `MyConnection`.

1. Rather than having `MyConnection` be a class that implements the resource adapter's `Connection` interface, modify `MyConnection` to be an interface that extends `Connection`.
2. Implement a `MyConnectionImpl` class that implements the `MyConnection` interface.

Turning Proxy Generation On and Off

If you know for sure whether or not a connection proxy can be used in the resource adapter, you can avoid a proxy test by explicitly setting the `use-connection-proxies` element in the WebLogic Server 8.1 version of `weblogic-ra.xml` to `true` or `false`.

> **Note:**
>
> WebLogic Server still supports Java EE Connector Architecture 1.0 resource adapters. For 1.0 resource adapters, continue to use the WebLogic Server 8.1 deployment descriptors found in weblogic-ra.xml. It contains elements that continue to accommodate 1.0 resource adapters.

If set to `true`, the proxy test is not performed and connection properties are generated.

If set to `false`, the proxy test is not performed and connection proxies are generated.

If `use-connection-proxies` is unspecified, the proxy test is performed and proxies are generated if the test passes. (The test passes if a `ClassCastException` is not thrown by the resource adapter).

> **Note:**
>
> The test cannot detect a `ClassCastException` caused by the client code.

Reset a Connection Pool

You may need to reset a connection pool to recover a connection pool that is in an unhealthy state without interfering other running connection pools, or to make nondynamic configuration changes that could not take effect through an update operation. For example, changing properties on a `ManagedConnectionFactory` or changing transaction support for connection. You can reset a connection pool in one of two ways:

- Reset—If no connections in the pool are in use, the pool is recreated. The new pool includes any configuration changes you may have made prior to the reset. If a connection is in use, the pool is not reset.
- Force Reset—Immediately discards all used and unused connections and the pool is recreated. The new pool includes any configuration changes you may have made prior to the reset.

Use the following steps to reset a connection pool from the WebLogic Server Administration Console:

1. Select your resource adapter from the Summary of Deployments table.
2. Select **Control** > **Outbound Connection Pools**
3. Select the connection pools to reset.
4. Click **Reset** or **Force Reset**.

Testing Connections

If a resource adapter's `ManagedConnectionFactory` implements the `Validating` interface, then the application server can test the validity of existing connections. You can test either a specific outbound connection or the entire pool of outbound connections for a particular `ManagedConnectionFactory`. Testing the entire pool results in testing each connection in the

pool individually. See section 6.5.3.4 Detecting Invalid Connections in JSR 322: Java EE Connector Architecture 1.6.

Configuring Connection Testing

The following optional elements in the `weblogic-ra.xml` deployment descriptor allow you to control the testing of connections in the pool.

- `test-frequency-seconds` - The connector container periodically tests all the free connections in the pool. Use this element to specify the frequency with which the connections are tested. The default is 0, which means the connections will not be tested.
- `test-connections-on-create` - Determines whether the connection should be tested upon its creation. By default it is false.
- `test-connections-on-release` - Determines whether the connection should be tested upon its release. By default it is false.
- `test-connections-on-reserve` - Determines whether the connection should be tested upon its reservation. By default it is false.

Testing Connections in the Administration Console

To test a resource adapter's connection pools:

1. In the WebLogic Server Administration Console, open the Deployments page and select the resource adapter in the Deployments table.
2. Select the Test tab.

   You will see a table of connection pools for the resource adapter and the test status of each pool.
3. Select the connection pool you want to test and click Test.

See Test outbound connections in the *Oracle WebLogic Server Administration Console Online Help*.

6
Transaction Management

The system-level transaction management contract that is defined by the Java Connector Architecture is a contract between the transaction manager and an EIS that supports transactional access to EIS resource managers. This contract enables WebLogic Server to use its transaction manager to manage transactions across multiple resource managers for outbound communication to EISes.

- Supported Transaction Levels
- Configuring Transaction Levels

For more information about transaction management, see Chapter 7, Transaction Management, in JSR 322: Java EE Connector Architecture 1.6. For information about transaction management for inbound communication from EISes to WebLogic Server, see Transactional Inflow.

Supported Transaction Levels

A transaction is a set of operations that must be committed together or not at all for the data to remain consistent and to maintain data integrity. Transactional access to EISes is an important requirement for business applications. The Java EE Connector Architecture 1.7 supports the use of transactions.
WebLogic Server utilizes the WebLogic Server Transaction Manager implementation and supports resource adapters having XA, local, or no transaction support. You define the type of transaction support in the `transaction-support` element in the `ra.xml` file; a resource adapter can support only one type. You can use the `transaction-support` element in the `weblogic-ra.xml` deployment descriptor to override the value specified in `ra.xml`. See Configuring Transaction Levels, and #unique_117/unique_117_Connect_42_I1082166 in Table A-18 for details.

Resource adapters conforming to Java EE Connector Architecture 1.7 can optionally specify the level of transaction support at run time. This requires the implementation of the `TransactionSupport` interface. For more information, see Specifying and Obtaining Transaction Support Level.

XA Transaction Support

XA transaction support allows a transaction to be managed by a transaction manager external to a resource adapter (and therefore external to an EIS). When an application component demarcates an EIS connection request as part of a transaction, the application server is responsible for enlisting the XA resource with the transaction manager. When the application component closes that connection, the application server cleans up the EIS connection once the transaction has completed.

Oracle recommends creating a LocalTransaction outbound connection pool for an XA transaction capable resource adapter for improved performance.

Local Transaction Support

Local transaction support allows WebLogic Server to manage resources that are local to the resource adapter. Unlike XA transaction, local transaction generally cannot participate in a two-phase commit protocol (2PC). The only way a local transaction resource adapter can be involved in a 2PC transaction is if it is the only local transaction resource involved in the transaction and if the WebLogic Server Connector container uses a Last Resource Commit Optimization whereby the outcome of the transaction is governed by the resource adapter's local transaction.

A local transaction is normally started by using the API that is specific to that resource adapter, or the CCI interface if it is supported for that adapter. When a resource adapter connection that is configured to use local transaction support is created and used within the context of an XA transaction, WebLogic Server automatically starts a local transaction to be used for this connection. When the XA transaction completes and is ready to commit, prepare is first called on the XA resources that are part of the XA transaction. Next, the local transaction is committed.

If the commit fails on the local transaction, the XA transaction and all the XA resources are rolled back. If the commit succeeds, all the XA resources for the XA transaction are committed. When an application component closes the connection, WebLogic Server cleans up the connection once the transaction has completed.

No Transaction Support

If a resource adapter is configured to use no transaction support, the resource adapter can still be used in the context of a transaction. However, in this case, the connections used for that resource adapter are never enlisted in a transaction and behave as if no transaction was present. In other words, operations performed using these connections are made to the underlying EIS immediately, and if the transaction is rolled back, the changes are not undone for these connections.

Runtime Transaction Support Level Specification

JSR 322: Java EE Connector Architecture 1.6 states that a resource adapter may optionally determine and classify the level of transaction support it can provide at run time. To expose information about the level of transaction support at run time, a `ManagedConnectionFactory` must implement the `TransactionSupport` interface. JSR 322: Java EE Connector Architecture 1.6 also defines rules and priorities on transaction support levels set in descriptors, annotations, and the `TransactionSupport` interface. For example, WebLogic Server uses the value returned by the `getTransactionSupport` method and ignores the value specified by the resource adapter's deployment descriptor and the `@Connector` metadata annotation.

WebLogic Server exposes information about the runtime transaction support level in the `ConnectorConnectionPoolRuntimeMBean.RuntimeTransactionSupport` MBean attribute and also in the WebLogic Server Administration Console.

To view the runtime transaction level support in the WebLogic Server Administration Console:

1. In the **Summary of Deployments** page, select the resource adapter.
2. Click **Monitoring** > **Outbound Connection Pools**, and view the items in the **Runtime Transaction Support** column.

Configuring Transaction Levels

You specify a transaction support level for a resource adapter in the Java EE standard resource adapter deployment descriptor, `ra.xml`. To specify the transaction support level:

- For No Transaction, add the following entry to the `ra.xml` deployment descriptor file:
  `<transaction-support>NoTransaction</transaction-support>`
- For XA Transaction, add the following entry to the `ra.xml` deployment descriptor file:
  `<transaction-support>XATransaction</transaction-support>`
- For Local Transaction, add the following entry to the `ra.xml` deployment descriptor file:
  `<transaction-support>LocalTransaction</transaction-support>`

Resource adapters conforming to Java EE Connector Architecture 1.6 can optionally specify the level of transaction support at run time. This requires the implementation of the `TransactionSupport` interface. For more information, see Specifying and Obtaining Transaction Support Level.

The transaction support value specified in the `ra.xml` deployment descriptor is the default value for all Connection Factories of the resource adapter. You can override this value for a particular Connection Factory by specifying a value in the `transaction-support` element of the `weblogic-ra.xml` deployment descriptor.

The value of `transaction-support` must be one of the following:

- `NoTransaction`
- `LocalTransaction`
- `XATransaction`

For more information on specifying the transaction level in the `ra.xml` deployment descriptor, see Section 20.7, Resource Adapter XML Schema Definition, in JSR 322: Java EE Connector Architecture 1.6. For more information on specifying the transaction level in the `weblogic-ra.xml` deployment descriptor, see weblogic-ra.xml Schema.

Configure XA Transaction Recovery Credential Mapping

For pools which support XA Transactions, WebLogic Server may try to perform transaction recovery for the Java EE Connector Architecture connection pool if WebLogic Server finds pending transactions in the pool during a server startup. If pending transactions are found, WebLogic Server gets a ManagedConnection to EIS during recovery using `ManagedConnectionFactory.createManagedConnection(javax.security.auth.Subject subject, ConnectionRequestInfo cxRequestInfo)`.

If EIS requires explicit credentials (such as user name and password) to sign-on, the you need to configure WebLogic Server with appropriate credentials by configuring a special credential mapping for the initial connection. See Initial Connection: Requires a ManagedConnection from Adapter Without Application's Request . WebLogic Server uses `null` as `Subject` if a mapping is not found.

> **Note:**
>
> You do not need to configure this special credential mapping if the EIS doesn't require explicit credentials.

7

Message and Transactional Inflow

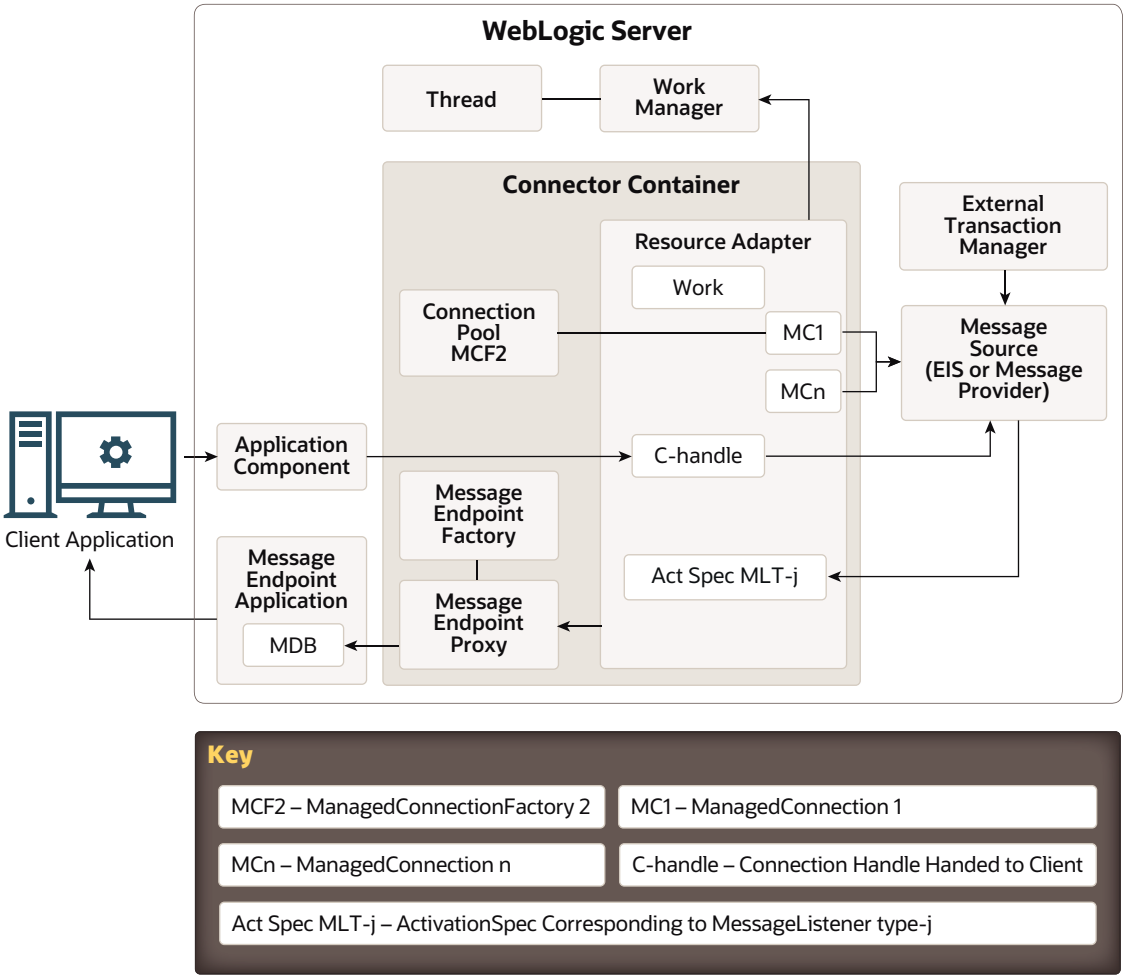
WebLogic resource adapters use inbound connections to handle message inflow as well as transactional inflow. These inbound connections require several key components, such as a communications channel and protocol to be used with the EIS, message types recognized by the resource adapter, a Work instance to process the incoming message and deliver it to a message endpoint, and much more.

Overview of Message and Transactional Inflow

Message inflow refers to inbound communication from an EIS to the application server, using a resource adapter. Inbound messages can be part of a transaction that is governed by a Transaction Manager that is external to WebLogic Server and the resource adapter.

The following diagram provides an overview of how messaging and transaction inflow occurs within a resource adapter and the role played by the Work Manager. For details about transactional inflow, see also Transactional Inflow.

Figure 7-1 Messaging and Transactional Inflow Architecture



Architecture Components

Figure 7-1 contains the following components:

- A client application, which connects to an application running on WebLogic Server, but which also needs to connect to an EIS
- An external system (in this case, an EIS or Enterprise Information System)
- An application component (an EJB) that the client application uses to submit outbound requests to the EIS through the resource adapter
- A message endpoint application (a message-driven bean and possibly other Java EE components) used for the receipt of inbound messages from the EIS through the resource adapter
- The WebLogic Server Work Manager and an associated thread (or threads) to which the resource adapter submits Work instances to process inbound messages and possibly process other actions.
- An external Transaction Manager, to which the WebLogic Server Transaction Manager is subordinate for transactional inflow of messages from the EIS

- The WebLogic Server Connector container in which the resource adapter is deployed. The container manages the following:
  - A deployed resource adapter that provides bi-directional (inbound and outbound) communication to and from the EIS.
  - An active `Work` instance.
  - Multiple managed connections (MC1, ..., MCn), which are objects representing the outbound physical connections from the resource adapter to the EIS.
  - Connection handles (C-handle) returned to the application component from the connection factory of the resource adapter and used by the application component for communicating with the EIS.
  - One of perhaps many activation specifications. There is an activation specification (`ActivationSpec`) that corresponds to each specific message listener type, MLT-j. For information about requirements for an `ActivationSpec` class, see Chapter 13, Message Inflow in JSR 322: Java EE Connector Architecture 1.6.
  - One of the connection pools maintained by the container for the management of managed connections for a given `ManagedConnectionFactory` (in this case, MCF-2. A Connector container could include multiple connection pools, each corresponding to a different type of connections to a single EIS or even different EISes).
  - A `MessageEndpointFactory` created by the EJB container and used by the resource adapter to create proxies to `MessageEndpoint` instances (MDB instances from the MDB pool).
- An external message source, which could be an EIS or Message Provider

Inbound Communication Scenario

This section describes a basic inbound communication scenario that may be described using the diagram, showing how inbound messages originate in an EIS, flow into the resource adapter, and are handled by a Message-driven Bean. For related information, see Figure 1-1.

A typical simplified inbound sequence involves the following steps:

1. The EIS sends a message to the resource adapter.
2. The resource adapter inspects the message and determines what type of message it is.
3. The resource adapter may create a `Work` object and submit it to the Work Manager. The Work Manager performs the succeeding work in a separate Thread, while the resource adapter can continue waiting for other incoming messages.
4. Based on the message type, the resource adapter (either directly or as part of a `Work` instance) looks up the correct message endpoint to which it will send the message.
5. Using the message endpoint factory corresponding to the type of message endpoint it needs, the resource adapter creates a message endpoint (which is a proxy to a message-driven bean instance from the MDB pool).
6. The resource adapter invokes the message listener method on the endpoint, passing it message content based on the message it received from the EIS.
7. The message is handled by the MDB in one of several possible ways:
   a. the MDB may handle the message directly and possibly return a result to the EIS through the resource adapter
   b. the MDB may distribute the message to some other application component

c. the MDB may place the message on a queue to be picked up by the client

d. the MDB may directly communicate with the client application.

How Message Inflow Works

To manage message inflow, a resource adapter that supports inbound communication from an EIS to the application server typically includes a proprietary communications channel and protocol, a set of recognized message types, and a dispatching mechanism.

- A proprietary communications channel and protocol is required for connecting to and communicating with an EIS. The communications channel and protocol are not visible to the application server in which the resource adapter is deployed. See Proprietary Communications Channel and Protocol.
- One or more message types that are recognized by the resource adapter must be established.
- A dispatching mechanism is required for dispatching a message of a given type to another component in the application server.

Handling Inbound Messages

A resource adapter may handle an inbound message in a variety of ways. For example, it may:

- Handle the message locally, that is, within the `ResourceAdapter` bean, without involving other components.
- Pass the message off to another application component. For example, it may look up an EJB and invoke a method on it.
- Send the message to a message endpoint. Typically, a message endpoint is a message-driven bean (MDB). For more information, see Message Inflow to Message Endpoints (Message-Driven Beans).

Inbound messages may return a result to the EIS that is sending the message. A message requiring an immediate response is referred to as synchronous (the sending system waits for a response). This is also referred to as request-response messaging. A message that does not expect a response as part of the same exchange with the resource adapter is referred to as asynchronous or event notification-based communication. A resource adapter can support asynchronous or synchronous communications for all three destinations listed above.

Depending upon the transactional capabilities of the resource adapter and the EIS, inbound messages can be either part of a transaction (XA) or not (non-transactional). If the messages are XA, the controlling transaction may be coordinated by an external Transaction Manager (transaction *inflow*) or by the application server's Transaction Manager. See Transactional Inflow.

In most cases, inbound messages in a resource adapter are dispatched through a `Work` instance in a separate thread. The resource adapter wraps the work to be done in a `Work` instance and submits it to the application server's Work Manager for execution and management. A resource adapter can submit a Work instance using the `doWork()`, `startWork()`, or `scheduleWork()` methods depending upon the scheduling requirements of the work.

Proprietary Communications Channel and Protocol

The resource adapter can expose connection configuration information to the deployer by various means; for example, as properties on the `ResourceAdapter` bean or properties on the `ActivationSpec` object. An alternative is to use the same communication channel for inbound as well as outbound traffic. Thus you can also set configuration information on the outbound connection pool.

Message Inflow to Message Endpoints (Message-Driven Beans)

As of EJB 2.1, message-driven beans (MDBs) accommodate the delivery of messages from inbound resource adapters. Prior to EJB 2.1, an MDB supported only Java Message Service (JMS) messaging. That is, an MDB had to implement the `javax.jms.MessageListener` interface, including the `onMessage(javax.jms.Message)` message listener method. MDBs were bound to JMS components and the JMS subsystem delivered the messages to MDBs by invoking the `onMessage()` method on an instance of the MDB. With EJB 2.1, the JMS-only MDB restriction has been lifted.
The main ingredients for message delivery to an MDB by way of a resource adapter are:

- An inbound message of a certain type (determined by the resource adapter/EIS contract)
- An `ActivationSpec` object implemented by the resource adapter
- A mapping between message types and message listener interfaces
- An MDB that implements a given message listener interface
- A deployment-time binding between an MDB and a resource adapter

For more information about message-driven Beans, see Message-Driven EJBs in *Developing Enterprise JavaBeans, Version 2.1, for Oracle WebLogic Server*.

Deployment-Time Binding Between an MDB and a Resource Adapter

A resource adapter can be deployed independently (as a standalone RAR) or as part of an enterprise application (EAR). An MDB can also be deployed independently (as a standalone JAR) or as part of an enterprise application (EAR). In either case, an MDB whose messages are derived from a resource adapter must be bound to the resource adapter. The following sections describe binding the MDB and resource adapter and subsequent messaging operations.

Binding an MDB and a Resource Adapter

To bind an MDB and a resource adapter, you must:

1. Set the `jndi-name` element in the `weblogic-ra.xml` deployment descriptor for the resource adapter. See jndi-name in weblogic-ra.xml Schema.
2. Set the `adapter-jndi-name` element in the `weblogic-ejb-jar.xml` deployment descriptor to match the value set in the corresponding `jndi-name` element in the resource adapter.
3. Assume that the resource adapter is deployed prior to the MDB. (The MDB could be deployed before the resource adapter is deployed; in that case, the deployed MDB polls until the resource adapter is deployed.) When the resource adapter is deployed, the `ResourceAdapter` bean is bound into JNDI using the name specified.

4. The MDB is deployed, and the MDB container invokes an application server-specific API that looks up the resource adapter by its JNDI name and invokes the specification-mandated `endpointActivation(MessageEndpointFactory, ActivationSpec)` method on the resource adapter.
5. The MDB container provides the resource adapter with a configured `ActivationSpec` (containing configuration information) and a factory for the creation of message endpoint instances.
6. The resource adapter saves this information for later use in message delivery. The resource adapter thereby knows what message listener interface the MDB implements. This information is important for determining what kind of messages to deliver to the MDB.

Dispatching a Message

When a message arrives from the EIS to the resource adapter, the resource adapter determines where to dispatch it. The following is a possible sequence of events:

1. A message arrives from the EIS to the resource adapter.
2. The resource adapter examines the message and determines its type by looking it up in an internal table. The resource adapter determines the message type corresponds to a particular pair (`MessageEndpointFactory`, `ActivationSpec`).
3. The resource adapter determines the message should be dispatched to an MDB.
4. Using the `MessageEndpointFactory` for that type of message endpoint (one to be dispatched to an MDB), the resource adapter creates an MDB instance by invoking `createEndpoint()` on the factory.
5. The resource adapter then invokes the message listener method on the MDB instance, passing any required information (such as the body of the incoming message) to the MDB.
6. If the message listener does not return a value, the message dispatching process is complete.
7. If the message listener returns a value, the resource adapter determines how to handle that value. This may or may not result in further communication with the EIS, depending upon the contract with the EIS.

Activation Specifications

A resource adapter is configured with a mapping of message types and activation specifications. The activation specification is a JavaBean that implements `javax.resource.spi.ActivationSpec`. The resource adapter has an `ActivationSpec` class for each supported message type. The mapping of message types and activation specifications is configured in the `ra.xml` deployment descriptor, as described in Configuring Inbound Connections. For more information about `ActivationSpecs`, see Chapter 13, Message Inflow, in JSR 322: Java EE Connector Architecture 1.6.

Administered Objects

As described in section 13.4.2.3 of JSR 322: Java EE Connector Architecture 1.6, a resource adapter may provide the Java class name and the interface type of an optional set of JavaBean classes representing administered objects that are specific to

a messaging style or message provider. You configure administered objects in the `admin-objects` elements of the `ra.xml` and `weblogic-ra.xml` deployment descriptor files. As with outbound connections and other WebLogic resource adapter configuration elements, you can define administered objects at three configuration scope levels:

- Global - Specify parameters that apply to all administered objects in the resource adapter using the `default-properties` element. See weblogic-ra.xml Schema in Table A-15
- Group - Specify parameters that apply to all administered objects belonging to a particular administered object group specified in the `ra.xml` deployment descriptor using the `admin-object-group` element. The properties specified in a group override any parameters specified at the global level. See admin-object-group.

  The `admin-object-interface` element (a subelement of the `admin-object-group` element) serves as a required unique element (a key) to each `admin-object-group`. There must be a one-to-one relationship between the `admin-object-interface` element in `weblogic-ra.xml` and the `admin-object-interface` element in `ra.xml`.
- Instance - Under each admin object group, you can specify administered object instances using the `admin-object-instance` element of the `weblogic-ra.xml` deployment descriptor. These correspond to the individual administered objects for the resource adapter. You can use the `admin-object-properties` subelement to specify properties at the instance level too; properties specified at the instance level override those provided at the group and global levels. See admin-object-instance.

Transactional Inflow

Transactional inflow is established by a transaction inflow contract, which allows the resource adapter to handle transaction completion and crash recovery calls that are initiated by an EIS. The transactional inflow contract also ensures that ACID properties of the imported transaction are preserved. For more information about transaction inflow, see Chapter 15, Transaction Inflow, in JSR 322: Java EE Connector Architecture 1.6.
When an EIS passes a message through a resource adapter to the application server, it may pass a transactional context under which messages are delivered or work is performed. The inbound transaction will be controlled by a transaction manager external to the resource adapter and application server. See Message Inflow to Message Endpoints (Message-Driven Beans).

A resource adapter may act as a bridge between the EIS and the application server for transactional control. That is, the resource adapter receives messages that it interprets as XA callbacks for participating in a transaction with a external Transaction Manager.

WebLogic Server can function as an XA resource to a external Transaction Manager through its interposed Transaction Manager. The WebLogic Server Transaction Manager maps external transaction IDs to WebLogic Server-specific transaction IDs for such transactions.

The WebLogic Server Transaction Manager is subordinate to the external Transaction Manager, which means that the external Transaction Manager ultimately determines whether the transaction succeeds or is rolled back. See Participating in Transactions Managed by a Third-Party Transaction Manager in *Developing JTA Applications for Oracle WebLogic Server*. As part of the Java EE Connector Architecture 1.6, the ability for a resource adapter to participate in such a transaction is now exposed through a Java EE standard API.

The following process explains how a resource adapter would participate in a external transaction. For more information, see section 15.4, Transaction Inflow Model, in JSR 322: Java EE Connector Architecture 1.6.

1. The resource adapter receives an inbound message with the transaction context that arrived along with the incoming message.
2. The resource adapter represents the transaction context using the `javax.transaction.xa.Xid` instance.
3. The resource adapter creates a new `Work` instance to process the incoming message and deliver it to a message endpoint, and also creates an instance of an `ExecutionContext` (`javax.resource.spi.work.ExecutionContext`), setting the `Xid` it created and also setting a transaction timeout value. Version 1.6 of the Connector Architecture defines a standard class, `TransactionContext`, which resource adapters may use instead of the `ExecutionContext` for propagating the transaction context from the EIS to the application server.
4. The resource adapter submits the `Work` object and the `TransactionContext` (or `ExecutionContext`) to the Work Manager for processing. At this point, the Work Manager performs the necessary work to enlist the transaction and start it with the WebLogic Server Transaction Manager.

   To use a `TransactionContext`, the `Work` class must:

   a. Implement the `javax.resource.spi.work.WorkContextProvider` interface.
   b. Create and return a `TransactionContext` instance in the `getWorkContexts()` method.

   > **Note:**
   >
   > If the resource adapter uses a `TransactionContext`, the adapter must not use an `ExecutionContext`.

5. Subsequent XA calls from the external Transaction Manager are sent through the resource adapter and communicated to the WebLogic Server Transaction Manager. In this way, the resource adapter acts as a bridge for the XA calls between the external Transaction Manager and the WebLogic Server Transaction Manager, which is acting as a resource manager.

Using the Transactional Inflow Model for Locally Managed Transactions

When the resource adapter receives requests from application components running in the same server instance as the resource adapter that need to be delivered to an MDB as part of the same transaction as the resource adapter request, the transaction ID must be obtained from the transaction on the current thread and placed in a `TransactionContext` (or `ExecutionContext`).

In this case, WebLogic Server does not use the Interposed Transaction Manager but simply passes the transaction on to the Work Thread used for message delivery to the MDB.

Configuring and Managing Long-Running Work

WebLogic Server supports the use of `HintsContext.LONGRUNNING_HINT`, which if set to `true` in a resource adapter `Work` class, causes a `Work` instance to be established as a

long-running work item that WebLogic Server schedules in a separate daemon thread, not in a `Work` thread. `LONGRUNNING_HINT` performs the same function as the WebLogic Server extension annotation `@LongRunning`.
WebLogic Server extends Connector Architecture 1.6 by providing the ConnectorWorkManagerRuntimeMBean, which contains attributes for configuring and monitoring long-running `Work` instances. These attributes, described in the following sections, are also exposed in the WebLogic Server Administration Console.

- Setting the Maximum Number of Concurrent Long-Running Work Instances
- Monitoring Long-Running Work

For more information about the `@LongRunning` extension annotation, see `LongRunning` in *Java API Reference for Oracle WebLogic Server*.

Setting the Maximum Number of Concurrent Long-Running Work Instances

Oracle recommends that you minimize the number of long-running `Work` instances executing concurrently because each long running work runs in its own daemon thread. Having too many concurrent long-running Work instances can exhaust the thread resources in WebLogic Server and cause a negative impact on server performance and stability. WebLogic Server may introduce restrictions on maximum concurrent long running works allowed in a future release.

You can use the WebLogic Server Administration Console to set the maximum allowed number of concurrent `Work` instance requests as follows:

1. Select the resource adapter in the **Summary of Deployments** > **Control** page.
2. Select **Configuration** > **Workload**.
3. Enter a new value in **Maximum Number of Concurrent Long Running Requests**, if desired, and click **Save**.

   If you save a new value, the **Save Deployment Plan Assistant** is displayed, which prompts you to select or enter the path of a deployment plan file. For more information about working with deployment plans, see Understanding WebLogic Server Deployment in *Deploying Applications to Oracle WebLogic Server*.

Note the following:

- You can also view the maximum number of concurrent `Work` instance requests allowed from the Resource Adapter: Monitoring: Workload page in the WebLogic Server Administration Console, as described in Monitoring Long-Running Work.
- As an alternative to using the WebLogic Server Administration Console, you can use the `max-concurrent-long-running-requests` element in the `weblogic-ra.xml` file to set the maximum allowed number of concurrent `Work` instance requests. For information, see connector-work-manager.

Monitoring Long-Running Work

The `ConnectorWorkManagerRuntimeMBean` exposes long-running run-time information about the resource adapter's specific Work Manager in the following MBean attributes:

- `ConnectorWorkManagerRuntimeMBean.ActiveLongRunningRequests` — Returns the number of current active long-running `Work` instance requests.

- `ConnectorWorkManagerRuntimeMBean.CompletedLongRunningRequests` — Returns the number of completed long-running `Work` instance requests.
- `ConnectorWorkManagerRuntimeMBean.MaxConcurrentLongRunningRequests` — Returns the maximum number of concurrent `Work` instance requests allowed.

To view information about the currently active or completed long-running `Work` instance requests using the WebLogic Server Administration Console:

1. Select the resource adapter in the **Summary of Deployments** > **Control** page.
2. Select **Monitoring** > **Workload**.

   The following information about long-running `Work` instance requests is available from the **Long Running Work Managers** table:

Table 7-1 Description of Columns in the Long Running Work Managers Table

Column Name	Description
Active Requests	The number of currently active long-running `Work` instance requests.
Completed Requests	The number of completed long-running `Work` instance requests.
Max Concurrent Requests Allowed	The maximum number of concurrent `Work` instance requests allowed.

8
Security

WebLogic Server provides several security services for resource adapters for inbound and outbound communication. Resource adapters must be configured with authentication and other necessary security information to be able to establish connections with external systems.

- Container-Managed and Application-Managed Sign-on
- Credential Mapping for Making Outbound Connections
- Security Inflow
- Security Policy Processing
- Configuring Security Identities for Resource Adapters
- Configuring Connection Factory-Specific Authentication and Re-authentication Mechanisms

For more information about WebLogic security, see *Understanding Security for Oracle WebLogic Server* and *Securing Resources Using Roles and Policies for Oracle WebLogic Server*.

Container-Managed and Application-Managed Sign-on

When a resource adapter makes an outbound connection to an Enterprise Information System (EIS), it needs to sign on with valid security credentials. In accordance with the Java Connector Architecture 1.6 specification, WebLogic Server supports both container-managed and application-managed sign-on for outbound connections. At runtime, WebLogic Server determines the chosen sign-on mechanism, based on the information specified in either the invoking client component's deployment descriptor or the `res-auth` element of the resource adapter deployment descriptor. A sign-on mechanism specified in a resource adapter's deployment descriptor takes precedence over one specified in the calling component's deployment descriptor. Even when using container-managed sign-on, any security information explicitly specified by the client component is presented on the call to obtain the connection.
If the WebLogic Server Java EE 1.6 Connector Architecture implementation cannot determine the sign-on mechanism that is being requested by the client component, the connector container attempts container-managed sign-on.

Application-Managed Sign-on

With application-managed sign-on, the client component supplies the necessary security credentials (typically a user name and password) when making the call to obtain a connection to an EIS. In this scenario, the application server provides no additional security processing other than to pass along this information in the request for the connection.

Container-Managed Sign-on

WebLogic Server and an EIS each maintain independent security realms. A goal of container-managed sign-on is to permit a user to sign on to WebLogic Server and be able to use applications that access an EIS through a resource adapter without having to sign on separately to the EIS. Container-managed sign-on in WebLogic Server uses **outbound credential mappings**, which map credentials (either username/password pairs or security tokens) of WebLogic security principals (which may be either authenticated individual users or client applications) to the corresponding credentials required to access the EIS. For any deployed resource adapter, you can configure outbound credential mappings for applicable security principals. For related information, see Outbound Credential Mappings.

Credential Mapping for Making Outbound Connections

The Java Connector Architecture 1.6 specification requires that credentials are stored in a `javax.security.auth.Subject`. When an outbound connection is being made, these credentials are passed to either the `createManagedConnection` or the `matchManagedConnection` method of the `ManagedConnectionFactory` object. Outbound credential mappings, which are stored in the WebLogic Server embedded LDAP server, are specific to outbound resource adapters.
When creating outbound credential mappings of WebLogic Server users to usernames in an EIS to which you want to connect using a resource adapter, note the following:

- WebLogic Server supports creating outbound credential mappings for WebLogic Server users who are defined in the default security realm only. If you are using a security realm that you have customized, you need to define it as the default security realm before configuring outbound credential mappings for resource adapters. See Customizing the Default Security Configuration in *Administering Security for Oracle WebLogic Server* and Change the default security realm in *Oracle WebLogic Server Administration Console Online Help*.
- You must define the `authentication-mechanism` element for the connection pool in either of the following deployment descriptor files:
  - `ra.xml`, which works for all connection pools of the resource adapter
  - `weblogic-ra.xml` for each individual connection pool

  If there is no valid `authentication-mechanism` element defined, the outbound credential mapping will not take effect, as explained in Authentication Mechanisms. The following is a sample `ra.xml` file snippet:

```
<authentication-mechanism>
<authentication-mechanism-type>BasicPassword</authentication-mechanism-type>
<credential-interface>javax.resource.spi.security.PasswordCredential</
credential-interface>
</authentication-mechanism>
```

Authentication Mechanisms

WebLogic Server users must be authenticated whenever they request access to a protected WebLogic Server resource. For this reason, each user is required to provide a credential (a username/password pair or a digital certificate) to WebLogic Server.

Password authentication is the only authentication mechanism supported by WebLogic Server out of the box. Password authentication consists of a user ID and password. Based on the configured mappings, when a user requests connection to a resource adapter, the appropriate credentials for that user are supplied to the resource adapter.

The SSL (or HTTPS) protocol can be used to provide an additional level of security to password authentication. Because the SSL protocol encrypts the data transferred between the client and WebLogic Server, the user ID and password of the user do not flow in clear text. Using SSL, WebLogic Server can authenticate the user without compromising the confidentiality of the user's ID and password. See Configuring SSL in *Administering Security for Oracle WebLogic Server*.

Outbound Credential Mappings

Outbound credential mappings are specific to outbound resource adapters. You configure outbound credential mappings using the WebLogic Server Administration Console. Before you can configure credential mappings, you must successfully deploy the resource adapter.

> **Note:**
>
> The first time you deploy a resource adapter, it has no configured outbound credential mappings and the initial connections will fail until they are configured.

If the resource adapter requires credentials and is configured to create connections at deployment time (meaning the `initial-capacity` element in the `weblogic-ra.xml` is set to greater than `0`), the initial connection may fail. To prevent initial connection failure, Oracle recommends you set the `initial-capacity` element the connection pool to `0` for its connection pool for the initial installation and deployment of a resource adapter. Once the resource adapter is deployed for the first time, you can change the value of the `initial-capacity` element. For more information, see initial-capacity: Setting the Initial Number of ManagedConnections.

You can configure outbound credential mappings for individual outbound connection pools or globally for all the connection pools in the resource adapter. When the resource adapter receives a request for a connection, WebLogic Server searches for outbound credential mappings configured for a specific connection pool and then checks the mappings configured globally for the resource adapter.

Review the situations described in the following sections:

- Non-initial Connection: Requires ManagedConnection from Adapter Upon Application's Request
- Initial Connection: Requires a ManagedConnection from Adapter Without Application's Request
- Special Users

Non-initial Connection: Requires ManagedConnection from Adapter Upon Application's Request

WebLogic Server requires a ManagedConnection from the adapter upon an application's request. For example, an application wants to get a connection from a pool but there is no

available ManagedConnection in the pool so WebLogic Server needs to make a request to the adapter to create a new ManagedConnection.

> **Note:**
>
> Applies only to Container-Managed sign-on.

The server searches for outbound mappings in the following order:

1. Specific mappings (or anonymous mapping if unauthenticated) at the connection factory level.
2. Specific mappings (or anonymous mapping if unauthenticated) at the global level.
3. Default mappings at the connection factory level.
4. Default mappings at the global level.

Example 8-1 Outbound Credential Mapping Examples

```
poolA
   system user name: admin
   system password: admin_password
   default user name: guest1
   default password: guest1_password

poolB
   wlsjoe user name: harry
   wlsjoe password: harry_password

global
   system user name: sysman
   system password: sysman_password
   wlsjoe user name: scott
   wlsjoe password: scott_password
   default user name: viewer
   default password: viewer_password
   anonymous user name: foo
   anonymous password: foo_password
```

Referring to the example provided in Example 8-1, consider an application authenticated as `system` that makes a connection request against `poolA`. Because a specific outbound credential mapping is defined for `system` for `poolA`, the resource adapter uses this mapping (`admin`/*`admin_password`*).

If the application makes the same request against `poolB` as `system`, there is no corresponding specific outbound credential mapping for `system`. Therefore, the server searches for the credential mapping at the `global` level where it finds a mapping (`sysman`/*`sysman_password`*).

If another application authenticates as `wlsjoe` and makes a request against `poolA`, it finds no mapping for `wlsjoe` defined for `poolA`. It then searches at the global level and finds a mapping for `wlsjoe` (`scott`/*`scott_password`*). Against `poolB`, the application would find the mapping defined for `poolB` (`harry`/*`happy_password`*).

If an application authenticated as `user1` makes a request against `poolA`, it finds no mapping for `user1` for `poolA`. The following sequence occurs:

1. The application searches at the global level, which also has no mapping for `user1`.
2. The application searches the `poolA` outbound mappings for a default mapping and finds a default mapping.

If an application does not authenticate to WebLogic Server and makes a request against `poolA`, it finds no outbound mapping for anonymous user for `poolA`. It then searches at the global level and finds a mapping for the anonymous user (`foo`/*`foo_password`*).

For example, in Example 8-1, consider two connection pools with the following outbound credential mappings:

Initial Connection: Requires a ManagedConnection from Adapter Without Application's Request

WebLogic Server requires a ManagedConnection from an adapter without the application's request. This can either be when WebLogic Server creates initial connections at deployment time (meaning the `initial-capacity` element in `weblogic-ra.xml` is set to greater than 0), or when WebLogic Server needs to get a ManagedConnection specifically for XA recovery.

> **Note:**
>
> Applies to both Container-Managed sign-on and Application-Managed sign-on.

WebLogic Server searches for outbound mappings in the following order:

1. Initial mappings at the connection factory level.
2. Initial mappings at the global level.
3. Default mappings at the connection factory level.
4. Default mappings at the global level.

Example 8-2 Credential Mapping Examples

```
poolA
   initial user name: admin
   initial password: admin_password

poolB
   default user name: harry
   default password: harry_password

global
   initial user name: sysman
   initial password: sysman_password
```

Referring to Example 8-2, WebLogic Server needs to perform XA Recovery for `poolA` and so makes a connection request against `poolA`. Because the initial outbound credential mapping is defined for system for `poolA`, the resource adapter uses this mapping (`admin`/*`admin_password`*).

If WebLogic Server makes the same request against `poolB`, there is no corresponding initial outbound credential mapping for `poolB`. WebLogic Server then searches for the initial credential mapping at the global level where it finds a mapping (`sysman`/*`sysman_password`*).

If neither an initial nor default mapping is defined, WebLogic Server uses `null` as the `Subject` when making calls to the adapter to create a ManagedConnection.

For example, consider two connection pools with the following outbound credential mappings:

Special Users

Three special users are provided for use by resource adapters:

- Initial User (user for creating initial connections) — If you define an outbound credential mapping for this user, the specified credentials are used for the initial connections created when:
  - Starting the connection pool for this resource adapter
  - Doing XA transaction recovery for the connection pool

  The `InitialCapacity` parameter on the pool specifies the number of initial connections. If you do not define a mapping for this user, the default mapping (if provided) is used. Otherwise, no credentials are provided for the initial connections.
- Anonymous User (unauthenticated WebLogic Server user) — If you define a mapping for this user, the specified credentials are used when no user is authenticated for the connection request on the resource adapter.
- Default User — If you define a mapping for this user, the specified credentials are used when:
  - No other mapping applies for the current user.
  - No anonymous mapping is provided in the case where there is no authenticated user.

Creating Outbound Credential Mappings Using the Console

You can create outbound credential maps with the WebLogic Server Administration Console. If you are using the WebLogic Credential Mapping provider, the outbound credential maps are stored in the embedded LDAP server. For information about how to create an outbound credential map, see Create outbound credential mappings in the *Oracle WebLogic Server Administration Console Online Help*.

Security Inflow

The Java Connector Architecture 1.6 specification defines a standard, generic security context shared among the EIS, the resource adapter, and the application server that leverages the work done in the resource adapter container, as specified in JSR 196: Java Authentication Service Provider Interface for Containers. The security context enables a resource adapter to establish security information that is used when submitting a `Work` instance for execution and delivering messages to message endpoints that are hosted in WebLogic Server.
The Java Connector Architecture 1.6 specification:

- Defines an abstract class `SecurityContext` as the contract between the resource adapter and the application server

- Defines two scenarios on how to handle flown-in identities based on whether or not they belong to the application server's security domain:
  - Case 1 (see Section 16.4.3, Case 1: Identity in the Container Security Domain, in JSR 322: Java EE Connector Architecture 1.6.)
  - Case 2 (Section 16.4.4, Case 2: Identity Translated Between Security Domains.)
- Uses the CallbackHandler defined in the JSR 196: Java Authentication Service Provider Interface for Containers.
- Uses three callbacks from JSR 196: CallerPrincipalCallback, GroupPrincipalCallback, and PasswordValidationCallback.

> **Note:**
>
> When the WebLogic Server Connector container calls the `setupSecurityContext` method of the `SecurityContext` implementation provided by the resource adapter, the `serviceSubject` passed to the adapter will always be null.

Inbound Principal Mappings

A resource adapter deployed in the WebLogic Connector container can flow in an identity (that is, a caller principal, a group principal, or both) into a container, and the identity may be defined in either the WebLogic domain (as in the Case 1 scenario) or in the EIS security domain (as in the Case 2 scenario).

If the identity is defined in the EIS security domain, the WebLogic Connector container must be able to map the flown-in principal to a principal defined in the WebLogic domain. To support this scenario, WebLogic Server provides the ability to create an **inbound principal mapping** between the EIS principal and the corresponding WebLogic domain.

The following mappings can be created:

- Default mapping of EIS user names to either a specific WebLogic user, or the WebLogic user `anonymous`
- A specific EIS user name to either a specific WebLogic user, or the WebLogic user `anonymous`
- Default mapping of EIS group names to a WebLogic group name
- A specific EIS group name to a WebLogic group name

A principal name defined in an inbound principal mapping configuration must contain at least one non-space character. A string that contains only space characters is not a valid principal name (and is not accepted by the WebLogic Server Administration Console).

Note the following behavior regarding inbound principal mapping:

- Although JSR 322: Java EE Connector Architecture 1.6 allows a resource adapter to pass any user and group combination to the container, Connector Architecture 1.6 also allows the container to apply security restrictions. In the case of WebLogic Server, not all user and group combinations are valid: the WebLogic principals specified in the mapping must currently be defined in the WebLogic security realm, and the user must be defined in the WebLogic security realm as being a valid member of the group specified in the mapping. This is a requirement imposed by WebLogic Server.

For example, if a mapping specifies a particular user and group combination, and either the user or the group is not defined in the WebLogic Server security realm, the mapping is not valid. Additionally, if both the user and group are defined in the security realm, but the user is not a member of the particular group specified in the mapping, the mapping is not valid. When WebLogic Server determines that a mapping is not valid, it throws an exception.

Note also that WebLogic Server does not validate users or groups at the time an inbound principal mapping is configured. Because a security realm can be modified after the resource adapter has been deployed, WebLogic principals specified in an inbound principal mapping are validated only at run time.

- A flown-in identity cannot run as a principal (that is, a user or group) that is mapped to an administrator role, such as `Admin`, `AdminChannelUser`, `Deployer`, `Operator`, or `Monitor`.
- If no default inbound mapping is configured for an EIS user principal, and no mapping specific to the EIS user is configured, the user is mapped to an unauthenticated user.
- If no default inbound mapping is configured for a EIS group principal, and no mapping specific to the EIS group is configured, the group principal is ignored.
- Inbound principal mappings can be configured after the resource adapter has been deployed.

For information about how to create an inbound principal mapping using the WebLogic Server Administration Console, see Create inbound principal mappings in *Oracle WebLogic Server Administration Console Online Help*.

Security Inflow Callback Requirements

When a resource adapter flows in a identity that is used by the application server through handling CallerPrincipalCallback, GroupPrincipalCallback, and PasswordValidationCallback, JSR 322: Java EE Connector Architecture 1.6 does not specify any restrictions how those callbacks may be combined. However, not all combinations are valid in WebLogic Server Connector Architecture 1.6. The WebLogic Connector container validates these callbacks according to the requirements described in this section. You must design resource adapters so that they meet these requirements when they pass callbacks to the WebLogic Connector container. Otherwise, those callbacks are rejected.

WebLogic Server imposes the following requirements on callbacks passed to the Connector container:

- If a resource adapter handles a PasswordValidationCallback, the adapter must also handle a CallerPrincipalCallback. The WebLogic Security Service requires that a caller principal that is established by means of a CallerPrincipalCallback must match the user name that is authenticated by means of the PasswordValidationCallBack.
- If a resource adapter handles a GroupPrincipalCallback, the adapter must also handle a CallerPrincipalCallback.
- A resource adapter must not handle a PasswordValidationCallback in Case 2 (see Section 16.4.4, Case 2: Identity Translated Between Security Domains, in JSR 322: Java EE Connector Architecture 1.6). Because the username and password in the PasswordValidationCallback belong to the EIS security domain, the application server (that is, WebLogic Server) cannot authenticate them.

Backward Compatibility with Connector Architecture 1.5 and 1.0

WebLogic Server allows a resource adapter to use a configured principal to execute the `Work.run()` method. This principal can be configured in the WebLogic Server Administration Console, as described in Configure security principals in *Oracle WebLogic Server Administration Console Online Help*, or in the `weblogic-ra.xml` file using the `run-work-as-principal-name` and `default-principal-name`.

The `Work.run()` method then executes using the principal, if configured, or `anonymous`, by default, if this principal is not configured.

This mechanism provides a basic security configuration at the adapter level that applies to all `Work` instances submitted by the adapter. However, other security principals cannot be used selectively for different `Work` instances.

The security context feature in Connector Architecture 1.6 provides more flexibility by allowing each `Work` instance to provide its own SecurityContext, allowing each `Work` instance to be run under a different security principal.

Because the WebLogic Server Connector container is backward compatible with 1.0 and 1.5 adapters, note the following behavior when a resource adapter submits a `Work` instance:

- If the `Work` instance is submitted without a SecurityContext, the `Work` instance uses the principal defined in the `run-work-as-principal-name` and `default-principal-name` elements in the `weblogic-ra.xml` file.
- If the `Work` instance is submitted with a SecurityContext, the `Work` instance runs under the security principals that are defined according to the description of the `SecurityContext` class in JSR 322: Java EE Connector Architecture 1.6. The principals defined in the `run-work-as-principal-name` and `default-principal-name` elements, if present, are ignored.

Security Policy Processing

A security policy is an association between a WebLogic resource and one or more users, groups, or security roles and is designed to protect the WebLogic resource against unauthorized access. JSR 322: Java EE Connector Architecture 1.6 defines default security policies for resource adapters running in an application server. It also defines how resource adapters can provide their own specific security policies overriding the default. The `weblogic.policy` file that ships with WebLogic Server establishes the default security policies as specified in the Java EE Connector Architecture Specification.
If the resource adapter does not have a specific security policy defined, WebLogic Server establishes the runtime environment for the resource adapter with the default security policies specified in the `weblogic.policy` file, which conforms to the defaults specified by the Java EE Connector Architecture Specification. If the resource adapter has defined specific security policies, WebLogic Server establishes the runtime environment for the resource adapter with a combination of the default security policies for resource adapters and the specific policies defined for the resource adapter. You define specific security policies for resource adapters using the `security-permission-spec` element in the `ra.xml` deployment descriptor file.

For more information on security policy processing requirements, see the Security Permissions section of Chapter 21, Runtime Environment, in JSR 322: Java EE Connector Architecture 1.6. For more information about security policies and the WebLogic security

framework, see Security Policies in *Securing Resources Using Roles and Policies for Oracle WebLogic Server*.

Configuring Security Identities for Resource Adapters

Security identities determine the security principals that can perform particular resource adapter functions. In a WebLogic resource adapter, you can either have a single security identity that can perform all functions, or separate identities for separate classes of functions. You can define the following four types of security identities in the `weblogic-ra.xml` deployment descriptor:

- default principal — Security principal that can perform all resource adapter tasks.
- run-as principal — Security principal used by calls from the connector container into the resource adapter code during connection requests.
- run-work-as principal — Security principal used for Work instances launched by the resource adapter.
- manage-as principal — Security principal used for resource adapter management tasks, such as startup, shutdown, testing, and transaction management.

Example 8-3 is an excerpt from a `weblogic-ra.xml` deployment descriptor that illustrates how you would configure all four of these available security identities for performing different resource adapter tasks.

Example 8-3 Configuring All Security Identities for Resource Adapters

```
<weblogic-connector xmlns="http://xmlns.oracle.com/weblogic/weblogic-connector">
   <jndi-name>900blackbox-notx</jndi-name>
   <security>
      <default-principal-name>
         <principal-name>system</principal-name>
      </default-principal-name>
      <run-as-principal-name>
         <principal-name>raruser</principal-name>
      </run-as-principal-name>
      <run-work-as-principal-name>
         <principal-name>workuser</principal-name>
      </run-work-as-principal-name>
      <manage-as-principal-name>
         <principal-name>raruser</principal-name>
      </manage-as-principal-name>
   </security>
</weblogic-connector>
```

Example 8-4 illustrates how you could use the `default-principal-name` element to configure a single default principal security identity for performing all resource adapter tasks.

Example 8-4 Configuring a Single Default Principal Identity for a Resource Adapter

```
<weblogic-connector xmlns="http://xmlns.oracle.com/weblogic/weblogic-connector">
   <jndi-name>900blackbox-notx</jndi-name>
   <security>
      <default-principal-name>
         <principal-name>system</principal-name>
      </default-principal-name>
   </security>
</weblogic-connector>
```

For more information on setting security identity properties, see security.

default-principal-name: Default Identity

You can define a single security identity that can be used for all resource adapter purposes using the `default-principal-name` element. If values are not specified for `run-as-principal-name`, `manage-as-principal-name`, and `run-work-as-principal-name`, they default to the value set for `default-principal-name`.

The value of `default-principal-name` can be set to a defined WebLogic Server user name such as `system` or to use an anonymous identity (which is the equivalent of having no security identity) as shown inExample 8-5

For example, you can create a single security identity that makes all calls from WebLogic Server into the resource adapter and manages all resource adapter management tasks with a default `system` identity as shown in Example 8-6:

Example 8-5 Using a Defined WebLogic Server Name

```
<security>
   <default-principal-name>
      <principal-name>system</principal-name>
   </default-principal-name>
</security>
```

You can set the `default-principal-name` element to `anonymous` as follows:

Example 8-6 Setting Up an Anonymous Identity

```
<security>
   <default-principal-name>
      <use-anonymous-identity>true</use-anonymous-identity>
   </default-principal-name>
</security>
```

manage-as-principal-name: Identity for Running Management Tasks

You can define a management identity that is used for running various resource adapter management tasks such as startup, shutdown, testing, shrinking, and transaction management using the `manage-as-principal-name` element.

As with `default-principal-name`, the value of `manage-as-principal-name` can be set to a defined WebLogic Server user name such as `system` or to use an `anonymous` identity (which is the equivalent of having no security identity). If you do not set up a value for the `manage-as-principal-name` element, it defaults to the value set up for `default-principal-name`. If no value is set up for `default-principal-name`, it defaults to the `anonymous` identity.

Example 8-7 illustrates how you can configure a resource adapter to run management calls using the WebLogic Server-defined user name `system`.

Example 8-7 Using a Defined WebLogic Server Name

```
<security>
   <manage-as-principal-name>
      <principal-name>system</principal-name>
   </manage-as-principal-name>
</security>
```

Example 8-8 illustrates how you can configure a resource adapter to run management calls using an `anonymous` identity.

Example 8-8 Setting Up an Anonymous Identity

```
<security>
   <manage-as-principal-name>
      <use-anonymous-identity>true</use-anonymous-identity>
   </manage-as-principal-name>
</security>
```

run-as-principal-name: Identity Used for Connection Calls from the Connector Container into the Resource Adapter

You define the principal name that should be used by all calls from the connector container into the resource adapter code during connection requests in the `run-as-principal-name` element. This principal name is used, for example, when resource adapter objects such as the `ManagedConnectionFactory` are instantiated - in other words, when the WebLogic Server connector container makes calls to the resource adapter, the identity defined in the `run-as-principal-name` element is used. This may include calls as part of either inbound or outbound requests or setup, or as part of initialization not specific to either inbound or outbound resource adapters (for example, `ResourceAdapter.start()`).

The value of the `run-as-principal-name` element can be set in one of three ways:

- To a defined WebLogic Server name
- To use an anonymous identity
- To use the security identity of the calling code.

If the value of the `run-as-principal-name` element is not defined, it defaults to the value of the `default-principal-name` element. If the `default-principal-name` element is not defined, it defaults to the identity of the requesting caller.

run-work-as-principal-name: Identity Used for Performing Resource Adapter Management Tasks

For inbound resource adapters, Oracle recommends that you use Work instances to execute inbound requests. To establish the security identity for Work instances launched by a resource adapter, you specify this value using the `run-work-as-principal-name` element. However, Work instances can also be created as part of outbound resource adapters to execute outbound requests. If an adapter does not use Work instances to handle inbound requests, then inbound requests are either run with no security context established (`anonymous`) or the resource adapter can make WebLogic Server-specific calls to authenticate as a WebLogic Server user. In this case, the WebLogic Server user security context is used.

The value of the `run-work-as-principal-name` element can be set in one of three ways:

- To a defined WebLogic Server name
- To use an anonymous identity
- To use the security identity of the calling code

If the value of the `run-work-as-principal-name` element is not defined, it defaults to the value of the `default-principal-name` element. If the `default-principal-name` element is not defined, it defaults to the identity of the requesting caller.

To run work using the requesting caller's identity, you specify the `run-work-as-principal-name` element as shown in Example 8-9:

Example 8-9 Using the Requesting Caller's Identity

```
<security>
   <run-work-as-principal-name>
      <use-caller-identity>true</use-caller-identity>
   </run-work-as-principal-name>
</security>
```

Configuring Connection Factory-Specific Authentication and Re-authentication Mechanisms

You specify authentication and re-authentication mechanisms for a resource adapter in the Java EE standard resource adapter deployment descriptor, `ra.xml`. These settings apply to all outbound connection factories.

- The `authentication-mechanism` element specifies an authentication mechanism to be used by all outbound connection factories.
- The `reauthentication-support` element specifies whether outbound connection factories support re-authentication of existing Managed-Connection instances. This is intended to be the default value for all connection factories of the resource adapter.

You can override the `authentication-mechanism` and `reauthentication-support` values in the `ra.xml` deployment descriptor by specifying them in the `weblogic-ra.xml` deployment descriptor. Doing so allows you to apply these settings to a specific connection factory rather than to all connection factories. See authentication-mechanism and reauthentication-support in Table A-18.

9
Packaging and Deploying Resource Adapters

To deploy a WebLogic resource adapter, you first package it in a resource adapter archive (RAR) file, and them deploy it in either an exploded directory format or as an archive file. There are requirements for creating the RAR file depending on several factors, such as whether the resource adapter is deployed standalone or with a Java EE application EAR, and also considerations regarding how you want to deploy it.

- Packaging Resource Adapters
- Deploying Resource Adapters

Deploying applications on WebLogic Server is covered in more detail in Deploying and Packaging from a Split Development Directory in *Developing Applications for Oracle WebLogic Server*.

Packaging Resource Adapters

For production and development purposes, Oracle recommends packaging your assembled resource adapter (RAR) as part of an enterprise application (EAR). There are several factors to consider when packaging resources adapters, such as the packaging directory structure, dependencies on platform-specific native libraries, and more.

Packaging Directory Structure

A resource adapter is a WebLogic Server component contained in a resource adapter archive (RAR) within the `applications/` directory. The deployment process begins with the RAR or a deployment directory, both of which contain the compiled resource adapter interfaces and implementation classes created by the resource adapter provider. Regardless of whether the compiled classes are stored in a RAR or a deployment directory, they must reside in subdirectories that match their Java package structures.

Resource adapters use the same directory format, whether the resource adapter is packaged in an exploded directory format or as a RAR. A typical directory structure of a resource adapter is shown in Example 9-1:

Example 9-1 Resource Adapter Directory Structure

```
/META-INF/ra.xml
/META-INF/weblogic-ra.xml
/META-INF/MANIFEST.MF (optional)
/images/ra.jpg
/readme.html
/eis.jar
/utilities.jar
/windows.dll
/unix.so
```

Packaging Considerations

The following are packaging requirements for resource adapters:

- Deployment descriptors (`ra.xml` and `weblogic-ra.xml`) must be in a directory called `META-INF`.
- An optional `MANIFEST.MF` also resides in `META-INF`. A manifest file is automatically generated by the JAR tool and is always the first entry in the JAR file. By default, it is named `META-INF/MANIFEST.MF`. The manifest file is the place where any meta-information about the archive is stored.
- A resource adapter deployed in WebLogic Server supports the `class-path` entry in `MANIFEST.MF` to reference a class or resource such as a property.
- The resource adapter can contain multiple JARs that contain the Java classes and interfaces used by the resource adapter. (For example, `eis.jar` and `utilities.jar`.) Ensure that any dependencies of a resource adapter on platform-specific native libraries are resolved.
- The resource adapter can contain native libraries required by the resource adapter for interacting with the EIS. (For example, `windows.dll` and `unix.so`.)
- The resource adapter can include documentation and related files not directly used by the resource adapter. (For example, `readme.html` and `/images/ra.jpg`.)
- When a standalone resource adapter RAR is deployed, the resource adapter must be made available to all Java EE applications in the application server.
- When a resource adapter RAR packaged within a Java EE application EAR is deployed, the resource adapter must be made available only to the Java EE application with which it is packaged. This specification-compliant behavior may be overridden if required.

Packaging Limitation

If you reload a standalone resource adapter without reloading the client that is using it, the client may cease to function properly. This limitation is due to JSR 322: Java EE Connector Architecture 1.6 limitation of not providing a remotable interface.

Packaging Resource Adapter Archives (RARs)

After you stage one or more resource adapters in a directory, you package them in a Java Archive (JAR) with a `.rar` file extension.

> **Note:**
>
> Once you have assembled the resource adapter, Oracle recommends that you package it as part of an enterprise application. This allows you to take advantage of the split development directory structure, which provides a number of benefits over the traditional single directory structure. See Creating a Split Development Directory Environment in *Developing Applications for Oracle WebLogic Server*.

To stage and package a resource adapter:

1. Create a temporary staging directory anywhere on your hard drive.
2. Compile or copy the resource adapter Java classes into the staging directory.

3. Create a JAR to store the resource adapter Java classes. Add this JAR to the top level of the staging directory.
4. Create a `META-INF` subdirectory in the staging directory.
5. Create an `ra.xml` deployment descriptor in the `META-INF` subdirectory and add entries for the resource adapter.

> **Note:**
>
> Refer to the following document for information about the `ra.xml` document type definition: `http://xmlns.jcp.org/xml/ns/javaee/connector_1_7.xsd`.

6. Create a `weblogic-ra.xml` deployment descriptor in the `META-INF` subdirectory and add entries for the resource adapter.

> **Note:**
>
> Refer to weblogic-ra.xml Schema for information on the contents of the `weblogic-ra.xml` file.

7. When the resource adapter classes and deployment descriptors are set up in the staging directory, you can create the RAR with a JAR command such as:

   ```
   jar cvf jar-file.rar -C staging-dir
   ```

   This command creates a RAR that you can deploy on a WebLogic Server or package in an enterprise application archive (EAR).

   The `-C` *`staging-dir`* option instructs the JAR command to change to the `staging-dir` directory so that the directory paths recorded in the JAR are relative to the directory where you staged the resource adapters.

For more information on this topic, see Creating and Configuring Resource Adapters: Main Steps.

Deploying Resource Adapters

The deployment of a resource adapter is similar to the deployment of web applications, EJBs, and Enterprise Applications. As with these deployment units, you can deploy a resource adapter in an exploded directory format or as an archive file. WebLogic Server also provides a number of deployment options to choose from, including whether to use the production redeployment feature, which allows you to redeploy a new version of an application alongside an older version of the same application and thereby eliminate downtime.

Deployment Options

You can deploy a standalone resource adapter (or a resource adapter packaged as part of an enterprise application) using any one of these tools:

- WebLogic Server Administration Console

- `weblogic.Deployer` tool
- `wldeploy` Ant task
- WebLogic Scripting Tool (WLST)

For information about these application deployment techniques, see Deploying Applications and Modules with weblogic.deployer in *Deploying Applications to Oracle WebLogic Server*.

You can use a deployment plan to deploy a resource adapter deployment. For a resource adapter, a WebLogic Server deployment plan is an optional XML document that resides outside of the RAR and configures the resource adapter for deployment to a specific WebLogic Server environment. A deployment plan works by setting deployment property values that would normally be defined in the resource adapter's deployment descriptors, or by overriding property values that are already defined in the deployment descriptors. For information on deployment plans, see Configuring Applications for Production Deployment in *Deploying Applications to Oracle WebLogic Server*.

You can also deploy a resource adapter using auto-deployment. This may be useful during development and early testing. For more information, see Auto-Deploying Applications in Development Domains in *Deploying Applications to Oracle WebLogic Server*

Resource Adapter Deployment Names

When you deploy a resource adapter archive (RAR) or deployment directory, you must specify a name for the deployment unit, for example, `myResourceAdapter`. This name provides a shorthand reference to the resource adapter deployment that you can later use to undeploy or update the resource adapter.

When you deploy a resource adapter, WebLogic Server implicitly assigns a deployment name that matches the path and filename of the RAR or deployment directory. You can use this assigned name to undeploy or update the resource adapter after the server has started.

The resource adapter deployment name remains active in WebLogic Server until the server is rebooted. Undeploying a resource adapter does not remove the associated deployment name; you can use the same deployment name to redeploy the resource adapter at a later time.

Production Redeployment

Using WebLogic Server's production redeployment feature, you can redeploy a new version of a WebLogic Server application alongside an older version of the same application. By default, WebLogic Server immediately routes new client requests to the new version of the application, while routing existing client connections to the older version. After all clients using the older application version complete their work, WebLogic Server retires the older application so that only the new application version is active.

Suspendable Interface and Production Redeployment

Typically, a resource adapter bean implements the `javax.resource.spi.ResourceAdapter` interface. This interface defines `start()` and

`stop()` methods. This type of resource adapter is not eligible for production redeployment. Resource adapters connect to one or more EISes for incoming/outgoing communication. All communication is performed in a resource adapter-proprietary way with no knowledge of the application server. If on-the-fly production redeployment is attempted, the application server can only provide notifications to the resource adapter to manage the migration of connections from the existing resource adapter to a new instance. However, the resource adapter can implement the `Suspendable` interface, which provides the capability to allow resource adapters to participate in production redeployment. For information about implementing the `Suspendable` interface, see Suspending and Resuming Resource Adapter Activity.

Production Redeployment Requirements

All of the following requirements must be met by both the old and new version of the resource adapter in order for production redeployment to work; otherwise, the redeployment fails.

- The resource adapter must be based on Connector Architecture 1.7. (Support for production redeployment of 1.0 resource adapters is not available.)
- The resource adapter must implement the `Suspendable` interface (see Example 3-3).
- The resource adapter must be packaged inside an enterprise application (EAR file). Production redeployment of standalone resource adapters is not supported.
- The `Suspendable.supportsVersioning()` method must return `true` when invoked by WebLogic Server.
- The `enable-access-outside-app` element in the `weblogic-ra.xml` descriptor must be set to `false`.

Production Redeployment Process

The following process assumes the older version of the resource adapter is deployed and running. It also assumes that the older version (named `old`) as well as the newer version (named `new`) of the resource adapter meet all of the requirements mentioned in Production Redeployment Requirements, as well as the application requirements described in Redeploying Applications in a Production Environment in *Deploying Applications to Oracle WebLogic Server*.

The following calls are made into the resource adapters during production redeployment:

1. WebLogic Server calls `new.init(old, null)` to inform the new resource adapter that it is replacing the old resource adapter.
2. WebLogic Server calls `old.startVersioning(new, null)` to inform the old resource adapter to start its production redeployment operation with the new resource adapter.
3. WebLogic Server calls `new.start(extendedBootstrapContext)`. See Extended BootstrapContext.
4. When the old resource adapter is finished (meaning it has succeeded in migrating all clients and inbound connections to the new resource adapter), it calls `(ExtendedBootstrapContext)bsCtx.complete()`. This informs WebLogic Server that it is safe to undeploy the old resource adapter.
5. When undeployment occurs, WebLogic Server calls `old.stop()` and production redeployment is complete.

The calls to `new.init()` and `old.startVersioning()` give the old and new resource adapters an opportunity to migrate inbound or outbound communications from the old to the new resource adapter. How this is done is up to the individual resource adapter developer.

Deploying a Resource Adapter Configured with Multiple Outbound Connection Pools

By default, when deploying a resource adapter that is configured with multiple outbound connection pools, the adapter deployment fails if a failure occurs in any connection pool. However, a deployment option is available that enables deployment to succeed, with the failed connection pools isolated from the healthy ones. This enables you to isolate, diagnose, and repair the failed connection pools and dynamically update the deployment without the need to redeploy the whole adapter.

To configure resource adapter deployment to succeed if a failure occurs with an outbound connection pool, you can do either of the following:

- Using the WebLogic Server Administration Console, make sure the **Deploy As A Whole** flag is not checked. This option is available from the **Resource Adapter** > **Configuration** > **General** page. See Configure resource adapter properties in the *Oracle WebLogic Server Administration Console Online Help*.
- Set the `deploy-as-a-whole` element in the `weblogic-ra.xml` file to `false`.

A
weblogic-ra.xml Schema

You can configure WebLogic Server-specific deployment descriptor elements inside the `weblogic-ra.xml` file. The schema for `weblogic-ra.xml` is `http://xmlns.oracle.com/weblogic/weblogic-connector/1.5/weblogic-connector.xsd`. If your resource adapter archive (RAR) does not contain a `weblogic-ra.xml` deployment descriptor, WebLogic Server automatically selects the default values of the deployment descriptor elements.

weblogic-connector

The `weblogic-connector` element is the root element of the WebLogic-specific deployment descriptor for the deployed resource adapter. You can define the following elements within the `weblogic-connector` element.

Table A-1 weblogic-connector subelements

Element	Required/Optional	Description
`native-libdir`	Required if native libraries are present.	Specifies the directory where all the native libraries exist that are required by the resource adapter.
`jndi-name`	Required only if a resource adapter bean is specified.	Specifies the JNDI name for the resource adapter. The resource adapter bean is registered into the JNDI tree with this name. It is not a required element if no resource adapter bean is specified. It is not a functional element if a JNDI name is specified for a resource adapter without a resource adapter bean.

Table A-1 (Cont.) weblogic-connector subelements

Element	Required/Optional	Description
`enable-access-outside-app`	Optional	As stated byJSR 322: Java EE Connector Architecture 1.6 , if the resource adapter is packaged within an application (in other words, within an EAR), only components within the application should have access to the resource adapter. This element allows you to override this functionality. **Note:** This element does not apply for standalone resource adapters. Default Value: `false` **Note:** When set to false, the resource adapter can *only* be accessed by clients that reside within the *same* application in which the resource adapter resides. For version 1.0 resource adapters (supported in this release), the default value for this element is set to `true`.
`enable-global-access-to-classes`	Optional	When set to `true`, the resource adapter allows global access to its classes, and the adapter's classes are loaded by the WebLogic Server system classpath classloader directly so that these classes can be accessed by all applications. When set to `true`, the EE compliant setting of resource adapter in the domain configuration is ignored. See About Resource Adapter Classes in *Developing Applications for Oracle WebLogic Server*. The default value is `false`, in which case the adapter's classes are loaded by a classloader that is a child of the EAR's application classloader. This value normally should be set to `true` for standalone adapters. When set to `true`, you must restart WebLogic Server if you change the adapter's classes and want to redeploy the adapter.
`deploy-as-a-whole`	Optional	When set to `true`, the resource adapter deployment fails if any error occurs, such as a failure with an outbound connection pool or an admin object bean. When set to `false`, the resource adapter deployment succeeds, but in a HEALTH_CRITICAL state, if an error occurs when creating or configuring at least one outbound connection pool. This setting enables you to isolate, diagnose, and correct a failed outbound connection pool without needing to redeploy the resource adapter. If any other error occurs during deployment, such as the inability to parse or validate the `ra.xml` or `weblogic-ra.xml` files, a ResourceAdapter bean failure, or an admin object bean failure, the resource adapter deployment fails. Default value: `true`

Table A-1 (Cont.) weblogic-connector subelements

Element	Required/Optional	Description
`work-manager`	Optional	This complex element is used to specify all the configurable elements for creating the Work Manager that will be used by the resource adapter bean. The `work-manager` element is imported from the `weblogic-javaee.xsd` schema. The Work Manager dynamically adjusts the number of work threads to avoid deadlocks and achieve optimal throughput subject to concurrency constraints. It also meets objectives for response time goals, shares, and priorities. For subelements of `work-manager`, see work-manager .
`connector-work-manager`	Optional	This complex element is used to specify all the configurable elements for the Connector Work Manager for this adapter module itself. This element provides configurations that are not supported by the standard Work Manager. For subelements of `connector-work-manager`, see connector-work-manager .
`security`	Optional	This complex element is used to specify all the security parameters for the operation of the resource adapter. See security, for information on the security defaults that will be taken by the connector container.
`properties`	Optional	This complex element is used to override any properties that have been specified for the resource adapter bean in the `ra.xml` file. For subelements of `properties`, see properties.

Table A-1 (Cont.) weblogic-connector subelements

Element	Required/Optional	Description
`admin-objects`	Optional	This complex element defines all of the admin objects in a resource adapter. As with the `outbound-resource-adapter` complex element (see outbound-resource-adapter), the `admin-objects` complex element has four hierarchical property levels that specify the configuration scope: 1. Global level — at this level, you specify parameters that apply to all admin objects in the resource adapter; you do so using the `default-properties` element. See Table A-14. 2. Group level — at this level, you specify parameters that apply to all admin objects belonging to a particular admin object group specified in the `ra.xml` deployment descriptor; you do so using the `admin-object-group` element. The properties specified in the group override any parameters that are specified at the global level. See admin-object-group. 3. Instance level — under each admin object group, you can use the `admin-object-instance` element to specify admin object instances. These correspond to the admin object instances for the resource adapter. You can specify properties at the instance level and override those properties provided in the group and global levels. See admin-object-instance. For `admin-objects` subelements, see admin-objects .

Table A-1 (Cont.) weblogic-connector subelements

Element	Required/Optional	Description
`outbound-resource-adapter`	Optional	This complex element is used to describe the outbound components of a resource adapter. As with the admin-objects complex element, this element has three hierarchical property levels that specify the configuration scope for defining outbound connection pools: 1. Global level — at this level, you specify parameters that apply to all outbound connection pools in the resource adapter using the `default-connection-properties` element. See default-connection-properties . 2. Group level — at this level, you specify parameters that apply to all outbound connections belonging to a particular connection factory specified in the `ra.xml` deployment descriptor using the `connection-definition-group` element. A one-to-one correspondence exists from a connection factory in `ra.xml` to a connection definition group in `weblogic-ra.xml`. The properties specified in a group override any parameters specified at the global level. See connection-definition-group. 3. The instance level — under each connection definition group, you can specify connection instances. These correspond to the individual connection pools for the resource adapter. Parameters can be specified at this level too and these override those provided at the group and global levels. See connection-instance. For `outbound-resource-adapter` subelements, see outbound-resource-adapter .

work-manager

The `work-manager` element is a complex element that is used to specify all the configurable elements for creating the Work Manager that will be used by the resource adapter bean. The `work-manager` element is imported from the `weblogic-javaee.xsd` schema. The following subelements can be configured in the `work-manager` element.

Table A-2 work-manager subelements

Element	Required/ Optional	Description
`name`	Required	Specifies the name of the Work Manager. JSR 322: Java EE Connector Architecture 1.6 describes how a resource adapter can submit work threads to the application server. These work threads are managed by the WebLogic Server Work Manager. The Work Manager dynamically adjusts the number of work threads to avoid deadlocks and achieve optimal throughput subject to concurrency constraints. It also meets objectives for response time goals, shares, and priorities.

`response-time-request-class`
`fair-share-request-class`
`context-request-class`
`request-class-name`
	Optional	A `work-manager` element can include one and only one of the following four elements:
		`response-time-request-class` - Defines the response time request class for the application. Response time is defined with attribute goal-ms in milliseconds. The increment is ((goal - T) Cr)/R, where T is the average thread use time, R the arrival rate, and Cr a coefficient to prioritize response time goals over fair shares.
		`fair-share-request-class` - Defines the fair share request class. Fair share is defined with attribute percentage of default share. Therefore, the default is 100. The increment is Cf/(P R T), where P is the percentage, R the arrival rate, T the average thread use time, and Cf a coefficient for fair shares to prioritize them lower than response time goals.
		`context-request-class` - Defines the context class. Context is defined with multiple cases mapping contextual information, like current user or its role, cookie, or work area fields to named service classes.
		`request-class-name` - Defines the request class name.

`min-threads-constraint` `min-threads-constraint-name`	Optional	You can choose between the following two elements: `min-threads-constraint` - Used to guarantee a number of threads the server allocates to requests of the constrained work set to avoid deadlocks. The default is zero. A min-threads value of one is useful, for example, for a replication update request, which is called synchronously from a peer. `min-threads-constraint-name` - Defines a name for the `min-threads-constraint` element.

Table A-2 (Cont.) work-manager subelements

Element	Required/ Optional	Description
`max-threads-constraint` `max-threads-constraint-name`	Optional	You can choose between the following two elements: `max-threads-constraint` - Limits the number of concurrent threads executing requests from the constrained work set. The default is unlimited. For example, consider a constraint defined with maximum threads of 10 and shared by 3 entry points. The scheduling logic ensures that not more than 10 threads are executing requests from the three entry points combined. `max-threads-constraint-name` - Defines a name for the `max-threads-constraint` element.
`capacity` `capacity-name`	Optional	You can choose between the following two elements: `capacity` - Constraints can be defined and applied to sets of entry points, called constrained work sets. The server starts rejecting requests only when the capacity is reached. The default is zero. Note that the capacity includes all requests, queued or executing, from the constrained work set. This constraint is primarily intended for subsystems like JMS, which do their own flow control. This constraint is independent of the global queue threshold. `capacity-name` - Defines a name for the `capacity` element.

connector-work-manager

The `connector-work-manager` element is a complex element that is used to specify all the configurable elements for the Connector Work Manager for the resource adapter module. This element provides configurations that are not supported by the standard WebLogic Work Manager. The following subelement can be configured in the `connector-work-manager` element.

Table A-3 connector-work-manager subelement

Element	Required/ Optional	Description
`max-concurrent-long-running-requests`	Optional	Specifies the maximum number of concurrent long-running `Work` instance requests allowed for a resource adapter instance. Because each long-running `Work` instance request executes in its own thread, an excessive number of long-running `Work` requests can have a negative affect on server performance and stability. A resource adapter typically needs only a few long-running `Work` requests, such as periodically listening to a socket or scheduling other `Work` instances. New long-running `Work` request submissions are rejected if the number of currently active long-running `Work` requests exceeds the specified limit. Default value: 10

security

The `security` complex element contains default security information that can be configured for the connector container. For more information, see Configuring Security Identities for Resource Adapters.

Table A-4 security subelements

Element	Required/ Optional	Description
`default-principal-name`	Optional	Specifies the default secure ID to be used for calls into the resource adapter. If this value is not specified, the default is the `anonymous` identity, which is the same as no security identity. See default-principal-name for subelements of this element.
`manage-as-principal-name`	Optional	Specifies the secure ID to be used for running various resource adapter management tasks, including startup, shutdown, testing, shrinking, and transaction management. If not specified, it defaults to the `default-principal-name` value. If `default-principal-name` is not specified, it defaults to the `anonymous` identity. See manage-as-principal-name for subelements of this element.
`run-as-principal-name`	Optional	Specifies the secure ID to be used by all calls from the connector container into the resource adapter code during connection requests. (This element currently applies only to outbound functions.) If not specified, it defaults to the `default-principal-name` value. If `default-principal-name` is not specified, it uses the identity of the requesting caller. See run-as-principal-name for subelements of this element.

Table A-4 (Cont.) security subelements

Element	Required/ Optional	Description
`run-work-as-principal-name`	Optional	Specifies the secure ID to be used to run all work instances started by the resource adapter. If not specified, it defaults to the `default-principal-name` value. If `default-principal-name` is not specified, it uses the identity that was used to start the work. See run-work-as-principal-name for subelements of this element.
`security-work-context`	Optional	This complex element specifies all security contextual parameters of the `WorkContext`. Two choices related to establishing the caller identity for a work instance are described in JSR 322: Java EE Connector Architecture 1.6: • Case 1: The resource adapter flows an identity into the application server's security policy domain. In this case, the application server may just use the initiating principal, flown-in from the resource adapter, as the caller principal in the security context that the `Work` instance executes as. • Case 2: The resource adapter flows in an identity belonging to the EIS security domain. The resource adapter establishes a connection to the EIS and executes a `Work` instance in the context of an EIS identity. In this case, the initiating or caller principal does not exist in the application server's security domain. A translation from one domain to the other is required to be performed. That is, the user or group name in the EIS security domain is mapped to a corresponding user or group name in the application server's security domain. If no such a user or group mapping is found, the default mapping is applied. The element `inbound-mapping-required` specifies whether the flown in identity translation from the EIS security domain to the application server's security domain is required. See security-work-context, for subelements of this element.

default-principal-name

The `default-principal-name` element contains the following subelements.

Table A-5 default-principal-name subelements

Element	Required/ Optional	Description
`use-anonymous-identity`	Required	Specifies that the anonymous identity should be used.
`principal-name`	Required	Specifies that the principal name should be used. This should match a defined WebLogic Server user name.

manage-as-principal-name

The `manage-as-principal-name` element contains the following subelements.

Table A-6 manage-as-principal-name subelements

Element	Required/ Optional	Description
`use-anonymous-identity`	Required	Specifies that the anonymous identity should be used.
`principal-name`	Required	Specifies that the principal name should be used. This should match a defined WebLogic Server user name.

run-as-principal-name

The `run-as-principal-name` element contains the following subelements.

Table A-7 run-as-principal-name subelements

Element	Required/ Optional	Description
`use-anonymous-identity`	Required	Specifies that the anonymous identity should be used.
`principal-name`	Required	Specifies that the principal name should be used. This should match a defined WebLogic Server user name.
`use-caller-identity`	Required	Specifies that the caller's identity should be used.

run-work-as-principal-name

The `run-work-as-principal-name` element contains the following subelements.

Table A-8 run-work-as-principal-name subelements

Element	Required/ Optional	Description
`use-anonymous-identity`	Required	Specifies that the `anonymous` identity should be used.
`principal-name`	Required	Specifies that the principal name should be used. This should match a defined WebLogic Server user name.
`use-caller-identity`	Required	Specifies that the caller's identity should be used.

security-work-context

The `security-work-context` element contains the following subelements.

Table A-9 security-work-context subelements

Element	Required/ Optional	Description
`inbound-mapping-required`	Optional	The default value is `false`, which means Case 1. All `caller-principal-mapping` and `group-principal-mapping` subelements are ignored. If set to `true`, it means Case 2. All `caller-principal-mapping` and `group-principal-mapping` elements are used to determine the correct mapping from the EIS security domain to the WebLogic domain. Default value: `false`
`caller-principal-default-mapped`	Optional	Specifies the default mapping for EIS user names to either a specific WebLogic user name or the WebLogic user `anonymous`. That is, if no WebLogic user name is found for an EIS user, this default mapping is used. See caller-principal-default-mapped, for subelements of this element.
`caller-principal-mapping`	Optional	Specifies the mapping of an EIS user name to either a specific WebLogic user name or the WebLogic `anonymous` identity. There may be zero or more `caller-principal-mapping` elements specified in `weblogic-ra.xml`. See caller-principal-mapping, for subelements of this element.
`group-principal-default-mapped`	Optional	Specifies the default mapping for EIS group names to a specific WebLogic group name. That is, if no WebLogic group name is found for an EIS group, this default mapping is used.
`group-principal-mapping`	Optional	Specifies the mapping of an EIS group name to specific WebLogic group name. There may be zero or more `group-principal-mapping` elements specified in `weblogic-ra.xml`. See group-principal-mapping, for subelements of this mapping.

caller-principal-default-mapped

The `caller-principal-default-mapped` element contains the following subelements.

Table A-10 caller-principal-default-mapped subelements

Element	Required/ Optional	Description
`use-anonymous-identity`	Required	Specifies that the WebLogic `anonymous` user identity should be used. Note that you can choose either `use-anonymous-identity` or `principal-name`, but not both.
`principal-name`	Required	Specifies that the principal name should be used. This should match a WebLogic user name defined in the WebLogic security realm.

caller-principal-mapping

The `caller-principal-mapping` complex element is used to specify a mapping from an EIS group name to WebLogic group name. It contains the following subelements.

Table A-11 caller-principal-mapping subelements

Element	Required/ Optional	Description
`eis-caller-principal`	Required	Specifies an EIS user principal name.
`mapped-caller-principal`	Required	Specifies either the mapped WebLogic user principal name *or* the `anonymous` user identity (but not both).

group-principal-mapping

The `group-principal-mapping` element contains the following subelements.

Table A-12 group-principal-mapping subelements

Element	Required/ Optional	Description
`eis-group-principal`	Required	Specifies an EIS group principal name.
`mapped-group-principal`	Required	Specifies the mapped WebLogic group principal name.

properties

The `properties` element, a subelement of `weblogic-connector`, is a container for properties specified for the resource adapter bean in `ra.xml`. It holds one more or more `property` elements.

You define `property` elements within the `properties` element as follows.

Table A-13 properties subelements

Element	Required/ Optional	Description
`property`	Required	The `property` element is used to override a property that has been specified for the resource adapter bean in the `ra.xml` file. It holds two subelements: `name` - Specifies the same name as the `config-property-name` element (a subelement of `config-property` in the `ra.xml` deployment descriptor). Setting this parameter causes the associated `config-property-value` element in `ra.xml` to be overridden. This is a required element. `value` - Specifies the value that overrides `config-property-value` element (a subelement of `config-property` in the `ra.xml` deployment descriptor). This is an optional element.

admin-objects

The `admin-objects` complex element defines all of the admin objects in the resource adapter. As with the outbound-resource-adapter complex element, the `admin-objects` complex element has three hierarchical property levels that you can specify.
The `admin-objects` element is a sub-element of the `weblogic-connector` element. You can define the following elements within the `admin-objects` element.

Table A-14 admin-objects subelements

Element	Required/ Optional	Description
`default-properties`	Optional	Specifies the default properties that apply to all admin objects (at the global level) in the resource adapter. The `default-properties` element can contain one or more `property` elements, each holding a `name` and `value` pair. See properties .
`admin-object-group`	One or more	Specifies the default parameters that apply to all admin objects belonging to a particular admin object group specified in the `ra.xml` deployment descriptor. The properties specified in the group override any parameters that are specified at the global level. For `admin-object-group` subelements, see admin-object-group .

admin-object-group

The `admin-object-group` element is used to define an admin object group. At the group level, you specify parameters that apply to all admin objects belonging to a particular admin object group specified in the `ra.xml` deployment descriptor. The properties specified in the group override any parameters that are specified at the global level.

The admin-object-interface element (a subelement of the admin-object-group element) serves as a required unique element (a key) to each admin-object-group. There must be a one-to-one relationship between the weblogic-ra.xml admin-object-interface element and the ra.xml adminobject-interface element.

The admin-object-group element is a sub-element of the weblogic-connector element. You can define the following elements within the admin-object-group element

Table A-15 admin-object-group

Element	Required/ Optional	Description
admin-object-interface	Required	The admin-object-interface element serves as a required unique element (a key) to each admin-object-group. There must be a one-to-one relationship between the weblogic-ra.xml admin-object-interface element and the ra.xml adminobject-interface element.
admin-object-class	Required in 1.6 adapters	The combination of the admin-object-interface element and the admin-object-class element serves as a required unique element (a key) to each admin-object-group. There must be a one-to-one relationship between the following two pairs: • The admin-object-interface and admin-object-class element pair defined in weblogic-ra.xml • admin-object-interface and admin-object-class element pair defined in ra.xml
default-properties	Optional	Specifies all the default properties that apply to all admin objects in this admin object group. The default-properties element can contain one or more property elements, each holding a name and value pair. See properties.
admin-object-instance	One or more	Specifies one or more admin object instances within the admin object group, corresponding to the admin object instances for the resource adapter. You can specify properties at the instance level and override those provided in the group and global levels. For subelements, see admin-object-instance.

admin-object-instance

You can define the following subelements under admin-object-instance.

Table A-16 admin-object-instance subelements

Element	Required/ Optional	Description
`jndi-name`	Required	The JNDI name used to define the reference name for the connection instance. The connection pool is bound into a JNDI that clients outside the application can see. **Note:** The enable-access-outside-app element must be set to `true`.
`properties`	Optional	Defines all the properties that apply to the admin object instance. The `properties` element can contain one or more `property` elements, each holding a `name` and `value` pair. See properties.

outbound-resource-adapter

The `outbound-resource-adapter` element is a sub-element of the `weblogic-connector` element. You can define the following elements within the `outbound-resource-adapter` element.

Table A-17 outbound-resource-adapter subelements

Element	Required/ Optional	Description
`default-connection-properties`	Optional	This complex element is used to specify the properties at an global level. At this level, the user is able to specify parameters that apply to all outbound connection pools in the resource adapter. For subelements, see default-connection-properties.
`connection-definition-group`	One or more	This element is used to specify all the connection definition groups. There must be a one-to-one correspondence relationship between the connection factories in the `ra.xml` deployment descriptor and the groups in the `weblogic-ra.xml` deployment descriptor. A group does not have to exist in the `weblogic-ra.xml` deployment descriptor for every connection factory in `ra.xml`. However, if a group exists, there must be at least one connection instance in the group. The properties specified in the group override any parameters that are specified at the global level using `default-connection-properties`. For subelements, see connection-definition-group.

default-connection-properties

The `default-connection-properties` element is a sub-element of the `outbound-resource-adapter` element. You can define the following elements within the `default-connection-properties` element.

Table A-18 default-connection-properties subelements

Element	Required/ Optional	Description
`pool-params`	Optional	Serves as the root element for providing connection pool-specific parameters for this connection factory. WebLogic Server uses these specifications to control the behavior of the maintained pool of `ManagedConnections`. This is an optional element. Failure to specify this element or any of its specific element items results in default values being assigned. Refer to the description of each individual element for the designated default value. For subelements, see pool-params.
`logging`	Optional	Contains parameters for configuring logging of the `ManagedConnectionFactory` and `ManagedConnection` objects of the resource adapter. For subelements, see logging.

`transaction-support`	Optional	Specifies the level of transaction support for a particular Connection Factory. It provides the ability to override the transaction-support value specified in the `ra.xml` deployment descriptor that is intended to be the default value for all Connection Factories of the resource adapter.
		The value of transaction-support must be one of the following:
		`NoTransaction`
		`LocalTransaction`
		`XATransaction`
		For related information, see Connection Management.

`authentication-mechanism`	Optional	The `authentication-mechanism` element specifies an authentication mechanism supported by a particular Connection Factory in the resource adapter. It provides the ability to override the `authentication-mechanism` value specified in the `ra.xml` deployment descriptor that is intended to be the default value for all Connection Factories of the resource adapter. Note that `BasicPassword` mechanism type should support the `javax.resource.spi.security.PasswordCredential` interface.

Table A-18 (Cont.) default-connection-properties subelements

Element	Required/ Optional	Description
`reauthentication-support`	Optional	A Boolean that specifies whether a particular connection factory supports re-authentication of an existing `ManagedConnection` instance. It provides the ability to override the `reauthentication-support` value specified in the `ra.xml` deployment descriptor that is intended to be the default value for all Connection Factories of the resource adapter.
`properties`	Optional	The `properties` element includes one or more property elements, which define name and value subelements that apply to the default connections.
`res-auth`	Optional	Specifies whether to use container- or application-managed security. The values for this element can be one of `Application` or `Container`. The default value is `Container`.

pool-params

The `pool-params` element is a sub-element of the `default-connection-properties` element. You can define the following elements within the `pool-params` element.

Table A-19 pool-params subelements

Element	Required/ Optional	Description
`initial-capacity`	Optional	Specifies the initial number of ManagedConnections, which WebLogic Server attempts to create during deployment. Default Value: 1
`max-capacity`	Optional	Specifies the maximum number of ManagedConnections, which WebLogic Server will allow. Requests for newly allocated ManagedConnections beyond this limit results in a `ResourceAllocationException` being returned to the caller. Default Value: 10
`capacity-increment`	Optional	Specifies the maximum number of additional ManagedConnections that WebLogic Server attempts to create during resizing of the maintained connection pool. Default Value: 1
`shrinking-enabled`	Optional	Specifies whether unused ManagedConnections will be destroyed and removed from the connection pool as a means to control system resources. Default Value: true
`shrink-frequency-seconds`	Optional	Specifies the amount of time (in seconds) the Connection Pool Management waits between attempts to destroy unused ManagedConnections. Default Value: 900 seconds

Table A-19 (Cont.) pool-params subelements

Element	Required/ Optional	Description
`highest-num-waiters`	Optional	Specifies the maximum number of threads that can concurrently block waiting to reserve a connection from the pool. Default Value: 0
`highest-num-unavailable`	Optional	Specifies the maximum number of ManagedConnections in the pool that can be made unavailable to the application for purposes such as refreshing the connection. Note that in cases like the backend system being unavailable, this specified value could be exceeded due to factors outside the pool's control. Default Value: 0
`connection-creation-retry-frequency-seconds`	Optional	The periodicity of retry attempts by the pool to create connections. Default Value: 0
`connection-reserve-timeout-seconds`	Optional	Sets the number of seconds after which the call to reserve a connection from the pool will timeout. Default Value: -1 (do not block when reserving resources)
`test-frequency-seconds`	Optional	The frequency with which connections in the pool are tested. Default Value: 0
`test-connections-on-create`	Optional	Enables the testing of newly created connections. Default Value: false
`test-connections-on-release`	Optional	Enables testing of connections when they are being released back into the pool. Default Value: false
`test-connections-on-reserve`	Optional	Enables testing of connections when they are being reserved. Default Value: false
`profile-harvest-frequency-seconds`	Optional	Specifies how frequently the profile for the connection pool is being harvested.
`ignore-in-use-connections-enabled`	Optional	When the connection pool is being shut down, this element is used to specify whether it is acceptable to ignore connections that are in use at that time.
`match-connections-supported`	Optional	Indicates whether the resource adapter supports the `ManagedConnectionFactory.matchManagedConnections()` method. If the resource adapter does not support this method (always returns null for this method), then WebLogic Server bypasses this method call during a connection request. Default Value: true

logging

The `logging` element is a sub-element of the `default-connection-properties` element. You can define the following elements within the `logging` element.

Table A-20 logging subelements

Element	Required/ Optional	Description
`log-filename`	Optional	Specifies the name of the log file from which output generated from the `ManagedConnectionFactory` or a `ManagedConnection` is sent. The full address of the filename is required.
`logging-enabled`	Optional	Indicates whether or not the log writer is set for either the `ManagedConnectionFactory` or `ManagedConnection`. If this element is set to true, output generated from either the `ManagedConnectionFactory` or `ManagedConnection` will be sent to the file specified by the `log-filename` element. Default Value: false
`rotation-type`	Optional	Sets the file rotation type. Possible values are `bySize`, `byTime`, `none` `bySize` - When the log file reaches the size that you specify in `file-size-limit`, the server renames the file as `FileName.n`. `byTime` - At each time interval that you specify in `file-time-span`, the server renames the current log file. After the server renames a file, subsequent messages accumulate in a new file with the name that you specified in `log-filename`. `none` - Messages accumulate in a single file. You must erase the contents of the file if the log size becomes unwieldy. Default Value: `bySize`
`number-of-files-limited`	Optional	Specifies whether to limit the number of files that this server instance creates to store old log messages. (Requires that you specify a `rotation-type` of `bySize` or `byTime`). After the server reaches this limit, it overwrites the oldest file. If you do not enable this option, the server creates new files indefinitely and you must clean up these files as you require. If you enable `number-of-files-limited` by setting it to true, the server refers to your `rotationType` variable to determine how to rotate the log file. Rotate means that you override your existing file instead of creating a new file. If you specify `false` for `number-of-files-limited`, the server creates numerous log files rather than overriding the same one. Default Value: false
`file-count`	Optional	The maximum number of log files that the server creates when it rotates the log. This number does not include the file that the server uses to store current messages. (Requires that you enable `number-of-files-limited`.) Default Value: 7

Table A-20 (Cont.) logging subelements

Element	Required/ Optional	Description
`file-size-limit`	Optional	The size that triggers the server to move log messages to a separate file. (Requires that you specify a rotation-type of `bySize`.) After the log file reaches the specified minimum size, the next time the server checks the file size, it will rename the current log file as `FileName.n` and create a new one to store subsequent messages. Default Value: 500
`rotate-log-on-startup`	Optional	Specifies whether a server rotates its log file during its startup cycle. Default Value: true
`log-file-rotation-dir`	Optional	Specifies the directory path where the rotated log files will be stored.
`rotation-time`	Optional	The start time for a time-based rotation sequence of the log file, in the format `k:mm`, where `k` is 1-24. (Requires that you specify a rotation-type of `byTime`.) At the specified time, the server renames the current log file. Thereafter, the server renames the log file at an interval that you specify in `file-time-span`. If the specified time has already past, then the server starts its file rotation immediately. By default, the rotation cycle begins immediately.
`file-time-span`	Optional	The interval (in hours) at which the server saves old log messages to another file. (Requires that you specify a `rotation-type` of `byTime`.) Default Value: 24

connection-definition-group

The `connection-definition-group` element is used to define a connection definition group. At the group level, you specify parameters that apply to all outbound connections belonging to a particular connection factory specified in the `ra.xml` deployment descriptor using the `connection-definition-group` element. A one-to-one correspondence exists from a connection factory in `ra.xml` to a connection definition group in `weblogic-ra.xml`. The properties specified in a group override any parameters specified at the global level.

The `connection-factory-interface` element (a subelement of the `connection-definition-group` element) serves as a required unique element (a key) to each `connection-definition-group`. There must be a one-to-one relationship between the `weblogic-ra.xml connection-definition-interface` element and the `ra.xml connectiondefinition-interface` element.

The `connection-definition-group` element is a sub-element of the `outbound-resource-adapter` element. You can define the following elements within the `connection-definition-group` element.

Table A-21 connection-definition-group subelements

Element	Description
`connection-factory-interface`	Every connection definition group has a key (a required unique element). This key is the `connection-factory-interface`. The value specified for `connection-factory-interface must be equal to the value specified for connection-factory-interface in ra.xml`.
`default-connection-properties`	This complex element is used to define properties for outbound connections at the group level. See default-connection-properties.
`connection-instance`	Under each connection definition group, the user can specify connection instances. These correspond to the individual connection pools for the resource adapter. Parameters can be specified at this level too and these override those provided in the group and global levels. This element specifies a description of the connection pool. (A connection instance is equivalent to a connection pool.) It is used to document the connection pool. See connection-instance.

connection-instance

You can define the following subelements under `connection-instance`.

Table A-22 connection-instance subelements

Element	Required/ Optional	Description
`description`	Optional	Specifies a description of the connection instance.
`jndi-name`	Required	The JNDI name used to define the reference name for the connection instance.
`connection-properties`	Optional	Defines all the properties that apply to the connection instance. The `connection-properties` element can contain one or more `property` elements, each holding a `name` and `value` pair. See properties.

B

Resource Adapter Best Practices

When developing and deploying WebLogic resource adapters, consider Oracle's best practices.

Classloading Optimizations for Resource Adapters

When preparing resource adapter classes for packaging in a RAR file, consider Oracle's best practices for classloading optimizations.

You can package resource adapter classes in one or more JAR files, and then place the JAR files in the RAR file. These are called nested JARs. When you nest JAR files in the RAR file, and classes need to be loaded by the classloader, the JARs within the RAR file must be opened and closed and iterated through for each class that must be loaded.

If there are very few JARs in the RAR file and if the JARs are relatively small in size, there will be no significant performance impact. On the other hand, if there are many JARs and the JARs are large in size, the performance impact can be great.

To avoid such performance issues, you can do either of the following:

1. Deploy the resource adapter in an exploded format. This eliminates the nesting of JARs and hence reduces the performance hit involved in looking for classes.
2. If deploying the resource adapter in exploded format is not an option, the JARs can be exploded within the RAR file. This also eliminates the nesting of JARs and thus improves the performance of classloading significantly.

Connection Optimizations

Oracle recommends that resource adapters implement the optional enhancements described in sections 7.16.1 and 7.16.2 of the Java EE Connector Architecture 1.6 specification. Implementing these interfaces allows WebLogic Server to provide several features that will not be available without them.
Lazy Connection Association Optimization, as described in section 7.16.1, allows the server to automatically clean up unused connections and prevent applications from hogging resources. Lazy Transaction Enlistment Optimization, as described in 7.16.2, allows applications to start a transaction after a connection is already opened.

Thread Management

Resource adapter implementations should use the `WorkManager` to launch operations that need to run in a new thread, rather than creating new threads directly. This allows WebLogic Server to manage and monitor these threads. For more information, see Chapter 10, Work Management, in JSR 322: Java EE Connector Architecture 1.6.

InteractionSpec Interface

For EIS access, WebLogic Server supports the Common Client Interface (CCI), which defines a standard client API for application components that enables application components and EAI frameworks to drive interactions across heterogeneous EISes. For more information, see Chapter 17, Common Client Interface, in JSR 322: Java EE Connector Architecture 1.6.
As a best practice, you should not store the `InteractionSpec` class that the CCI resource adapter is required to implement in the RAR file. Instead, you should package it in a separate JAR file outside of the RAR file, so that the client can access it without having to put the `InteractionSpec` interface class in the generic CLASSPATH.

With respect to the `InteractionSpec` interface, it is important to note that when all application components (EJBs, resource adapters, Web applications) are packaged in an EAR file, all common classes can be placed in the `APP-INF/lib` directory. This is the easiest possible scenario.

This is not the case for standalone resource adapters (packaged as RAR files). If the interface is serializable (as is the case with `InteractionSpec`), then both the client and the resource adapter need access to the `InteractionSpec` interface as well as the implementation classes. However, if the interface extends `java.io.Remote`, then the client only needs access to the interface class.

Using javax.jms.ConnectionFactory

When using an EJB or servlet to send messages using a JCA adapter backing a JMS provider using XA transactions, the `resource-ref` needs to be `java.lang.object`.

In a WebLogic Server environment, specifying `javax.jms.ConnectionFactory` implements WebLogic JMS Wrappers which are not compatible with this JCA adapter configuration. See Enhanced Support for Using WebLogic JMS with EJBs and Servlets in *Developing JMS Applications for Oracle WebLogic Server*.