# BEA WebLogic® Java Adapter for Mainframe

## Programming Guide

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BEA WebLogic Java Adapter for Mainframe Programming Guide

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# 1 Introduction to Generating Applications

Integrating applications that run on the mainframe with applications that run within BEA WebLogic Server requires solving three significant problems:

- Connectivity -- How can applications invoke each other when they are running on different hosts? WebLogic JAM provides software components that establish connections between your WebLogic and mainframe environments. These components are described in detail in the *BEA WebLogic Java Adapter for Mainframe Configuration and Administration Guide*.
- Data Transformation -- Java applications running in WebLogic Server use Java numeric representation and character encoding schemes. Applications running in the mainframe environment use different numeric and character encoding schemes. In order for applications running in these disparate environments to communicate, the data that is communicated must be transformed between these different representations.
- Programmatic Access -- Java applications running in WebLogic Server require an Application Programming Interface (API) to access applications running in the mainframe environment. There also must be an API that allows Java applications to be accessed on behalf of mainframe applications.

WebLogic JAM provides Java classes that transform data to and from the native binary data types of the mainframe. WebLogic JAM provides a software development tool that allows you to generate Java applications. These generated Java applications include data translation code (DataViews) that translates data between Java and

mainframe data formats. These generated Java applications also contain the methods needed to invoke mainframe applications, or to be invoked by mainframe applications, in conjunction with WebLogic JAM.

This section discusses the following topics:

- Understanding How WebLogic JAM Uses DataViews
- Understanding How WebLogic JAM Provides Programmatic Access to Services
- Application Model Overview
- Roadmap for WebLogic JAM Programming

# Understanding How WebLogic JAM Uses DataViews

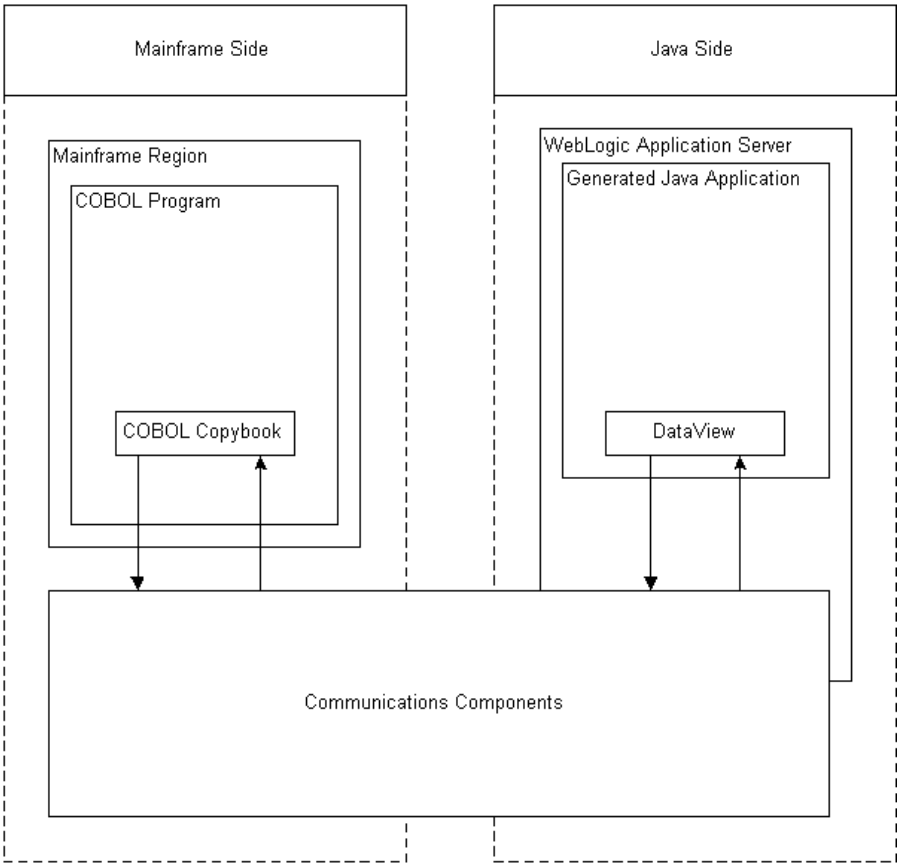
In order to request services from the mainframe, WebLogic JAM must know the data formats required by these services. These data formats are usually available as COBOL copybooks.

Mainframe data records are represented in WebLogic JAM by Java DataViews. These DataViews are generated by the eGen Application Generator (hereafter referred to as the eGen utility) and provide all of the data translation necessary to communicate with mainframe applications. The eGen utility parses a COBOL copybook and generates Java DataView code that captures the data record described in the copybook. (For more information on the eGen utility, see Understanding eGen.)

Figure 1-1 illustrates how WebLogic JAM uses DataViews. This illustration shows the COBOL copybook on the mainframe side, which contains the data formats for the mainframe services. When a request is made for a Java service, the data is passed through the communications components, which are described in more detail in the *BEA WebLogic Java Adapter for Mainframe Introduction*. As part of this process, the WebLogic JAM Gateway initializes a DataView, performing the proper translation of the data. The data is utilized by the Java applications in the form of the DataView.

When the response is sent back, the WebLogic JAM Gateway translates the data back into the copybook format and sends it back to the mainframe.

**Figure 1-1 How WebLogic JAM Uses DataViews**




# Understanding How WebLogic JAM Provides Programmatic Access to Services

Using WebLogic JAM, BEA WebLogic Server applications can make requests for mainframe services and receive responses to those requests. Applications in which these types of requests are made are referred to as WebLogic Server to Mainframe

Applications. Also, mainframe applications can make requests from Java applications (EJBs) running in WebLogic Server and receive responses to those requests. Applications in which these types of requests are made are referred to as Mainframe to WebLogic Server Applications.

WebLogic JAM provides an API that allows Java applications running under WebLogic Server to invoke services running on the mainframe. All such requests for mainframe services are made by calling the `callService()` method of the `EgenClient` class. The Java applications generated by the eGen utility contain a method that calls the `callService()` method of the `EgenClient` class. These generated applications can access the `callService()` method by either being extensions of the `EgenClient` class or having an `EgenClient` class as a member. Instead of using the eGen utility to generate application code, you can also write your own applications that make requests of mainframe services by calling the `callService()` method (see Performing Your Own Data Translation.)

WebLogic JAM provides an API that allows clients running on the mainframe to invoke services provided by stateless session EJBs running under WebLogic Server and receive responses to those requests. EJBs that can be invoked by WebLogic JAM on behalf of mainframe clients extend the `EgenServerBean` class. The WebLogic JAM Gateway calls the `dispatch()` method of the `EgenServerBean` class when a request is made from a mainframe client. The server EJBs generated by the eGen utility extend the `EgenServerBean` class. They also provide an implementation of the `dispatch()` method that includes the necessary data transformation, as well as making a call to the method that actually performs the business logic. You can write your own EJBs to service mainframe requests by extending the `EgenServerBean` class and implementing the `dispatch()` method.

WebLogic JAM also provides the ability for mainframe clients to queue messages on JMS queues and topics. No coding is necessary for this; it is simply a matter of configuration (see WebLogic JAM to JMS).

# Application Model Overview

This guide provides four Java application models you can use as guides for creating your own applications. The following sections give you a brief overview of these models:

- Mainframe to WebLogic Server Application Models
- WebLogic Server to Mainframe Application Models

## Mainframe to WebLogic Server Application Models

In a Mainframe to WebLogic Server application, a request originates from a mainframe and is serviced by an EJB invoked by a WebLogic JAM Gateway.

The following Mainframe to WebLogic Server application model is discussed in this guide:

- Generating a Server Enterprise Java Bean-Based Application

## WebLogic Server to Mainframe Application Models

In a WebLogic Server to Mainframe application, a request originates on a WebLogic client or server, and is serviced by a mainframe program invoked by the WebLogic JAM Gateway in cooperation with the CRM.

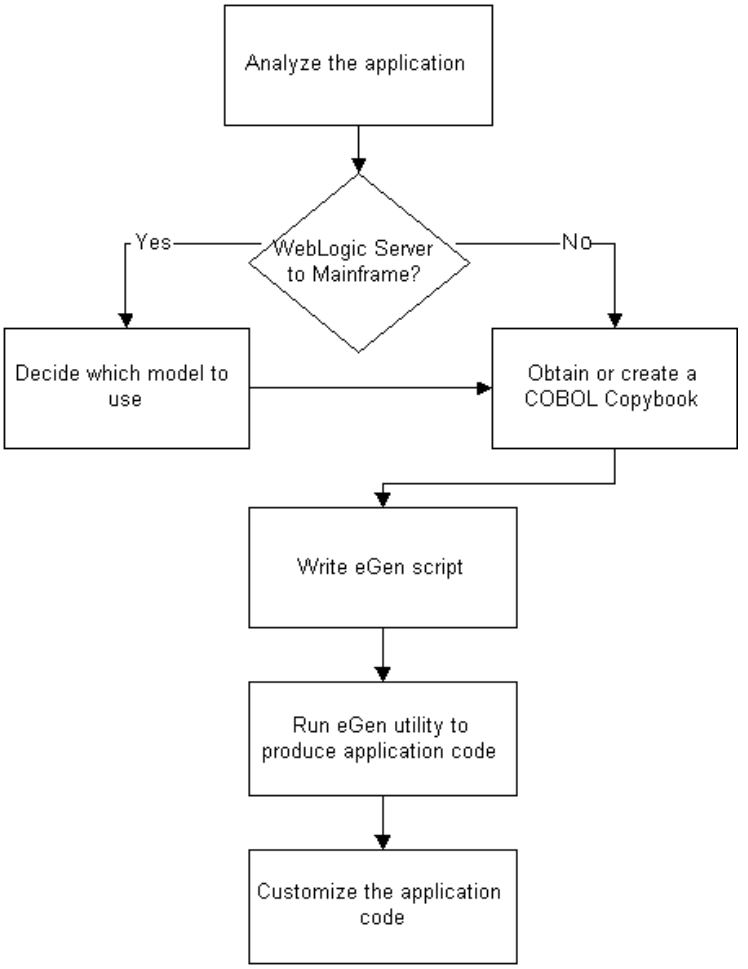
The following WebLogic Server to Mainframe application models are discussed in this guide:

- Generating a Stand-Alone Client Application
- Generating a Client Enterprise Java Bean-Based Application
- Generating a Servlet Application

# Roadmap for WebLogic JAM Programming

The steps outlined in Figure 1-2 provide you with a high-level guideline to all of the tasks and processes that you must perform to generate applications using WebLogic JAM. You can think of these steps as a roadmap to guide you through the process and to point you to the resources available to help you.

**Figure 1-2 Roadmap for JAM Programming**




1. Analyze the application and determine if it is Mainframe to WebLogic Server or WebLogic Server to Mainframe. If the application is WebLogic Server to Mainframe, decide which model you are going to use (see WebLogic Server to Mainframe Application Models for more information).
2. Obtain or create a COBOL copybook (see Obtaining a COBOL Copybook for more information).

3. Write the eGen script. The eGen script has two parts. The first part defines the DataView. The second part defines the application code (see Writing an eGen Script for more information).
4. Use the COBOL copybook and the eGen script as input for the eGen utility. This produces the DataView and the application code (see Processing eGen Scripts with the eGen Utility for more information).
5. Customize the application code. This can be done by extending the code to perform the tasks required for your application (see Basic Programming Techniques for more information).

# 2 Generating a Java Application with the eGen Application Generator

This section discusses the following topics:



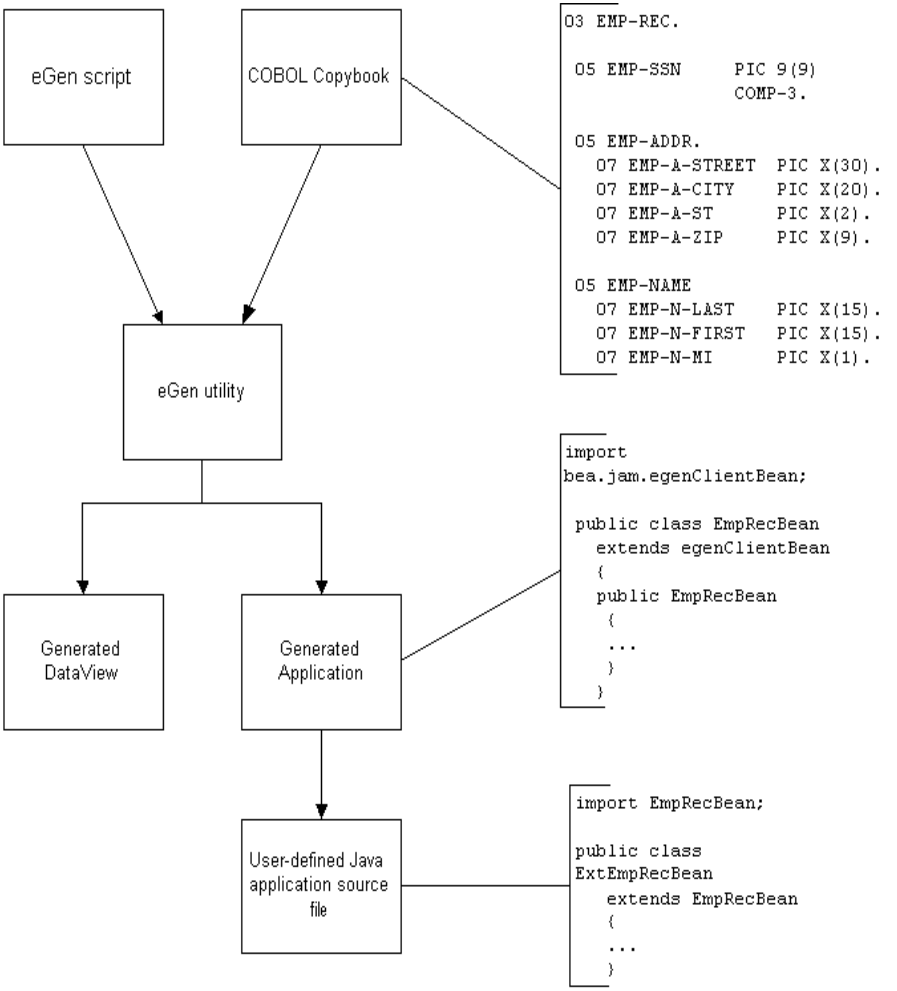
## Understanding eGen

The eGen Application Generator, also known as the eGen utility, is installed with WebLogic JAM. It generates Java applications from a COBOL copybook and a user-defined script file.

The eGen utility generates a Java application by processing a script you create, called an eGen script. A Java DataView is defined by the first section of the script. This DataView is used by the application code to provide data access and conversions, as well as to perform other miscellaneous functions. The actual application code is defined by the second section of the script.

Figure 2-1 illustrates how the eGen utility works. This illustration shows the eGen script and COBOL copybook file being used as input to the eGen utility, and the output that is generated is the DataView and the Java application. The generated Java application may be used in a variety of ways. In some cases, it may be used as is. However, in most cases, you will need to extend the generated application in some way, or it may become a member of the actual user-defined application.

**Figure 2-1 Understanding the eGen utility**



# Working With COBOL Copybooks

A COBOL CICS or IMS mainframe application typically uses a copybook source file to define its data layout. This file is specified in a COPY directive within the `LINKAGE SECTION` of the source program for a CICS application, or in the `WORKING-STORAGE SECTION` of an IMS program. If the CICS or IMS application does not use a copybook file, you will have to create one from the data definition contained in the program source.

Each copybook's contents are parsed by the eGen utility, producing DataView sub-classes that provide facilities to:

- Convert COBOL data types to and from Java data types. This includes conversions for mainframe data formats and code pages.
- Convert COBOL data structures to and from Java data structures.
- Convert the provided data structures into other arbitrary formats.

## Obtaining a COBOL Copybook

The eGen utility must have a COBOL Copybook to use as input. There are two methods you can use to obtain this Copybook:

- Creating a New COBOL Copybook
- Using an Existing COBOL Copybook

### Creating a New COBOL Copybook

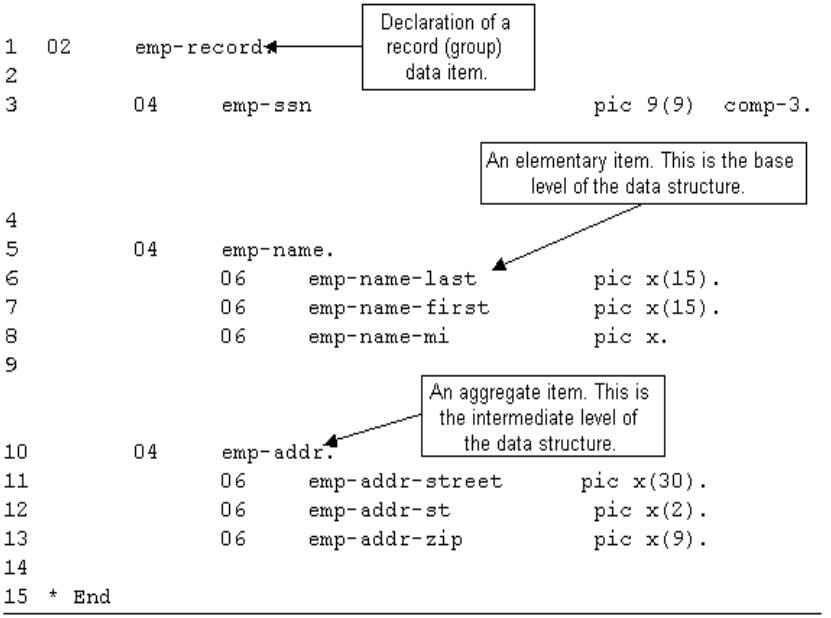
If you are producing a new application on the mainframe or modifying one, then one or more new copybooks may be required. You should keep in mind the COBOL features and data types supported by WebLogic JAM as you create these copybooks (see eGen Application Generator Reference for more information).

## Using an Existing COBOL Copybook

When a mainframe application has an existing DPL or APPC interface, the data for that interface is usually described in a COBOL copybook. Before using an existing COBOL Copybook, verify that the interface does not use any COBOL features or data types that WebLogic JAM does not support (see Limitations of the eGen Utility).

An example COBOL copybook source file is shown in Listing 2-1.

**Listing 2-1 Sample `emprec.cpy` COBOL Copybook**




```
1   02      emp-record.
2
3           04      emp-ssn                         pic 9(9)   comp-3.
4
5           04      emp-name.
6                   06      emp-name-last           pic x(15).
7                   06      emp-name-first          pic x(15).
8                   06      emp-name-mi             pic x.
9
10          04      emp-addr.
11                  06      emp-addr-street       pic x(30).
12                  06      emp-addr-st            pic x(2).
13                  06      emp-addr-zip           pic x(9).
14
15  * End
```

## Limitations of the eGen Utility

The eGen utility is able to translate most COBOL copybook data types and data clauses into their Java equivalents; however, it is unable to translate some obsolete constructs and floating point data types. For information on COBOL data types that can be translated by the eGen utility, see DataView Programming Reference. If the eGen utility is unable to fully support constructs or data types, it:

- Treats them as alphanumeric data types (if reasonable)
- Ignores them (if their support is unimportant to WebLogic JAM's operation)
- Reports them as errors

If the eGen utility reports constructs or data types as errors, you must modify them, so they can be translated.

# Writing an eGen Script

After you have obtained a COBOL Copybook for the mainframe applications, you are ready to write an eGen script. This eGen script and the COBOL copybook that describes your data structure will be processed by the eGen utility to generate a DataView and application code which will serve as the basis for your custom Java application.

An eGen script has two sections. These are:

- DataView. The DataView section of the script generates Java DataView code from a COBOL copybook. The class file compiled from the generated code extends the Java DataView class. Generating DataViews is discussed in detail in the remainder of this section.

  **Note:** If the purpose of your eGen script is to generate a DataView for use with the WebLogic JAM to JMS EJB, or to launch a WebLogic Integration event, you only need to create the DataView section of the script.

- Java application. The Java application section of the script generates the Java application code. This is discussed in detail in Basic Programming Techniques.

# Writing the DataView Section of an eGen Script

The eGen utility parses a COBOL copybook and generates Java DataView code that encapsulates the data record declared in the copybook. It does this by parsing an eGen script file containing a DataView definition similar to the example shown in Listing 2-2 (keywords are in bold). The section containing the DataView definition is the first section of the eGen script. Application code is generated by the second section.

**Listing 2-2 Sample DataView Section of an eGen script**

```
generate view examples.CICS.outbound.gateway.EmployeeRecord from
emprec.cpy
```

Analyzing the parts of this line of code, we see that **generate view** tells the eGen utility to generate a Java DataView code file. `examples.CICS.outbound.gateway.EmployeeRecord` tells the eGen utility to call the DataView file `EmployeeRecord.java`. The package is called `examples.CICS.outbound.gateway`. The `EmployeeRecord` class defined in `EmployeeRecord.java` is a subclass of the DataView class. The phrase `from emprec.cpy` tells the eGen utility to form the `EmployeeRecord` DataView file from the COBOL copybook `emprec.cpy`.

Additional `generate view` statements may be added to an eGen script in order to produce all the DataViews required by your application. Also, additional options may be specified in the eGen script to change details of the DataView generation. For example, the following script will generate a DataView class that uses codepage `cp500` for conversions to and from mainframe format. If the codepage clause is not specified, the default codepage of `cp037` is used.

**Listing 2-3 Sample DataView Section with Codepage Specified**

```
generate view examples.CICS.outbound.gateway.EmployeeRecord from
emprec.cpy codepage cp500
```

The following script will generate additional output intended to support use of the DataView class with XML data:

**Listing 2-4 Sample DataView Section Supporting XML**

```
generate view sample.EmployeeRecord from emprec.cpy support xml
```

Additional files generated for XML support are listed in Table 2-1.

**Table 2-1 Additional Files for DataView XML Support.**

| File Name | File Purpose |
|---|---|
| *classname*.dtd | XML DTD for XML messages accepted and produced by this DataView. |
| *classname*.xsd | XML schema for XML messages accepted and produced by this DataView. |

# Processing eGen Scripts with the eGen Utility

After you have written your eGen script, you must process it to generate the DataView and application code. This Java code must then be compiled and deployed. The same eGen script usually contains both the definitions of the DataView and application code, and both are produced with a single processing of the script. However, in this Programming Guide, the script is explained in two steps, so the actual code generated can be analyzed in greater detail.

# Creating an Environment for Generating and Compiling the Java Code

When you process the eGen scripts and compile the generated Java code, you must have access to the Java classes and applications used in the code generation and compilation processes. Adding the correct elements to your `CLASSPATH` and `PATH` environment variables provides this access.

For the eGen utility:

- Add `<JAM_INSTALL_DIR>\lib\jam.jar` to your `CLASSPATH`.
- Add `<JAM_INSTALL_DIR>\bin` to your `PATH`.

For compilation:

- Add `<JAM_INSTALL_DIR>\lib\jam.jar` to your `CLASSPATH`.
- Add `<WLS_HOME>\lib\weblogic.jar` to your `CLASSPATH`.
- Add the path of your DataView class files to your `CLASSPATH` . You will need access to these classes when you compile your Java application code.

**Notes:** UNIX users must use "/" instead of "\" when adding directory paths as specified above.

Running `config\verify\setVerifyEnv.cmd` (on Windows systems) or `config/verify/setVerifyEnv.sh` (on UNIX systems) will perform the above actions necessary for the eGen utility.

# Generating the Java DataView Code

For the eGen script named `emprec.egen` shown in Listing 2-2, the following shell command parses the copybook file named `emprec.cpy` (see Listing 2-1) and generates the `EmployeeRecord.java` source file in the current directory:

**Listing 2-5 Sample Copybook Parse Command**

```
egencobol emprec.egen
```

If no error or warning messages are issued, the copybook is compatible with WebLogic JAM and the source files are created. Note that no application source files are generated by processing the `emprec.egen` script. This is because there are no application generating commands in this script.

**Note:** Refer to eGen Application Generator Reference for suggestions on resolving any problems encountered.

The following example illustrates the resulting generated Java source file, `EmployeeRecord.java` with some comments and implementation details removed for clarity.

**Listing 2-6 Generated `EmployeeRecord.java` Source File**

```
//EmployeeRecord.java
//Dataview class generated by egencobol emprec.cpy

package examples.CICS.outbound.gateway;

//Imports

import bea.dmd.DataView.DataView;
...

/**DataView class for EmployeeRecord buffers*/
public final class EmployeeRecord
    extends DataView
{
    ...

    // Code for field "emp-ssn"
    private BigDecimal     m_empSsn;

    public BigDecimal getEmpSsn() {...}

    /** DataView subclass for emp-name Group */
    public final class EmpName3V
            extends DataView
    {
             ...

            // Code for field "emp-name-last"
            private String  m_empNamelast;

            public void setEmpNameLast(String value) {...}
            public String getEmpNameLast() {...}

            .
            .
            .

    // Code for field "emp-name"
    private EmpName3V  m_empname;
... public Empname3V getEmpname() {...}

}

//End EmployeeRecord.java
```

The package name is defined in the eGen script

The data record is encapsulated in a class that extends the DataView class

Each class member variable corresponds to a field in the data record

Each data field has accessor functions

Each aggregate data field has a corresponding nested inner class that extends the DataView class

Each data field within an aggregate data field has accessor functions

Each COBOL data field name is converted into a Java identifier

# Special Considerations for Compiling the Java Code

You must compile the Java code generated by the eGen utility. However, there are some special circumstances to consider. Because the application code is dependent on the DataView code, you must compile the DataView code and make sure that the resulting DataView class files are in your environment's `CLASSPATH` before compiling your application code. You must make sure that all of the DataView class files can be referenced by the application code compilation.

For example, the compilation of `EmployeeRecord.java` results in four class files:

- `EmployeeRecord.class`
- `EmployeeRecord$EmpRecord1V.class`
- `EmployeeRecord$EmpRecord1V$EmpName3V.class`
- `EmployeeRecord$EmpRecord1V$EmpAddr7V.class`

All of these class files are used when compiling your application code.

CHAPTER

# 3 Basic Programming Techniques

This section discusses the following topics:



## Choosing an eGen Java Application Model

There are four different types or models of Java applications that can be generated by the eGen utility. These models, which can be classified as either Mainframe to WebLogic Server or WebLogic Server to Mainframe, are described below.

Mainframe to WebLogic Server (request originates on the mainframe and is serviced by WebLogic):

- Server EJB. The server EJB is a Stateless Session EJB that provides a service to the mainframe.

WebLogic Server to Mainframe (request originates on the WebLogic client or server and is serviced by the mainframe):

- Client Class. The client class is a stand-alone Java class that invokes mainframe services. This class may be built into your own EJB or utilized in some other way within your code.
- Client EJB. The client EJB is a Stateless Session EJB that invokes mainframe services. It may be called by a servlet or other client programs. This is the normal model for building a production application with access to mainframe services. A servlet that invokes the EJB's methods may be added for testing or demonstration purposes.
- Servlet Only. The servlet-only application is a servlet that presents a simple form and invokes mainframe services directly. This is the simplest model, but it may not be suitable for production applications.

Choose one of these four model types to use as the basis for your Java application. Once you have chosen a model type, refer to the section from the following list for instructions on writing the script and implementing the model you have chosen:

- Generating a Server Enterprise Java Bean-Based Application
- Generating a Stand-Alone Client Application
- Generating a Client Enterprise Java Bean-Based Application
- Generating a Servlet Application

For all of the applications you generate, you must provide a script file containing definitions for the application, including the COBOL copybook file name and the DataView class names.

# Generating the Java Application Code

The Java application code can be generated at the same time that you generate the Java DataView code. To generate Java application code, the eGen script that you process must contain instructions for generating the Java application along with the instructions for generating the DataView code.

Referring to the sample files in `samples\verify\gateway\outbound`, the following command generates `Chardata.java` and `BaseClient.java`. The DataView file is `Chardata.java`, and the application file is `BaseClient.java`.

```
> egencobol baseClient.egen
```

# General Form of an eGen Script

As previously stated, most eGen scripts consist of two major sections:

- The DataView section described in Writing an eGen Script.
- The Application section, which defines the Java application code that the eGen utility is to generate (described in Writing the Application Section of an eGen Script).

## Writing the Application Section of an eGen Script

The application section of an eGen script contains the information about the Java class files that the eGen utility is to generate for a particular application. The application section is divided into two distinct subsections, which are actually lists. The two lists are:

- List of Services -- Describes the remote services that are configured for JAM and are called by the classes that the eGen script defines. This list is not present in the script if the classes to be generated by the eGen utility are all server EJB's.
- List of Application Components -- Components for which the eGen utility is to generate the class files. This list contains one or more definitions of stand alone clients, client EJB's, servlets, or server EJB's.

### List of Services

Scripts that are used to define the application components that the eGen utility is to generate usually contain a list of one or more service definitions. If the application components are all server or Mainframe to WebLogic Server EJB's, this list of services

is not present. This is because this list of service definitions describes remote services configured in JAM; server EJB's do not call remote services since the requests are flowing outward from the mainframe.

The general form of a service definition is as follows (keywords are in bold):

```
service servicename accepts inputViewname returns outputViewname
```

Table 3-1 describes the service definition parameters.

**Table 3-1 Service Definition Parameters**

| Parameter | Definition |
|---|---|
| `servicename` | Must match the name of a remote service that is defined in the WebLogic JAM configuration (see the *BEA WebLogic Java Adapter for Mainframe Configuration and Administration Guide*). |
| `inputViewname` | The name of a DataView that will be the input or request data for the service. |
| `outputViewname` | The name of the DataView that is the output or response from the service. |

**Note:** The `inputViewname` and `outputViewname` do not have to be the same; however, due to the way many applications are written, they often are the same.

Following is an example of a service definition:

```
service TOUPPER accepts Chardata returns Chardata
```

In this example, the service `TOUPPER` is a configured remote service. As far as the Java application making the request for a mainframe service through WebLogic JAM is concerned, this service accepts as input a `Chardata` DataView. The actual mainframe server application accepts as input the COBOL copybook which corresponds to a `Chardata` DataView. As far as the Java application is concerned, the output or response from the mainframe service is a `Chardata` DataView.

## List of Application Components

In order for the eGen utility to generate code for Java applications, the eGen script must contain a list of one or more definitions of the application components that are to be generated. This list of definitions of application components can contain definitions of stand-alone clients, client or server EJB's, and servlets. This list of definitions also contains the definition of any HTML pages that are used by servlets defined in the list.

**Note:** The definition of an HTML page appearing in this list by itself will not cause any code to be generated.

The general form of an application component definition is as follows:

```
model identifier [model-dependent-parameters]
{ details }
```

Table 3-2 describes the application component definition parameters.

**Table 3-2 Application Component Definition Parameters**

| Parameter | Definition |
|---|---|
| `model` | Indicates to the eGen utility the type of application component that is to be generated. The possible values of this identifier are:<br>■ client class<br>■ client ejb<br>■ server ejb<br>■ servlet<br>■ page |
| `identifier` | This is generally the class name (or class name stem for EJB's) for the application component that is to be generated. The identifier includes the package name. For an HTML page, the identifier is the page name. |

| Parameter | Definition |
|---|---|
| `model-dependent-parameters` | These further describe the application component to the eGen utility and can vary a great deal depending on the model. For a stand-alone client, there would be no `model-dependent-parameters` given. For an EJB (client or server), the home interface identifier for the bean must be given. For a servlet, the initial HTML page that is to be displayed is given. For an HTML page, the title of the page is given. |
| `details` | These give details about the code for the application component. For a stand-alone client, as well as an EJB, these details would include the definitions of class methods that will call services defined in the script. For a servlet, there usually will not be any details given. For an HTML page, these details include the DataView that is to be displayed and any buttons that will be displayed on the page. |

Following is an example of an application component definition:

```
client ejb sample.SampleClient my.sampleBean
 {
        method newEmployee
                is service sampleCreate
 }
```

The example states the following:

- This is the definition for a client or EJB.
- The `classname` for this EJB is `SampleClient`. That is, the eGen utility will generate files named `SampleClient.java`, `SampleClientBean.java`, and `SampleClientHome.java`.
- The package name is `sample`.
- The home interface identifier for this bean is `my.sampleBean`.
- The bean will have a method called `newEmployee` that calls the `sampleCreate` service. The `sampleCreate` service is defined elsewhere in the file.

Specific details about the application component definitions for each application model, as well as the files that the eGen utility generates for each model, are discussed in the following sections.

# Mainframe to WebLogic Server Application Models

In a Mainframe to WebLogic Server application, a request originates on a mainframe and is serviced by an EJB invoked by a WebLogic JAM Gateway.

## Generating a Server Enterprise Java Bean-Based Application

This type of application produces Java classes that comprise an EJB application acting as a remote server from the viewpoint of the mainframe. The classes process service requests originating from the mainframe (remote) system and transfer data records to and from the mainframe. From the viewpoint of the Java classes, they receive EJB method requests. From the viewpoint of the mainframe application, it invokes remote CICS or IMS programs.

### Components of an eGen Server EJB Script

The general form of a definition of a server (Mainframe to WebLogic Server) EJB that appears in an eGen script is as follows (keywords are in bold):

```
server ejb classname ejbregistration transaction
   transaction-attribute
{servermethod}
```

Table 3-3 describes the server EJB definition keywords and parameters.

**Table 3-3 Service EJB Definition Keywords and Parameters**

| Keyword/Parameter | Definition |
|---|---|
| **`server ejb`** | Indicates to the eGen utility the type of application component that is to be generated. |
| `classname` | Indicates the class name stem for the EJB. For example, if the `classname` is `SampleServer`, then the following files are generated by the eGen utility:<br>■ `SampleServer.java`<br>■ `SampleServerBean.java`<br>■ `SampleServerHome.java`<br>**Note:** The package name should be included in the `classname`. |
| `ejbregistration` | The name that will be used to register the home interface for the EJB. |
| **`transaction`** `transaction-attribute` | This keyword and parameter are optional. They are used to manage the level of transaction demarcation. The possible values of the `transaction-attribute` are:<br>■ `NotSupported`<br>■ `Required`<br>■ `Supports`<br>■ `RequiresNew`<br>■ `Mandatory`<br>■ `Never`<br>**Note:** If the **`transaction`** keyword is not present in the definition, the default value of the `transaction-attribute` is `Supports`. For a detailed explanation of how the WebLogic Server EJB container responds to the `transaction-attribute` setting, see the section on Transaction Attributes in the EJB 2.0 Specification. |

| Keyword/Parameter | Definition |
|---|---|
| `servermethod` | Method that appears in the EJB implementation (must be in braces). The general form of a `servermethod` definition is as follows (keywords are in bold):<br>**`method`** `methodname (inputDataView)` **`returns`** `outputDataView`<br>Table 3-4 describes the parameters of a `servermethod` definition. |

**Table 3-4 Parameters for the servermethod**

| Parameter | Definition |
|---|---|
| `methodname` | The name of the method. |
| `inputDataView` | The name of the DataView that is the type of the input parameter for the method (must be in parenthesis). |
| `outputDataView` | The name of the DataView that is the type returned from the method. |

Following is an example of a server (Mainframe to WebLogic Server) EJB definition that appears in an eGen script:

```
server ejb sample.SampleServer my.sampleServer
{
       method newEmployee (EmployeeRecord)
              returns EmployeeRecord
}
```

The example states the following:

- This is the definition for a server EJB class. The generated EJB class files are defined in the Generated Files section that follows.
- The `my.sampleServer` is the home interface identifier for this bean in the WebLogic deployment description.
- The **`transaction`** keyword is not present in this example, so it defaults to `Supports`.

- The server class method `newEmployee` takes its input from the DataView `EmployeeRecord` and writes its output to an `EmployeeRecord` output DataView.

## Generated Files

Table 3-5 lists the files generated from the example server (Mainframe to WebLogic Server) EJB described in Components of an eGen Server EJB Script. These files are described in the sections following the table.

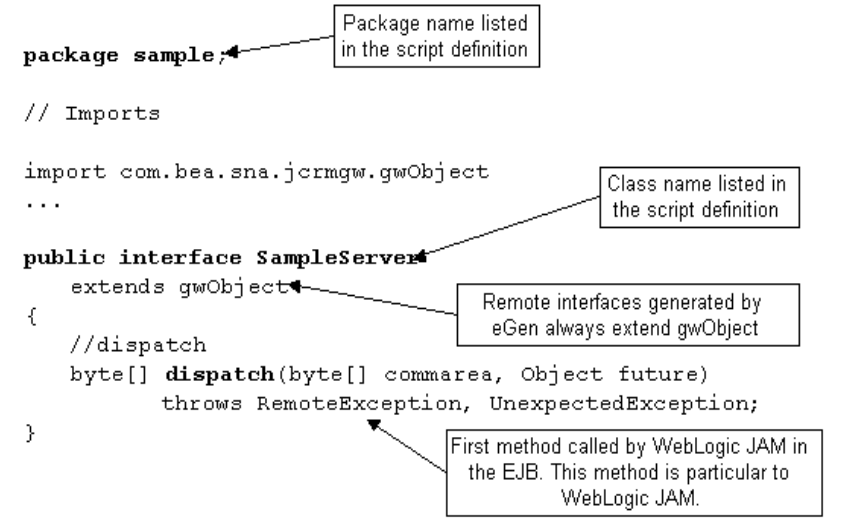
**Table 3-5 Sample Script Generated Files**

| File | Content |
|---|---|
| `SampleServer.java` | Source for the EJB remote interface. |
| `SampleServerBean.java` | Source for the EJB implementation. |
| `SampleServerHome.java` | Source for the EJB home interface. |
| `SampleServer-jar.xml` | Deployment descriptor. |
| `wl-SampleServer-jar.xml` | WebLogic deployment information. |

### SampleServer.java Source File

Listing 3-1 shows the partial contents of the generated remote interface `SampleServer.java` source file.

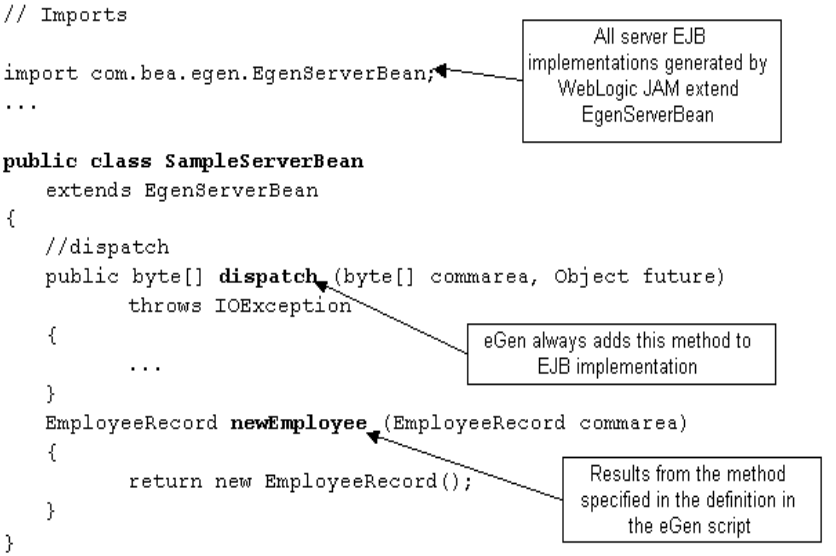
**Listing 3-1 Sample SampleServer.java Contents**




## SampleServerBean.java Source File

Listing 3-2 shows the partial contents of the generated EJB implementation `SampleServerBean.java` source file.

**Listing 3-2 Sample SampleServerBean.java Contents**




## SampleServerHome.java Source File

The eGen utility generates a standard home interface class for the server EJB.

## SampleServer-jar.xml Source File

The following line from the deployment descriptor file results from the transaction attribute in the definition in the eGen script.

```
<trans-attribute>Supports</trans-attribute>
```

As described in Components of an eGen Server EJB Script, this element indicates the level of transaction demarcation. If the `transaction-attribute` is not present in the definition, the default value is `Supports`. So, in this example, the transaction attribute was not listed in the script definition.

### wl-SampleServer-jar.xml Source File

The following line from the WebLogic deployment information file results from the home interface name in the eGen script.

```
<jndi-name>my.sampleServer</jndi-name>
```

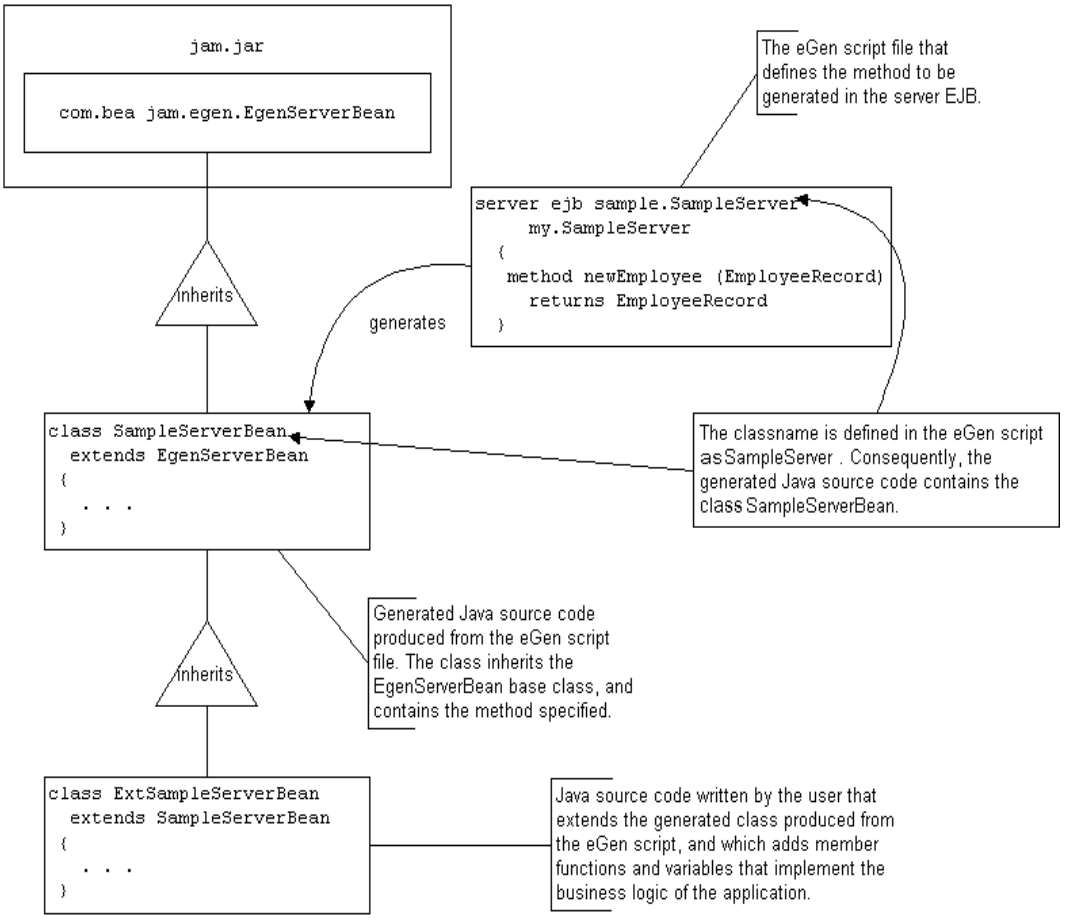
As described in Components of an eGen Server EJB Script, `my.sampleServer` is the home interface identifier for this bean in the WebLogic deployment description.

## Customizing a Server Enterprise Java Bean-Based Application

The generated server enterprise Java bean-based applications are only intended for customizing, since they perform no real work without customization. This section describes the way generated server EJB code can be customized.

The following figure illustrates the relationships and inheritance hierarchy between the WebLogic JAM classes comprising the application.

**Figure 3-1 The WebLogic JAM Server EJB Class Hierarchy**




The generated Java code for a server EJB application is a class that inherits the class `EgenServerBean`. The `EgenServerBean` class is provided in the WebLogic JAM distribution jar file. This base class provides the basic framework for an EJB. It provides the required methods for a Stateless Session EJB.

The following listing shows an example `ExtSampleServerBean` class that extends the generated `SampleServerBean` class, providing an implementation of the `newEmployee()` method. The example method prints a message indicating that a `newEmployee` request has been received.

**Listing 3-3 Sample ExtSampleServerBean.java Contents**

```
package sample;

public class ExtSampleServerBean extends SampleServerBean
{
       public EmployeeRecord newEmployee (EmployeeRecord in)
       {
         System.out.println("New Employee: " +
              +in.getEmpRecord().getEmpName().getEmpNameFirst()
              + " "
              + in.getEmpRecord().getEmpname().getEmpNameLast());
         return in;
       }
}
```

Once it has been written, the `ExtSampleServerBean` class and the other EJB Java source files must be compiled and deployed in the same manner as other EJBs. Before deploying, the deployment descriptor must be modified; the *ejb-class* must be set to the name of your extended EJB implementation class (see Deploying a WebLogic JAM eGen EJB).

### Compiling and Deploying

Refer to the WebLogic Server documentation for more information. The sample file provided with WebLogic Server contains a build script for reference.

# WebLogic Server to Mainframe Application Models

In a WebLogic Server to Mainframe application, a request originates on a WebLogic client or server, and is serviced by a mainframe program invoked by the WebLogic JAM Gateway in cooperation with the CRM.

# Generating a Stand-Alone Client Application

This type of application produces simple Java classes that perform the appropriate conversions of data records sent between Java and the mainframe and call mainframe services, but without all of the EJB support methods. These classes are intended to be lower-level components upon which more complicated applications are built.

## Components of an eGen Stand-Alone Application Script

The general form of a definition of a stand-alone client class that appears in an eGen script is as follows (keywords are in bold):

```
client class classname
{ clientmethods }
```

Table 3-6 describes the stand-alone client class definition keywords and parameters.

**Table 3-6 Stand-Alone Client Class Definition Keywords and Parameters**

| Keyword/Parameter | Definition |
|---|---|
| **`client class`** | Indicates to the eGen utility the type of application component that is to be generated. |
| `classname` | Indicates the class name for the client class.<br>**Note:** The package name should be included in the `classname`. |
| `clientmethods` | List of methods that appear in the client class implementation (must be in braces). These methods are wrappers for calls to services that are defined in the `services` section of the eGen script. The general form of the definition for a `clientmethod` in an eGen script is as follows:<br>**`method`** `methodname is` **`service`** `servicename`<br>Table 3-7 describes the parameters of a `clientmethod` definition. |

**Table 3-7 Parameters for the clientmethod**

| Parameter | Definition |
|---|---|
| `methodname` | The name of the method. |
| `servicename` | Indicates the remote service for which this method acts as a wrapper for a WebLogic JAM call. This service must be defined in the same eGen script. |

Following is an example of a stand-alone client class definition that appears in an eGen script:

```
client class sample.SampleClass
{
       method newEmployee
       is service sampleCreate
}
```

The example states the following:

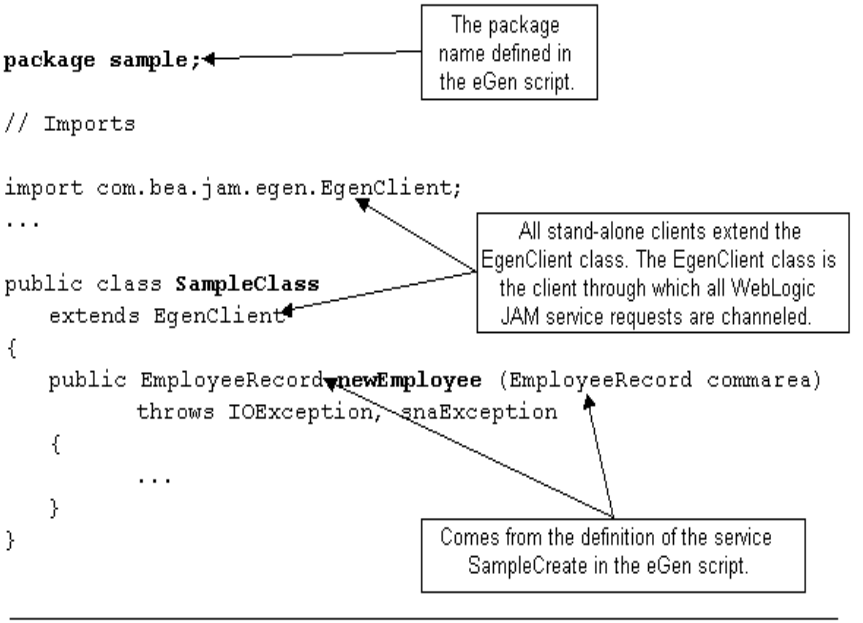
- This is the definition of a simple client class.
- The package name is `sample` and `SampleClass` is the class name.
- The **`method`** `newEmployee` acts as a wrapper for a WebLogic JAM call to the remote service `sampleCreate`.
- This service must be defined in the same eGen script as the client class.

## Generated Files

The file `SampleClass.java`, containing the source for the `sample` class, is generated.

Listing 3-4 shows the partial contents of the `SampleClass.java` source file.

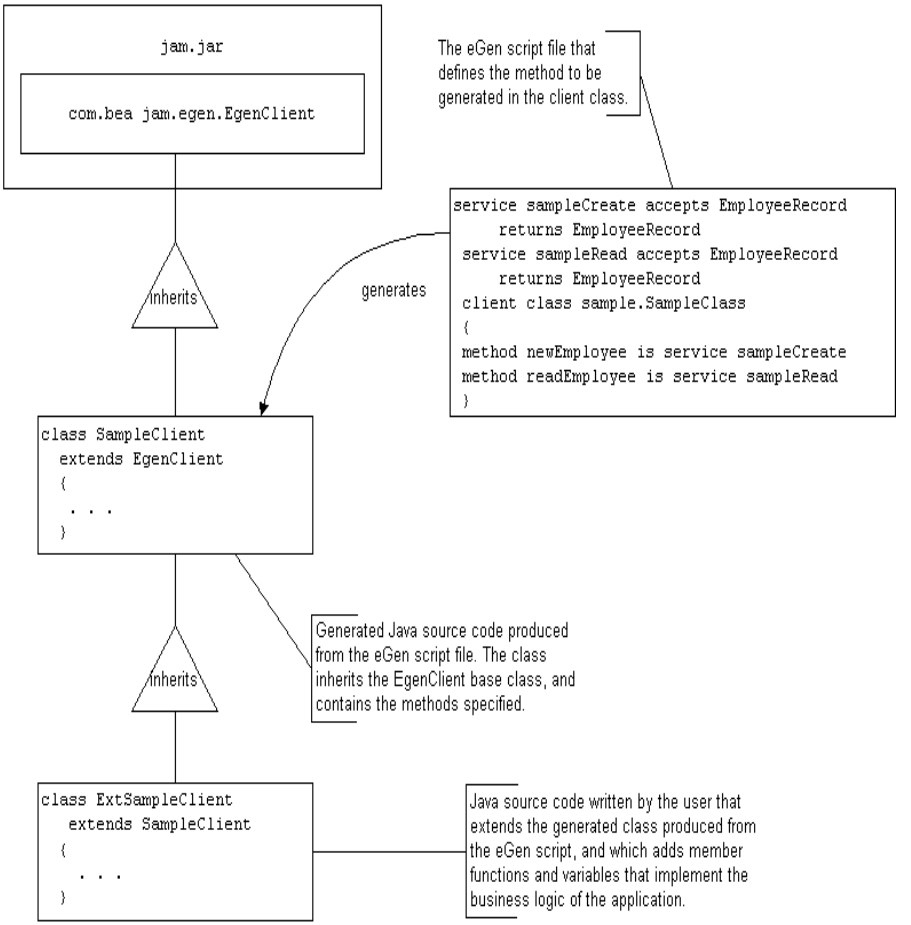
**Listing 3-4 Sample SampleClass.java Source File**




## Customizing a Stand-Alone Java Application

The following figure illustrates the relationships and inheritance hierarchy between the WebLogic JAM classes comprising the stand-alone java application.

**Figure 3-2 The WebLogic JAM Client Class Hierarchy**




The generated Java code for a client class application is a class that inherits class `EgenClient`. The `EgenClient` class is provided in the WebLogic JAM distribution `jam.jar` file. This base class provides the basic framework for a client to the WebLogic JAM Gateway, as well as the required methods for accessing the gateway.

Your class, which extends or uses the `SampleClient` class, simply overrides or calls these methods to provide additional business logic, modifying the contents of the DataView. Your class may also add additional methods.

The following listing shows an example `ExtSampleClass` class that extends the generated `SampleClient` class.

**Listing 3-5 Sample ExtSampleClient.java Contents**

```
package sample;

public class ExtSampleClient extends SampleClass
{
       // createEmployee
       //
       public EmployeeRecord newEmployee(EmployeeRecord
              commarea)
       throws IOException, snaException
       {
         if (!isSsnValid(commarea.getEmpRecord().getEmpSsn()))
         {
         // The SSN is not valid
         throw new Error("Invalid Social Security Number:"+
              commarea.getEmpRecord().getEmpSsn());
         }
       return super.newEmployee(commarea);
       }
       .
       .
       .
// Private functions

       /*******************************************************
       * Validates an SSN field.
       */

       private boolean isSsnValid(BigDecimal ssn)
       {
         if (ssn.longValue() < 100000000)
         {
           // Oops, appears to be less than 9 digits.
           return false;
         }
         return (true);
       }
}
```

Once it has been written, the `ExtSampleClient` class and the other Java source files must be compiled and placed in your `CLASSPATH`.

Instead of extending the generated client, you can also write classes that have the generated client as a member. This is an especially useful alternative if the class you write must extend some other class.

# Generating a Client Enterprise Java Bean-Based Application

This type of application produces Java classes that comprise an EJB application. The class methods are invoked from requests originating from other EJB classes or other WebLogic Server client classes and transfer data records to and from the mainframe (remote system). From the viewpoint of the mainframe, the Java classes act as a remote CICS or IMS client. From the viewpoint of the WebLogic Server client classes, they act as regular EJB classes.

## Components of an eGen Client EJB Script

In order to produce an EJB-based application, the script file that defines your DataViews must be edited to describe both the mainframe services accessed and the EJB that will access them.

The general form of a definition of a client (WebLogic Server to Mainframe) EJB that appears in an eGen script is as follows (keywords are in bold):

```
client ejb classname ejbregistration transaction
   transaction-attribute
{clientmethods}
```

Table 3-8 describes the client EJB script keywords and parameters.

**Table 3-8 Client EJB Script Keywords and Parameters**

| Keyword/Parameter | Definition |
|---|---|
| **`client ejb`** | Indicates to the eGen utility the type of application component that is to be generated. |

| Keyword/Parameter | Definition |
|---|---|
| `classname` | Indicates the class name stem for the EJB. For example, if the `classname` is `SampleClient`, the following files are generated by the eGen utility:<br>■ `SampleClient.java`<br>■ `SampleClientBean.java`<br>■ `SampleClientHome.java`<br>**Note:** The package name should be included in the `classname`. |
| `ejbregistration` | The name that will be used to register the home interface for the EJB. |
| **`transaction`**<br>`transaction-attribute` | This keyword and parameter are optional. They indicate the level of transaction demarcation. The possible values of `transaction-attribute` are:<br>■ `NotSupported`<br>■ `Required`<br>■ `Supports`<br>■ `RequiresNew`<br>■ `Mandatory`<br>■ `Never`<br>**Note:** If the **`transaction`** keyword is not present in the definition, the default value of the `transaction-attribute` is `Supports`. For a detailed explanation of how the WebLogic Server EJB container responds to the `transaction-attribute` setting, see the section on Transaction Attributes in the EJB 2.0 Specification. |
| `clientmethods` | List of methods that appear in the EJB implementation. These methods are wrappers for calls to remote services that are defined in the services section of the eGen script. The general form of a `clientmethod` definition is as follows (keywords are in bold):<br>**`method`** `methodname` **`is service`** `servicename`<br>Table 3-9 describes the parameters of a client method definition. |

**Table 3-9 Client Method Definition Parameters**

| Parameter | Definition |
|---|---|
| `methodname` | The name of the method. |
| `servicename` | Indicates the remote service for which this method acts as a wrapper for a WebLogic JAM call. This service must be defined in the same eGen script. |

Following is an example of a client (WebLogic Server to Mainframe) EJB definition that appears in an eGen script:

```
client ejb sample.SampleClient my.sampleBean
{
       method newEmployee
       is service sampleCreate
}
```

The example states the following:

- This listing defines a Java bean class named `SampleClient` in the package `sample` with a method named `newEmployee`.
- The method corresponds to service name `sampleCreate`.
- The EJB home will be registered in Java Naming and Directory Interface (JNDI) under the name `my.sampleBean`.

## Generated Files

Table 3-10 lists the files generated from the client (WebLogic Server to Mainframe) EJB described in Components of an eGen Client EJB Script. These files are described in the sections following the table.

**Table 3-10 Sample Script Generated Files**

| File | Content |
|---|---|
| `SampleClient.java` | Source for the EJB remote interface. |
| `SampleClientBean.java` | Source for the EJB implementation. |

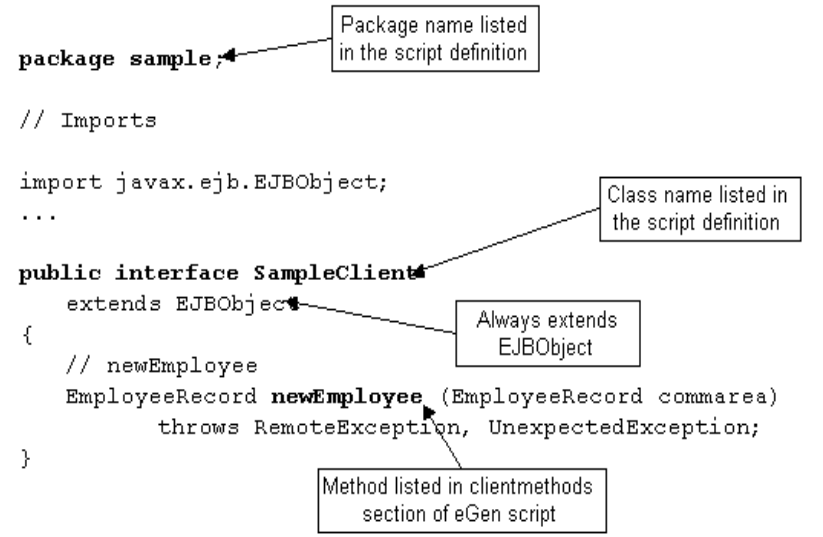
**Table 3-10 Sample Script Generated Files**

| | |
|---|---|
| `SampleClientHome.java` | Source for the EJB home interface. |
| `SampleClient-jar.xml` | Deployment descriptor. |
| `wl-SampleClient-jar.xml` | WebLogic deployment information. |

## SampleClient.java Source File

Listing 3-6 shows the partial contents of the generated remote interface `SampleClient.java` source file. Following the listing are descriptions of the elements in this file.

**Listing 3-6 Sample SampleClient.java Contents**



## SampleClientBean.java Source File

Listing 3-7 shows the partial contents of the generated EJB implementation `SampleClientBean.java` source file. Following the listing are descriptions of the elements in this file.

**Listing 3-7 Sample SampleClientBean.java Contents**

```
//Imports

import com.bea.jam.egen.EgenClientBean;
...

public class SampleClientBean
    extends EgenClientBean
{
    // newEmployee
    public EmployeeRecord newEmployee (EmployeeRecord commarea)
           throws IOException, snaException
    {
           ...
    }
}
```

All client EJB implementations generated by WebLogic JAM extend EgenClientBean

Results from the method in the eGen script

## SampleClientHome.java Source File

The eGen utility generates a standard home interface class for the client EJB.

## SampleClient-jar.xml Source File

The following line from the deployment descriptor file results from the transaction demarcation listed in the definition in the eGen script.

```
<trans-attribute>Supports</trans-attribute>
```

As described in Components of an eGen Client EJB Script, this element indicates the level of transaction demarcation. If the `transaction-attribute` is not present in the definition, the default value is `Supports`. In this example, the `transaction-attribute` was not listed in the script definition.

### wl-SampleServer-jar.xml Source File

The following line from the WebLogic deployment information file results from the Home Interface name in the eGen script.

```
<jndi-name>my.sampleBean</jndi-name>
```

As described in Components of an eGen Client EJB Script, `my.sampleBean` is the home interface identifier for this bean in the WebLogic deployment description.

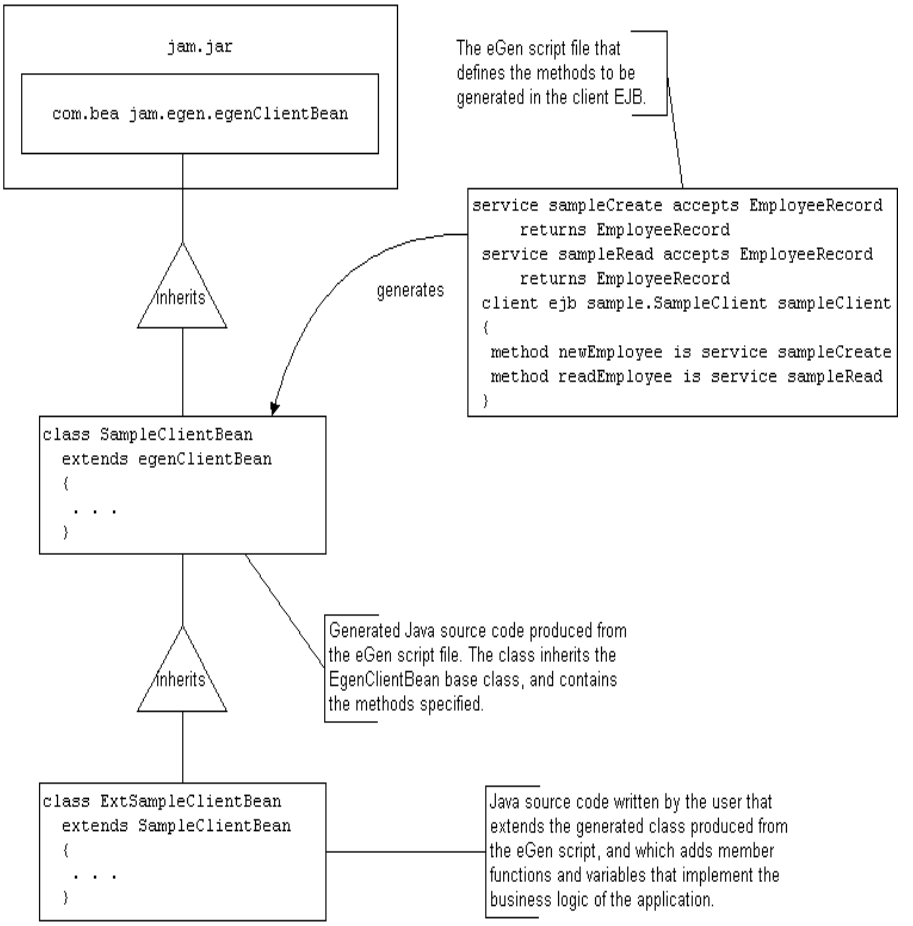
**Note:** You can edit the deployment descriptor to change the pool size, etc.

## Customizing an Enterprise Java Bean-Based Application

The generated client enterprise Java bean-based applications are generally intended for customizing. Without customization, the only function they perform is communication with the mainframe. This section describes the way generated client EJB code can be customized.

The following figure illustrates the relationships and inheritance hierarchy between the WebLogic JAM classes comprising the application.

**Figure 3-3 The WebLogic JAM Client EJB Class Hierarchy**




The generated Java code for a client EJB application is a class that inherits class `egenClientBean`. The `egenClientBean` class is provided in the WebLogic JAM distribution jar file.

Listing 3-8 illustrates an example `ExtSampleClientBean` class that extends the generated `SampleClientBean` class, adding a validation function (`isSsnValid()`) for the `emp-ssn` (`m_empSsn`) field of the DataView `EmployeeRecord` class. If the `emp-ssn` field is determined to be invalid, an exception occurs. Otherwise, the original function is called to perform the mainframe operation.

**Listing 3-8 Example ExtSampleClientBean.java Class**

```
package Sample;

// Imports

import java.math.BigDecimal;
import java.io.IOException;

import com.bea.sna.jcrmgw.snaException;

// Local imports

import sample.EmployeeRecord;
import sample.SampleClientBean;

/*****************************************************************
* Extends the SampleCientBean EJB class, adding additional business
logic.
*/

public class ExtSampleClientBean
       extends SampleClientBean
{
//Public functions

...

/*****************************************************************
 * Create a new employee record.
 */

 public EmployeeRecord newEmployee (EmployeeRecord commarea)
         throws IOException, snaException
{
       if (!isSsnValid (commarea.getEmpRecord().getEmpSsn()))
       {
       // The SSN is not valid.
       throw new Error ("Invalid Social Security Number:"
              + commarea.getEmpRecord().getEmpSsn());

       }
       //
         // Make the remote call.
         return super.newEmployee(commarea);
       }
}

// Private Functions
/*****************************************************************
```

```
* Validate an SSN field
*
* @return
* True if the SSN is valid, otherwise false.
*/

private boolean isSsnValid(final BigDecimal ssn)
{
       if (ssn.longValue() < 100000000)
       {
              // Oops, appears to be less than 9 digits
              return false;
       }
       return true;
}
}
```

When it has been written, the `ExtSampleClientBean` class and the other EJB Java source files must be compiled and deployed in the same manner as other EJBs. Prior to deploying, the deployment descriptor must be modified; the `ejb-class` property must be set to the name of your extended EJB implementation class (see Deploying a WebLogic JAM eGen EJB).

### Compiling and Deploying

Refer to the BEA WebLogic Server documentation for more information. The sample file provided with WebLogic Server contains a build script for reference.

## Generating a Servlet Application

A WebLogic JAM servlet application is a Java servlet that executes within BEA WebLogic Server. The application is started from a web browser when the user enters a URL that is configured to invoke the servlet. The servlet presents an HTML form containing data fields and buttons. The buttons can be configured to invoke:

- EJB methods
- Remote gateway services (via the JAM Gateway)

In general, servlets generated by the eGen utility are intended for testing purposes and are not easily customized to provide a more aesthetically pleasing interface.

In order to produce a servlet application, create an eGen script file and use the eGen utility to generate your typed data record (DataView), and Servlet code.

In order to define a servlet application using an eGen script, you must define the following:

- HTML pages displayed by the servlet
- The servlet itself

## Components of an eGen HTML Page Definition

The general form of an HTML page that appears in an eGen script is as follows (keywords are in bold):

```
page pagename title
{ view viewname
  buttons {buttonlist}
}
```

Table 3-11 describes the HTML page definition keywords and parameters.

**Table 3-11 HTML Page Definition Keywords and Parameters**

| Keyword/Parameter | Definition |
|---|---|
| **page** | Indicates to the eGen utility the type of application component that is to be generated. |
| pagename | Indicates the name of the page so it can be referenced by the servlet and other page definitions in the script. |
| title | The title that will be displayed on the HTML page. |
| viewname | Indicates the name of the DataView that is to be displayed on the page. This DataView must be defined elsewhere in the eGen script. |

| Keyword/Parameter | Definition |
|---|---|
| `buttonlist` | List of buttons that are displayed on the page. The buttons can either call EJB methods or remote services that are defined elsewhere in the eGen script. The general form of the definition for a button in the buttonlist depends on whether it is a remote service button or an EJB. |

The general syntax for a remote service button in an eGen script is as follows (keywords are in bold):

```
buttonname service (servicename) shows pagename
```

Table 3-12 describes the remote service button definition keywords and parameters.

**Table 3-12 Remote Service Button Definition Keywords and Parameters**

| Keyword/Parameter | Definition |
|---|---|
| `buttonname` | The label that appears on the button. |
| `servicename` | The name of the remote service (must be in parenthesis). |
| `pagename` | The page used to display the results. |

The general syntax for an EJB button in an eGen script is as follows (keywords are in bold):

```
buttonname ejbmethod () shows pagename
```

**Note:** Empty parenthesis must follow `ejbmethod`.

Table 3-13 describes the EJB button definition keywords and parameters.

**Table 3-13 EJB Button Definition Keywords and Parameters**

| Keyword/Parameter | Definition |
|---|---|
| `buttonname` | The label that appears on the button. |

| Keyword/Parameter | Definition |
|---|---|
| `ejbmethod` | The name of the EJB method that is to be called. This method should be specified in the following form:<br>`packagename.EJBclass.method` |
| `pagename` | The page used to display the results. |

Following is an example of an HTML page that appears in an eGen script:

```
page initial “Initial Page”
{
       view EmployeeRecord

       buttons
       {
              “Create”
                     service (“sampleCreate”)
                     shows fullPage
       }
}
```

This listing defines an HTML page named `initial`, with a text title of `Initial Page`, that displays an `EmployeeRecord` record object as an HTML form. It also specifies that the form has a button labeled `Create`. When the button is pressed, the service `sampleCreate` is invoked and is passed the contents of the browser page as an `EmployeeRecord` object (the fields of which may have been modified by the user). Afterwards, the `fullPage` page is used to display the results.

## Components of an eGen Servlet Definition

The general form of a servlet definition that appears in an eGen script is as follows (keywords are in bold):

```
servlet classname shows pagename
```

Table 3-14 describes the servlet definition keywords and parameters.

**Table 3-14 Servlet Definition Keywords and Parameters**

| Keyword/Parameter | Definition |
|---|---|
| **`servlet`** | Indicates the type of application component that is to be generated. |
| `classname` | Indicates the class name for the servlet.<br>**Note:** The package name should be included in the `classname`. |
| `pagename` | The name of the page that is initially displayed by the servlet. This page must be defined elsewhere in the script. |

Following is an example of a servlet definition that appears in an eGen script:

```
servlet sample.SampleServlet shows initial
```

The example states the following:

- This is the definition of an application servlet class named `SampleServlet` in the package `sample`.
- The servlet is to be displayed in the HTML page named `initial`.

## Generated Files

The eGen servlet definition described in Components of an eGen Servlet Definition generates a servlet source code file called `SampleServlet.java`.

## Customizing a Servlet WebLogic JAM Application

The generated Java classes produced for servlet applications are intended for proof of concept and prototypes. They can be customized in limited ways. It is presumed that some other development tool will be used to develop a servlet or other user interface on top of the generated EJBs or client classes.

# Supplying Security Credentials

WebLogic JAM has the capability to accept user ID and password information from a Java client program, and apply that information to access a secure service on the mainframe.

**Note:** When security information is transmitted via the connection between the WebLogic JAM Gateway and the CRM, it is sent in clear text (not encrypted). You should not send this information over a network that can be read by unauthorized parties.

## Security Levels

There are three levels of security that are supported by WebLogic JAM.

- Local -- No user information from the Java client is required to access a mainframe service. Use of this security level implies that any user with access to execute the Java client program should have access to a mainframe service.
- Identify -- A user ID specified by the Java client is required to access a mainframe service. This user ID is passed to the mainframe to verify that it is a valid user ID. Use of this security level implies that there is a trusted relationship between the Java and mainframe environments, since there is no re-verification of the user's identity in the mainframe environment.
- Verify -- A user ID and password specified by the Java client are required to access a mainframe service. The password is used to re-verify the user's identity in the mainframe environment.

**Notes:** Refer to the *BEA WebLogic Java Adapter for Mainframe Configuration and Administration Guide* for information on setting the security level for a CRM link and using a default user ID.

Refer to your mainframe security documentation for more specific information about establishing and administrating mainframe security.

## Supplying Security Credentials in a WebLogic JAM Client Program

User security information can be supplied in a WebLogic JAM stand-alone client or client EJB. There are two methods in the `EgenClient` object that support this operation:

- `EgenClient.setUserId(String)`

  This method sets the user ID to the value specified in the `String` argument.

- `EgenClient.setPassword(String)`

  This method sets the user password to the value specified in the `String` argument.

These methods can be called on any sub-class of `EgenClient`, such as the client classes generated by the eGen utility. The methods are not inserted automatically by the eGen utility; they must be manually added to the client program source, and should be called prior to the any calls to `EgenClient.callService()`.

The methods `setUserID` and `setPassword` can be called on any subclass of `EgenClientBean`, such as the client EJBs generated by the eGen utility. `EgenClientBean` has methods by the same name that act as wrappers for calls to methods of the `EgenClient` member of the `EgenClientBean` class.

Calls to the `EgenClient.setUserId()` method within a WebLogic JAM client will override any default user ID value configured for the CRM link the client is using.

These methods cannot be used with the servlet-only applications, since they do not use the `EgenClient` object directly. Servlet-only applications can make use of the default user ID to support security level **Identify**.

Listing 3-9 illustrates a class that extends the generated EJB implementation to provide security credentials to the Gateway during these operations.

**Listing 3-9 Example of Class with Security Credentials**

```
// ExtSampleClientBean.java
//

package sample;

// Imports
//
```

```
import java.io.IOException;
import com.bea.sna.jcrmgw.snaException;

/**
 * EJB implementation.
 */
public class ExtSampleClientBean extends SampleClientBean
{
    protected byte[] callService(String svc, byte[] input)
            throws snaException, IOException
    {
            setUserid("JAMUSER");
            setPassword("JAMPASS");

            return super.callService(svc, input);
    }
}

// END ExtSampleClientBean.java
```

**Note:** WebLogic JAM will return an `SNANotAuthorized` exception if the credentials are rejected by the mainframe security package.

# WebLogic JAM to JMS

WebLogic JAM includes an EJB that has two major functions:

- Inserts request data into JMS topics or queues
- Converts EBCDIC data into an ASCII XML document for use with custom applications

WebLogic JAM to JMS is a utility stateless session EJB that uses a DataView generated by the eGen utility to convert the data. The EJB is contained in the `jam.ear` file with a default JNDI name of `JAMToJMS`.

The general process for this insertion and conversion is described in the following sections.

1. Obtain a COBOL Copybook.

The mainframe client application must have a COBOL record layout (copybook) to describe the message comprising the request. This layout is used to generate Java classes that can be used for data transformation. Refer to Obtaining a COBOL Copybook for more information.

2. Generate a DataView with XML Support.

   Make sure that your eGen script is written to generate DataViews that support XML, as shown in the following code example:

   ```
   generate view empRecData from emprec support xml
   ```

   For more information on DataViews, refer to Writing the DataView Section of an eGen Script. For more information on generating the DataView source files, see Processing eGen Scripts with the eGen Utility. These files can be compiled for deployment. The schema and DTD can be made available to the XML application as necessary.

3. Compile the DataView `.java` files (see Creating an Environment for Generating and Compiling the Java Code).

4. Copy the DataView class files created by the eGen utility to a directory in the WebLogic Server CLASSPATH.

5. Create a JMS Event definition. For specific instructions, refer to the *BEA WebLogic Java Adapter for Mainframe Configuration and Administration Guide*.

   For an example of how to use the WebLogic JAM to JMS feature, refer to the *BEA WebLogic Java Adapter for Mainframe Samples Guide*.

# 4 Deploying Applications

Deployment is the process of installing servlets and/or EJBs on WebLogic Server. Application deployment in WebLogic Server has evolved to the J2EE standard for web application deployment.

The following information is not intended to specifically describe how applications are deployed in WebLogic Server. For specific information, refer to Quick Start information and detailed documentation for deploying applications in the WebLogic Server online documentation at:

```
http://edocs/wls/docs61/quickstart/quick_start.html
http://edocs/wls/docs61/servlet/admin.html#156888
http://edocs/wls/docs61/ejb/EJB_deployover.html
```

This section discusses the following topics:



## Deploying a WebLogic JAM eGen EJB

A WebLogic JAM eGen EJB (client or server) is deployed like any other WebLogic EJB. Considerations that are specific to WebLogic JAM are:

- Deployment descriptors generated by the eGen utility need to be renamed.

- If the EJB is to contain business logic in addition to WebLogic JAM access code, a subclass must be created.
- If multiple EJBs are created, the generated deployment descriptors must be manually merged if the beans are to be deployed in the same `.jar` file.

# Renaming Deployment Descriptors

The EJB deployment descriptors generated by the eGen utility are named based on the generated EJB, rather than the using the standard J2EE and WebLogic file names. This is to avoid file naming conflicts if multiple beans are generated in the same directory. As a result, these descriptors must be renamed before the EJB is packaged and deployed. Following are the naming conventions used, where `BeanName` is the name of the generated EJB:

| Generated Descriptor Name | Deployed Descriptor Name |
|---|---|
| `BeanName-jar.xml` | `ejb-jar.xml` |
| `wl-BeanName.xml` | `weblogic-jar.xml` |

For example, consider the following portion of an eGen script:

```
client ejb TestClient TestClientHome
{
       method newEmployee
       is service emplCreate
}
```

In this script, the descriptions generated would be named `TestClient-jar.xml` and `wl-TestClient.xml` respectively.

# Adding Business Logic to a Generated EJB

The EJBs generated by the eGen utility contain the infrastructure for calling mainframe services and returning the results of those services. If you want to present a different API that performs some business logic before deferring to the generated service methods, you will need to create a new bean class that sub-classes the generated code.

If you want to maintain the same remote interface generated by the eGen utility but add business logic before/after the mainframe call, simply derive a new class from the generated bean class while retaining the generated home and remote interfaces. For example, if our generated `TestClientBean.java` contains a method named `newEmployee()`, you could insert business logic as follows:

```
public class MyLogicBean extends TestClientBean
{
       public dataView newEmployee(dataView in)
       {
              // perform before business logic here
              dataView out = super.newEmployee(in);
              // perform after business logic here
              return(out);
       }
}
```

However, if you want to present a different remote interface in addition to adding business logic, you also need to create new remote and home interfaces to support your new bean.

In either case, be sure to update the generated deployment descriptors to reflect your new bean classes.

For example, suppose you used the eGen utility to generate an EJB named `TestClientBean`, and that bean had been extended as in the above example by a bean class named `MyLogicBean`. The eGen utility would have generated a deployment descriptor with the name `TestClient-jar.xml`. The generated deployment descriptor would need to be renamed `ejb-jar.xml` before deployment. The `ejb-class` element's value should also be changed from `TestClientBean` to `MyLogicBean` to reflect the new bean class name as in the example below.

```
<ejb-jar>
    <enterprise-beans>
      <session>
        <ejb-name>TestClient</ejb-name>
```

```
            <home>TestClientHome</home>
            <remote>TestClient</remote>
            <ejb-class>MyLogicBean</ejb-class>
            <session-type>Stateless</session-type>
            <transaction-type>Container</transaction-type>
          </session>
        </enterprise-beans>
          ...
</ejb-jar>
```

# Merging Multiple Deployment Descriptors

Multiple WebLogic JAM EJB's can be generated as part of a single application. This can be done in a single eGen script, or by running the eGen utility multiple times with different scripts. If these beans are to be deployed in a single `.jar` file, the generated deployment descriptors for each must be merged into a single `ejb-jar.xml` and `weblogic-jar.xml`.

# Sample EJB Deployment

Following are instructions for the deployment of a sample eGen-created EJB.

1. Build your EJB deployment `.jar` file. Listing 4-1 will build the client EJB deployment `.jar` file from the components generated by the `tradeserver.egen` eGen script and `TradeRecord.cpy`.

**Listing 4-1 Script for Building JAM_TradeServer.jar**

```
@rem --- Adjust these variables to match your environment -----------------
set TARGETJAR=JAM_TradeServer.jar
set JAVA_HOME=c:\bea\jdk131
set WL_HOME=c:\bea\wlserver6.1sp1
set JAM_HOME=c:\bea\wljam5.0
@rem  ------ end of Adjustable variables -----------------------------------

set JAMJARS=%JAM_HOME%\lib\jam.jar
set CLASSPATH=%JAM_HOME%\lib\jam.jar;%JAM_HOME%\lib\tools.jar;
%WL_HOME%\lib\weblogic.jar
set PATH=%JAVA_HOME%\bin;%JAVA_HOME%\lib;%PATH%
```

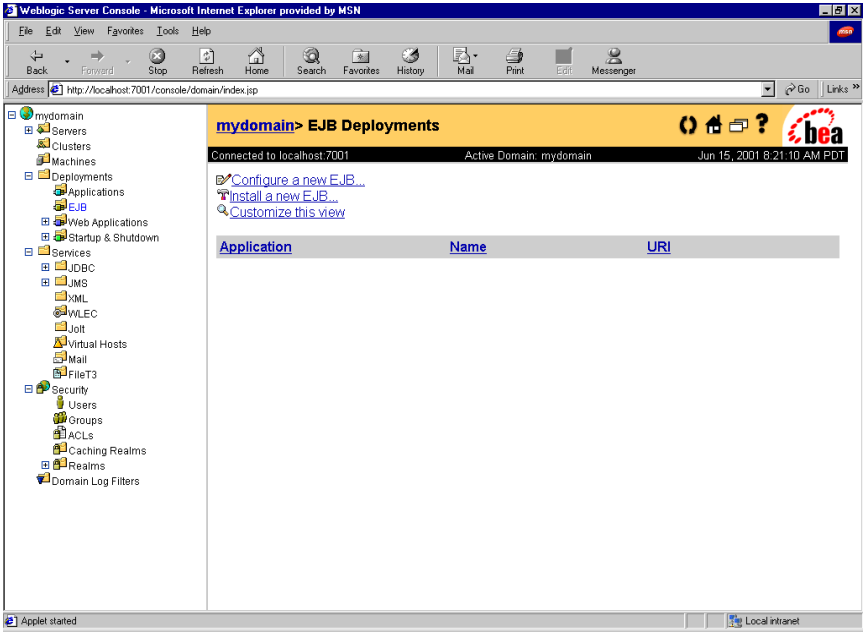
```
@rem  Create the build directory, and copy the deployment
@rem  descriptors into it.
@rem  You should have already run your egen script so your xml files
@rem  are already built.

md build build\META-INF
copy TradeServer-jar.xml ejb-jar.xml
copy wl-TradeServer-jar.xml weblogic-ejb-jar.xml
copy *.xml build\META-INF

@rem  Compile ejb classes into the build directory (jar preparation)
javac -d build -classpath %CLASSPATH%  *.java

@rem  Make a standard ejb jar file, including XML deployment
@rem  descriptors
cd build
jar cvf std_%TARGETJAR% META-INF sample
cd ..

@rem  Run ejbc to create the deployable jar file

java -classpath %CLASSPATH% -Dweblogic.home=%WL_HOME% weblogic.ejbc -compiler
javac build\std_%TARGETJAR% %TARGETJAR%
```

2. Deploy the EJB in BEA WebLogic Server by configuring it as a new EJB in the WebLogic Administration Console. Configure this new EJB as follows:

   a. Click the **EJB** icon under **Deployments**.

      The **EJB Deployments** screen appears (see Figure 4-1).

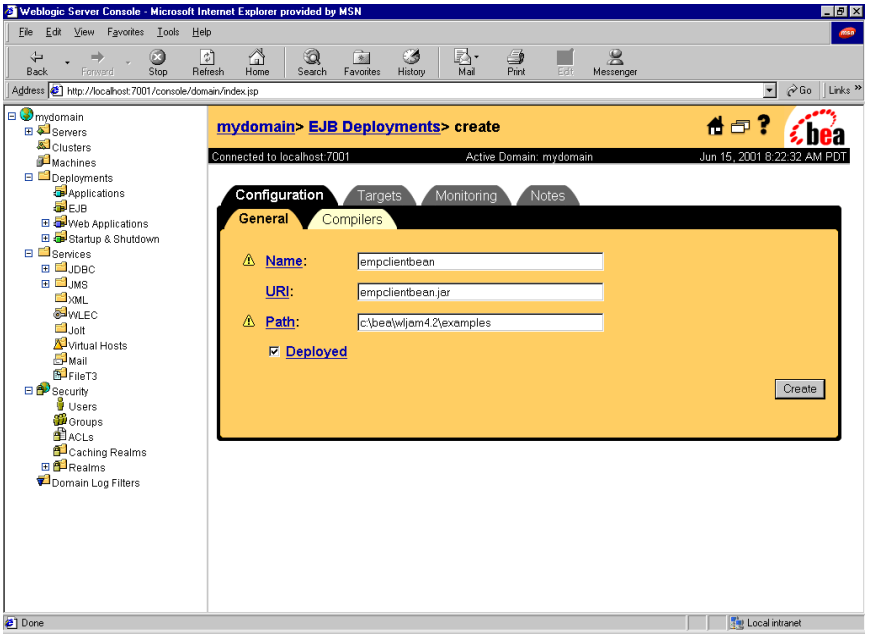
**Figure 4-1 Configuring a New EJB**




b. Click the **Configure a new EJB** link.

The **EJB Deployments Create** screen appears (see Figure 4-2).

**Figure 4-2 New EJB Configuration Screen**




c. Enter the name of your EJB in the **Name** field, the EJB Deployment `.jar` file in the **URI** field, and the path to the EJB Deployment `.jar` file in the **Path** field. Make sure that the **Deployed** checkbox is checked. Then, click **Create**.

   Your JAM eGen EJB is now deployed.

# Deploying a WebLogic JAM eGen Servlet (Quick-Start Deployment)

The basic JAM eGen servlet is deployed like any other WebLogic servlet. The configuration for the eGen servlet is stored in the `web.xml` file in an applications directory associated with a domain. The basic default configuration can be found in the following directory:

```
<BEA_HOME>/<JAM_INSTALL_DIR>/config/verify/applications/
     DefaultWebApp/WEB-INF/web.xml
```

For example, suppose a servlet is generated by executing the eGen utility on a script containing the following servlet definition:

```
servlet sample.SampleServlet shows initial
```

This produces a servlet class file named `SampleServlet` in a package called `sample`.

For the `SampleServlet`, add the `classes` and `sample` directories, so the directory structure looks like the following:

```
<BEA_HOME>/<JAM_HOME>/config/verify/applications/
     DefaultWebApp/WEB-INF/classes/sample
```

The `SampleServlet` and the associated DataView class, which are the result of compiling the `*.java` files generated by the eGen utility, should be placed in the `sample` directory.

`SampleServlet` can be configured with an XML entry (added to `web.xml`) similar to the one shown in Listing 4-2:

**Listing 4-2 XML Entry to Configure the SampleServlet Servlet**

```
<web-app>
       <servlet>
              <servlet-name>
                     SampleServlet
              </servlet-name>
              <servlet-class>
                     sample.SampleServlet
              </servlet-class>
       </servlet>
       <servlet-mapping>
              <servlet-name>
                     SampleServlet
              </servlet-name>
              <url-pattern>
                     /SampleServlet/*
              </url-pattern>
       </servlet-mapping>
</web-app>
```

`SampleServlet` can then by invoked by entering the following URL in the location field of your web browser:

```
http://<host>:<port>/SampleServlet
```

If WebLogic Server is running on your local machine and you used the default port (7001) when you installed WebLogic Server, `SampleServlet` can be invoked by the following URL:

```
http://localhost:7001/SampleServlet
```

# 5 Understanding Programming Flows

This section illustrates the interaction between WebLogic Server and mainframe programs. The following topics are discussed:

- Distributed Program Link Programming Flows
- IMS Implicit APPC Programming Flows
- Common Programming Interface for Communications Programming Flows

## Distributed Program Link Programming Flows

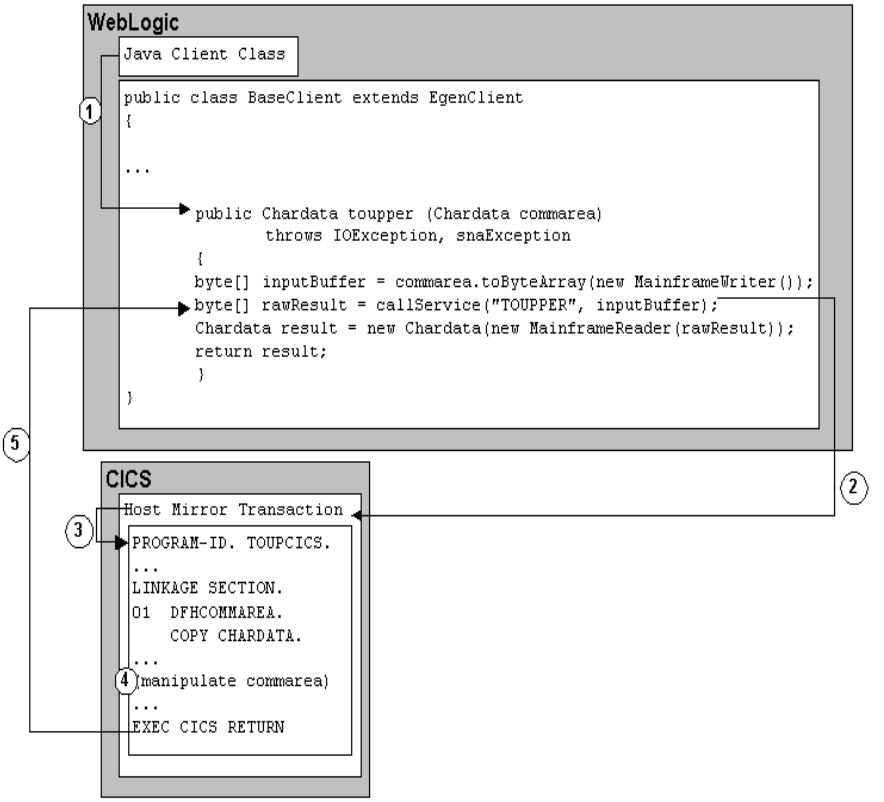
The following examples of DPL programming flows are discussed:

- Java Client Request/Response to CICS DPL
- CICS Request/Response DPL to WebLogic Server EJB
- CICS DPL Asynchronous No Reply to WebLogic Server Application
- Transactional Java Client Request/Response to CICS DPL
- Transactional CICS Request/Response DPL to WebLogic Server EJB

# Java Client Request/Response to CICS DPL

Figure 5-1 illustrates a Java Client Request/Response to CICS DPL programming flow.

**Figure 5-1 Java Client Request/Response to CICS DPL**



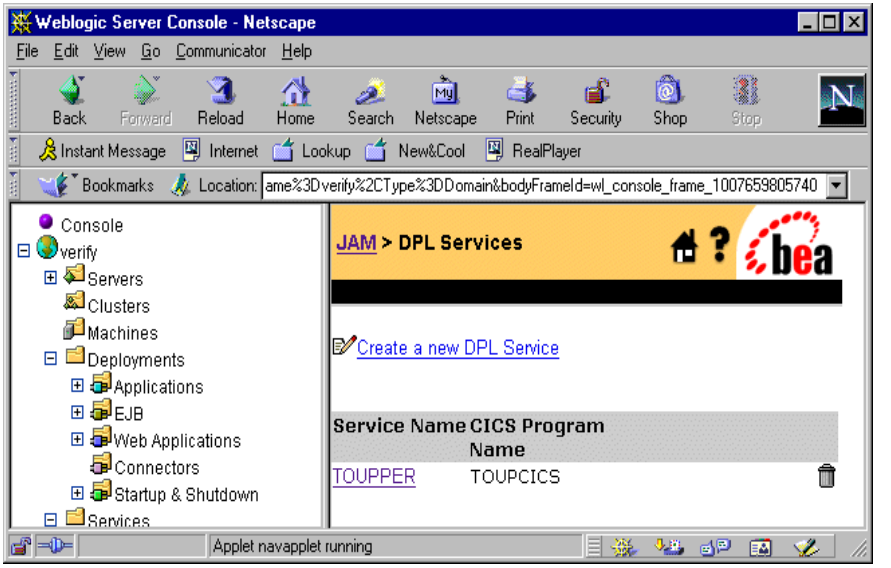

The following steps describe the Java Client Request/Response to CICS DPL programming flow.

1. A Java client class (such as a stand-alone client, EJB, etc.) makes a call to the `BaseClient.toupper` method with a `Chardata` DataView as the parameter.

2. In the `toupper` method, a call is made to the `EgenClient.callService` method.

   **Note:** The `BaseClient` extends `EgenClient`, so the `BaseClient` inherits the `callService` method from `EgenClient`.

   The value of the first parameter is `TOUPPER`. `TOUPPER` is the name of the DPL Service that is mapped to the CICS DPL program `TOUPCICS` in the WebLogic Administrative Console.




3. The host mirror transaction starts the `TOUPCICS` program and passes the contents of the `inputBuffer` byte array as the `commarea`.

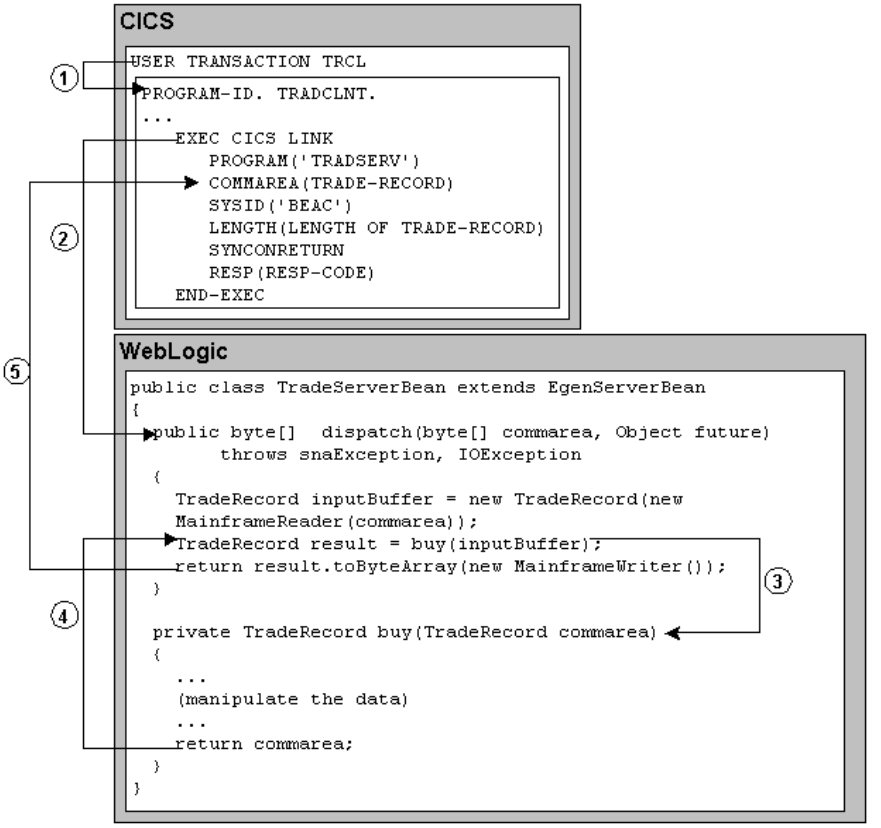
4. The `TOUPCICS` program processes the data.

5. The CICS server returns the `commarea`. The data is returned from the `EgenClient.callService` method as the byte array `rawResult`.

# CICS Request/Response DPL to WebLogic Server EJB

Figure 5-2 illustrates a CICS request/response DPL to WebLogic Server EJB programming flow.

**Figure 5-2 CICS Request/Response DPL to WebLogic Server EJB**

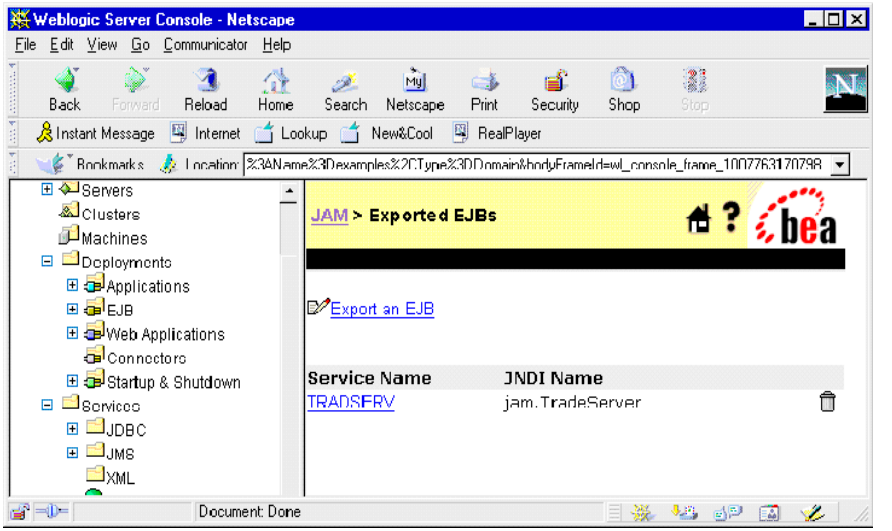



The following steps describe the CICS request/response DPL to WebLogic Server EJB programming flow.

1. The user-entered transaction `TRCL` invokes the `TRADCLNT` program.

   The `EXEC CICS LINK` command causes the advertised service `TRADSERV` to execute. The `SYSID` value is set to the name of the connection associated with the CRM Logical Unit. The `SYNCONTRETURN` parameter indicates that the WebLogic Server EJB will not be involved in the CICS transaction.

2. In the WebLogic Administration Console, the `TRADSERV` service is mapped to the JNDI name `jam.TradeServer` for the `TradeServer` EJB. This causes the dispatch method of `TradeServerBean` to be invoked.




3. The `buy` method is invoked from the `dispatch` method.

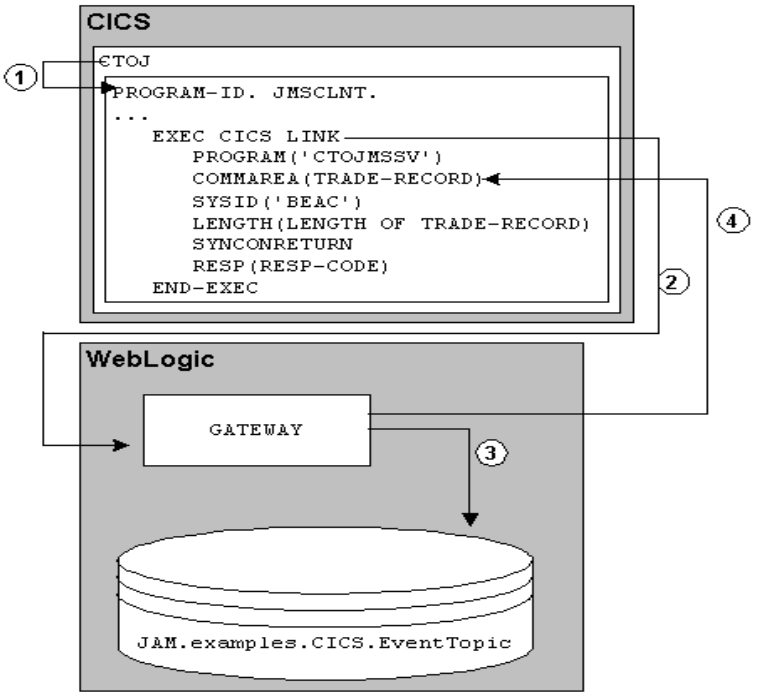
4. The business logic is performed, and the result is returned to the `dispatch` method.

5. The data is returned from the `dispatch` method into the `COMMAREA`.

# CICS DPL Asynchronous No Reply to WebLogic Server Application

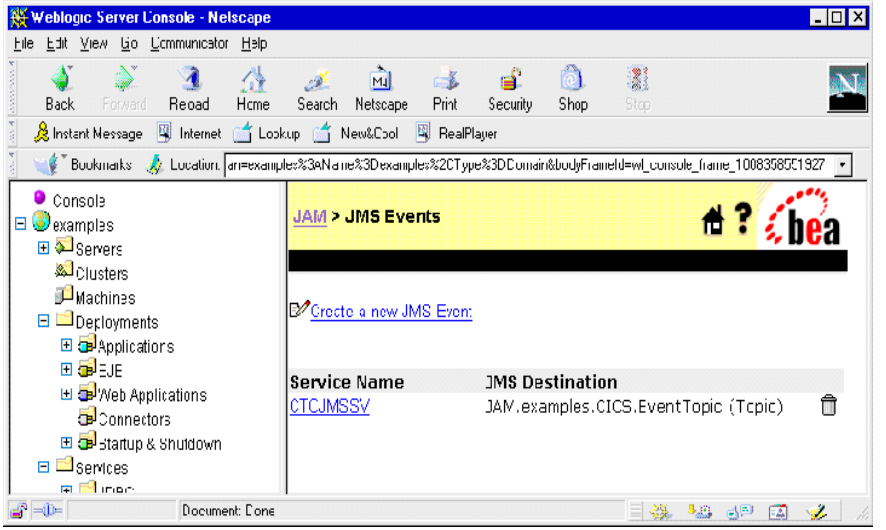
Figure 5-3 illustrates a CICS DPL asynchronous no reply to Java server programming flow.

**Figure 5-3 CICS DPL asynchronous no reply to Java server**




The following steps describe the CICS DPL asynchronous no reply to Java server programming flow.

1. The user-entered transaction `CTOJ` invokes the `JMSCLNT` program.
2. The `EXEC CICS LINK` command causes the advertised service `CTOJMSSV` to execute. The `SYSID` value is set to the name of the connection associated with the CRM Logical Unit. The `SYNCONTRETURN` parameter indicates that the WebLogic Server EJB will not be involved in the CICS transaction.
3. The Gateway sends the message to the JMS Event `CTOJMSSV`. In the WebLogic Administration Console, the `CTOJMSSV` service name is mapped to the JMS topic `Jam.examples.CICS.EventTopic`.

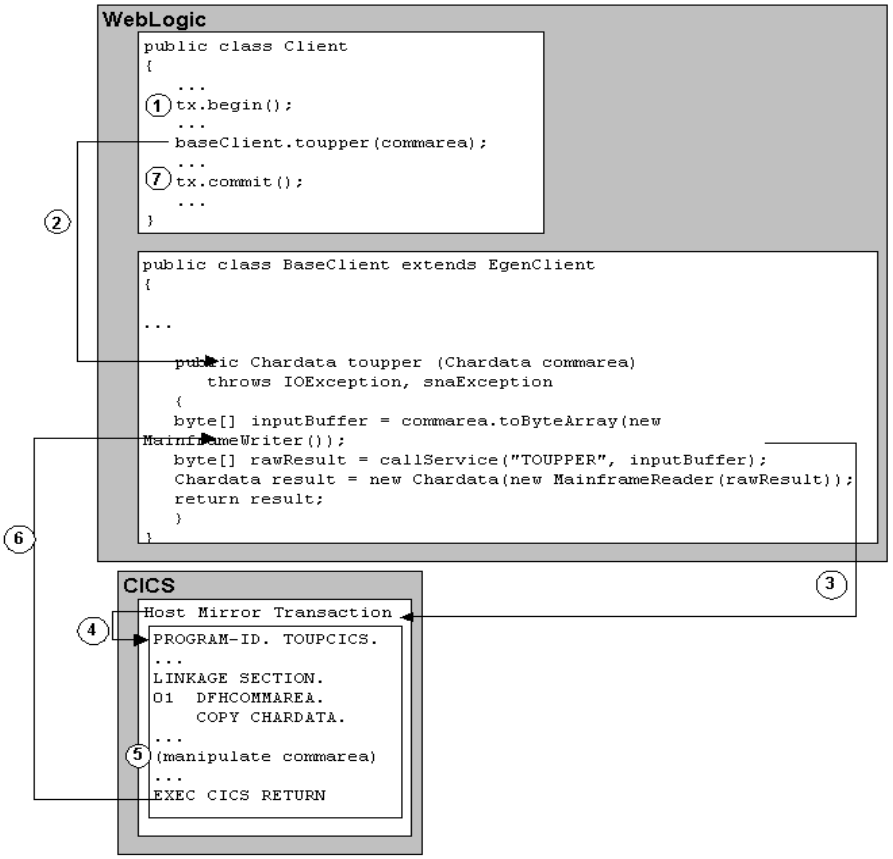



4. Data that is identical to the request data is returned in the `COMMAREA` to `JMSCLNT`.

# Transactional Java Client Request/Response to CICS DPL

Figure 5-4 illustrates a transactional Java client request/response to CICS DPL programming flow.

**Figure 5-4 Transactional Java Client Request/Response to CICS DPL**

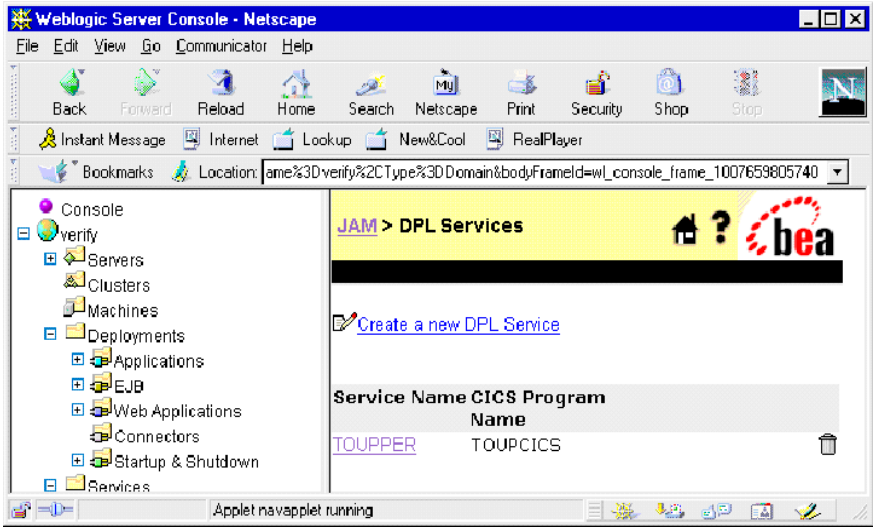



The following steps describe the transactional Java client request/response to CICS DPL programming flow.

1. A Java client class calls the `begin` method of a `UserTransaction` object to start a transaction.
2. Within the boundaries of that transaction, the Java client class makes a call to the `BaseClient.toupper` method with a `Chardata` DataView as the parameter.
3. In the `toupper` method, a call is made to the `EgenClient.callService` method.

**Note:** The `BaseClient` extends `EgenClient`, so the `BaseClient` inherits the `callService` method from `EgenClient`.

The value of the first parameter is `TOUPPER`. `TOUPPER` is the name of the DPL Service that is mapped to the CICS DPL program `TOUPCICS` in the WebLogic Administration Console.

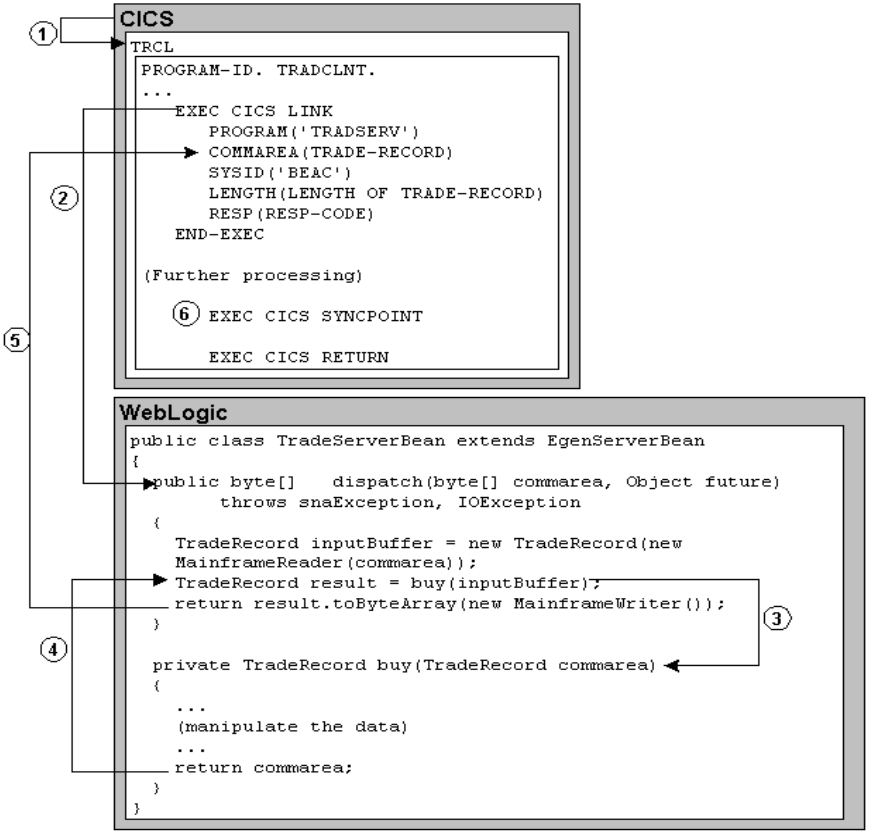



4. The host mirror transaction starts the `TOUPCICS` program and passes the contents of the `inputBuffer` byte array as the commarea.
5. The `TOUPCICS` program processes the data.
6. The CICS server returns the `commarea`. The data is returned from the `EgenClient.callService` method as the byte array `rawResult`.
7. The Java client class calls the `commit` method of the `UserTransaction` object to indicate the successful completion of the transaction. This causes the commit of the WebLogic managed resources, as well as the resources held by the Host Mirror Transaction.

# Transactional CICS Request/Response DPL to WebLogic Server EJB

Figure 5-5 illustrates a transactional CICS request/response DPL to WebLogic Server EJB programming flow.

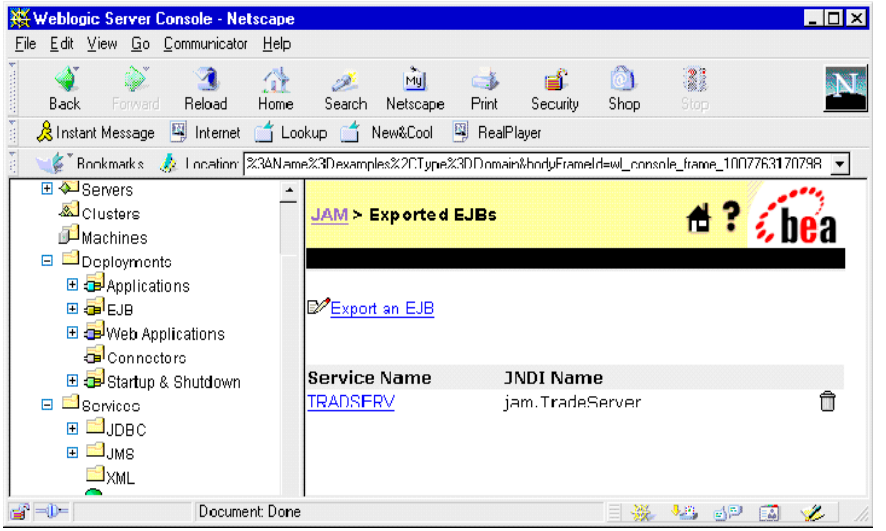
**Figure 5-5 Transactional CICS Request/Response DPL to WebLogic Server EJB**




The following steps describe the transactional CICS request/response DPL to WebLogic Server EJB programming flow.

1. The user-entered transaction `TRCL` invokes the `TRADCLNT` program.
2. The `EXEC CICS LINK` command causes the advertised service `TRADSERV` to execute. The `SYSID` value is set to the name of the connection associated with the CRM Logical Unit. When the `SYNCONRETURN` command is not included in the `EXEC CICS LINK`, this indicates that the WebLogic Server is involved in the CICS transaction.

   In the WebLogic Administration Console, the `TRADSERV` service is mapped to the JNDI name `jam.TradeServer` for the `TradeServer` EJB. This causes the dispatch method of `TradeServerBean` to be invoked.




3. The `buy` method is invoked from the dispatch method.
4. The business logic is performed, and the result is returned to the `dispatch` method.
5. The data is returned from the `dispatch` method into the `COMMAREA`.
6. If necessary, further processing can be done in `TRADCLNT` before the `EXEC CICS SYNCPOINT` that ends the transaction.

# IMS Implicit APPC Programming Flows

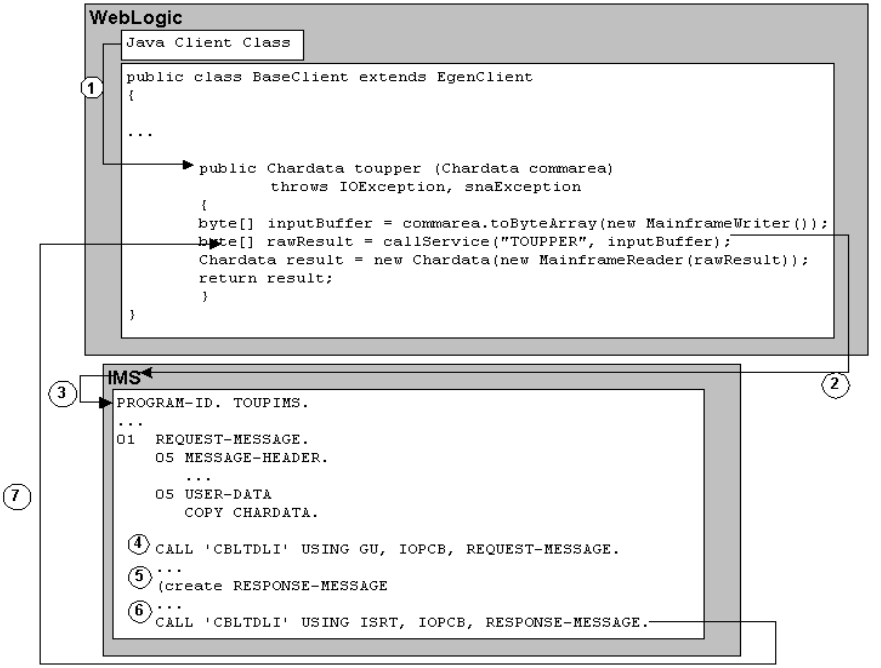
The following examples of IMS implicit APPC programming flows are discussed:

- Java Client Request/Response to IMS Transaction Program
- IMS Asynchronous No Reply Transaction Program to Java Server
- Transactional Java Client Request/Response to IMS Transaction Program

## Java Client Request/Response to IMS Transaction Program

Figure 5-6 illustrates a Java Client Request/Response to IMS programming flow.

**Figure 5-6 Java Client Request/Response to IMS Transaction Program**

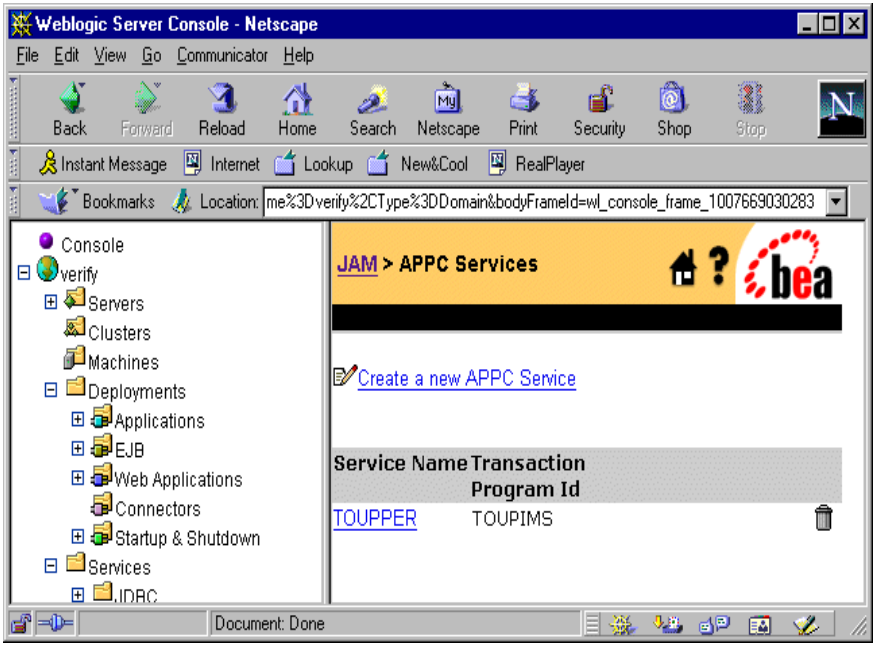



The following steps describe the Java Client Request/Response to IMS programming flow.

1. A Java client class (such as a stand-alone client, EJB, etc.) makes a call to the `BaseClient.toupper` method with a `Chardata` DataView as the parameter.
2. In the `toupper` method, a call is made to the `EgenClient.callService` method.

   **Note:** The `BaseClient` extends `EgenClient`, so the `BaseClient` inherits the `callService` method from `EgenClient`.

   The value of the first parameter is `TOUPPER`. `TOUPPER` is the name of the APPC Service that is mapped to the IMS transaction `TOUPIMS` in the WebLogic Administrative Console.

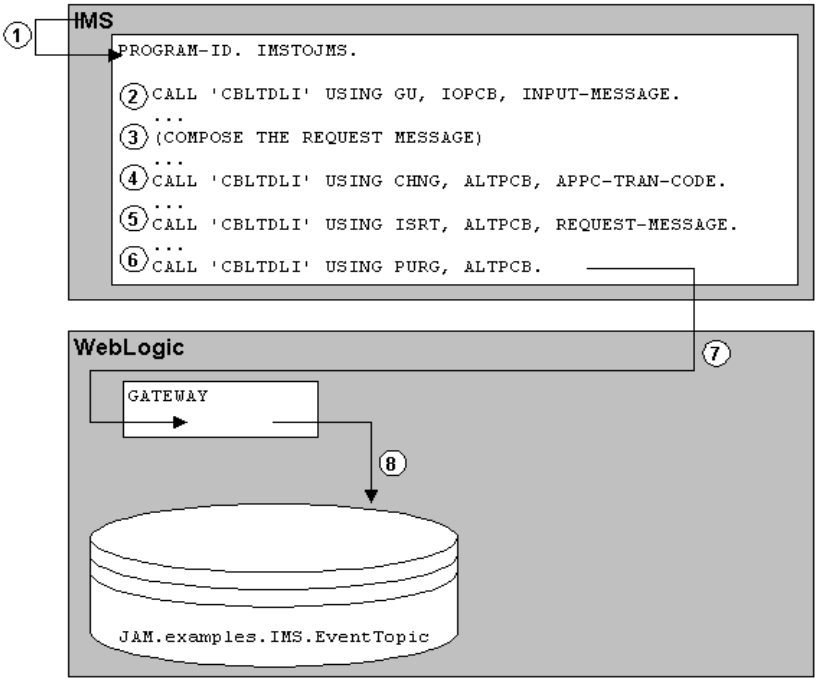



3. IMS starts the `TOUPIMS` transaction. This transaction executes the associated program `TOUPIMS`. The contents of the `inputBuffer` byte array are placed on an `IOPCB` as request data.
4. The `TOUPIMS` program accesses the request data by performing a `get unique` on the `IOPCB`.
5. The `TOUPIMS` program processes the data and creates a response message.
6. The `TOUPIMS` program inserts the response data to the `IOPCB`.
7. IMS returns the response data back to the requester. The data is returned from the `EgenClient.callService` method as the byte array `rawResult`.

# IMS Asynchronous No Reply Transaction Program to Java Server

Figure 5-7 illustrates an IMS asynchronous no reply transaction program to a Java server programming flow.

**Figure 5-7 IMS Asynchronous No Reply Transaction Program to Java Server**




The following steps describe the IMS transaction program to asynchronous no reply Java Server programming flow.

1. IMS starts the `IMSTOJMS` transaction. This transaction executes the associated program `IMSTOJMS`.
2. The `IMSTOJMS` program accesses the input data by doing a `get unique` on the `IOPCB`.

3. The IMSTOJMS program composes the request message.
4. The IMSTOJMS program issues a call with the CHNG function code to store the appropriate logical terminal name in a modifiable alternate PCB.

   **Note:** To use an alternate PCB, you must include a PCB statement in your PSB (see Listing 5-1).

**Listing 5-1 IMS PSBGEN for a Modifiable Alternate PCB for the IMS Client**

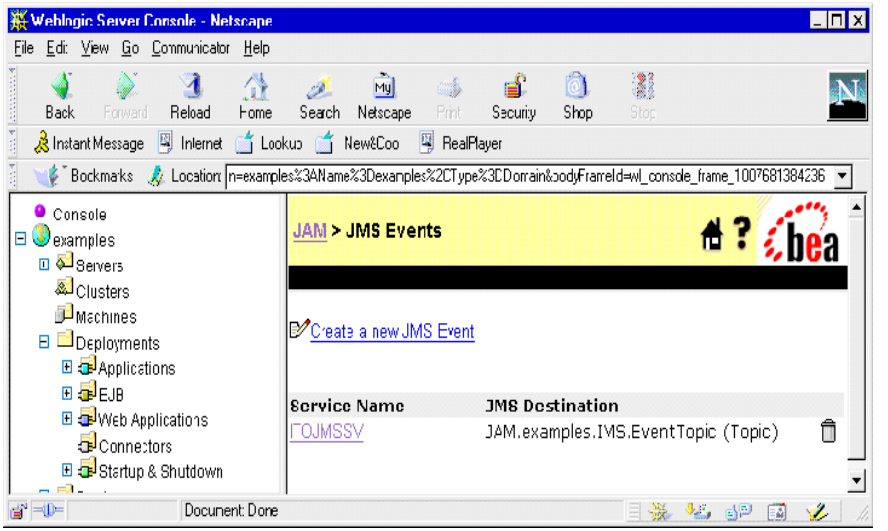
```
PCB    TYPE=TP,MODIFY=YES
PSBGEN PSBNAME=IMSTOJMS,CMPAT=YES,LANG=COBOL
```

**Note:** The logical terminal name, in this case JAMIMS01, must be mapped to an LU name and a transaction name in a LU 6.2 Descriptor. In Listing 5-2, JAMIMS01 is mapped to the LU CRMLU and the transaction ITOJMSSV.

**Listing 5-2 LU 6.2 Descriptor**

```
A JAMIMS01 LUNAME=CRMLU TPNAME=ITOJMSSV SYNCLEVEL=N
```

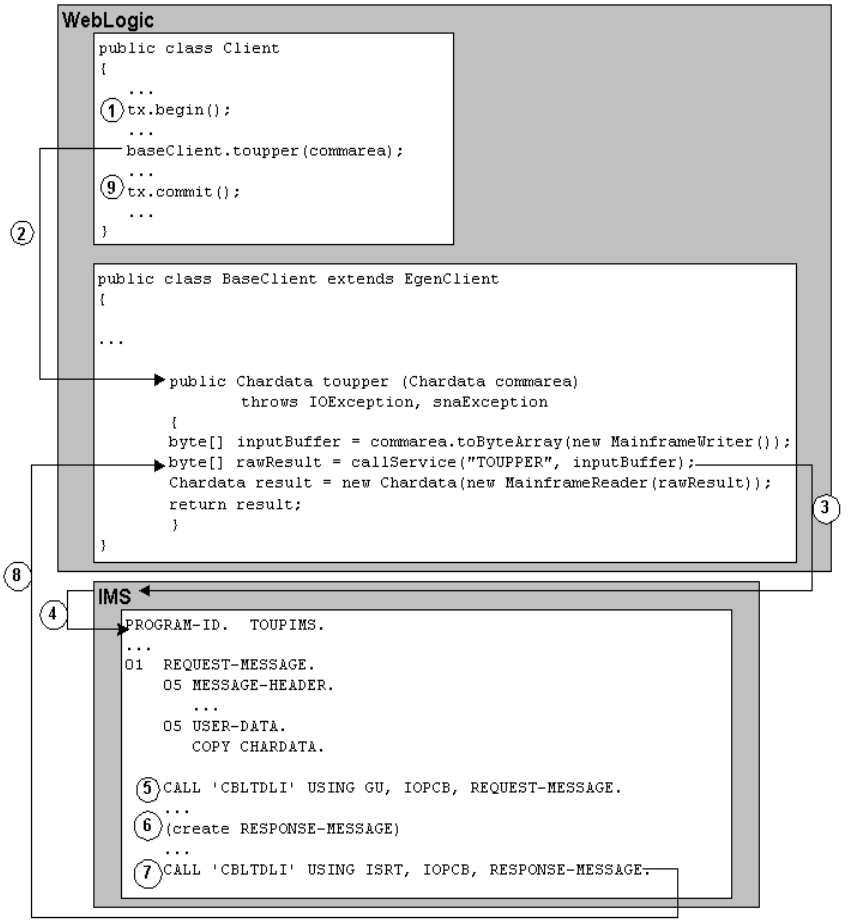
5. The IMSTOJMS program issues an insert call with the request message to the alternate PCB, ALTPCB.
6. The IMSTOJMS program issues a PURG call to the alternate PCB, ALTPCB, to tell IMS to send the request message.
7. IMS sends the request message to the indicated LU, the LU configured for the CRM. The request message is forwarded to the Gateway.
8. The gateway sends the message to the JMS Event ITOJMSSV. ITOJMSSV is the transaction name in the LU 6.2 descriptor in Listing 5-2. In the WebLogic Administration Console, the ITOJMSSV service name is mapped to the JMS topic JAM.examples.IMS.EventTopic.




# Transactional Java Client Request/Response to IMS Transaction Program

Figure 5-8 illustrates a transactional Java client request/response to an IMS transaction programming flow.

**Figure 5-8 Transactional Java Client Request/Response to an IMS Transaction Program**




The following steps describe the transactional Java client request/response to IMS transaction programming flow.

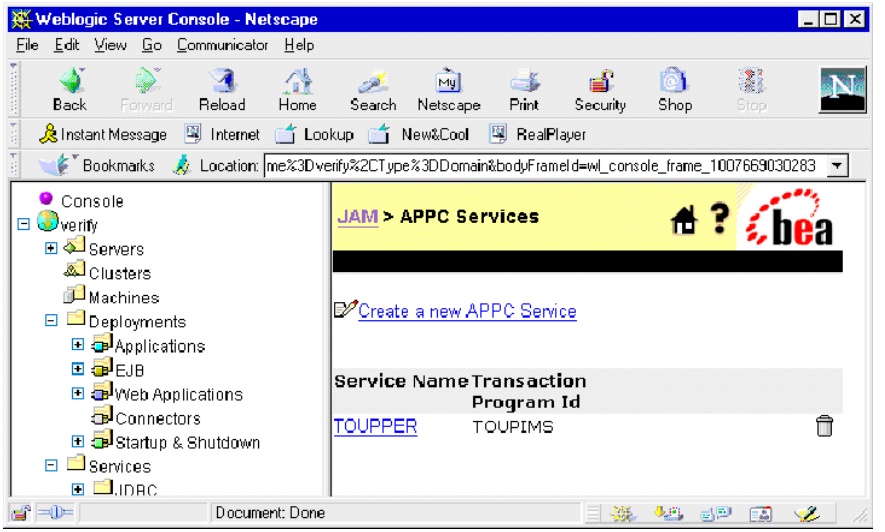
1. A Java client class calls the `begin` method of a `UserTransaction` object to start a transaction.

2. Within the boundaries of that transaction, the Java client class makes a call to the `BaseClient.toupper` method with a `Chardata` DataView as the parameter.

3. In the `toupper` method, a call is made to the `EgenClient.callService` method.

   **Note:** The `BaseClient` extends `EgenClient`, so the `BaseClient` inherits the `callService` method from `EgenClient`.

   The value of the first parameter is `TOUPPER`. `TOUPPER` is the name of the APPC Service that is mapped to the IMS transaction `TOUPIMS` in the WebLogic Administration Console.




4. IMS starts the `TOUPIMS` transaction that executes the associated program `TOUPIMS`. The contents of the `inputBuffer` byte array are placed on an IOPCB as request data.

5. The `TOUPIMS` program accesses the request data by doing a `get unique` on the IOPCB.

6. The `TOUPIMS` program processes the data and creates a response message.

7. The `TOUPIMS` program inserts the response data to the IOPCB.

8. IMS returns the response data back to the requester. The data is returned from the `EgenClient.callService` method as the byte array `rawResult`.

9. The Java client class calls the `commit` method of the `UserTransaction` object to indicate the successful completion of the transaction. This causes the commit of the WebLogic managed resources, as well as the resources managed by IMS.

# Common Programming Interface for Communications Programming Flows

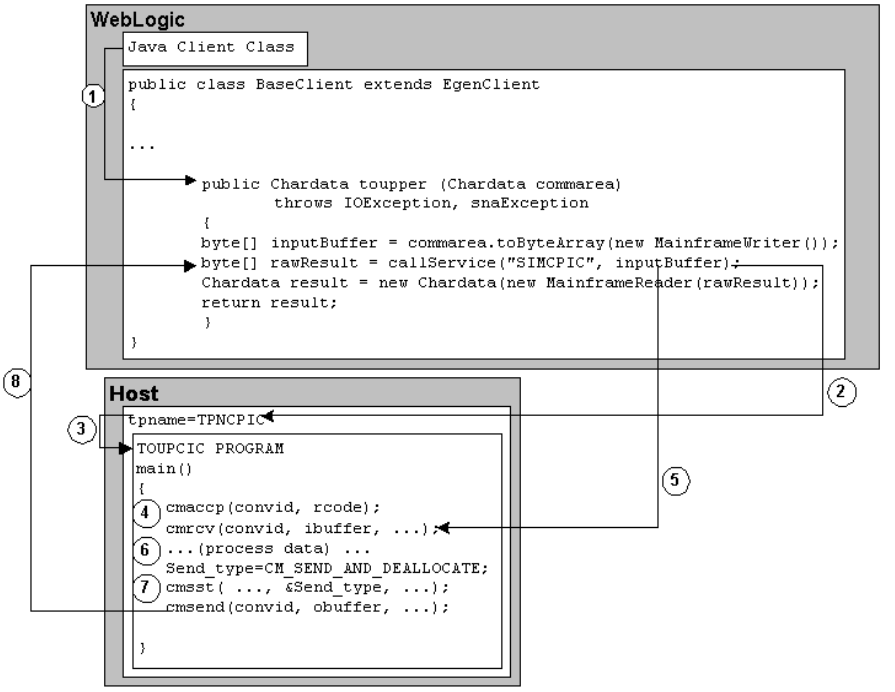
The following examples of CPI-C programming flows are discussed:

- Java Client Request/Response to Host CPI-C
- Host CPI-C Request/Response to WebLogic Server EJB
- Transactional Java Client Request/Response to Host CPI-C
- Host CPI-C Asynchronous No Reply to Java Server
- Transactional Host CPI-C Request/Response to WebLogic Server EJB

## Java Client Request/Response to Host CPI-C

Figure 5-9 illustrates a Java client request/response to a host CPI-C programming flow.

**Figure 5-9 Java Client Request/Response to Host CPI-C**

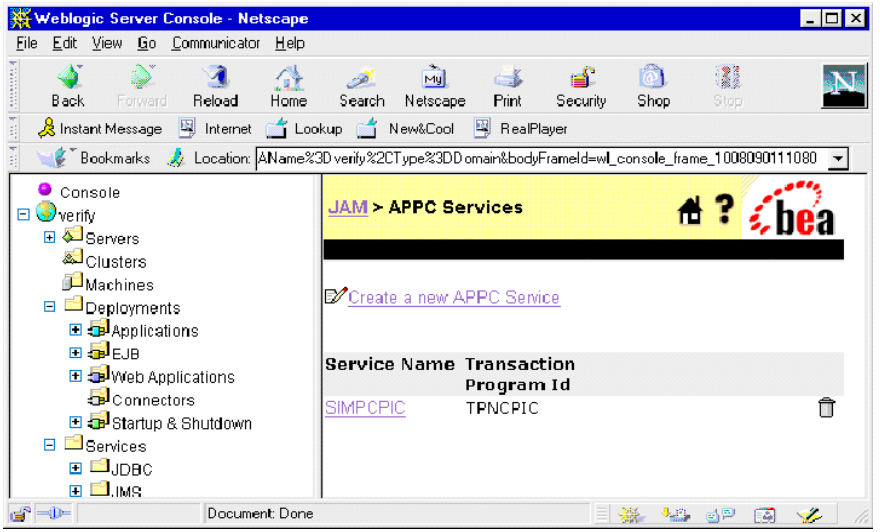



The following steps describe the Java client request/response to host CPI-C programming flow.

1. A Java client class (such as a stand-alone client, EJB, etc.) makes a call to the `BaseClient.toupper` method with a `Chardata` dataview as the parameter.
2. In the `toupper` method, a call is made to the `EgenClient.callService` method.

   **Note:** The `BaseClient` extends `EgenClient`, so the `BaseClient` inherits the `callService` method from `EgenClient`.

   The value of the first parameter is `SIMPCPIC`. `SIMPCPIC` is the name of the APPC Service that is mapped to the CPI-C Transaction Program ID `TPNCPIC` in the WebLogic Administration Console.

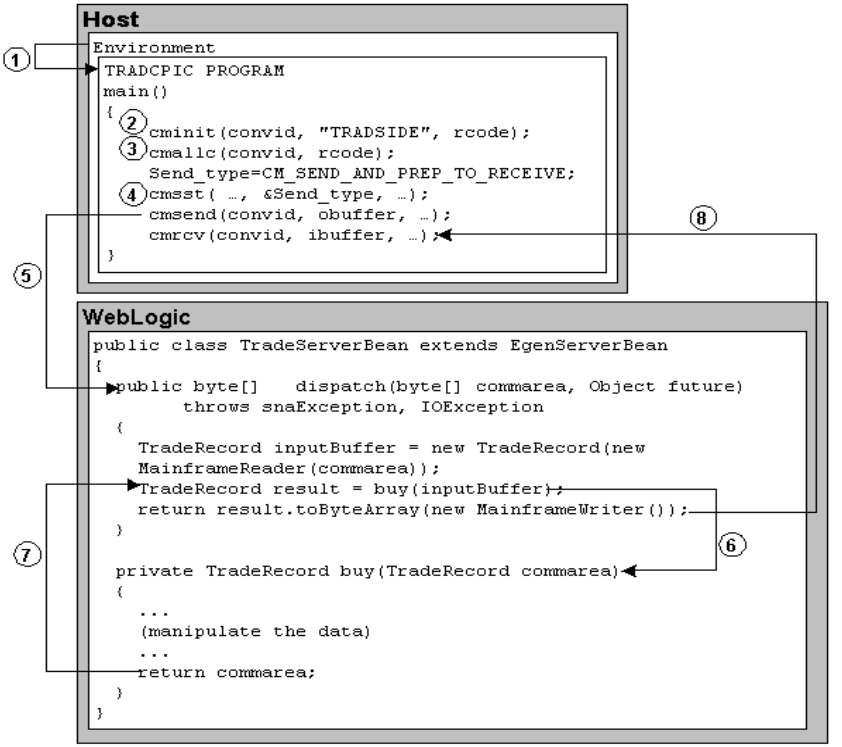



3. The transaction program `TPNCPIC` invokes the `TOUPCPIC` program.
4. `TOUPCPIC` accepts the conversation with the `cmaccp` call. The conversation ID returned in `convid` is used for all other requests on this conversation.
5. The `cmrcv` request receives the `inputBuffer` buffer contents for processing.
6. The `TOUPCPIC` program processes that data.
7. The `cmsst` request prepares for the send request by setting the send type to `CM_SEND_AND_DEALLOCATE`.
8. The `cmsend` request returns the `obuffer` contents. The data is returned from the `EgenClient.callService` method as the byte array `rawResult`.

# Host CPI-C Request/Response to WebLogic Server EJB

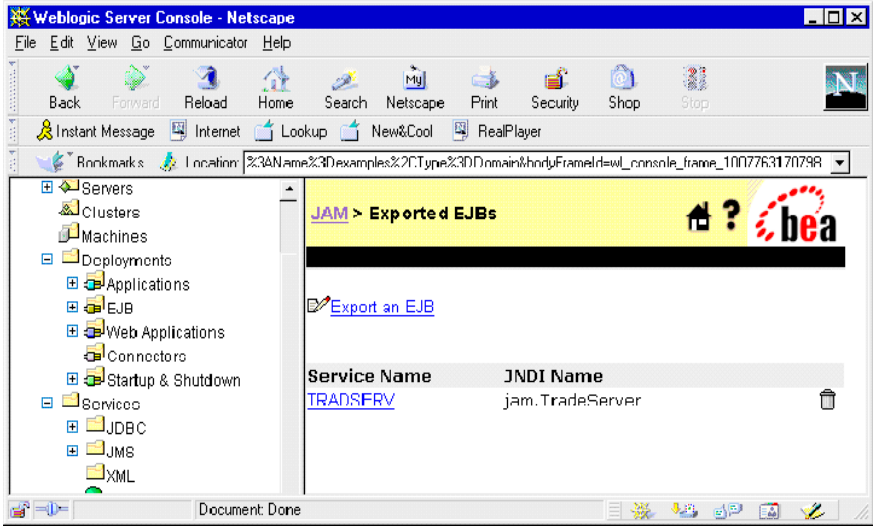
Figure 5-10 illustrates a host CPI-C request/response to WebLogic Server EJB programming flow.

**Figure 5-10 Host CPI-C Request/Response to WebLogic Server EJB**




The following steps describe the host CPI-C request/response to WebLogic Server EJB programming flow.

1. The CPI-C application program `TRADCPIC` is invoked using the environment start-up specifications.
2. The `TRADCPIC` client requests `cminit` to establish conversation attributes and receive a conversation ID that will be used on all other requests on this conversation. The remote server and service are named in the CPI-C side information entry `TRADSIDE`.
3. The `cmallc` request initiates the advertised service `TRADSERV`. In the WebLogic Administration Console, the `TRADSERV` service is mapped to the JNDI name `jam.TradeServer` for the `TradeServer` EJB.

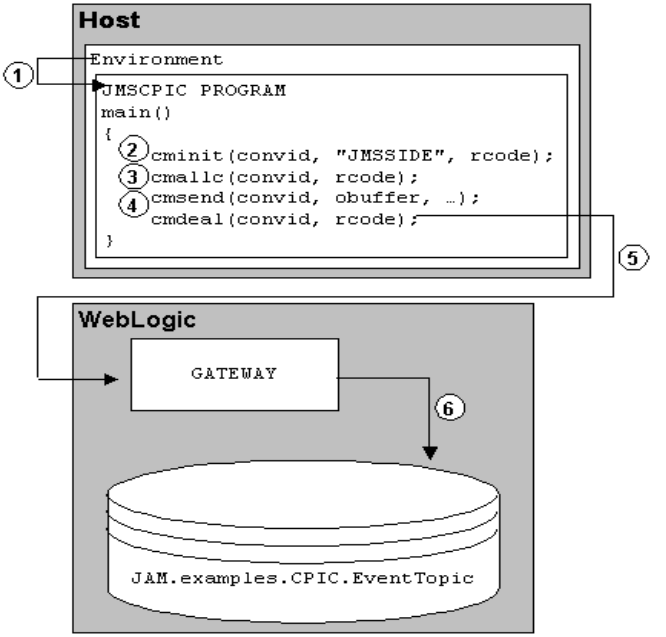



4. The `cmsst` request prepares the next `send` request by setting the send type to `CM_SEND_AND_PREP_TO_RECEIVE`.
5. The `cmsend` request immediately sends the contents of the `obuffer` to the dispatch method of `TradeServerBean` in the `commarea` byte array and relinquishes control.
6. The `buy` method is messaged from the `dispatch` method.
7. The business logic is performed, and the result is returned to the `dispatch` method.
8. The `cmrcv` request receives the contents of the byte array returned from the `dispatch` method in the `ibuffer` buffer, and notification that the conversation has ended with the return code value of `CM_DEALLOCATED_NORMAL`.

# Host CPI-C Asynchronous No Reply to Java Server

Figure 5-11 illustrates a Host CPI-C asynchronous no reply to Java server programming flow.

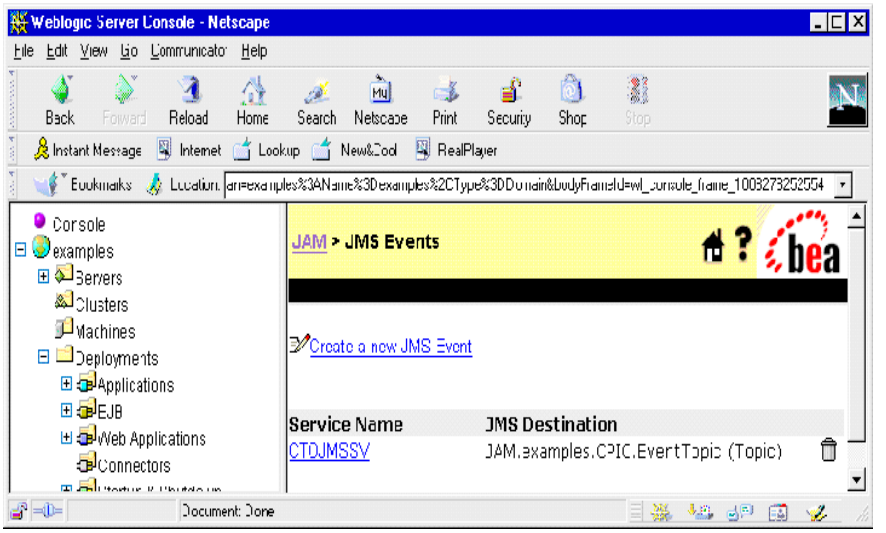
**Figure 5-11 Host CPI-C Asynchronous No Reply to Java Server**




The following steps describe the Host CPI-C asynchronous no reply to Java server programming flow.

1. The CPI-C application program `JMSCPIC` is invoked using the environment start-up specifications.
2. The `JMSCPIC` client requests `cminit` to establish conversation attributes and receive a conversation ID that will be used on all other requests on this conversation. The remote server and service are named in the CPI-C side information entry `JMSSIDE`.
3. The `cmallc` request initiates the advertised service `CTOJMSSV`.
4. The `cmsend` request sends the contents of the `obuffer` to the `CTOJMSSV` service.
5. The `cmdeal` request flushes the data and indicates the conversation is finished. The request message is forwarded to the Gateway.

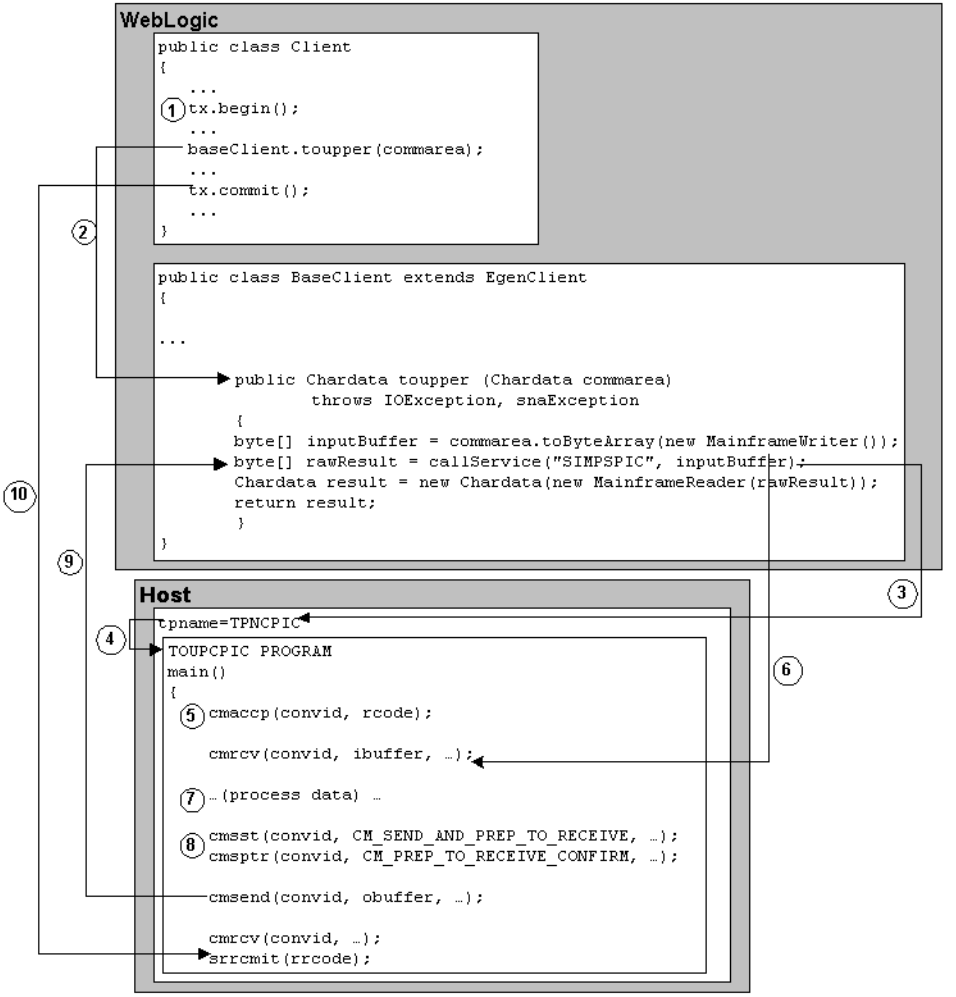
6. The Gateway sends the message to the JMS Event `CTOJMSSV`. In the WebLogic Administration Console, the `CTOJMSSV` service name is mapped to the JMS topic `JAM.examples.CPIC.EventTopic`.




# Transactional Java Client Request/Response to Host CPI-C

Figure 5-12 illustrates a transactional Java client request/response to a Host CPI-C programming flow.

**Figure 5-12 Transactional Java Client Request/Response to a Host CPI-C**




The following steps describe the transactional Java client request/response to a host CPI-C programming flow.

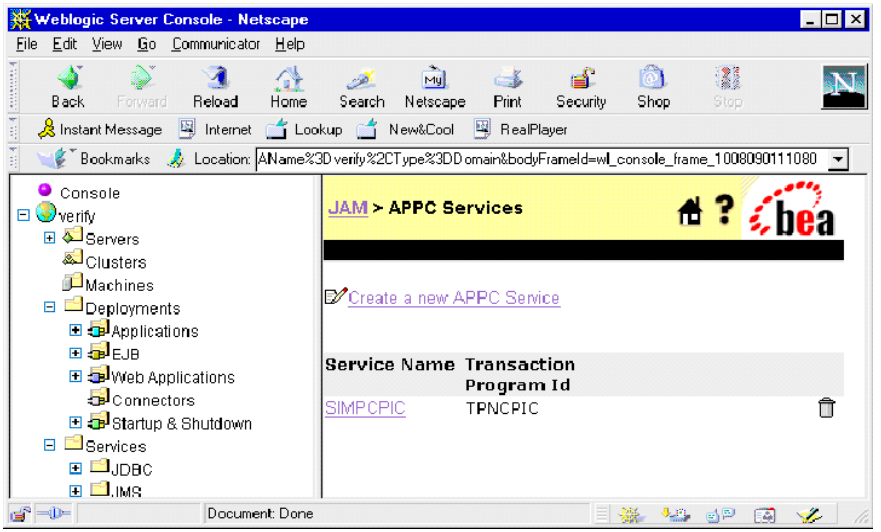
1. A Java client class calls the `begin` method of a `UserTransaction` object to start a transaction.

2. Within the boundaries of that transaction, the Java client class (stand-alone client, EJB, etc.) makes a call to the `BaseClient.toupper` method with a `Chardata` DataView as the parameter.

3. In the `toupper` method, a call is made to the `EgenClient.callService` method.

   **Note:** The `BaseClient` extends `EgenClient`, so the `BaseClient` inherits the `callService` method from `EgenClient`.

   The value of the first parameter is `SIMPCPIC`. `SIMPCPIC` is the name of the APPC Service that is mapped to the CPI-C transaction program ID `TPNCPIC` in the WebLogic Administration Console.




4. The transaction program with the `tpname` `TPNCPIC` invokes the `TOUPCPIC` program.

5. `TOUPCPIC` accepts the conversation with the `cmaccp` call. The conversation ID returned in `convid` is used for all other requests on this conversation.

6. The `cmrcv` request receives the `inputBuffer` buffer contents for processing.

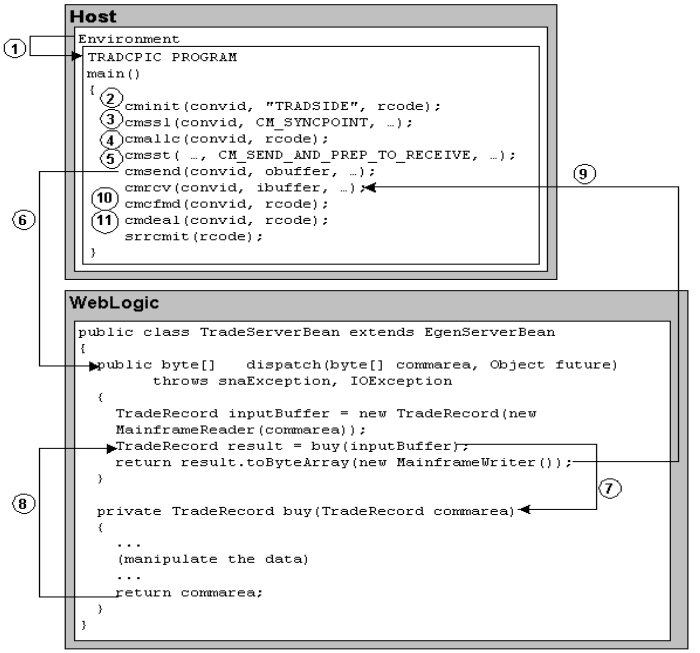
7. The `TOUPCPIC` program processes that data.

8. The `cmsst` and `cmsptr` prepare the next send request by setting the send type to `CM_SEND_AND_PREP_TO_RECEIVE` and by setting the prepare-to-receive type to `CM_PREP_TO_RECEIVE_CONFIRM`. The `CONFIRM` indicates that the service has completed successfully.
9. The `cmsend` request returns the `obuffer` contents. The data is returned from the `EgenClient.callService` method as the byte array `rawResult`.
10. The Java client class calls the `commit` method of the `UserTransaction` object to indicate the successful completion of the transaction and request the commit of all updated resources. The `cmrcv` request receives the `commit` request, and responds explicitly to the request with the SAA Resource/Recovery commit call `srrcmit`. The conversation is ended after the successful commit exchange.

# Transactional Host CPI-C Request/Response to WebLogic Server EJB

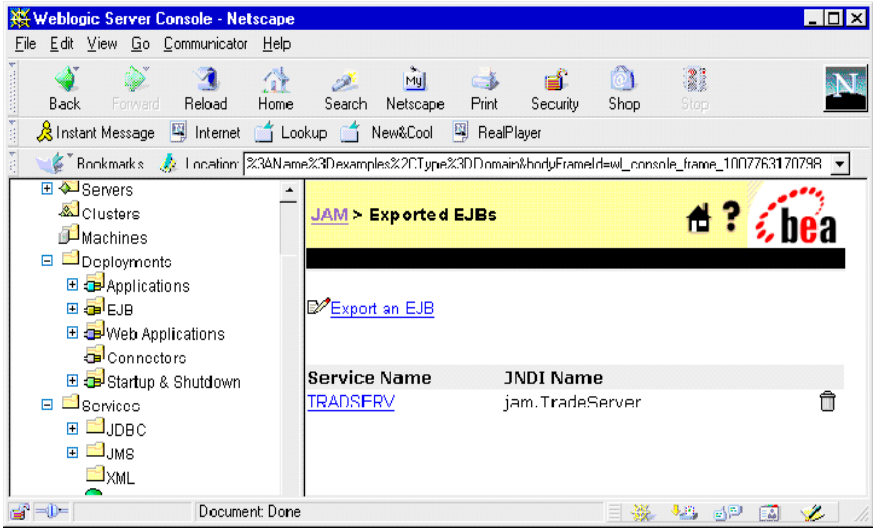
Figure 5-13 illustrates a transactional host CPI-C request/response to WebLogic Server EJB programming flow.

**Figure 5-13 Transactional Host CPI-C Request/Response to WebLogic Server EJB**




The following steps describe the transactional host CPI-C request/response to WebLogic Server EJB programming flow.

1. The CPI-C application program `TRADCPIC` is invoked using the environment start-up specifications.
2. The `TRADCPIC` client requests `cminit` to establish conversation attributes and receive a conversation ID that will be used on all other requests on this conversation. The remote server and service are named in the CPI-C side information entry `TRADSIDE`.
3. The `cmssl` sets the conversation attribute to sync-level 2 with `CM_SYNCPOINT`. This allows the WebLogic EJB to participate in the transaction.
4. The `cmallc` request initiates the advertised service `TRADSERV`. In the WebLogic Administration Console the `TRADSERV` service is mapped to the JNDI name `jam.TradeServer` for the `TradeServer` EJB.




5. The `cmsst` request prepares the next send request by setting the send type to `CM_SEND_AND_PREP_TO_RECEIVE`.

6. The `cmsend` request immediately sends the contents of the `obuffer` to the dispatch method of `TradeServerBean` in the `commarea` byte array and relinquishes control.

7. The `buy` method is messaged from the `dispatch` method.

8. The business logic is performed, and the result is returned to the `dispatch` method.

9. The `cmrcv` request receives the contents of the byte array returned from the `dispatch` method in the `ibuffer` buffer. The `cmrcv` receives a confirm request indicating the conversation should terminate.

10. The client replies positively to the confirm request with `cmcfmd`.

11. The `TRADCPIC` client prepares to free the conversation with the `cmdeal` request. The conversation in `CM_DEALLOCATE_SYNC_LEVEL` commits all updated resources in the transaction and waits for the SAA resource recovery verb, `srrcmit`. After the commit sequence has completed, the conversation terminates.

# 6 Performing Your Own Data Translation

This section discusses the following topics:



## Why Perform Your Own Data Translation?

The automatic data translation provided by DataViews can usually fill your needs. The eGen-generated DataViews relieve your application of the burden of translating data between the mainframe EBCDIC environment and the Java runtime environment. In addition, native mainframe data types that are not supported in Java (such as packed, zoned decimal, etc.) are automatically mapped to appropriate Java data types. However, occasionally you may want to bypass these features and create your own data translation. Following are some advantages of bypassing the eGen/DataView infrastructure:

- Unnecessary data translation may be avoided

  If the data has been acquired in the appropriate format, it can simply be transmitted to the mainframe bypassing the DataView translation overhead.

- Contents of data buffer may be dynamically determined at runtime

  In some cases, this may be preferable to a DataView generated from a copybook containing numerous REDEFINES representing various record types.

Simple interfaces are provided for translating data both from and to the mainframe. In addition, a simple `callService()` method is available for making mainframe service requests.

# Using EgenClient Directly

`EgenClient` is the WebLogic JAM class responsible for making service calls from WebLogic Server to the mainframe. This class is the foundation of all WebLogic Server to Mainframe communication by eGen-created EJB and Servlet objects. `EgenClient` may also be used directly by applications to issue mainframe service requests. Listing 6-1 shows the public methods available for your use:

**Listing 6-1 EgenClient Public Interface**

```
package com.bea.jam.egen;

import java.io.IOException;
import com.bea.sna.jcrmgw.snaException;

public class EgenClient
{
       public EgenClient();
       public EgenClient(String serverURL);
       public void setServerURL(String serverURL);
       public byte[] callService(String service, byte[] in)
              throws snaException, IOException;
       public void setUserID(String userid);
       public void setPassword(String password);
}
```

Table 6-1 lists the definitions of the public interface methods:

**Table 6-1 EgenClient Public Interface Methods**

| Method | Description |
|---|---|
| `EgenClient()` | The default constructor. Constructing an `EgenClient` class using the default constructor will search for a `jam.url` property containing the WebLogic JAM Gateway server URL. |
| `EgenClient(URL)` | If the `EgenClient` class is provided a URL at construction, it will be used in place of the search for a `jam.url` property. |
| `setServerURL(URL)` | This method may be used to override the URL set at construction. All service calls following the invocation of this method will use the URL provided. |
| `callService(service, in)` | This method is the workhorse of the `EgenClient` class. The mainframe service in the WebLogic JAM configuration named `service` will be called and passed the buffer provided by the `in` parameter. The response buffer of the service is returned from this method. |
| `setUserID(userid)` | This method sets the User ID used to access a mainframe service. |
| `setPassword(password)` | This method sets the password used to access a mainframe service. |

# How EgenClient Locates a WebLogic JAM Gateway

The `EgenClient` class requires a connection to a WebLogic Server running a WebLogic JAM Gateway to communicate with a mainframe. This connection is accomplished via a URL provided by the caller identifying the server, or cluster of servers, hosting the WebLogic JAM Gateway(s). The `EgenClient` class attempts to obtain this URL from the following sources (listed in priority order):

1. If the `EgenClient.setServerURL()` method has been called, the URL provided is used to locate a WebLogic JAM Gateway.

2. If a URL was provided on the `EgenClient` constructor, this URL is used to locate a WebLogic JAM Gateway.
3. `EgenClient` checks for the existence of a `jam.url` system property and, if present, uses its value as the URL to locate a WebLogic JAM gateway.
4. `EgenClient` searches the `CLASSPATH` for a file named `jam.properties`. If this properties file is found and contains a `jam.url` entry, this value is used to locate a WebLogic JAM Gateway.
5. `EgenClient` assumes that it is running on the same WebLogic Server as the WebLogic JAM Gateway and attempts to establish a local connection.

# Using EgenClient to Make a Mainframe Request

Listing 6-2 illustrates calling a mainframe service via the `EgenClient` class. This example assumes that a properly formatted mainframe buffer is passed as a parameter, and that the URL of a correctly configured WebLogic JAM Gateway is set via the `jam.url` property.

**Listing 6-2 Mainframe Request Using EgenClient**

```
import com.bea.jam.egen.EgenClient;
import com.bea.sna.jcrmgw.snaException;
import java.io.IOException;
       .
       .
public byte[] getPurchaseOrder(byte[] poNum)
              throws IOException
{
       try
       {
       return(new EgenClient().callService("GetPO", poNum));
       }
       catch (snaException e)
       {
              throw new IOException(e.getMessage());
       }
}
```

The sections that follow provide information on dynamically creating mainframe buffers and interpreting the responses from mainframe services.

# Translating Buffers from Java to Mainframe Representation

Support for creating buffers for input to a mainframe service is provided by the `com.bea.base.io.MainframeWriter` class. This class functions similar to a Java `java.io.DataOutputStream` object. It translates Java data types and all mainframe-native data types. For numeric data types, this translation service provides a conversion from Java native numeric types to those available on the mainframe. For string data types, a translation is performed from UNICODE to EBCDIC by default, although the output codepage used is configurable.

## MainframeWriter Public Interface

Listing 6-3 shows the public methods provided by the `MainframeWriter` class.

**Listing 6-3 MainframeWriter Class Public Methods**

```
package com.bea.base.io;

public class MainframeWriter
{
       public MainframeWriter();
       public MainframeWriter(String codepage);
       public void setDefaultCodepage(String cp)
       public byte[] toByteArray();
       public void writeRaw(byte[] bytes
              throws IOException;
       public void writeFloat(float value)
              throws IOException;
       public void writeDouble(double value)
              throws IOException;
       public void write(char c)
```

```
            throws IOException;
        public void writePadded(String s, char padChar, int length)
            throws IOException;
        public void write16bit(int value)
            throws IOException;
        public void write16bitUnsigned(int value)
            throws IOException;
        public void write16bit(long value, int scale)
            throws IOException, ArithmeticException;
        public void write16bitUnsigned(long value, int scale)
            throws IOException, ArithmeticException;
        public void write32bit(int value)
            throws IOException;
        public void write32bitUnsigned(long value)
            throws IOException;
        public void write32bit(long value, int scale)
            throws IOException, ArithmeticException;
        public void write32bitUnsigned(long value, int scale)
            throws IOException, ArithmeticException;
        public void write64bit(long value)
            throws IOException;
        public void write64bitUnsigned(long value)
            throws IOException;
        public void write64bitBigUnsigned(BigDecimal value)
            throws IOException;
        public void write64bit(long value, int scale)
            throws IOException, ArithmeticException;
        public void write64bit(BigDecimal value, int scale)
            throws IOException, ArithmeticException;
        public void write64bitUnsigned(long value, int scale)
            throws IOException, ArithmeticException;
        public void write64bitUnsigned(BigDecimal value, int scale)
            throws IOException, ArithmeticException;
        public void writePacked(BigDecimal value, int digits,
            int precision, int scale)
            throws ArithmeticException, IOException;
        public void writePackedUnsigned(BigDecimal value,
            int digits, int precision, int scale)
            throws ArithmeticException, IOException;
}
```

Following are the definitions of these methods:

**Table 6-2 MainframeWriter Class Public Method Definitions**

| Method | Description |
|---|---|
| `MainframeWriter()` | The default constructor. Constructs a `MainframeWriter` using the default code page of `cp037` (EBCDIC). |
| `MainframeWriter(cp)` | Constructs a `MainframeWriter` using the specified codepage for character field translation. |
| `setDefaultCodepage(cp)` | Set the codepage to be used for all future data translations. |
| `toByteArray()` | Returns the translated buffer constructed by writing data to the `MainframeWriter` class as a byte array. |
| `writeRaw(bytes)` | Write a raw byte array to the output buffer. |
| `writeFloat(num)` | Convert a floating point number from the IEEE Java float data type to IBM 4 byte floating point format. The equivalent COBOL picture clause is `PIC S9V9 COMP-1`. |
| `writeDouble(num)` | Convert a floating point number from the IEEE Java double data type to IBM 8 byte floating point format. The equivalent COBOL picture clause is `PIC S9V9 COMP-2`. |
| `write(c)` | Translate and write a single character to the output buffer. The equivalent COBOL picture clause is `PIC X`. |
| `writePadded(str, pad, len)` | Translate and write a string to a fixed length character field. The passed pad character is used if the length of the passed string is less than `len`. If the length of the passed string is greater than `len`, it will be truncated to `len` characters. The equivalent COBOL picture clause is `PIC X(len)`. |

| Method | Description |
|---|---|
| `write16bit(num)` | Writes a signed 16 bit binary integer to the output buffer. The equivalent COBOL picture clause is `PIC S9(4) COMP`. |
| `write16bitUnsigned(num)` | Writes an unsigned 16 bit binary integer to the output buffer. The equivalent COBOL picture clause is `PIC 9(4) COMP`. |
| `write16bit(num, scale)` | Writes a signed 16 bit integer to the output buffer after moving the implied decimal point left by scale digits. For example, the call write16bit(100, 1) would result in the value 10 being written. The equivalent COBOL picture clause is PIC S9(4) COMP. |
| `write16bitUnsigned(num, scale)` | Writes an unsigned 16 bit integer to the output buffer after moving the implied decimal point left by `scale` digits. For example, the call `write16bitUnsigned(100, 1)` would result in the value 10 being written. The equivalent COBOL picture clause is `PIC 9(4) COMP`. |
| `write32bit(num)` | Writes a signed 32 bit binary integer to the output buffer. The equivalent COBOL picture clause is `PIC S9(8) COMP`. |
| `write32bitUnsigned(num)` | Writes an unsigned 32 bit binary integer to the output buffer. The equivalent COBOL picture clause is `PIC 9(8) COMP`. |
| `write32bit(num, scale)` | Writes a signed 32 bit integer to the output buffer after moving the implied decimal point left by `scale` digits. For example, the call `write32bit(100L, 1)` would result in the value 10 being written. The equivalent COBOL picture clause is `PIC S9(8) COMP`. |

| Method | Description |
|---|---|
| `write32bitUnsigned(num, scale)` | Writes an unsigned 32 bit integer to the output buffer after moving the implied decimal point left by `scale` digits. For example, the call `write32bitUnsigned(100L, 1)` would result in the value 10 being written. The equivalent COBOL picture clause is `PIC 9(8) COMP`. |
| `write64bit(num)` | Writes a signed 64 bit binary integer to the output buffer. The equivalent COBOL picture clause is `PIC S9(15) COMP`. |
| `write64bitUnsigned(num)` | Writes an unsigned 64 bit binary integer to the output buffer. The equivalent COBOL picture clause is `PIC 9(15) COMP`. |
| `write64bit(num, scale)` | Writes a signed 64 bit integer to the output buffer after moving the implied decimal point left by `scale` digits. For example, the call `write64bit(100L, 1)` would result in the value 10 being written. The equivalent COBOL picture clause is `PIC S9(15) COMP`. |
| `write64bitUnsigned(num, scale)` | Writes an unsigned 64 bit integer to the output buffer after moving the implied decimal point left by `scale` digits. For example, the call `write64bitUnsigned(100L, 1)` would result in the value 10 being written. The equivalent COBOL picture clause is `PIC 9(15) COMP`. |
| `writePacked(num, digits, prec, scale)` | Writes a decimal number as an IBM signed packed data type with `digits` decimal digits total and `prec` digits to the right of the decimal point. Prior to conversion, the number is scaled to the left `scale` digits. The equivalent COBOL picture clause is `PIC S9(digits-prec)V9(prec) COMP-3`. |

| Method | Description |
|---|---|
| `writePackedUnsigned(num, digits, prec, scale)` | Writes a decimal number as an IBM unsigned packed data type with `digits` decimal digits total and `prec` digits to the right of the decimal point. Prior to conversion the number is scaled to the left `scale` digits. The equivalent COBOL picture clause is `PIC 9(digits-prec)V9(prec) COMP-3`. |

# Using MainframeWriter to Create Data Buffers

As an example of using the `MainframeWriter` class to create a mainframe data buffer, assume we have a mainframe service which accepts the data record shown in Listing 6-4:

**Listing 6-4 Data Record**

```
01 INPUT-DATA-REC.
       05  FIRST-NAME       PIC X(10).
       05  LAST-NAME        PIC X(10).
       05  AGE              PIC S9(4) COMP.
       05  HOURLY-RATE      PIC S9(3)V9(2) COMP-3.
```

Listing 6-5 shows a Java test program that creates a buffer matching this record layout using the `MainframeWriter` translation class:

**Listing 6-5 Java Test Program**

```
import java.math.BigDecimal;

import com.bea.base.io.MainframeWriter;

public class MakeBuffer
{
    public static void main(String[] args) throws Exception
    {
```

```
      MainframeWriter mf = new MainframeWriter();
      mf.writePadded("Edgar", ' ', 10);            // first name
      mf.writePadded("Jones", ' ', 10);            // last name
      mf.write16bit(22);                           // age
      mf.writePacked(new BigDecimal(22.50), 5, 2, 0);// hourly rate
      byte[] buffer = mf.toByteArray();
      System.out.println(getHexString(buffer));
    }

    private static String getHexString(byte[] buffer)
    {
      StringBuffer hexStr = new StringBuffer(buffer.length * 2);
      for (int i = 0; i < buffer.length; ++i)
      {
          int n = buffer[i] & 0xff;
          hexStr.append(hex[n >> 4]);
          hexStr.append(hex[n & 0x0f]);
      }
      return(hexStr.toString());
    }

    private static char[] hex =
      {
          '0', '1', '2', '3', '4', '5', '6', '7',
          '8', '9', 'A', 'B', 'C', 'D', 'E', 'F'
      };
}
```

The output of running this sample program is:

```
C584878199404040404D1969585A240404040400016022 50C
```

This buffer breaks down as follows:

```
FIRST-NAME    C584878199404040404"Edgar" + 5 spaces in EBCDIC
LAST-NAME     D1969585A24040404040"Jones" + 5 spaces in EBCDIC
AGE           0016                 22 as 16 bit integer
HOURLY-RATE   02250C               22.50 positive packed number
                                   (decimal point is assumed)
```

# Translating Buffers from Mainframe Format to Java

Support for translating data received from the mainframe to Java data types is provided by the `com.bea.base.io.MainframeReader` class. This class operates in a manner similar to a Java `jam.io.DataInputStream`, and performs translations from mainframe data types to equivalent types usable by a Java program. Like the MainframeWriter class, the codepage used for string translations may be configured and defaults to EBCDIC.

## MainframeReader Public Interface

Listing 6-6 shows the public methods provided by the `MainframeReader` class.

**Listing 6-6 MainframeReader Class Public Methods**

```
package com.bea.base.io;

public class MainframeReader
{
       public MainframeReader(byte[] buffer);
       public MainframeReader(byte[] buffer, String codepage);
       public void setDefaultCodepage(String cp);
       public byte[] readRaw(int count) throws IOException;
       public float readFloat() throws IOException;
       public double readDouble() throws IOException;
       public char readChar() throws IOException;
       public String readPadded(char padChar, int length)
              throws IOException;
       public short read16bit() throws IOException;
       public int read16bitUnsigned() throws IOException;
       public long read16bit(int scale) throws IOException;
       public int read32bit() throws IOException;
       public long read32bit(int scale)
              throws IOException;
       public long read32bitUnsigned() throws IOException;
       public long read32bitUnsigned(int scale) throws IOException;
```

```
        public long read64bit() throws IOException;
        public long read64bitUnsigned()
               throws IOException;
        public long read64bit(int scale)
               throws IOException;
        public BigDecimal read64bitBigUnsigned()
               throws IOException;
        public BigDecimal read64bitBig(int scale)
               throws IOException
        public BigDecimal readPackedUnsigned(int digits,
               int precision, int scale)
               throws ArithmeticException, IOException;
        public BigDecimal readPacked(int digits,
               int precision, int scale)
               throws ArithmeticException, IOException;
}
```

Following are the definitions of these methods:

**Table 6-3 MainframeReader Class Public Method Definitions**

| Method | Description |
|---|---|
| `MainframeReader(buffer)` | Constructs a `MainframeReader` for the passed buffer using the default code page of `cp037` (EBCDIC). |
| `MainframeReader(buffer, cp)` | Constructs a `MainframeReader` for the passed buffer using the specified codepage for character field translation. |
| `setDefaultCodepage(cp)` | Sets the codepage to be used for all future character translations. |
| `readRaw(count)` | Read count characters from the buffer without any translation and return them as a byte array. |
| `readFloat()` | Read a 4 byte IBM floating point number and return it as a Java float data type. |
| `readDouble()` | Read an 8 byte IBM floating point number and return it as a Java double data type. |
| `readChar()` | Read and translate a single character. |

| Method | Description |
|---|---|
| `readPadded(pad, len)` | Read and translate a fixed length character field and return it as a Java String. The length of the field is passed as `len` and the field pad character is passed as `pad`. Trailing instances of the `pad` character are removed before the data is returned. |
| `read16bit()` | Read a 16 bit binary integer and return it as a Java short. |
| `read16bitUnsigned()` | Read an unsigned 16 bit integer and return it as a Java int. |
| `read16bit(scale)` | Read a 16 bit binary integer and scale the value by 10^scale. For example, if the value 10 is read via `read16bit(1)`, the returned value would be 100. |
| `read32bit()` | Read a 32 bit binary integer and return it as a Java int. |
| `read32bit(scale)` | Read a 32 bit binary integer and scale the value by 10^scale. For example, if the value 10 is read via `read32bit(1)`, the returned value would be 100. |
| `read32bitUnsigned()` | Read an unsigned 32 bit integer and return it as a Java long. |
| `read32bitUnsigned(scale)` | Read an unsigned 32 bit binary integer and scale the value by 10^scale. For example, if the value 10 is read via `read32bit(1)`, the returned value would be 100. |
| `read64bit()` | Read a 64 bit binary integer and return it as a Java long. |
| `read64bitUnsigned()` | Read an unsigned 64 bit integer and return it as a Java long. |

| Method | Description |
|---|---|
| `read64bitUnsigned(scale)` | Read an unsigned 64 bit binary integer and scale the value by 10^scale. For example, if the value 10 is read via `read32bit(1)`, the returned value would be 100. |
| `read64bitBigUnsigned()` | Read an unsigned 64 bit integer and return it as a Java `BigDecimal`. |
| `read64bitBig(scale)` | Read a signed 64 bit integer and scale the value by 10^scale. The value is returned as a Java `BigDecimal`. |
| `readPackedUnsigned(digits, prec, scale)` | Read an unsigned packed number consisting of `digits` numeric digits with `prec` digits to the right of the decimal. The value is scaled by 10^scale returned as a Java `BigDecimal`. |
| `readPacked(digits, prec, scale)` | Read a signed packed number consisting of `digits` numeric digits with `prec` digits to the right of the decimal. The value is scaled by 10^scale returned as a Java `BigDecimal`. |

# Using MainframeReader to Translate Data Buffers

As an example of using the `MainframeReader`, class following is a program that translates and displays the fields in the mainframe buffer created above. Our input buffer consists of the binary data:

```
C5848781994040404040D1969585A240404040400016022 50C
```

Listing 6-7 shows the sample program used to process this buffer.

**Listing 6-7 Sample Program**

```
import java.math.BigDecimal;
import com.bea.base.io.MainframeReader;

public class ShowBuffer
```

```
{
     public static void main(String[] args) throws Exception
     {
     String data =
         "C584878199404040404D1969585A2404040404000016022500C";
     byte[] buffer = buildBinary(data);
     MainframeReader mf = new MainframeReader(buffer);
     System.out.println(" First Name: " + mf.readPadded(' ', 10));
     System.out.println("  Last Name: " + mf.readPadded(' ', 10));
     System.out.println("        Age: " + mf.read16bit());
     System.out.println("Hourly Rate: " + mf.readPacked(5, 2, 0));
     }

     private static byte[] buildBinary(String data)
     {
         byte[] buffer = new byte[data.length() / 2];
         for (int i = 0; i < buffer.length; ++i)
         {
             int msb = hex.indexOf(data.charAt(i * 2));
             int lsb = hex.indexOf(data.charAt(i * 2 + 1));
             buffer[i] = (byte) (msb << 4 | lsb);
         }
     return(buffer);
     }

     private static final String hex = "0123456789ABCDEF";
}
```

When run, the program produces the following output:

```
First Name: Edgar
Last Name: Jones
Age: 22
Hourly Rate: 22.50
```

CHAPTER

# 7 Diagnostics

This section discusses the following topics:

- Gateway Statistics
- Gateway Tracing
- Low-Level Client Diagnostics
- CRM Tracing
- APPC API Tracing

## Gateway Statistics

You can display the statistics for a Gateway definition using the WebLogic Administration Console. For instructions on accessing Gateway statistics, refer to the *BEA WebLogic Java Adapter for Mainframe Configuration and Administration Guide*. The statistics information displayed for the Gateway is listed in Table 7-1.

**Table 7-1 Statistics Categories**

| | |
|---|---|
| Total Requests | The number of requests that have reached the gateway. This may be larger than the sum of successes and failures if some requests are still being processed. |
| Total Successes | The number of requests that have successfully been processed to completion by the gateway. Application level failures may be reported as gateway successes. |

| | |
|---|---|
| Average Response Time | The average response time for all successful requests and some failures. Failures that fail before they are transmitted over the network do not affect this statistic. Timeouts do not affect this statistic until a late reply is received. |
| Total Failures | The total number of failures of any kind. |
| No Response | The number of requests that have timed out and have never received a response of any kind. |
| Late Response | The number of requests that timed out and then received a response. |
| Other | The number of request that failed other than by timeout. |

# Gateway Tracing

WebLogic JAM runtime traces are sent to the WebLogic log as "Debug" messages. Debug messages are written to each WebLogic Server's log file but are not sent to the administration server. In addition, these messages are only sent to the server's `stdout` if the server's configuration has both the **Log to Stdout** and **Debug to Stdout** options selected on the server's Logging/General page.

For instructions on accessing Gateway tracing options, refer to the *BEA WebLogic Java Adapter for Mainframe Configuration and Administration Guide*. The user trace categories displayed for the Gateway are listed in Table 7-2.

**Table 7-2 User Trace Categories**

| | |
|---|---|
| User level trace | Produces trace records for the beginning and completion of all user requests, both to and from the mainframe. The completion message will indicate the success or failure of the request. |
| User dump trace | Produces trace records with a hexadecimal dump of the user data associated with all user requests and replies. This trace level will also cause the trace records for User level trace to be produced. |

Here is an example of a trace for two user requests:

```
<Nov 15, 2001 3:53:06 PM GMT-06:00> <Debug> <JAM1> <[5560199] Beginning of
request:134217866 service:sampleCreate>

<Nov 15, 2001 3:53:06 PM GMT-06:00> <Debug> <JAM1> <[5560199] ---- request data
dump ----

0000: 00 00 00 00 0f d3 81 a2 a3 61 f0 40 40 40 40 40   .....Last/0
0010: 40 40 40 40 c6 89 99 a2 a3 61 f1 40 40 40 40 40       First/1
0020: 40 40 40 d4 f3 f2 f0 f0 40 c1 95 a8 a2 a3 99 85      M3200 Anystre
0030: 85 a3 40 c3 96 a4 99 a3 40 40 40 40 40 40 40 40   et Court
0040: 40 40 e3 e7 f7 f7 f5 f5 f5 f0 f0 f0 f0              TX775550000
------------------------------
>

<Nov 15, 2001 3:53:07 PM GMT-06:00> <Debug> <JAM1> <[5560199] End of
request:134217866>

<Nov 15, 2001 3:53:07 PM GMT-06:00> <Debug> <JAM1> <[5560199] ---- response data
dump ----

0000: 00 00 00 00 0f d3 81 a2 a3 61 f0 40 40 40 40 40   .....Last/0
0010: 40 40 40 40 c6 89 99 a2 a3 61 f1 40 40 40 40 40       First/1
0020: 40 40 40 d4 f3 f2 f0 f0 40 c1 95 a8 a2 a3 99 85      M3200 Anystre
0030: 85 a3 40 c3 96 a4 99 a3 40 40 40 40 40 40 40 40   et Court
0040: 40 40 e3 e7 f7 f7 f5 f5 f5 f0 f0 f0 f0              TX775550000
------------------------------
>

<Nov 15, 2001 3:53:07 PM GMT-06:00> <Debug> <JAM1> <[5560199] Starting one phase
commit>

<Nov 15, 2001 3:53:07 PM GMT-06:00> <Debug> <JAM1> <[5560199] Beginning of
request:1207959692 service:sampleRead>

<Nov 15, 2001 3:53:07 PM GMT-06:00> <Debug> <JAM1> <[5560199] ---- request data
dump ----

0000: 00 00 00 00 0f d3 81 a2 a3 61 f0 40 40 40 40 40   .....Last/0
0010: 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40
0020: 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40
0030: 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40 40
0040: 40 40 40 40 40 40 40 40 40 40 40 40 40
------------------------------
>

<Nov 15, 2001 3:53:07 PM GMT-06:00> <Debug> <JAM1> <[5560199] End of
request:1207959692>

<Nov 15, 2001 3:53:07 PM GMT-06:00> <Debug> <JAM1> <[5560199] ---- response data
dump ----
```

```
0000: 00 00 00 00 0f d3 81 a2 a3 61 f0 40 40 40 40 40   .....Last/0
0010: 40 40 40 40 c6 89 99 a2 a3 61 f1 40 40 40 40 40       First/1
0020: 40 40 40 d4 f3 f2 f0 f0 40 c1 95 a8 a2 a3 99 85      M3200 Anystre
0030: 85 a3 40 c3 96 a4 99 a3 40 40 40 40 40 40 40 40   et Court
0040: 40 40 e3 e7 f7 f7 f5 f5 f5 f0 f0 f0 f0              TX775550000
------------------------------
>

<Nov 15, 2001 3:53:07 PM GMT-06:00> <Debug> <JAM1> <[5560199] Starting one phase
commit>
```

The trace categories listed in Table 7-3 are for use if you find it necessary to contact BEA Technical Support. They may be used to collect data about your system necessary to resolve problems.

**Table 7-3 System Trace Categories**

| | |
|---|---|
| CRMAPI trace | Produces trace records showing the messages exchanged between the Gateway and the CRM. |
| JAM socket trace | Produces trace records showing a hexadecimal dump of the data exchanged between the Gateway and the CRM. |
| Configuration trace | Produces trace records showing operations within the WebLogic Administration Console and interactions between it and the Gateway. |
| Thread level trace | Produces trace records showing operations within the Gateway related to its internal threads and subtasks. |

# Low-Level Client Diagnostics

WebLogic JAM includes two low-level features to support diagnosing problems with eGen-based client programs. While these facilities are not designed for use in a production environment, they should be useful during development. These features are enabled by adding the settings listed in Table 7-4 to the java statement at the end of your `startWebLogic.cmd` file for the BEA WebLogic Server domain that you are currently running.

**Table 7-4 Client Diagnostic Settings**

| | |
|---|---|
| bea.jam.client.loopback | Set to "true" to bypass the gateway & simply loop the request bytes back to the client. |
| bea.jam.client.stub | Set to the full name of a class to be used as a gateway stub. |

Listing 7-1 provides an example in **bold** of the changes that need to be made to the java statement in the `startWebLogic.cmd` file necessary to enable the client diagnostic loopback feature. This file can be found in the `<WLS_HOME>\config\<domain>` directory. The java statement can be found near the end of the file.

**Listing 7-1 startWebLogic.cmd Loopback Example**

```
                              ...
"%JAVA_HOME%\bin\java" -hotspot -ms64m -mx64m -classpath
%CLASSPATH% -Dweblogic.Domain=mydomain
-Dbea.jam.client.loopback=true -Dweblogic.Name=myserver
"-Dbea.home=g:\bea"
"-Djava.security.policy==g:\bea\wlserver6.1sp2/lib/weblogic.polic
y" -Dweblogic.management.password=%WLS_PW% weblogic.Server
                              ...
```

# Client Loopback

If the client loopback feature is enabled, all requests receive a response that is exactly equal to the request data. Note that this loopback response is accomplished while the data is in mainframe format. If a service accepts one DataView subclass and returns a different one, a conversion failure in trying to construct the resulting DataView subclass may occur.

**Note:** When the client loopback feature is enabled, a Gateway need not be deployed.

## Client Stub Operation

The client stub operation enables you to replace the gateway with your own class, in effect providing a replacement for the entire target mainframe. This feature is valuable for testing or proof-of-concept situations where the mainframe connection is not available.

Your stub class must:

- Provide a constructor that takes no arguments.
- Be available on your `CLASSPATH`.
- Contain a method for each service that is to be supported. This method must take some DataView subclass as its only argument and return a DataView subclass.

# CRM Tracing

The CRM has tracing options that can be enabled for advanced debugging of WebLogic JAM applications. Refer to the *BEA WebLogic Java Adapter for Mainframe Configuration and Administration Guide* for information about setting trace levels.

On Windows NT and Unix systems, traces are written to a file in the directory in which the CRM was started. If the environment variable `APPDIR` is set, the trace will be written to the directory it specifies. The file name will be specified as:

`CRM.<pid>.trace.<seq>`

Where `<pid>` is the process ID of the CRM process, and `<seq>` is the sequence number of the trace file, which is always 0.

On MVS systems, traces are written to `SYSOUT`, which is identified by `TRACE DD NAME`.

# Viewing Trace Output

With a few exceptions, each line in the trace output is preceded by a time tag, identifying the date and time the line was written.

**Note:** The time tag information in the CRM trace should reflect the current system time. In order to make use of the correct time zone information on Unix and MVS systems, it is important that the TZ environment variable be set correctly. If this variable is not set correctly on your system, refer to your system documentation for further information.

After the time tag, a four-digit number appears, identifying the number of the task that wrote the line to the trace. This number can be useful when multiple processes are connected to the CRM.

If the trace level of the CRM is greater than one, a plus sign (+) following the task number indicates that a line in the trace is level 1 output. For example, in the sequence:

```
Tue Oct 09 10:45:10.291 0001 +CRM initialization complete --
Normal dispatching begins

Tue Oct 09 10:45:10.291 0001  CRM state transition from
InitializationInProgress to Reset
```

The line `CRM initialization complete` is level 1 output, and the line `CRM state transition` is not (it is level 3 output).

When the trace level is set to 3, hex dump information will appear in the trace. These entries will appear interspersed with other trace statements. An example follows:

```
OFFS  ---------------- HEXADECIMAL-----------------  *------ASCII-----*
0000: 00 00 00 B2 63 00 00 56 BE AC 05 00 00 04 00 02  (....c..V........)
0010: 00 00 00 00 00 00 00 1C 7E 71 00 00 00 00 00 96  (........q......)
0020: 7E 76 00 00 41 30 36 52 65 67 69 6F 6E 00 00 00  (.v..A06Region...)
0030: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  (................)
0040: 00 00 00 00 01 57 45 42 4C 00 43 49 43 53 00 53  (.....WEBL.CICS.S)
0050: 4E 41 43 52 4D 00 00 00 00 00 00 00 00 00 00 00  (NACRM...........)
0060: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 41 30  (..............A0)
0070: 36 43 49 43 53 00 00 00 00 00 00 00 00 00 00 00  (6CICS...........)
0080: 00 00 00 00 00 00 00 00 00 00 00 00 00 41 30 36  (.............A06)
0090: 43 49 43 53 00 00 53 4D 53 4E 41 31 30 30 00 4C  (CICS..SMSNA100.L)
00A0: 4F 43 41 4C 00 00 00 00 00 00 02 00 00 04 00 02  (OCAL............)
00B0: EA 60                                            (..)
```

These entries consist of offset information in the left column, followed by columns with the data in hexadecimal format, followed by an ASCII or EBCDIC representation of the data. The data is read from left to right, top to bottom.

Hex dump information for application data appears in a slightly different format, with two different representations of the user data. An example follows:

```
00000 |12345678 9fe29489 a3884040 40404040| |.....Smith      |
00010 |40404040 d1968895 40404040 40404040| |    John        |
00020 |404040d8 f1f2f3f4 40c59394 40e2a34b| |   Q1234 Elm St.|
00030 |40404040 40404040 40404040 40404040| |                |
00040 |4040e3d5 f1f2f3f4 f5404040 40000000| |  TN12345    ...|
```

The two columns following the hex data contain the user data in “actual” and “native” representations. In the “actual” representation, the binary data is represented directly as character data, with unprintable characters appearing as a period (.). In the “native” representation, the binary data is converted to the native character format (EBCDIC or ASCII), allowing text fields to be viewed directly.

**Note:** The above example was taken from a CRM trace from an EBCDIC machine, so the “actual” and “native” columns both contain readable text.

# APPC API Tracing

The BEA support team might request an APPC API trace for diagnosis of a customer problem. The mapping of the APPC API trace is BEA internal.

The VTAM APPC API may be captured by enabling the APPC API tracing. The API trace shows the parameters and values passed and returned to the VTAM APPC stack. The API trace is captured to the GTF tracing facility. The GTF tracing facility must be active in the mainframe region to capture the API traces.

After capturing the traces, you must format the print using GTF formatting procedures such as IPCS. The APPC API trace is written to GTF as user id '2EA'. You may use this ID to filter the GTF print to include only the APPC API traces.

Refer to the *BEA WebLogic Java Adapter for Mainframe Configuration and Administration Guide* for information about setting APPC tracing.

# Viewing APPC Trace Output

The APPC API trace captures the parameters and values used by the CRM to make a VTAM APPC request. The trace will show the APPC verb control block before and after the request is made. The response to the request will show return codes and returned values.

The following example of a request and a response was formatted by using the IBM provided program `IKJEFT01`.

```
HEXFORMAT AID FF FID 00 EID  E2EA
 +0000  00F82400  E2C8C1C6  C6C5D9F3  8A19D260  E3D76DE2  E3C1D9E3  C5C4D9C5  D8E4C5E2  | .8..BEAJOB01..K-TP_STARTEDREQUES
 +0020  E3404040  000E0000  00000000  00000000  00000000  00000000  00000000  00000000  | T   ............................
 +0040  C4E5F1F0  C4D1E2F1  40404040  40404040  40404040  40404040  40404040  40404040  | DV10DJS1
 +0060  40404040  40404040  40404040  40404040  40404040  40404040  40404040  40404040  |
 +0080  40404040  40404040  000040                                                      |         ..


HEXFORMAT AID FF FID 00 EID  E2EA
 +0000  00F82400  E2C8C1C6  C6C5D9F3  8A19D260  E3D76DE2  E3C1D9E3  C5C4D9C5  E2D7D6D5  | .8..BEAHOB01..K-TP_STARTEDRESPON
IPCS PRINT LOG FOR USER CER
_____________________________________________________________________________________________________________________________
 +0020  E2C5C1D7  6DD6D240  40404040  40404040  40404040  40404040  40404040  40404040  | SEAP_OK
 +0040  000E0000  00000000  00000000  00000000  0B911D30  0B912230  00000000  C4E5F1F0  | .................j...j......DV10
 +0060  C4D1E2F1  40404040  40404040  40404040  40404040  40404040  40404040  40404040  | DJS1
 +0080  40404040  40404040  40404040  40404040  40404040  40404040  40404040  40404040  |
 +00A0  40404040  000040                                                               |     ..
```

CHAPTER

# A DataView Programming Reference

This section provides the rules that allow you to identify what form a generated Java class takes from a given COBOL copybook processed by the eGen Application Generator (eGen utility). An understanding of the rules facilitates a programmer's ability to correctly code any custom programs that make use of the generated classes.

The eGen utility maps a COBOL copybook into a Java class. The COBOL copybook contains a data record description. The eGen utility derives the generated Java class from the `com.bea.dmd.dataview.DataView` class (later referred to as `DataView`), which is provided on your WebLogic JAM product CD-ROM in the `jam.jar` file.

This section discusses data mapping rules in the following topics:

- Known Limitations of WebLogic JAM working with COBOL Copybooks

You should find the COBOL terms in this section easy to understand; however, you may need to use a COBOL reference book or discuss the terms with a COBOL programmer. Also, you can process a copybook with the eGen utility and examine the generated Java code in order to understand the mapping.

# Field Name Mapping Rules

When you process a COBOL copybook containing field names, they are mapped to Java names by the eGen utility. All alphabetic characters are mapped to lower case, except in the following two cases.

1. All dashes are removed and the character following the dash is mapped to upper case.
2. When a prefix is added to the name (as when creating a field accessor function name), the first character of the base name is mapped to upper case.

Table A-1 lists some mapping examples.

**Table A-1 Example Field Name Mapping from COBOL to Java and Accessor**

| COBOL Field Name | Java Base Name | Sample Accessor Name |
|---|---|---|
| `EMP-REC` | `empRec` | `setEmpRec` |
| `500-REC-CNT` | `500RecCnt` | `set500RecCnt` |

# Field Type Mappings

When you process a COBOL copybook, the data types of fields are mapped to Java data types. The mapping is performed by the eGen utility according to the following rules:

1. Groups map to `DataView` subclasses.
2. All alphanumeric fields are mapped to type `String`.
3. All edited numeric fields are mapped to type `String`.
4. All `SIGN SEPARATE`, `BLANK WHEN ZERO` or `JUSTIFIED RIGHT` fields are mapped to type `String`.
5. `SIGN IS LEADING` is not supported.
6. The types `COMP-1`, `COMP-2`, `COMP-5`, `COMP-X`, and `PROCEDURE-POINTER` fields are not supported (an error message is generated).
7. All `INDEX` fields are mapped to Java type `int`.
8. `POINTER` maps to Java type `int`.
9. All numeric fields with any digits to the right of the decimal point are mapped to type `BigDecimal`.
10. All `COMP-3` (packed) fields are mapped to type `BigDecimal`.
11. All other numeric fields are mapped as shown in Table A-2.

**Table A-2 Numeric Field Mapping**

| Number of Digits | Java Type |
|---|---|
| <= 4 | `short` |
| > 4 and <= 9 | `int` |
| > 9 and <= 18 | `long` |
| > 18 | `BigDecimal` |

# Group Field Accessors

Each nested group in a COBOL copybook is mapped to a corresponding `DataView` subclass. The generated subclasses are nested exactly as the COBOL groups in the copybook. In addition, the eGen utility generates a private instance variable of this class type and a `get` accessor.

For example, the following copybook:

```
10 MY-RECORD.
       20  MY-GRP.
              30  ALNUM-FIELD            PIC X(20).
```

Produces code similar to the following:

```
public MyGrp2V getMyGrp();
public static class MyGrp2V extends DataView
{
              // Class definition
}
```

# Elementary Field Accessors

Each elementary field is mapped to a private instance variable within the generated DataView subclass. Access to this variable is accomplished by two accessors that are generated (`set` and `get`).

These accessors have the following forms:

```
public void setFieldName(FieldType value);
```

```
public FieldType getFieldName();
```

Where:

`FieldType`
: is described in the Field Type Mappings section.

`FieldName`
: is described in the Field Name Mapping Rules section.

For example, the following copybook:

```
10 MY-RECORD.
       20  NUMERIC-FIELD                 PIC S9(5).
       20  ALNUM-FIELD                   PIC X(20).
```

Produces the accessors:

```
public void setNumericField(int value);
public int getNumericField();
public void setAlnumField(String value);
public String getAlnumField();
```

# Array Field Accessors

Array fields are handled according to the field accessor rules described in Group Field Accessors and Elementary Field Accessors, with the addition that each accessor takes an additional `int` argument that specifies which array entry is to be accessed, for example:

```
public void          set FieldName(int index, FieldType value);
public FieldType     get FieldName(int index);
```

Array fields specified with the `DEPENDING ON` clause are handled the same as fixed-size arrays with the following special rules:

1. The accessors may be used to `get` or `set` any instance up to the maximum array index.
2. The controlling (`DEPENDING ON`) variable is evaluated when the DataView is converted to or from an external format, such as a mainframe format. The eGen utility converts only the array elements with subscripts less than the controlling value.

# Fields with REDEFINES Clauses

Fields that participate in a `REDEFINES` set are handled as a unit. A private `byte[]` variable is declared to hold the underlying mainframe data, as well as a private `DataView` variable. Each of the redefined fields has an accessor or accessors. These accessors take more CPU overhead than the normal accessors because they perform conversions to and from the underlying `byte[]` data.

For example the copybook:

```
10 MY-RECORD.
       20 INPUT-DATA.
              30 INPUT-A                                PIC X(4).
              30 INPUT-B                                PIC X(4).
       20 OUTPUT-DATA REDEFINES INPUT-DATA              PIC X(8).
```

Produces Java code similar to the following:

```
private byte[] m_redef23;
private DataView m_redef23DV;
public InputDataV   getInputData();
public String getOutputData();
public void   setOutputData(String value);
public static class InputDataV extends DataView
{
// Class definition.
}
```

# COBOL Data Types

This section summarizes the COBOL data types supported by WebLogic JAM software. Table A-3 lists the COBOL data item definitions recognized by the eGen utility. Table A-4 lists the syntactical features and data types recognized by the eGen utility. If a COBOL feature is unsupported and it is not listed as ignored in the table, an error message is generated.

**Table A-3 Major COBOL Features**

| COBOL Feature | Support |
|---|---|
| IDENTIFICATION DIVISION | Unsupported |
| ENVIRONMENT DIVISION | Unsupported |
| DATA DIVISION | Partially Supported |
| WORKING-STORAGE SECTION | Partially Supported |
| Data record definition | Supported |
| PROCEDURE DIVISION | Unsupported |
| COPY | Unsupported |
| COPY REPLACING | Unsupported |
| EJECT, SKIP1, SKIP2, SKIP3 | Supported |

**Table A-4 COBOL Data Types**

| COBOL Type | Java Type |
|---|---|
| COMP, COMP-4, BINARY *(integer)* | Short/Int/Long |
| COMP, COMP-4, BINARY *(fixed)* | BigDecimal |
| COMP-3, PACKED-DECIMAL | BigDecimal |
| COMP-5 | Unsupported |
| COMP-X | Unsupported |
| `DISPLAY` *`numeric (zoned)`* | BigDecimal |
| `BLANK WHEN ZERO` *`(zoned)`* | String |
| SIGN IS LEADING *(zoned)* | Unsupported |
| `SIGN IS LEADING SEPARATE` *`(zoned)`* | String |
| `SIGN IS TRAILING` *`(zoned)`* | String |

**Table A-4 COBOL Data Types**

| COBOL Type | Java Type |
|---|---|
| `SIGN IS TRAILING SEPARATE` *`(zoned)`* | String |
| edited numeric | String |
| `COMP-1, COMP-2` *`(float)`* | Unsupported |
| edited float numeric | String |
| `DISPLAY` *`(alphanumeric)`* | String |
| edited alphanumeric | String |
| INDEX | Int |
| POINTER | Int |
| PROCEDURE-POINTER | Unsupported |
| JUSTIFIED RIGHT | Unsupported (ignored) |
| SYNCHRONIZED | Unsupported (ignored) |
| REDEFINES | Supported |
| 66 RENAMES | Unsupported |
| 66 RENAMES THRU | Unsupported |
| 77 level | Supported |
| 88 level *(condition)* | Unsupported (ignored) |
| group record | Inner Class |
| `OCCURS` *`(fixed array)`* | Array |
| `OCCURS DEPENDING` *`(variable-length array)`* | Array |
| OCCURS INDEXED BY | Unsupported (ignored) |
| OCCURS KEY IS | Unsupported (ignored) |

# Other Access Methods for Generated DataView Classes

WebLogic JAM allows you to access DataView classes through several methods as described in the following sections:

- Mainframe Access to DataView Classes
- XML Access to DataView Classes
- Hashtable Access to DataView Classes

## Mainframe Access to DataView Classes

This section describes how mainframe format data may be moved into and out of DataView classes. The eGen Application Generator writes this code for you, so this information is provided as reference.

Mainframe format data may be extracted from a DataView class through the use of the `MainframeWriter` class. Listing A-1 shows a sample of code that may be used to perform the extraction.

**Listing A-1 Sample Code for Extracting Mainframe Format Data from a DataView Class**

```
import com.bea.base.io.MainframeWriter;
import com.bea.dmd.dataview.DataView;

   ...

   /**
    * Get mainframe format data from a DataView into a byte[].
    */
   byte[] getMainframeData(DataView dv)
   {
        try
        {
```

```
            MainframeWriter mw = new MainframeWriter();
            // To override the DataView's codepage, change the
            // above constructor call to something like:
            // ...new MainframeWriter("cp1234");

            return dv.toByteArray(mw);
        }
        catch (java.io.IOException e)
        {
            // Some conversion failure occurred…
        }
    }
```

If you want to override the codepage provided when the DataView was generated, you may provide another codepage as a `String` argument to the `MainframeWriter` constructor, as shown in the comment in Listing A-2.

Loading mainframe data into a DataView is a similar process, in this case requiring the use of the `MainframeReader` class. Listing A-2 shows a sample of code that may be used to perform the load.

**Listing A-2 Sample Code for Loading Mainframe Data into a DataView Class**

```
import com.bea.base.io.MainframeReader;
import com.bea.dmd.dataview.DataView;

   ...

   /**
    * Put a byte[] containing mainframe format data into a DataView.
     */
   MyDataView     putMainframeData(byte[] buffer)
   {
        MainframeReader mr = new MainframeReader(buffer);
        // To override the DataView's codepage, change the above
        // constructor call to something like:
        // …new MainframeReader("cp1234", buffer);
       .
       .
       .
   MyDataView dv;
       .
       .
```

```
    .
try
     {
      // Construct a new DataView with the mainframe data.
          dv = new MyDataView(mr);

      // Or, to load a pre-existing DataView with mainframe data.
      // dv.mainframeLoad(mr);
     }
     catch (java.io.IOException e)
     {
          // Some conversion failure occurred.
     }

     return dv;
}
```

# XML Access to DataView Classes

Facilities are provided to move XML data into and out of DataView classes. These operations are performed through the use of the `XmlLoader` and `XmlUnloader` classes.

- `XmlLoader` is used to load XML data into a DataView.
- `XmlUnloader` is used to unload data from a DataView into XML.
- If the eGen script used to produce the DataView specifies the "support xml" option, then both a DTD and an XML/Schema that describe the XML format for this DataView are produced.

Listing A-3 shows an example of the code used to load XML data into a DataView.

**Listing A-3 Sample Code for Loading XML Data into a DataView**

```
import com.bea.dmd.dataview.DataView;
import com.bea.dmd.dataview.XmlLoader;

   ...

   void loadXmlData(String xml, DataView dv)
```

```
{
     XmlLoader xl = new XmlLoader();
     try
     {
        // Load the xml. Note that the xml argument may be either
          // a String or a org.w3c.dom.Element object.
          xl.load(xml, dv);
     }
     catch (Exception e)
     {
          // Some conversion error occurred.
     }
}
```

Listing A-4 shows an example of the code used to unload a DataView into XML.

**Listing A-4 Sample Code for Unloading a DataView into XML**

```
import com.bea.dmd.dataview.DataView;
import com.bea.dmd.dataview.XmlUnloader;

   ...

   String unloadXmlData(DataView dv)
   {
        XmlUnloader xu = new XmlUnloader();

        try
        {
             String xml = xu.unload(dv);
             return xml;
        }
        catch (Exception e)
        {
             // Some conversion error occurred.
        }
   }
```

# Hashtable Access to DataView Classes

WebLogic JAM also provides facilities to load and unload DataView objects using Hashtable objects. Hashtable objects are most often used to move data from one DataView to another similar DataView.

When DataView fields are moved into Hashtables, each field is given a key that is a string reflecting the location of the field within the original copybook data structure. Listing A-5 shows a sample of a COBOL Copybook.

**Listing A-5 Sample emprec.cpy COBOL Copybook**

```
1       *-------------------------------------------------------
2       * emprec.cpy
3       *       An employee record.
4       *-------------------------------------------------------
5
6       02      emp-record.
7
8               04      emp-ssn                 pic 9(9)  comp-3.
9
10              04      emp-name.
11                      06      emp-name-last   pic x(15).
12                      06      emp-name-first  pic x(15).
13                      06      emp-name-mi     pic x.
14
15              04      emp-addr.
16                      06      emp-addr-street pic x(30).
17                      06      emp-addr-st     pic x(2).
18                      06      emp-addr-zip    pic x(9).
19
20      * End
```

The fields for the COBOL Copybook in Listing A-5 are stored into a Hashtable as shown in Table A-5.

**Table A-5 COBOL Copybook Hashtable**

| Key String | Content Type |
|---|---|
| empRecord.empSsn | BigDecimal |
| empRecord.empName.empNameLast | String |
| empRecord.empName.empNameFirst | String |
| empRecord.empName.empNameMi | String |
| empRecord.empAddr.empAddrStreet | String |
| empRecord.empAddr.empAddrSt | String |
| empRecord.empAddr.empAddrZip | String |

## Code for Unloading and Loading Hashtables

Following is an example of the code used to **unload** a DataView into a Hashtable.

```
Hashtable ht = new HashtableUnloader().unload(dv);
```

Following is an example of the code used to **load** a Hashtable into an existing DataView.

```
new HashtableLoader().load(dv);
```

## Rules for Unloading and Loading Hashtables

The basic rules of Hashtable **unloading** are:

- All data elements in the DataView are placed into the Hashtable.
- Each data item is stored as an object of its Java type. Elements of `int/short/long` type are converted to `Integer/Short/Long`.
- Arrays are mentioned at the appropriate level in the key as an index enclosed in "[", "]" pairs. For instance, if empAddr was an array, then one key into the Hashtable might be `empRecord.empAddr[2].empAddrStreet`.

The basic rules of Hashtable **loading** are:

- All data elements in the DataView attempt to acquire a value from the Hashtable. If no matching key exists, the element retains its original value.
- Hashtable members of the wrong type result in a `ClassCastException` being thrown.

## Name Translator Interface Facility

A name translator interface facility is available to provide Hashtable name mappings. Both `HashtableLoader` and `HashtableUnloader` provide a constructor that accepts an argument of type `com.bea.dmd.dataview.NameTranslator`. Table A-6 lists the descriptions of the public interface methods that must be implemented.

**Table A-6 Name Translator Interface**

| Method | Description |
|---|---|
| `translate(String input)` | This method received a `String` object as an input parameter and returns a `String` object. |

You can write classes that implement this interface for your application. These implementations are used to translate the key strings before the Hashtable is accessed.

Following are some useful implementations that are included in the WebLogic JAM library:

| Class Constructor | Purpose |
|---|---|
| NameFlattener() | Reduces the key to the portion following the final period character. |
| PrefixChanger(String old, String add) | Removes an old prefix & adds a new one. |
| PrefixChanger(String old) | Removes a prefix. |

The `HashtableLoader`, `HashtableUnloader`, and the various name translator classes are included in the "com.bea.dmd.dataview" package.

# Known Limitations of WebLogic JAM working with COBOL Copybooks

Following are some of the known limitations of this version of the WebLogic JAM product.

- Continuation lines are not recognized in COBOL copybooks. This is only a problem for long character literals occurring within `VALUES` clauses. Comment out the relevant clause to fix the problem.
- COBOL copybooks with array (table) data items having an `OCCURS DEPENDING ON` clause must be structured so that the depending-on counter data item is not contained within the same group data item as the one containing the array.
- `USAGE` clauses on group data items in COBOL copybooks are not properly propagated to their subordinated member data items.

# B eGen Application Generator Reference

This section contains reference pages for the WebLogic JAM eGen Application Generator (eGen utility). This information includes the rules for writing the script file that controls the code generator.

## Synopsis

The eGen utility maps a COBOL copybook into a Java class.

Invoke the utility with the following command:

```
java com.bea.jam.egen.EgenCobol scriptfile
```

where:

`java`
: is the name of the Java virtual machine executable in the Java Development Kit (JDK).

`com.bea.jam.egen.EgenCobol`
: is the full class name of the eGen utility.

*`scriptfile`*
: is the script file that controls the eGen utility. You must write this script file on an application-by-application basis. (See Listing B-1 for an example).

If the WebLogic JAM installation bin directory has been added to your path, the eGen utility may also be invoked with the following command:

```
egencobol scriptfile
```

**Listing B-1 Example of `scriptfile.egen`**

```
### example script
#

view demo.CustomDataView from emprec.cpy

service demoService accepts CustomDataView returns CustomDataView

page demoPage "Demo Page"
{
    view demo.CustomDataView

    buttons
    {
              "Try It" service(demoService) shows demoPage
    }
}

servlet demo.DemoServlet shows demoPage
```

# Script Syntax Reserved Words

The reserved words shown below must be used as specified in the Grammar section.

**Note:** A reserved word can be used as an identifier if it is enclosed in either single or double quotation marks (refer to General Rules).

| | | | | | |
|---|---|---|---|---|---|
| accepts | buttons | class | client | codepage | ejb |
| from | generate | group | is | method | page |

| | | | | | |
|---|---|---|---|---|---|
| reset | returns | server | service | servlet | shows |
| support | view | transaction | xml | | |

# General Rules

- The '#' character and all following characters on the same line are a comment. Use the '#' character to specify commented text.
- The character sequence "//" and all following characters on the same line are a comment. Use the "//" characters to specify commented text.
- The character sequence "/*" and all following characters until the occurrence of the sequence "*/" are a comment. Use the "/*" characters to specify commented text that extends beyond one line.
- White space (including new lines) is not significant, except when it is used to separate tokens. White space includes new lines, carriage returns, tabs, spaces, etc.
- Any sequence of letters, digits, underscores, or periods is a word.
- Any word that does not match a reserved word is an identifier.
- Any sequence of characters is treated as an identifier if it is enclosed in either single or double quotes. This allows the use of reserved words and sequences that contain spaces.

# Grammar

The eGen script grammar uses a modified Backus-Naur Form (BNF) syntax, which is used in many industry-standard software reference guides. BNF syntax specifies a context-free grammar. Reserved words are shown in bold. Comments are in italics preceded by a dash (—).

```
script:
      definition | script definition

fulldefinition:
      generate definition | definition

definition:
      viewdef | servicedef | servletdef | ejbdef | classdef |
      pagedef

viewdef:
      view viewname from copybook | viewdf viewmodifier

viewmodifier:
      codepage codepagename | support xml

servicedef:
      service servicename accepts fullViewname returns fullViewname

servletdef:
      servlet classname shows pagename

ejbdef:
      clientejb | serverejb

clientejb:
       client ejb classname ejbspec { clientmethods }

serverejb:
       server ejb classname ejbspec { servermethoddef }

classdef:
       client class classname { clientmethods }

ejbspec:
       ejbregistration | ejbregistration transactiondef

transactiondef:
       transaction [NotSupported | Required | Supports |
       RequiresNew | Mandatory | Never]

pagedef:
       page pagename title { view viewname buttons { buttonlist } }

buttonlist:
      buttondef | buttonlist buttondef

buttondef:
      servicebutton | ejbbutton
```

```
clientmethods:
      clientmethoddef | clientmethods clientmethoddef

clientmethoddef:
       method methodname is servicename

servermethoddef:
       method methodname (fullviewname) returns fullviewname

servicebutton:
       buttonname service ( servicename ) shows pagename

ejbbutton:
      buttonname ejbmethod ( ) shows pagename

viewname:
      classname

fullViewname:
      viewname | viewname [ codepagename ]

copybook:
      identifier
      —An identifier that names a file containing a COBOL data definition.

servicename:
      identifier
      —An identifier that matches a resource definition in your jcrmgw.cfg file

pagename:
      identifier
      —An identifier that names a page definition.

codepagename:
      identifier
      —The name of a codepage to be used for character translation to/from
      mainframe data formats. This must be a codepage supported by the JDK being
      used.

methodname:
      identifier
      —The name to be given to a generated Java method.

classname:
      identifier
      —An identifier that names a Java class, including any package name.
```

```
ejbregistration:
      identifier
      —The name that will be used to register the home interface for an EJB.

title:
      identifier
      —The title to be placed into the HTML generated for a page.

buttonname:
      identifier
      —A button name that will be used in the HTML generated for a page.

ejbmethod:
      identifier
      —An EJB classname and method specification that should look like this:
      package.ejbclass.method
            or
      ejbclass.method
```

# Results of Running the eGen Application Generator

- The specified COBOL copybook is parsed for each DataView definition (described in DataView Programming Reference) and a Java source file for the specified DataView class is generated in the current directory.

  If XML support was requested, then the following files are also produced:

  - *viewname*.dtd - DTD file
  - *viewname*.xsd - XML Schema file

- For each servlet definition, a Java source file is generated in the current directory for the specified class.
- For each client class definition, a Java source file is generated in the current directory for the specified class.

- For each EJB definition, three Java source files, a WebLogic deployment information file, and a deployment descriptor text file are generated in the current directory. The names of the generated files are listed in below.

| Name of File | Purpose |
|---|---|
| *classname*Home.java | EJB Home Interface |
| *classname*Bean.java | EJB Implementation class |
| *classname*.java | EJB Remote Interface |
| *classname*-jar.xml | EJB Deployment descriptor |
| wl-classname-jar.xml | WebLogic Deployment Info |

# C Understanding How WebLogic JAM Uses XML

BEA WebLogic Java Adapter for Mainframe (WebLogic JAM) uses the capabilities of XML to exchange data between different applications and operating systems. Understanding basic XML terms will help you to understand WebLogic JAM's XML capabilities and how they are used.

This section discusses the following topics:



## What is XML?

Extensible Markup Language, or XML, is a text format for exchanging data between different systems. It allows data to be described in a simple, standard, text-only format. Since the data is presented in a standard form, applications on disparate systems can interpret the data using simple text parsing tools, instead of having to interpret data in proprietary binary formats.

XML documents come in two varieties: data and metadata.

- XML Data Document

  Data records can be converted into XML documents, which can then be transmitted to other applications. The XML data documents contain a single top-level entity (or tag) that represents the entire data record. Fields within the record are represented by other subordinate entities nested within the top-level entity. Each entity has a unique tag name, which corresponds to a field within the original data record. Each entity has content, which is the actual data value of the field. Entities may also have attributes, which are values attached to the entities that augment the normal content values. The XML data document file name ends with a .xml extension.

  See Listing C-2 for an example XML data document.

- XML Metadata

  Every XML document consists of a top-level entity, which in turn may be composed of subordinate entities. The structure of these entities, which included their tag names, the order in which they occur, the type and length of their content values, and their allowed attribute values, is described by a metadata definition. Metadata definitions can take the form of XML documents themselves. There are two standard formats for XML metadata documents: XML Document Type Definition (DTD) and XML Schema.

# Document Type Definition

A Document Type Definition, or DTD, defines the legal building blocks of an XML document. It defines the document structure with a list of legal elements (tags). While XML provides an application independent way of sharing data, the DTD provides a common definition for interchanging data.

Your application can use a standard DTD to verify that data that you receive from the outside world is valid. You can also use a DTD to verify your own data.

The XML DTD file name ends with a .dtd extension.

See Listing C-3 for an example XML DTD document.

## XML Schema

A schema specifies the structure of an XML document and constraints on its content. While XML is the meta-language that provides the rules for defining tag languages, an XML Schema document is a formal specification of the grammar for a particular tag language. The schema defines the elements that can appear within the document and the attributes that can be associated with an element. It also defines the structure of the document: which elements are child elements of others, the sequence in which the child elements can appear, and the number of child elements. It defines whether an element is empty or can include text. The schema can also define default values for attributes.

XML Schema is more precise than DTD, providing more descriptive information about each XML element. It is likely that XML Schema will eventually replace XML DTD as the dominant standard metadata format.

A schema is useful for validating the document content to determine whether a document is a valid instance of the grammar expressed by that schema and for describing your grammar for use by others.

The XML Schema file name ends with a .xsd extension.

See Listing C-4 for an example XML Schema document.

# How WebLogic JAM Uses XML

The WebLogic JAM eGen Application Generator provides the ability to generate both XML Schema and XML DTD (Document Type Definition) documents for a given COBOL copybook record definition. The WebLogic JAM runtime environment provides the capability of converting data records into XML data documents formatted according to their corresponding schema or DTD definitions.

The following listings show examples of the XML files generated by the eGen utility from the COBOL Copybook for an employee information record.

Listing C-1 shows an example of an employee information record from a COBOL Copybook. The eGen utility generates an XML Schema and a DTD from the employee information record. Listing C-2 shows the corresponding XML document that

conforms to the XML Schema and DTD generated from the employee record information, Listing C-3 shows the corresponding DTD, and Listing C-4 shows the corresponding XML Schema.

**Listing C-1 COBOL Copybook for Employee Information Record (emprec.cpy)**

```
*-------------------------------------------------------
* emprec.cpy
* Employee record.
*
* @(#)$Id: emprec.cpy,v 1.2 1999/11/12 01:16:41 $
*-------------------------------------------------------
        02  emp-record.

        04  emp-ssn                    pic 9(9) comp-3.

        04  emp-name.
                06  emp-name-last      pic x(15).
                06  emp-name-first     pic x(15).
                06  emp-name-mi        pic x.

        04  emp-addr.
                06  emp-addr-street    pic x(30).
                06  emp-addr-st        pic x(2).
                06  emp-addr-zip       pic x(9).

* End
```

**Listing C-2 Example XML Document that Conforms to a DTD and XML Schema Generated from the eGen Application Generator (emprec.xml)**

```
<emprec>
   <empRecord>
     <empSsn>660337645</empSsn>
     <empName>
       <empNameLast>Doe</empNameLast>
       <empNameFirst>John</empNameFirst>
       <empNameMi>P</empNameMi>
     </empName>
     <empAddr>
       <empAddrStreet>3235 Possum Park Ln.</empAddrStreet>
       <empAddrSt>TX</empAddrSt>
       <empAddrZip>758050000</empAddrZip>
```

```
     </empAddr>
   </empRecord>
</emprec>
```

**Listing C-3 DTD Generated from eGen Application Generator (emprec.dtd)**

```
<!--
! DTD emprec 1.0
!
! Definition:   emprec
! Version:      1.0
! Source:       ../symbol/emprec.cpy
! Generated:    2000-09-27T19:18:25.084Z
! Created:      2000-09-27T19:18:24.937Z
! Modified:     1999-11-12T01:16:41.000Z
!-->

<!ELEMENT emprec
 ( empRecord )>

<!ATTLIST emprec
  date CDATA #DEFAULT "unknown">
  <!-- format="ccyy-mm-ddThh:mm:ss.mmmZ" -->

<!ATTLIST emprec
  version CDATA #DEFAULT "1.0">

<!-- empRecord -->
<!ELEMENT empRecord
 ( empSsn ,
   empName ,
   empAddr )>


<!-- empRecord.empSsn -->
<!ELEMENT empSsn
  (#PCDATA)>

<!-- empRecord.empName -->
<!ELEMENT empName
 ( empNameLast ,
   empNameFirst ,
   empNameMi )>

<!-- empRecord.empName.empNameLast -->
```

```
<!ELEMENT empNameLast
  (#PCDATA)>

<!-- empRecord.empName.empNameFirst -->
<!ELEMENT empNameFirst
  (#PCDATA)>

<!-- empRecord.empName.empNameMi -->
<!ELEMENT empNameMi
  (#PCDATA)>

<!-- empRecord.empAddr -->
<!ELEMENT empAddr
 ( empAddrStreet ,
   empAddrSt ,
   empAddrZip )>

<!-- empRecord.empAddr.empAddrStreet -->
<!ELEMENT empAddrStreet
  (#PCDATA)>

<!-- empRecord.empAddr.empAddrSt -->
<!ELEMENT empAddrSt
  (#PCDATA)>

<!-- empRecord.empAddr.empAddrZip -->
<!ELEMENT empAddrZip
  (#PCDATA)>

<!-- End -->
```

**Listing C-4 XML Schema Generated from eGen Application Generator (emprec.xsd)**

```
<?xml version="1.0"?>
<schema
   xmlns:xsd="http://www.w3.org/1999/XMLSchema">

  <xsd:annotation>
    <xsd:documentation>
      Schema:       emprec
      Version:      1.0
      Source:       ../symbol/emprec.cpy
      Generated:    2000-09-27T19:19:42.857Z
      Created:      2000-09-27T19:19:43.708Z
```

```
    Modified:     1999-11-12T01:16:41.000Z
  </xsd:documentation>
</xsd:annotation>

<xsd:element name="emprec">
  <xsd:complexType>

    <xsd:attribute name="date"
       type="xsd:timeInstant"/>

    <xsd:attribute name="version"
       type="xsd:string"
       use="default"
       value="1.0"/>

    <xsd:element name="empRecord">
      <xsd:complexType>

        <xsd:element name="empSsn">
          <xsd:simpleType base="xsd:integer">
            <xsd:precision value="9"/>
            <xsd:minInclusive value="0">
          </xsd:simpleType>
          <!-- <%picture value="9(9)"/> -->
        </xsd:element>

        <xsd:element name="empName">
          <xsd:complexType>

            <xsd:element name="empNameLast"
               type="xsd:string"
               length="15"/>
               <!-- <%picture value="x(15)"/> -->

            <xsd:element name="empNameFirst"
               type="xsd:string"
               length="15"/>
               <!-- <%picture value="x(15)"/> -->

            <xsd:element name="empNameMi"
               type="xsd:string"
               length="1"/>
               <!-- <%picture value="x"/> -->

          </xsd:complexType>
        </xsd:element> <!--"empName"-->

        <xsd:element name="empAddr">
          <xsd:complexType>
```

```
                    <xsd:element name="empAddrStreet"
                       type="xsd:string"
                       length="30"/>
                       <!-- <%picture value="x(30)"/> -->

                    <xsd:element name="empAddrSt"
                       type="xsd:string"
                       length="2"/>
                       <!-- <%picture value="x(2)"/> -->

                    <xsd:element name="empAddrZip"
                       type="xsd:string"
                       length="9"/>
                       <!-- <%picture value="x(9)"/> -->

                  </xsd:complexType>
                </xsd:element> <!--"empAddr"-->

              </xsd:complexType>
            </xsd:element> <!--"empRecord"-->


        </xsd:complexType>
      </xsd:element> <!--"emprec"-->

    </schema>
```

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