BEA WebLogic Integration™

Developing Adapters

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Developing Adapters

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About This Document

Developing Adapters is organized as follows:

- "Introduction to the ADK" provides a brief background on the WebLogic Integration Adapter Development Kit. It discusses service and event adapters, the design-time GUI, and what to do before you start building an adapter.
- "Concepts" discusses of some of the ADK concepts relevant to adapter development, including events and services, design time versus run time, logging, and the adapter logical name.
- "Tools" describes the ADK tools provided that you can use to build adapters. These tools include the sample adapter, the GenerateAdapterTemplate utility, the Ant-based build process, XML tools, and Javadoc.
- "Creating a Custom Development Environment" shows how to use the GenerateAdapterTemplate utility to clone the sample adapter and customize a development environment for your new adapter.
- "Using the Logging Toolkit" describes how to use the ADK logging toolkit to implement logging. It also includes a discussion of the Apache log4j specification, which is the core of the ADK logging framework.
- "Developing a Service Adapter" shows you how to build an adapter that supports services. It delineates all of the steps required to successfully create the adapter and shows relevant code samples where necessary.
- "Developing an Event Adapter" shows you how to build an adapter that supports events. It delineates all of the steps required to successfully create the adapter and shows relevant code samples where necessary.
- "Developing a Design-Time GUI" shows you how to build a graphical user interface that adapter users need to define, deploy, and test their application views. It delineates all of the steps required to successfully create the GUI and shows relevant code samples where necessary.

- "Deploying Adapters" describes the procedures for deploying adapters to WebLogic Integration. It describes how to deploy an adapter both manually and from the WebLogic Server Console.
- "Creating an Adapter Not Specific to WebLogic Integration" shows you how to modify the procedures described in Chapter 6, "Developing a Service Adapter," and Chapter 7, "Developing an Event Adapter," to develop an adapter that can be used on the WebLogic Server but not within the confines of WebLogic Integration.
- "XML Toolkit" describes the tools available in WebLogic Integration to facilitate creating valid XML documents.
- "Migrating Adapters to WebLogic Integration 2.1" describes the changes to the adapter deployment method from WebLogic Integration 2.0 and how to register the design-time Web application under WebLogic Integration 2.1.
- "Adapter Setup Worksheet" is a worksheet that will help you conceptualize the adapter you are building before you actually begin to code. It will help you define such components as the adapter logical name and the Java package base name and help you determine the locales for which you need to localize message bundles.
- "The DBMS Adapter" describes how the ADK was used to build a DBMS adapter. It also contains a simple task-driven example of how to use the DBMS adapter.
- "The E-mail Adapter" describes how the ADK was used to build an E-mail adapter. It also contains a simple task-driven example of how to use the E-mail adapter.

What You Need to Know

Developing Adapters is designed primarily for use by adapter developers who will use the ADK to develop service adapters, event adapters, and the design-time GUI that adapter users employ to create application views.

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If you do not have the Adobe Acrobat Reader, you can get it for free from the Adobe Web site at `http://www.adobe.com/`.

Related Information

The following resources are also available:

- BEA WebLogic Server documentation (`http://e-docs.beasys.com`)
- BEA WebLogic Process Integrator documentation (`http://e-docs.beasys.com`)
- XML Schema Specification (`http://www.w3.org/TR/xmlschema-0/`)
- The Sun Microsystems, Inc. J2EE Connector Architecture Specification (`http://java.sun.com/j2ee/connector/`)

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In your e-mail message, please indicate that you are using the documentation for this release of WebLogic Integration.

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When contacting Customer Support, be prepared to provide the following information:

- Your name, e-mail address, phone number, and fax number
- Your company name and company address
- Your machine type and authorization codes
- The name and version of the product you are using
- A description of the problem and the content of pertinent error messages

Documentation Conventions

The following documentation conventions are used throughout this document.

Convention	Item
Ctrl+Tab	Indicates that you must press two or more keys simultaneously.
italics	Indicates emphasis or book titles.

Convention	Item

`monospace text`	Indicates code samples, commands and their options, data structures and their members, data types, directories, and file names and their extensions. Monospace text also indicates text that you must enter from the keyboard.
	Examples:
	`#include <iostream.h> void main ( ) the pointer psz`
	`chmod u+w *`
	`\tux\data\ap`
	`.doc`
	`tux.doc`
	`BITMAP`
	`float`

`monospace boldface text`	Identifies significant words in code. *Example*: `void` **`commit`** `( )`
`monospace italic text`	Identifies variables in code. *Example*: `String` *`expr`*
UPPERCASE TEXT	Indicates device names, environment variables, and logical operators. *Examples*: LPT1 SIGNON OR
`{ }`	Indicates a set of choices in a syntax line. The braces themselves should never be typed.

`[ ]`	Indicates optional items in a syntax line. The brackets themselves should never be typed.
	Example:
	`buildobjclient [-v] [-o name ] [-f` *`file-list`*`]...`
	`[-l` *`file-list`*`]...`

`|`	Separates mutually exclusive choices in a syntax line. The symbol itself should never be typed.

Convention	Item

. . .	Indicates one of the following in a command line:
	■ That an argument can be repeated several times in a command line
	■ That the statement omits additional optional arguments
	■ That you can enter additional parameters, values, or other information
	The ellipsis itself should never be typed.
	Example:
	`buildobjclient [-v] [-o name ] [-f file-list]...`
	`[-l file-list]...`

. . .	Indicates the omission of items from a code example or from a syntax line. The vertical ellipsis itself should never be typed.

1 Introduction to the ADK

This guide is the “how to” guide for using the WebLogic Integration Adapter Development Kit (ADK). It will show you how to develop, test, and deploy event and service adapters and the design-time user interface.

This section provides information on the following subjects:

- What is the ADK?
- What are Adapters?
- The Design-Time GUI
- Before You Begin

Section Objectives

This section serves as an overview to using the ADK to develop event and service adapters and a design-time GUI. You will learn:

- What adapters are and how they are used.
- Prerequisites you must meet before beginning adapter development.
- Terminology associated with adapter development.

What is the ADK?

The ADK is the tool set for implementing the event and service protocol of BEA WebLogic Integration; that is, it is a collection of frameworks that support the development, testing, packaging, and distribution of resource adapters for WebLogic Integration. Specifically, the ADK is comprised of the following four frameworks:

- Design-time
- Run-time
- Logging
- Packaging

Requirements for Adapter Development

The ADK addresses three requirements for adapter development:

- Structure: A prominent theme in any integrated development and debugging environment (IDDE) is development project organization. You want a well structured development environment so you can immediately begin coding the adapter. You do not want to spend time designing and organizing a build process. The ADK provides an organized development environment, build process, intuitive class names and class hierarchy, and test methodology. Since the ADK encompasses so many advanced technologies, an incremental development process (code a little, test a little) is the key to success. The ADK test process allows the developer to make a simple change and test it immediately.
- Minimal Exposure to Peripheral Implementation Details: Peripheral implementation details are sections of code that are needed to support a robust software program, but are not directly related to the kernel of the program. Moreover, peripheral implementation details are sections of code that are needed to support the framework the software program runs in. For example, the J2EE Connector Architecture specification requires that the `javax.resource.cci.InteractionSpec` implementation class provide getter and setter methods that follow the JavaBeans design pattern. To support the

JavaBeans design pattern, you need to support `PropertyChangeListeners` and `VetoableChangeListeners` in your implementation class. You do not want to have to study the JavaBeans specification to learn how to do this. Rather, you want to focus on implementing the enterprise information system (EIS)-specific details of the adapter. The ADK provides base a base implementation for a majority of the peripheral implementation details of an adapter.

- A Clear Road Map to Success: A key concept in adapter development is the exit criteria. The exit criteria answers the question: "How do I know I am done with an implementation?" In other words, you want a clear road map of what needs to be implemented to complete an adapter. The ADK provides a clear methodology for developing an adapter. The ADK methodology organizes your thoughts around a few key concepts: events, services, design time, and run time.

What the ADK Provides

The ADK provides:

- Run-time support for events and services.
- An API to integrate an adapter's user interface into the WebLogic Integration Application View Management Console.

  The added value provided by the ADK is that adapters can become an integral part of a single graphical console application that allows business users to construct integration solutions.

What are Adapters?

Resource adapters—referred to in this document as "adapters"—are software that connect one application to another when those applications are not originally designed to communicate with each other. For example, an order entry system built by one company requires an adapter to communicate with a customer information system built by another.

By using the ADK, you can create two types of adapters:

- Service adapters, which consume messages.
- Event adapters, which generate messages.

You can also use the ADK to create J2EE-compliant adapters that are not specific to Weblogic Integration but still comply with the J2EE Connector Architecture Specification.

Service Adapters

Service adapters receive an XML request document from a client and invoke a specific function in the underlying enterprise information system (EIS). They are consumers of messages and may or may not provide a response. There are two ways to invoke a service: asynchronous and synchronous. With an asynchronous service adapter, the client application issues a service request and then proceeds with its processing. The client application does not wait for the response. With a synchronous service adapter, the client waits for the response before proceeding with its processing. BEA WebLogic Integration supports both of these service adapter invocations, relieving you from having to provide this functionality.

Service adapters perform the following four functions:

- Receive service requests from an external client.
- Transform the XML request document into the EIS specific format. The request document conforms to the request XML schema for the service. The request XML schema is based on metadata in the EIS.
- Invoke the underlying function in the EIS and wait for its response.
- Transform the response from the EIS specific data format to an XML document that conforms to the response XML schema for the service. The response XML schema is based on metadata in the EIS.

As with events, the ADK implements the aspects of these four functions that are generic across all service adapters.

To learn how to develop a service adapter, see Chapter 6, “Developing a Service Adapter.”

Event Adapters

Event adapters are designed to propagate information from an EIS into WebLogic Server. These types of adapters can be described as publishers of information.

There are two basic types of event adapters: in-process and out-of-process. In-process event adapters execute within the same process as the EIS. Out-of-process adapters execute in a separate process. In-process and out-of-process event adapters only differ in how they accomplish the data extraction process.

Event adapters running in a WebLogic Integration environment perform the following three functions:

- Respond to events deemed to be of interest to some external party that occur inside the running EIS and extract data about the event from the EIS into the adapter.
- Transform event data from the EIS specific format to an XML document that conforms to the XML schema for the event. The XML schema is based on metadata in the EIS.
- Propagate the event to an event context obtained from the application view.

The ADK implements the aspects of these three functions that are generic across all event adapters. Consequently, you can focus on the EIS specific aspects of their adapter. This concept is the same as the concept behind Enterprise Java Beans (EJB). With EJB, the container provides system-level services for EJB developers so they can focus on implementing business application logic.

To learn how to develop an event adapter, see Chapter 7, “Developing an Event Adapter.”.

J2EE-Compliant Adapters Not Specific to WebLogic Integration

These adapters do not contain WebLogic Integration specifics and can be plugged into any application server that supports the J2EE Connector Architecture specification. These adapters can be developed by making minor modifications to the procedures

given for developing a service adapter. To learn how to develop an adapter that is not specific to WebLogic Integration, see Appendix A, "Creating an Adapter Not Specific to WebLogic Integration."

The Design-Time GUI

Along with event and service adapters, the ADKs design-time framework provides the tools you will use to build the Web-based GUI that adapter users need to define, deploy, and test their application views (see "The Application View" below). Although each adapter has EIS-specific functionality, all adapters require a GUI for deploying application views. This framework minimizes the effort required to create and deploy these interfaces, primarily by using these two components:

- A Web application component that allows you to build an HTML-based GUI by using Java Server Pages (JSP). This component is augmented by tools such as the JSP templates and tag library and the JavaScript library.
- A deployment helper component, called `AbstractDesignTimeRequestHandler` that provides a simple API for deploying, undeploying, and editing application views on a WebLogic Server.

To learn how to develop a design-time GUI, see Chapter 8, "Developing a Design-Time GUI."

The Application View

A key component of application integration component of WebLogic Integration is the *application view*. The application view represents a business-level interface to the specific functionality in an application. An adapter represents a system-level interface to all the functionality in the application. An application view is configured for a single business purpose and contains only the services related to that business purpose. These services require only business-relevant data to be specified in the request document and return only business-relevant data in the response document. Under the covers, the application view combines this business-relevant data with stored metadata necessary for the adapter. The adapter takes both the business-relevant data and the stored metadata and executes a system-level function on the application.

The application view also represents both events and services that support a business purpose. This allows the business user to interact with the application view for all communication with an application. This bidirectional communication is actually supported by two adapter components (the event adapter and service adapter). The application view abstracts this fact from the user and presents them with a unified business interface to the application.

For more information about application views, see "Introduction to Using Application Integration" in *Using Application Integration*.

The Packaging Framework

The ADK packaging framework provides a tool set for packaging an adapter for delivery to a customer. Ideally, all adapters are installed, configured, and uninstalled the same on a WebLogic Server. Moreover, all service adapters must be J2EE compliant. The packaging framework makes creating a J2EE adapter archive (`.rar`) file, Web application archive (`.war`) file, the enterprise archive (`.ear`) file, and WebLogic Integration design environment archive easy.

Before You Begin

Before you can actually begin developing an adapter, be sure the WebLogic Integration is installed on your computer. See *Installing BEA WebLogic Integration* and the *BEA WebLogic Integration Release Notes* for more information.

2 Concepts

This section describes some of the more important concepts with which you should become familiar before attempting to develop an adapter or design-time GUI. You will see additional discussion of all of the following concepts at some point in the adapter/GUI development procedures.

This section provides information on the following subjects:

- Run Time Versus Design Time
- Events and Services
- Logging
- Adapter Logical Name

Run Time Versus Design Time

Adapter activity falls within one of two conceptual entities: run time and design time. Run time refers to functionality that occurs when adapters execute their processes. Design time refers to the adapter user's implementation of an application view; in essence, design time is the act of creating, deploying, and testing an application view.

Run time and design time are characterized in the ADK by the run-time and design-time frameworks. The run-time framework is comprised of the tools used when developing adapters while the design-time framework refers to the tools you will use to design Web-based user interfaces. Run time and design time are discussed in greater detail below.

Run-Time Framework

The run-time framework is the set of tools you will use to develop event and service adapters. To support event adapter development, the run-time framework provides a basic, extensible event generator. For service adapter development, the run-time framework provides a complete J2EE-compliant adapter.

The classes supplied by the run-time framework provide the following benefits:

- They allow you to focus on EIS specifics rather than J2EE specifics.
- They minimize the effort needed to use the ADK logging framework.
- They simplify the complexity of J2EE Connector Architecture.
- They minimize redundant code across adapters.

In addition, the run-time framework provides abstract base classes to help you implement an event generator to leverage the event support provided by the ADK environment.

A key component of the run-time framework is the run-time engine, which hosts the adapter component responsible for handling service invocations and manages:

- physical connections to the EIS
- login authentication
- transaction management

all in compliance with the J2EE Connector Architecture standard. These features are provided by WebLogic Server.

Design-Time Framework

The design-time framework provides the tools you will use to build the Web-based GUI that adapter users need to define, deploy, and test their application views. Although each adapter has EIS-specific functionality, all adapters require a GUI for deploying application views. This framework minimizes the effort required to create and deploy this GUI, primarily by using these two components:

- A Web application component that allows you to build an HTML-based GUI by using JSPs. This component is augmented by tools such as the JSP templates and tag library and the JavaScript library.
- A deployment helper component that provides a simple API for deploying, undeploying, and editing application views on a WebLogic Server.

The design-time interface for each adapter is a J2EE Web application that is bundled as a `.war` file. A Web application is a bundle of `.jsp`, `.html`, image files, and so on. The Web application descriptor is `web.xml`. The descriptor instructs the J2EE Web container how to deploy and initialize the Web application.

Every Web application has a context. The context is specified during deployment and identifies resources associated with the Web application under the Web container's doc root.

Events and Services

The ADK is used to create two types of adapters: event adapters and service adapters. Within the ADK architecture, services and events are defined as a self-describing objects (that is, the name indicates the business function) that use XML schema to define their input and output.

Events

An event is an XML document published by an application view when an event of interest occurs within an EIS. Clients that want to be notified of events register their interest with an application view. The application view then acts as a broker between the target application and the client. When a client has subscribed to events published by an application view, the application view notifies the client whenever an event of interest occurs within the target application. When an event subscriber is notified that an event of interest has occurred, it is passed an XML document that describes the event. Application views that publish events can also provide clients with the XML schema for the publishable events.

Note: The application view represents a business-level interface to the specific functionality in an application. For more information on this feature, please refer to *Introducing Application Integration*.

Services

A service is a business operation within an application that is exposed by the application view. It exists as a request/response mechanism; that is, when an application receives a request to invoke a business service, the application view invokes that functionality within its target application and then returns (or, responds with) an XML document that describes the results.

To define a service, you will need to determine and define the input requirements, output expectations, and the content of the interaction specification. A request is submitted in two parts:

- An interaction specification, containing static "secondary metadata" about the request.
- Basic input, which identifies the value of any variables; for example, in a DBMS transaction, the SQL statement is included in the interaction specification and the value of the variable in the input requirement. The result of the transaction is considered the output expectation.

Logging

Logging is an essential feature of an adapter component. Most adapters are used to integrate different applications and do not interact with end users while processing data. Unlike the behavior of a front-end component, when an adapter encounters an error or warning condition, it cannot stop processing and wait for an end-user to respond.

Moreover, the applications that adapters connect to are typically mission-critical business applications. For example, an adapter might be required to keep an audit report of every transaction with an EIS. Consequently, adapter components should provide both accurate logging and auditing information. The ADKs logging framework is designed to handle the needs of both logging and auditing.

The Logging Toolkit

The ADK provides the logging toolkit, which allows you to log localized messages to multiple output destinations. The logging toolkit leverages the work of the open source project, Apache Log4j.

The logging toolkit wraps the critical classes within Log4j to provide added functionality when you are building J2EE-compliant adapters and is provided in the `logtoolkit.jar` file.

For information on using the logging toolkit, see Chapter 5, “Using the Logging Toolkit.”

The Logging Framework

With the ADK, logging of adapter activity is accomplished by implementing the logging framework. This framework gives you the ability to log internationalized and localized messages to multiple output destinations. It provides a range of configuration parameters you can use to tailor message category, priority, format, and destination.

The logging framework uses a categorical hierarchy to allow inheritance of logging configuration by all packages and classes within an adapter. The framework allows parameters to be easily modified during run time.

Internationalization and Localization

The logging framework allows you to internationalize log messages. Internationalized applications are easy to tailor to the idioms and languages of end users around the world without re-factoring the code. Localization is the process of adapting software

for a specific region or language by adding locale-specific components and text. The logging framework uses the internationalization and localization facilities provided by the Java platform.

Adapter Logical Name

Each adapter created must have an *adapter logical name*; that is, a unique identifier that represents an individual adapter and serves as the organizing principle for all adapters. As such, the adapter logical name is how an individual adapter is identified and is also used to name the following:

- message bundle
- logging configuration
- log categories

The adapter logical name is a combination of the vendor name, the type of EIS connected to the adapter, and the version number of the EIS. By convention, this information is expressed as *vendor_EIS-type_EIS version*; for example, `BEA_WLS_SAMPLE_ADK`, where:

- `BEA_WLS` is the vendor
- `SAMPLE` is the EIS-type
- `ADK` is the EIS version

Where the Adapter Logical Name is Used

The adapter logical name is used with adapters in the following ways:

- It is used as a convention, although this is not required.
- It is used during adapter deployment adapter deployment as part of the `.war`, `.rar`, `.jar`, and `.ear` filenames.

- It is used as an organizing principle, as described in "As an Organizing Principle" on page 2-8.
- It is used as a return value to the abstract method `getAdapterLogicalName()` in `com.bea.adapter.web`, as described in "As the Return Value for getAdapterLogicalName()" on page 2-9.

In Adapter Deployment

The `Name` attribute of the `<ConnectorComponent>` element must be the adapter logical name. This is the key application integration uses to associate application views to a deployed resource adapter, as shown for the sample adapter in Listing 2-1.

Listing 2-1 Name Attribute of the ConnectorComponent Element

```
<ConnectorComponent
    Name="BEA_WLS_SAMPLE_ADK"
    Targets="myserver"
    URI="BEA_WLS_SAMPLE_ADK.rar"/>
```

Note: The adapter logical name is used as the name of the `.rar` file as a convention, but is not required in the URI attribute.

When an application view is deployed, it has an associated J2EE Connector Architecture CCI connection factory deployment. For example, if a user deploys the `abc.xyz` application view, WebLogic Integration deploys a new `ConnectionFactory` and binds it to the JNDI location `com.bea.wlai.connectionFactories.abc.xyz.connectionFactoryInstance`. For efficiency sake, the new connection factory deployment uses the `<ra-link-ref>` setting in the `weblogic-ra.xml` deployment descriptor.

The `<ra-link-ref>` element allows for the logical association of multiple deployed connection factories with a single deployed adapter. The specification of the optional `<ra-link-ref>` element with a value identifying a separately deployed connection factory will result in this newly deployed connection factory sharing the adapter which had been deployed with the referenced connection factory. In addition, any values

defined in the referred connection factory's deployment will be inherited by this newly deployed connection factory unless specified. The adapter logical name is used as the value for the `<ra-link-ref>` element.

As an Organizing Principle

Table 2-1 lists the areas that use the adapter logical name as an organizing principle.

Table 2-1 Areas that Use the Adapter Logical Name as an Organizing Principle

Area	How the Adapter Logical Name is Used
Logging	The adapter logical name is used as the base log category name for all log messages that are unique to the adapter. Consequently, the adapter logical name is passed as the value for the following parameters: ■ RootLogContext in `WLI_HOME/adapters/`*`ADAPTER`*`/src/eventrouter/WEB-INF/web.xml` ■ RootLogContext in `WLI_HOME/adapters/`*`ADAPTER`*`/src/rar/META-INF/ra.xml` ■ RootLogContext in `WLI_HOME/adapters/`*`ADAPTER`*`/src/rar/META-INF/weblogic-ra.xml` ■ RootLogContext in `WLI_HOME/adapters/`*`ADAPTER`*`/src/war/WEB-INF/web.xml` Where *`ADAPTER`* is the name of you adapter; for example: `WLI_HOME/adapters/dbms/src/war/WEB-INF/web.xml` In addition, the adapter logical name is used as the base for the name of the Log4J configuration file for the adapter; `.xml` is appended to the name. For example, the Log4J configuration file for the sample adapter is `BEA_WLS_SAMPLE_ADK.xml`.

Table 2-1 Areas that Use the Adapter Logical Name as an Organizing Principle

Area	How the Adapter Logical Name is Used
Localization	The adapter logical name is used as the base name for message bundles for an adapter. For example, the default message bundle for the sample adapter is `BEA_WLS_SAMPLE_ADK.properties`. Consequently, the adapter logical name is passed as the value for the following parameters: ■ MessageBundleBase in `WLI_HOME/adapters/`*`ADAPTER`*`/src/eventrouter/WEB-INF/web.xml` ■ MessageBundleBase in `WLI_HOME/adapters/`*`ADAPTER`*`/src/rar/META-INF/ra.xml` ■ MessageBundleBase in `WLI_HOME/adapters/`*`ADAPTER`*`/src/rar/META-INF/weblogic-ra.xml` ■ MessageBundleBase in `WLI_HOME/adapters/`*`ADAPTER`*`/src/war/WEB-INF/web.xml` Where *`ADAPTER`* is the name of you adapter; for example: `WLI_HOME/adapters/dbms/src/war/WEB-INF/web.xml`

As the Return Value for getAdapterLogicalName()

Lastly, the adapter logical name is used as the return value to the abstract method `getAdapterLogicalName()` on the `com.bea.adapter.web.AbstractDesignTimeRequestHandler`. This return value is used during the deployment of application views as the value for the `RootLogContext` for a connection factory.

Enterprise Archive (.ear) Files

The ADK uses Enterprise Archive files—`.ear` files—for deploying adapters. A single `.ear` file contains the `.war` and `.rar` files and the Event Router Web application files necessary to deploy an adapter. An example of an `.ear` file is shown in Listing 2-2.

Listing 2-2 .ear File Structure

```
adapter.ear
     application.xml
     sharedJar.jar
     adapter.jar
     adapter.rar
          META-INF
               ra.xml
               weblogic-ra.xml
               MANIFEST.MF
     designtime.war
          WEB-INF
               web.xml
          META-INF
               MANIFEST.MF
     eventrouter.war
          WEB-INF
               web.xml
          META-INF
               MANIFEST.MF
```

The .ear file for the sample adapter is shown in Listing 2-3.

Listing 2-3 Sample Adapter .ear File

```
sample.ear
    application.xml
    adk.jar (shared .jar between .war and .rar)
    bea.jar (shared .jar between .war and .rar)

        BEA_WLS_SAMPLE_ADK.jar (shared .jar between .war and .rar)

        BEA_WLS_SAMPLE_ADK.war (Web application with
           META-INF/MANIFEST.MF entry Class-Path:
           BEA_WLS_SAMPLE_ADK.jar adk.jar bea.jar log4j.jar
            logtoolkit.jar xcci.jar xmltoolkit.jar)

        BEA_WLS_SAMPLE_ADK.rar (Resource Adapter
           with META-INF/MANIFEST.MF entry Class-Path:
           BEA_WLS_SAMPLE_ADK.jar adk.jar bea.jar log4j.jar
            logtoolkit.jar xcci.jar xmltoolkit.jar)
```

```
log4j.jar (shared .jar between .war and .rar)
logtoolkit.jar (shared .jar between .war and .rar)
xcci.jar (shared .jar between .war and .rar)
xmltoolkit.jar (shared .jar between .war and .rar)
```

Notice that neither the `.rar` nor .`war` files include any shared `.jar` files inside of them; rather, they both refer to the shared `.jar` files off the root of the `.ear`.

For more information on using `.ear` files to deploy adapters, see Chapter 9, "Deploying Adapters."

3 Tools

The ADK provides a robust set of tools to assist you in developing adapters and the design-time GUI.

This section includes information on the following subjects:

- Sample Adapter
- The GenerateAdapterTemplate Utility
- ADK Javadoc
- Ant-Based Build Process
- XML Tools

Sample Adapter

The ADK contains a sample adapter that provides non-EIS specific code examples to help you start building an adapter. Do not confuse this sample adapter with the e-mail and DBMS adapters also included with WebLogic Integration; these adapters are documented in Appendix E, "The DBMS Adapter," and Appendix F, "The E-mail Adapter." You can find them in `WLI_HOME/adapters/dbms` and `WLI_HOME/adapters/email`.

Why Use the Sample Adapter?

The purpose of the sample adapter is to free you from much of the coding necessary to build an adapter. It provides concrete implementations of key abstract classes that only require customization for your specific EIS. In addition, the ADK provides the GenerateAdapterTemplate utility with which you can quickly clone the sample adapter development tree for use by the adapter you are developing. See "The GenerateAdapterTemplate Utility" on page 3-3.

What's In the Sample Adapter

Specifically the sample adapter contains:

`sample.cci.ConnectionImpl`
: A concrete implementation of the `Connection` interface that represents an application-level handle used by a client to access the underlying physical connection.

`sample.cci.InteractionImpl`
: A class that demonstrates how to implement a design pattern using the `DesignTimeInteractionSpecImpl` class.

`sample.cci.InteractionSpecImpl`
: An interface that provides a base implementation for you to extend by using getter and setter methods for the standard interaction properties

`sample.client.ApplicationViewClient`
: A class that demonstrates how to invoke a service and listen for an event on an application view.

`sample.eis.EIS`
`sample.eis.EISEvent`
`sample.eis.EISListener`
: These are classes that represent for demonstration purposes, a simple EIS.

`sample.event.EventGenerator`
: A concrete extension to `AbstractPullEventGenerator` that shows how to extend the ADK base class to construct an event generator.

`sample.event.OfflineEventGeneratorTestCase`
: A class you can use to test the inner workings of your event generator outside of Weblogic Server.

`sample.spi.ManagedConnectionFactoryImpl`
: A concrete extension to `AbstractManagedConnectionFactory` that you can customize for a specific EIS.

`sample.spi.ManagedConnectionImpl`
: A concrete extension to `AbstractManagedConnection` that you can customize this class for a specific EIS.

`sample.spi.ConnectionMetaDataImpl`
: A concrete extension to `AbstractConnectionMetaData` that you can customize for a specific EIS.

`sample.spi.NonManagedScenarioTestCase`
: A class you can test your SPI and CCI classes in a non-managed scenario.

`sample.web.DesignTimeRequestHandler`
: A concrete extension to `AbstractDesignTimeRequestHandler` that shows how to add an event or service at design time.

Note: For more details on the classes extended by those in the sample adapter, please refer to the ADK Javadocs.

The GenerateAdapterTemplate Utility

To facilitate using the sample adapter, the ADK provides GenerateAdapterTemplate, a command-line utility you can use to clone the sample adapter development tree and create a new adapter development tree. See Chapter 4, “Creating a Custom Development Environment,” for complete instructions on using this tool.

ADK Javadoc

ADK classes, interfaces, methods, and constructors are defined in the development kit’s Javadocs. Javadocs are included with the WebLogic Integration installation and are stored in `WLI_HOME/adapters/`*`ADAPTER`*`/docs/api`, where *`ADAPTER`* is the name of the adapter, such as Sample, DBMS, or e-mail; for example, `WLI_HOME/adapters/dbms/docs/api`.

Ant-Based Build Process

The ADK employs a build process based upon Ant, a 100% pure Java-based build tool. For the ADK, Ant does the following:

- Creates a Java archive (`.jar`) file for the adapter.
- Creates a `.war` file for an adapter's Web application.
- Creates a `.rar` file for a J2EE-compliant adapter.
- Encapsulate the above listed components into a `.ear` file for deployment.

Why Use Ant?

Traditionally, build tools are inherently shell-based. They evaluate a set of dependencies and then execute commands, not unlike those you would issue on a shell. While it is simple to extend these tools by using or writing any program for your operating system, you are also limited to that OS, or at least that OS type (for example, Unix).

Ant is preferable to shell-based make tools for the following reasons:

- Instead of a model where it is extended with shell-based commands, it is extended using Java classes.
- Instead of writing shell commands, the configuration files are XML-based, calling out a target tree where various tasks get executed. Each task is run by an object that implements a particular task interface. While this removes some of the expressive power inherent in being able to construct a shell command, it gives your application the ability to be cross-platform.
- If you want to execute a shell command, Ant has an execute rule that allows different commands to be executed based on the OS upon which it executing.

For complete instruction on setting up Ant, see "Step 2c: Setting Up the Build Process" on page 6-10.

XML Tools

The ADK ships with two XML development tools, which are considered part of the metadata support layer for the design-time framework. These tools, which comprise the XML Toolkit, are:

- XML Schema API—Characterized by the Schema Object Model (`SOM`), this API is used to programmatically build XML schemas. The SOM is a set of tools that extracts many of the common details, such as syntactical complexities of XML schema operations so that you can focus on its more fundamental aspects.
- XML Document API— Characterized by `IDocument`, this API provides the x-path interface to a document object model (DOM) document.

For instructions on using these tools, refer to Appendix B, "XML Toolkit."

Also, your installation of WebLogic Integration includes Javadoc on both of these APIs.

- For SOM, go to `WLI_HOME/docs/apidocs/com/bea/schema`
- For IDocument, go to `WLI_HOME/docs/apidocs/com/bea/document`

4 Creating a Custom Development Environment

Warning: We strongly recommend that you *do not* directly alter the sample adapter included with the ADK. Instead, use the GenerateAdapterTemplate utility described in this chapter. Modifying the sample adapter by any other means might result in unexpected and unsupported behavior.

To facilitate using the sample adapter (see "Sample Adapter" on page 3-1), the ADK provides GenerateAdapterTemplate, a command-line utility you can use to clone the sample adapter development tree and create a new adapter development tree.

This section provides information on the following subjects:

- Adapter Setup Worksheet
- Using GenerateAdapterTemplate

Adapter Setup Worksheet

The adapter setup worksheet is a questionnaire that will help you identify and collect critical information about the adapter you are developing. You can find this questionnaire in Appendix D, "Adapter Setup Worksheet."

This worksheet is a set of 20 questions that will help you identify critical adapter information, such as EIS type, vendor, and version, locale and national language of the deployment, the adapter logical name, and whether or not the adapter supports services. When you run GenerateAdapterTemplate, you will be prompted to enter this information. When the information is processed, a custom development tree for your adapter will be created.

Using GenerateAdapterTemplate

This section describes how to use GenerateAdapterTemplate. You will need to perform the following steps:

- Step 1. Execute GenerateAdapterTemplate
- Step 2. Rebuild the Tree
- Step 3. Deploy the Adapter to WebLogic Integration

Step 1. Execute GenerateAdapterTemplate

To use this tool, do the following:

1. Open a command-line from the `WLI_HOME/adapters/utils` directory and execute one the following commands:
   - For Windows NT: `GenerateAdapterTemplate.cmd`
   - For Unix: `GenerateAdapterTemplate.sh`

   The system responds:

```
WLI_HOME/adapters/utils>generateadaptertemplate
************************************************************

Welcome! This program helps you generate a new adapter
development tree by cloning the ADK's sample adapter development
tree.

Do you wish to continue? (yes or no); default='yes':
```

2. Select yes by pressing Enter.

   The system responds:

   ```
   Please choose a name for the root directory of your adapter
   development tree:
   ```

3. Enter a unique, easy-to-remember directory name (for example, *dir_name*) and press Enter.

   The system responds:

   ```
   created directory WLI_HOME/adapters/dir_name

   Enter the EIS type for your adapter:
   ```

   (Where *dir_name* is the new directory name.)

   Note: If you entered a directory name that already exists, the system will respond:

   ```
   WLI_HOME/adapters/dir_name already exists, please choose
   a new directory that does not already exist!

   Please choose a name for the root directory of your adapter
   development tree:
   ```

4. Enter an identifier for the EIS type to which your adapter will be connecting. Press Enter.

   The system responds:

   ```
   Enter a short description for your adapter:
   ```

5. Enter a short, meaningful description of the adapter you are about to develop and press Enter.

   The system responds:

   ```
   Enter the major version number for your adapter; default='1':
   ```

6. Either press Enter to accept the default or enter the appropriate version number and then press Enter.

   The system responds:

   ```
   Enter the minor version number for your adapter; default='0':
   ```

7. Either press Enter to accept the default or type the appropriate minor version number and then press Enter.

The system responds:

```
Enter the vendor name for your adapter:
```

8. Enter the vendor's name and press Enter.

   The system responds:

   ```
   Enter an adapter logical name; default='default_name':
   ```

9. Either press Enter to accept the default or type the adapter logical name you want to use. Press Enter. The default adapter logical name (*'default_name'*) is based upon the WebLogic Integration recommended format of *vendor name_EIS-type_version-number*.

   The system responds:

   ```
   Enter the Java package base name for your adapter
   (e.g. sample adapter's is sample): Java package base name
   ```

10. Enter the Java package base name in package format and press Enter. Package format is dot-separated and begins with your URL extension (`.com`, `.org`, `.edu`, and so on), followed by the company name, then by additional adapter identifiers; for example, `com.your_co.adapter.EIS`.

    The system responds:

    ```
    The following information will be used to generate your new
    adapter development environment:

    EIS Type = 'SAP R/3'

    Description = 'description'

    Major Version = '1'

    Minor Version = '0'

    Vendor = 'vendor_name'

    Adapter Logical Name = 'adapter_logical_name'

    Java Package Base = 'com.java.package.base'

    Are you satisfied with these values? (enter yes or no or q to
    quit);

    default='yes':
    ```

11. To confirm the information, press Enter.

    The system responds with the appropriate build information.

Note: If you enter no, you will be routed back to Step 4. If you enter q (quit), the application will terminate.

Step 2. Rebuild the Tree

After completing the clone process, change to the new directory and use Ant, the ADK's build tool to rebuild the entire tree. For more information on Ant, see "Ant-Based Build Process" on page 3-4.

To rebuild the tree by using Ant, do the following:

1. Edit `antEnv.cmd` (Windows) or `antEnv.sh` (Unix) in `WLI_HOME/adapters/ADAPTER/utils`.
2. Set the following variables to valid paths:
   - `BEA_HOME` - The top-level directory for your BEA products; for example, `c:/bea`.
   - `WLI_HOME` - The location of your WebLogic Integration directory.
   - `JAVA_HOME` - The location of your Java Development Kit.
   - `WL_HOME` - The location of your WebLogic Server directory.
   - `ANT_HOME` - The location of your Ant home, typically `WLI_HOME/adapters/utils`.

   Note: The installer will perform this step for you; however, you should be aware that these settings control the Ant process.

   On Unix, the Ant file in `WLI_HOME/adapters/utils` needs to have an execute permission set. To add the execute permission, type: `chmod u+x ant.sh`.
3. Execute `antEnv` from the command-line to set the necessary environment variables for your shell.
4. Execute `ant release` from the `WLI_HOME/adapters/ADAPTER/project` directory to build the adapter (where `ADAPTER` is the name of the new adapter development root).

   Executing `ant release` will generate the Javadoc for the adapter. You can view the Javadoc by going to:

`WLI_HOME/adapters/ADAPTER/docs/`

This file provides environment specific instructions for deploying your adapter in WebLogic Integration. Specifically, it provides `config.xml` entries and the replacements for the path already made. In addition, the file provides mapping information. You can copy the contents of `overview.html` directly into `config.xml`, which will facilitate adapter deployment, as described in "Step 3. Deploy the Adapter to WebLogic Integration" on page 4-6.

Step 3. Deploy the Adapter to WebLogic Integration

After rebuilding the new adapter, deploy it into WebLogic Integration. You can deploy an adapter either manually or from the WebLogic Server Console. See Chapter 9, "Deploying Adapters," for complete information.

CHAPTER

5 Using the Logging Toolkit

Logging is an essential feature of an adapter component. Most adapters are used to integrate different applications and do not interact with end users while processing data. Unlike the behavior of a front-end component, when an adapter encounters an error or warning condition, it cannot stop processing and wait for an end-user to respond.

With the ADK, you can log adapter activity by implementing a logging framework. This framework gives you the ability to log internationalized and localized messages to multiple output destinations. It provides a range of configuration parameters you can use to tailor message category, priority, format, and destination.

This section contains information on the following subjects:

- Logging Toolkit
- Logging Configuration File
- Logging Concepts
- How to Set Up Logging
- Logging Framework Classes
- Internationalization and Localization of Log Messages
- Saving Contextual Information in a Multi-Threaded Component

Logging Toolkit

The ADKs logging toolkit allows you to log internationalized messages to multiple output destinations. The logging toolkit leverages the work of the open source project Apache Log4j. This product includes software developed by the Apache Software Foundation (http://www.apache.org).

The logging toolkit is a framework that wraps the necessary Log4j classes to provide added functionality for J2EE-compliant adapters. It is provided in the logtoolkit.jar file under: WLI_HOME/lib. This .jar file depends on DOM, XERCES, and Log4j. The XERCES dependency is satisfied by weblogic.jar and xmlx.jar provided in the WebLogic Server distribution. The WebLogic Integration distribution includes the required version of Log4j, log4j.jar, in WLI_HOME/lib.

The Log4j package is distributed under the Apache public license, a full-fledged open source license certified by the open source initiative. The latest Log4j version, including full-source code, class files and documentation can be found at the Apache Log4j Web site (http://www.apache.org).

Logging Configuration File

Throughout this section, you will see references to and code snippets from the logging configuration file. This file is an .xml file that is identified by the adapter logical name; for example, BEA_WLS_DBMS_ADK.xml. It contains the base information for the four logging concepts discussed in “Logging Concepts” on page 5-3 and can be modified for your specific adapter.

The ADK provides a basic logging configuration file, BEA_WLS_SAMPLE_ADK.xml, in WLI_HOME/adapters/sample/src. To modify this file for your adapter, run GenerateAdapterTemplate. This utility will customize the sample version of the logging configuration file with information pertinent to your new adapter and place the customized version in the new adapter’s development environment. For more information on GenerateAdapterTemplate, see Chapter 4, “Creating a Custom Development Environment.”

Logging Concepts

Prior to using the logging toolkit provided with the ADK, you should understand a few key concepts of the logging framework. Logging has four main components:

- Message Categories
- Message Priority
- Message Appenders
- Message Layout

These components work together to enable you to log messages according to message type and priority, and to control at run time how these messages are formatted and where they are reported.

Message Categories

Categories identify log messages according to criteria you defined and are a central concept of the logging framework. In the ADK, a category is identified by its name, such as `BEA_WLS_SAMPLE_ADK.DesignTime`.

Categories are hierarchically defined. That is, any category can inherit properties from parent categories. The hierarchy is defined thusly:

- A category is an ancestor of another category if its name followed by a dot is a prefix of the descendant category name.
- A category is a parent of a child category if there are no ancestors between itself and the descendant category.

For example, `BEA_WLS_SAMPLE_ADK.DesignTime` is a descendant of `BEA_WLS_SAMPLE_ADK`, which is a descendant of the root category. For example:

```
ROOT CATEGORY
  |
  |->BEA_WLS_SAMPLE_ADK
       |
       |->BEA_WLA_SAMPLE.ADK.DesignTime
```

The root category resides at the top of the category hierarchy; it always exists and it cannot be retrieved by name.

When you create categories, you should name them according to components in their adapter. For example, if an adapter has a design-time user interface component, the adapter could have a category, `BEA_WLS_SAMPLE_ADK.DesignTime`.

Message Priority

Every message has a priority that indicates its importance. Message priority is determined by the method on the ILogger interface used to log the message. In other words, calling the debug method on an ILogger instance generates a debug message.

The logging toolkit supports five possible priorities for a given message, as described in Table 5-1:

Table 5-1 Logging Toolkit Priorities

Priority	Description
`AUDIT`	Indicates an extremely important log message that relates to the business processing performed by an adapter. Messages with this priority will always be written to the log output.
`ERROR`	Indicates an error in the adapter. Error messages are internationalized/localized for the user.
`WARN`	Indicates a situation that is not an error, but could cause problems in the adapter. A warning message that is internationalized/localized for the user.
`INFO`	Indicates an informational message that is internationalized/localized for the user.
`DEBUG`	Indicates a debug message, which are used to determine how the internals of a component are working and are typically not internationalized.

The `BEA_WLS_SAMPLE_ADK` category has priority `WARN` because of the following child element:

```
<priority value='WARN' class='com.bea.logging.LogPriority'/>
```

The class for the priority must be `com.bea.logging.LogPriority`.

Assigning a Priority to a Category

You can assign a priority to a category. If a given category is not assigned a priority, it inherits one from its closest ancestor with an assigned priority; that is, the inherited priority for a given category is equal to the first non-null priority in the category hierarchy, starting at the given category and proceeding upwards in the hierarchy towards the root category.

A log message will be output to the log destination if its priority is higher than or equal to the priority of its category. Otherwise, the message will not be written to the log destinations. A category without an assigned priority will inherit one from the hierarchy. To ensure that all categories can eventually inherit a priority, the root category always has an assigned priority. A log statement of priority p in a category with inherited priority q, is enabled if p >= q. This rule assumes that priorities are ordered as follows: `DEBUG` < `INFO` < `WARN` < `ERROR` < `AUDIT`.

Message Appenders

The logging framework allows an adapter to log to multiple destinations by using an interface called an appender. Log4j provides appenders for:

- The console
- Files
- Remote socket servers
- NT Event Loggers
- Remote Unix Syslog daemons

In addition, the ADK log toolkit provides an appender that you can specify to output the log message to your WebLogic Server log.

A category may refer to multiple appenders. Each enabled logging request for a given category will be forwarded to all the appenders in that category, as well as the appenders higher in the hierarchy. In other words, appenders are inherited additively from the category hierarchy. For example, if a console appender is added to the root category, then all enabled logging requests will at least print on the console. If in addition a file appender is added to category “C,” then enabled logging requests for C

and C's children will print to a file and on the console. It is possible to override this default behavior so that appender accumulation is no longer additive by setting the additivity flag to false.

Note: If you have also added the console appender to directly to C, you will get two messages—one from C and one from the root—on the console. This is because the root category always logs to the console.

Listing 5-1 shows an appender for the WebLogic Server log:

Listing 5-1 Sample Code Showing an Appender for the WebLogic Server Log

```
<!--

  A WeblogicAppender sends log output to the Weblogic log. If
running outside of

  WebLogic, the appender writes messages to System.out

  -->

  <appender name="WebLogicAppender"
     class="com.bea.logging.WeblogicAppender"/>

</appender>
```

Message Layout

By using Log4j, you can also customize the format of a log message. This is accomplished by associating a layout with an appender. The layout is responsible for formatting a log message while an appender directs the formatted message to its destination. The log toolkit typically uses the PatternLayout to format its log messages. The PatternLayout, part of the standard Log4j distribution, lets you specify the output format according to conversion patterns similar to the C language `printf` function.

For example, the PatternLayout with the conversion pattern `%-5p%d{DATE} %c{4} %x - %m%n` will output a message like:

```
AUDIT 21 May 2001 11:00:57,109 BEA_WLS_SAMPLE_ADK - admin opened
connection to EIS
```

In the pattern,

- `%-5p` displays the priority of the message; in the example shown above, this is `AUDIT`
- `%d{DATE}` displays the date of the message; in the example shown above, this is `21 May 2001 11:00:57,109`
- `%c{4}` displays the category for the log message; in the example shown above, this is `BEA_WLS_SAMPLE_ADK`

The text after the "-" is the message of the statement.

Putting the Components Together

Listing 5-2 declares a new category for the sample adapter, sets its priority, and declares an appender to output log messages to a file:

Listing 5-2 Sample XML Code for Declaring a New Log Category

```
<!-

IMPORTANT!!! ROOT Category for the adapter; making this unique
prevents other adapters from logging to your category

-->

<category name='BEA_WLS_SAMPLE_ADK' class='com.bea.logging.
   LogCategory'>

  <!-
    Default Priority Level; may be changed at runtime
    DEBUG means log all messages from the adapter's code base
    INFO means log informationals, warnings, errors, and audits
    WARN means log warnings, errors, and audits
    ERROR means log errors and audits
    AUDIT means log audits only
  -->

    <priority value='WARN' class='com.bea.logging.LogPriority'/>

   <appender-ref ref='WebLogicAppender'/>

</category>
```

Note: You must specify the class as `com.bea.logging.LogCategory`.

How to Set Up Logging

Note: The following procedure assumes that you have cloned a development environment by running the GenerateAdapterTemplate utility. For more information on this utility, see Chapter 4, "Creating a Custom Development Environment."

Setting up the logging framework for your adapter is a four-step process.

1. Identify all of the basic components used in the adapter. For example, if your adapter has an EventGenerator, you might want to have an EventGenerator component; if it supports a design-time GUI, you will need a design-time component.
2. Open the base log configuration file from the cloned adapter. This file is found in `WLI_HOME/adapters/ADAPTER/src/` and will have the extension `.xml`. For example, the DBMS adapter configuration file is in `WLI_HOME/adapters/dbms/src`. It's called `BEA_WLS_DBMS_ADK.xml`.
3. In the base log configuration file, add the category elements for all adapter components you identified. For each category element, establish a priority. Listing 5-3 shows how a category for an EventGenerator with a priority of DEBUG is added.

Listing 5-3 Sample Code Adding an EventGenerator Log Category with a Priority of DEBUG

```
<category name='BEA_WLS_DBMS_ADK.EventGenerator'
            class='com.bea.logging.LogCategory'>
    <priority value='DEBUG'
              class='com.bea.logging.LogPriority'/>
</category>
```

4. Determine the appender and add it to the configuration file. If necessary, add message formatting information. Listing 5-4 shows how a basic file appender is added within the `<appender>` element. Instructions within the `<layout>` element identify the message format pattern.

   Note: In this version of WebLogic Integration, all sample adapters use the `WebLogicAppender` by default.

Listing 5-4 Sample Code Adding a File Appender and Layout Pattern

```
<!-- A basic file appender -->
<appender name='FileAppender'
   class='org.apache.Log4j.FileAppender'>
    <!-- Send output to a file -->
    <param name='File' value='BEA_WLS_DBMS_ADK.log'/>
    <!-- Truncate existing -->
    <param name="Append" value="true"/>
    <!-- Use a basic LOG4J pattern layout -->
    <layout class='org.apache.Log4j.PatternLayout'>
      <param name='ConversionPattern' value='%-5p %d{DATE} %c{4}
         %x - %m%n'/>
    </layout>
</appender>
```

At this point, you should review these other configuration files to confirm their settings:

- `WLI_HOME/adapters/ADAPTER/src/eventrouter/web-inf/web.xml`; The AbstractEventGenerator uses the logging information entered in the base configuration file to configure the log framework at initialization time.
- `WLI_HOME/adapters/ADAPTER/src/rar/META-INF/ra.xml and weblogic-ra.xml`; The `AbstractManagedConnectionFactory` uses the logging information entered in the base configuration file to configure the log framework at initialization time.
- `WLI_HOME/adapters/ADAPTER/src/war/web-inf/web.xml`; The `RequestHandler` (the parent of `AbstractDesignTimeRequestHandler`) uses

the logging information entered in the base configuration file to configure the log framework at initialization time.

In the preceding paths, `ADAPTER` is the name of your adapter; for example, for the DBMS sample adapter, the path would be:

```
WLI_HOME/adapters/dbms/src/rar/META-INF/ra.xml
```

Logging Framework Classes

In addition to understanding the basic concepts of the logging framework, you will also need to understand three main classes provided in the log toolkit:

- `com.bea.logging.ILogger`
- `com.bea.logging.LogContext`
- `com.bea.logging.LogManager`

com.bea.logging.ILogger

This is the main interface to the logging framework. It provides numerous convenience methods for logging messages.

In "How to Set Up Logging" on page 5-8, you saw how you can configure logging in the base log configuration file. You can also configure logging programmatically by implementing the logging methods listed below:

- `logger.setPriority("DEBUG");` changes the minimum priority of messages printed from the current ILogger.
- `logger.addRuntimeDestination (writer);` adds an additional appender used when the container passes its `PrintWriter` to the adapter.
- `logger.warn("Some message", true);` logs a message with the priority level `WARN`, without using the `ResourceBundle`. The boolean indicates that the string is a message, not a key.

- `logger.warn("someKey");` logs a message with the priority level `WARN`, by looking it up with `"someKey"` in the `ResourceBundle`.
- `logger.info("someKey", anObjArray);` logs a message with the priority level `INFO` by looking up a template with `someKey` in the `ResourceBundle` and filling in the blanks with the elements of `anObjArray`.
- `logger.error(exception);` logs a message with the priority level `ERROR`, by passing an exception (Throwable) to this method. It will call `getMessage()`, and include a stack trace. All logging methods that take a Throwable as an argument log a stack trace.

com.bea.logging.LogContext

This class encapsulates information needed to identify an ILogger instance in the logging framework. Currently, a LogContext encapsulates a log category name and a locale, such as `en_US`. This class is the primary key for uniquely identifying an `ILogger` instance in the log manager.

com.bea.logging.LogManager

This class provides a method to allow you to configure the logging framework and provides access to `ILogger` instances.

To properly configure the log toolkit for your adapter, the ADK implements the `LogManager`'s `configure()` method with the arguments shown in Listing 5-5:

Listing 5-5 Sample Code for Configuring the Log Toolkit

```
public static LogContext
   configure(String strLogConfigFile,
             String strRootLogContext,
             String strMessageBundleBase,
             Locale locale,
              ClassLoader classLoader)
```

Table 5-2 describes the arguments passed by `configure()`:

Table 5-2 `configure()` Arguments

Argument	Description
`strLogConfigFile`	This file contains the log configuration information for your adapter. The file should exist on the classpath. We recommend that you include this file into your adapter's main `.jar` file so that it can be included in the `.war` and `.rar` files for your adapter. This file should conform to the `Log4j.dtd`. The `Log4j.dtd` file is provided in the `Log4j.jar` in the WebLogic Integration distribution.
`strRootLogContext`	This is the name of the logical root of the category hierarchy for your adapter. For the sample adapter, this value is `BEA_WLS_SAMPLE_ADK`.
`strMessageBundleBase`	This is the base name for the message bundles for your adapter. It is required by the ADK that you use message bundles. For the sample adapter, this value is `BEA_WLS_SAMPLE_ADK`.
`locale`	This identifies the locale (language and nation). The logging toolkit organizes categories into different hierarchies based on locale. For example, if your adapter supports two locales `en_US` and `fr_CA`, the log toolkit will maintain two category hierarchies, one for `en_US` and one for `fr_CA`.
`classLoader`	This is the `ClassLoader` the `LogManager` should use to load resources, such as `ResourceBundles` and log configuration files.

Once the configuration is complete, you can retrieve `ILogger` instances for your adapter by supplying a `LogContext` object:

Listing 5-6 Sample Code for Supplying a LogContext Object

```
LogContext logContext = new LogContext("BEA_WLS_SAMPLE_ADK",
   java.util.Locale.US);
```

```
ILogger logger = LogManager.getLogger(logContext);
logger.debug("I'm logging now!");
```

The ADK hides most of the log configuration and setup for you. The `com.bea.adapter.spi.AbstractManagedConnectionFactory` class configures the log toolkit for service adapters and the `AbstractEventGenerator` configures the log toolkit for event adapters. In addition, all of the Client Connector Interface (CCI) and Service Provider Interface (SPI) base classes provided in the ADK provide access to an `ILogger` and its associated `LogContext`.

For other layers in the adapter to access the correct `ILogger` object, there are two approaches you can take.

Note: "Other layers" refers to layers in an adapter that support the CCI/SPI layer, such as a socket layer for establishing communication to the EIS.

- **Approach 1**: The CCI/SPI layers can pass the `LogContext` object into the lower layers. This works but also adds overhead.
- **Approach 2**: The CCI layer can establish the `LogContext` for the current running thread at the earliest possible place in the code. The ADK's `com.bea.adapter.cci.ConnectionFactoryImpl` class sets the `LogContext` for the current running thread in the `getConnection()` methods. The `getConnection()` methods are the first point of contact a client program has with your adapter. Consequently, lower layers in an adapter can safely access the `LogContext` for the current running thread by using the code in:

Listing 5-7 Code Accessing `LogContext` for the Current Thread

```
public static LogContext getLogContext(Thread t)
   throws IllegalStateException, IllegalArgumentException
```

Additionally, we supply a convenience method on the `LogManager`:

```
public static ILogger getLogger() throws IllegalStateException
```

This method provides an `ILogger` for the current running thread. There is one caveat to using this approach: lower layers should not store the `LogContext` or `ILogger` as members. Rather, they should dynamically retrieve them from the

LogManager. An IllegalStateException is thrown if this method is called before a LogContext is set for the current running thread.

Internationalization and Localization of Log Messages

Internationalization (I18N) and localization (L10N) are central concepts to the ADK logging framework. All logging convenience methods on the `ILogger` interface, except the debug methods, allow I18N. The implementation follows the Java Internationalization standards, using `ResourceBundle` objects to store locale-specific messages or templates. Sun MicroSystems provides a good online tutorial on using the I18N and L10N standards of the Java language.

Saving Contextual Information in a Multi-Threaded Component

Most real-world systems have to deal with multiple clients simultaneously. In a typical multi-threaded implementation of such a system, different threads will handle different clients. Logging is especially well suited to trace and debug complex distributed applications. A common approach to differentiate the logging output of one client from another is to instantiate a new separate category for each client. This promotes the proliferation of categories and increases the management overhead of logging.

A lighter technique is to uniquely stamp each log request initiated from the same client interaction. Neil Harrison described this method in “Patterns for Logging Diagnostic Messages” in *Pattern Languages of Program Design 3*, edited by R. Martin, D. Riehle, and F. Buschmann (CITY: Addison-Wesley, 1997).

To uniquely stamp each request, the user pushes contextual information into the Nested Diagnostic Context (NDC). The log toolkit provides a separate interface for accessing NDC methods. The interface is retrieved from the ILogger by using the method `getNDCInterface()`.

NDC printing is turned on in the XML configuration file (with the symbol `%x`). Every time a log request is made, the appropriate logging framework component includes the entire NDC stack for the current thread in the log output. The user will not need to intervene in this process. In fact, the user is responsible only for placing the correct information in the NDC by using the push and pop methods at a few well-defined points in the code.

Listing 5-8 Sample Code

```
public void someAdapterMethod(String aClient) {
    ILogger logger = getLogger();

  INestedDiagnosticContext ndc = logger.getNDCInterface();

  // I'm keeping track of this client name for all log messages

  ndc.push("User name=" + aClient);

  // method body …

  ndc.pop();

  }
```

A good place to use the NDC is in your adapter's CCI `Interaction` object.

6 Developing a Service Adapter

Service adapters receive an XML request document from a client and invoke the associated function in the underlying EIS. They are consumers of messages and may or may not provide a response. Service adapters perform the following four functions:

- They receive service requests from an external client.
- They transform the XML request document into the EIS specific format. The request document conforms to the request XML schema for the service. The request XML schema is based on metadata in the EIS.
- They invoke the underlying function in the EIS and wait for its response.
- They transform the response from the EIS specific data format to an XML document that conforms to the response XML schema for the service. The response XML schema is based on metadata in the EIS.

This section contains information on the following subjects:

- Service Adapters in the Run-Time Environment
- The Flow of Events
- Step 1: Development Considerations
- Step 2: Configuring the Development Environment
- Step 3: Implementing the SPI
- Step 4: Implementing the CCI
- Step 5: Testing the Adapter

- Step 5: Testing the Adapter

J2EE-Compliant Adapters Not Specific to WebLogic Integration

The steps outlined in this chapter are directed primarily at developing adapters for use with WebLogic Integration. You can also use the ADK to develop adapters that can be used outside of the WebLogic Integration environment by following the steps herein, but modifying them as described in Appendix A, “Creating an Adapter Not Specific to WebLogic Integration.”

Service Adapters in the Run-Time Environment

Figure 6-1 and Figure 6-2 show the processes executed when a service adapter is used in the run-time environment. Figure 6-1 shows an asynchronous service adapter while Figure 6-2 shows a synchronous adapter.

Figure 6-1 An Asynchronous Service Adapter in the Run-Time Environment

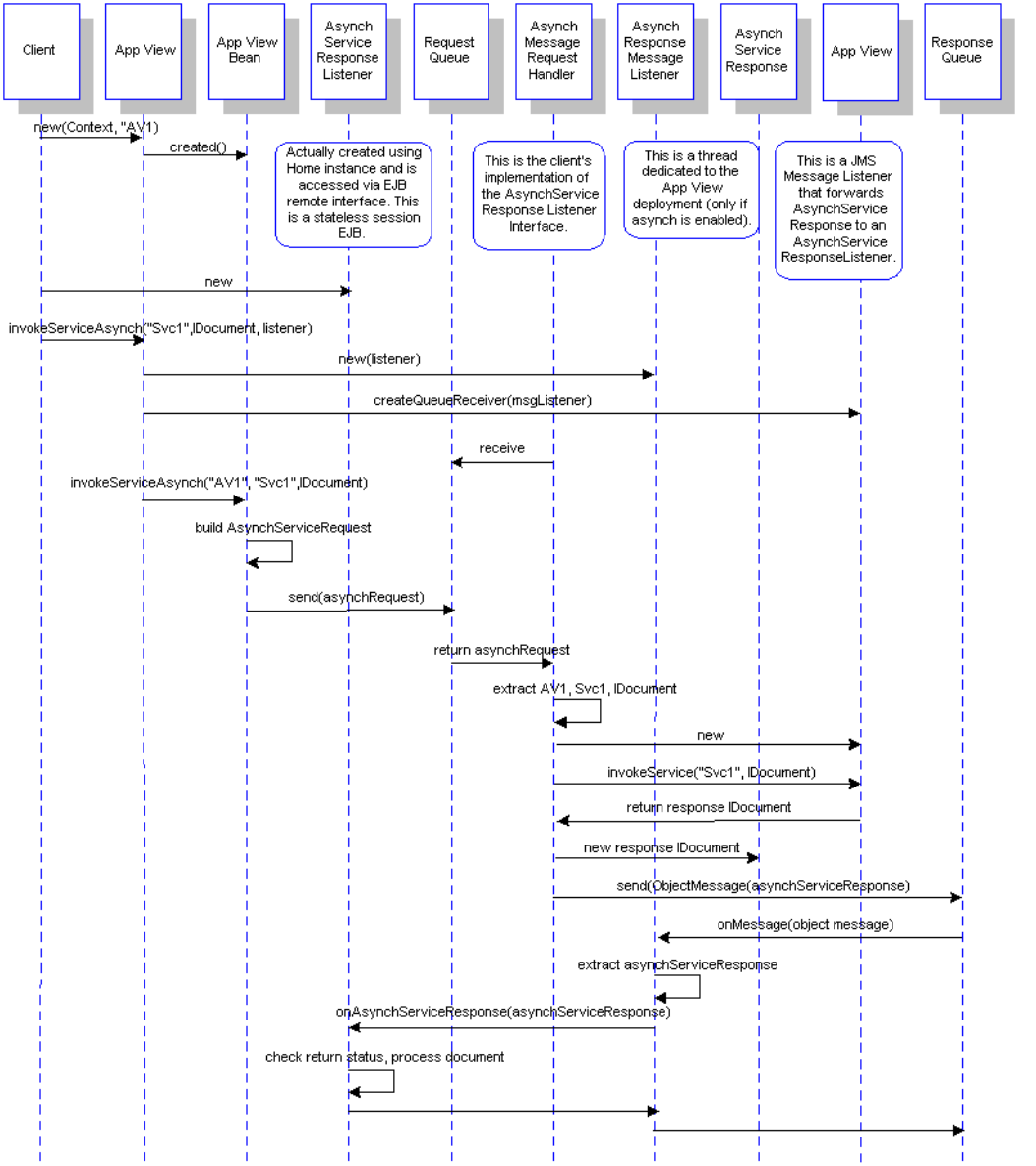
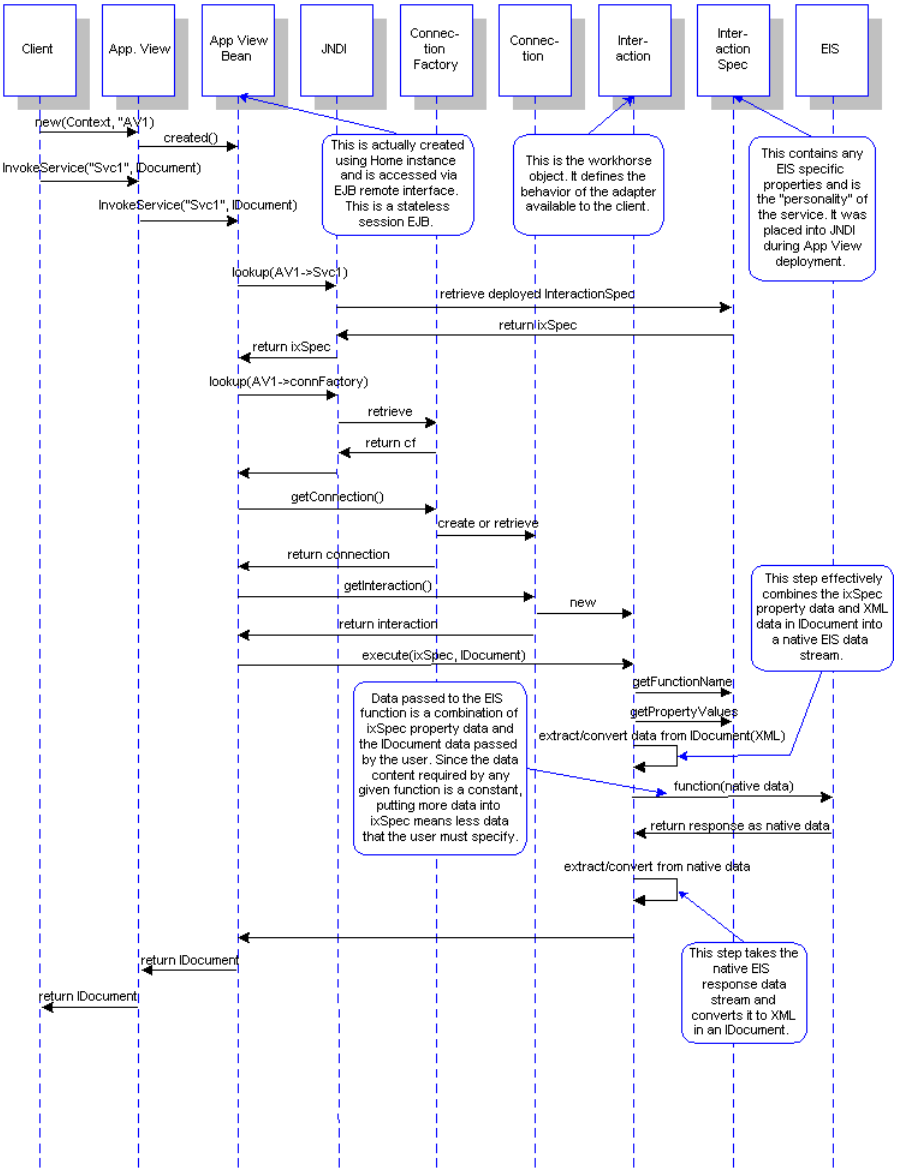


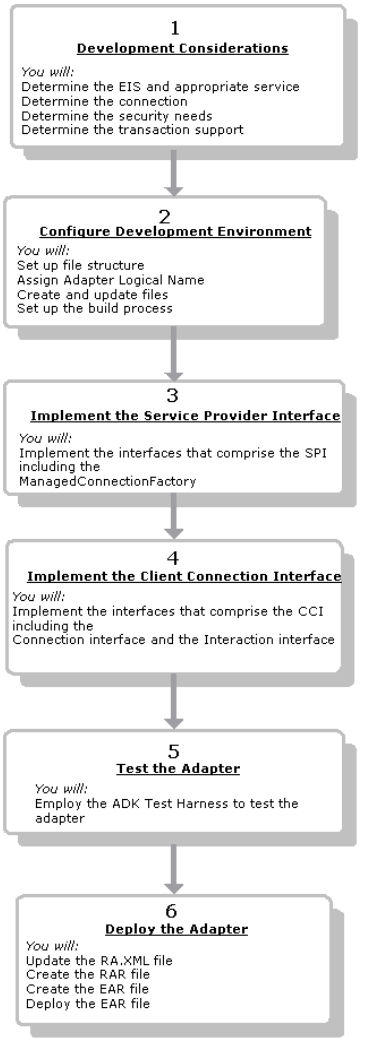
Figure 6-2 Synchronous Service Adapter in the Run-Time Environment



The Flow of Events

Figure 6-3 outlines the steps required to develop a Service Adapter.

Figure 6-3 Service Adapter Flow of Events



Step 1: Development Considerations

You will need to consider the items listed below before commencing with service adapter development. The Adapter Setup Worksheet will provide much of this information. See Appendix D, “Adapter Setup Worksheet.”

- Determine the EIS and the appropriate service.

  You need to identify the EIS and the type of service required for this adapter; that is, based upon your knowledge of the EIS, you must identify the interface to the back-end functionality.

- Determine the expensive connection object.

  You need to determine the “expensive” connection object required to invoke a function within the EIS. The expensive connection object is a resource required to communicate with the EIS and requires the allocation of system resources; for example, a socket connection or DBMS connection. A valuable asset of J2EE Connector Architecture is that the application server provides pooling of these objects. Therefore, you must determine this object for your adapter, as it will need to be pooled by the application server.

- Determine the security needs.

  You need to consider and understand how to pass connection authentication across the connection request path. To do this, your adapter will need to implement a `connectionRequestInfo` class. The ADK provides the class `ConnectionRequestInfoMap` to map authorization information, such as username and password, to the connection to facilitate `ConnectionRequestInfo` implementation.

  The ADK conforms to the *J2EE Connector Architecture Specification 1.0*. For more information on connection architecture security, please refer to “Security” in that document. Go to `http://java.sun.com/j2ee/` to download the specification.

  The *J2EE Connector Architecture Specification 1.0* will download as a `.pdf` file.

- Determine transaction support.

  You need to identify which type of transaction demarcation support to implement with the adapter:

- Local transaction demarcation
- XA-compliant transaction demarcation

Note: For more information on transaction demarcation support, please see "Transaction Demarcation" on page 6-24 or:

http://java.sun.com/j2ee/blueprints/transaction_management/platform/index.html

Step 2: Configuring the Development Environment

This step describes the processes you must complete to prepare your computer for adapter development.

Note: The steps described below can be completed simply be running the GenerateAdapterTemplate utility. For more information on using this utility, see Chapter 4, "Creating a Custom Development Environment."

Step 2a: Set Up the File Structure

Installing WebLogic Integration creates the file structure necessary not only to run an adapter, but also to use the ADK. The ADK files appear under `WLI_HOME/adapters/`, where `WLI_HOME` is the directory where you installed WebLogic Integration. You need to verify that, upon installation, the necessary directories and files appear in your `WLI_HOME` directory. The file structure that follows under `WLI_HOME` is described in Table 6-1:

Table 6-1 ADK File Structure

File Path/Filename	Description
`adapters`	This directory contains the ADK.

Table 6-1 ADK File Structure (Continued)

File Path/Filename	Description
`adapters/src/war`	All files under this directory should be included in the `.war` file for an adapter. This directory contains `.jsp` files, `.html` files, images, etc.
`adapters/utils`	This directory contains a file used by the build process to timestamp `.jar` files.
`adapters/dbms`	This directory contains a sample J2EE-compliant adapter built with the ADK.
`adapters/dbms/docs`	This directory should contain the user guide, release notes, and installation guide for the sample adapter.
`adapters/email`	This directory contains a sample J2EE-compliant adapter built with the ADK.
`adapters/email/docs`	This directory should contain the user guide, release notes, and installation guide for the sample adapter.
`adapters/sample`	This directory contains a sample adapter that you can use to start developing their own adapter.
`adapters/sample/project`	This directory contains the Apache Jakarta Ant build file `build.xml`. This file contains build information for compiling the source code, generating the `.jar`, and `.ear` files, and for generating Javadoc information. See "Step 2c: Setting Up the Build Process" on page 6-10 for details on how to build the adapter.
`adapters/sample/src`	This directory contains all the source code for an adapter. It is up to you to decide to provide source code with your adapter.
`adapters/sample/src/BEA_WLS_SAMPLE_ ADK.properties`	This file contains messages used by the adapter for internationalization and localization.
`adapters/sample/src/BEA_WLS_SAMPLE_ADK.xml`	This file provides a basic configuration file for the logging framework. You should use this file to develop their own adapter logging configuration file.
`adapters/sample/src/eventrouter/WEB-INF/web.xml`	This is the configuration file for the event router Web application.

Table 6-1 ADK File Structure (Continued)

File Path/Filename	Description
`adapters/sample/src/rar/META-INF/ra.xml`	This file contains configuration information about a J2EE-compliant adapter. You should use this file as a guide on which parameters needed by the ADKs run-time framework.
`adapters/sample/src/rar/META-INF/weblogic-ra.xml`	This file contains configuration information about a J2EE-compliant adapter that is specific to the Weblogic Server J2EE engine. You should use this file as an example for setting up the `weblogic-ra.xml` file for their adapter. It is required for Weblogic Server.
`adapters/sample/src/sample`	This directory contains the source code for the adapter.
`adapters/sample/src/war`	All files under this directory should be included in the Web application archive (`.war`) file for an adapter. This directory contains `.jsp` files, `.html` files, images, and so on. For more information on Web applications for Weblogic Server, look here
`adapters/sample/src/war/WEB-INF/web.xml`	This is the Web application descriptor
`adapters/sample/src/war/WEB-INF/weblogic.xml`	The `weblogic.xml` file contains WebLogic-specific attributes for a Web Application.
`adapters/sample/src/ear/META-INF/application.xml`	`application.xml` is a J2EE application that contains a connector and Web application for configuring application views for the adapter.

Modifying the Directory Structure

When you clone a development tree by using GenerateAdapterTemplate, the file paths and files under `adapters/sample` are automatically cloned and updated to reflect the new development environment. The changes are reflected in the file `WLI_HOME/adapters/ADAPTER/docs/api/index.html` (where `ADAPTER` is the name of the new development directory). This file also contains code that you can copy and paste into the `config.xml` file for the new adapter that will set up WebLogic Integration to host the adapter.

Step 2b: Assign the Adapter Logical Name

Next, you need to assign the adapter's logical name. By convention, this name is comprised of the vendor name, the type of EIS connected to the adapter, and the version number of the EIS and is expressed as *vendor_EIS-type_EIS version*. For example:

```
BEA_WLS_SAMPLE_ADK
```

For more information on the adapter logical name, see "Adapter Logical Name" on page 2-6.

Step 2c: Setting Up the Build Process

The ADK employs a build process based upon Ant, a 100% pure Java-based build tool. For more information on Ant, please see "Ant-Based Build Process" on page 3-4. For more information on using Ant, see:

`http://jakarta.apache.org/ant/index.html`.

The sample adapter shipped with the ADK (located in `WLI_HOME/adapters/sample/project`) contains the file `build.xml`. This is the Ant build file for the sample adapter. It contains the tasks needed to build a J2EE-compliant adapter. Running the GenerateAdapterTemplate utility to clone a development tree for your adapter creates a `build.xml` file specifically for that adapter. This will free you from having to customize the sample `build.xml` and will ensure that the code is correct. For information on using the GenerateAdapterTemplate utility, see Chapter 4, "Creating a Custom Development Environment."

The Manifest File

Among the files created by GenerateAdapterTemplate is `MANIFEST.MF`, the manifest file. This file contains classloading instructions for each component that uses the file. A manifest file is created for each `/META-INF` directory except `ear/META-INF`.

Listing 6-1 shows an example of the manifest file included with the sample adapter.

Listing 6-1 Manifest File Example

```
Manifest-Version: 1.0

Created-By: BEA Systems, Inc.

Class-Path: BEA_WLS_SAMPLE_ADK.jar adk.jar bea.jar log4j.jar
 logtoolkit.jar xmltoolkit.jar wlai-common.jar wlai-ejb-client.jar
 xcci.jar
```

The first line of the file contains version information and the second line shows vendor information. The third line contains the relevant classpath or classloading instructions. The `Class-Path` property contains references to resources required by the component. It identifies the shared `.jar` files, which are separated by spaces. You must ensure that these `.jar` files are included in the shared area of the `.ear` file (see "Enterprise Archive (.ear) Files" on page 2-9).

Note: When the filename `MANIFEST.MF` appears in a `.war` file, it must appear in uppercase letters. If it does not, Unix will not recognize it and an error will occur.

build.xml Components

If you open `build.xml` and review its components, you will better understand how this file works. This section describes the prominent elements of `build.xml`.

Note: The following examples are taken from the sample adapter, *not* a cloned version thereof.

1. The first line you encounter:

   ```
   <project name='BEA_WLS_SAMPLE_ADK' default='all' basedir='.'>
   ```

   sets the name attribute of the root project element.

2. Listing 6-2 sets the archive file (`.jar`, `.war`, and `.rar`) names.

Listing 6-2 Setting Archive File Names

```
<property name='JAR_FILE' value='BEA_WLS_SAMPLE_ADK.jar'/>
<property name='RAR_FILE' value='BEA_WLS_SAMPLE_ADK.rar'/>
<property name='WAR_FILE' value='BEA_WLS_SAMPLE_ADK_Web.war'/>
<property name='EVENTROUTER_JAR_FILE'
  value='BEA_WLS_SAMPLE_ADK_EventRouter.jar'/>
<property name='EVENTROUTER_WAR_FILE'
  value='BEA_WLS_SAMPLE_ADK_EventRouter.war'/>
<property name='EAR_FILE' value='BEA_WLS_SAMPLE_ADK.ear'/>
```

3. Listing 6-3 shows a list of standard properties for the ADK. You should not need to alter them.

Listing 6-3 Standard ADK Properties

```
<property name='ADK' value='${WLI_LIB_DIR}/adk.jar'/>
<property name='ADK_WEB' value='${WLI_LIB_DIR}/adk-web.jar'/>
<property name='ADK_TEST' value='${WLI_LIB_DIR}/adk-test.jar'/>
<property name='ADK_EVENTGENERATOR' value='${WLI_LIB_DIR}/
  adk-eventgenerator.jar'/>
<property name='BEA' value='${WLI_LIB_DIR}/bea.jar'/>
<property name='LOGTOOLKIT' value='${WLI_LIB_DIR}/
  logtoolkit.jar'/>
<property name='WEBTOOLKIT' value='${WLI_LIB_DIR}/
  webtoolkit.jar'/>
<property name='WLAI_COMMON' value='${WLI_LIB_DIR}/
  wlai-common.jar'/>
<property name='WLAI_EJB_CLIENT' value='${WLI_LIB_DIR}/
  wlai-ejb-client.jar'/>
<property name='WLAI_EVENTROUTER' value='${WLI_LIB_DIR}/
  wlai-eventrouter.jar'/>
<property name='WLAI_EVENTROUTER_CLIENT' value='${WLI_LIB_DIR}/
  wlai-eventrouter-client.jar'/>
<property name='WLAI_SERVLET_CLIENT' value='${WLI_LIB_DIR}/
  wlai-servlet-client.jar'/>
<property name='XMLTOOLKIT' value='${WLI_LIB_DIR}/
  xmltoolkit.jar'/>
<property name='XCCI' value='${WLI_LIB_DIR}/xcci.jar'/>
```

To the list in Listing 6-3, you can add any additional `.jar` files and/or classes that are specific to your adapter.

4. Listing 6-4 sets up the `classpath` for compiling:

Listing 6-4 Sample for Setting the Classpath

```
<path id='CLASSPATH'>
   <pathelement location='${SRC_DIR}'/>
   <pathelement path='${ADK}:${ADK_EVENTGENERATOR}:
      ${ADK_WEB}:${ADK_TEST}:${BEA}:${LOGTOOLKIT}:${WEBTOOLKIT}
      :${WLAI_EJB_CLIENT}:${WLAI_COMMON}:${WLAI_EVENTROUTER}:
      ${XCCI}: ${XMLTOOLKIT}'/>
   <pathelement path='${XMLX_JAR}'/>
   <pathelement path='${LOG4J_JAR}:${JUNIT}'/>
   <pathelement path='${WEBLOGIC_JAR}:${env.BEA_HOME}'/>
</path>
```

To this information, you can add code that will produce the following:

- All the binaries and archives for the adapter:

Listing 6-5 Sample of Calling All Binaries and Archives

```
<target name='release' depends='all, apidoc'/>
   <!-- This target produces all the binaries and archives
   or the adapter -->
<target name='all' depends='ear'/>
```

- All the binaries and archives for the adapter, as well as the Javadoc:

  `<target name='release' depends='all,apidoc'/>`

- A version_info file for inclusion into archives, as shown in Listing 6-6:

Listing 6-6 Sample version_info File

```
<!-- This target produces a version_info file for inclusion into
archives -->
```

```
<target name='version_info'>
   <java classname='GenerateVersionInfo'>
      <arg line='-d${basedir}'/>
      <classpath>
         <pathelement path='${WLI_HOME}/adapters/utils:
            ${WEBLOGIC_JAR}:${XMLX_JAR}'/>
      </classpath>
   </java>
</target>
```

5. Listing 6-7 produce the `.jar` file for the adapter. This fileset element specifies what is included into the `.jar` file. Run-time aspects of the adapter are included in the main jar, while additional classes, such as the design-time GUI support classes, are included in the `.war` or other jar files.

Listing 6-7 Sample Code Setting `.jar` File Contents

```
<target name='jar' depends='packages,version_info'>
   <delete file='${LIB_DIR}/${JAR_FILE}'/>
   <mkdir dir='${LIB_DIR}'/>
   <jar jarfile='${LIB_DIR}/${JAR_FILE}'>
```

6. Listing 6-8 includes the “includes” list from the adapter's source directory. For the adapter described in these code samples, all the classes in the `sample/cci` and `sample/spi` packages are included, as well as the logging configuration file and message bundles.

Listing 6-8 Sample Code for Including the “Includes” List

```
<fileset dir='${SRC_DIR}'
   includes='sample/cci/*.class,sample/spi/*.class,
   sample/eis/*. class,*.xml,*.properties'/>
```

7. Listing 6-9 includes version information about the `.jar` file:

Listing 6-9 Setting `.jar` File Version Information

```
<!-- Include version information about the JAR file -->
   <fileset dir='${basedir}'
                  includes='version_info.xml'/>
</jar>
```

8. Listing 6-10 produces the J2EE adapter archive (`.rar`) file. The `.rar` file should contain all classes and `.jar` files that the adapter needs. This `.rar` can be deployed into any J2EE-compliant application server that the adapter depends upon. This example includes the following targets:
   - Version information for this `.rar` file.
   - The `deployment descriptor` for the adapter.

Listing 6-10 Sample Code for Creating the Connection Architecture `.rar` File

```
<target name='rar' depends='jar'>
<delete file='${LIB_DIR}/${RAR_FILE}'/>
   <mkdir dir='${LIB_DIR}'/>
   <jar jarfile='${LIB_DIR}/${RAR_FILE}'
      manifest='${SRC_DIR}/rar/META-INF/MANIFEST.MF'>
      <fileset dir='${SRC_DIR}/rar'includes='META-INF/ra.xml,
         META-INF/weblogic-ra.xml' excludes=
        'META-INF/MANIFEST.MF'/>
   </jar>
</target>
```

9. Listing 6-11 produces the J2EE Web application archive (`.war`) file. It also includes code that cleans up the existing environment:

Listing 6-11 Sample Code Producing the `.war` File

```
<target name='war' depends='jar'>
<!-- Clean-up existing environment -->

    <delete file='${LIB_DIR}/${WAR_FILE}'/>
    <copy file='${WLI_HOME}/adapters/src/war/WEB-INF/taglibs/
```

```
        adk.tld' todir='${SRC_DIR}/war/WEB-INF/taglibs'/>
      <java classname='weblogic.jspc' fork='yes'>
         <arg line='-d ${SRC_DIR}/war -webapp ${SRC_DIR}/
           war -compileAll -depend'/>
         <classpath refid='CLASSPATH'/>
      </java>

<!-- The first adapter should compile the common ADK JSPs -->

    <java classname='weblogic.jspc' fork='yes'>
      <arg line='-d ${WLI_HOME}/adapters/src/war -webapp
             ${WLI_HOME}/adapters/src/war -compileAll
      -depend'/>
      <classpath refid='CLASSPATH'/>
    </java>

<war warfile='${LIB_DIR}/${WAR_FILE}'
  webxml='${SRC_DIR}/war/WEB-INF/web.xml'
  manifest='${SRC_DIR}/war/META-INF/    MANIFEST.MF'>

<!--
IMPORTANT! Exclude the WEB-INF/web.xml file from
the WAR as it already gets included via the webxml attribute
above
-->

      <fileset dir="${SRC_DIR}/war" >
         <patternset >
           <include name="WEB-INF/weblogic.xml"/>
           <include name="**/*.html"/>
           <include name="**/*.gif"/>
         </patternset>
      </fileset>

<!--

IMPORTANT! Include the ADK design time framework into the
 adapter's design time Web application.

-->

      <fileset dir="${WLI_HOME}/adapters/src/war" >
         <patternset >
           <include name="**/*.css"/>
           <include name="**/*.html"/>
           <include name="**/*.gif"/>
            <include name="**/*.js"/>
         </patternset>
      </fileset>

<!-- Include classes from the adapter that support the design
 time UI -->
```

```
      <classes dir='${SRC_DIR}' includes='sample/web/*.class'/>
      <classes dir='${SRC_DIR}/war'includes='**/*.class'/>
      <classes dir='${WLI_HOME}/adapters/src/war' includes=
         '**/*.class'/>

<!--

Include all JARs required by the Web application under the
WEB-INF/lib directory of the WAR file that are not shared in the
EAR

-->

<lib dir='${WLI_LIB_DIR}' includes='adk-web.jar,
  webtoolkit.jar'/>
</war>
</target>
```

10. Listing 6-12 includes all `.jar` files required by the Web application to be included in the `<lib>` component of the `build.xml` file.

Listing 6-12 Sample Code to Include `.jar` Files Required by Web Application

```
<lib dir='${WLI_LIB_DIR}' includes='adk-web.jar,
    webtoolkit.jar'/>
```

11. Listing 6-13 includes the `.ear` file.

Listing 6-13 Sample Code to Include `.ear` File

```
<target name='ear' depends='rar,eventrouter_jar,war'>

    <delete file='${LIB_DIR}/${EAR_FILE}'/>

   <!-- include an eventrouter that shares the jars
   rather than includes them-->

   <delete file='${LIB_DIR}/${EVENTROUTER_WAR_FILE}'/>
   <delete dir='${SRC_DIR}/eventrouter/WEB-INF/lib'/>

    <war warfile='${LIB_DIR}/${EVENTROUTER_WAR_FILE}
      'webxml='${SRC_DIR}/eventrouter/WEB-INF/web.xml
```

```
        'manifest='${SRC_DIR}/eventrouter/META-INF/
        MANIFEST.MF'>

        <fileset dir='${basedir}' includes='version_info.xml'/>
        <fileset dir="${SRC_DIR}/eventrouter" >
           <patternset>
             <exclude name="WEB-INF/web.xml"/>
             <exclude name="META-INF/*.mf"/>
           </patternset>
        </fileset>

        <lib dir='${LIB_DIR}' includes='${EVENTROUTER_JAR_
           FILE}'/>
        <lib dir='${WLI_LIB_DIR}'includes=
             'adk-eventgenerator.jar,wlai-eventrouter.jar,
            wlai-servlet-client.jar'/>
      </war>

      <jar jarfile='${LIB_DIR}/${EAR_FILE}'>
        <fileset dir='${basedir}' includes='version_info.xml'/>
        <fileset dir='${SRC_DIR}/ear' includes=
                'application.xml'/>
        <fileset dir='${LIB_DIR}'includes='${JAR_FILE},
           ${RAR_FILE}, ${WAR_FILE},${EVENTROUTER_WAR_FILE}'/>
        <fileset dir='${WLI_LIB_DIR}'includes='adk.jar,bea.jar,
           logtoolkit.jar,xcci.jar,xmltoolkit.jar'/>
        <fileset dir='${WLI_LIB_DIR}'includes='log4j.jar,
           wlai-common.jar,wlai-ejb-client.jar'/>
      </jar>

      <delete file='${LIB_DIR}/${EVENTROUTER_WAR_FILE}'/>
      <delete file='${LIB_DIR}/${EVENTROUTER_JAR_FILE}'/>
      <delete file='${LIB_DIR}/${WAR_FILE}'/>
      <delete file='${LIB_DIR}/${RAR_FILE}'/>

  </target>
```

Within the `.ear` target, in Listing 6-14, is the EventRouter specific to the `.ear` deployment. This event router cannot be deployed by itself. Listing 6-14 shows how to include the event router.

Listing 6-14 Sample Code for Including `.ear`-specific EventRouter

```
    <delete file='${LIB_DIR}/${EVENTROUTER_WAR_FILE}'/>
    <delete dir='${SRC_DIR}/eventrouter/WEB-INF/lib'/>
```

```
<war warfile='${LIB_DIR}/${EVENTROUTER_WAR_FILE}
   'webxml='${SRC_DIR}/eventrouter/WEB-INF/web.xml
   'manifest='${SRC_DIR}/eventrouter/META-INF/
   MANIFEST.MF'>

   <fileset dir='${basedir}' includes='version_info.xml'/>
   <fileset dir="${SRC_DIR}/eventrouter" >
      <patternset >
         <exclude name="WEB-INF/web.xml"/>
         <exclude name="META-INF/*.mf"/>
      </patternset>
   </fileset>

   <lib dir='${LIB_DIR}' includes='${EVENTROUTER_
      JAR_FILE}'/>
   <libdir='${WLI_LIB_DIR}'
     includes='adk-eventgenerator.jar,
     wlai-eventrouter.jar,wlai-servlet-client.jar'/>

</war>
```

Within the `.ear` target, in Listing 6-14, you will also find all common or shared jars, as shown in Listing 6-15.

Listing 6-15 Sample Code Showing Inclusion of Common or Shared `.jar` Files

```
<jar jarfile='${LIB_DIR}/${EAR_FILE}'>

    <fileset dir='${basedir}' includes='version_info.xml'/>
    <fileset dir='${SRC_DIR}/ear' includes='application.xml'/>
    <fileset dir='${LIB_DIR}'includes='${JAR_FILE},${RAR_FILE},
       ${WAR_FILE},${EVENTROUTER_WAR_FILE}'/>
    <fileset dir='${WLI_LIB_DIR}'includes='adk.jar,bea.jar,
       logtoolkit.jar,xcci.jar,xmltoolkit.jar'/>
    <fileset dir='${WLI_LIB_DIR}'includes='log4j.jar,
       wlai-common.jar,wlai-ejb-client.jar'/>

</jar>
```

12. Listing 6-16 compiles all the Java source files for this project:

Listing 6-16 Sample Code for Compiling Java Source

```
<target name='packages'>
    <echo message='Building ${ant.project.name}...'/>
    <javac srcdir='${SRC_DIR}'>
       <classpath refid='CLASSPATH'/>
    </javac>
</target>
```

13. Next, you construct the EventRouter `.jar` file, as shown in Listing 6-17.

Listing 6-17 Sample Code Constructing the EventRouter `.jar` File

```
<target name='eventrouter_jar' depends='packages,version_info'>
    <delete file='${LIB_DIR}/${EVENTROUTER_JAR_FILE}'/>
        <jar jarfile='${LIB_DIR}/${EVENTROUTER_JAR_FILE}'>
           <fileset dir='${SRC_DIR}'
                        includes='sample/event/*.class'/>
           <fileset dir='${basedir}'
                        includes='version_info.xml'/>
        </jar>
</target>
```

14. Next, you will produce the J2EE `.war` file, as shown in Listing 6-18. This file is the event router used for stand-alone deployment.

Listing 6-18 Sample Code Producing the EventRouter Target for Stand-Alone Deployment

```
<target name='eventrouter_war' depends='jar,eventrouter_jar'>
    <delete file='${LIB_DIR}/${EVENTROUTER_WAR_FILE}'/>
    <delete dir='${SRC_DIR}/eventrouter/WEB-INF/lib'/>
       <war warfile='${LIB_DIR}/${EVENTROUTER_WAR_FILE}'webxml=
          '${SRC_DIR}/eventrouter/WEB-INF/web.xml'>
         <fileset dir='${basedir}' includes='version_info.xml'/>
         <fileset dir='${SRC_DIR}/eventrouter' excludes=
        'WEB-INF/web.xml'/>
    <lib dir='${LIB_DIR}' includes='${JAR_FILE},
       ${EVENTROUTER_JAR_FILE}'/>
```

```
    <lib dir='${WLI_LIB_DIR}'includes='adk.jar,
       adk-eventgenerator.jar,bea.jar,logtoolkit.jar,
       wlai-common.jar,wlai-ejb-client.jar,wlai-
       eventrouter.jar,wlai-servlet-client.jar,
       xmltoolkit.jar'/>
    <lib dir='${WLI_LIB_DIR}' includes='log4j.jar'/>
    </war>
</target>
```

15. Listing 6-19 generates the Javadoc.

Listing 6-19 Sample Code for Generating Javadocs

```
<target name='apidoc'>
    <mkdir dir='${DOC_DIR}'/>
    <javadoc sourcepath='${SRC_DIR}'
            destdir='${DOC_DIR}'
            packagenames='sample.*'
            author='true'
            version='true'
            use='true'
            overview='${SRC_DIR}/overview.html'
            windowtitle='WebLogic BEA_WLS_SAMPLE_ADK Adapter
               API Documentation'
            doctitle='WebLogic BEA_WLS_SAMPLE_ADK Adapter
                API Documentation'
            header='WebLogic BEA_WLS_SAMPLE_ADK Adapter'
            bottom='Built using the WebLogic Adapter
                 Development Kit (ADK)'>
        <classpath refid='CLASSPATH'/>
    </javadoc>
</target>
```

16. Listing 6-20 shows the targets that clean the files created by their counterparts:

Listing 6-20 Sample Code for Including Clean-Up Code

```
<target name='clean' depends='clean_release'/>
<target name='clean_release' depends='clean_all,clean_apidoc'/>
<target name='clean_all'depends='clean_ear,clean_rar,clean_war,
```

```
      clean_eventrouter_war,clean_test'/>
   <target name='clean_test'>
      <delete file='${basedir}/BEA_WLS_SAMPLE_ADK.log'/>
      <delete file='${basedir}/mcf.ser'/>
   </target>
   <target name='clean_ear' depends='clean_jar'>
      <delete file='${LIB_DIR}/${EAR_FILE}'/>
   </target>
   <target name='clean_rar' depends='clean_jar'>
      <delete file='${LIB_DIR}/${RAR_FILE}'/>
   </target>
   <target name='clean_war' depends='clean_jar'>
      <delete file='${LIB_DIR}/${WAR_FILE}'/>
      <delete dir='${WLI_HOME}/adapters/src/war/jsp_servlet'/>
   </target>
   <target name='clean_jar' depends='clean_packages,clean_version_
      info'>
      <delete file='${LIB_DIR}/${JAR_FILE}'/>
   </target>
   <target name='clean_eventrouter_jar'>
      <delete file='${LIB_DIR}/${EVENTROUTER_JAR_FILE}'/>
   </target>
   <target name='clean_eventrouter_war' depends='clean_
      eventrouter_jar'>
      <delete file='${LIB_DIR}/${EVENTROUTER_WAR_FILE}'/>
   </target>
   <target name='clean_version_info'>
      <delete file='${basedir}/version_info.xml'/>
   </target>
   <target name='clean_packages'>
      <delete>
         <fileset dir='${SRC_DIR}' includes='**/*.class'/>
      </delete>
   </target>
   <target name='clean_apidoc'>
      <delete dir='${DOC_DIR}'/>
   </target>

</project>
```

Step 2d: Create the Message Bundle

Any message destined for the end-user should be placed in a message bundle. The message bundle is simply a `.properties` text file that contains key=value pairs that allow you to internationalize messages. When a locale and national language are specified at run time, the contents of the message is interpreted, based upon the key=value pair, and the message is presented to the user in the correct language for his or her locale.

For instructions on creating a message bundle, please refer to the JavaSoft tutorial on internationalization at:

`http://java.sun.com/docs/books/tutorial/i18n/index.html`

Step 3: Implementing the SPI

The Service Provider Interface (SPI) contains the objects that provide and manage connectivity to the EIS, establish transaction demarcation, and provide a framework for service invocation. All J2EE-compliant adapters must provide an implementation for these interfaces in the `javax.resource.spi` package.

How to Use this Section

This section (“Step 3: Implementing the SPI”) contains descriptions of the interfaces you can use to implement the SPI. A minimum of three interfaces are necessary to complete the task (see “Basic SPI Implementation” on page 6-24). Each of these are described in detail, followed by a discussion of how they were extended in the sample adapter included with the ADK.

Following the three required interfaces, the additional interfaces are described in detail, including information regarding why you might use them and how they benefit an adapter.

Basic SPI Implementation

To implement the SPI for your adapter, you need to extend *at least* these three interfaces:

- `ManagedConnectionFactory`, which supports connection pooling by providing methods for matching and creating a ManagedConnection instance.
- `ManagedConnection`, which represents a physical connection to the underlying EIS.
- `ManagedConnectionMetaData`, which provides information about the underlying EIS instance associated with a `ManagedConnection` instance.

Ideally, you will implement these interfaces in the order specified above.

In addition to these three interfaces, you can implement any of the other interfaces described in this step, as your adapter needs dictate.

ManagedConnectionFactory

`javax.resource.spi.ManagedConnectionFactory`

`ManagedConnectionFactory` instance is a factory of both ManagedConnection and EIS-specific connection factory instances. This interface supports connection pooling by providing methods for matching and creating a `ManagedConnection` instance.

Transaction Demarcation

A critical component of the ManagedConnectionFactory is transaction demarcation. You will need to determine which statements in your program are included in a single transaction. J2EE defines a transaction management contract between an application server and an adapter (and its underlying resource manager). The transaction management contract has two parts, depending of the type of transaction:

- XA-compliant Transaction
- Local Transaction

XA-compliant Transaction

A `javax.transaction.xa.XAResource`-based contract occurs between a transaction manager and a resource manager in a distributed transaction processing (DTP) environment. A JDBC driver or a JMS provider implements this interface to support association between a global transaction and a database or message service connection.

The `XAResource` interface can be supported by any transactional resource that is intended for use by application programs in an environment where transactions are controlled by an external transaction manager; for example a database management system where an application accesses data through multiple database connections. Each database connection is enlisted with the transaction manager as a transactional resource. The transaction manager obtains an `XAResource` for each connection participating in a global transaction. The transaction manager uses the `start()` method to associate the global transaction with the resource; it uses the `end()` method to disassociate the transaction from the resource. The resource manager associates the global transaction to all work performed on its data between the `start()` and `end()` method invocation.

At transaction commit time, the resource managers are informed by the transaction manager to prepare, commit, or rollback a transaction according to the two-phase commit protocol.

Local Transaction

A local transaction management contract occurs when an adapter implements the `javax.resource.spi.LocalTransaction` interface to provide support for local transactions that are performed on the underlying resource manager. These contracts enable an application server to provide the infrastructure and run-time environment for transaction management. Application components rely on this transaction infrastructure to support their component-level transaction model.

For more information on transaction demarcation support, please refer to:

http://java.sun.com/j2ee/blueprints/transaction_management/platform/index.html

ADK Implementations

The ADK provides an abstract foundation for an adapter, the AbstractManagedConnectionFactory. This foundation provides the following feature:

- Provides basic support for internationalization/localization of exception and log messages for an adapter.
- Provides hooks into the log toolkit.
- Provides getter and setter methods for standard connection properties (username, password, server, connectionURL, port).
- Provides access to adapter metadata gathered from a `java.util.ResourceBundle` for an adapter.
- Allows adapter providers to plug in license checking into the initialization process for the factory. If the license verification fails, then client applications cannot get a connection to the underlying EIS, thus making the adapter useless.
- Provides state verification checking to support JavaBeans-style post-constructor initialization.

There are several key methods that you must supply implementations for. The following paragraphs describe these methods.

createConnectionFactory()

`createConnectionFactory()`, shown in Listing 6-21, is responsible for constructing the factory for application-level connection handles for the adapter. In other words, clients of your adapter will use the object returned by this method to obtain a connection handle to the EIS.

If the adapter supports a CCI interface, it is recommended that you return an instance of `com.bea.adapter.cci.ConnectionFactoryImpl` or an extension of this class. The key to implementing this method correctly is to propagate the ConnectionManager, LogContext, and ResourceAdapterMetaData into the client API.

Listing 6-21 createConnectionFactory() Example

```
protected Object
    createConnectionFactory(ConnectionManager connectionManager,
                            String strAdapterName,
                            String strAdapterDescription,
                            String strAdapterVersion,
                            String strVendorName)
    throws ResourceException
```

createManagedConnection()

`createManagedConnection()`, shown in Listing 6-22, is responsible for constructing a ManagedConnection instance for your adapter. The ManagedConnection instance encapsulates the expensive resources needed to communicate with the EIS. This method is called by the ConnectionManager when it determines a new ManagedConnection is required to satisfy a client's request. A common design pattern with adapters is to open the resources needed to communicate with the EIS in this method and then pass the resources into a new ManagedConnection instance.

Listing 6-22 createManagedConnection() Example

```
public ManagedConnection
    createManagedConnection(Subject subject, ConnectionRequestInfo
       info)
   throws ResourceException
```

checkState()

`checkState()` gets called by the AbstractManagedConnectionFactory before it attempts to perform any of its factory responsibilities. Use this method to verify that all members that need to be initialized before the ManagedConnectionFactory can perform its SPI responsibilities have been initialized correctly. Implement this method as shown here:

```
protected boolean checkState()
```

equals()

`equals()` tests the object argument for equality. It is important to implement this method correctly as it is used by the ConnectionManager for managing the connection pools. This method should include all important members in its equality comparison. Implement this method as shown here:

```
public boolean equals(Object obj)
```

hashCode()

`hashCode()` provides a hash code for the factory. It is also used by the ConnectionManager for managing the connection pools. Consequently, this method should generate a hashCode based upon properties that determine the uniqueness of the object. Implement this method as shown here:

```
public int hashCode()
```

matchManagedConnections()

Lastly, the ManagedConnectionFactory must supply an implementation of the `matchManagedConnections()` method. The AbstractManagedConnectionFactory provides an implementation of the `matchManagedConnections()` method that relies upon the `compareCredentials()` method on AbstractManagedConnection.

In order to provide logic that will match managed connections, you will need to override `AbstractManagedConnection`'s `compareCredentials()` method. This method is invoked when the ManagedConnectionFactory attempts to match a connection with a connection request for the ConnectionManager.

Currently, AbstractManagedConnectionFactory's implementation extracts a `PasswordCredential` from the supplied `Subject/ConnectionRequestInfo` parameters. If both parameters are null, this method returns true because it has already been established that the ManagedConnectionFactory for this instance is correct. Listing 6-23 shows this implementation:

Listing 6-23 compareCredentials() Implementation

```
public boolean compareCredentials(Subject subject,
                          ConnectionRequestInfo info)
            throws ResourceException
     {
       ILogger logger = getLogger();
```

Next, you need to extract a PasswordCredential from either the JAAS Subject or the SPI ConnectionRequestInfo using the ADK's `ManagedConnectionFactory`. An example is shown in Listing 6-24:

Listing 6-24 Extracting a PasswordCredential

```
PasswordCredential pc = getFactory().
getPasswordCredential(subject, info);
     if (pc == null)
     {
       logger.debug(this.toString() + ": compareCredentials
```

In the example shown in Listing 6-24, JAAS Subject and ConnectionRequestInfo are null, which assumes a match. This method will not get invoked unless it has already been established that the factory for this instance is correct. Consequently, if the Subject and ConnectionRequestInfo are both null, then the credentials match by default; therefore, the result of pinging this connection determines the outcome of the comparison. Listing 6-25 shows how to programmatically ping the connection.

Listing 6-25 Pinging a Connection

```
return ping();
}
        boolean bUserNameMatch = true;
        String strPcUserName = pc.getUserName();
           if (m_strUserName != null)
{

logger.debug(this.toString() + ": compareCredentials >>> comparing
  my username ["+m_strUserName+"] with client username
   ["+strPcUserName+"]");
```

Next, you need to see if the user supplied in either the Subject or the ConnectionRequestInfo is the same as our user. We do not support re-authentication in this adapter, so if they do not match, this instance cannot satisfy the request. The following line of code does that:

```
bUserNameMatch = m_strUserName.equals(strPcUserName);
```

If usernames match, ping the connection to determine if this is still a good connection. Otherwise, there is no match and no reason to ping. The following line of code does that:

```
return bUserNameMatch ? ping() : false;
```

Explanation of the Implementation

Under a managed scenario, the application server invokes the `matchManagedConnections()` method on the ManagedConnectionFactory for an adapter. The specification does not indicate how the application server determines which ManagedConnectionFactory to use to satisfy a connection request. The ADKs AbstractManagedConnectionFactory implements `matchManagedConnections()`. The first step in this implementation is to compare "this" (that is, the `ManagedConnectionFactory` instance on which the `ConnectionManager` invoked matchManagedConnections) to the `ManagedConnectionFactory` on each `ManagedConnection` in the set supplied by the application server. For each `ManagedConnection` in the set that has the same `ManagedConnectionFactory`, the implementation invokes the `compareCredentials()` method. This method allows each `ManagedConnection` object to determine if it can satisfy the request.

`matchManagedConnections()` gets called by the `ConnectionManager` (as shown in Listing 6-26) to try to find a valid connection in the pool it is managing. If this method returns null, then the `ConnectionManager` will allocate a new connection to the EIS via a call to `createManagedConnection()`.

Listing 6-26 `matchManagedConnections()` Method Implementation

```
public ManagedConnection
matchManagedConnections(Set connectionSet,
                        Subject subject,
                        ConnectionRequestInfo info)
        throws ResourceException
```

This class uses the following approach to matching a connection:

1. It iterates over the <code>connectionSet</code> for each object in the set (until a match is found). Then it determines whether to not it's an `AbstractManagedConnection`.
2. If it is, this connection is compared to the `ManagedConnectionFactory` for the `AbstractManagedConnection` from the set.

3. If the factories are equal, then the `compareCredentials()` method is invoked on the `AbstractManagedConnection`.
4. If this method returns true, then the instance is returned.

AbstractManagedConnectionFactory Properties Required at Deployment

To use the base implementation of `AbstractManagedConnectionFactory`, you need to provide the following properties at deployment time:

Table 6-2 AbstractManagedConnectionFactory Properties

Property Name	Property Type	Applicable Values	Description	Default
`LogLevel`	`java.lang.String`	`ERROR, WARN, INFO, DEBUG`	Logs verbosity level	`WARN`
`LanguageCode`	`java.lang.String`	valid ISO Language Code, see `http://www.ics.uci.edu/pub/ietf/http/related/iso639.txt`	Determines the desired locale for log messages	`en`
`CountryCode`	`java.lang.String`	valid ISO Country Code, see `http://www.chemie.fu-berlin.de/diverse/doc/ISO_3166.html`	Determines the desired locale for log messages	`US`
`MessageBundleBase`	`java.lang.String`	Any valid Java Class name or file name	Determines the message bundle for log messages	none, required
`LogConfigFile`	`java.lang.String`	Any valid file name	Configures the LOG4J system	none, required
`RootLogContext`	`java.lang.String`	Any valid Java String	Categorizes log messages from this connection factory	none, required
`AdditionalLogContext`	`java.lang.String`	Any valid Java String	Adds additional information to uniquely identify messages from this factory	none, optional

Other Key ManagedConnectionFactory Features in the ADK

In the ADK sample adapter, the class `sample.spi.ManagedConnectionFactoryImpl` is provided. This class extends `AbstractManagedConnectionFactory`. Use this class as an example of how to extend the ADK's base class.

For the complete sample adapter ManagedConnectionFactory implementation code listing, see:

`WLI_HOME/adapters/sample/src/sample/spi/ManagedConnectionFactoryImpl.java`

ManagedConnection

`javax.resource.spi.ManagedConnection`

The `ManagedConnection` object is responsible for encapsulating all expensive resources needed to establish connectivity to the EIS. A `ManagedConnection` instance represents a physical connection to the underlying EIS. `ManagedConnection` objects are pooled by the application server in a managed environment.

ADK Implementation

The ADK provides an abstract implementation of `ManagedConnection`. The base class provides logic for managing connection event listeners and multiple application-level connection handles per `ManagedConnection` instance.

When implementing the `ManagedConnection` interface, you need to determine the transaction demarcation support provided by the underlying EIS. For more information on transaction demarcation, see “Transaction Demarcation” on page 6-24.

The ADK provides `AbstractManagedConnection`, an abstract implementation for the `javax.resource.spi.ManagedConnection` interface that:

- Provides access to the ADK logging framework.
- Manages a collection connection event listeners.
- Provides convenience methods for notifying all connection event listeners of connection related events.

- Simplifies clean-up and destruction of a ManagedConnection instance.

The sample adapter that comes with the ADK includes ManagedConnectionImpl, which extends AbstractManagedConnection. For the complete sample adapter `ManagedConnection` implementation code listing, see:

```
WLI_HOME/adapters/sample/src/sample/spi/ManagedConnectionFactoryImpl.java
```

ManagedConnectionMetaData

`javax.resource.spi.ManagedConnectionMetaData`

The `ManagedConnectionMetaData` interface provides information about the underlying EIS instance associated with a `ManagedConnection` instance. An application server uses this information to get run-time information about a connected EIS instance.

ADK Implementation

The ADK provides `AbstractManagedConnectionMetaData`, an abstract implementation of the `javax.resource.spi.ManagedConnectionMetaData` and `javax.resource.cci.ConnectionMetaData` interfaces that:

- Simplifies exception handling.
- Provides access to an `AbstractManagedConnection` instance.
- Allows you to focus on implementing EIS-specific logic.
- Prevents you from having a separate metadata class for the CCI and SPI implementations.

The sample adapter that comes with the ADK includes `ConnectionMetaDataImpl`, which extends `AbstractManagedConnectionMetaData`. For the complete code listing, see:

```
WLI_HOME/adapters/sample/src/sample/spi/ConnectionMetaDataImpl.java
```

ConnectionEventListener

`javax.resource.spi.ConnectionEventListener`

The `ConnectionEventListener` interface provides an event callback mechanism that enables an application server to receive notifications from a `ManagedConnection` instance.

ADK Implementation

The ADK provides two concrete implementations of `ConnectionEventListener`:

- `com.bea.adapter.spi.ConnectionEventLogger`, which logs connection-related events to the adapter's log by using the ADK logging framework.
- `com.bea.adapter.spi.NonManagedConnectionEventListener`, which destroys `javax.resource.spi.ManagedConnection` instances when the adapter is running in a non-managed environment. This implementation:
  - Logs connection-related events using the ADK logging framework.
  - Destroys `ManagedConnection` instances when a connection related error occurs.

In most cases, the implementations provided by the ADK are sufficient; you should not need to provide your own implementation of this interface.

ConnectionManager

`javax.resource.spi.ConnectionManager`

The `ConnectionManager` interface provides a hook for the adapter to pass a connection request to the application server.

ADK Implementation

The ADK provides a concrete implementation of this interface, `com.bea.adapter.spi.NonManagedConnectionManager`. This implementation provides a basic connection manager for adapters running in a non-managed environment. In a managed environment, this interface is provided by the application server. In most cases, you can use the implementation provided by the ADK.

`NonManagedConnectionManager` is a concrete implementation of the `javax.resource.spi.ConnectionManager` interface. It serves as the `ConnectionManager` in the non-managed scenario for an adapter; it does not provide any connection pooling or any other quality of service.

ConnectionRequestInfo

`javax.resource.spi.ConnectionRequestInfo`

The `ConnectionRequestInfo` interface enables an adapter to pass its own request specific data structure across the connection request flow. An adapter extends the empty interface to support its own data structures for a connection request.

ADK Implementation

The ADK provides a concrete implementation of this interface called `ConnectionRequestInfoMap`. This is a concrete implementation of the `javax.resource.spi.ConnectionRequestInfo` interface and provides a `java.util.Map` interface to such connection request information as username and password.

LocalTransaction

`javax.resource.spi.LocalTransaction`

The `LocalTransaction` interface provides support for transactions that are managed internal to an EIS resource manager, and do not require an external transaction manager.

ADK Implementation

The ADK provides an abstract implementation of this interface called `AbstractLocalTransaction`. This implementation allows you to focus on implementing the EIS-specific aspects of a `LocalTransaction`. This implementation:

- Simplifies exception handling.
- Allows adapter providers to focus on implementing EIS-specific transaction logic.
- Prevents you from having a separate metadata class for the CCI and SPI implementations.

Step 4: Implementing the CCI

The client interface allows a J2EE-compliant application to connect to and access back-end systems. The client interface manages the flow of data between the client application and the back-end system and does not have any visibility into what either the container or the application server are doing with the adapter. The client interface specifies the format of the request and response records for a given interaction with the EIS.

First, you must determine if your adapter must support the J2EE-compliant Common Client Interface (CCI). Although not a requirement in the current J2EE specification, it is likely to be a requirement in a later version. Consequently, the ADK focuses on helping you implement a CCI interface for your adapter.

How to Use this Section

This section (“Step 4: Implementing the CCI”) describes some of the interfaces you can use to implement the CCI. A minimum of two interfaces are necessary to complete the task (see “Basic CCI Implementation” on page 6-37). Each of these is described in detail, followed by a discussion of how they were extended in the sample adapter included with the ADK.

Following the two required interfaces, the additional interfaces are described in detail, including information regarding why you might use them and what benefit they provide to an adapter.

Basic CCI Implementation

To implement the CCI for your adapter, you need to extend *at least* these two interfaces:

- `Connection`, which represents an application-level handle that is used by a client to access the underlying physical connection.
- `Interaction`, which enables a component to execute EIS functions.

Ideally, you will implement these interfaces in the order specified above.

In addition to these interfaces, you can implement any of the other interfaces described in this step, as your adapter needs dictate. These interfaces are:

- `ConnectionFactory`
- `ConnectionMetaData`
- `ConnectionSpec`
- `InteractionSpec`
- `LocalTransaction`
- `Record`
- `ResourceAdapterMetaData`

Connection

`javax.resource.cci.Connection`

A `Connection` represents an application-level handle that is used by a client to access the underlying physical connection. The actual physical connection associated with a `Connection` instance is represented by a `ManagedConnection` instance.

A client gets a `Connection` instance by using the `getConnection()` method on a `ConnectionFactory` instance. A `Connection` can be associated with zero or more `Interaction` instances.

ADK Implementation

The ADK provides an abstract implementation of this interface called `AbstractConnection`. This interface provides the following functionality:

- Access to the ADK logging framework
- Access to an `AbstractManagedConnection` instance
- State management and assertion checking

You will need to extend this class by providing an implementation for:

```
public Interaction createInteraction()
        throws ResourceException
```

This method creates an interaction associated with this connection. An interaction enables an application to execute EIS functions. This method:

- Returns: `Interaction` instance
- Throws: `ResourceException` - Exception if the create operation fails

Interaction

`javax.resource.cci.Interaction`

The `javax.resource.cci.Interaction` enables a component to execute EIS functions. An `Interaction` instance supports the following ways of interacting with an EIS instance:

- An `execute()` method that takes an input `Record`, output `Record`, and an `InteractionSpec`. This method executes the EIS function represented by the `InteractionSpec` and updates the output `Record`.
- An `execute()` method that takes an input `Record` and an `InteractionSpec`. This method implementation executes the EIS function represented by the `InteractionSpec` and produces the output `Record` as a return value.

An `Interaction` instance is created from a connection and is required to maintain its association with the `Connection` instance. The `close()` method releases all resources maintained by the adapter for the interaction. The close of an `Interaction` instance should not close the associated `Connection` instance.

ADK Implementation

The ADK provides an implementation of this interface called `AbstractInteraction`. This interface:

- Provides access to the ADK logging framework.
- Manages warnings.

You must supply a concrete extension to `AbstractInteraction` that implements `execute()`. Use at least one of the following versions of `execute()`:

execute() Version 1

The `execute()` method declared in Listing 6-27 shows an interaction represented by the `InteractionSpec`. This form of invocation takes an input record and updates the output record.

This method:

- Returns true if execution of the EIS function has been successful and output `Record` has been updated; otherwise it returns false.
- Throws ResourceException - Exception if execute operation fails.

Listing 6-27 `execute()` Version 1 Code Example

```
public boolean execute(InteractionSpec ispec,
                       Record input,
                       Record output)
                throws ResourceException
```

The parameters `for execute()` version 1 are:

Table 6-3 `execute()` Version 1 Parameters

Parameters	Description
ispec	InteractionSpec representing a target EIS data/function module
input	Input Record
output	Output Record

execute() Version 2

The `execute()` method declared in Listing 6-28 also executes an `Interaction` represented by the `InteractionSpec`. This form of invocation takes an input `Record` and returns an output `Record` if the execution of the `Interaction` has been successful.

This method:

- Returns an output `Record` if execution of the EIS function has been successful; otherwise it throws an exception.
- Throws ResourceException - Exception if the execute operation fails.

If an exception occurs, this method will notify its `Connection`, which will take the appropriate action, including closing itself.

Listing 6-28 execute() Version 2 Code Example

```
public Record execute(InteractionSpec ispec,
                      Record input)
               throws ResourceException
```

The parameters for `execute()` version 2 are:

Table 6-4 execute() Version 2 Parameters

Parameter	Description
ispec	InteractionSpec representing a target EIS data/function module
input	Input Record

Using XCCI to Implement the CCI

XCCI (XML-CCI) It is a dialect of CCI that uses XML-based record formats to represent data. It provides the tools and framework for supporting this record format. There are two primary components of XCCI: `Services` and `DocumentRecords`.

A service represents functionality available in an EIS and is comprised of four components:

- Unique Business Name

  Every service has a unique business name that indicates its role in an integration solution. For example, in an integration solution involving a Customer Relationship Management (CRM) system, you may have a service named "CreateNewCustomer". It is important to understand that the service name should reflect the business purpose of the service; it is an abstraction from the name of the function(s) your service invokes in the EIS

- Request Document Definition

  The request document definition describes the input requirements for a service. The `com.bea.document.IDocumentDefinition` interface embodies all the metadata about a document type. It includes the document schema (structure and usage), and the root element name for all documents of this type. The root element name is needed because an XML schema can define more than one possible root element.

- Response Document Definition

  The response document definition describes the output for a service.

- Additional Metadata

A service is a higher-order component in an integration solution that hides most of the complexity involved in executing functionality in an EIS. In other words, a service does not expose many of the details required to interact with the EIS in its public interface. This implies that some of the information required to invoke a function in an EIS is not provided by the client in the request. Consequently, most services need to store additional metadata. In WebLogic Integration, this additional metadata is encapsulated by an adapter's `javax.resource.cci.InteractionSpec` implementation class.

DocumentRecord

`com.bea.connector.DocumentRecord`

At run time, the XCCI layer expects `DocumentRecord` objects as input to a service and returns DocumentRecord objects as output from a service. `DocumentRecord` implements the `javax.resource.cci.Record` and the `com.bea.document.IDocument` interfaces. See “Record” on page 6-50 for a description of that interface. `IDocument`, which facilitates XML input and output from the CCI layer in an adapter, is described in the following section.

IDocument

`com.bea.document.IDocument`

An `IDocument` is a higher-order wrapper around the W3C Document Object Model (DOM). The primary value-add of the `IDocument` interface is that it provides an XPath interface to elements in an XML document. In other words, `IDocument` objects are queryable and updatable using XPath strings. For example, The XML document shown in Listing 6-29 describes a person named “Bob” and some of the details about “Bob.”

Listing 6-29 XML Example

```
<Person name="Bob">
    <Home squareFeet="2000"/>
    <Family>
       <Child name="Jimmy">
          <Stats sex="male" hair="brown" eyes="blue"/>
       </Child>
       <Child name="Susie">
          <Stats sex="female" hair="blonde" eyes="brown"/>
```

```
        </Child>
    </Family>
</Person>
```

By using `IDocument`, you can retrieve Jimmy's hair color using the code shown in Listing 6-30:

Listing 6-30 IDocument Data Retrieval Code Sample

```
System.out.println("Jimmy's hair color: " +
   person.getStringFrom("//Person[@name=\"Bob\"]/Family/Child
   [@name=\"Jimmy\"]/Stats/@hair");
```

On the other hand, if you used DOM, you would need to enter the code shown in Listing 6-31:

Listing 6-31 DOM Data Retrieval Code Sample

```
String strJimmysHairColor = null;
org.w3c.dom.Element root = doc.getDocumentElement();
if (root.getTagName().equals("Person") &&
    root.getAttribute("name").equals("Bob") {
     org.w3c.dom.NodeList list = root.
        getElementsByTagName("Family");
   if (list.getLength() > 0) {
     org.w3c.dom.Element family = (org.w3c.dom.
        Element)list.item(0);

    org.w3c.dom.NodeList childList =
family.getElementsByTagName("Child");
    for (int i=0; i < childList.getLength(); i++) {
    org.w3c.dom.Element child = childList.item(i);
       if (child.getAttribute("name").equals("Jimmy")) {
    org.w3c.dom.NodeList statsList =
       child.getElementsByTagName("Stats");
       if (statsList.getLength() > 0) {
    org.w3c.dom.Element stats = statsList.item(0);
           strJimmysHairColor = stats.getAttribute("hair");
```

```
        }
      }
    }
  }
}
```

As you can see, by using `IDocument`, you can simplify your code.

ADK-Supplied XCCI Classes

The ADK provides several classes that will help you implement XCCI for your adapters. This section describes those classes.

AbstractDocumentRecordInteraction

`com.bea.adapter.cci.AbstractDocumentRecordInteraction`

This class extends the ADK's abstract base `Interaction`, `com.bea.adapter.cci.AbstractInteraction`. The purpose of this class is to provide convenience methods for manipulating `DocumentRecords` and to reduce the amount of error handling the you need to implement. Specifically, this class declares:

```
protected abstract boolean execute(
  InteractionSpec ixSpec,
  DocumentRecord inputDoc,
  DocumentRecord outputDoc
) throws ResourceException
```

and

```
protected abstract DocumentRecord execute(
  InteractionSpec ixSpec,
  DocumentRecord inputDoc
) throws ResourceException
```

These methods will not be invoked on the concrete implementation until the parameters have been verified that they are `DocumentRecord` objects.

DocumentDefinitionRecord

`com.bea.adapter.cci.DocumentDefinitionRecord`

This class allows the adapter to return an `IDocumentDefinition` from its `DocumentRecordInteraction` implementation. This class is useful for satisfying design-time requests to create the request and/or response document definitions for a service.

DocumentInteractionSpecImpl

`com.bea.adapter.cci.DocumentInteractionSpecImpl`

This class allows you to save the request document definition and response document definition for a service into the `InteractionSpec` provided to the execute method at run time. This is useful when the `Interaction` for an adapter needs access to the XML schemas for a service at run time.

XCCI Design Pattern

A common design pattern that emerges when using the XCCI approach is to support the definition of services in the `Interaction` implementation. In other words, the `javax.resource.cci.Interaction` implementation for an adapter allows a client program to retrieve metadata from the underlying EIS in order to define a WebLogic Integration service. Specifically, this means that the interaction must be able to generate the request and response XML schemas and additional metadata for a service. Additionally, the `Interaction` could also allow a client program to browse a catalog of functions provided by the EIS. This approach facilitates a thin client architecture for your adapter.

The ADK provides the `com.bea.adapter.cci.DesignTimeInteraction-SpecImpl` class to help you implement this design pattern. The `sample.cci.InteractionImpl` class demonstrates how to implement this design pattern using the `DesignTimeInteractionSpecImpl` class.

Using Non-XML J2EE-Compliant Adapters

The ADK provides a plug-in mechanism for using non-XML adapters with WebLogic Integration. Not all pre-built adapters use XML as their `javax.resource.cci.Record` data type; for example:

- You have developed a J2EE-compliant adapter with a proprietary record format.

- You purchased a third-party J2EE-compliant adapter that uses a proprietary record format in the adapter's CCI layer.

To facilitate implementation of these types of adapters, the ADK provides the `com.bea.connector.IRecordTranslator` interface. At run time, the application view engine uses an adapter's `IRecordTranslator` implementation to translate request and response records before executing the adapter's service.

Since the application integration engine only supports `javax.resource.cci.Record` of type `com.bea.connector.DocumentRecord`, you must translate this proprietary format to a document record for request and response records. You do not need to rewrite the adapter's CCI interaction layer. By inserting a class into the WebLogic Integration engine classpath that implements `IRecordTranslator`, the application view engine will execute the translate methods in your translator class on each record for request and response.

The requirements and restrictions for implementing this translator class are that there is a one to one correlation between adapter and the translator. The plug-in architecture loads the translator class by name, using the full class name of the adapter's `InteractionSpec` plus the phrase "RecordTranslator"; for example, if the adapter's `InteractionSpec` class name was `com.bea.adapter.dbms.cci.InteractionSpecImpl`, then the engine would load the class `com.bea.adapter.dbms.cci.InteractionSpecImplRecordTranslator` if it was available.

See the Javadoc for `com.bea.connector.IRecordTranslator` at `WLI_HOME/docs/apidocs/com/bea/connector/IRecordTranslator.html` for a description of the methods that must be implemented.

ConnectionFactory

`javax.resource.cci.ConnectionFactory`

`ConnectionFactory` provides an interface for getting connection to an EIS instance. An implementation of the `ConnectionFactory` interface is provided by an adapter.

The application code looks up a `ConnectionFactory` instance from JNDI namespace and uses it to get EIS connections.

An implementation class for `ConnectionFactory` is required to implement `java.io.Serializable` and `javax.resource.Referenceableinterfaces` to support JNDI registration.

ADK Implementation

The ADK provides `ConnectionFactoryImpl`, a concrete implementation of the `javax.resource.cci.ConnectionFactory` interface that provides the following functionality:

- Access to the ADK logging framework
- Access to adapter metadata
- Implementation of the `getConnection()` method

Typically, you will not need to extend this class and can use it outright.

ConnectionMetaData

`javax.resource.cci.ConnectionMetaData`

`ConnectionMetaData` provides information about an EIS instance connected through a Connection instance. A component calls the method `Connection.getMetaData` to get a `ConnectionMetaData` instance.

ADK Implementation

By default, the ADK provides an implementation of this class via the `com.bea.adapter.spi.AbstractConnectionMetaData` class. You will need to extend this abstract class and implement its four abstract methods for your adapter.

ConnectionSpec

`javax.resource.cci.ConnectionSpec`

`ConnectionSpec` is used by an application component to pass connection request-specific properties to the `ConnectionFactory.getConnection()` method.

It is recommended that you implement the `ConnectionSpec` interface as a JavaBean so that it can support tools. The properties on the `ConnectionSpec` implementation class must be defined through the getter and setter methods pattern.

The CCI specification defines a set of standard properties for an `ConnectionSpec`. The properties are defined either on a derived interface or an implementation class of an empty `ConnectionSpec` interface. In addition, an adapter may define additional properties specific to its underlying EIS.

ADK Implementation

Since the `ConnectionSpec` implementation must be a JavaBean, the ADK does not supply an implementation for this class.

InteractionSpec

`javax.resource.cci.InteractionSpec`

An `InteractionSpec` holds properties for driving an interaction with an EIS instance. It is used by an interaction to execute the specified function on an underlying EIS.

The CCI specification defines a set of standard properties for an `InteractionSpec`. An `InteractionSpec` implementation is not required to support a standard property if that property does not apply to its underlying EIS.

The `InteractionSpec` implementation class must provide getter and setter methods for each of its supported properties. The getter and setter methods convention should be based on the JavaBeans design pattern.

The `InteractionSpec` interface must be implemented as a JavaBean in order to support tools. An implementation class for `InteractionSpec` interface is required to implement the java.io.Serializable interface.

The `InteractionSpec` contains information that is not in Record but helps determine what EIS function to invoke.

The standard properties are described in Table 6-5:

Table 6-5 Standard InteractionSpec Properties

Property	Description
`FunctionName`	Name of an EIS function
`InteractionVerb`	Mode of interaction with an EIS instance: `SYNC_SEND`, `SYNC_SEND_RECEIVE`, `SYNC_RECEIVE`
`ExecutionTimeout`	The number of milliseconds an Interaction will wait for an EIS to execute the specified function

The following standard properties are used to give hints to an interaction instance about the `ResultSet` requirements:

- `FetchSize`
- `FetchDirection`
- `MaxFieldSize`
- `ResultSetType`
- `ResultSetConcurrency`

A CCI implementation can provide additional properties beyond that described in the InteractionSpec interface.

Note: The format and type of the additional properties is specific to an EIS and is outside the scope of the CCI specification.

ADK Implementation

The ADK contains a concrete implementation of `javax.resource.cci.InteractionSpec` called `InteractionSpecImpl`. This interface provides a base implementation for you to extend by using getter and setter methods for the standard interaction properties described in Table 6-5.

LocalTransaction

javax.resource.cci.LocalTransaction

The LocalTransaction interface is used for application-level local transaction demarcation. It defines a transaction demarcation interface for resource manager local transactions. The system contract level LocalTransaction interface (as defined in the javax.resource.spi package) is used by the container for local transaction management.

A local transaction is managed internal to a resource manager. There is no external transaction manager involved in the coordination of such transactions.

A CCI implementation can (but is not required to) implement the LocalTransaction interface. If the LocalTransaction interface is supported by a CCI implementation, then the method Connection.getLocalTransaction() should return a LocalTransaction instance. A component can then use the returned LocalTransaction to demarcate a resource manager local transaction (associated with the Connection instance) on the underlying EIS instance.

The com.bea.adapter.spi.AbstractLocalTransaction class also implements this interface.

For more information on local transactions, see "Transaction Demarcation" on page 6-24.

Record

javax.resource.cci.Record

The javax.resource.cci.Record interface is the base interface for representing an input or output to the execute() methods defined on an Interaction. For more information on the execute() methods, see "execute() Version 1" on page 6-39 and "execute() Version 2" on page 6-40

A MappedRecord or IndexedRecord can contain another Record. This means that you can use MappedRecord and IndexedRecord to create a hierarchical structure of any arbitrary depth. A basic Java type is used as the leaf element of a hierarchical structure represented by a MappedRecord or IndexedRecord.

The Record interface can be extended to form one of the representations shown in Table 6-6:

Table 6-6 Record Interface Representations

Representation	Description
MappedRecord	A key-value pair based collection representing a record. This interface is based on the java.util.Map.
IndexedRecord	An ordered and indexed collection representing a record. This interface is based on the java.util.List.
JavaBean based representation of an EIS abstraction	An example is a custom record generated to represent a purchase order in an ERP system.
javax.resource.cci. ResultSet	This interface extends both java.sql.ResultSet and javax.resource.cci.Record. A ResultSet represents tabular data.

Assuming the adapter implements a CCI interface, the next consideration is the record format for a service. A service has a request record format and a response record format. The request record provides input to the service and the response record provides the EIS response.

ADK Implementation

The ADK focuses on helping you implement an XML-based record format in the CCI layer. To this end, the ADK provides the DocumentRecord class. In addition, you can use BEA's schema toolkit to develop schemas to describe the request and response documents for a service.

The ADK provides RecordImpl, a concrete implementation of the javax.resource.cci.Record interface that provides getter and setter methods for record name and description.

If an adapter provider wants to use an XML-based record format (which is highly recommended), the ADK also provides the com.bea.adapter.cci.Abstract DocumentRecordInteraction class. This class ensures that the client passes DocumentRecord objects. In addition, this class provides convenience methods for accessing content in a DocumentRecord.

ResourceAdapterMetaData

`javax.resource.cci.ResourceAdapterMetaData`

The interface `javax.resource.cci.ResourceAdapterMetaData` provides information about capabilities of an adapter implementation. A CCI client uses a `ConnectionFactory.getMetaData` to get metadata information about the adapter. The `getMetaData()` method does not require establishment of an active connection to an EIS instance. The `ResourceAdapterMetaData` interface can be extended to provide more information specific to an adapter implementation.

Note: This interface does not provide information about an EIS instance that is connected through the adapter.

ADK Implementation

The ADK provides `ResourceAdapterMetaDataImpl` that encapsulates adapter metadata and provides getters and setters for all properties.

Step 5: Testing the Adapter

The ADK provides a test harness that leverages JUnit, an open-source tool for unit testing. You can find more information on JUnit at:

http://`www.junit.org`

`com.bea.adapter.test.TestHarness` does the following:

- Reads a properties file containing test configuration information.
- Initializes the log toolkit.
- Initializes JUnit TestSuite.
- Loads test classes and executes them using JUnit.
- Allows you to test code off-line and outside of Weblogic Server.

Using the Test Harness

To use the test harness in the ADK, complete the following steps:

1. Create a class that extends `junit.framework.TestCase`. The class must provide a static method named suite that returns a new `junit.framework.TestSuite`.
2. Implement test methods; name of methods should begin with "test".
3. Create/alter the `test.properties` in the project directory (if you clone the sample adapter, then your adapter will already have a base `test.properties` in the project directory). The properties file should contain any configuration properties needed for your test case.
4. Invoke the test using Ant. Your Ant `build.xml` file will need a test target that invokes the `com.bea.adapter.test.TestHarness` class with the properties file for your adapter. For example, the sample adapter uses the Ant target shown in Listing 6-32:

Listing 6-32 Ant Target Specified in the Sample Adapter

```
<target name='test' depends='packages'>
    <java classname='com.bea.adapter.test.TestHarness'>
       <arg value='-DCONFIG_FILE=test.properties'/<classpath
          refid='CLASSPATH'/>
    </java>
```

This target invokes the JVM with main class `com.bea.adapter.test.TestHarness` using the classpath established for the sample adapter and passes the command-line argument:

```
-DCONFIG_FILE=test.properties
```

Test Case Extensions Provided by the ADK

The sample adapter ships with two basic `TestCase` extensions:

- `sample.spi.NonManagedScenarioTestCase`

- sample.event.OfflineEventGeneratorTestCase

sample.spi.NonManagedScenarioTestCase

NonManagedScenarioTestCase allows you to test your SPI and CCI classes in a non-managed scenario. Specifically, this class tests the following:

- Initialization of the ManagedConnectionFactory implementation
- Serialization/De-serialization of the ManagedConnectionFactory instance
- Opening a connection to the EIS
- Closing a connection to the EIS; you can make sure all associated resources are getting closed when a connection is closed

sample.event.OfflineEventGeneratorTestCase

sample.event.OfflineEventGeneratorTestCase allows you to test the inner workings of your event generator outside of Weblogic Server. Specifically, this class tests the following for the event generator:

- It simulates the event router and instantiates a new instance of the adapter's event generator.
- It passes the test.properties to the event generator for initialization; this allows you to test your initialization logic.
- It refreshes the event generator randomly; this allows you to test your setupNewTypes() and removeDeadTypes() methods.
- It receives event postings and displays them to the log file for the adapter.

sample.client.ApplicationViewClient

sample.client.ApplicationViewClient offers an additional way of test your adapter. This class is a Java program that demonstrates how to invoke a service and listen for an event on an application view. The Ant build.xml provides the "client" target to allow you to use the ApplicationViewClient program. Executing ant client will provide the usage for the program. To see an example of sample.client.ApplicationViewClient.java, go to WLI_HOME/adapters/sample/src/sample/client.

Note: `sample.client.ApplicationViewClient` is not integrated with the test harness.

Step 6: Deploying the Adapter

After implementing the SPI and CCI interfaces for an adapter, and then testing it, deploy it into WebLogic Integration. You can deploy an adapter either manually or from the WebLogic Server Console. See Chapter 9, “Deploying Adapters,” for complete information.

7 Developing an Event Adapter

Event adapters propagate information from an EIS into the WebLogic Integration environment. These types of adapters can be described as publishers of information. All WebLogic Integration event adapters perform the following three functions:

- They respond to “events” that occur inside the running EIS and extract data about the event from the EIS into the adapter.
- They transform event data from the EIS specific format to an XML document that conforms to the XML schema for the event. The XML schema is based on metadata in the EIS.
- They propagate the event into the WebLogic Integration environment by using the event router.

WebLogic Integration implements the aspects of these three functions that are generic across all event adapters. You only need to focus on the EIS specific aspects of your adapter.

This section contains information on the following subjects:

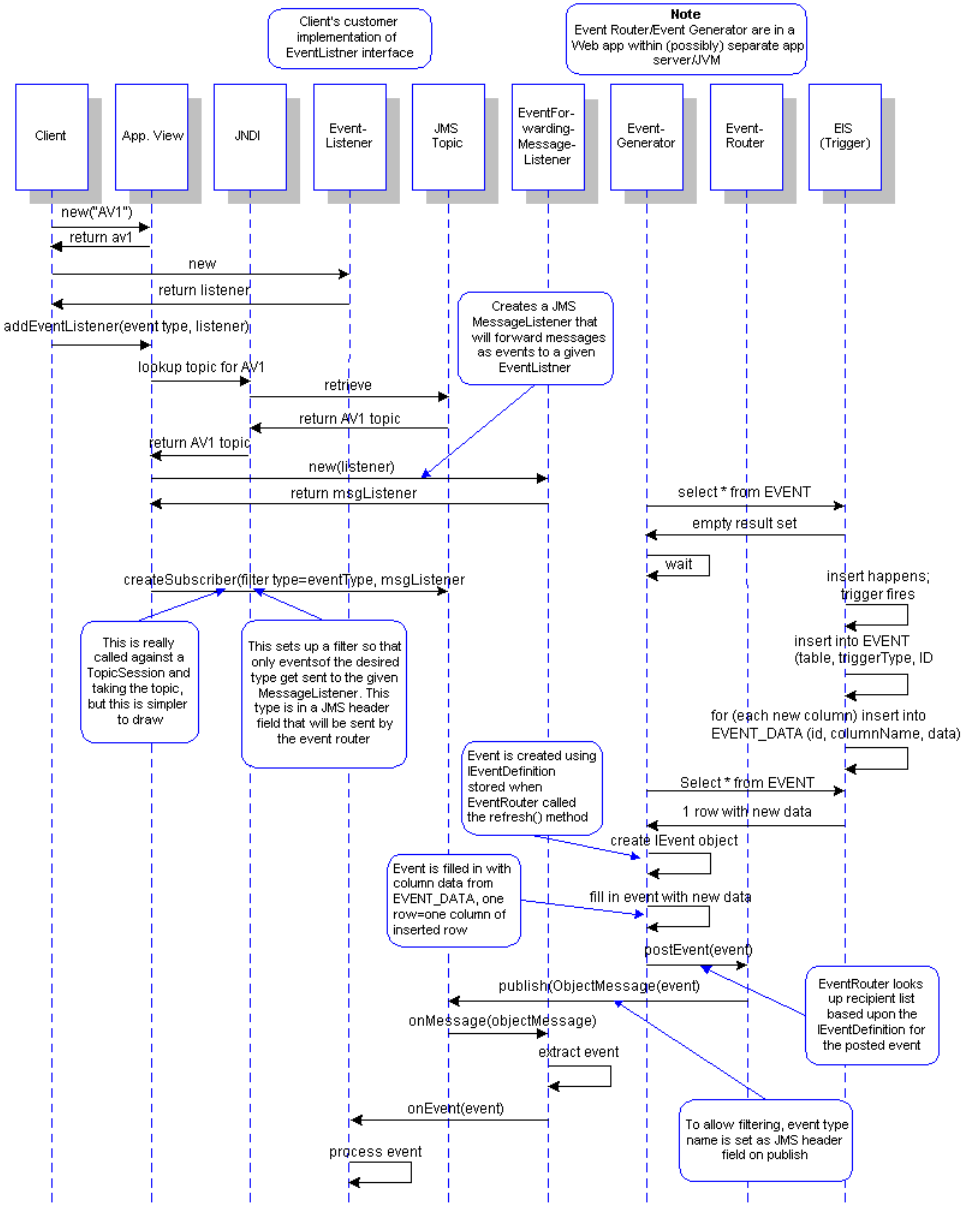
- Event Adapters in the Run-time Environment
- The Flow of Events
- Step 1: Development Considerations
- Step 2: Configuring the Development Environment
- Step 3: Implementing the Adapter
- Step 4: Testing the Adapter

- Step 5. Deploying the Adapter

Event Adapters in the Run-time Environment

The behavior of an Event in the run-time environment is depicted in Figure 7-1.

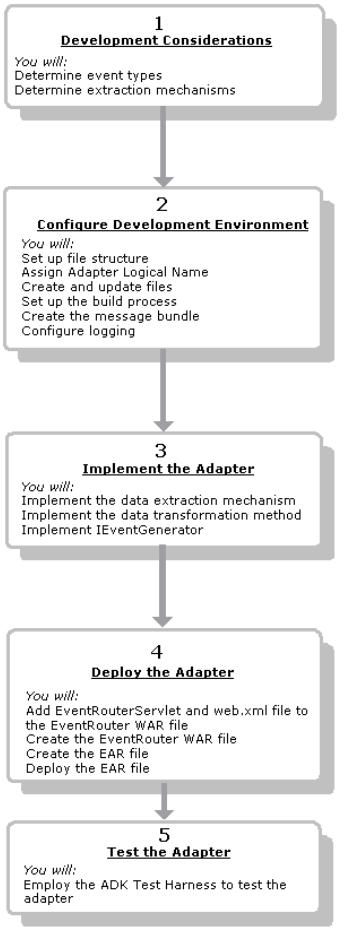
Figure 7-1 Event Adapters in the Run-time Environment



The Flow of Events

Figure 7-2 outlines the steps required to develop an Event Adapter.

Figure 7-2 Event Adapter Flow of Events



Step 1: Development Considerations

These are the items you need to consider before commencing with event adapter development. The Adapter Setup Worksheet will provide much of this information. See Appendix D, “Adapter Setup Worksheet.”

1. Determine the event types.

   You need to identify what exactly comprises the event:

   - What will its contents be?
   - How will it be defined in the XML schema?
   - What will trigger it?

2. Determine the data extraction method.

   Next, you need to decide which method of data extraction will be used:

   - “Push,” wherein the EIS notifies the adapter of an event.
   - “Pull,” where the adapter polls the EIS and pulls event data from it.

   Use the pull method when your adapter needs to poll the EIS to determine a change-of-state. Use a push event when you want to implement an event generation that works more like a publish/subscribe model.

Step 2: Configuring the Development Environment

This step describes the processes you must complete to prepare your computer for adapter development.

Step 2a: Set up the File Structure

The file structure necessary to build an event adapter is the same as that required for service adapters. See "Step 2a: Set Up the File Structure" in Chapter 6, "Developing a Service Adapter."

Step 2b: Assign the Adapter Logical Name

Next, you need to assign the adapter's logical name. By convention, this name is comprised of the vendor name, the type of EIS connected to the adapter, and the version number of the EIS and is expressed as *vendor_EIS-type_EIS version*. For example, `BEA_WLS_SAMPLE_ADK`, where:

- `BEA_WLS` is the vendor
- `SAMPLE` is the EIS-type
- `ADK` is the EIS version

Step 2c: Set Up the Build Process

WebLogic Integration employs a build process based upon Ant, a 100% pure Java-based build tool. For more information on Ant, please see "Ant-Based Build Process" on page 3-4. For more information on using Ant, go to:

`http://jakarta.apache.org/ant/index.html`

The sample adapter shipped with WebLogic Integration (located in `WLI_HOME/adapters/sample`) contains the file `build.xml` (located in `WLI_HOME/adapters/sample/project`). This is the Ant build file for the sample adapter. It contains the tasks needed to build a J2EE-compliant adapter. Running the GenerateAdapterTemplate utility to clone a development tree for your adapter creates a `build.xml` file specifically for that adapter. This will free you from having to customize the sample `build.xml` and will ensure that the code is correct. For information on using the GenerateAdapterTemplate utility, see Chapter 4, "Creating a Custom Development Environment."

For more information on the build process, see “Step 2c: Setting Up the Build Process,” in Chapter 6, “Developing a Service Adapter.”

Step 2d: Create the Message Bundle

Any message destined for the end-user should be placed in a message bundle. The message bundle is simply a `.properties` text file that contains key=value pairs that allow you to internationalize messages. When a locale and national language are specified at run time, the contents of the message is interpreted, based upon the key=value pair, and the message is presented to the user in the correct language for his or her locale.

For instructions on creating a message bundle, please refer to the JavaSoft tutorial on internationalization at:

`http://java.sun.com/docs/books/tutorial/i18n/index.html`

Step 2e: Configure Logging

The final step in configuring your development environment is to configure logging. Before you begin, read more about logging in Chapter 2, “Concepts.” Logging is accomplished using the logging tool Log4j, developed as part of the Apache Jakarta project. For information on using this tool, please see Chapter 5, “Using the Logging Toolkit.”

Create an Event Generation Logging Category

For event adapters, you will need to create a logging category specifically for event generation (for more information on logging categories, see “Message Categories” on page 5-3). Edit the logging configuration file for the specific adapter (*`adapter_logical_name`*`.xml` in `WLI_HOME/adapters/ADAPTER/src/` where `ADAPTER` is the adapter you are building) by adding the code in Listing 7-1.

Listing 7-1 Sample Code Creating an Event Generation Logging Category

```
<category name='BEA_WLS_SAMPLE_ADK.EventGenerator' class='com.bea.
   logging.LogCategory'>
</category>
```

You must replace *BEA_WLS_SAMPLE_ADK* with your adapter logical name.

By not setting any specific parameters for this category, it will inherit all of the parent category's property settings. In this example, the parent category is `BEA_WLS_SAMPLE_ADK`.

Step 3: Implementing the Adapter

Implementing an event adapter is a two-step process. You need to:

- Create an event generator. This process implements the data extraction method (that is, will you extract data by a push or a pull mechanism) and the `IEventGenerator` interface. This interface is used by the event router to drive the event generation process.
- Implement the data transformation method.

This section shows you how to accomplish these tasks.

Step 3a: Create an Event Generator

Event generation provides an adapter with a mechanism to either receive notification from an EIS or poll an EIS for the specific occurrence of an event. The event generation provided by the WebLogic Integration engine is very powerful in that a single event generator can support multiple types of events. An event type is defined by the configuration properties for an event.

Typically event properties are defined by the properties associated with an event at design time. When configuring an event adapter, the adapter may have one or more Web pages that it uses to collect event properties. These properties are saved with the application view descriptor and passed back to the event at run time. The WebLogic Integration engine uses the properties and the source application view to determine how to route back to the listeners. For instance, two separate deployments of the same event generator with identical properties will result in only a single `IEventDefinition` being created by the WebLogic Integration engine. Whereas, a single `IEventDefinition` will be created for every deployment of a single event adapter where the properties are different. It is the responsibility of the event generator to determine which `IEventDefinition` to use in the routing process. This is typically done based on property values and specific event occurrences.

The `IEventDefinition` objects are used by your implementation of the event generator to route specific events back to their listener. As discussed before, the WebLogic Integration engine will create `IEventDefinition` objects for deployed application views containing events. You will use the IEventDefinition objects to extract specific properties regarding the deployment of an application view, or to access schema and routing objects. You need to employ these attributes when routing an event.

How the Data Extraction Mechanism is Implemented

WebLogic Integration supports two mechanisms for data extraction:

- Push event generation. A state change is recognized when the object generating events pushes a notification to the event generator. When the Push Event generator receives the event, the WebLogic Integration engine then routes to a deployed application view. The push event generator uses a publish/subscribe model.
- Pull event generation, which is used when polling is necessary to accomplish the determination of a state having changed. A process continually queries an object until it has determined a change in state, at which point it creates an event, which the BEA WebLogic Integration engine then routes to a deployed application view.

The "Pull" Mechanism

The mechanism relies on a polling technique to determine if an event has taken place. To implement a Pull scenario you must derive your event generator from the `AbstractPullEventGenerator` in the `com.bea.adapter.event` package.

Note: `adk-eventgenerator.jar` file must be included in your `.war` make file. `adk-eventgenerator.jar` contains the ADK base classes required to implement an event generator.

The ADK supplies several abstract methods in the `AbstractPullEventGenerator` that you must override in your implementation. These methods are described in Table 7-1.

Table 7-1 AbstractPullEventGenerator Methods

Method	Description
`postEvents()`	The `postEvents()` method is called from the run method in the `AbstractPullEventGenerator` at an interval that is determined by the Event Router configuration files. The `postEvents()` method is where you add any polling and routing code. The `postEvents()`method is the control method for the rest of your event generation, message transformation, and routing code.
`setupNewTypes()`	The `setupNewTypes()` method is used to preprocess any `IEventDefinition` object being deployed. Only valid new `IEventDefinition` objects are passed to the `setupNewTypes()` method.
`removeDeadTypes()`	The `removeDeadTypes()` method is used to handle any clean up required for `IEventDefinition` objects that are being un-deployed. The WebLogic Integration engine calls `removeDeadTypes()` when application views with associated events are being un-deployed.
`doInit()`	`doInit()` is called while the event generator is being constructed. During the initialization process the event generator can use pre-defined configuration values to setup the necessary state or connections for the event generation process.

Table 7-1 AbstractPullEventGenerator Methods (Continued)

Method	Description
`doCleanUpOnQuit()`	`doCleanUpOnQuit()` is called before ending the thread driving the event generation process. Use this method to free any resources allocated by your event generation process.

The "Push" Mechanism

The Push scenario uses notification to trigger the routing of an event. To implement the Push scenario you must derive your event generator from the `AbstractPushEventGenerator` class in the `com.bea.adapter.event` package. There are several other supporting classes included in the event package. These classes are described in Table 7-2.

Note: `adk-eventgenerator.jar` must be included in your `.war` make file. `adk-eventgenerator.jar` contains the WebLogic Integration base classes required to implement an event generator.

Table 7-2 AbstractPushEventGenerator Classes

Class	Description
`AbstractPushEventGenerator`	The `AbstractPushEventGenerator` class contains the same abstract and concrete methods as the `AbstractPullEventGenerator`. These methods are intended to be used in the same manner as the `AbstractPullEventGenerator` implementation. See Table 7-1 for a list of these methods and responsibilities.

Table 7-2 AbstractPushEventGenerator Classes (Continued)

Class	Description
`IPushHandler`	The `IPushHandler` is an interface provided primarily to abstract the generation of an event from the routing of an event; however, it is not required to implement a Push scenario. The `IPushHandler` is intended to be tightly coupled with the `PushEventGenerator`. It is the `PushEventGenerator` that will initialize, subscribe, and clean up the `PushHandler` implementation. The `IPushHandler` provides a simple interface to abstract the generation logic. The interface provides methods to initialize, subscribe to Push events, and clean up resources.
`PushEvent`	The `PushEvent` is an event object derived from `java.util.EventObject`. The `PushEvent` is intended to wrap an EIS notification and be sent to any `IPushEventListener` objects.
`EventMetaData`	The `EventMetaData` class is intended to wrap any data necessary for event generation. The `EventMetaData` class is passed to the `IPushHandler` on initialization. To see a sample usage for these objects refer to the e-mail sample code.

How the Event Generator is Implemented

An event generator implementation typically follows this flow of control:

- `doInit();` This method creates and validates connections to the EIS.
- `setupNewTypes();` This method processes `IEventDefinition` objects creating any required structures for processing.
- `postEvents()`; This method iteratively invokes one of the two data extraction mechanisms:
  - Push: Poll the EIS for an event. If the event exists, determine which `IEventDefinition` objects will receive the event. Transform event data into

an IDocument object using the associated schema. Route the IDocument object using the IEvent associated with the IEventDefinition object.

- Pull: When notified of an event the postEvents() method will extract the event data from the PushEvent object and transform the event data to an IDocument object. The IDocument object is created based on the schema associated with the event adapter. When the IDocument contains the necessary event data it is routed to the correct IEventDefinition objects.

- removeDeadTypes(); This method removes the dead IEventDefinition objects from any data structures being used for event processing. Free any resources associated. IEventDefinition objects are considered "dead" when the application view is undeployed.

- doCleanUpOnQuit(); This method removes any resources allocated during event processing.

The following is a series of code samples that implement an event generator with a Pull mechanism.

Listing 7-2 shows the class declaration for the sample adapter's (Pull) event generator.

Note: The AbstractPullEventGenerator implements the Runnable interface, which enables it to run on its own thread.

Listing 7-2 Sample Code Implementing a Pull Data Extraction Mechanism

```
public class EventGenerator
  extends AbstractPullEventGenerator
```

Sample EventGenerator

Listing 7-3 shows the simple constructor for an event generator. You must invoke the parent's constructor so that the parent's members get initialized correctly. The listing then shows how the doInit() method receives configuration information from the map variable and validates the parameters. The sample contains any parameters associated with the event generator at design time.

Listing 7-3 Sample Constructor for an EventGenerator

```
public EventGenerator()
{
super();
}
    protected void doInit(Map map)
       throws java.lang.Exception
    {
    ILogger logger = getLogger();

    m_strUserName = (String)map.get("UserName");
         if (m_strUserName == null || m_strUserName.length() == 0
    {
     String strErrorMsg =
         logger.getI18NMessage("event_generator_no_UserName");
         logger.error(strErrorMsg);
     throw new IllegalStateException(strErrorMsg);
    }
    m_strPassword = (String)map.get("Password");
         if (m_strPassword == null || m_strPassword.length() == 0)
    {
     String strErrorMsg = logger.getI18NMessage
        ("event_generator_no_Password");
     logger.error(strErrorMsg);
         throw new IllegalStateException(strErrorMsg);
    }
```

`postEvents()` is called from the run method of our parent class, as shown in Listing 7-4. This method polls the EIS to determine when a new event occurs. This method will be invoked at a fixed interval, which is defined in the `web.xml` file for the event router.

Listing 7-4 Sample Code Implementing `postEvents()` Method

```
*/  protected void postEvents(IEventRouter router)
        throws java.lang.Exception
    {

    ILogger logger = getLogger();
```

```
// TODO: a real adapter would need to call into the EIS to
// determine ifany new events occured since the last time
// this method was invoked. For the sake of example, we'll just
// post a single event every time this method gets invoked...
// event data will be the current time on the
// The system formatted according to the event definition...
// we'll look for several event types...

Iterator eventTypesIterator = getEventTypes();
if (eventTypesIterator.hasNext())

{
 do
{

  // The event router is still interested in this type of event

   IEventDefinition eventDef = (IEventDefinition)
      eventTypesIterator.next();
   logger.debug("Generating event for " + eventDef.getName());

   // Create a default event (just blank/default data)

   IEvent event = eventDef.createDefaultEvent();

   // Get the format for the event

  java.util.Map eventPropertyMap = eventDef.
     getPropertySet();
  String strFormat = (String)eventPropertyMap.get
     ("Format");
     if( logger.isDebugEnabled() )
     logger.debug("Format for event type '"+eventDef.
        getName()+"' is '"+strFormat+"'");
     java.text.SimpleDateFormat sdf =
        new java.text.SimpleDateFormat(strFormat);
    IDocument payload = event.getPayload();
    payload.setStringInFirst("/SystemTime", sdf.format(new
       Date()));

    // let's log an audit message for this...

    try
    {
     logger.audit(toString() + ": postEvents >>> posting event
         ["+payload.toXML()+"] to router");
    }

      catch (Exception exc)
```

```
        {
          logger.warn(exc);
        }

       // This call actually posts the event to the IEventRouter

        router.postEvent(event);
        } while (eventTypesIterator.hasNext());
        }

    }// end of postEvents
```

A real adapter would need to call into the EIS to determine if any new events occurred since the last time this method was invoked. You can see a concrete example of this in the DBMS adapter included with the ADK. Refer to the `postEvent()` method in `EventGenerator.java`, which is in:

`WLI_HOME/adapters/dbms/src/com/bea/adapter/dbms/event/`

Adding New Event Types

`setupNewTypes()` gets called during refresh to handle any new event types. This allows us to perform any setup we need to handle a new type. The parent class has already sanity-checked the `listOfNewTypes()` and logged it; so you don't need to do that here.

Listing 7-5 Sample Code Showing the Template for `setupNewTypes()`

```
protected void setupNewTypes(java.util.List listOfNewTypes)
   {
    Iterator iter = listOfNewTypes.iterator();
       while (iter.hasNext())
      {
       IEventDefinition eventType = (IEventDefinition)iter.next();
      }
    }
```

Removing Event Types for Application Views that are Undeployed

`removeDeadTypes()` is called during refresh to handle any event types for application views that have been undeployed. You will need to perform a cleanup process to ensure that this event type is no longer handled, such as closing resources needed to handle this specific event type. Listing 7-6 shows how `removeDeadTypes()` is implemented.

Listing 7-6 Sample Code Showing the Template for `removeDeadTypes()`

```
protected void removeDeadTypes(java.util.List listOfDeadTypes)

{
   Iterator iter = listOfDeadTypes.iterator();
      while (iter.hasNext())
{
   IEventDefinition eventType = (IEventDefinition)iter.next();
```

Removing Resources

Finally, `doCleanUpOnQuit()` gets called when the event generator is shutting down, This method removes any resources allocated during event processing. The sample adapter stubs in this method. The template for implementing this method is shown in Listing 7-7.

Listing 7-7 Sample Code Showing doCleanUpOnQuit() Method Call

```
protected void doCleanUpOnQuit()
    throws java.lang.Exception
    {
     ILogger logger = getLogger();
     logger.debug(this.toString() + ": doCleanUpOnQuit");
    }
}
```

Step 3b: Implement the Data Transformation Method

Data transformation is the process of taking data from the EIS and transforming it into an XML schema that can be read by the application server. For each event, a schema will define what the XML output looks like. This is accomplished by using the `SOM` and `IDocument` class libraries. The following code listings show the data transformation sequence:

- Listing 7-8 shows the code used to transform data from the EIS into XML schema.
- Listing 7-9 shows the XML schema created by the code in Listing 7-8.
- Listing 7-10 shows the valid XML document created by the schema shown in Listing 7-9.

Listing 7-8 Sample Code for Transforming EIS Data into XML Schema

```
SOMSchema schema = new SOMSchema();
SOMElement root = new SOMElement("SENDINPUT");
SOMComplexType mailType = new SOMComplexType();
root.setType(mailType);
SOMSequence sequence = mailType.addSequence();
SOMElement to = new SOMElement("TO");
to.setMinOccurs("1");
to.setMaxOccurs("unbounded");
sequence.add(to);
SOMElement from = new SOMElement("FROM");
from.setMinOccurs("1");
from.setMaxOccurs("1");
sequence.add(from);
SOMElement cc = new SOMElement("CC");
cc.setMinOccurs("1");
cc.setMaxOccurs("unbounded");
sequence.add(cc);
SOMElement bcc = new SOMElement("BCC");
bcc.setMinOccurs("1");
bcc.setMaxOccurs("unbounded");
sequence.add(bcc);
SOMElement subject = new SOMElement("SUBJECT");
subject.setMinOccurs("1");
subject.setMaxOccurs("1");
sequence.add(bcc);
SOMElement body = new SOMElement("BODY");
```

```
if (template == null)
    { body.setMinOccurs("1");
      body.setMaxOccurs("1");
    }else
      { Iterator iter = template.getTags();
         if (iter.hasNext())
         { SOMComplexType bodyComplex = new SOMComplexType();
            body.setType(bodyComplex);
          SOMAll all = new SOMAll();
         while (iter.hasNext())
         { SOMElement eNew = new SOMElement((String)iter.next());
            all.add(eNew);
         }//endwhile
          bodyComplex.setGroup(all);
         }//endif
     }//endif
sequence.add(body);
schema.addElement(root);
```

Listing 7-9 XML Schema Created by Code in Listing 7-8

```
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
<xsd:element name="SENDINPUT">
    <xsd:complexType>
        <xsd:sequence>
            <xsd:element name="TO" maxOccurs="unbounded"
               type="xsd: string"/>
            <xsd:element name="FROM" type="xsd:string"/>
            <xsd:element name="CC" maxOccurs="unbounded"
                type="xsd:string"/>
            <xsd:element name="BCC" maxOccurs=
               "unbounded" type= "xsd:string"/>
            <xsd:element name="BCC" maxOccurs="unbounded"
                type="xsd:string"/>
            <xsd:element name="BODY" type="xsd:string"/>
        </xsd:sequence>
    </xsd:complexType>
</xsd:element>
```

Listing 7-10 Valid XML Document Created by Schema in Listing 7-9

```
</xsd:schema>
<?xml version="1.0"?>
<!DOCTYPE SENDINPUT>
<SENDINPUT>
  <TO/>
  <FROM/>
  <CC/>
  <BCC/>
  <BCC/>
  <BODY/>

</SENDINPUT> <xsd:schema
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
```

Step 4: Testing the Adapter

You can test the adapter by using the adapter test harness provided with WebLogic Integration. See “Step 5: Testing the Adapter,” in Chapter 6, “Developing a Service Adapter,”for a complete description of this tool and instructions for using it.

Step 5. Deploying the Adapter

After rebuilding the new adapter, deploy it into WebLogic Integration. You can deploy an adapter either manually or from the WebLogic Server Console. See Chapter 9, “Deploying Adapters,” for complete information.

8 Developing a Design-Time GUI

The ADKs design-time framework provides the tools you will use to build the web-based GUI that adapter users need to define, deploy, and test their application views. Although each adapter has EIS-specific functionality, all adapters require a GUI for deploying application views. The design-time framework minimizes the effort required to create and deploy these interfaces, primarily by using these two components:

- A web application component that allows you to build an HTML-based GUI by using Java Server Pages (JSP). This component is augmented by tools such as the JSP templates and tag library and the JavaScript library.
- The `abstractDesignTimeRequestHandler` class, which provides a simple API for deploying, undeploying, copying, and editing application views on a WebLogic Server.

This section includes information on the following subjects:

- Introduction to Design-Time Form Processing
- Design-Time Features
- File Structure
- The Flow of Events
- Step 1: Development Considerations
- Step 2: Determining the Screen Flow
- Step 3: Configuring the Development Environment

- Step 4: Implementing the Design-Time GUI
- Step 5: Write the HTML Forms
- Step 6. Implementing the Look-and-Feel

Introduction to Design-Time Form Processing

There are a variety of approaches to processing forms using Java Servlets and JSPs. The basic requirements of any form processing approach are:

1. Display an HTML form.

   To accomplish this task, you must:

   - Generate the form layout using HTML.
   - Indicate to the user which fields are mandatory.
   - Prepopulate fields with defaults, if any.

2. When the user submits the form data, validate the field values in the HTTP request.

   To accomplish this task, you must:

   - Supply logic to determine if all mandatory fields have a value.
   - For each value submitted, validate it against a set of constraints; for example, seeing if an age field is a valid integer between 1 and 120.

3. If any field values are invalid, the form must be redisplayed to the user with an error message next to each erroneous field on the form. The error message should be localized for the user's preferred locale if the web application supports multiple locales. In addition, the user's last input should be redisplayed so they do not have to re-input any valid information. The web application should continue with Step 2 and loop as many times as needed until all fields submitted are valid.

4. Once all fields have passed coarse-grained validation, the form data must be processed. While processing the form data, an error condition may be encountered that does not relate to individual field validation, such as a Java exception. The form will need to be re-displayed to the user with a localized error message at the top of the page. As with step 3, all input fields should be saved so the user does not have to re-enter any valid information.

   To accomplish this task, the web application developer must:

   - Determine which object or method implements the form processing API.
   - Determine how and when to advance the user to the next page in the web application.

5. If the form processing succeeds, the next page in the web application is displayed to the user.

Form Processing Classes

As you can imagine, or have experienced, implementing all these steps for every form in a web application is quite a tedious and error prone development process. The ADK design-time framework simplifies this process by using a Model-View-Controller paradigm. There are five classes involved in the form processing mechanism:

RequestHandler

`com.bea.web.RequestHandler`

This class provides HTTP request processing logic. This class is the model component of the MVC-based mechanism. This object is instantiated by the `ControllerServlet` and saved in the HTTP session under the key `handler`. The ADK provides the `com.bea.adapter.web.AbstractDesignTimeRequestHandler`. This abstract base class implements functionality needed to deploy an application view that is common across all adapters. You will need to extend this class to supply adapter/EIS specific logic.

ControllerServlet

com.bea.web.ControllerServlet

This class is responsible for receiving an HTTP request, validating each value in the request, delegating the request to a `RequestHandler` for processing, and determining which page to display to the user. The `ControllerServlet` uses Java reflection to determine which method to invoke on the `RequestHandler`. The `ControllerServlet` looks for an HTTP request parameter named `doAction` to indicate the name of the method that implements the form processing logic. If this parameter is not available, the `ControllerServlet` does not invoke any methods on the `RequestHandler`.

The `ControllerServlet` is configured in the `web.xml` file for the web application. The `ControllerServlet` is responsible for delegating HTTP requests to a method on a `RequestHandler`. You do not need to provide any code to use the `ControllerServlet`. However, you must supply the initial parameters listed in Table 8-5.

ActionResult

com.bea.web.ActionResult

`ActionResult` encapsulates information about the outcome of processing a request. Also provides information to the `ControllerServlet` to help it determine the next page to display to the user.

Word and Its Descendants

com.bea.web.validation.Word

All fields in a web application require some validation. The `com.bea.web.validation.Word` and its descendants supply logic to validate form fields. If any fields are invalid, the `Word` object uses a message bundle to retrieve an internationalized/localized error message for the field. The ADK supplies the custom validators described in Table 8-1.

Table 8-1 Custom Validators for Word Object

Validator	Description
`Integer`	Determines if the value for a field is an integer within a specified range.
`Float/Double`	Determines if the value for a field is a floating point value within a specified range.
`Identifier`	Determines if the value for a field is a valid Java identifier.
`Perl 5 Regular Expression`	Determines if the value for a field matches a Perl 5 regular expression.
`URL`	Determines if the supplied value is a valid URL
`Email`	Determines if the supplied value contains a list of valid e-mail addresses.
`Date`	Determines if the supplied value is a valid date using a specified date/time format

AbstractInputTagSupport and Its Descendants

`com.bea.web.tag.AbstractInputTagSupport`

The tag classes provided by the Web toolkit are responsible for:

- Generating the HTML for a form field and pre-populating its value with a default, if applicable.
- Displaying a localized error message next to the form field if the supplied value is invalid.
- Initializing a `com.bea.web.validation.Word` object and saving it in web application scope so that the validation object is accessible by the `ControllerServlet` using the form field's name.

Submit Tag

Additionally, the ADK provides a submit tag, such as:

```
<adk:submit name='xyz_submit' doAction='xyz'/>
```

This tag ensures the `doAction` parameter is passed to the ControllerServlet in the request. This results in the `ControllerServlet` invoking the `xyz()` method on the registered `RequestHandler`.

Form Processing Sequence

This section discusses the sequence in which forms are processed. Figure 8-1 shows how forms are processed.

Prerequisites

Before forms can be processed, the following must occur:

1. When a JSP containing a custom ADK input tag is being written to the HTTP response object, the tag ensures that it initializes an instance of `com.bea.web.validation.Word` and places it into the web application scope, keyed by the input field name. This makes the validation object available to the `ControllerServlet` so that it can perform coarse-grained validation on an HTTP request prior to submitting the request to the `RequestHandler`. For example,

   ```
   <adk:int name='age' minInclusive='1' maxInclusive='120'
   required='true'/>
   ```

2. The HTML for this tag will be generated when the JSP engine invokes the `doStartTag()` method on an instance of `com.bea.web.tag.IntegerTagSupport`. The `IntegerTagSupport` instance will instantiate a new instance of `com.bea.web.validation.IntegerWord` and add it to web application scope under the key `age`. Consequently, the `ControllerServlet` can retrieve the `IntegerWord` instance from its `ServletContext` whenever it needs to validate a value for age. The validation will ensure that any value passed for age is greater than or equal to one and less than or equal to 120.

3. Lastly, the HTML form must also submit a hidden field named `doAction`. The value of this parameter is used by the `ControllerServlet` to determine the method on the `RequestHandler` that can process the form.

Following these prerequisites, the JSP form appears as shown in Listing 8-1:

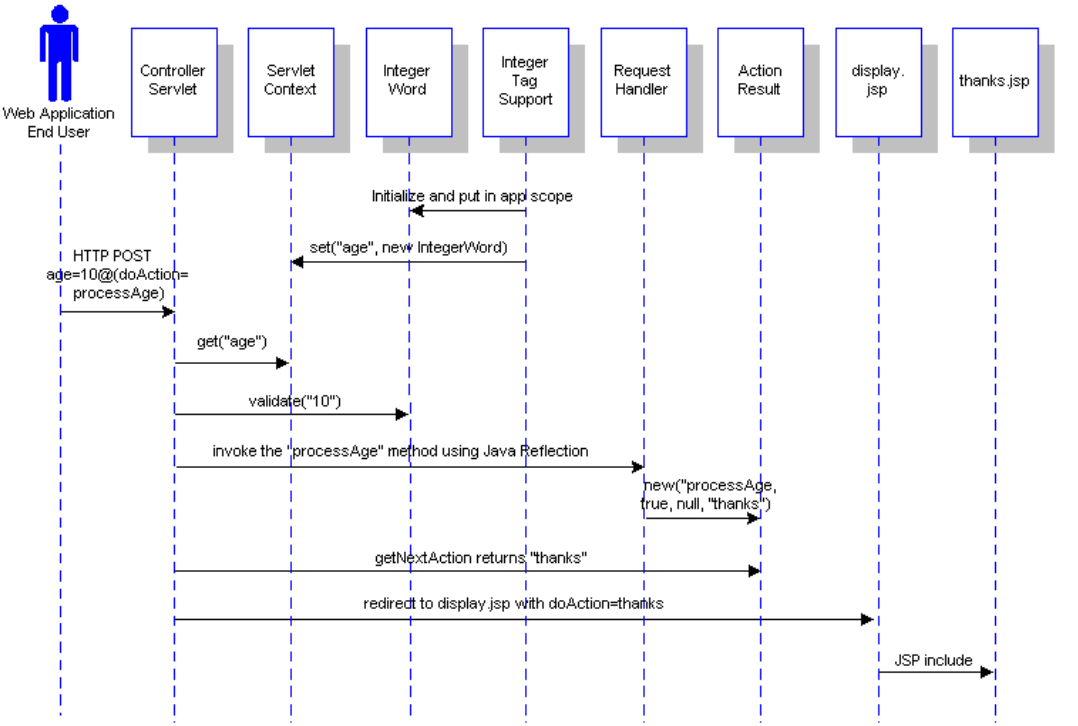
Listing 8-1 Sample JSP Form

```
<form method='POST' action='controller'>
    Age: <adk:int name='age' minInclusive='1' maxInclusive='120'
       required='true'/>
    <adk:submit name='processAge_submit' doAction='processAge'/>
</form>
```

Steps in the Sequence

The sequence diagram shown in Figure 8-1 illustrates the transactions that occur during form processing.

Figure 8-1 UI Form Processing Sequence Diagram



The sequence is as follows:

1. User submits the form with `age=10`, `doAction=processAge`.
2. `ControllerServlet` retrieves the age field from the HTTP request.
3. `ControllerServlet` retrieves a `com.bea.web.validation.Word` object from its `ServletContext` using key `age`. The object is an instance of `com.bea.web.validation.IntegerWord`.
4. `ControllerServlet` invokes the `validate()` method on the `Word` instance and passes `10` as a parameter.
5. The Word instance determines that the value 10 is greater than or equal to 1 and is less than or equal to 120. The Word instance returns true to indicate that the value is valid.
6. The `ControllerServlet` retrieves the `RequestHandler` from the session or creates it and adds it to the session as `handler`.
7. The `ControllerServlet` uses the Java Reflection API to locate and invoke the `processAge()` method on the `RequestHandler`. An exception is generated if the method does not exist. The method signature is:

   ```
   public ActionResult processAge(HttpServletRequest request)
   throws Exception
   ```

8. The `RequestHandler` processes the form input and returns an ActionResult object to indicate the outcome of the processing. The `ActionResult` contains information used by the `ControllerServlet` to determine the next page to display to the user. The next page information should be the name of another JSP or HTML page in your web application; for example, `thanks` would display the `thanks.jsp` page to the user.
9. The the ActionResult is a success, then the `ControllerServlet` redirects the HTTP response to the display page for the web application. In the ADK, the display page is typically display.jsp.
10. The `display.jsp` includes the JSP indicated by the `content` parameter; for example, `thanks.jsp`, and displays it to the user.

Design-Time Features

Design-time development has its own features, different from those associated with run-time adapter development. This section describes those features.

Java Server Pages

A design-time GUI is comprised of a set of ten Java Server Pages. JSPs are simply HTML pages that call Java servlets to invoke some transaction. To the user, the JSP looks just like any other web page.

The JSPs that comprise a design-time GUI are:

Table 8-2 Design-Time GUI JSPs

Filename	Description
`display.jsp`	The display page, also called the Adapter Home Page; this page contains the HTML necessary to create the look-and-feel of the application view.
`login.jsp`	The Adapter Design-Time Login page.
`confconn.jsp`	The Confirm Connection page; this page provides a form for the user to specify connection parameters for the EIS.
`appvwadmin.jsp`	The Application View Administration page; this page provides a summary of an undeployed application view.
`addevent.jsp`	The Add Event page; this page allows the user to add a new event to the application view.
`addservc.jsp`	The Add Service page; this page allows the user to add a new service to the application view.
`edtevent.jsp`	The Edit Event page is an optional page that allows users to edit events.
`edtservc.jsp`	The Edit Service page is an optional page that allows users to edit services.

Table 8-2 Design-Time GUI JSPs (Continued)

Filename	Description
`depappvw.jsp`	The Deploy Application View page; this page allows the user to specify deployment properties.
`appvwsum.jsp`	The Summary page; this page displays the following information about an application view: ■ Deployed State; that is, whether the application view is deployed or undeployed ■ Connection Criteria ■ Deployment Information (pooling configuration, log level, and security) ■ List of Events ■ List of Services

For a discussion on how to implement these JSPs, please refer to "Step 2: Determining the Screen Flow" on page 8-18.

JSP Templates

The design-time framework provides a set of JSP templates for rapidly assembling a web application to define, deploy, and test a new application view for an adapter. A template is an HTML page that is dynamically generated by a Java Servlet based on parameters provided in the HTTP request. Templates are used to minimize the number of custom pages and custom HTML needed for a web application. The templates supplied by the ADK provide three primary features for adapter developers.

- The ADK design-time templates provide most of the HTML forms needed to deploy an application view. In most cases, you will only have to supply three custom forms:
  - One to collect the EIS-specific connection parameters.
  - A second to collects the EIS-specific information needed to add an event.
  - A third to collect the EIS-specific information needed to add a service. In addition, you can supply a custom JSP for browsing a metadata catalog for an EIS.

- The templates also leverage the internationalization and localization features of the Java platform. The content of every page in the web application is stored in a message bundle. Consequently, the web interface for an adapter can be quickly internationalized.
- The templates centralize look-and-feel into a single location.

Refer to "JSP Templates" on page 8-10 for a complete list of JSP templates provided by the ADK.

The ADK Tag Library

The JSP tag library helps to develop user-friendly HTML forms and abstracts complexity from the adapter page developers. Custom tags for form input components allow page developers to seamlessly link to the validation mechanism. Custom tags are provided for the following HTML input tags:

Table 8-3 ADK JSP Tags

Tag	Description
`adk:check box`	Determines if the checkbox form field should be checked when a form is displayed; this tag does not perform validation.
`adk:content`	Provides access to a message in the message bundle.
`adk:date`	Verifies the user's input is a date value that meets a specific format.
`adk:double`	Verifies the user's input is a double value.
`adk:email`	Verifies the user's input is a vaADKlid list of e-mail addresses (one or more).
`adk:float`	Verifies the user's input is a float value.
`adk:identifier`	Verifies the user's input is a valid Java identifier.
`adk:int`	Verifies the user's input is an integer value.
`adk:label`	Displays a label from the message bundle.
`adk:password`	Verifies the user's input in a text field against a Perl 5 regular expression and marks the input with an asterisk (*).

Table 8-3 ADK JSP Tags (Continued)

Tag	Description
`adk:submit`	Links the form to the validation mechanism.
`adk:text`	Verifies the user's input against a Perl 5 regular expression.
`adk:textarea`	Verifies the user's input into a text area matches a Perl 5 regular expression.
`adk:url`	Verifies the user's input is a valid URL.

JSP Tag Attributes

You can customize the JSP tags by applying the attributes listed in Table 8-4:

Table 8-4 JSP Tag Attributes

Tag	Requires Attributes	Optional Attributes
`adk:int`, `adk:float`, `adk:double`	`name` - field name	`default` - default value on page display `maxlength` - maximum length of value `size` - display size `minInclusive` - value supplied by user must be greater than or equal to this value `maxInclusive` - value supplied by user must be less than or equal to this value `minExclusive` - value supplied by user must be strictly greater than this value `maxExclusive` - value supplied by user must be strictly less than this value `required` - (default is false, not required) `attrs` - additional HTML attributes

Table 8-4 JSP Tag Attributes (Continued)

Tag	Requires Attributes	Optional Attributes
`adk:date`	`name` - field name	`default` - default value on page display `maxlength` - maximum length of value `size` - display size `required` - (default is false, field is not required) `attrs` - additional HTML attributes `lenient` - should the date formatter be lenient in its parsing? default is false `format` - the expected format of the user's input, default is “mm/dd/yyyy”
`adk:email`, `adk:url`, `adk:identifier`	`name` - field name	`default` - default value on page display `maxlength` - maximum length of value `size` - display size `required` - (default is false, field is not required) `attrs` - additional HTML attributes
`adk:text`, `adk:password`	`name` - field name	`default` - default value on page display `maxlength` - maximum length of value `size` - display size `required` - (default is false, field is not required) `attrs` - additional HTML attributes `pattern` - a Perl 5 regular expression
`adk:textarea`	`name` - field name	`default` - default value on page display `required` - (default is false, field is not required) `attrs` - additional HTML attributes `pattern` - a Perl 5 regular expression `rows` - number of rows to display `columns` - number of columns to display

Note: For more information on tag usage, see `adk.tld` in:

`WLI_HOME/adapters/src/war/WEB-INF/taglibs`

JavaScript Library

The ADK provides JavaScript for opening and closing child windows.

The Application View

The application view represents a business-level interface to the specific functionality in an application. For more information, see “The Application View” on page 1-6.

File Structure

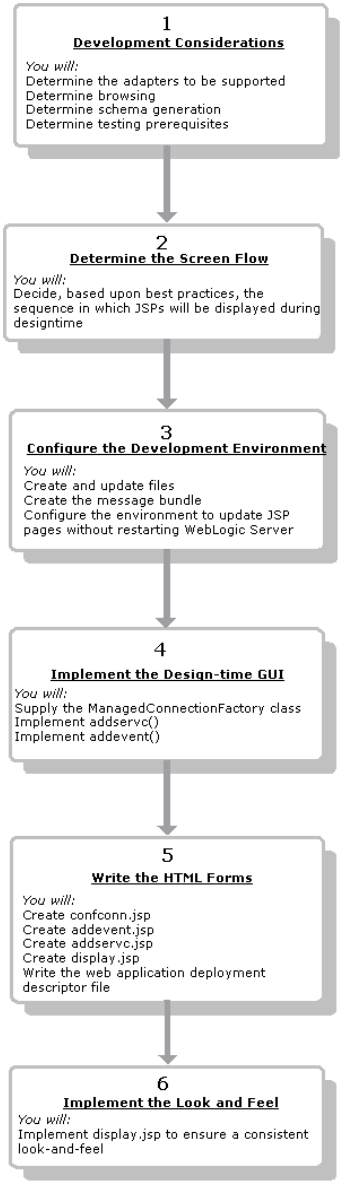
The file structure necessary to build a design-tim GUI adapter is the same as that required for service adapters. See “Step 2a: Set Up the File Structure” on page 6-7. In addition to the structure described there, you should also be aware that:

- The design-time interface for each adapter is a J2EE web application that is bundled as a `.war` file.
- A web application is a bundle of `.jsp`, `.html` and image files.
- The Web application descriptor is `WLI_HOME/adapters/ADAPTER/src/war/WEB-INF/web.xml`. This descriptor instructs the J2EE web container how to deploy and initialize the web application.

The Flow of Events

Figure 8-2 outlines the steps required to develop a design-time GUI.

Figure 8-2 Design-Time GUI Development Flow of Events



Step 1: Development Considerations

These are the items you need to consider before commencing with design-time GUI development:

- Determine the adapters to be supported.

  Will this GUI support event adapters? Service adapters? Both?

- Determine browsing.

  The EIS must supply functions to access the event/service catalog. If the EIS does not supply these, the user can't browse the catalogs. If the EIS does supply them, we recommend the following design principle: a call from the design-time UI to get metadata from the EIS is really no different than a call from a run-time component. Both execute functions on the back-end EIS.

  Consequently, you need to leverage your run-time architecture as much as possible to provide the design-time metadata features. You should invoke design-time specific functions that use a CCI Interaction object. The sample adapter included with the ADK provides an example/framework of this approach. You can find the sample adapater in `WLI_HOME/adapters/sample`.

- Determine schema generation.

  How will the adapter generate the request/response schema for a service? Will it make a call to the EIS or use some other methodology? Generally, the adapter needs to call the EIS to get metadata about a function or event. The adapter then transforms the EIS metadata into XML schema format. To make this happen, you need to invoke the SOM API. Again, the sample adapter provides instructions for implementing the SOM API. For more information on this API, see "The ADK Tag Library" on page 8-11.

- Determine the testing prerequisites.

  Will some sort of service testing be supported? If so, you need to provide:

  - A class that transforms the XML response schema into an HTML form. For an example, see:

    ```
    WLI_HOME/adapters/dbms/docs/api/com/bea/adapter/dbms/utils/class-use/TestFormBuilder.html
    ```

- A JSP named `testform.jsp` that invokes the transformation and displays the HTML form. To see an example of this file, go to `WLI_HOME/adapters/dbms/src/war/`.

Step 2: Determining the Screen Flow

Next, you need to determine the order in which the JSPs will appear when the user displays the application view. This section describes the basic, required screen flow for a successful application view. Note that these are minimum requirements, as you can add more screens to the flow to meet your specific needs.

Screen 1: Logging In

The application view is a secure system, therefore, the user will need to log in before he or she can implement the view. The Application View Console - Logon page thus must be the first page the user sees.

To use this page, the user supplies a valid username and password. That information is then validated to ensure that the user is a member of the adapter group in the default WebLogic Server security realm.

Note: The security for the Application View web application is specified in the `WLI_HOME/adapters/ADAPTER/src/war/WEB-INF/web.xml` file, which is shipped in the `wlai.war` file.

Screen 2. Managing Application Views

Once the user successfully logs in, the Application View Management Console page appears. This page lists the folders that contain the application views, the status of these folders, and any action taken on them. From this page, the user can either view existing application views or add new ones.

- To view an existing application view, the user clicks the appropriate folder and drills down to the desired application view. The user then selects the application

view and the Application View Summary page appears (`appvwsum.jsp`; see "Screen 9: Summarizing the Application View" on page 8-23).

- To add a new application view, the user clicks Add Application View, which will display the Define New Application View page.

Screen 3: Defining the New Application View

The Define New Application View page (`defappvw.jsp`) allows the user to define a new application view in any folder in which the client is located. To do this, the user needs to provide a description that associates the application view with an adapter. This form provides text boxes for entering the application view name and description and a drop-down list box displaying adapters with which the user can associate the application view.

Once the new adapter is defined, the user selects OK and the Configure Connection page appears.

Screen 4: Configuring the Connection

If the new application view is valid, the user will need to configure the connection. Therefore, once the application view is validated, the next screen in the flow should be the Configure Connection Parameters page (`confconn.jsp`). This page provides a form for the user to specify connection parameters for the EIS. Since connection parameters are specific to every EIS, this page is different across all adapters.

When the user submits the connection parameters, the adapter attempts to open a new connection to the EIS using the parameters. If successful, the user is forwarded to the next page, Application View Administration.

Screen 5: Administering the Application View

With a new application view created, the user will need a way of administering it. Therefore, the next screen in the flow should be the Application View Administration page (`appvwadmin.jsp`). This page provides a summary of an undeployed application view. Specifically, it shows the following:

- Connection criteria

  The connection criteria section provides a link that returns the user to the Configure Connection page so that he or she can change connection parameters.

- List of events

  For each event on the application view, the user can do the following:

  - View the XML schema.
  - Remove the event. When the user chooses to remove the event, the system confirms this before removing the event.
  - Provide event properties.

- List of services

  For each service on the application view, the user can do the following:

  - View the request XML schema.
  - View the response XML schema.
  - Remove the service. When the user chooses to remove the service, the system will confirm that choice before removing the event.
  - Provide service properties.

In addition to providing a list of events and a list of services on the application view, the page provides a link to add a new event or service.

Screen 6: Adding an Event

The user will obviously need to add new events to an application view. Therefore, the Application View Administration page contains a link to the Add Event page (`addevent.jsp`). This page allows the user to add a new event to the application view.

The following rules apply to a new event:

- Every event must have a unique name.
  - The event name can only contain a-z, A-Z, 0-9, and underscore (_) and must begin with a letter. Spaces, dots, commas, and so on are not allowed.
  - The length of the name cannot exceed 256 characters.

  - The event name must be unique to the application view. If the user specifies an event name that is not unique, the form will reload with an error message indicating that the event is already defined.

- Optionally, the user can specify a description for the event. This description cannot exceed 2048 (2K) characters.
- In addition to name and description, every event has EIS specific parameters. The collection of EIS-specific parameters define an event type for the adapter.
- Optionally, some adapters provide a mechanism for browsing the event catalog for an EIS.

After adding and saving a new event, the user will be returned to the Application View Administration page.

Screen 7: Adding a Service

As with events, the user will also need to add new services to an application view. Therefore, the Application View Administration page contains a link to the Add Service page (`addservc.jsp`). This page allows the user to add a new service to the application view.

The following rules apply to a new event:

- Every service must have a unique name.
  - The service name can only contain a-z, A-Z, 0-9, and underscore (_) and must begin with a letter. Spaces, dots, commas, and so on are not allowed.
  - The length of the name cannot exceed 256 characters.
  - The service name must be unique to the application view. If the user specifies a service name that is not unique, the form will reload with an error message indicating that the service is already defined.
- Optionally, the user can specify a description for the service. This description cannot exceed 2048 (2K) characters.
- In addition to name and description, every service has EIS specific parameters. The collection of EIS specific parameters define an service type for the adapter.

- Optionally, some adapters provide a mechanism for browsing the service catalog for an EIS.

After adding and saving a new service, the user will be returned to the Application View Administration page.

Screen 8: Deploying an Application View

Once the user adds at least one service or event, he or she can deploy the application view. Deploying an application view makes it available to process events and services. If the user chooses to deploy the application view, he or she will be forwarded to the Deploy Application View page (`depappvw.jsp`).

This screen allows the user to specify deployment properties. The user can specify:

- Connection pooling parameters
  - Minimum pool size: must be greater than or equal to 0.
  - Maximum pool size: must be greater than or equal to one.
  - Target fraction of maximum pool size: must be greater than zero and less than one.
  - Allow Pool to Shrink: is the connection pool allowed to shrink?
- Logging level: The user can specify one of four logging levels
  - Log all messages
  - Log informationals, warnings, errors, and audit messages
  - Log warnings, errors, and audit messages
  - Log errors and audit messages
- Security: The user can access a form to apply security restrictions for the application view by clicking on the link that reads Restrict Access. This creates a child window.

Controlling User Access

The user can grant or revoke a user's access privileges by specifying a user or group name in the form provided. Each application view has two types of access: read and write.

- Read access allows the user to execute services and subscribe to events.
- Write access allows the user to deploy/edit/undeploy the application view.

Deploying the Application View

The user deploys the application view by clicking the deploy button. He or she must decide whether or not the application view should be deployed persistently. *Persistent deployment* means that the application view will be redeployed whenever the application server is restarted.

Saving the Application View

The user can save an undeployed application view and return to it later via the Application View Management Console. This process assumes that all deployed application views are saved in the repository. In other words, deploying an unsaved application view will automatically save it.

Screen 9: Summarizing the Application View

Upon successful application view deployment, the user will be forwarded to the Application View Summary page (`appvwsum.jsp`). This page provides the following information about an application view:

- Deployed state: Deployed or Undeployed
  - If the application view is deployed:

    The page will show a link to undeploy the application view. If the user chooses the Undeploy link, a child window will ask the user to confirm his choice to undeploy the application view. If the user confirms, the application view will be undeployed and the summary page will be redisplayed. Undeployed application views are still saved in the repository. This allows the user to edit or remove the application view.

If the adapter supports the testing of events, the Summary page displays a test link for each event. Testing of events is not directly supported by the ADK. Also, if the adapter supports the testing of services, the summary page will display a test link for each service. The ADK demonstrates one possible approach to testing services by providing the `testservc.jsp` and `testrslt.jsp` files. You are free to use these pages to devise your own service testing strategy.

- If the application view is not deployed:

  The page will show a Link to Deploy the application view. If the user chooses the Deploy link, the application view will be deployed and the application view summary page will reload.

  The page will show a link to edit the application view. If the user chooses the Edit link, a child window ask the user to confirm his or her choice to edit the application view. If the user confirms the choice to edit, the Application View Administration page appears.

  The page will show a link to remove the application view. If the user chooses the Remove link, a child window will ask the user to confirm his or her choice to remove the application view from the ADK repository. If the user confirms, the application view will be deleted from the WebLogic Integration repository and the user will be redirected to the adapter main page.

- Connection criteria
- Deployment information (pooling configuration, log level, and security)
- List of events: For each event, there will be a link to view the schema and, if supported, to test the event. The user cannot remove events from this page; they must choose to edit first.
- List of services: For each service, the page will contain a link to view the request schema and the response schema, and, if supported, to test the service. The user cannot remove services from this page; they must undeploy and edit first.

Step 3: Configuring the Development Environment

This step describes the processes you must complete to prepare your computer for design-time GUI development.

Step 3a: Create the Message Bundle

Next, you need to create the message bundle. Any message destined for the end-user should be placed in a message bundle. This bundle is simply a `.properties` text file that contains key=value pairs that allow you to internationalize messages. When a locale and national language are specified at run time, the contents of the message is interpreted, based upon the key=value pair and the message is presented to the user in the correct language for his or her locale.

For instructions on creating a message bundle, please refer to the JavaSoft tutorial on internationalization at:

`http://java.sun.com/docs/books/tutorial/i18n/index.html`

Step 3b: Configure the Environment to Update JSPs Without Restarting the WebLogic Server

The design-time UI is deployed as a J2EE web application from a `.war` file. A `.war` file is simply a `.jar` file with a web application descriptor in `WEB-INF/web.xml` in the `.jar` file. However, the `.war` file does not allow the J2EE Web container in WebLogic Server to re-compile JSP's on the fly. Consequently, you normally have to restart WebLogic Server just to change a JSP file. Since this goes against the spirit of JSP, the ADK suggests the following workaround to enable you to update JSPs without restarting WebLogic Server:

1. Construct a valid `.war` file for your adapter's design-time UI. For the sample adapter, this is accomplished by using Ant. Listing 8-2 shows the target that produces the J2EE `.war` file:

Listing 8-2 Sample Code Showing Target that Creates a .war File

```
<target name='war' depends='jar'>

<!-- Clean-up existing environment -->

<delete file='${LIB_DIR}/${WAR_FILE}'/>
<delete dir='${SRC_DIR}/war/WEB-INF/lib'/>
<delete dir='${SRC_DIR}/war/WEB-INF/classes'/>

<war warfile='${LIB_DIR}/${WAR_FILE}'
   webxml='${SRC_DIR}/war/WEB-INF/web.xml'>
    <fileset dir='${PROJECT_DIR}' includes='version_info.xml'/>

    <!--

    IMPORTANT! Exclude the WEB-INF/web.xml file from the WAR
    as it already gets included via the webxml attribute above

    -->

    <fileset dir='${SRC_DIR}/war' excludes='WEB-INF/web.xml'/>

    <!--

    IMPORTANT! Include the ADK design time framework into the
    adapter's design time Web application.
    -->

    <fileset dir='${ROOT}/adk/src/war'/>

    <!-- Include classes from the adapter that support the design
    time UI -->

    <classes dir='${SRC_DIR}' includes='sample/web/*.class'/>

    <!--

    Include all JARs required by the Web application under
    the WEB-INF/lib directory of the WAR file

    -->

   <lib dir='${LIB_DIR}' includes='${JAR_FILE}'/>

   <lib dir='${WLAI_LIB_DIR}'
      includes='adk.jar,adk-web.jar,bea.jar,
      logtoolkit.jar,webtoolkit.jar,wlai-common.jar,
      wlai-ejb-client.jar,xcci.jar,xmltoolkit.jar'/>
```

```
    <lib dir='${RESOURCE_DIR}/log4j' includes='log4j.jar'/>
    <lib dir='${RESOURCE_DIR}/OROMatcher-1.1.0a' includes=
       'oromatcher.jar'/>
    <lib dir='${RESOURCE_DIR}/xml' includes='xerces_dp1.jar'/>
    <lib dir='${RESOURCE_DIR}/xml' includes='xalan.jar'/>
</war>

<!-- Unjar the WAR into a temp directory; for development -->

<unjar src='${LIB_DIR}/${WAR_FILE}' dest='${LIB_DIR}/
   BEA_WLS_SAMPLE_ADK_Web'/>

</target>
```

This Ant target constructs a valid `.war` file for the design-time interface in the `PROJECT_ROOT/lib` directory, where `PROJECT_ROOT` is the location under the WebLogic Integration installation where the developer is constructing the adapter; for example, the DBMS adapter is being constructed in:

`WLI_HOME/adapters/DBMS`

In addition, this target performs an "unjar" operation in the `/lib` directory. This extracts the `.war` into a temporary directory. This is the key to having WebLogic Server recompile JSPs without restarting.

Next, load your web application into WebLogic Server and configure the development environment. Do the following:

2. To load your web application into WebLogic Server, you can use the WebLogic console, but we recommend that you edit the `config.xml` file for your domain; for example:

   `BEA_HOME/wlserver6.1/config/mydomain/config.xml`.

   Note: If you choose to edit your `config.xml` file, you will need to add an `<application>` element under the domain element:

3. Replace `BEA_WLS_SAMPLE_ADK_Web` with your adapter's logical name.

4. Replace `WLI_HOME` with the location of your WebLogic Integration installation; replace `PROJECT_ROOT` with the directory name of your adapter development tree, as shown in Listing 8-3.

Listing 8-3 Sample Code Showing Name of Adapter Development Tree

```
<Application Deployed="true" Name="BEA_WLS_SAMPLE_ADK_Web"
   Path="WLI_HOME\adapters\PROJECT_ROOT\lib">

    <WebAppComponent Name="BEA_WLS_SAMPLE_ADK_Web"
       ServletReloadCheckSecs="1" Targets="myserver" URI=
       "BEA_WLS_SAMPLE_ADK_Web"/>

</Application>
```

Note: If you run GenerateAdapterTemplate, the information in Listing 8-3 will be automatically updated. You can then open `WLI_HOME/adapters/ADAPTER/src/overview.html` and copy and paste it as your `config.xml` entry.

The key is the URI attribute of the `<WebAppComponent>` element. Notice that it points to `BEA_WLS_SAMPLE_ADK_Web` and not `BEA_WLS_SAMPLE_ADK_Web.war`. This is the temporary directory that you created when you created the `.war` file. It contains your extracted `.war` file contents. WebLogic Server will watch this directory for JSP changes.

5. To change a JSP, do not change it in the temporary directory; change it from the `src/war` directory and then rebuild the war target. Remember, when the `.war` file is created, it is also extracted into the directory WebLogic Server is watching. WebLogic Server will pick up the changes to the specific JSP only. The watch interval used by WebLogic Server is set by the `pageCheckSeconds` in `WEB-INF/weblogic.xml`. Listing 8-4 shows how this is done:

Listing 8-4 Sample Code Showing How to Set the Watch Interval

```
<jsp-descriptor>
    <jsp-param>
        <param-name>compileCommand</param-name>
        <param-value>/jdk130/bin/javac.exe</param-value>
    </jsp-param>
    <jsp-param>
        <param-name>keepgenerated</param-name>
        <param-value>true</param-value>
    </jsp-param>
    <jsp-param>
        <param-name>pageCheckSeconds</param-name>
```

```
            <param-value>1</param-value>
        </jsp-param>
        <jsp-param>
            <param-name>verbose</param-name>
            <param-value>true</param-value>
        </jsp-param>
    </jsp-descriptor>
```

This approach also tests whether your `.war` file is being constructed correctly.

6. Finally, you should precompile JSPs when the server starts. This saves you from having to load every page before knowing if they will compile correctly. To enable precompilation you will need to have `weblogic.xml` from the sample adapter and the following element in your `WLI_HOME/adapters/ADAPTER/src/war/WEB-INF/web.xml` file. Listing 8-5 shows how this is done:

Listing 8-5 Sample Code Showing How to Enable Precompilation of JSPs

```
<context-param>
    <param-name>weblogic.jsp.precompile</param-name>
    <param-value>true</param-value>
</context-param>
```

You can also pre-compile your JSPs using the WebLogic JSP compiler when you build your `.war` target using Ant. This is accomplished by performing the tasks outlined in Listing 8-6 and described here:

- The first task creates the directory where WebLogic Server looks for JSP servlet classes at run time. Please note one caveat to using this approach: you have to specify the target server name. Consequently, it may not suffice as a deployment strategy.
- The second task invokes the JSP compiler `jspc`, provided in WebLogic Server. This task pre-compiles all the JSPs for your web application and places them in the `WLI_HOME/adapters/ADAPTER/lib/BEA_WLS_SAMPLE_ADK_Web/WEB-INF/_tmp_war_myserver_ myserver_BEA_WLS_SAMPLE_ADK_Web` directory for your web application (this directory does not exist until you build

the adapter specified in ADAPTER. Consequently, this allows you to ensure your JSPs will compile every time you build your adapter.

Listing 8-6 Sample Code Showing an Alternate Way to Enable Precompilation of JSPs

```
<mkdir dir='${LIB_DIR}/BEA_WLS_SAMPLE_ADK_Web/
   WEB-INF/_tmp_war_myserver_myserver_BEA_WLS_SAMPLE_ADK_Web/
   jsp_servlet'/>

<!--
This precompiles the JSPs in the Web application during the build.
However, this will only prevent WebLogic from precompiling if the
target server is 'myserver'. If the user is using any other target
server name, the JSP pages will be re-precompiled when the server
starts
-->

<java classname='weblogic.jspc' fork='yes'>
    <arg line='-d ${LIB_DIR}/BEA_WLS_SAMPLE_ADK_Web/WEB-INF/
       _tmp_war_myserver_myserver_BEA_WLS_SAMPLE_ADK_Web -webapp
       ${LIB_DIR}/BEA_WLS_SAMPLE_ADK_Web -compileAll -contextPath
       BEA_WLS_SAMPLE_ADK_Web -depend -keepgenerated'/>
<classpath refid='CLASSPATH'/>
</java>
```

For more information on precompiling JSPs, see:

http://e-docs.bea.com/wls/docs61/jsp/reference.html#precompile

Step 4: Implementing the Design-Time GUI

Implementing the steps described in “Introduction to Design-Time Form Processing” on page 8-2 for every form in a web application is a tedious and error prone development process. The design-time framework simplifies this process when you are using a Model-View-Controller paradigm.

To implement the design-time GUI, you need to implement the `DesignTimeRequestHandler` class. This class accepts user input from a form and performs a design-time action. To implement this class, you must extend the `AbstractDesignTimeRequestHandler` provided with the ADK; see the Javadoc for this class for a detailed overview of the methods provided by this object.

Extend AbstractDesignTimeRequestHandler

The `AbstractDesignTimeRequestHandler` provides utility classes for deploying, editing, copying, and removing application views on the WebLogic Server. It also provides access to an application view descriptor. The application view descriptor provides the connection parameters, list of events, list of services, log levels, and pool settings for an application view. The parameters are shown on the Application View Summary page.

At a high-level, the `AbstractDesignTimeRequestHandler` provides an implementation for all actions that are common across adapters. Specifically, these actions are:

- Define the application view.
- Configure the connection.

  Note: The ADK provides the method to process connection parameters to obtain a CCI connection but does not supply the `confconn.jsp`. See "Step 5a: Create the confconn.jsp Form" on page 8-34 for instructions on creating this form.
- Deploy the application view.
- Provide application view security.
- Edit the application view.
- Undeploy the application view.

Methods to Include

To ensure these actions, you must supply the following methods when you create the concrete implementation of `AbstractDesignTimeRequestHandler`:

- `initServiceDescriptor();`

This method adds a service to an application view at design time (see “Step 4b. Implement initServiceDescriptor()” on page 8-32).

- `initEventDescriptor();`

  This method adds an event to an application view at design time (see “Step 4c. Implement initEventDescriptor()” on page 8-33).

You also need to provide in every concrete implementation of `AbstractDesignTimeRequestHandler` the following two methods:

- `protected String getAdapterLogicalName();`

  This method returns the adapter logical name and is used to deploy an application view under an adapter logical name.

- `protected Class getManagedConnectionFactoryClass();`

  This method returns the SPI `ManagedConnectionFactory` implementation class for the adapter.

Step 4a. Supply the ManagedConnectionFactory Class

To supply the `ManagedConnectionFactory` class, you need to implement the following method:

```
protected Class getManagedConnectionFactoryClass();
```

This method returns the SPI `ManagedConnectionFactory` implementation class for the adapter. This class is needed by the `AbstractManagedConnectionFactory` when attempting to get a connection to the EIS.

Step 4b. Implement initServiceDescriptor()

For service adapters, you need to implement `initServiceDescriptor()` so that the adapter user can add services at design time. This method is implemented as shown in Listing 8-7:

Listing 8-7 `initServiceDescriptor()` Implementation

```
protected abstract void initServiceDescriptor(ActionResult result,
                                    IServiceDescriptor sd,
                                    HttpServletRequest request)
     throws Exception
```

This method is invoked by the `AbstractDesignTimeRequestHandler's addservc()` implementation. It is responsible for initializing the EIS-specific information of the `IServiceDescriptor` parameter. The base class implementation of `addservc()` handles the error handling, etc. The `addservc()` method is invoked when the user submits the addservc JSP.

Step 4c. Implement initEventDescriptor()

For event adapters, you will need to implement `initEventDescriptor()` so that the adapter user can add events at design time. This method is implemented as shown in Listing 8-8:

Listing 8-8 `initEventDescriptor()` Implementation

```
protected abstract void
    initEventDescriptor(ActionResult result,
                        IEventDescriptor ed,
                        HttpServletRequest request)
    throws Exception;
```

This method is invoked by the `AbstractDesignTimeRequestHandler's addevent()` implementation. It is responsible for initializing the EIS-specific information of the `IServiceDescriptor` parameter. The base class implementation of `addevent()` handles such concepts as error handling. The `addevent()` method is invoked when the user submits the addevent JSP. You should not override `addevent`, as it contains common logic and delegates EIS-specific logic to `initEventDescriptor()`.

Note: When adding properties to a service descriptor, the property names must follow the bean name standard otherwise the service descriptor does not update the InteractionSpec correctly.

Step 5: Write the HTML Forms

The final step to implementing a design-time GUI is to write the various forms that comprise the interface.

- See "Java Server Pages" on page 8-9 for a list and description of the necessary forms.
- See "Step 2: Determining the Screen Flow" on page 8-18 for the specific details of each form.

The following sections describe how to actually code these forms and include a sample of that code.

Step 5a: Create the confconn.jsp Form

This page provides an HTML form for users to supply connection parameters for the EIS. You are responsible for providing this page with your adapter's design-time web application. This form posts to the `ControllerServlet` with `doAction=confconn`. This implies that the `RequestHandler` for your design-time interface must provide the following method:

```
public ActionResult confconn(HttpServletRequest request) throws
   Exception
```

The implementation of this method is responsible for using the supplied connection parameters to create a new instance of the adapter's `ManagedConnectionFactory`. The `ManagedConnectionFactory` supplies the CCI `ConnectionFactory`, which is used to obtain a connection to the EIS. Consequently, the processing of the confconn form submission verifies that the supplied parameters are sufficient for obtaining a valid connection to the EIS.

The confconn form for the sample adapter is shown in Listing 8-9:

Listing 8-9 Coding confconn.jsp

```
<%@ taglib uri='/WEB-INF/taglibs/adk.tld' prefix='adk' %>
<form method='POST' action='controller'>
    <table>
        <tr>
            <td><adk:label name='userName' required='true'/></td>
            <td><adk:text name='userName' maxlength='30' size=
               '8'/></td>
        </tr>
        <tr>
            <td><adk:label name='password' required='true'/></td>
            <td><adk:password name='password' maxlength='30'
                size='8'/></td>
        </tr>
        <tr>
            <td colspan='2'><adk:submit name='confconn_submit'
               doAction='confconn'/></td>
        </tr>
    </table>
</form>
```

The following paragraphs describe the contents of Listing 8-9.

Including the ADK Tag Library

The line:

```
<%@ taglib uri='/WEB-INF/taglibs/adk.tld' prefix='adk' %>
```

instructs the JSP engine to include the ADK tag library. These tags are listed in Table 8-3.

Posting the ControllerServlet

The line:

```
<form method='POST' action='controller'>
```

instructs the form to post to the `ControllerServlet`. The `ControllerServlet` is configured in the `web.xml` file for the web application and is responsible for delegating HTTP requests to a method on a `RequestHandler`. You do not need to provide any code to use the `ControllerServlet`; however, you must supply the initial parameters, described in Table 8-5:

Table 8-5 `ControllerServlet` Parameters

Parameter	Description
`MessageBundleBase`	This property specifies the base name for all message bundles supplied with an adapter. The ADK always uses the adapter logical name for its sample adapters. However, you are free to choose your own naming convention for message bundles. Notice that this property is also established in the `ra.xml`.
`DisplayPage`	This property specifies the name of the JSP that controls screen flow and look-and-feel. In the sample adapter, this page is `display.jsp`.
`LogConfigFile`	This property specifies the log4j configuration file for the adapter.
`RootLogContext`	This property specifies the root log context. Log context helps categorize log messages according to modules in a program. The ADK uses the adapter logical name for the root log context so that all messages from a specific adapter will be categorized accordingly.
`RequestHandlerClass`	This property provides the fully qualified name of the request handler class for the adapter. In the sample adapter, this value is “sample.web.DesignTimeRequestHandler”. See below for details on implementing a DesignTimeRequestHandler.

Displaying the Label for the Form Field

The line:

```
<adk:label name='userName' required='true'/>
```

displays a label for a field on the form. The value that is displayed is retrieved from the message bundle for the user. The “required” attribute indicates if the user must supply this parameter to be successful.

Displaying the Text Field Size

The line:

```
<adk:text name='userName' maxlength='30' size='8'/>
```

sets a text field of size 8 with maximum length (max length) of 30.

Displaying a Submit Button on the Form

The line:

```
<adk:submit name='confconn_submit' doAction='confconn'/>
```

displays a button on the form that allow the adapter user to submit the input. The label on the button will be retrieved from the message bundle using the `confconn_submit` key. When the form data is submitted, the `ControllerServlet` will locate the `confconn` method on the registered request handler (see the `RequestHandlerClass` property) and pass the request data to it.

Implementing confconn()

The `AbstractDesignTimeRequestHandler` provides an implementation of the `confconn()` method. This implementation leverages the Java Reflection API to map connection parameters supplied by the user to setter methods on the adapter's `ManagedConnectionFactory` instance. You only need to supply the concrete class for your adapter's `ManagedConnectionFactory` by implementing this method:

```
public Class getManagedConnectionFactoryClass()
```

Step 5b: Create the addevent.jsp form

This form allows the user to add a new event to an application view. This form is EIS specific. The `addevent.jsp` form for the sample adapter is shown in Listing 8-10:

Listing 8-10 Sample Code Creating the addevent.jsp Form

```
<%@ taglib uri='/WEB-INF/taglibs/adk.tld' prefix='adk' %>
<form method='POST' action='controller'>
```

```
    <table>
        <tr>
            <td><adk:label name='eventName' required='true'/></td>
            <td><adk:text name='eventName' maxlength='100'
               size='50'/></td>
        </tr>
        <tr>
            <td colspan='2'><adk:submit name='addevent_submit'
               doAction='addevent'/></td>
        </tr>
    </table>
</form>
```

The following paragraphs describe the contents of `addevent.jsp`:

Including the ADK Tag Library

The line:

```
<%@ taglib uri='/WEB-INF/taglibs/adk.tld' prefix='adk'%>
```

instructs the JSP engine to include the ADK tag library. These tags are described in Table 8-3.

Posting the ControllerServlet

The line:

```
<form method='POST' action='controller'>
```

instructs the form to post to the `ControllerServlet`. The `ControllerServlet` is configured in the `web.xml` file for the web application and is responsible for delegating HTTP requests to a method on a `RequestHandler`. You do not need to provide any code to use the `ControllerServlet`; however, you must supply the initial parameters, as described in Table 8-5, “ControllerServlet Parameters.”

Displaying the Label for the Form Field

The line:

```
<adk:label name='eventName' required='true'/>
```

displays a label for a field on the form. The value that is displayed is retrieved from the message bundle for the user. The “required” attribute indicates if the user must supply this parameter to be successful.

Displaying the Text Field Size

The line:

```
<adk:text name='eventName' maxlength='100' size='50'/>
```

sets a text field of size 50 with maximum length (max length) of 100.

Displaying a Submit Button on the Form

The line:

```
<adk:submit name='addevent_submit' doAction='addevent'/>
```

displays a button on the form that allow the adapter user to submit the input. The label on the button will be retrieved from the message bundle using the `addevent_submit` key. When the form data is submitted, the `ControllerServlet` will locate the `addevent()` method on the registered request handler (see the `RequestHandlerClass` property) and pass the request data to it.

Adding Additional Fields

You must also add any additional fields that the user requires for defining an event. See the DBMS or e-mail adapters for examples of forms with multiple fields.

Step 5c: Create the addservc.jsp form

This form allows the user to add a new service to an application view. This form is EIS-specific. The `addservc.jsp` form for the sample adapter is shown in Listing 8-11:

Listing 8-11 Coding addservc.jsp

```
<%@ taglib uri='/WEB-INF/taglibs/adk.tld' prefix='adk' %>
<form method='POST' action='controller'>
    <table>
        <tr>
            <td><adk:label name='serviceName' required='true'/>
               </td>
            <td><adk:text name='serviceName' maxlength='100'
              size='50'/></td>
        </tr>
        <tr>
           <td colspan='2'><adk:submit name='addservc_submit'
              doAction='addservc'/></td>
        </tr>
    </table>
</form>
```

Including the ADK Tag Library

The line:

```
<%@ taglib uri='/WEB-INF/taglibs/adk.tld' prefix='adk' %>
```

instructs the JSP engine to include the ADK tag library. The ADK tag library supports the user-friendly form validation provided by the ADK. The ADK tag library provides the tags described in Table 8-3.

Posting the ControllerServlet

The line:

```
<form method='POST' action='controller'>
```

instructs the form to post to the `ControllerServlet`. The `ControllerServlet` is configured in the `web.xml` file for the web application and is responsible for delegating HTTP requests to a method on a `RequestHandler`. You do not need to provide any code to use the `ControllerServlet`; however, you must supply the initial parameters as described in Table 8-5, “ControllerServlet Parameters.”

Displaying the Label for the Form Field

The line:

```
<adk:label name='servcName' required='true'/>
```

displays a label for the form field. The value that is displayed is retrieved from the message bundle for the user. The “required” attribute indicates if the user must supply this parameter to be successful.

Displaying the Text Field Size

The line:

```
<adk:text name='eventName' maxlength='100' size='50'/>
```

sets a text field of size 50 with maximum length (max length) of 100.

Displaying a Submit Button on the Form

The line:

```
<adk:submit name='addservc_submit' doAction='addservc'/>
```

displays a button on the form that allow the adapter user to submit the input. The label on the button will be retrieved from the message bundle using the `addservc_submit` key. When the form data is submitted, the `ControllerServlet` will locate the `addservc` method on the registered `RequestHandler` (see the `RequestHandlerClass` property) and pass the request data to it.

Adding Additional Fields

You must also add any additional fields that the user requires for defining a a service. See the DBMS or e-mail adapters for examples of forms with multiple fields.

Step 5d: Implement Edit Events and Services (optional)

If you want to give adapter users the capability of editing events and services during design time, you will need to edit the `wlai.properties` file, create the `edtservc.jsp` and `edtevent.jsp` forms, and implement some specific methods. This step describes those tasks.

Note: This step is optional. You do not need to provide users with these capabilities.

Update wlai.properties

First, update the system properties in `wlai.properties` for the sample adapter by making the following changes to that file:

- Add the following properties:

```
edtservc_title=Edit Service

edtservc_description=On this page, you edit service
properties.

edtevent_description=On this page, you edit event
properties.edtevent_title=Edit Event

glossary_description=This page provides definitions for
commonly

used terms.

service_submit_add=Add

service_label_serviceDesc=Description:

service_submit_edit=Edit

service_label_serviceName=Unique Service Name:

event_submit_add=Add

event_label_eventDesc=Description:

event_label_eventName=Unique Event Name:

event_submit_edit=Edit

eventLst_label_edit=Edit

serviceLst_label_edit=Edit

event_does_not_exist=Event {0} does not exist in application
view {1}.
```

```
service_does_not_exist=Service {0} does not exist in
Application View {1}.

no_write_access={0} does not have write access to the
Application View.
```

- Remove the following properties:

```
addservc_submit_add=Add

addevent_label_eventDesc=Description:

addservc_label_serviceName=Unique Service Name:

addevent_submit_add=Add

pingTable_invalid=The ping table cannot be reached.  Please
enter a valid table in the existing database to ping.

pingTable=Ping Table

addevent_label_eventName=Unique Event Name:

addservc_label_serviceDesc=Description:
```

After updating `wlai.properties`, compare the files to ensure sure that they are synchronized.

Create edtservc.jsp and addservc.jsp

These Java server pages are called in order to provide editing capabilities. The main difference between the edit JSPs and the add JSP files is the loading of descriptor values. For this reason, the DBMS and e-mail adapters use the same HTML for both editing and adding.

These HTML files are statically included in the JSP page. This saves duplication of JSP/HTML and properties. The descriptor values are mapped into the controls displayed on the edit page. From there, you can submit any changes.

In order to initialize the controls with values defined in the descriptor, call the `loadEvent/ServiceDescriptorProperties()` method on the `AbstractDesignTimeRequestHandler`. This method sets all of the service's properties into the `RequestHandler`. Once these values are set, the `RequestHandler` maps the values to the ADK controls being used in the JSP file. The default implementation of `loadEvent/ServiceDescriptorProperties()` uses the property name associated with the ADK tag to map the descriptor values. If you used values other than the ADK tag names to map the properties for a service or event, override these methods to provide the descriptor to the ADK tag-name mapping.

Initialize the `RequestHandler` prior to the resolution of HTML. This initialization should only take place once. Listing 8-12 shows the code used to load the `edtevent.jsp`:

Listing 8-12 Sample Code Used to Load `edtevent.jsp`

```
if(request.getParameter("eventName") != null){
handler.loadEventDescriptorProperties(request);
}
```

The `edtservc.jsp` should submit to `edtservc`. For example:

```
<adk:submit name='edtservc_submit' doAction='edtservc'/>
```

The `edtevent.jsp` should submit to `edtevent`. For example:

```
<adk:submit name='edtevent_submit' doAction='edtevent'/>
```

See the DBMS and e-mail adapters for specific examples. Go to either

`WLI_HOME/adapters/dbms/src/war`

or

`WLI_HOME/adapters/email/src/war`

Implement Methods

Finally, implement the methods described in Table 8-6.

Table 8-6 Methods to Implement with `edtservc.jsp` and `edtevent.jsp`

Methods	Description
`loadServiceDescriptorProperties` and `loadEventDescriptorProperties`	These methods load the `RequestHandler` with the ADK tag-to-value mapping. If the developer uses the same values to name the ADK tag and load the Service/Event Descriptor, then the mapping is free. Otherwise, the developer must override these methods in their `DesigntimeRequestHandler` to provide these mappings.

Table 8-6 Methods to Implement with `edtservc.jsp` and `edtevent.jsp` (Continued)

Methods	Description
`boolean supportsEditableServices()` and `boolean supportsEditableEvents()`	These two methods are used as markers. If they return `true`, the edit link is displayed on the Application View Administration page. Override in the `DesigntimeRequestHandler` is provided.
`editServiceDescriptor` and `editEventDescriptor`	These methods are used to persist the edited service or event data. These methods extract the ADK tag values from the request and add them back into the Service or Event Descriptor. In addition, these methods handle any special processing for the schemas associated with the event or service. If the schemas need modification, they should be updated here. Once the values read in from the request are no longer needed, they should be removed from the `RequestHandler`.

See the sample adapters for an example of how these methods are implemented.

Step 5e: Write the WEB-INF/web.xml Web Application Deployment Descriptor

You will need to create a `WEB-INF/web.xml` web application deployment descriptor for your adapter. When you clone an adapter from the sample adapter by using GenerateAdapterTemplate, a `web.xml` file for that adapter will be automatically generated.

The important components of this file are described in Listing 8-13 through Listing 8-17:

Listing 8-13 web.xml Servlet Components

```
<servlet>
    <servlet-name>controller</servlet-name>
    <servlet-class>com.bea.web.ControllerServlet</servlet-class>
    <init-param>
        <param-name>MessageBundleBase</param-name>
```

```
    <param-value>BEA_WLS_SAMPLE_ADK</param-value>
        <description>The base name for the message bundles
           for this adapter. The ControllerServlet uses this
           name and the user's locale information to
           determine which message bundle to use to
           display the HTML pages.</description>
</init-param>

<init-param>
    <param-name>DisplayPage</param-name>
    <param-value>display.jsp</param-value>
        <description>The name of the JSP page
           that includes content pages and provides
           the look-and-feel template. The ControllerServlet
           redirects to this page to let it determine what to
           show the user.</description>
</init-param>

<init-param>
    <param-name>LogConfigFile</param-name>
    <param-value>BEA_WLS_SAMPLE_ADK.xml</param-value>
        <description>The name of the sample adapter's
           LOG4J configuration file.</description>
</init-param>

<init-param>
    <param-name>RootLogContext</param-name>
    <param-value>BEA_WLS_SAMPLE_ADK</param-value>
        <description>The root category for log messages
           for the sample adapter. All log messages created
           by the sample adapter will have a context starting
            with this value.</description>
</init-param>

<init-param>
    <param-name>RequestHandlerClass</param-name>
    <param-value>sample.web.DesignTimeRequestHandler
    </param- value>
        <description>Class that handles design
           time requests</description>
</init-param>

<init-param>
    <param-name>Debug</param-name>
    <param-value>on</param-value>
        <description>Debug setting (on|off, off is
           default)</description>
</init-param>
```

```
    <load-on-startup>1</load-on-startup>
</servlet>
```

This component shown in Listing 8-14 maps the `ControllerServlet` to the name "controller". This action is important because the ADK JSP forms assume the `ControllerServlet` is mapped to the logical name "controller".

Listing 8-14 `web.xml` `ControllerServlet` Mapping Component

```
<servlet-mapping>
    <servlet-name>controller</servlet-name>
    <url-pattern>controller</url-pattern>
</servlet-mapping>
```

This component shown in Listing 8-15 declares the ADK tag library:

Listing 8-15 `web.xml` ADK Tab Library Component

```
<taglib>
    <taglib-uri>adk</taglib-uri>
    <taglib-location>/WEB-INF/taglibs/adk.tld</taglib-location>
</taglib>
```

This component shown in Listing 8-16 declares the security constraints for the web application. Currently, the user must belong to the adapter group:

Listing 8-16 `web.xml` Security Constraint Component

```
<Security-constraint>
    <web-resource-collection>
        <web-resource-name>AdapterSecurity</web-resource-name>
            <url-pattern>*.jsp</url-pattern>
    </web-resource-collection>
```

```
    <auth-constraint>
        <role-name>adapter</role-name>
    </auth-constraint>

    <user-data-constraint>
        <transport-guarantee>NONE</transport-guarantee>
    </user-data-constraint>
</security-constraint>
```

This component shown in Listing 8-17 declares the login configuration:

Listing 8-17 `web.xml` Login Configuration Component

```
<login-config>
    <auth-method>FORM</auth-method>
    <realm-name>default</realm-name>
    <form-login-config>
        <form-login-page>/login.jsp</form-login-page>
        <form-error-page>/login.jsp?error</form-error-page>
    </form-login-config>

</login-config>

<security-role>
    <role-name>adapter</role-name>
</security-role>
```

Step 6. Implementing the Look-and-Feel

An important programming practice you should observe when developing a design-time GUI is to implement a consistent look-and-feel across all pages in the application view. The look-and-feel is determined by `display.jsp`. This page is included with the ADK and provides the following for the design-time web application:

- Establishes the look-and-feel template for all pages.

- Includes other JSPs based on the content HTTP request parameter. If the `content` HTTP request parameter is not supplied, `display.jsp` must include `main.jsp`.
- Registers the error page for Java exceptions as `error.jsp` from the ADK.

To implement a look-and-feel across a set of pages, do the following:

1. Use `display.jsp` from the sample adapter as a starting point. See `WLI_HOME/adapters/sample/src/war/WEB-INF/web.xml` for an example.
2. Using HTML, alter the look-and-feel markup in this page to reflect your own look-and-feel or company identity standards.
3. Somewhere in your HTML markup, be sure to include:

   ```
   <%pageContext.include(sbPage.toString());%>
   ```

   This code is a custom JSP tag used to include other pages. This tag uses the JSP scriptlet "`sbPage.toString()`" to include an HTML or JSP into the display page. `sbPage.toString()` evaluates to the value for the HTTP request parameter content at run time.

Step 7. Testing the Sample Adapter Design-Time Interface

A test driver has been created to verify the basic functionality of the sample adapter design-time interface. The test driver is based on HTTP Unit (a framework for testing web interfaces which is available from `http://www.httpunit.org`). HTTP Unit is related to the JUnit test framework (available from `http://www.junit.org`). Versions of both HTTP Unit and JUnit are included with WebLogic Integration.

The test driver executes a number of tests. It creates application views, add both events and services to application views, deploy and undeploy application views, and test both events and services. The test driver removes all application views after completely successfully.

Files and Classes

All of the test cases are contained in the `DesignTimeTestCase` class or its parent class, `AdapterDesignTimeTestCase`. `DesignTimeTestCase` (located in the `sample.web` package and the `WLI_HOME/adapters/sample/src/sample/web` folder) contains the tests specific to the sample adapter. `AdapterDesignTimeTestCase` (located in the `com.bea.adapter.web` package and the `WLI_HOME/lib/adk-web.jar` file) contains tests that apply to all adapters and several convenience methods.

Run the tests

To the design-time interface, use this procedure:

1. Start WebLogic Server with the sample adapter deployed. Next, change the current working folder to the specific project folder and execute the `setenv` command script, as shown in the following steps.
2. Go to `WLI_HOME` and, at the command prompt, enter `setenv`.

   The `setenv` command script creates the necessary environment for the next step.
3. Go to the sample adapter's web folder by entering at the command prompt:

   ```
   cd WLI_HOME/adapters/sample/project
   ```
4. Edit the `designTimeTestCase.properties` file. Change the line containing the list of test cases to execute so that it includes `web.DesignTimeTestCase`. The line should read:

   ```
   test.case=web.DesignTimeTestCase
   ```
5. Near the end of the file, you might need to change two entries, username and password. Specify the username and password that the test driver should use to connect to WebLogic Integration.
6. After editing the `test.properties` file, start WebLogic Server.
7. Run the tests by entering at the command prompt:

   ```
   ant designtimetest
   ```

9 Deploying Adapters

Once you have created an adapter, you must deploy it by using an Enterprise Archive (`.ear`) file. An `.ear` file simplifies this task by deploying all adapter components in a single step. You can deploy an `.ear` file either from the WebLogic Server Administration Console or manually, by manipulating the `config.xml` file.

This section contains information about the following subjects:

- Using Enterprise Archive (.ear) Files
- Deploying Adapters
- Editing Web Application Deployment Descriptors

Using Enterprise Archive (.ear) Files

Each adapter is deployed from a single Enterprise Archive (`.ear`) file. An `.ear` file contains a design-time Web application `.war` file, an adapter `.rar` file, an adapter `.jar` file, and any shared `.jar` files required for deployment. Optionally, it can also include an event router Web application file. The `.ear` file should be structured as shown in Listing 9-1.

Listing 9-1 .ear File Structure

```
adapter.ear
     application.xml
     sharedJar.jar
     adapter.jar
     adapter.rar
```

```
          META-INF
               ra.xml
               weblogic-ra.xml
               MANIFEST.MF
     designtime.war
          WEB-INF
               web.xml
          META-INF
               MANIFEST.MF
     eventrouter.war
          WEB-INF
               web.xml
          META-INF
               MANIFEST.MF
```

The `.ear` file for the sample adapter is shown in Listing 9-2.

Listing 9-2 .ear File for the Sample Adapter

```
sample.ear
  application.xml
     adk.jar (shared .jar between .war and .rar)
     bea.jar (shared .jar between .war and .rar)
     BEA_WLS_SAMPLE_ADK.jar (shared .jar between .war and .rar)

     BEA_WLS_SAMPLE_ADK.war (Web application with
              META-INF/MANIFEST.MF entry Class-Path:
          BEA_WLS_SAMPLE_ADK.jar adk.jar bea.jar log4j.jar
             logtoolkit.jar xcci.jar xmltoolkit.jar)

       BEA_WLS_SAMPLE_ADK.rar (Resource Adapter with
          META-INF/MANIFEST.MF entry Class-Path:
           BEA_WLS_SAMPLE_ADK.jar adk.jar bea.jar log4j.jar
            logtoolkit.jar xcci.jar xmltoolkit.jar)

       log4j.jar (shared .jar between .war and .rar)
       logtoolkit.jar (shared .jar between .war and .rar)
       xcci.jar (shared .jar between .war and .rar)
       xmltoolkit.jar (shared .jar between .war and .rar)
```

Notice that neither the .rar nor .war file includes the shared .jar files; them; rather, Instead, both types of files refer to the shared .jar files by using the <manifest.classpath> attribute.

Using Shared .jar Files in an .ear File

The design-time application uses an adapter's SPI classes in an unmanaged scenario. Consequently, an adapter's SPI and CCI classes should be contained in a shared .jar file that resides in the same directory as the .ear file. To allow the .war and .rar classloaders to access the classes in the shared .jar, you must specify, in the MANIFEST.MF files, a request for inclusion of the shared .jar files. For more information about MANIFEST.FM, see either "The Manifest File" on page 6-10 or "Understanding the Manifest" at the following URL:

http://developer.java.sun.com/developer/Books/JAR/basics/manifest.html

The BEA_WLS_SAMPLE_ADK.rar and BEA_WLS_SAMPLE_ADK.war files contain META-INF/MANIFEST.MF, as shown in Listing 9-3:

Listing 9-3 Manifest File Example

```
Manifest-Version: 1.0

Created-By: BEA Systems, Inc.

Class-Path: BEA_WLS_SAMPLE_ADK.jar adk.jar bea.jar log4j.jar
logtoolkit.jar xcci.jar xmltoolkit.jar
```

Note: The name of the file, MANIFEST.MF, is spelled in all uppercase. If it is not spelled correctly, it is not recognized on a UNIX system and an error occurs.

.ear File Deployment Descriptor

Listing 9-4 shows the deployment descriptor, which declares the components of an `.ear` file. In this case, these components include the design-time `.war`, event router `.war`, and adapter `.rar` modules.

Listing 9-4 Deployment Descriptor for the .ear File

```
<!DOCTYPE application PUBLIC '-//Sun Microsystems, Inc.//DTD J2EE
Application 1.3//EN'
'http://java.sun.com/dtd/application_1_3.dtd'>

<application>
     <display-name>BEA_WLS_SAMPLE_ADK</display-name>
     <description>This is a J2EE application that contains a sample
          connector, Web application for configuring
           application views for the adapter, and an
           event router Web application.</description>
     <module>
           <connector>BEA_WLS_SAMPLE_ADK.rar</connector>
     </module>
     <module>
           <web>
              <web-uri>BEA_WLS_SAMPLE_ADK.war</web-uri>
              <context-root>BEA_WLS_SAMPLE_ADK_Web</context-root>
           </web>
     </module>
     <module>
           <web>
                <web-uri>BEA_WLS_SAMPLE_ADK_EventRouter.
                     .war</web-uri>
                <context-root>BEA_WLS_SAMPLE_ADK_
                     EventRouter</context-root>
           </web>
     </module>
</application>
```

Note: The adapter `.jar` files must be included in the system classpath.

You can deploy the adapter via the WebLogic Server Administration Console or by adding an application component to `config.xml`. These procedures are described in "Deploying Adapters" on page 9-5.

You must also configure the event router Web application using the WebLogic Server Administration Console. For more information, see "Editing Web Application Deployment Descriptors" on page 9-8.

Deploying Adapters

You can deploy adapters by either of the following methods:

- By using the WebLogic Server Administration Console
- By manually editing `config.xml`

This section provides procedures for both methods.

Deploying Adapters by Using the WebLogic Server Administration Console

To configure and deploy an adapter from the WebLogic Server Administration Console, complete the following procedure:

1. Open the WebLogic Server Administration Console.
2. In the navigation tree (in the left pane), choose Deployments→Applications.

   The Applications page is displayed.
3. Select Configure a new application.

   The Configure a new Application page is displayed.
4. Enter values in the following fields:
   - In the Name field, enter the logical name of the adapter.
   - In the Path field, enter the path for the appropriate `.ear` file.
   - In the Deployed field, make sure that the check box is selected.
5. Click Apply to create the new entry.

6. Select Configure Components.
7. Set the target for each component individually.

When you install an application (or application component) via the WebLogic Server Administration Console, you also create entries for that application or component in the configuration file for the relevant domain (`/config/DOMAIN_NAME/config.xml`, where *DOMAIN_NAME* is your domain). WebLogic Server also generates JMX Management Beans (MBeans) that enable you to configure and monitor the application and application components.

Deploying Adapters Manually

To deploy the adapter manually, you must first modify the `config.xml` file. Within the `<Application>` element, you must set the `Deployed=` *value* to *true* and specify the logical name of the adapter with the `Name=` *value* parameter setting. Additionally, you must:

- Set the pathname for the `.ear` file.
- Specify the appropriate connector component and Web application components.

Listing 9-5 shows how the `config.xml` file is modified to deploy the sample adapter. In this listing, the path directive points to the `.ear` file and each component describes the URI of its own deployment.

Listing 9-5 Sample Code for Deploying an Adapter by Using config.xml

```
<!-- This deploys the EAR file -->

<Application Deployed="true" Name="BEA_WLS_SAMPLE_ADK"
   Path="WLI_HOME/adapters/sample/lib/BEA_WLS_SAMPLE_ADK.ear">
    <ConnectorComponent Name="BEA_WLS_SAMPLE_ADK"
       Targets="myserver" URI="BEA_WLS_SAMPLE_ADK.rar"/>
    <WebAppComponent Name="BEA_WLS_SAMPLE_ADK_EventRouter"
       Targets="myserver" URI="BEA_WLS_SAMPLE_ADK_
       EventRouter.war"/>

    <WebAppComponent Name="BEA_WLS_SAMPLE_ADK_Web"
        Targets="myserver" URI="BEA_WLS_SAMPLE_ADK_Web.war"/>
</Application>
```

Note: You must replace *WLI_HOME* with the correct path for the WebLogic Integration root directory for your environment.

Once `config.xml` is updated, deploy the adapter by completing the following procedure:

1. Add the adapter `.jar` file(s) to the classpath and restart WebLogic Server. This step is required because WebLogic Server does not currently load an `.ear` file with a single classloader.
2. Restart the server.
3. Add the adapter group to the default WebLogic Server security realm using the WebLogic Server Administration Console at the following URL:
   `http://<host>:<port>/`
4. Add a user to the adapter group using the WebLogic Server Administration Console. Save your changes.
5. To configure and deploy application views, go to:

   `http://<host>:<port>/wlai`

   In this URL, replace *<host>* with the name of your server and *<port>* with the listening port. For example:

   `http://localhost:7001/wlai`

   Now complete the procedures provided in "Defining Application Views" in *Using Application Integration*.

   Note: You will be prompted to log in by supplying a username and password. Use the password you added earlier.

Adapter Auto-registration

WebLogic Integration uses an automatic registration process during adapter deployment. To implement the automatic registration process, use one of the procedures provided in "Registering the Design-time Web Application" on page C-3.

Editing Web Application Deployment Descriptors

For some adapters, you may need to change the deployment parameters of the Event Router Web application. For the DBMS adapter, for example, you might need to change the data source used by its event generator.

This section explains how to use the Deployment Descriptor Editor provided by the WebLogic Server Administration Console to edit the following Web application deployment descriptors:

- `web.xml`
- `weblogic.xml`

Deployment Parameters

You can change any parameter of the Event Router Servlet. These parameters are:

- `eventGeneratorClassName`
- `userID`
- `password`
- `dataSource`
- `jdbcDriverClassName`
- `dbURL`
- `dbAccessFlag`
- `eventCatalog`
- `eventSchema`
- `RootLogContext`
- `AdditionalLogContext`
- `LogConfigFile`
- `LogLevel`

- `MessageBundleBase`
- `LanguageCode`
- `CountryCode`
- `sleepCount`

Editing the Deployment Descriptors

To edit the Web application deployment descriptors, complete the following procedure:

1. Open the WebLogic Server Administration Console in your browser by accessing the following URL:

   `http://`*`host`*`:`*`port`*`/console`

   In this URL, replace *`host`* with the name of the computer on which WebLogic Server is running, and *`port`*, with the number of the port on which WebLogic Server is listening. For example:

   ```
   http://localhost:7001/console
   ```

2. In the left pane, expand two nodes: the Deployments node and the Web Applications node below it.

3. Right-click the name of the Web application for which you want to edit the deployment descriptors. From the drop-down menu select Edit Web Application Descriptor. The WebLogic Server Administration Console is displayed in a new browser.

   The Console consists of two panes. The left pane contains a navigation tree composed of all the elements in the two Web application deployment descriptors. The right pane contains a form for the descriptive elements of the `web.xml` file.

4. To edit, delete, or add elements in the Web application deployment descriptors, expand the node in the left pane that corresponds to the deployment descriptor file you want to edit. The following nodes are available:

   - The WebApp Descriptor node contains the elements of the `web.xml` deployment descriptor.

- The WebApp Ext node contains the elements of the `weblogic.xml` deployment descriptor.

5. To edit an existing element in one of the Web application deployment descriptors, complete the following procedure:

   a. Navigate the tree in the left pane, clicking parent elements until you find the element you want to edit.

   b. Click the name of the appropriate element. A form is displayed in the right pane with a list of either the attributes or the subelements of the selected element.

   c. Edit the text in the form in the right pane.

   d. Click Apply.

6. To add a new element to one of the Web application deployment descriptors, complete the following procedure:

   a. Navigate the tree in the left pane, clicking parent elements until you find the name of the element you want to create.

   b. Right-click the name of the appropriate element and select Configure a New Element from the drop-down menu. A form is displayed in the right pane.

   c. Enter the element information in the form in the right pane.

   d. Click Create.

7. To delete an existing element from one of the Web application deployment descriptors, complete the following procedure:

   a. Navigate the tree in the left pane, clicking parent elements until you find the name of the element you want to delete.

   b. Right-click the name of the appropriate element and select Delete Element from the drop-down menu. A confirmation page is displayed.

   c. Click Yes on the Delete confirmation page to verify that you want to delete the element.

8. Once you have made all your changes to the Web application deployment descriptors, click the root element of the tree in the left pane. The root element is either the name of the Web application `*.war` archive file or the name that is displayed for the Web application.

9. Click Validate if you want to ensure that the entries in the Web application deployment descriptors are valid.
10. Click Persist to write your edits of the deployment descriptor files to disk in addition to WebLogic Server memory.

A Creating an Adapter Not Specific to WebLogic Integration

The procedures for developing J2EE-compliant adapters outlined in Chapter 6, "Developing a Service Adapter," and Chapter 7, "Developing an Event Adapter," primarily pertain to adapters developed for use with WebLogic Integration. By making modifications to the steps described in that chapter, you can build an adapter compliant with the J2EE Connector Architecture specification but not WebLogic Integration-specific. This section describes those modifications.

This section contains information on the following subjects:

- Using this Section
- Building the Adapter
- Updating the Build Process

Using this Section

This section shows you how to modify the steps for developing a J2EE-compliant adapter in order to build one that is not specifically designed to run with WebLogic Integration. Each of the steps in this section will refer back to one of the steps described

in Chapter 6, “Developing a Service Adapter,” and describe how to modify that step. You should understand each of these steps thoroughly before proceeding with the modifications described below.

Building the Adapter

This procedure assumes that you have installed WebLogic Integration as described in *Installing BEA WebLogic Integration*.

1. Determine the development considerations as described in “Step 1: Development Considerations” in Chapter 6, “Developing a Service Adapter.” Ignore the final bullet point that refers to transaction support. This is because WebLogic Server does not support local or XA transactions.
2. Run GenerateAdapterTemplate, as described in Chapter 4, “Creating a Custom Development Environment.”
3. Assign the adapter logical name, as described in “Step 2b: Assign the Adapter Logical Name” on page 6-10.
4. Implement the SPI, as described in “Basic SPI Implementation” on page 6-24 You must extend the following classes:
   - `AbstractManagedConnectionFactory` (see “ManagedConnectionFactory” on page 6-24).
   - `AbstractManagedConnection` (see “ManagedConnection” on page 6-32).
   - `AbstractConnectionMetaData` (see “ManagedConnectionMetaData” on page 6-33).

   As you implement these classes, note the following:
   - WebLogic Server does not support adapters that use transactional semantics.
   - Do not implement the `ConnectionManager` interface, as the adapters you are developing here are managed adapters; that is, they are designed to plug into WebLogic Server.
5. Extend `AbstractConnectionFactory`.

Updating the Build Process

In addition to the steps described in "Building the Adapter" on page A-2 you need to modify the `build.xml` file to create an adapter not specific to WebLogic Integration. To update the build process, do the following:

1. In your code editor, open the ADK's `build.xml` file.
2. Refer to "Step 2c: Setting Up the Build Process" on page 6-10. This step includes the section "build.xml Components" on page 6-11 that breaks down the `build.xml` file into separate code listings.
3. Locate Listing 6-11 and Listing 6-12.
4. Remove everything in those listings from `build.xml`.

B XML Toolkit

The XML Toolkit provided with BEA WebLogic Integration's Adapter Development Kit helps you develop valid XML documents to transmit information from an EIS to the application on the other side of the adapter. It incorporates many of the operations required for XML manipulation into a single location, relieving you of these often tedious chores.

This section contains information on the following subjects:

- Toolkit Packages
- IDocument
- Schema Object Model (SOM)

Toolkit Packages

The XML Toolkit is comprised primarily of these two Java packages:

- `com.bea.document`
- `com.bea.schema`

These packages are in the `xmltoolkit.jar` file, which is installed with the ADK when you install WebLogic Integration. They include complete Javadoc for each class, interface, and method. To see the Javadoc, go to:

`WLI_HOME/docs/apidocs/index.html`

Where `WLI_HOME` is the folder where WebLogic Integration is installed.

IDocument

com.bea.document.IDocument

An `IDocument` is a container that combines the W3C Document Object Model (DOM) with an XPath interface to elements in an XML document. This combination makes `IDocument` objects queryable and updatable simply by using XPath strings. These strings eliminate the need to parse through an entire XML document to find specific information by allowing you to specify just the elements you want to query and return the values of those queries.

For example, The XML document shown in Listing B-1 describes a person named "Bob" and some of the details about "Bob."

Listing B-1 XML Example

```
<Person name="Bob">
    <Home squareFeet="2000"/>
    <Family>
        <Child name="Jimmy">
            <Stats sex="male" hair="brown" eyes="blue"/>
        </Child>
        <Child name="Susie">
            <Stats sex="female" hair="blonde" eyes="brown"/>
        </Child>
    </Family>
</Person>
```

Now, let's say you want to retrieve Jimmy's hair color from the `<child>` element. Were you to use DOM, you would need to use the code shown in Listing B-2:

Listing B-2 DOM Data Retrieval Code Sample

```
String strJimmysHairColor = null;
org.w3c.dom.Element root = doc.getDocumentElement();
if (root.getTagName().equals("Person") && root.getAttribute("name").
   equals("Bob") {
    org.w3c.dom.NodeList list = root.getElementsByTagName("Family"); if
```

```
            (list.getLength() > 0) {
          org.w3c.dom.Element family = (org.w3c.dom.Element)list.item(0);
          org.w3c.dom.NodeList childList = family.getElementsByTagName ("Child");
          for (int i=0; i < childList.getLength(); i++) {
               org.w3c.dom.Element child = childList.item(i);
               if (child.getAttribute("name").equals("Jimmy")) {
                    org.w3c.dom.NodeList statsList = child.
                       getElementsByTagName("Stats");
                    if (statsList.getLength() > 0) {
                         org.w3c.dom.Element stats = statsList.item(0);
                         strJimmysHairColor = stats.getAttribute("hair");
                    }
               }
          }
     }
}
```

However, by using IDocument, you can retrieve Jimmy's hair color by creating the XPath string that seeks exactly that information, as shown in Listing B-3:

Listing B-3 IDocument Data Retrieval Code Sample

```
System.out.println("Jimmy's hair color: " + person.getStringFrom
   ("//Person[@name=\"Bob\"] /Family/Child[@name=\"Jimmy\"]/Stats/@hair");
```

As you can see, by using `IDocument`, you can simplify the code necessary to query and find information in a document.

Schema Object Model (SOM)

`SOM` is an interface for programmatically building XML schemas. An adapter calls into an EIS for specific request/response metadata, which then needs to be programatically transformed into an XML schema. `SOM` is a set of tools that extracts and validates many of the common details—such as syntactical complexities of schema—so that you can focus on its more fundamental aspects.

How SOM Works

An XML schema is like a contract between the EIS and an application on the other side of the adapter. This contract specifies how data coming from the EIS must appear in order for the application to manipulate it. A document (that is, an XML-rendered collection of metadata from the EIS) is considered valid if it meets the rules specified in the schema, regardless of whether or not the document's XML is correct. For example, if a schema required a name to appear in a <name> element and that element required two child elements, <firstname> and <lastname>, to be valid the document from the EIS would have to appear in the form shown in Listing B-4 and the schema would have to appear as it does in Listing B-5.

Listing B-4 Document Example

```
<name>
     <firstname>Joe</firstname>
     <lastname>Smith</lastname>
</name>
```

Listing B-5 Schema Example

```
<schema>
    <element name="name">
        <complexType>
            <sequence>
                <element name="firstname" />
                <element name="lastname" />
            </sequence>
        </complexType>
    </element>
</schema>
```

No other form of <name></name>, for example:

```
<name>Joe Smith</name>
```

would be valid, even though the XML is correct.

Creating the Schema

You can create an XML schema programatically by using the classes and methods provided with SOM. The benefit to this tool is that you only need to populate the variables in the program components to tailor a schema for your needs. For example, the following code examples create a schema that validates a purchase order document. Listing B-6 sets up the schema and adds the necessary elements.

Listing B-6 Purchase Order Schema

```
import com.bea.schema.*;
import com.bea.schema.type.SOMType;

public class PurchaseOrder
{
    public static void main(String[] args)
    {
        System.out.println(getSchema().toString());
    }

    public static SOMSchema getSchema()
    {
        SOMSchema po_schema = new SOMSchema();

    po_schema.addDocumentation("Purchase order schema for
      Example.com.\nCopyright 2000 Example.com.\nAll rights
      reserved.");

        SOMElement purchaseOrder =
           po_schema.addElement("purchaseOrder");

        SOMElement comment = po_schema.addElement("comment");

        SOMComplexType usAddress =
           po_schema.addComplexType("USAddress");

        SOMSequence seq2 = usAddress.addSequence();

    // adding an  object to a SOMSchema defaults to type="string"
    seq2.addElement("name");
    seq2.addElement("street");
    seq2.addElement("city");
    seq2.addElement("state");
    seq2.addElement("zip", SOMType.DECIMAL);
```

Attributes can be set in the same way that elements are created. Listing B-7 sets these attributes. To correctly set these attributes, you must maintain their addressibility.

Listing B-7 Setting the Attributes of Parent Attributes

```
SOMAttribute country_attr = usAddress.addAttribute("country",
   SOMType.NMTOKEN);
    country_attr.setUse("fixed");
    country_attr.setValue("US");
```

Like `complexTypes`, `simpleTypes` can be added to the root of the schema. Listing B-8 shows how to do this.

Listing B-8 Adding simpleTypes to the Schema Root

```
SOMSimpleType skuType = po_schema.addSimpleType("SKU");
SOMRestriction skuRestrict = skuType.addRestriction
   (SOMType.STRING);
skuRestrict.setPattern("\\d{3}-[A-Z]{2}");

SOMComplexType poType =
   po_schema.addComplexType("PurchaseOrderType");

purchaseOrder.setType(poType);
poType.addAttribute("orderDate", SOMType.DATE);
```

The `addSequence()` method of a `SOMComplexType` object returns a `SOMSequence` reference, allowing you to modify the element that was added to the element. In this way, as shown in Listing B-9, objects are added to the schema.

Listing B-9 Implementing `addSequence()` to Modify an Element

```
SOMSequence poType_seq = poType.addSequence();
    poType_seq.addElement("shipTo", usAddress);
    poType_seq.addElement("billTo", usAddress);
```

Attributes of an element within a schema can be set by calling the setter methods of the `SOMElement` object. For example, Listing B-10 shows the implementation of `setMinOccurs()` and `setMaxOccurs()`.

Listing B-10 Implementing `setMinOccurs()` and `setMaxOccurs()`

```
SOMElement commentRef = new SOMElement(comment);
    commentRef.setMinOccurs(0);
    poType_seq.add(commentRef);
SOMElement poType_items = poType_seq.addElement("items");

SOMComplexType itemType = po_schema.addComplexType("Items");
SOMSequence seq3 = itemType.addSequence();
SOMElement item = new SOMElement("item");
    item.setMinOccurs(0);
    item.setMaxOccurs(-1);
    seq3.add(item);
SOMComplexType t = new SOMComplexType();
    item.setType(t);
SOMSequence seq4 = t.addSequence();
    seq4.addElement("productName");
SOMElement quantity = seq4.addElement("quantity");
SOMSimpleType st = new SOMSimpleType();
    quantity.setType(st);
SOMRestriction restrict =
   st.addRestriction(SOMType.POSITIVEINTEGER);
   restrict.setMaxExclusive("100");
```

In this example, the items element for `PurchaseOrderType` was created before `Items` type; therefore, you must create the reference and set the type once the Items type object is available by using the code shown in Listing B-11:

Listing B-11 Setting the Type Once the Items Type Object is Available

```
poType_items.setType(itemType);
```

Finally, you need to add an element to the schema. Adding an element to a can be done either by implementing the `addElement()` method of SOMSequence or the `add()` method from a previously created `SOMElement`. Listing B-12 shows both of these methods.

Listing B-12 Adding an Element to the Schema

```
seq4.addElement("USPrice", SOMType.DECIMAL);

    SOMElement commentRef2 = new SOMElement(comment);
       commentRef2.setMinOccurs(0);
       seq4.add(commentRef2);

    SOMElement shipDate = new SOMElement("shipDate", SOMType.DATE);
       shipDate.setMinOccurs(0);
       seq4.add(shipDate);
    t.addAttribute("partNum", skuType);

    return po_schema;
  }
}
```

The Resulting Schema

Execution of this code shown in Listing B-6 through Listing B-12 creates the schema shown in Listing B-13.

Listing B-13 XML Schema Definition Document

```
<?xml version="1.0" ?>
<!DOCTYPE schema (View Source for full doctype...)>
<xsd:schema xmlns:xsd="http://www.w3.org/2000/XMLSchema">
    <xsd:annotation>

        <xsd:documentation>Purchase order schema for Example.com.
           Copyright 2000 Example.com. All rights
           reserved.</xsd:documentation>

    </xsd:annotation>
```

```
  <xsd:simpleType name="SKU">
      <xsd:annotation>
      </xsd:annotation>
      <xsd:restriction base="xsd:string">
          <xsd:pattern value="\d{3}-[A-Z]{2}" />
      </xsd:restriction>
  </xsd:simpleType>

  <xsd:complexType name="PurchaseOrderType">
      <xsd:sequence>
          <xsd:element type="USAddress" name="shipTo" />
          <xsd:element type="USAddress" name="billTo" />
          <xsd:element ref="comment" minOccurs="0" />
          <xsd:element type="Items" name="items" />
      </xsd:sequence>

      <xsd:attribute name="orderDate" type="xsd:date" />
  </xsd:complexType>

  <xsd:complexType name="Items">
      <xsd:sequence>
          <xsd:element maxOccurs="unbounded" name="item"
             minOccurs="0">
              <xsd:complexType>
                  <xsd:sequence>
                      <xsd:element type="xsd:string"
                         name="productName"/>
                      <xsd:element name="quantity">
                         <xsd:simpleType>
                             <xsd:restriction base=
                                "xsd:positiveInteger">
                                 <xsd:maxExclusive value="100"/>
                             </xsd:restriction>
                         </xsd:simpleType>
                      </xsd:element>
                      <xsd:element type="xsd:decimal" name=
                         "USPrice" />
                      <xsd:element ref="comment"
                         minOccurs="0" />
                      <xsd:element type="xsd:date"
                         name="shipDate" minOccurs="0" />
                  </xsd:sequence>
                  <xsd:attribute name="partNum" type="SKU" />
              </xsd:complexType>
        </xsd:element>
    </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="USAddress">
  <xsd:sequence>
```

```
        <xsd:element type="xsd:string" name="name" />
        <xsd:element type="xsd:string" name="street" />
        <xsd:element type="xsd:string" name="city" />
        <xsd:element type="xsd:string" name="state" />
        <xsd:element type="xsd:number" name="zip" />
    </xsd:sequence>

    <xsd:attribute name="country" use="fixed" value="US"
       type="xsd:NMTOKEN" />
</xsd:complexType>
<xsd:element type="PurchaseOrderType" name="purchaseOrder" />
<xsd:element type="xsd:string" name="comment" />
</xsd:schema>
```

Validating an XML Document

The schema shown in Listing B-13 is then used to validate a document sent from the EIS. For example, the document described in Listing B-14 passes schema validation based upon the schema we just created.

Listing B-14 Validated XML Document

```
<?xml version="1.0" ?>
<!DOCTYPE PurchaseOrder (View Source for full doctype...)>

<purchaseOrder orderDate="1/14/00">
<shipTo Country="US">
    <name>Bob Jones</name>
    <street>1000 S. 1st Street</street>
    <city>Denver</city>
    <state>CO</state>
    <zip>80111</zip>
</shipTo>

<billTo Country="US">
    <name>Bob Jones</name>
    <street>1000 S. 1st Street</street>
    <city>Denver</city>
    <state>CO</state>
    <zip>80111</zip>
</billTo>

<comment>None</comment>
```

```
<items>
    <item partNum="123-AA">
        <productName>Washer</productName>
        <quantity>20</quantity>
        <USPrice>0.22</USPrice>
        <comment>Only shipped 10</comment>
        <shipDate>1/14/00</shipDate>
    </item>
    <item partNum="123-BB">
        <productName>Screw</productName>
        <quantity>10</quantity>
        <USPrice>0.30</USPrice>
        <comment>None</comment>
        <shipDate>1/14/00</shipDate>
    </item>
</items>
</purchaseOrder>
```

How the Document is Validated

SOM can be used to validate XML DOM documents by using the `SOMSchema` method `isValid()`. `SOMElement` has a corresponding `isValid()` method for validating an element instead of the DOM document. The `isValid()` method determines if document or element is valid, and if not, compiles a list of the errors. If the document is valid, `isValid()` returns true and the list of errors is empty.

Implementing isValid()

Listing B-15 shows two ways to implement `isValid()`. Refer to the Javadoc for `isValid()` for complete API information. Go to:

```
WLI_HOME/docs/apidocs/com/bea/SOMSchema.html
```

Listing B-15 Examples of `isValid()` Implementation

```
public boolean isValid(org.w3c.dom.Document doc,
                       java.util.List errorList)
public boolean isValid(IDocument doc,
                       List errorList)
```

The parameters in Listing B-14 are:

- `doc` - The document instance to be validated
- `errorList` - A list of errors found in the document, doc

`isValid()` returns a boolean value of true if the document is valid with respect to this schema. If the document is not valid with respect to the schema, `isValid()` returns false and the errorList is populated.

errorList is a `java.util.List` for reporting errors found in the document, doc. The error list is cleared before validating the document. Therefore, the list implementation used must support the `clear()` method. If `isValid()` returns false, the error list is populated with a list of errors found during the validation procedure. The items in the list are instances of the class `com.bea.schema.SOMValidationException`. If `isValid()` returns true, `errorList` is empty.

isValid() Sample Implementation

Listing B-16 shows an example of an `isValid()` implementation.

Listing B-16 Sample Code Implementing `isValid()`

```
SOMSchema schema = ...;

IDocument doc = DocumentFactory.createDocument(new FileReader(f));
java.util.LinkedList errorList = new java.util.LinkedList();
boolean valid = schema.isValid(doc, errorList);...
if (! valid){
   System.out.println("Document was invalid. Errors were:");
   for (Iterator i = errorList.iterator; i.hasNext();)
{

       System.out.println(((SOMValidationException) i.next).
          toString());

   }
```

C Migrating Adapters to WebLogic Integration 2.1

Migrating an adapter developed under WebLogic Integration 2.0 to WebLogic Integration 2.1 is a simple process. The actual deployment method has been greatly simplified by reducing from three to one the actual number of files you need to create and deploy. Additionally, an auto-registration process has been added to eliminate the need to manually register an adapter.

This section contains information on the following subjects:

- Changes to the Deployment Method
- Registering the Design-time Web Application
- Other Migration Issues

Changes to the Deployment Method

To migrate an adapter, you need to change how the adapter is deployed. In WebLogic Integration 2.0, an adapter had the following deployable units:

- `.rar` file, which contains the J2EE-compliant adapter.

To create and deploy the .rar file for WebLogic Integration 2.0, the adapter developer bundled class files, the logging configuration, and message bundle(s) into a .jar file. This .jar file and META-INF/ra.xml was then bundled into .rar file. The adapter developer then deployed the .rar file into the J2EE-compliant container in the application server. The deployment procedure was different on every server.

- Design-time .war file, which is a Web application for the design-time component of the adapter.

  To construct a valid .war file for an adapter's design time UI, the adapter developer used the Ant build process. Within the process, an Ant target constructs a valid .war file for the design-time interface in the PROJECT_ROOT/lib directory. PROJECT_ROOT is the location under the WebLogic Integration 2.1 installation where the developer is constructing the adapter; for example:

  WLI_HOME/adapters/sample

  In addition, this target performs an "unjar" operation in the /lib directory. This extracts the .war into a temporary directory. This is the key to having WebLogic Integration recompile JSPs without restarting.

- Event router .war file, which is a Web application containing the event generator for an adapter.

  To make the event router .war file, the adapter developer included in it the following .jar files:

  - log4j.jar
  - wlai-common.jar
  - wlai-ejb-client.jar
  - wlai-eventrouter.jar
  - wlai-servlet-client.jar
  - logtoolkit.jar
  - adk-eventgenerator.jar

  The adapter developer also added any other .jar file upon which the event generator is dependent. These are specified in the <eventrouter> target in the build.xml file

How it's Done in WebLogic Integration

In WebLogic Integration 2.1, all components are contained in a single `.ear` file, which is deployed either manually or by using the WebLogic Integration Console. For more information on deploying adapters by using `.ear` files, see Chapter 9, "Deploying Adapters." For more information on `.ear` files, see Chapter 2, "Concepts." Refer to Listing 2-2 and Listing 2-3.

Additionally, the `build.xml` file has been updated to facilitate the use of `.ear` files. Refer to "build.xml Components" on page 6-11 for a detailed description of the WebLogic Integration `build.xml` file.

Registering the Design-time Web Application

In addition to the deployment unit changes, WebLogic Integration uses a different mechanism to register the design-time Web application context for an adapter.

In WebLogic Integration 2.0, users were required to make an entry into the `wlai.properties` file to register their adapter's design-time Web application into the Application View Management Console. This allowed the end user to associate the adapter with a new application view. This step has been replaced in WebLogic Integration by an automatic registration process during adapter deployment. To use the automatic registration process, use one of these procedures:

- Using a Naming Convention
- Using a Text File

Using a Naming Convention

The preferred approach is to use a naming convention for the design-time Web application and connector deployment.

When deploying an `.ear` file into WebLogic Integration, identify the file in `config.xml` by using the adapter logical name as the file name. Listing C-1 shows an example how to do this.

Listing C-1 Adding the Adapter Logical Name to `config.xml`

```
<Application Deployed="true" Name="ALN"
     Path="WLI_HOME/adapters/ADAPTER/lib/ALN.ear">
    <ConnectorComponent Name="ALN" Targets="myserver"
      URI="ALN.rar"/>
   <WebAppComponent Name="ALN_EventRouter" Targets="myserver"
      URI="ALN_EventRouter.war"/>
   <WebAppComponent Name="ALN_Web" Targets="myserver"
      URI="ALN_Web.war"/>
</Application>
```

where *ALN* is the adapter logical name. You must use the adapter logical name as the value for the Name attribute on the `<ConnectorComponent>` element. If you name the design-time Web application deployment as *ALN*`_Web`, the design-time Web application will automatically be registered into the Application View Management Console during deployment. The DBMS, e-mail, and sample adapters use this convention.

Using a Text File

Alternatively, you can include a text file named `webcontext.txt` in the root of your `.ear` file. `webcontext.txt` should contain the context for the design-time Web application for your adapter. This file must be encoded in UTF-8 format.

Other Migration Issues

The following are additional changes you need to make to enable an adapter built with WebLogic Integration 2.0 deployable in WebLogic Integration 2.1.

- Add a manifest file (`MANIFEST.MF`) to `WLI_HOME/adapters/ADAPTER/src/war/META-INF` for each `.war` file.
- Delete the file `display.jsp` from `WLI_HOME/adapters/ADAPTER/src/war/`. This file has been added to the ADK for WebLogic Integration 2.1.
- Delete the method `debugDocument(String strMessage, ILogger logger, IDocument doc)`. This method has been added to the ADK for WebLogic Integration 2.1

D Adapter Setup Worksheet

Use the worksheet beginning on the following page to help you identify and collect critical information about the adapter you are developing. The answers to the questions posed on the worksheet will help you conceptualize the adapter you are building before you actually began to code. They will help you define such components as the adapter logical name and the Java package base name and help you determine the locales for which you need to localize message bundles. If you are using the GenerateAdapterTemplate utility, the answers you provide on this worksheet are essential to its success.

Adapter Setup Worksheet

Before you begin developing an adapter, answer as many of the following questions as you can. Questions preceded by an asterisk (*) are required to use the GenerateAdapterTemplate utility.

1. *What is the name of the EIS for which you are developing an adapter?
2. *What is the version of the EIS?
3. *What is the type of EIS; for example, DBMS, ERP, etc.?
4. *Who is the vendor name for this adapter?
5. *What is the version number for this adapter?
6. *What is the adapter logical name?
7. Does the adapter need to invoke functionality within the EIS?

   If so, then your adapter needs to support services.
8. What mechanism/API is provided by the EIS to allow an external program to invoke functionality provided by the EIS?
9. What information is needed to create a session/connection to the EIS for this mechanism?
10. What information is needed to determine which function(s) will be invoked in the EIS for a given service?
11. Does the EIS allow you to query it for input and output requirements for a given function?

    If so, what information is needed to determine the input requirements for the service?
12. For all the input requirements, which ones are static across all requests? Your adapter should encode static information into an InteractionSpec object.
13. For all the input requirements, which ones are dynamic per request? Your adapter should provide an XML schema that describes the input parameters required by this service per request.

14. What information is needed to determine the output requirements for the service?
15. Does the EIS provide a mechanism to browse a catalog of functions your adapter can invoke? If so, your adapter should support browsing of services.
16. Does the adapter need to receive notifications of changes that occur inside the EIS? If so, then your adapter needs to support events.
17. What mechanism/API is provided by the EIS to allow an external program to receive notification of events in the EIS? The answer of this question will help determine if a pull or a push mechanism is developed.
18. Does the EIS provide a way to determine which events your adapter can support?
19. Does the EIS provide a way to query for metadata for a given event?
20. What locales (language/country) does your adapter need to support?

E The DBMS Adapter

This section contains information on the following subjects:

- Introduction to the DBMS Adapter
- How the DBMS Adapter Works
- How the DBMS Adapter Was Developed
- How the DBMS Adapter Design-Time GUI was Developed

Introduction to the DBMS Adapter

The DBMS adapter is a J2EE-compliant adapter built with the ADK. It provides a concrete example for adapter providers of how one might use the ADK to construct an adapter. A relational database was used as the EIS of an adapter because it allows adapter providers to focus on the adapter/ADK specifics, rather than become bogged-down in understanding a particular proprietary EIS.

The DBMS adapter gives you (developers and business analysts) a concrete example of an adapter, including a JSP-based GUI, to help you understand the possibilities that are at your disposal using the ADK to build adapters. If you are a business analyst, you might enjoy running through the interface to get a better understanding of an "application view", "service", and "event" as shown in "How the DBMS Adapter Works" on page E-2.

If you are an adapter developer, you will also want to review "How the DBMS Adapter Was Developed" on page E-24 and "How the DBMS Adapter Design-Time GUI was Developed" on page E-42 the code, and Javadoc to gain insight into how you can extend and use the classes of the ADK to build a J2EE-compliant adapter.

The DBMS adapter satisfies the following requirements:

- Provides a GUI that allows end-users to connect to a Cloudscape, Oracle, SQLServer, Sybase, or DB2 database.
- Uses the classes and tools of the ADK.
- Allows users to create application views with events and services.
- Allow users to test events and services.
- Provides a GUI that enables users to browse the catalogs, schemas, tables, and columns of the underlying database from the GUI.
- Supports the creation of services that perform selects, inserts, deletes, and updates against the database (EIS).

The DBMS adapter is a sample adapter. The adapter is not supported as a product component in a production environment. Because the adapter is intended as an example, rather than a production-ready adapter, it does not include a full set of features and has the following limitations:

- The adapter is unable to execute complex queries.
- The adapter is unable to execute Stored Procedures.

How the DBMS Adapter Works

This section provides you with an opportunity to see how the DBMS adapter works before you start developing one of your own. If you are a business analyst, you might enjoy running through the interface to get a feel for how the adapter works. The example in this section shows how to create a service that inserts a customer in the underlying database, and then demonstrates how an event is generated to notify others that this action has taken place.

This section contains information on the following subjects:

- Before You Begin
- Accessing the DBMS Adapter

- A Tour of the DBMS Adapter

Before You Begin

Make sure the following tasks have been performed before you try to access the DBMS adapter:

- Install the WebLogic Integration. For more information, see *Installing BEA WebLogic Integration*.
- Set up the ADK Ant-Based Make Process (see "Step 2c: Setting Up the Build Process" on page 6-10).
- Ensure that the DBMS adapter has been deployed so that the design-time GUI is accessible. For more information, see *Installing BEA WebLogic Integration*.

Accessing the DBMS Adapter

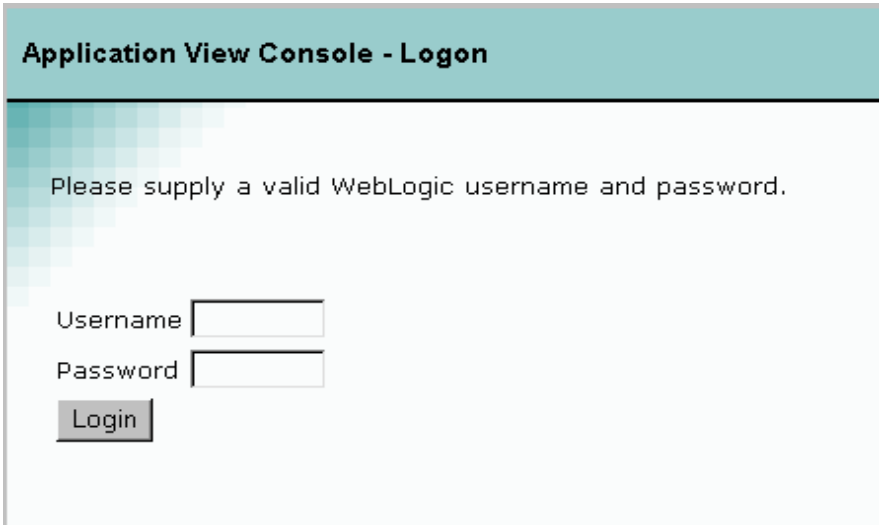
To access the DBMS adapter:

1. Open a new browser window.
2. Open the URL for your system's Application View Management Console and enter:

   `http://<HOSTNAME>:7001/wlai`

   The Application Integration Console - Logon page displays.

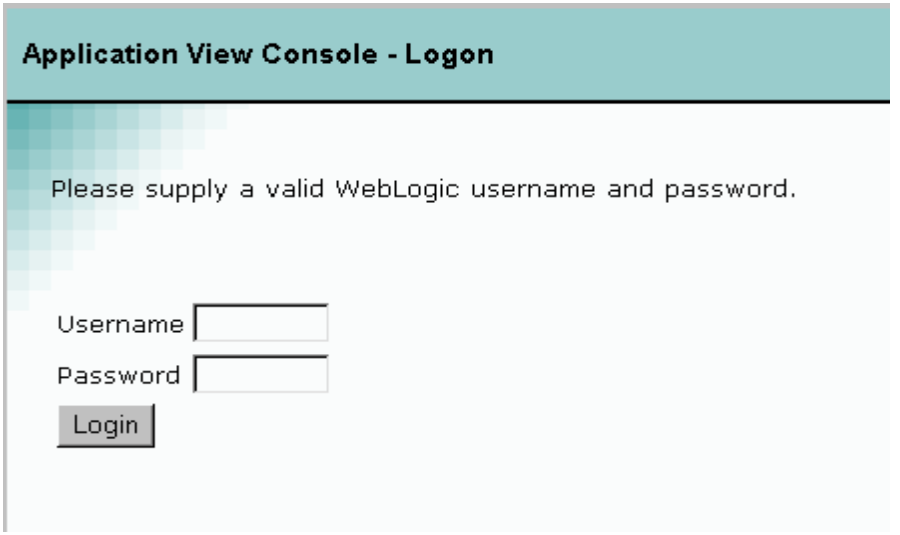
Figure E-1 Application View Console - Logon



A Tour of the DBMS Adapter

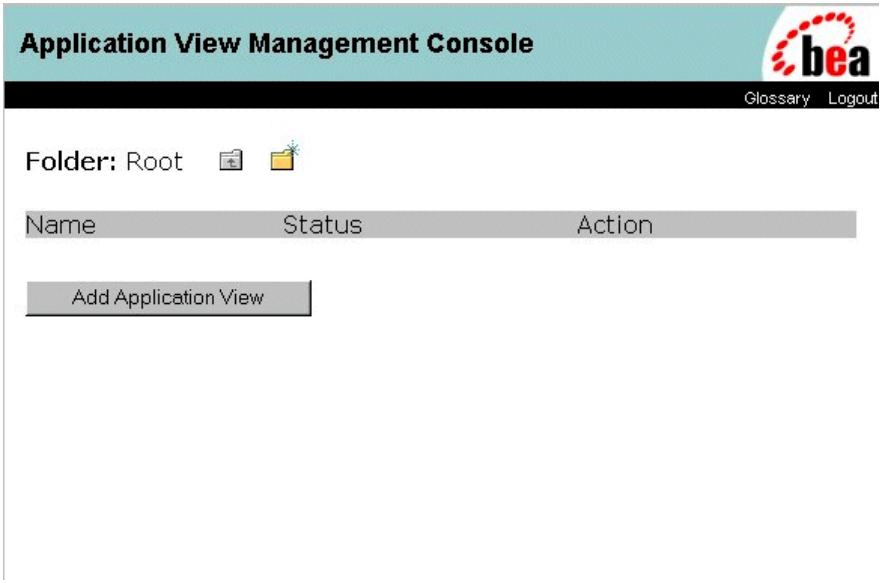
This section provides you with a short tour through the DBMS Adapter. Before you begin, you need to open the DBMS adapter Application View Console - Logon page on your browser. For information about accessing the DBMS adapter, see “Accessing the DBMS Adapter” on page E-3.

Figure E-2 Application View Console - Logon



1. To log on to the Application View Management Console, enter your WebLogic Username and Password, then click Login. The Application View Management Console displays.

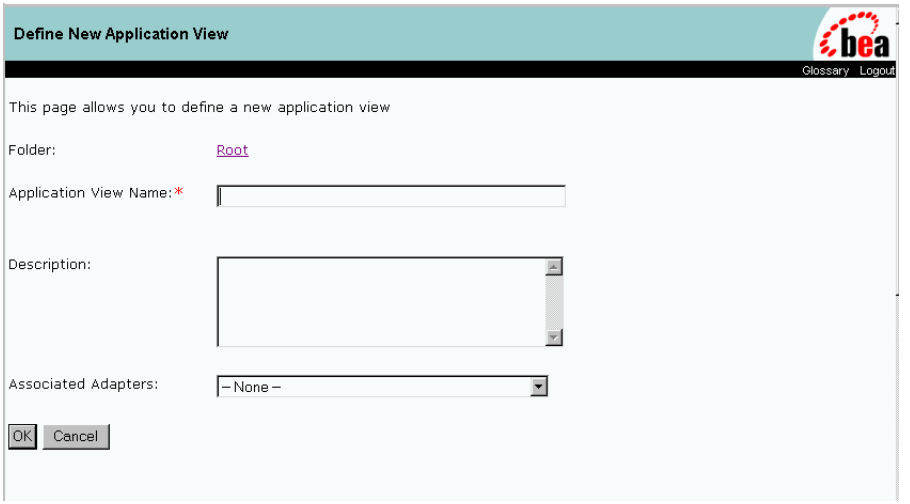
Figure E-3 Application View Management Console



2. Click Add Application View. The Define New Application View page displays. When you create the application view, you provide a description that associates the application view with the DBMS adapter.

   For detailed information about application views and about defining application views, see "Defining an Application View" in *Using Application Integration*.

Figure E-4 Define New Application View Page



3. To define an application view:

   a. In the Application View Name field, enter `AppViewTest`.

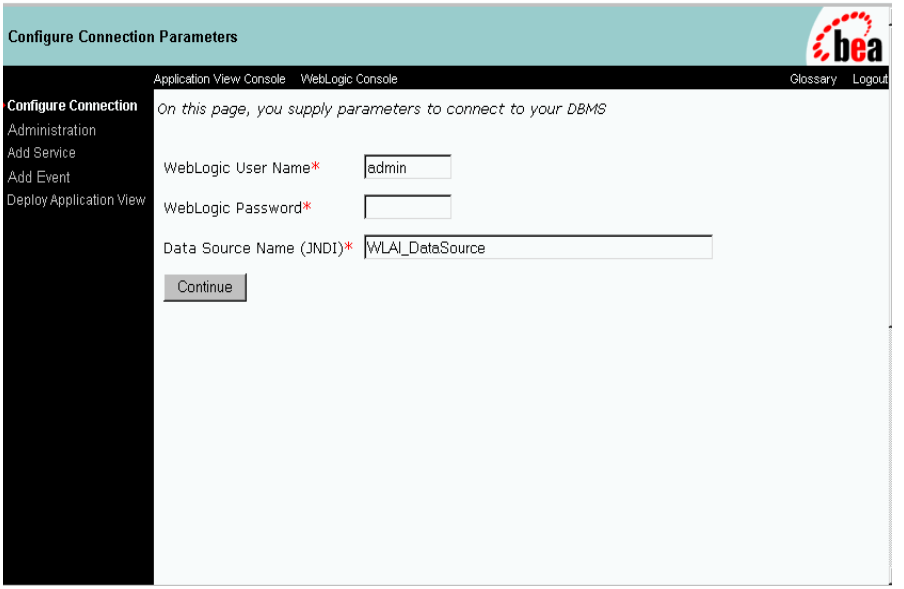
      The name should describe the set of functions performed by this application. Each application view name must be unique to its adapter. Valid characters are anything except ‘.’, ‘#’, ‘\’, ‘+’, ‘&’, ‘,’, ‘’’, ‘””, and a space.

   b. In the Description field, enter a brief description of the application view.

   c. From the Associated Adapters list, choose the DBMS adapter to use to create this application view.

   d. Click OK. The Configure Connection Parameters page appears.

Figure E-5 Configure Connection Parameters Page



4. At the Configure Connection Parameters page, you define the network-related information necessary for the application view to interact with the target EIS. You need to enter this information only once per application view:

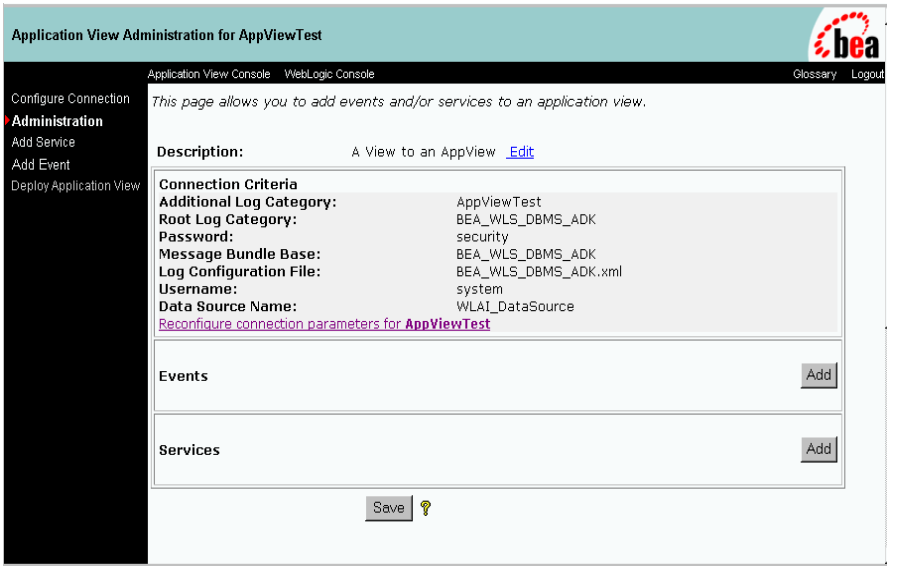
   a. Enter your WebLogic User Name and WebLogic Password.

   b. In the Data Source Name (JNDI) field, enter `WLAI_DataSource`.

   c. Click Continue. The Application View Administration page displays.

      The Application View Administration page summarizes the connection criteria and, once events and services are defined, you can view the schemas and summaries and also delete an event or service from this page.

Figure E-6 Application View Administration Page for AppViewTest



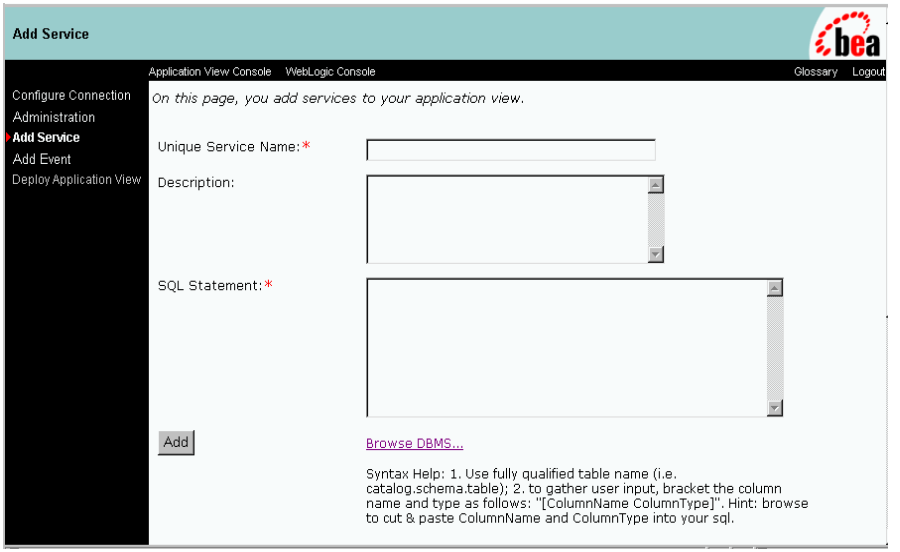
5. Now that you have created an application view, you are ready to add a service to it. To add the service you must supply a name for the service, provide a description and enter the SQL statement.

   You can use the browse link to browse the DBMS adapter database schemas and tables and specify the database table CUSTOMER_TABLE.

   To add a service:

   a. On the Application View Administration page, click Add in the Services group. The Add Service page displays.

Figure E-7 Add Service Page



b. In the Unique Service Name field, enter InsertCustomer.

c. In the Description field, enter a description of the service.

d. Click Browse DBMS to view the table and column structure of the database. If you are writing a complex query, you may leave the Browse window open in order to cut and paste table or column names into your query.

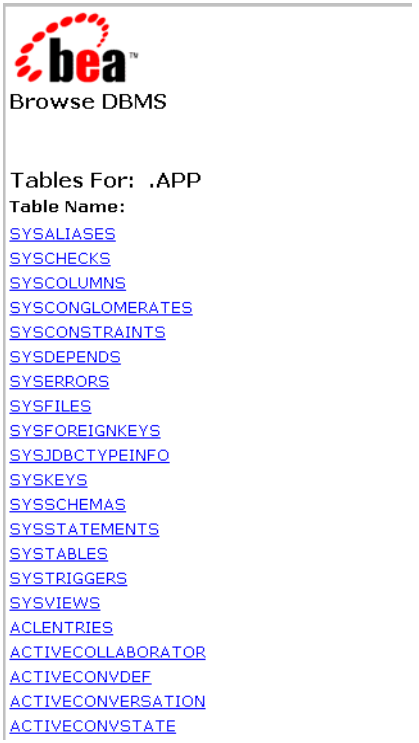
Figure E-8 Browse DBMS Page

e. In the DBMS Schemas for Catalog page, click APP.

Figure E-9 Browse DBMS Table Types Page

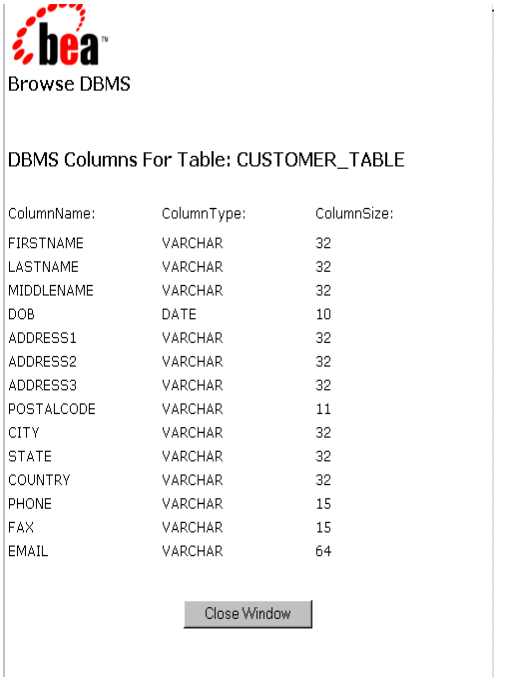
f. In the DBMS Table Types page, click TABLE.

Figure E-10 DBMS Browse Tables Page



g. In the Tables list for APP page, click CUSTOMER_TABLE. The Browse window now displays the column names and column types.

Figure E-11 Browse DBMS for Table Page



h. Click Close Window to close to close the window to return to the Add Service Page.

   This window is included in the tour to introduce you to the functionality and it is not necessary to select any text for this exercise.

i. In the Service Page, add the following information into the SQL Statement field:

```
Insert into APP.CUSTOMER_TABLE (FIRSTNAME, LASTNAME, DOB)
VALUES ([FIRSTNAME VARCHAR], [LASTNAME VARCHAR], [DOB
DATE])
```

j. Click Add. The Application View Administration page is displayed.

   For additional information about adding services, see "Defining an Application View" in the *Using Application Integration.*

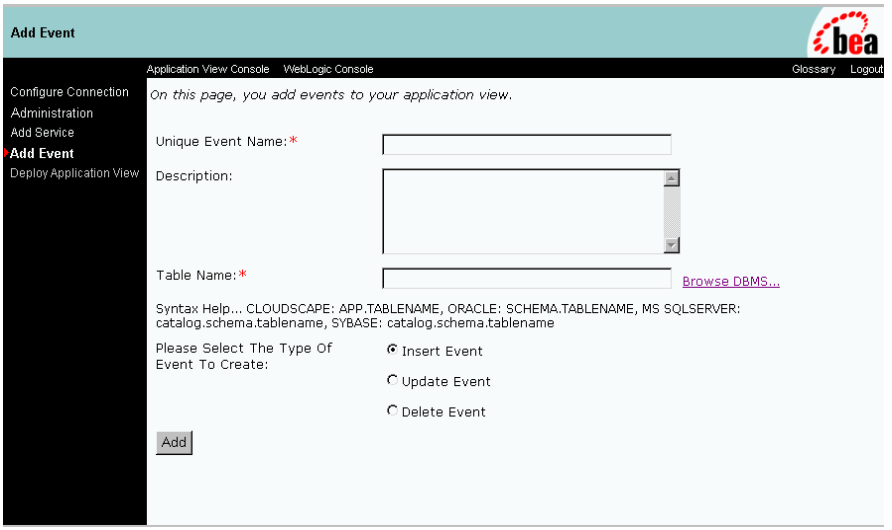
6. Add an event to your application view. In order to add an event, you must provide a unique event name and a description. Then you must specify the database table upon which a trigger should be added for the event. You must also specify if it is an insert, update or delete event.

   You can use the Browse DBMS link to browse the DBMS database schemas and tables and to specify the database table. Then you can automatically populate the field with the selected table name.

   To add an event:

   a. In the Application View Administration page, click Add in the Events field. The Add Event page displays.

Figure E-12 Add Event Page



   b. In the Unique Event Name field, enter `CustomerInserted`.

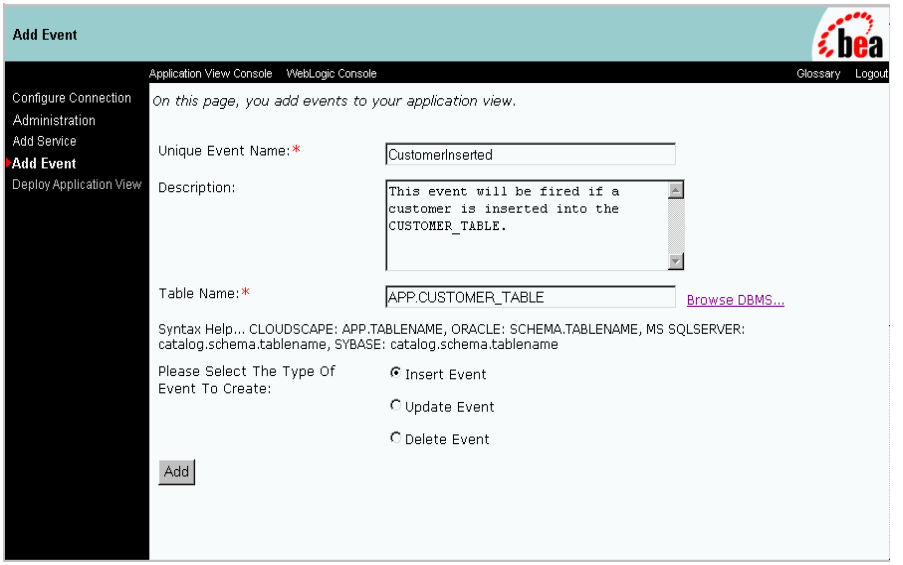
   c. In the Description field, enter a description of the event.

   d. Click the Browse DBMS link to view the table and column structure of the database.

Figure E-13 Browse DBMS Tables Page

e. Select the CUSTOMER TABLE radio button, and click Fill table name with selected table.

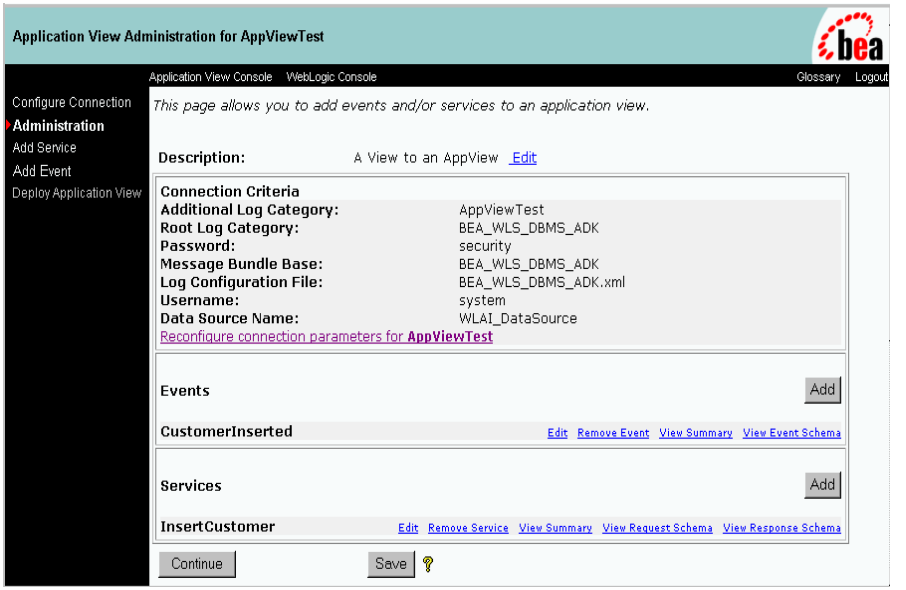
Figure E-14 Add Event Page



f. Select the Insert Event radio button.

g. When finished, click Add. The Application View Administration page displays.

Figure E-15 Application View Administration Page for AppViewTest



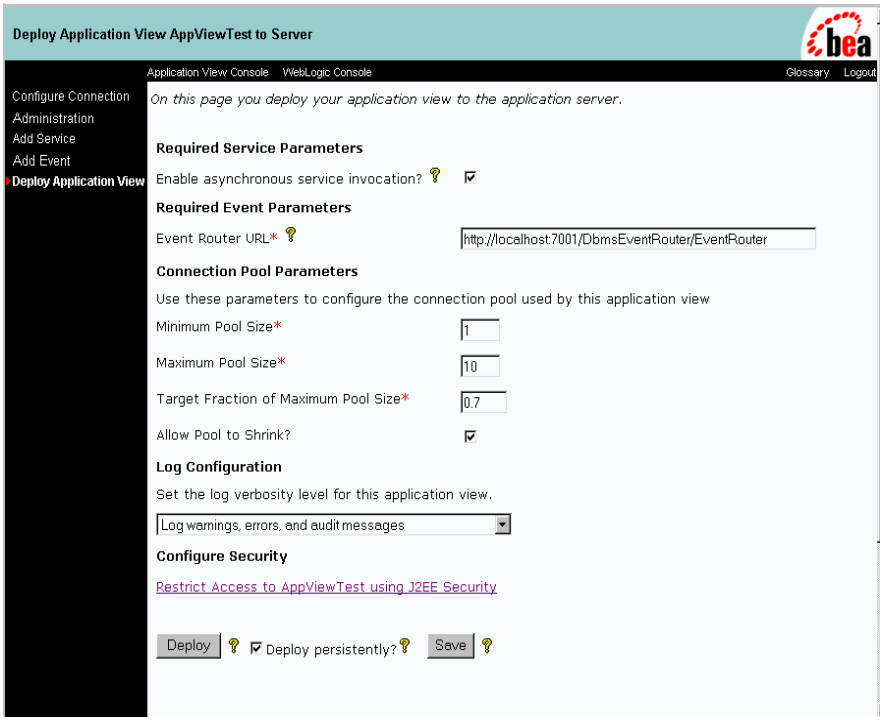
7. Prepare to deploy the application view. The Application View Administration page provides you with a single location for confirming the content of your application view before you save it or deploy it. In this page, you can view the following:

   - Confirm or edit the description of the application view.
   - Confirm or reconfigure Connection Criteria for the application view.
   - Delete services and events.
   - Save the application view so you can return to it later or deploy the application view to the server.

   After verifying the application view parameters, click Continue. The Deploy Application View to Server page displays.

8. Deploy the Application View. In order to deploy the application view, you must provide several parameters such as enabling asynchronous service invocation, providing the event router URL, and changing the connection pool parameters, among other parameters.

Figure E-16 Display Application View to Server Page



To deploy the application view:

a. Make sure the Enable Asynchronous Service Invocation check box is selected.

b. In the Event Router URL field, enter:

   `http://localhost:7001/DbmsEventRouter/EventRouter`

c. For the Connection Pool Parameters, accept the default values:

   Minimum Pool Size - 1

   Maximum Pool Size - 10

   Target Fraction of Maximum Pool Size - 0.7

   Allow Pool to Shrink - checked

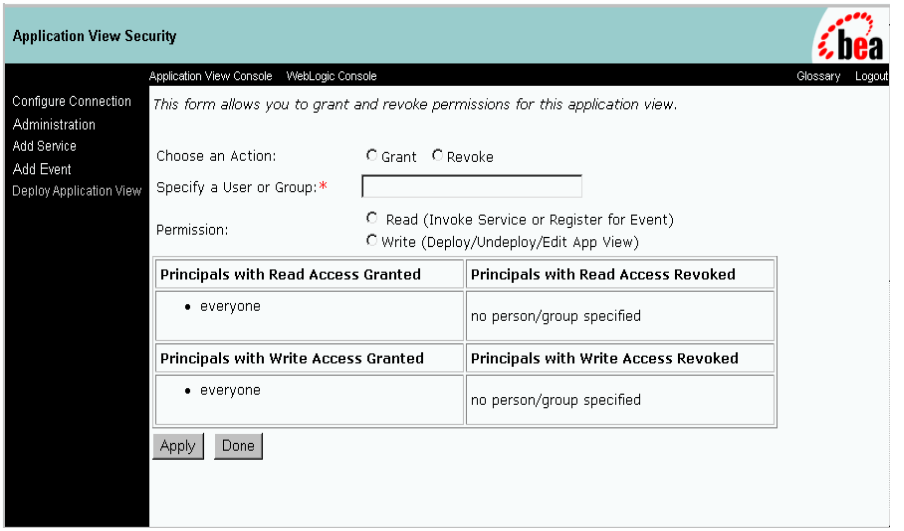
d. In the Log Configuration field, select Log warnings, errors, and audit messages.

e. Make sure the Deploy persistently? box is checked.

f. Click the Restrict Access link. The Application View Security page displays.

9. Set permissions for the application view. You can grant or revoke read and write access for a user or a group.

Figure E-17 Application View Security Page



To set permissions for the application view:

a. For Choose an Action, select the Revoke radio button.

b. In the Specify a User or Group, enter `Jdoe`.

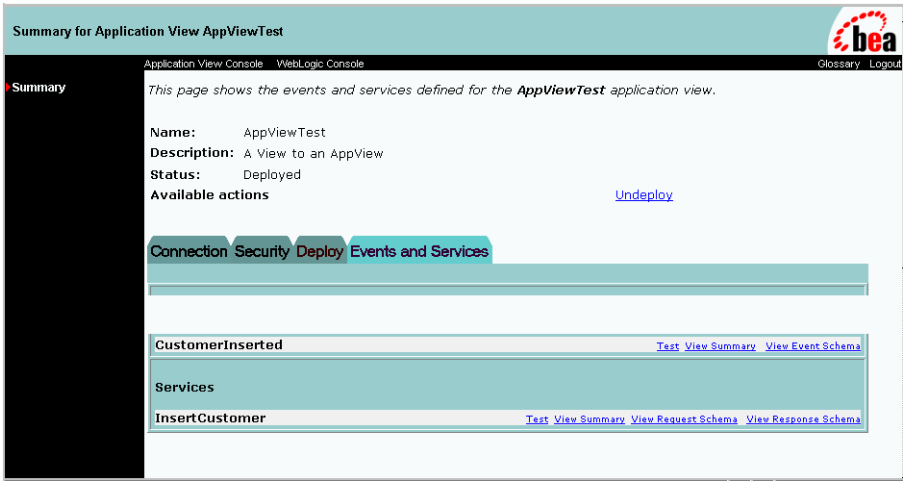
c. For Permission: select the Write (Deploy/Undeploy/Edit App View) radio button.

d. Click Done. The Deploy Application View Page displays.

e. Click Deploy.

10. Once the application view is deployed, the Summary for Application View page displays all relevant information about the deployed application view. Use the Summary for Application View page to view schemas, event and service summaries, test services and events and undeploy the application view.

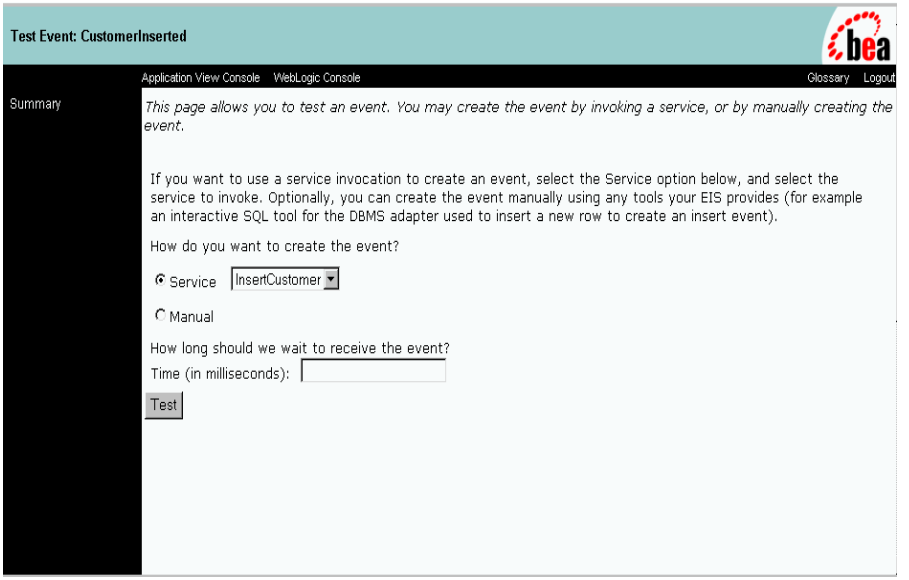
Figure E-18 Summary for Application View Page



11. Test an event. To ensure that the application view is working correctly, you can test the events and services in the application view. You can test an event by invoking a service or by manually creating the event. The user can also specify how long the application should wait to receive the event.

    a. In the Events group, on the CustomerInserted line, click Test. The Test Event page displays.

Figure E-19 Test Event Page

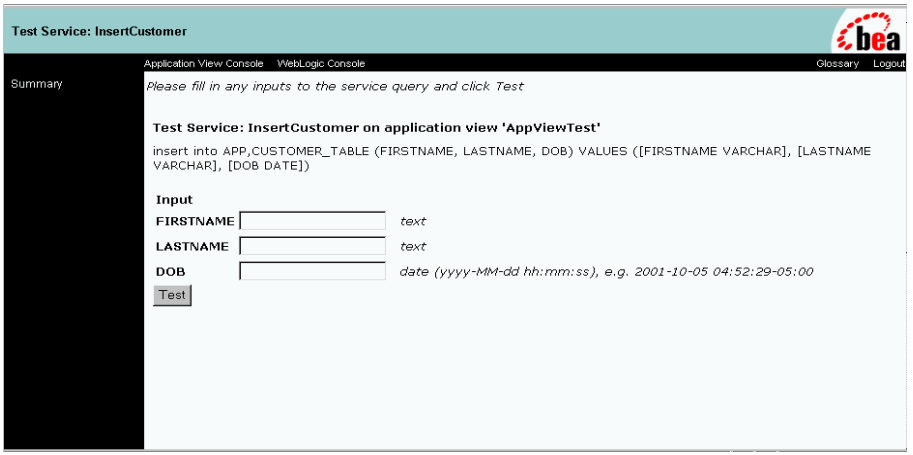


b. In the Test Event page, select the Service radio button, and select InsertCustomer in the Service menu.

c. In the How long should we wait to receive the event? field, enter `6000`.

d. Click Test. The Test Service page appears.

Figure E-20 Test Service Page



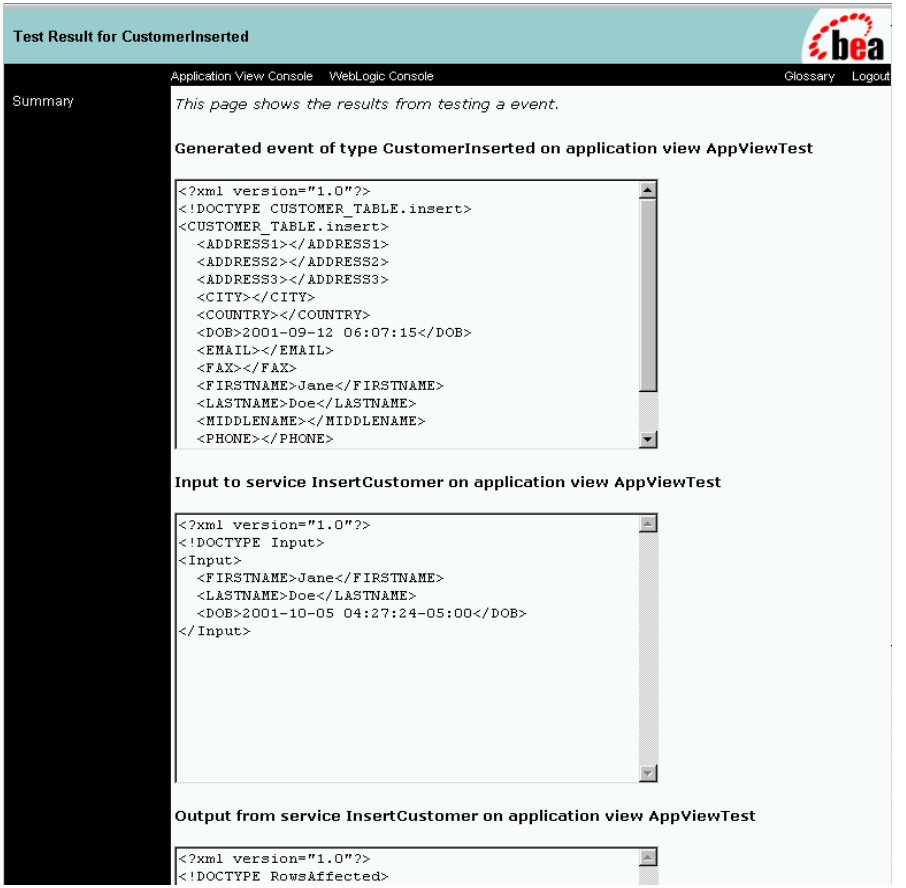
e. In the FIRSTNAME field, enter a first name.

f. In the LASTNAME field, enter a last name.

g. In the DOB field, enter a date of birth. The correct format is specified to the right of the edit box.

h. Click Test. The Test Result page displays to show the contents of the XML documents representing the event you generated and the response generated by the application view.

Figure E-21 Test Result Page



How the DBMS Adapter Was Developed

This section describes each interface used to develop the DBMS adapter. The ADK provides many of the necessary implementations required by a Java Connector Architecture-compliant adapter; however, since some interfaces cannot be fully implemented until the EIS and its environment are defined, the DBMS adapter was created to illustrate the detail-specific or concrete implementation of the abstract classes provided in the ADK.

The process of creating the DBMS adapter is comprised of the following steps:

- Development Reference Documentation
- Step 1: Development Considerations
- Step 2: Implementing the Server Provider Interface Package
- Step 3: Implementing the Common Client Interface Package
- Step 4: Implementing the Event Package
- Step 5: Deploying the DBMS Adapter

Development Reference Documentation

You can review the Javadoc and code for the methods defined in the steps that follow in this section to see how the implementations provided by the ADK were leveraged. You can find the Javadoc for this implementation in:

`WLI_HOME/adapters/dbms/docs/api/index.html`

You can find the code listing for this package in:

`WLI_HOME/adapters/dbms/src/com/bea/adapter/dbms/spi`

Note: `WLI_HOME` is the drive or home directory where WebLogic Integration is installed.

Step 1: Development Considerations

The Adapter Setup Worksheet (see Appendix D, "Adapter Setup Worksheet,") is available to help adapter developers identify and collect critical information about an adapter they are developing before they begin coding. For the DBMS adapter, the worksheet questions are answered as follows:

Note: Questions preceded by an asterisk (*) are required to use the GenerateAdapterTemplate utility.

1. **What is the name of the EIS for which you are developing an adapter?*

   Cloudscape, SQLServer, Oracle, Sybase, or DB2 databases.

2. **What is the version of the EIS?*

   Cloudscape 3.5.1, MSSQLServer 7.0, Oracle 8.1.6, Sybase 11.9.2, or DB2 7.2

3. **What is the type of EIS; for example, DBMS, ERP, etc.?*

   DBMS

4. **What is the vendor name for this adapter?*

   BEA

5. **What is the version number of this adapter?*

   None - Sample Only

6. **What is the adapter logical name?*

   BEA_WLS_DBMS_ADK

7. *Does the adapter need to invoke functionality within the EIS?*

   Yes

   If so, then your adapter needs to support services.

   Yes

8. *What mechanism/API is provided by the EIS to allow an external program to invoke functionality provided by the EIS?*

   JDBC

9. *What information is needed to create a session/connection to the EIS for this mechanism*?

   Database URL, driver class, user name, password

10. *What information is needed to determine which function(s) will be invoked in the EIS for a given service?*

    Function name, executeUpdate, executeQuery

11. *Does the EIS allow you to query it for input and output requirements for a given function?*

    Yes, you can browse data structures.

    If so, what information is needed to determine the input requirements for the service?

    SQL

12. *For all the input requirements, which ones are static across all requests? Your adapter should encode static information into an InteractionSpec object.*

    SQL

13. *For all the input requirements, which ones are dynamic per request? Your adapter should provide an XML schema that describes the input parameters required by this service per request.*

    The input requirements would change depending on the SQL expression for the service

14. *What information is needed to determine the output requirements for the service?*

    n/a

15. *Does the EIS provide a mechanism to browse a catalog of functions your adapter can invoke? If so, your adapter should support browsing of services.*

    Yes

16. *Does the adapter need to receive notifications of changes that occur inside the EIS? If so, then your adapter needs to support events.*

    Yes

17. *What mechanism/API is provided by the EIS to allow an external program to receive notification of events in the EIS? The answer of this question will help determine if a pull or a push mechanism is developed.*

    None. The DBMS adapter was built on the WebLogic Integration event generator using a pull mechanism.

18. *Does the EIS provide a way to determine which events your adapter can support?*

    Yes

19. *Does the EIS provide a way to query for metadata for a given event?*

    Yes

20. *What locales (language/country) does your adapter need to support?*

    Multiple

Step 2: Implementing the Server Provider Interface Package

To implement the DBMS adapter Server Provider Interface (SPI) and meet the J2EE-compliant SPI requirements, the classes in the ADK were extended to create the following concrete classes:

Table E-1 SPI Class Extensions

This concrete class...	Extends this ADK class...
`ManagedConnectionFactoryImpl`	`AbstractManagedConnectionFactory`
`ManagedConnectionImpl`	`AbstractManagedConnection`
`ConnectionMetaDataImpl`	`AbstractConnectionMetaData`
`LocalTransactionImpl`	`AbstractLocalTransaction`

These classes provide connectivity to an EIS and establish a framework for event listening and request transmission, establish transaction demarcation, and allow management of a selected EIS.

ManagedConnectionFactoryImpl

The first step in implementing an SPI for the DBMS adapter was to implement the `ManagedConnectionFactory` interface. A `ManagedConnectionFactory` supports connection pooling by providing methods for matching and creating a `ManagedConnection` instance.

Basic Implementation

The ADK provides `com.bea.adapter.spi.AbstractManagedConnectionFactory`, an implementation of the Java Connector Architecture interface `javax.resource.spi.ManagedConnectionFactory`. The DBMS adapter extends this class in `com.bea.adapter.dbms.spi.ManagedConnectionFactoryImpl`. Listing E-1 shows the derivation tree for `ManagedConnectionFactoryImpl`.

Listing E-1 com.bea.adapter.dbms.spi.ManagedConnectionFactoryImpl

```
javax.resource.spi.ManagedConnectionFactory
  |
  |-->com.bea.adapter.spi.AbstractManagedConnectionFactory
        |
        |-->com.bea.adapter.dbms.spi.ManagedConnectionFactoryImpl
```

Developers' Comments

The `ManagedConnectionFactory` is the central class of the Java Connector Architecture SPI package. The ADKs `AbstractManagedConnectionFactory` provides much of the required implementation for the methods declared in Sun MicroSystems' interface. To extend the ADKs `AbstractManagedConnectionFactory` for the DBMS adapter, the key `createConnectionFactory()` and `createManagedConnection()` methods were implemented. Overrides for `equals()`, `hashcode()`, `checkState()` were also written to provide specific behaviors for the databases supported by the DBMS adapter.

There are private attributes about which the superclass has no knowledge. When creating your adapters, you must provide setter/getter methods for these attributes. The abstract `createConnectionFactory()` method is implemented to provide an EIS-specific `ConnectionFactory` using the input parameters.

Additionally, `createManagedConnection()` is the main factory method of the class. It checks to see if the adapter is configured properly before doing anything else. It then implements methods of the superclass to get a connection and a password credential object. It then attempts to open a physical database connection; if this succeeds, it instantiates and returns a `ManagedConnectionImpl` (the DBMS adapter implementation of `ManagedConnection`), which is given the physical connection.

Other methods are getter/setter methods for member attributes.

ManagedConnectionImpl

A `ManagedConnection` instance represents a physical connection to the underlying EIS in a managed environment. `ManagedConnection` objects are pooled by the application server. For more information, read about how the ADK implements the `AbstractManagedConnection` instance in “ManagedConnection” on page 6-32.

Basic Implementation

The ADK provides `com.bea.adapter.spi.AbstractManagedConnection`, an implementation of the J2EE interface `javax.resource.spi.ManagedConnection`. The DBMS adapter extends this class in `com.bea.adapter.dbms.spi.ManagedConnectionImpl`. Listing E-2 shows the derivation tree for `ManagedConnectionImpl`.

Listing E-2 com.bea.adapter.dbms.spi.ManagedConnectionImpl

```
javax.resource.spi.ManagedConnection
  |
  |-->com.bea.adapter.spi.AbstractManagedConnection
        |
        |-->com.bea.adapter.dbms.spi.ManagedConnectionImpl
```

Developers’ Comments

This class is well documented in the Javadoc comments since the `ManagedConnection` is a crucial part of the Java Connector Architecture SPI specification. You should focus on our implementation of the following methods:

- `java.lang.object.getConnection(javax.security.auth.Subject subject, javax.resource.spi.ConnectionRequestInfo connectionRequestInfo)`
- `protected void destroyPhysicalConnection(java.lang.Object objPhysicalConnection)`
- `protected void destroyConnectionHandle(java.lang.Object objHandle)`
- `boolean compareCredentials(javax.security.auth.Subject subject, javax.resource.spi.ConnectionRequestInfo info)`

The `ping()` method is used to check whether the physical database connection (not our cci.`Connection`) is still valid. If an exception occurs, `ping()` is very specific about checking the type so that a connection is not needlessly destroyed.

Other methods are EIS specific or are simply required setter/getters.

ConnectionMetaDataImpl

The `ManagedConnectionMetaData` interface provides information about the underlying EIS instance associated with a `ManagedConnection` instance. An application server uses this information to get run-time information about a connected EIS instance. For more information, read about how the ADK implements the `AbstractConnectionMetaData` instance in “ManagedConnection” on page 6-32.

Basic Implementation

The ADK provides `com.bea.adapter.spi.AbstractConnectionMetaData`, an implementation of the J2EE interface `javax.resource.spi.ManagedConnection MetaData`. The DBMS adapter extends this class in `com.bea. adapter.dbms.spi.ConnectionMetaDataImpl`. Listing E-3 shows the derivation tree for `ConnectionMetaDataImpl`.

Listing E-3 com.bea.adapter.dbms.spi.ConnectionMetaDataImpl

```
javax.resource.spi.ManagedConnectionMetaData
  |
  |-->com.bea.adapter.spi.AbstractConnectionMetaData
        |
        |-->com.bea.adapter.dbms.spi.ConnectionMetaDataImpl
```

Developers' Comments

The ADKs `AbstractConnectionMetaData` implements the following:

- `javax.resource.cci.ConnectionMetaData`
- `javax.resource.spi.ManagedConnectionMetaData`

This implementation of the `ConnectionMetaData` class uses a `DatabaseMetaData` object. Since the ADK's abstract implementation was used, you must provide EIS-specific knowledge when implementing the abstract methods in this class.

LocalTransactionImpl

The `LocalTransaction` interface provides support for transactions that are managed internal to an EIS resource manager and do not require an external transaction manager. For more information, read about how the ADK implements the `AbstractLocalTransaction` instance in "LocalTransaction" on page 6-35.

Basic Implementation

The ADK provides `com.bea.adapter.spi.AbstractLocalTransaction`, an implementation of the J2EE interface `javax.resource.spi.LocalTransaction`. The DBMS adapter extends this class in `com.bea.adapter.dbms.spi.LocalTransactionImpl`. Listing E-4 shows the derivation tree for `LocalTransactionImpl`.

Listing E-4 com.bea.adapter.dbms.spi.LocalTransactionImpl

```
javax.resource.spi.LocalTransaction
  |
  |-->com.bea.adapter.spi.AbstractLocalTransaction
        |
        |-->com.bea.adapter.dbms.spi.LocalTransactionImpl
```

Developers' Comments

This class utilizes the ADKs abstract superclass which provides logging and event notification. The superclass implements both the CCI and SPI LocalTransaction interfaces provided by Sun. The DBMS adapter's concrete class implements the three abstract methods of the superclass:

- `doBeginTx()`
- `doCommitTx()`
- `doRollbackTx()`

Step 3: Implementing the Common Client Interface Package

To implement the DBMS adapter Common Client Interface (CCI) and meet the J2EE-compliant CCI requirements, ADK classes to create the following concrete classes were extended:

Table E-2 CCI Class Extensions

This concrete class...	Extends this ADK class...
`ConnectionImpl`	`AbstractConnection`
`InteractionImpl`	`AbstractInteraction`
`InteractionSpecImpl`	`InteractionSpecImpl`

These classes provide connectivity to and access back-end systems. The client interface specifies the format of the request and response records for a given interaction with the EIS.

Note: Although implementing the CCI is optional in the *Java Connector Architecture 1.0* specification, it is likely to be required in the future. For your reference, the DBMS adapter provides a complete implementation.

ConnectionImpl

A `Connection` represents an application-level handle that is used by a client to access the underlying physical connection. The actual physical connection associated with a Connection instance is represented by a `ManagedConnection` instance. For more information, read about how the ADK implements the `AbstractConnection` instance in “Connection” on page 6-37.

Basic Implementation

The ADK provides `com.bea.adapter.cci.AbstractConnection`, an implementation of the J2EE interface `javax.resource.cci.Connection`. The DBMS adapter in by implementing `com.bea.adapter.dbms.cci.ConnectionImpl`. Listing E-5 shows the derivation tree for `ConnectionImpl`.

Listing E-5 com.bea.adapter.dbms.cci.ConnectionImpl

```
javax.resource.cci.Connection
  |
  |-->com.bea.adapter.cci.AbstractConnection
        |
        |-->com.bea.adapter.dbms.cci.ConnectionImpl
```

Developers’ Comments

The `ConnectionImpl` class is the DBMS adapter's concrete implementation of the `javax.resource.cci.Connection interface`. It extends the ADKs AbstractConnection class. The actual physical connection associated with a connection instance is represented by a `ManagedConnection` instance.

A client gets a connection instance by using the `getConnection()` method on a `ConnectionFactory` instance. A connection can be associated with zero or more interaction instances. The simplicity of this concrete class is a testament to the power of extending the ADK's base classes.

InteractionImpl

The `Interaction` enables a component to execute EIS functions. An interaction instance is created from a connection and is required to maintain its association with the `Connection` instance. For more information, read about how the ADK implements the `AbstractInteraction` instance in "Interaction" on page 6-38.

Basic Implementation

The ADK provides `com.bea.adapter.cci.AbstractInteraction`, an implementation of the J2EE interface `javax.resource.cci.Interaction`. The DBMS adapter extends this class in `com.bea.adapter.dbms.cci.InteractionImpl`. Listing E-6 shows the derivation tree for `InteractionImpl`.

Listing E-6 com.bea.adapter.dbms.cci.InteractionImpl

```
javax.resource.cci.Interaction
  |
  |-->com.bea.adapter.cci.AbstractInteraction
        |
        |-->com.bea.adapter.dbms.cci.InteractionImpl
```

Developers' Comments

This is the concrete implementation of the ADKs Interaction object. As expected, the methods are EIS-specific implementations of Java Connector Architecture/ADK required methods.

Both versions of the Java Connector Architecture's `javax.resource.cci.InteractionExecute()`method (the central method of this class) were implemented. The main logic for the `execute()` method has the following signature: `public Record execute(InteractionSpec ispec, Record input)`. This method return the actual output record from the interaction, so it is the one that is called more often.

The second implementation is provided as a convenience method. This form of `execute()` has the following signature: `public boolean execute(InteractionSpec ispec, Record input, Record output)`. The second implementation's logic returns a boolean, which indicates only the success or failure of the interaction.

InteractionSpecImpl

An `InteractionSpecImpl` holds properties for driving an interaction with an EIS instance. An `InteractionSpec` is used by an interaction to execute the specified function on an underlying EIS.

The CCI specification defines a set of standard properties for an InteractionSpec, but an `InteractionSpec` implementation is not required to support a standard property if that property does not apply to its underlying EIS.

The `InteractionSpec` implementation class must provide getter and setter methods for each of its supported properties. The getter and setter methods convention should be based on the Java Beans design pattern. For more information, read about how the ADK implements the `InteractionSpecImpl` instance in "InteractionSpec" on page 6-48.

Basic Implementation

The ADK provides `com.bea.adapter.cci.InteractionSpecImpl`, an implementation of the J2EE interface `javax.resource.cci.InteractionSpec`. The DBMS adapter extends this class in `com.bea.adapter.dbms.cci.InteractionSpecImpl`. Listing E-7 shows the derivation tree for `InteractionSpecImpl`.

Listing E-7 com.bea.adapter.dbms.cci.InteractionSpecImpl

```
javax.resource.cci.InteractionSpec
  |
  |-->com.bea.adapter.cci.InteractionSpecImpl
        |
        |-->com.bea.adapter.dbms.cci.InteractionSpecImpl
```

Developers' Comments

An implementation class for InteractionSpec interface is required to implement the `java.io.Serializable` interface. `InteractionSpec` extends the ADK `InteractionSpec` in order to add setter/getter methods for the String attribute `m_sql`. The getter/setter methods should be based on the Java Beans design pattern as specified in the *Java Connector Architecture 1.0* specification.

Step 4: Implementing the Event Package

This package contains only one class: the DBMS adapter `EventGeneratorWorker`. It does the work for the event generator for the DBMS adapter.

EventGenerator

The `EventGenerator` class implements the following interfaces:

- `com.bea.wlai.event.IEventGenerator`
- `java.lang.Runnable`

Basic Implementation

The DBMS adapter event generator extends the ADK's `AbstractPullEventGenerator` because a database cannot "push" information to the event generator; you therefore need to "pull" or actually "poll" the database for changes about which you are interested in being notified. Listing E-8 shows the derivation tree for `EventGenerator`.

Listing E-8 EventGenerator

```
com.bea.adapter.event.AbstractEventGenerator
  |
  |-->com.bea.adapter.event.AbstractPullEventGenerator
        |
        |-->com.bea.adapter.dbms.event.DbmsEventGeneratorWorker
```

Developers' Comments

This concrete implementation of the ADK's `AbstractPullEventGenerator` implements the abstract methods:

- `protected abstract void postEvents(IEventRouter router) throws Exception`
- `protected abstract void setupNewTypes(List listOfNewTypes)`
- `protected abstract void removeDeadTypes(List listOfDeadTypes).`

It also overrides the following methods:

- `void doInit(Map map)`
- `void doCleanUpOnQuit().`

These methods are EIS specific and are used to identify an event within the context of the EIS while interacting with the database to create and remove event definitions and events. Additionally, these methods create and remove the actual triggers on the database that are fired when an event occurs.

The key method of the class is `postEvents()`. It creates the `IEvent` objects of the data taken from rows in the EVENT table of the database. This method takes an `IEventRouter` as an argument. After creating an `IEvent` using the `IEventDefinition` object's `createDefaultEvent()` method, it populates the event data, and the event is propagated to the router by calling `router.postEvent(event)`. Once the event is sent to the router, the method deletes the row of event data from the database.

The method `setupNewTypes()`creates new event definitions, making sure that the appropriate trigger is created for the database. For each event definition, the method creates a trigger information object that describes the catalog, schema, table, triggerType, and trigger key that the event definition represents. A map of trigger keys is kept so that triggers are not redundantly added to the database. If the map doesn't contain the new key, the trigger text for the database is generated.

The method `removeDeadTypes()` also creates a trigger information object; however, it also checks if one or more event types match it. All event definitions that match this trigger are removed from the map, and then the trigger is removed from the database.

Step 5: Deploying the DBMS Adapter

After implementing the SPI, CCI and event interfaces, deploy the adapter. To deploy the adapter, use the procedures outlined in this section:

- Before You Begin
- Step 5a: Update the ra.xml File
- Step 5b: Create the .rar File
- Step 5c: Build the .jar and .ear Files
- Step 5d: Create and Deploy the .ear File

Before You Begin

Before deploying the adapter into WebLogic Integration, do the following:

- Determine the location of the adapter on your computer; that is, `WLI_HOME/adapters/dbms` where `WLI_HOME` is the location of your WebLogic Integration installation. This location is referred to as `ADAPTER_ROOT` hereafter.
- Make sure the DBMS adapter's `.jar` and `.ear` files are built, as described in "Step 5: Deploying the DBMS Adapter."

Step 5a: Update the ra.xml File

The DBMS adapter provides the `ra.xml` file in the adapter's `.rar` file (`META-INF/ra.xml`). Since the DBMS adapter extends the `AbstactManagedConnectionFactory` class, the following properties were provided in the `ra.xml` file:

- `LogLevel`
- `LanguageCode`
- `CountryCode`
- `MessageBundleBase`
- `LogConfigFile`
- `RootLogContext`

- AdditionalLogContext

The DBMS adapter requires these additional declarations:

Table E-3 ra.xml Properties

Property	Example
UserName	The username for DBMS adapter login.
Password	The password for username.
DataSourceName	The name of the JDBC connection pool.

You can view the complete ra.xml file for the DBMS adapter in:

WLI_HOME/adapters/dbms/src/rar/META-INF/

Step 5b: Create the .rar File

Class files, logging configuration, and message bundle(s) should be bundled into a .jar file, which should then be bundled along with META-INF/ra.xml into the .rar file. The Ant build.xml file demonstrates how to properly construct this .rar file.

Step 5c: Build the .jar and .ear Files

To build the .jar and .ear files, use this procedure:

1. Edit antEnv.cmd (Windows) or antEnv.sh (Unix) in WLI_HOME/adapters/utils. You must set the following variables to valid paths:
   - BEA_HOME - The top-level directory for your BEA products.
   - WLI_HOME - The location of your Application Integration directory.
   - JAVA_HOME - The location of your Java Development Kit.
   - WL_HOME - The location of your WebLogic Server directory.
   - ANT_HOME - The location of your Ant home, typically WLI_HOME/adapters/utils.
2. Execute antEnv from the command-line to set the necessary environment variables for your shell.

3. Change directories to `WLI_HOME/adapters/dbms/project`.
4. Execute `ant release` from the `WLI_HOME/adapters/dbms/project` directory to build the adapter.

Step 5d: Create and Deploy the .ear File

To create and deploy the `.ear` file, thus deploying the DBMS adapter, use this procedure:

1. First, declare the adapter's `.ear` file in your domain's `config.xml` file, as shown in Listing E-9:

Listing E-9 Declaring the DBMS Adapter's `.ear` File

```
<!-- This deploys the EAR file -->

<Application Deployed="true" Name="BEA_WLS_DBMS_ADK"
Path="WLI_HOME/adapters/dbms/lib/BEA_WLS_DBMS_ADK.ear">

     <ConnectorComponent Name="BEA_WLS_DBMS_ADK" Targets="myserver"
        URI="BEA_WLS_DBMS_ADK.rar"/>

     <WebAppComponent Name="DbmsEventRouter" Targets="myserver"
        URI="BEA_WLS_DBMS_ADK_EventRouter.war"/>

    <WebAppComponent Name="BEA_WLS_DBMS_ADK_Web" Targets="myserver"
       URI="BEA_WLS_DBMS_ADK_Web.war"/>

</Application>
```

Note: Replace `WLI_HOME` with the correct path to the WebLogic Integration root directory for your environment.

2. Add the `.jar` file(s) for the adapter to the WebLogic Server classpath. At this time, WebLogic does not support shared `.jar` files in an `.ear` file; in other words, the Web applications and the adapters do not share a common classloader parent. Consequently, you need to place the shared `.jar` files in your adapter on the system classpath.
3. Restart WebLogic Server.

4. Once the server restarts, add the adapter group to the default WebLogic security realm by using the WebLogic Server Console Web application. To do this, navigate to `http://<host>:<port>/console` where *<host>* is the name of your server and *<port>* is the listening port; for example:

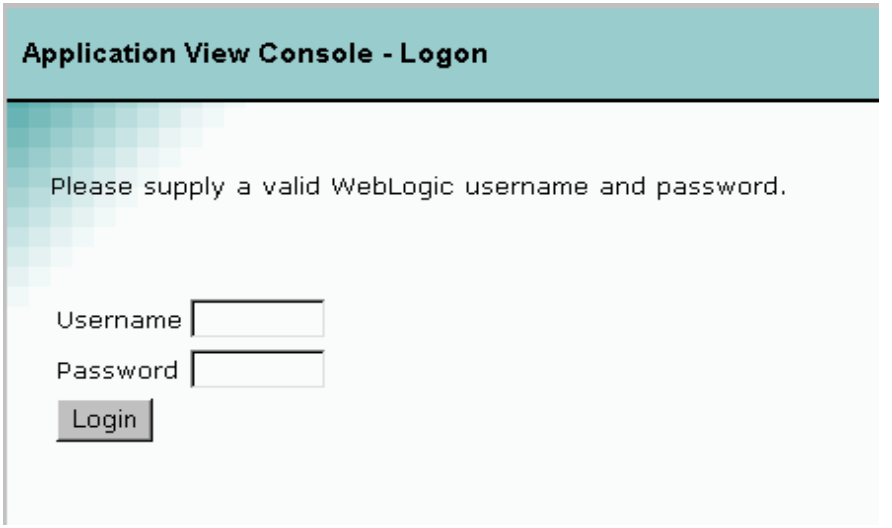
   ```
   http://localhost:7001/console
   ```

5. After you have added the adapter group, add a user to the adapter group using the WebLogic console Web application and save your changes.

6. To configure and deploy application views, navigate to `http://<host>:<port>/wlai`, where *<host>* is the name of your server and *<port>* is the listening port; for example:

   ```
   http://localhost:7001/wlai
   ```

   The Application View Console - Logon is displayed.



7. Log on to WebLogic Integration by entering your username and password in appropriate fields.

8. Configure and deploy the application views by using the procedures described in "Defining Application Views" in *Using Application Integration*.

How the DBMS Adapter Design-Time GUI was Developed

The design-time GUI is the user interface that allows the user to create application views, add services and events and deploy the adapter if it is hosted in the WebLogic Integration. This section discusses some specific design time issues that were considered during the development of the DBMS adapter.

The process of creating the DBMS adapter design-time GUI is comprised of the following steps:

- Step 1: Development Considerations
- Step 2: Determine Necessary Java Server Pages
- Step 3: Create the Message Bundle
- Step 4: Implementing the Design-time GUI
- Step 5: Writing Java Server Pages

Step 1: Development Considerations

Some of the important development considerations regarding the design-time GUI for the DBMS adapter included:

- Determine the database(s) that were going to be supported.
- Determine browsing depth.
- Determine the DBMS schema generation.
- Determine if the adapter should support testing of services and events.

Step 2: Determine Necessary Java Server Pages

The DBMS adapter uses the ADKs Java Server Pages (JSPs) for a design-time GUI; however, additional JSPs have been added to provide adapter-specific functionality. A description of the additional JSPs is in Table E-4:

Table E-4 Additional ADK JSPs

Filename	Description
`addevent.jsp`	The Add Event page allows a user to add a new event to the application view.
`addservice.jsp`	The Add Service page allows the user to add a new service to the application view.
`browse.jsp`	The Browse page handles the flow logic and display for the Browse window of the DBMS adapter. Although this functionality was developed specifically for this adapter, it illustrates a fairly common interaction between the design-time interface and the underlying adapter. It uses the `DesignTimeRequestHandler` (handler) of the DBMS adapter, which extends the ADK's AbstractDesignTimeRequestHandler. The best way to understand the browse functionality of the DBMS adapter is to deploy the adapter and use your Web browser to access the design-time framework.
`confconn.jsp`	The Confirm Connection page provides a form for a user to specify connection parameters for the EIS.
`testform.jsp`	The Testform page is included (<jsp:include page='testform.jsp'/>) in the ADK's testsrvc.jsp page. It accesses the InteractionSpec for this interaction and displays the SQL for the service on screen. It then creates a form for gathering required user input to test a service. It does this by getting the `RequestDocumentDefinition` from the handler's application view and then passing it along with the `.jsp` Writer to a utility class, com.bea.adapter.dbms.utils.TestFormBuilder, which actually creates the required form.

Step 3: Create the Message Bundle

To support the internationalization of all text labels, messages and exceptions, the DBMS adapter uses a message bundle based on a text property file. The property file uses copied name value pairs from the `BEA_WLS_SAMPLE_ADK` property file, and new entries were added for properties specific to the DBMS adapter.

The message bundle for the DBMS adapter is contained in WLI_HOME`/adapters/dbms/src` directory, which was installed with the ADK. Please refer to `BEA_WLS_DBMS_ADK.properties` in the directory above.

For additional instructions on creating a message bundle, refer to the JavaSoft tutorial on internationalization at:

`http://java.sun.com/docs/books/tutorial/i18n/index.html`

Step 4: Implementing the Design-time GUI

To implement the design-time GUI, you need to create a `DesignTimeRequestHandler` class. This class accepts user input from a form and provides methods to perform a design-time action. For more information on the `DesignTimeRequestHandler`, see “Step 4: Implementing the Design-Time GUI” on page 8-30.

The DBMS adapter public class `DesignTimeRequestHandler` extends `AbstractDesignTimeRequestHandler` and it provides the methods shown in Table E-5:

Table E-5 Methods for the DBMS Adapter Design-time GUI

Method	Description
`browse(java.lang.String dbtype, com.bea.connector.DocumentRecord input)`	Handles the back-end behavior for the “Browse” functionality of the `addevent.jsp` and `addservc.jsp`.
`getAdapterLogicalName()`	Returns the adapter's logical name and helps parent when deploying application views, etc.

Table E-5 Methods for the DBMS Adapter Design-time GUI (Continued)

Method	Description
`getManagedConnectionFactoryClass()`	Returns the adapter's SPI ManagedConnectionFactory implementation class, used by parent to get a CCI connection to the EIS.
`supportsServiceTest()`	Indicates that this adapter design time supports the testing of services.
`initServiceDescriptor(ActionResult result, IServiceDescriptor sd, HttpServletRequest request)`	Initializes a service descriptor which involves creating the request and response schemas for the service. A typical approach is to execute an Interaction against the EIS to retrieve metadata and transform it into an XML schema. Consequently, the CCI interface provided by the adapter was used. This method is called from the "addsrvc" method of the AbstractDesignTimeRequestHandler.
`initEventDescriptor(ActionResult result, IEventDescriptor ed, HttpServletRequest request)`	Initializes an event descriptor. The event descriptor provides information about an event on an application view. Subclasses will need to supply an implementation of this method. If events are not supported, then the implementation should throw an UnsupportedOperationException. This method will not be called (by the AbstractDesignTimeRequestHandler) until the event name and definition have been validated and it is confirmed that the event does not already exist for the application view.
`GetDatabaseType()`	This method is used to determine the type of dbms being used. At present WebLogic Integration supports Cloudscape, Oracle, Microsoft SQL Server, Sybase, and DB2.

Step 5: Writing Java Server Pages

The following issues are relevant for the DBMS adapter, and you may encounter them as you develop your own adapter.

- Custom JSP Tags

- Save an Object's State
- Write the WEB-INF/web.xml Web Application Deployment Descriptor

Custom JSP Tags

The Java Server Pages are displayed within the `display.jsp`; thus `display.jsp` is the first `.jsp` that needs to be written. The ADK provides a library of custom JSP tags, which are used extensively throughout the Java server pages of the ADK and DBMS adapter. They provide the ability to add validation, to save field values when the user clicks away, and a number of other features.

Save an Object's State

You may also need to save an object's state as you write the JSPs. There are a number of ways to save an object's state when building your adapter using the ADK. The `AbstractDesignTimeRequestHandler` maintains an `ApplicationViewDescriptor` of the application view being edited. This is often the best place to save state. Calls to the handler are fast and efficient.

You can also ask the `AbstractDesignTimeRequestHandler` for a Manager Bean, using its convenience methods: `getApplicationViewManager()`; `getSchemaManager()`; and `getNamespaceManager()`, to retrieve information from the repository about an application view. This is more time-consuming but may be necessary on occasion. Since it is a JSP, you can also use the session object, although everything put in the session must explicitly implement the `java.io.serializable` interface.

Write the WEB-INF/web.xml Web Application Deployment Descriptor

Write the `WEB-INF/web.xml` Web application deployment descriptor. In most cases, you should use the adapter's `web.xml` file as a starting point and modify the necessary components to fit your needs. To see the `web.xml` file for this adapter, go to:

```
WLI_HOME/adapters/dbms/src/war/WEB-INF/web.xml
```

For detailed information, see the BEA WebLogic Server product documentation at:

http://edocs.bea.com

F The E-mail Adapter

Note: The E-mail Adapter is deprecated as of this release of WebLogic Integration, and will be removed from the product in a future release.

This section contains information on the following subjects:

- Introduction to the E-mail Adapter
- How the E-mail Adapter Works
- How the E-mail Adapter was Developed
- Creating the E-mail Adapter Design-Time GUI

Introduction to the E-mail Adapter

The e-mail adapter is a J2EE-compliant adapter built with the WebLogic Integration ADK. The purpose of the e-mail adapter is to provide a way for any application to send notice in case of system failure or process completion. This notification is directed using e-mail, which could be configured to target multiple addresses or even a pager. A single templated message could be created for numerous errors allowing the adapter to plug in replaceable parameters and send the notification.

The e-mail adapter provides sample implementations of both a services and events. The event implementation provides sample code for both push and pull event generator paradigms. The service implementation enables the client to send and e-mail message with a minimum of information. Service-specific data is information required to send an e-mail message, such as source address, target addresses, subject, and the body of a message.

The e-mail adapter gives you (developers and business analysts) a concrete example of an adapter, including a JSP-based GUI, to help you understand the possibilities that are at your disposal using the ADK to build adapters. If you are a business analyst, you may enjoy running through the interface to get a better understanding of an "application view", "service", and "event" as shown in "How the E-mail Adapter Works" on page F-2.

If you are an adapter developer, you will also want to review "How the E-mail Adapter was Developed" on page F-14 and "Creating the E-mail Adapter Design-Time GUI" on page F-33, the code, and Javadoc to gain insight into how you can extend and use the classes of the ADK to build a JCA-compliant adapter.

How the E-mail Adapter Works

This section provides you with an opportunity to have a look at the e-mail adapter before you start developing an adapter of your own. If you are a business analyst, you may enjoy running through the interface to get a feel for how the adapter works. The example in this section shows how to create an application view for sending or receiving e-mails. This section contains information on the following subjects:

- Before You Begin
- Accessing the E-mail Adapter
- A Tour of the E-mail Adapter

Before You Begin

Make sure the following tasks have been performed before you try to access the e-mail adapter:

- Install WebLogic Integration. For more information, see *Installing BEA WebLogic Integration*.
- Set up the ADK Ant-Based Make Process. For more information, see "Step 2c: Setting Up the Build Process" on page 6-10.

- Ensure that the e-mail adapter has been deployed so that the design-time GUI is accessible. For more information, see the *Installing BEA WebLogic Integration*.

Accessing the E-mail Adapter

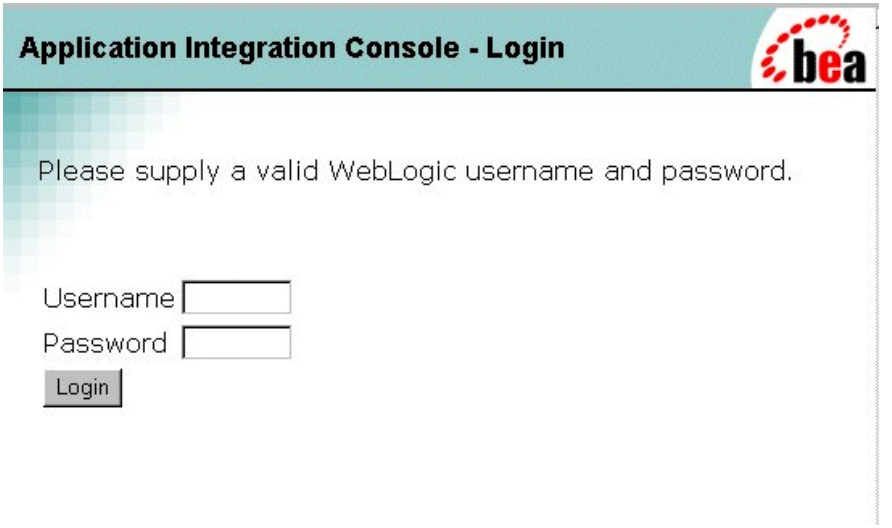
To access the e-mail adapter:

1. Open a new browser window.
2. Open the URL for your system's Application View Management Console.

   `http://<HOSTNAME>:7001/wlai`

   The Application Integration Console - Login page displays.

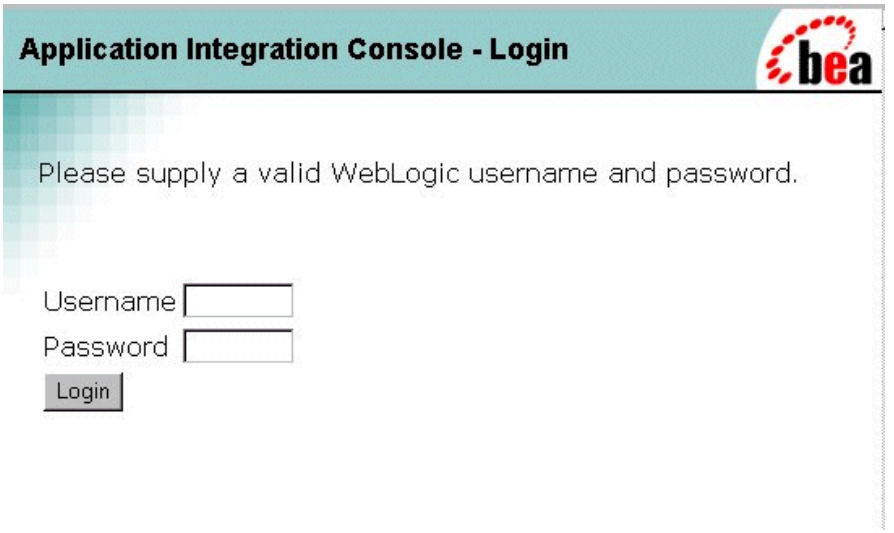
Figure F-1 Application Integration Console - Login



A Tour of the E-mail Adapter

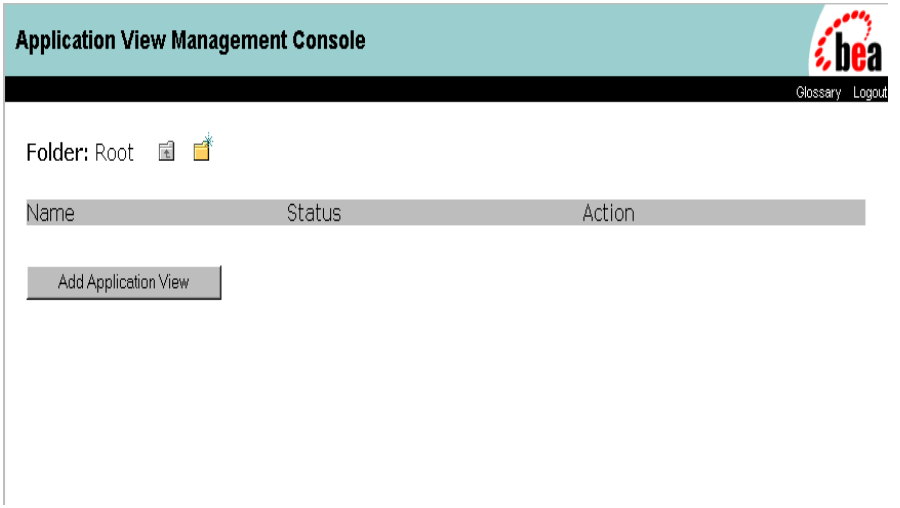
This section provides you with a short tour through the e-mail adapter. Before you begin, you need to have the e-mail adapter Login page up on your browser. For information about accessing the e-mail adapter, see “Accessing the E-mail Adapter” on page F-3.

Figure F-2 Application Integration Console - Login



1. To log on to the Application Integration Console - Login screen, enter your WebLogic Username and Password and click Login. The Application View Management Console displays.

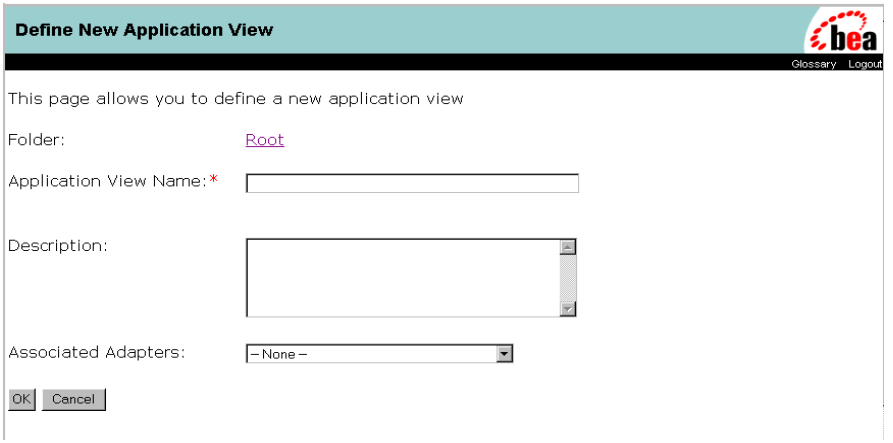
Figure F-3 Application View Management Console



2. Click Add Application View. The Define New Application View page displays. When you create the application view, you provide a description that associates the application view with the e-mail adapter.

   For detailed information about application views and about defining application views, see "Defining an Application View" in *Using Application Integration*.

Figure F-4 Define New Application View Page



3. To define an application view:

   a. In the Application View Name field, enter TestAppView.

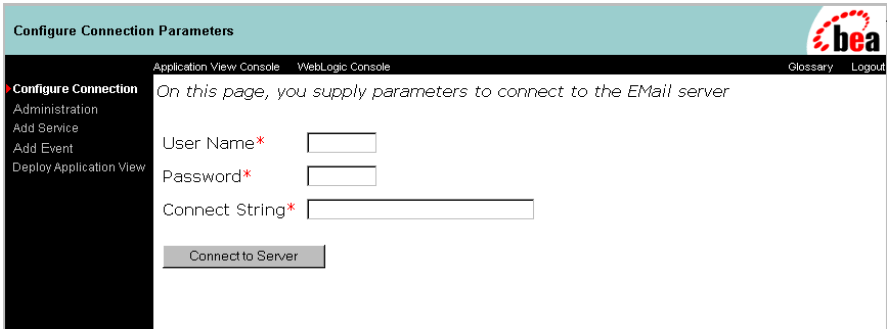
      The name should describe the set of functions performed by this application. Each application view name must be unique to its adapter. Valid characters are anything except ‘.’, ‘#’, ‘\’, ‘+’, ‘&’, ‘,’, ‘’’, ‘””, and a space.

   b. In the Description field, enter a brief description of the application view.

   c. From the Associated Adapters list, choose the e-mail adapter to use to create this application view.

   d. Click OK. The Configure Connection Parameters page displays.

Figure F-5 Configure Connection Parameters Page



4. At the Configure Connection Parameters page, you define the network-related information necessary for the application view to interact with the target EIS. You need to enter this information only once per application view:

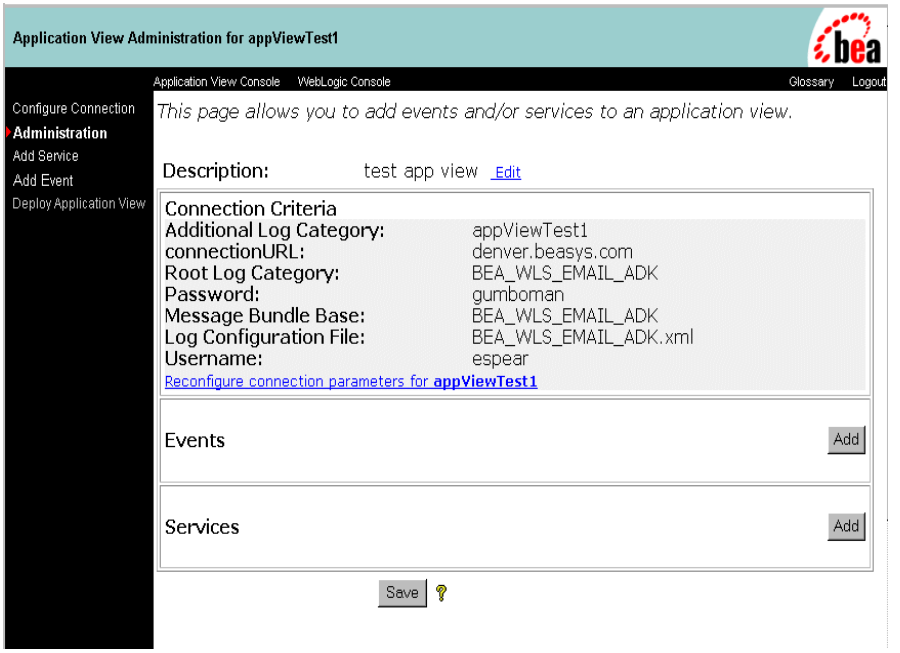
   a. Enter your e-mail User Name and e-mail Password.

   b. Enter the e-mail service URL in the Connect String field.

   c. Click Continue. The Application View Administration page displays.

   The Administration page summarizes the connection criteria, and once events and services are defined, you can view the schemas and summaries and also delete an event or service from this page.

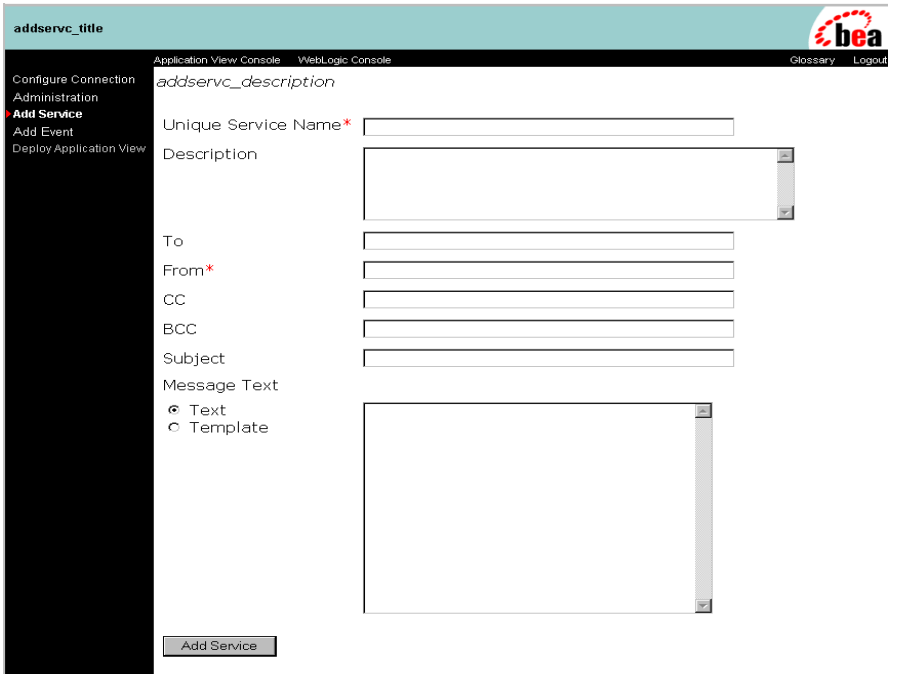
Figure F-6 Application View Administration Page for appViewTest



5. Now that you have created an application view, you are ready to add a service. To add a service:

   a. In the Administration page, click Add in the Services field. The Add Service page displays.

Figure F-7 Add Service Page



b. In the serviceName field, a meaningful name for the service.

c. In the serviceDesc field, enter a user description for the service.

d. In the To field, enter a list of target e-mail addresses.

e. In the From field, enter the source e-mail address.

f. In the CC filed, enter a list of e-mail addresses to receive a copy.

g. In the BCC field, enter a list of e-mail addresses to receive a blind copy, delimited by a semicolon.

h. In the Subject Field, enter the subject of the e-mail.

i. Select the Text radio button to send a plain text message. Select Template to define replaceable parameters.

   The body type can be either text or template. A template can contain tags for replaceable parameters.

j. In the open text field, enter the text of the message.

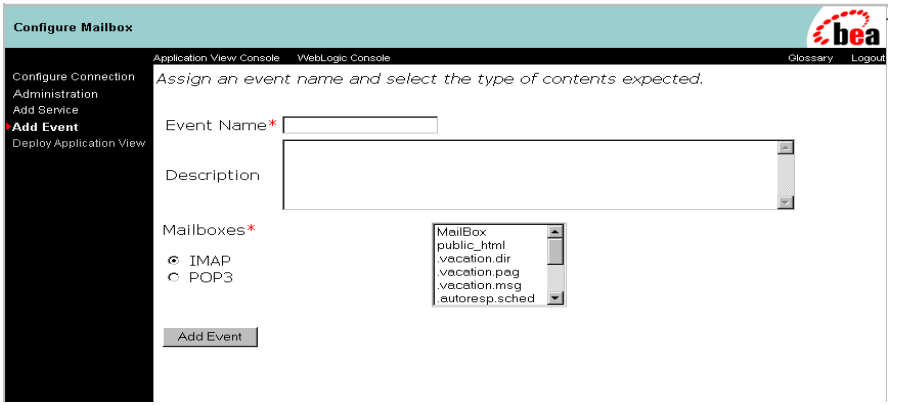
The e-mail body can contain replaceable parameters if the type is template, otherwise it will contain a text message.

k. Click Add Service. The Administration page displayed.

6. Now that you have created an application view, you are ready to add an event to it. To add an event:

a. In the Administration page, click Add in the Event field. The Add Event page for the event type appears; in this case, that is Configure Mailbox.

Figure F-8 Add Event Page for Configure Mailbox



b. In the eventName field, enter a meaningful name for the event.

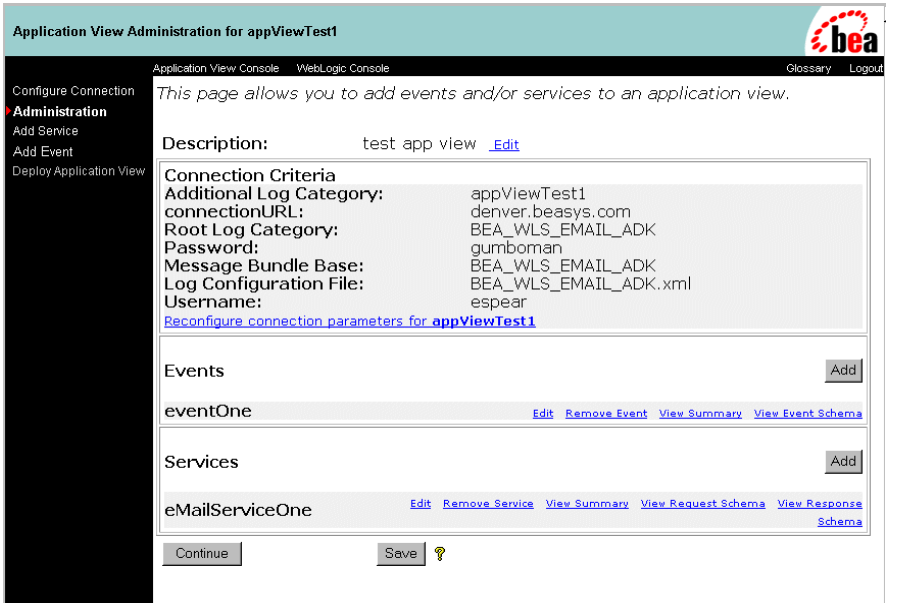
c. In the eventDesc field, enter a description of the event.

d. Select either the IMAP or POP3 radio button. When configuring an event you can use either the POP3, or IMAP access protocols depending on the type of event generator you wish to deploy. Use IMAP if you are trying to deploy the Push event generator. Use POP3 to deploy the Pull event generator. When IMAP is selected you can select a folder to listen to. POP3/Pull supports the use of a single folder, the INBOX folder.

e. Scroll to select a folder to query for mail.

f. Click Add Event. The Application View Administration page displays.

Figure F-9 Application View Administration Page for appViewTest

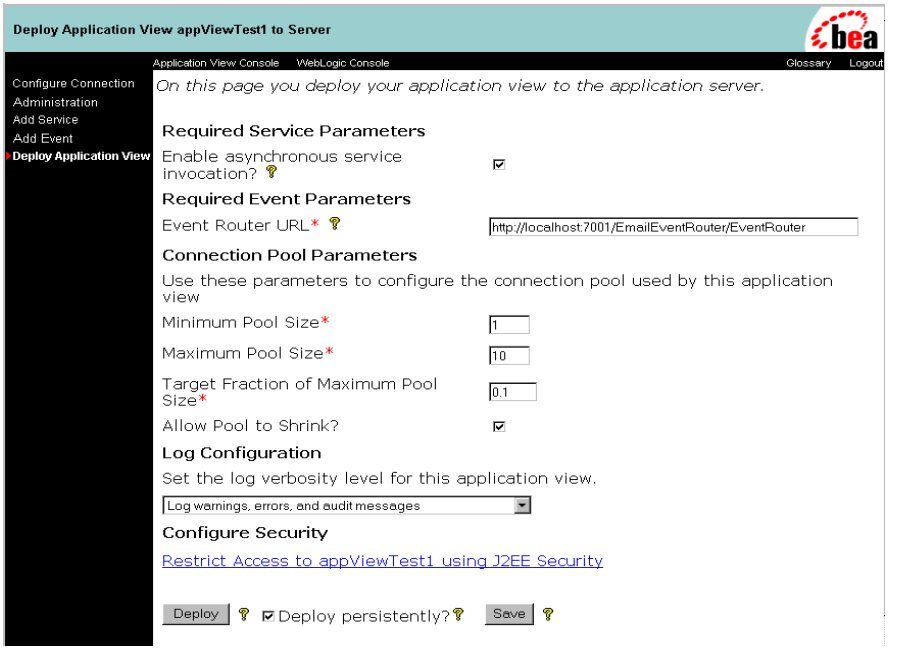


7. Prepare to deploy the application view. The Application View Administration page provides you with a single location for confirming the content of your application view before you save it or deploy it. In this page, you can view the following:

   - Confirm or edit the description of the application view.
   - Confirm or reconfigure Connection Criteria for the application view.
   - Delete services and events.
   - Save the application view so you can return to it later or deploy the application view to the server.

   After verifying the application view parameters, click Continue. The Deploy Application View to Server page displays.

Figure F-10 Deploy Application View to Servers Page



8. Deploy the Application View. In order to deploy the application view, you must provide several parameters such as enabling asynchronous service invocation, providing the event router URL, and changing the connection pool parameters, among other parameters.

   To deploy the application view:

   a. Make sure the Enable Asynchronous Service Invocation check box is unchecked.

   b. In the Event Router URL field, enter `http://<HOSTNAME>:<PORT>/EmailEventRouter/EventRouter`

   c. For the Connection Pool Parameters, accept the default values:

      Minimum Pool Size - 1

      Maximum Pool Size - 10

      Target Fraction of Maximum Pool Size - 0.1

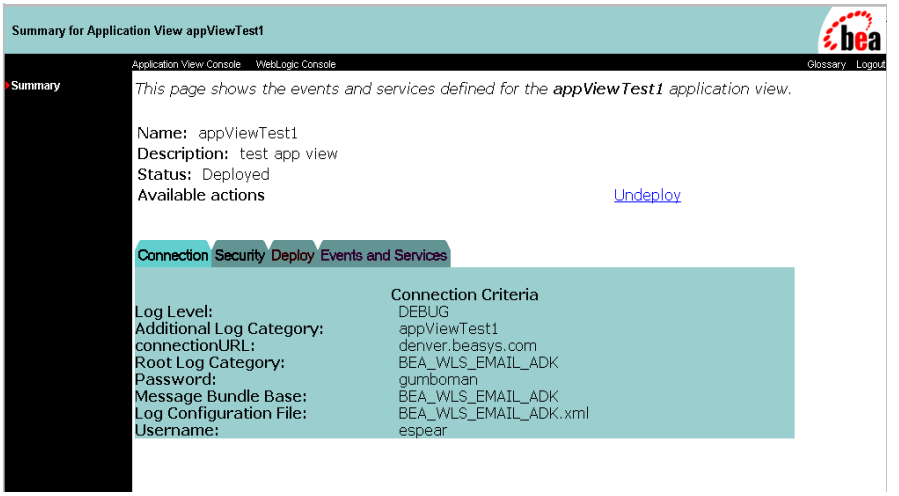
Allow Pool to Shrink - checked

d. In the Log Configuration field, set the log verbosity level to Log warnings, errors, and audit messages.

e. Make sure the Deploy persistently? box is checked.

f. Click Deploy.

Figure F-11 Application View Summary Page



9. Once the application view is deployed, the summary page displays all relevant information about the deployed application view. Click the appropriate tab on the Summary page to view schemas, event and service summaries, test services and events. You can also undeploy the application view by clicking Undeploy.

How the E-mail Adapter was Developed

This section describes each interface used to develop the e-mail adapter. The ADK provides many of the necessary implementations required by a J2EE-compliant adapter; however, since some interfaces cannot be fully implemented until the EIS and its environment are defined, the e-mail adapter was created to illustrate the detail-specific or concrete implementation of the abstract classes provided in the ADK.

The process of creating the e-mail adapter is comprised of the following steps:

- Development Reference Documentation
- Step 1: Development Considerations
- Step 2: Implementing the Server Provider Interface Package
- Step 3: Implementing the Common Client Interface Package
- Step 4: Implementing the Event Package
- Step 5: Deploying the Adapter

Development Reference Documentation

You can review the Javadoc and code for the methods defined in the steps that follow in this section to see how the implementations provided by the ADK were leveraged.

- You can find the Javadoc for this implementation in:

  `WLI_HOME/adapters/dbms/docs/api/index.html`

- You can find the code listing for this package in:

  `WLI_HOME/adapters/email/src/`

  in the `/cci`, `/event`, and `/spi` directories

Note: `WLI_HOME` is the drive or home directory where WebLogic Integration is installed.

Step 1: Development Considerations

The "Adapter Setup Worksheet" is available to help adapter developers identify and collect critical information about an adapter they are developing before they begin coding. For the e-mail adapter, the worksheet questions are answered as follows:

Note: Questions preceded by an asterisk (*) are required to use the GenerateAdapterTemplate utility.

1. **What is the name of the EIS for which you are developing an adapter?*

   e-mail API

2. **What is the version of the EIS?*

   n/a

3. **What is the type of EIS; for example, DBMS, ERP, etc.?*

   e-mail API

4. **Who is the vendor name of this adapter?*

   BEA

5. **What is the version number for this adapter?*

   None - Sample Only

6. **What is the adapter logical name?*

   BEA_WLS_EMAIL

7. *Does the adapter need to invoke functionality within the EIS?*

   Yes

   If so, then your adapter needs to support services.

   Yes

8. *What mechanism/API is provided by the EIS to allow an external program to invoke functionality provided by the EIS?*

   It is an API.

9. *What information is needed to create a session/connection to the EIS for this mechanism*?

Need to acquire a session, and from the session you can get a transport object. The transport will be used to send mail.

10. *What information is needed to determine which function(s) will be invoked in the EIS for a given service?*

    Javadoc for e-mail API.

11. *Does the EIS allow you to query it for input and output requirements for a given function?*

    No

    If so, what information is needed to determine the input requirements for the service?

    n/a

12. *For all the input requirements, which ones are static across all requests? Your adapter should encode static information into an InteractionSpec object.*

    To, From, CC, BCC, Subject, Body, Type

13. *For all the input requirements, which ones are dynamic per request? Your adapter should provide an XML schema that describes the input parameters required by this service per request.*

    To, From, CC, BCC, Subject, Body, Type

14. *What information is needed to determine the output requirements for the service?*

    Success or failure of a send call if in error. Need to extract the error and any e-mail addresses in the error.

15. *Does the EIS provide a mechanism to browse a catalog of functions your adapter can invoke? If so, your adapter should support browsing of services.*

    No

16. *Does the adapter need to receive notifications of changes that occur inside the EIS? If so, then your adapter needs to support events.*

    Yes. Need to provide examples of both types of events.

17. *What mechanism/API is provided by the EIS to allow an external program to receive notification of events in the EIS? The answer of this question will help determine if a pull or a push mechanism is developed.*

Can either poll a folder for new messages or add a listener (IMAP) to a folder for new messages.

18. *Does the EIS provide a way to determine which events your adapter can support?*

    No

19. *Does the EIS provide a way to query for metadata for a given event?*

    Some

20. *What locales (language/country) does your adapter need to support?*

    English

Step 2: Implementing the Server Provider Interface Package

To implement the e-mail adapter Server Provider Interface (SPI) and meet the J2EE-compliant SPI requirements, the classes in the ADK were extended to create the following concrete classes:

Table F-1 SPI Class Extensions

This concrete class...	Extends this ADK class...
`ManagedConnectionFactoryImpl`	`AbstractManagedConnectionFactory`
`ManagedConnectionImpl`	`AbstractManagedConnection`
`ConnectionMetaDataImpl`	`AbstractConnectionMetaData`

These classes provide connectivity to an EIS could be used to establish transaction demarcation, and allow management of a selected EIS.

ManagedConnectionFactoryImpl

The first step in implementing an SPI for the e-mail adapter was to implement the `ManagedConnectionFactory` interface. A `ManagedConnectionFactory` supports connection pooling by providing methods for matching and creating a `ManagedConnection` instance.

Basic Implementation

The ADK provides `com.bea.adapter.spi.AbstractManagedConnection Factory`, an implementation of the Java Connector Architecture interface `javax.resource.spi. ManagedConnectionFactory`. The e-mail adapter extends this class in `email.spi.ManagedConnectionFactoryImpl`. Listing F-1shows the derivation tree for `ManagedConnectionFactoryImpl`.

Listing F-1 `com.bea.adapter.email.spi.ManagedConnectionFactoryImpl`

```
javax.resource.spi.ManagedConnectionFactory
  |
  |-->com.bea.adapter.spi.AbstractManagedConnectionFactory
        |
        |-->email.spi.ManagedConnectionFactoryImpl
```

Developers' Comments

`ManagedConnectionFactory` creates physical connections to an underlying EIS for the application server. A physical connection is encapsulated by a `ManagedConnection` instance.

`ManagedConnectionFactoryImpl` is a factory for both managed connections and adapter specific `connectionFactory` instances. The e-mail adapter has a simple implementation for this factory object. Four methods were implemented from the base classes, two of which are abstract. The abstract methods are `createConnectionFactory()` and `createManagedConnection()`. Both of these implementations return adapter-specific object instances. The concrete methods overridden by the e-mail adapter include `checkState()` and `hashCode()`. The implementation of `checkState()` validates the connection parameters required for the adapter to acquire a physical connection. The implementation of `hashCode()` is also based on connection parameters specific to the e-mail adapter.

ManagedConnection

A `ManagedConnection` instance represents a physical connection to the underlying EIS in a managed environment. `ManagedConnection` objects are pooled by the application server. For more information, read about how the ADK implements the `AbstractManagedConnection` instance in "ManagedConnection" on page 6-32.

Basic Implementation

The ADK provides `com.bea.adapter.spi.AbstractManagedConnection`, an implementation of the J2EE interface `javax.resource.spi.ManagedConnection`. The e-mail adapter extends this class in `email.spi.ManagedConnectionImpl`. Listing F-2 shows the derivation tree for `ManagedConnectionImpl`.

Listing F-2 com.bea.adapter.email.spi.ManagedConnectionImpl

```
javax.resource.spi.ManagedConnection
  |
  |-->com.bea.adapter.spi.AbstractManagedConnection
        |
        |-->email.spi.ManagedConnectionImpl
```

Developers' Comments

The ManagedConnectionImpl represents the physical connection to the EIS. The e-mail adapter overrides what is probably the minimum required functionality of the base classes. There are two abstract methods and two concrete methods that the e-mail adapter implements: `getConnection()` and `createMetaData()`.

The method `getConnection()` is used to wrap the current ManagedConnection with a `ConnectionImpl` and return it to the caller. The value for `myCredentials` is compared with the `connectionRequestInfo` passed. If they match, the current `ManagedConnection` is wrapped with a `ConnectionImpl`. The `createMetaData()` method simply instantiates and returns a `ConnectionMetaDataImpl`.

The other two methods, `destroyPhysicalConnection()` and `compareCredentials()`, are overridden because they are either too simple or empty in the base class. These are both concrete methods in the base class. The method `destroyPhysicalConnection()` is adapter specific; this method is used to free resources associated with acquiring a physical connection.

The compareCredentials() method is used by matchManagedConnections() method in the ManagedConnectionFactory. The matchManagedConnections() method tries to associate a request for connection with an existing connection matching the same criteria. The criteria is defined in the compareCredentials() method. Usernames are used by the e-mail adapter as the criteria.

ConnectionMetaDataImpl

The ManagedConnectionMetaData interface provides information about the underlying EIS instance associated with a ManagedConnection instance. An application server uses this information to get run-time information about a connected EIS instance. For more information, read about how the ADK implements the AbstractConnectionMetaData instance in "ConnectionMetaData" on page 6-47.

Basic Implementation

The ADK provides com.bea.adapter.spi.AbstractConnectionMetaData, an implementation of the J2EE interface javax.resource.spi.ManagedConnection MetaData. The e-mail adapter extends this class in email.spi.ConnectionMetaDataImpl. Listing F-3 shows the derivation tree for ConnectionMetaDataImpl.

Listing F-3 com.bea.adapter.email.spi.ConnectionMetaDataImpl

```
javax.resource.spi.ManagedConnectionMetaData
  |
  |-->com.bea.adapter.spi.AbstractConnectionMetaData
        |
        |-->email.spi.ConnectionMetaDataImpl
```

Developers' Comments

The ConnectionMetaDataImpl class provides metadata for an EIS. The metadata implementation describes very specific data required by the application server. The e-mail adapter provides an implementation for the abstract methods declared in the base class. These methods provide product name, product version, user name, and max connections allowed.

Step 3: Implementing the Common Client Interface Package

To implement the e-mail adapter Common Client Interface (CCI) and meet the J2EE-compliant CCI requirements, classes in the ADK to create the following concrete classes were extended

Table F-2 CCI Class Extensions

This concrete class...	Extends this ADK class...
`ConnectionImpl`	`AbstractConnection`
`InteractionImpl`	`AbstractInteraction`
`InteractionSpecImpl`	`InteractionSpecImpl`

These classes provide connectivity to and access back-end systems. The client interface specifies the format of the request and response records for a given interaction with the EIS.

Note: Although implementing the Common Client Interface (CCI) is optional in the Java Connector Architecture 1.0 specification, it is likely to be required in the future. To be prepared, the e-mail adapter provides a complete implementation.

ConnectionImpl

A `Connection` represents an application-level handle that is used by a client to access the underlying physical connection. The actual physical connection associated with a `Connection` instance is associated with a `ManagedConnection` instance. For more information, read about how the ADK implements the `AbstractConnection` instance in “Connection” on page 6-37.

Basic Implementation

The ADK provides `com.bea.adapter.cci.AbstractConnection`, an implementation of the J2EE interface `javax.resource.cci.Connection`. The e-mail adapter extends this class in `email.cci.ConnectionImpl`. Listing F-4 shows the derivation tree for `ConnectionImpl`.

Listing F-4 com.bea.adapter.email.cci.ConnectionImpl

```
javax.resource.cci.Connection
  |
  |-->com.bea.adapter.cci.AbstractConnection
        |
        |-->email.cci.ConnectionImpl
```

Developers' Comments

The `ConnectionImpl` class is an application-level handle used to access EIS-level resources and functionality. For the e-mail adapter the implementation is simple. Derived-functionality was used for all methods except the `createInteraction()` method. This method is an abstract method provided in the connection interface, and unless you have specific needs, this is usually the only method that needs to be defined/overridden. For implementation, you need to return an application-level interaction object.

InteractionImpl

The `Interaction` enables a component to execute EIS functions. An `Interaction` instance is created from a connection and is required to maintain its association with the `Connection` instance. For more information, read about how the ADK implements the `AbstractInteraction` instance in "Interaction" on page 6-38.

Basic Implementation

The ADK provides `com.bea.adapter.cci.AbstractInteraction`, an implementation of the J2EE interface `javax.resource.cci.Interaction`. The e-mail adapter extends this class in `email.cci.InteractionImpl`. Listing F-5 shows the derivation tree for `InteractionImpl`.

Listing F-5 com.bea.adapter.email.cci.InteractionImpl

```
javax.resource.cci.Interaction
  |
  |-->com.bea.adapter.cci.AbstractInteraction
        |
        |-->email.cci.InteractionImpl
```

Developers' Comments

An `Interaction` enables a component to execute EIS functions. The `InteractionImpl` class wraps EIS-specific functionality. Using the `ConnectionImpl`, you can use the physical EIS connection to provide application-level interfaces to the EIS. This is probably where you will spend most of your time.

The two `execute()` methods process according to the method being called and either return an output document in the parameter list or as a result of the call. The last method is `close()`. The `close()` method is used to free resources created in the execution of an EIS call. The `execute()` method creates an e-mail message based on data from both the `InteractionSpecImpl` and the input `DocumentRecord`. The data extracted is used to populate a `MimeMessage` object and is transported according to the internet address data contained. If an error is encountered it is returned in the output `DocumentRecord`.

InteractionSpecImpl

An `InteractionSpecImpl` holds properties for driving an interaction with an EIS instance. An `InteractionSpec` is used by an interaction to execute the specified function on an underlying EIS.

The CCI specification defines a set of standard properties for an `InteractionSpec`, but an `InteractionSpec` implementation is not required to support a standard property if that property does not apply to its underlying EIS.

The `InteractionSpec` implementation class must provide getter and setter methods for each of its supported properties. The getter and setter methods convention should be based on the JavaBeans design pattern. For more information, read about how the ADK implements the `InteractionSpecImpl` instance in "InteractionSpec" on page 6-48.

Basic Implementation

The ADK provides `com.bea.adapter.cci.InteractionSpecImpl`, an implementation of the J2EE interface `javax.resource.cci.InteractionSpec`. The e-mail adapter extends this class in `email.cci.InteractionSpecImpl`. Listing F-6 shows the derivation tree for `InteractionSpecImpl`.

Listing F-6 `com.bea.adapter.email.cci.InteractionSpecImpl`

```
javax.resource.cci.InteractionSpec
  |
  |-->com.bea.adapter.cci.InteractionSpecImpl
        |
        |-->email.cci.InteractionSpecImpl
```

Developers' Comments

The `InteractionSpecImpl` class provides properties used in the request to a service. In the case of the e-mail adapter the properties are specific to an e-mail message; for example: "To"; "From"; "Subject" etc. The `InteractionSpecImpl` is very much adapter specific. The data required to fulfill a request varies according to the request, and there are no abstract methods that need to be implemented.

Step 4: Implementing the Event Package

Some utility classes were created to help with implementation. These classes were extended from the ADK classes to the create the following concrete classes:

Table F-3 Event Class Extensions

This concrete class...	Extends the ADK class...
`EmailEventMetaData`	`EventMetaData`
`EmailPushEvent`	`PushEvent`
`EmailPushHandler`	`java.lang.Object`

Table F-3 Event Class Extensions

This concrete class...	Extends the ADK class...
`PullEventGenerator`	`AbstractPullEventGenerator`
`PushEventGenerator`	`AbstractPushEventGenerator`

EmailEventMetaData

The ADK provides `com.bea.adapter.event.EventMetaData`, an implementation of the `java.lang.Object`. The e-mail adapter extends this class by implementing `email.event.EmailEventMetaData`. Listing F-7 shows the derivation tree for `EmailEventMetaData`.

Listing F-7 EmailEventMetaData

```
com.bea.adapter.event.EventMetaData
  |
  |-->email.event.EmailEventMetaData
```

Developers' Comments

The `EmailMetaData` is used to pass information between the event generator and the handler.

EmailPushEvent

The ADK provides `com.bea.adapter.event.PushEvent`, an implementation of the `java.util.EventObject`. The e-mail adapter extends this class by implementing `email.event.EmailPushEvent`. Listing F-8 shows the derivation tree for `EmailPushEvent`.

Listing F-8 `EmailPushEvent`

```
java.util.EventObject
  |
```

```
|-->com.bea.adapter.event.PushEvent
      |
      |-->email.event.EmailPushEvent
```

Developers' Comments

The `EmailPushEvent` is used to send notification from the handler to the event generator.

EmailPushHandler

The `EmailPushHandler` extends implements `IPushHandler` and is the point of contact for the E-mail EIS. Listing F-9 shows the derivation tree for `EmailPushHandler`.

Listing F-9 `EmailPushHander`

```
com.bea.adapter.event.IPushHandler
  |
  |-->email.event.EmailPushHandler
```

Developers' Comments

The `EmailPushHandler` implements the ADK interface `IPushHandler`. The handler interface is provided to abstract EIS event generation from event routing functionality. This is not enforced since the interfaces provided are not required to implement the Push functionality.

The EmailPushHandler implements three interfaces:

- MessageCountListener
- Runnable
- IPushHandler

The only method implemented outside of the scope of the interface methods is `verifyConnection()`. The `verifyConnection()` method validates the connection to the EIS. It does nothing more than check to see if it is connected to the server.

One method of interest is the `run()` method. A thread was implemented in order to poll the folder for message count. Sun MicroSystems' implementation of the IMAP access protocol does not send notification without this polling, so this it does not provide good example of push generation. However, the idea is to show how to separate the generation functionality from the routing functionality. The rest of the implementation is fairly straightforward and follows the interfaces implemented.

PullEventGenerator

The ADK provides `com.bea.adapter.event.AbstractPullEventGenerator`, an implementation of the `java.lang.Object`. The e-mail adapter extends this class in `email.event.PullEventGenerator`. Listing F-10 shows the derivation tree for `PullEventGenerator`.

Listing F-10 `PullEventGenerator`

```
com.bea.adapter.event.AbstractEventGenerator
  |
  |-->com.bea.adapter.email.event.AbstractPullEventGenerator
    |
    |-->email.event.PullEventGenerator
```

Developers' Comments

The E-mail Pull event generator is a POP3-only event generator. The reason for this is that POP3 does not allow notifications to be received when a listener is added to the Inbox folder. In order to deploy the `PullEventGenerator` you need to modify some of the properties contained in the `EmailEventRouter web.xml` file. Once you have the correct properties, the `EmailEventRouter.war` file can be created using the ANT build process.

The E-mail `PullEventGenerator` supports a single event type, which is the notification of an e-mail being received in the Inbox folder using the POP3 access protocol. As such, the e-mail event generator probably doesn't need to implement `setupNewTypes()` and `removeDeadTypes()`; however, the event engine will give notification when event types are removed.

Other than the implementation of `setupNewTypes()` and `removeDeadTypes()`, the only other abstract method is `postEvents()`. The `postEvents()` method is the fulcrum to the event generation process. This is where you would add EIS-specific implementations. The e-mail event generator uses the `postEvents()` method to read from the Inbox and route new messages to any listeners.

One other method of interest is the `doCleanUpOnQuit()` method. This method provides a place to free any resources allocated in the event generation process. The e-mail event generator uses `doCleanUpOnQuit()` to free the mail store and release the mail session.

PushEventGenerator

The ADK provides `com.bea.adapter.event.AbstractPullEventGenerator`, an implementation of the `java.lang.Object`. The e-mail adapter extends this class in `email.event.PushEventGenerator`. Listing F-11 shows the derivation tree for `PushEventGenerator`.

Listing F-11 PushEventGenerator

```
com.bea.adapter.event.AbstractEventGenerator
  |
  |-->com.bea.adapter.email.event.AbstractPushEventGenerator
    |
    |-->email.event.PushEventGenerator
```

Developers' Comments

The E-mail Push event generator is an IMAP only event generator. It is a sample of the push event paradigm. Where the Pull Event Generator uses a thread to continuously poll for an event, the push methodology listens for an event to have been posted. If you look closely at the push event implementation, you will see that it uses a thread to process events in the `EmailPushEventHandler`. A thread is not necessary to implement the push event. A separate thread was used to implement the push generator.

Additionally, three other classes were used in the push implementation. These are:

- `EmailPushHandler`
- `EmailPushEvent`

- `EmailMetaData`

The `EmailPushHandler` serves to abstract the push event generation functionality from the event routing. The `EmailPushEvent` is used to send notification from the handler to the event generator. The `EmailMetaData` is used to pass information between the event generator and the handler. If you look closely at the `PushEventGenerator` code, you will find that it knows almost nothing of the EIS. It uses the `setNewTypes()` and `removeDeadTypes()` to create the array it needs to process events, and it uses `postEvents()` to process notifications.

Step 5: Deploying the Adapter

After implementing the SPI, CCI and event interfaces, the adapter was deployed. To deploy the adapter:

- Update the `ra.xml` file
- Create the .rar file
- Create and deploy the `.ear` file

Before You Begin

Before deploying the adapter into WebLogic Integration, do the following:

- Determine the location of the adapter on your computer; that is, `WLI_HOME/adapters/email` where `WLI_HOME` is the location of your WebLogic Integration installation. This location is referred to as `ADAPTER_ROOT` hereafter.
- Make sure the e-mail adapter's `.jar` and `.ear` files are built, as described in "Step 5c: Build the .jar and .ear Files."

Step 5a: Update the ra.xml File

The e-mail adapter provides the `ra.xml` file in the adapter's `.rar` file (`META-INF/ra.xml`). Since the e-mail adapter extends the AbstactManagedConnectionFactory class, the following properties were provided in the `ra.xml` file:

- `LogLevel`

- LanguageCode
- CountryCode
- MessageBundleBase
- LogConfigFile
- RootLogContext
- AdditionalLogContext

The e-mail adapter requires additional declarations, listed in Table F-4:

Table F-4 RA.XML Properties

Property	Example
UserName	The username for e-mail adapter login.
Password	The password for username.
ConnectionURL	URL to the e-mail server.

See "Editing Web Application Deployment Descriptors" on page 9-8 for instructions on updating these declarations. You can view the complete `ra.xml` file for the e-mail adapter in:

`WLI_HOME/adapters/email/src/rar/META-INF/`

Step 5b: Create the .rar File

Class files, logging configuration, and message bundle(s) should be bundled into a `.jar` file, which should then be bundled along with `META-INF/ra.xml` into the `.rar` file. The Ant `build.xml` file demonstrates how to properly construct this `.rar` file.

Step 5c: Build the .jar and .ear Files

To build the `.jar` and `.ear` files, use this procedure:

1. Edit `antEnv.cmd` (Windows) or `antEnv.sh` (Unix) in `WLI_HOME/adapters/utils`. You must set the following variables to valid paths:
   - `BEA_HOME` - The top-level directory for your BEA products.

- `WLI_HOME` - The location of your Application Integration directory.
- `JAVA_HOME` - The location of your Java Development Kit.
- `WL_HOME` - The location of your WebLogic Server directory.
- `ANT_HOME` - The location of your Ant home, typically `WLI_HOME/adapters/utils`.

2. Execute `antEnv` from the command-line to set the necessary environment variables for your shell.
3. Change directories to `WLI_HOME/adapters/email/project`.
4. Execute `ant release` from the `WLI_HOME/adapters/email/project` directory to build the adapter.

Step 5d: Create and Deploy the .ear File

To create and deploy the `.ear` file, thus deploying the e-mail adapter, use this procedure:

1. First, declare the adapter's `.ear` file in your domain's `config.xml` file, as shown in Listing F-12:

Listing F-12 Declaring the E-mail Adapter's `.ear` File

```
<!-- This deploys the EAR file -->

<Application Deployed="true" Name="BEA_WLS_EMAIL_ADK"
   Path="WLI_HOME/adapters/email/lib/BEA_WLS_EMAIL_ADK.ear">

     <ConnectorComponent Name="BEA_WLS_EMAIL_ADK"
        Targets="myserver" URI="BEA_WLS_EMAIL_ADK.rar"/>

     <WebAppComponent Name="EmailEventRouter" Targets="myserver"
        URI="BEA_WLS_EMAIL_ADK_EventRouter.war"/>

     <WebAppComponent Name="BEA_WLS_EMAIL_ADK_Web"
        Targets="myserver" URI="BEA_WLS_EMAIL_ADK_Web.war"/>

</Application>
```

Note: Replace `WLI_HOME` with the correct path to the WebLogic Integration root directory for your environment.

2. Add the `.jar` file(s) for the adapter to the WebLogic server classpath. At this time, WebLogic does not support shared `.jar` files in an `.ear` file; in other words, the Web applications and the adapters do not share a common classloader parent. Consequently, you need to place the shared `.jar` files in your adapter on the system classpath.

3. Restart the WebLogic Server.

4. Once the server restarts, add the adapter group to the default WebLogic security realm by using the WebLogic Server Console Web application. To do this, navigate to `http://<host>:<port>/console`, where *<host>* is the name of your server and *<port>* is the listening port; for example:

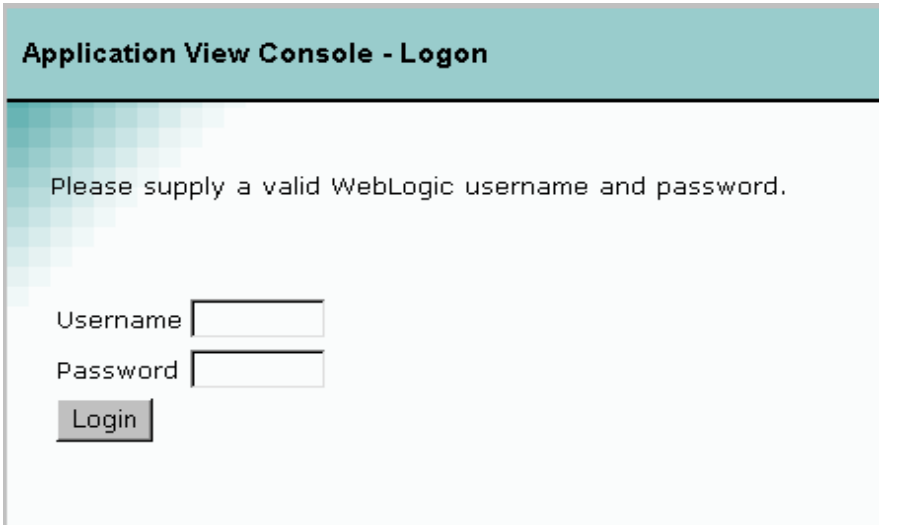
   ```
   http://localhost:7001/console
   ```

5. After you have added the adapter group, add a user to the adapter group using the WebLogic console Web application and save your changes.

6. To configure and deploy application views, navigate to `http://<host>:<port>/wlai`, where *<host>* is the name of your server and *<port>* is the listening port; for example:

   ```
   http://localhost:7001/wlai
   ```

   The Application View Console - Logon is displayed.



7. Log on to WebLogic Integration by entering your username and password in appropriate fields.
8. Configure and deploy the application views by using the procedures described in "Defining Application Views" in *Using Application Integration.*

Creating the E-mail Adapter Design-Time GUI

The design-time GUI is the user interface that allows the user to create application views, add services and events and deploy the adapter if it is hosted in the WebLogic Integration. This section discusses some specific design-time issues that were considered during the development of the e-mail adapter.

The process of creating the e-mail adapter design-time GUI is comprised of the following steps:

- Step 1: Development Considerations

- Step 2: Determine E-mail Adapter Screen Flow
- Step 3: Create the Message Bundle
- Step 4: Implementing the Design-time GUI
- Step 5: Writing Java Server Pages

Step 1: Development Considerations

Some of the important development considerations regarding the design-time GUI for the e-mail adapter included:

- Determine the e-mail server that will be supported
- Determine the e-mail schema generation
- Determine if the adapter should support testing of service and events.

Step 2: Determine E-mail Adapter Screen Flow

You should consider the order in which the Java server pages will appear when the user displays the application view.

Java Server Pages (JSP)

The e-mail adapter uses the ADK's Java server pages for a design-time GUI; however, additional JSPs have been added to provide adapter-specific functionality. A description of the additional JSPs is in table Table F-5:

Table F-5 Additional ADK JSPs

Filename	Description
`addevent.jsp`	The Add Event page allows a user to add a new event to the application view.
`addservc.jsp`	The Add Service page allows the user to add a new service to the application view.

Table F-5 Additional ADK JSPs (Continued)

Filename	Description
`confconn.jsp`	The Confirm Connection page provides a form for a user to specify connection parameters for the EIS.
`edtevent.jsp`	The Edit Event page is an optional page that allows users to edit events.
`edtservc.jsp`	The Edit Service page is an optional page that allows users to edit services.
`event.html`	This is a static `.html` file that contains the forms necessary for editing an event. This file is statically included into `edtevent.jsp`, which saves duplication of JSP/HTML coding and properties.
`service.html`	This is a static `.html` file that contains the forms necessary for editing a service. This file is statically included into `edtservc.jsp`, which saves duplication of JSP/HTML coding and properties.

Step 3: Create the Message Bundle

To support the Internationalization of all text labels, messages, exceptions, and so on, the e-mail adapter uses a message bundle based on a text property file. The property file uses copied name value pairs from the `BEA_WLS_SAMPLE_ADK` property file, and new entries were added for specific to the e-mail adapter.

The message bundle for the e-mail adapter is contained in WLI_HOME`/adapters/email/src` directory, which was installed with the ADK. Please refer to `BEA_WLS_EMAIL_ADK.properties` in the directory above.

For additional instructions on creating a message bundle, please refer to the JavaSoft tutorial on internationalization at:

`http://java.sun.com/docs/books/tutorial/i18n/index.html`

Step 4: Implementing the Design-time GUI

To implement the design-time GUI, you need to create a `DesignTimeRequestHandler` class. This class accepts user input from a form and performs a design-time action.

For more information, see “Step 4: Implementing the Design-Time GUI” on page 8-30.

E-mail Implementation

The E-mail `DesignTimeRequestHandler` class extends `AbstractDesignTimeRequestHandler` and provides these methods:

Method	Description
`addevent(javax.servlet.http.HttpServlet Request request)`	Adds an event to the application view.
`addservc(javax.servlet.http.HttpServlet Request request)`	Adds a service to the application view.
`getAdapterLogicalName()`	Returns my adapter's logical name and helps parent when deploying application views, etc.
getManagedConnectionFactoryClass()	Returns my adapter's SPI ManagedConnectionFactory implementation class, used by parent to get a CCI connection to my EIS.

Step 5: Writing Java Server Pages

Step 5a: Developers' Comments

1. Your JSPs will be displayed within your `display.jsp`; thus `display.jsp` is the first .jsp file that you need to copy. Use the display at the `display.jsp` in the example adapters (DBMS and e-mail) of the ADK as a starting point.

2. The ADK provides a library of custom `.jsp` tags, which are used extensively throughout the Java server pages of the ADK and e-mail adapter. They provide the ability to add validation, to save field values when the user clicks away, and a number of other features.

Saving an Object's State When Using the ADK

There are a number of ways to save an object's state when building your adapter using the ADK. The `AbstractDesignTimeRequestHandler` maintains an `ApplicationViewDescriptor` of the application view being edited. This is often the best place to save state. Calls to the handler are fast and efficient. You can also ask the `AbstractDesignTimeRequestHandler` for a manager bean, using its convenience methods: `getApplicationViewManager()`, `getSchemaManager()`, and `getNamespaceManager()`, to retrieve information from the repository about an application view. This is more time-consuming but may be necessary on occasion. Since it is a JSP, you can also use the session object, although everything put in the session must explicitly implement the `java.io.serializable` interface.

Step 5b: Write the WEB-INF/web.xml Web Application Deployment Descriptor

Write the `WEB-INF/web.xml` Web application deployment descriptor. In most cases, you should use the adapter's `web.xml` file as a starting point and modify the necessary components to fit your needs. You can see the code for the `web.xml` file for the e-mail adapter by going to:

```
WLI_HOME/adapters/email/src/war/WEB-INF/web.xml
```

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