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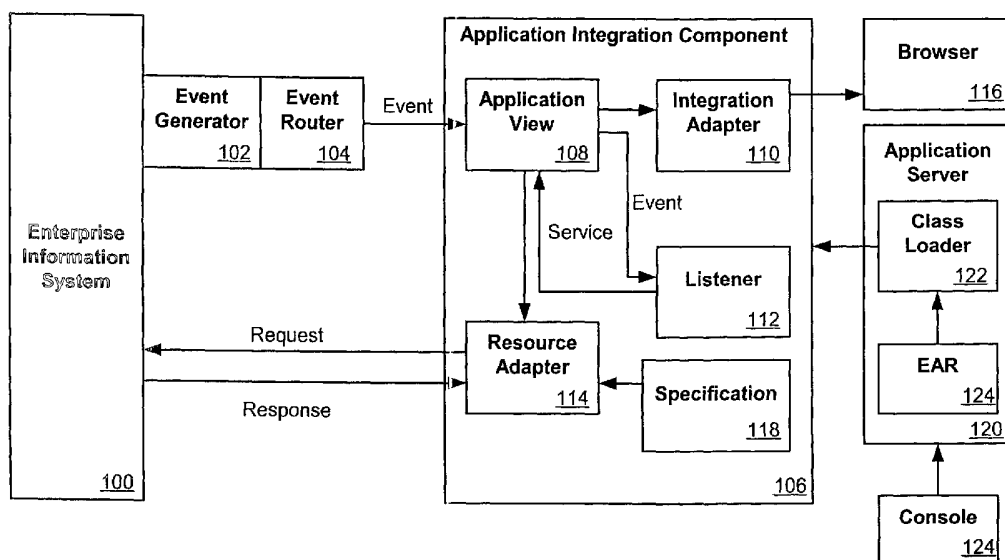
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(54) Title: SYSTEMS AND METHODS FOR MODULAR COMPONENT DEPLOYMENT



(57) Abstract: An integration component (106) such as an application integration engine can be bundled as a single, self-contained J2EE Enterprise archive (EAR) file (124). The bundling of the component into an EAR file enables the component to be deployed to any valid system (100) domain that is running and available. A recycling of the server (120) then may be necessary only if a Java archive file is added to the classpath for non-system domains. This description is not intended to be a complete description of, or limit the scope of, the invention. Other features, aspects, and objects of the invention can be obtained from a review of the specification, the figures, and the claims.

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**SYSTEMS AND METHODS FOR MODULAR COMPONENT  
DEPLOYMENT**

CLAIM OF PRIORITY

5 This application claims priority from U.S. provisional patent application  
"MODULAR DEPLOYMENT OF COMPONENTS", Application No. 60/377,354,  
filed May 2, 2002, incorporated herein by reference.

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15 CROSS-REFERENCED CASES

The following applications are cross-referenced and incorporated  
herein by reference:

20 U.S. Provisional Application No. 60/377,322 entitled "Application View  
Transactions," by Timothy Potter et al., filed May 2, 2002 (Attorney Docket No.:  
BEAS-01268US0).

U.S. Provisional Application No. 60/377,303 entitled "Adapter  
Deployment Without Recycle," by Timothy Potter et al., filed May 2, 2002  
(Attorney Docket No.: BEAS-01266US0).

25 U.S. Provisional Application No. 60/377,353 entitled "Shared Common  
Connection Factory," by Timothy Potter et al., filed May 2, 2002 (Attorney  
Docket No.: BEAS-01269US0).

FIELD OF THE INVENTION

30 The present invention relates to the deployment of software  
components across a system.

### BACKGROUND

In existing integration systems, the primary use of an application integration (AI) component, such as an application view, is through a business process management (BPM) workflow. Potential consumers of an AI component, such as Web service developers and portal developers, will also require access to an Enterprise information system (EIS). However, like a business process engineer, these developers are not interested in dealing with the intricate details of a particular EIS. Further, the developers want access to the AI component with minimal installation, configuration, and administration overhead.

Certain components are tightly integrated with the integration system, such that system providers do not worry about providing integration flexibility. Users purchasing an integration system get a pre-configured integration domain. If a user wants to use system functionality with other domains, such as a Web portal domain, it is necessary for the user to do the integration.

### BRIEF SUMMARY

Systems and methods in accordance with embodiments of the present invention can overcome deficiencies in existing integration systems by changing the way in which integration components are deployed to system domains. An integration component such as an application integration engine can be bundled as a single, self-contained J2EE Enterprise archive (EAR) file.

The bundling of the component into an EAR file enables the component to be deployed to any valid system domain that is running and available. A recycling of the server can then be necessary only if a Java archive file is added to the classpath for non-system domains.

Other features, aspects, and objects of the invention can be obtained from a review of the specification, the figures, and the claims.

### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram of a system in accordance with one embodiment of the present invention.

Figure 2 is a flowchart showing a method that can be used with the system of Figure 1.

### DETAILED DESCRIPTION

Systems and methods in accordance with embodiments of the present invention can allow application integration (AI) functionality to be imbedded deeply into an integration installation. In one such system, AI functionality can be bundled in an enterprise application archive (EAR) file that is available to any valid system domain. This packaging can retain backward compatibility with existing integration systems, while providing the lightweight solution that developers desire.

Such packaging can be used with modular deployment when, for example, a portal needs to access an EIS. Many such products and processes can leverage AI functionality. One purpose for using modular deployment is to make it as easy as possible to configure AI for downstream products. Presently, a user has to clean up what goes onto the classpath. It can be desirable to use Java™ 2 Enterprise Edition (J2EE) standards, as set forth by Sun Microsystems, Inc., of Santa Clara, CA, such as using an Enterprise application. An end-user can use an EAR file, for example, to use application integration with a non-system domain.

An exemplary integration system that can be used in accordance with embodiments of the present invention is shown in **Figure 1**. An integration adapter **110** can include a Web application that allows a user to browse documents or business programming application interfaces (BAPIs) that are available in an EIS system **100**, such as an SAP system, through a Web browser **116** without the Web application. A resource adapter **114** can be used to send requests to, and receive requests from, the EIS **100**. The resource adapter **114** can also be used to implement the connector specification **118**. An event router **104**, which can also be a Web application, can be used to route messages from the EIS **100** to an application view **108** for the application integration component **106**.

When an event occurs in the EIS **100**, an event generator **102** can detect the event and determine whether anyone should receive this event. To do this, the event generator **102** can check the types of events that have subscriptions, which can be maintained by the event router **104**. The event router can create an event object containing pertinent data about the event,

and can send the event object to the event router **104**. The event router **104** can send the event object to any application view **108** that is subscribed to the type of event object received from the event generator **102**. The application view **108** can receive the event object and notify any listener **112** registered for that type of event. Exemplary listeners can include integration process flow or custom business logic flow. A listener **112** can process the event object and determine whether a service should be invoked in response to the event.

The application view **108** can combine data from the event object with data held by the application view, such as in state variables, and can make a service invocation on a resource adapter **114**. The application view can accept the service request and determine which interaction to request on the resource adapter **114**. This mapping from service name to adapter interaction can allow the service to be business-centric and not system-function centric. The resource adapter **114** can carry out the request interaction with the EIS **100** and pass the data received from the application view **108**. This data can then be viewed, such as through a Web browser **116**, through the integration adapter **110**.

As shown in the method of **Figure 2**, an application component such as an AI engine can be bundled as a single, self-contained J2EE EAR file **200**. This bundling can enable the AI engine to be deployed to any valid, running system domain **202**. A user may still be required to re-cycle the server **206**, as the user may need to add a Java archive (JAR) file to the classpath for non-system domains **204**. A re-cycle may be needed due to classloading problems between an application view bean and a resource adapter, for example. Any classes that cross the bridge between an application view Enterprise JavaBean (EJB), which can be deployed from a system EAR file, to a resource adapter, which can be deployed in its own EAR file, can be loaded by the same classloader. In existing systems, the only way to have two Enterprise applications share a common class is to have that class on the system classpath. Consequently, a system EAR file cannot be deployed without a server re-cycle because the deployer will need to add a JAR file to the system classpath before starting the system.

An AI engine can use an integration repository for metadata persistence. The AI engine can rely on a pre-configured repository and

associated Java Database Connectivity (JDBC) connection pool and data source. In this case, the AI engine deployer can provide the JDBC data source name and credentials at the time of deployment. The AI engine can assume that the repository has already been installed in the data source.

5           An application view engine can use Java Message Service (JMS) resources to handle events and asynchronous service invocations. To support these functions, an application view engine can use functionality such as a JMS Connection Factory, JMS Template, JMS JDBC Store, and/or JMS Server. In addition, an AI engine can define a request and response queue for  
10 handling asynchronous service invocations. The AI engine deployer is not forced to define the JMS resources before deploying the AI engine. Consequently, at least two modes of operation can be supported for determining which JMS resources to use.

          The AI engine deployer can provide the name of pre-existing JMS  
15 resources, such as "JMSTemplate" and "JMSConnectionFactory". If a deployer provides the name for a JMS server, the developer may also need to configure the JMS JDBC store. The AI engine deployer does not need to provide the name of pre-existing JMS resources. The AI startup process can use JMS managed beans (MBeans) to define the necessary JMS resources.

20           AI startup and shutdown classes can be replaced by a Java HTTP servlet, such as "LifeCycleServlet". The servlet can be deployed in an integration Web application and loaded on startup. On startup, the servlet can also trigger the initialization sequence for the AI engine. The initial parameters provided to the servlet can serve as the configuration parameters for the AI  
25 engine. The user can change these parameters by editing a Web application descriptor, for example. A list of potential configuration parameters can include:

- logLevel - can contain the verbosity level for AI logging
- 30 • deploymentRepositoryRootPath - can hold the location where the AI engine saves connection factory deployment descriptors
- hostUserID - can be used to allow a remote event router (i.e. deployed from a Web application) to authenticate itself to the server so the remote router can post events.

- hostPassword - can store the password to allow a remote event router to authenticate itself to the server so that it can post events.
- 5     • ims.autogen - a flag (boolean) that can allow the AI startup process to autogenerate JMS resources.
- ims.serverName - name of the JMS Server on the local server
- ims.conn - JMS Connection Factory JNDI context
- repositoryDatasourceName - JDBC data source name

10     An application view management console can provide a way to view the configuration parameters for the AI engine, such as by providing a link to a page containing these parameters. Starting and stopping an AI engine can be done from a console via deploying and/or undeploying the integration application that contains the application integration component.

15     Certain properties can be edited by a user using a configuration page, including properties such as logLevel, hostPassword, and hostUserID. Since BPM may not always be installed with AI, AI can provide a simple command-line import/export tool for application views. The output of this tool can be a JAR file containing any artifacts owned by the application view. The user can be required to manually import/export any artifacts that are not owned, but are used by the application view.

20     An example of a common AI JAR file that can be added to the server classpath at startup is "ai-core.jar." This exemplary JAR can contain:

- log4j.jar contents
- logtoolkit.jar contents
- 25     • xmltoolkit.jar contents
- AI.jar contents|\_\_com/ai/\*.dtd
- com/ai/common/\*.class
- com/ai/message/\*.class
- xcci.jar contents

30     Such a JAR could be required for all clients of the AI system, for example. For integration domains, ai-core.jar can be added to a JAR such as "icommon.jar" so that the clients and server can access the base AI classes. Consequently, the AI experience for existing integration users can remain largely unchanged.

   A client JAR, such as "ai-client.jar", can be used to contain any classes

needed by clients of the AI engine, such as application view clients and resource adapter design time Web applications.

5 A server JAR file, such as "ai-server.jar," can contain all classes needed by the server-side components, and does not need to be included into any adapter EAR files or clients. For integration domains, ai-server.jar can be added to a server JAR such as iserver.jar so that server components can access the base AI server classes.

10 An MBean JAR file, such as "ai-mbean.jar," can be used to contain the application view MBeans and can be included on the system classpath for the integration server. For integration domains, ai-server.jar can be added to iserver.jar so that server components can access the MBean classes.

15 A server EJB JAR file, such as "ai-server-ejb.jar," can contain the base server classes and management EJBs. This JAR can be deployed before all other components of the AI engine, and can contain a startup EJB that can initialize AI.

20 An AI Web archive (WAR) file, such as "ai.war," can contain an application view management console Web application and the lifecycle servlet for the AI engine. An event processor EJB JAR file, such as "ai-eventprocessor-ejb.jar," can contain the event processing message driven EJB for handling AI events.

25 An asynchronous EJB JAR file, such as "ai-asyncprocessor-ejb.jar," can contain an asynchronous service processing message-driven EJB for handling asynchronous service invocations. A plug-in EJB JAR file, such as "ai-plugin-ejb.jar," can contain all classes for a plug-in for BPM. A plug-in WAR file, such as "ai-plugin.war," can contain the online help Web application for the AI Plug-in for BPM.

In order to configure deployment for integration domains that require AI, components such as the following can be added to an integration application element:

30 `<EJBComponent Name="AI Server EJBs" Targets="myserver" URI="ai-server-ejb.jar" DeploymentOrder="1"/>`

35 `<WebAppComponent Name="AI Application View Management Console" Targets="myserver" URI="ai.war" DeploymentOrder="2"/>`

`<EJBComponent Name="AI Event Processor Message Driven EJB" Targets="myserver" URI="ai-eventprocessor-ejb.jar"`



```

DeploymentOrder="3"/>

5 <EJBComponent Name="AI Async Service Processor Message
Driven EJB" Targets="myserver" URI="ai-asyncprocessor-
ejb.jar" DeploymentOrder="3"/>

10 <EJBComponent Name="AI Plug-In for BPM"
Targets="myserver" URI="ai-plugin-ejb.jar"
DeploymentOrder="10"/>

15 <WebAppComponent Name="AI Plug-In for BPM Online Help"
Targets="myserver" URI="ai-plugin.war"
DeploymentOrder="11"/>

```

15 For AI domains, there can be an AI EAR file, such as "ai.ear," which can contain any file needed to deploy the AI enterprise application outside of an AI domain. The EAR file can be structured as:

```

20 |__META-INF
|   |__application.xml (EAR file deployment descriptor)
|   |__ai.war (application view management console Web
application)
|   |__WEB-INF
|       |__lib
|           |__Webtoolkit.jar
25 |__ai-server-ejb.jar (AI Management EJBs)
|   |__Startup EJB
|   |__ApplicationView EJB
|   |__SchemaManager EJB
|   |__DeployManager EJB
30 |   |__ApplicationViewManager EJB
|   |__NamespaceManager EJB
|__ai-eventprocessor-ejb.jar
|__ai-asyncprocessor-ejb.jar
|__ibase.jar (ECI repository base classes)
35 |__irepository.jar (ECI repository classes)

```

Deployers may still need to add ai-core.jar to the system classpath and restart their server in some embodiments.

40 An application component such as the following can be added to the config.xml for the non-AI domain, or uploaded from the server console once the ai-core.jar file is on the classpath:

```

<Application Deployed="true" Name="Application
Integration" Path="<PATH_TO_EAR>/ai.ear">

```

```
5      <EJBComponent Name="AI Server EJBs" Targets="myserver"  
      URI="ai-server-ejb.jar" DeploymentOrder="1"/>  
  
      <WebAppComponent Name="AI Application View Management  
      Console" Targets="myserver" URI="ai.war"  
      DeploymentOrder="2"/>  
  
10     <EJBComponent Name="AI Event Processor Message Driven  
      EJB" Targets="myserver" URI="ai-eventprocessor-ejb.jar"  
      DeploymentOrder="3"/>  
  
      <EJBComponent Name="AI Async Processor Message Driven  
      EJB" Targets="myserver" URI="ai-asyncprocessor-ejb.jar"  
      DeploymentOrder="3"/>  
15  
  
      </Application>
```

A Plug-In for BPM may not be able to be deployed from the ai.ear file for AI domains.

20 An AI engine can use JMS resources such as a JMS server, a JMS connection factory, JMS queues, and JMS topics. If the JMS connection factory supplied by the user is not bound to a JNDI location, the factory can be cloned and bound to a location, such as com.ai.JMSConnectionFactory, so that internal AI components can be guaranteed to have access to a JMS  
25 connection factory. Queues that can be used include event queues, asynchronous request queues, and asynchronous response queues. Topics that can be used can include event topics, for example.

An AI engine can automatically define any necessary JMS resources that are not explicitly defined, such as for a standalone server and a cluster.  
30 This can free a user from having to define the resources, such as through a user interface (UI). Automatic definition can be done in a clustered or non-clustered environment. This can save the user from having to do an error-prone process of defining multiple JMS resources. This process can be relatively self-contained and can take care of defining necessary resources  
35 and dependencies. Using a system console to define multiple queues can be quite a tedious task, especially if the queues need to be distributed in a cluster.

A system administrator can simply specify configuration parameters such as the JMS server name (e.g., ai.jms.serverName ) and the JMS connection factory JNDI name (e.g., ai.jms.connectionFactoryJNDIName). In  
40 addition, if a user wishes to disable the auto-generation of JMS resources, the user can set a JMS auto-generation parameter, such as ai.jms.autogen, to

'false.' This can prevent the AI engine from attempting to auto-generate any JMS resources.

It may be desirable that adapters developed and tested on existing systems are able to run un-altered on systems in accordance with the present invention. If an adapter provider needs to rebuild an adapter against a new adapter development kit (ADK) that incorporates an embodiment in accordance with the present invention, the adapter provider may need to change the build procedure to account for new AI binary files such as those described above. Specifically, adapter developers may need to reference new JAR files such as the following:

```
<property name='AI_CORE' value='${AI_LIB_DIR}/ai-core.jar' />
```

```
<property name='AI_CLIENT' value='${AI_LIB_DIR}/ai-client.jar' />
```

```
<property name='AI_EVENTROUTER' value='${AI_LIB_DIR}/ai-eventrouter.jar' />
```

Adapter developers may also need to change how they declare the environment property. In one embodiment, this declaration can be implemented as, for example:

```
<property environment='env' />
```

The foregoing description of preferred embodiments of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations will be apparent to one of ordinary skill in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, thereby enabling others skilled in the art to understand the invention for various embodiments and with various modifications that are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalence.

CLAIMS

5 What is claimed is:

1. A method for the modular deployment of a integration component, comprising:

10 bundling an integration component as an enterprise archive file; and  
deploying the integration component to a valid system domain from the  
enterprise archive file.

2. A method according to claim 1, further comprising:

recycling a server for the valid system domain.

15 3. A method according to claim 1, further comprising:

adding a Java archive file for the integration component to the  
classpath for a non-system domain.

4. A method according to claim 3, further comprising:

20 recycling a server for the valid system domain.

5. A method according to claim 1, wherein:

25 bundling the integration component allows the integration component to  
be backward compatible with existing integration systems.

6. A method according to claim 1, wherein:

deploying the integration component allows the integration component  
to utilize JMS resources available to the valid system domain.

30 7. A method according to claim 1, further comprising:

configuring parameters for the integration component using a  
management console.

8. A system for the modular deployment of a integration component,

comprising:

means for bundling an integration component as an enterprise archive file; and

5 means for deploying the integration component to a valid system domain from the enterprise archive file.

9. A computer-readable medium, comprising:

means for bundling an integration component as an enterprise archive file; and

10 means for deploying the integration component to a valid system domain from the enterprise archive file.

10. A computer program product for execution by a server computer for deploying an adapter, comprising:

15 computer code for bundling an integration component as an enterprise archive file; and

computer code for deploying the integration component to a valid system domain from the enterprise archive file.

20 11. A computer system comprising:

a processor;

object code executed by said processor, said object code configured to:

bundle an integration component as an enterprise archive file;

25 and

deploy the integration component to a valid system domain from the enterprise archive file.

12. A computer data signal embodied in a transmission medium, comprising:

30 a code segment including instructions to bundle an integration component as an enterprise archive file; and

a code segment including instructions to deploy the integration component to a valid system domain from the enterprise archive file.

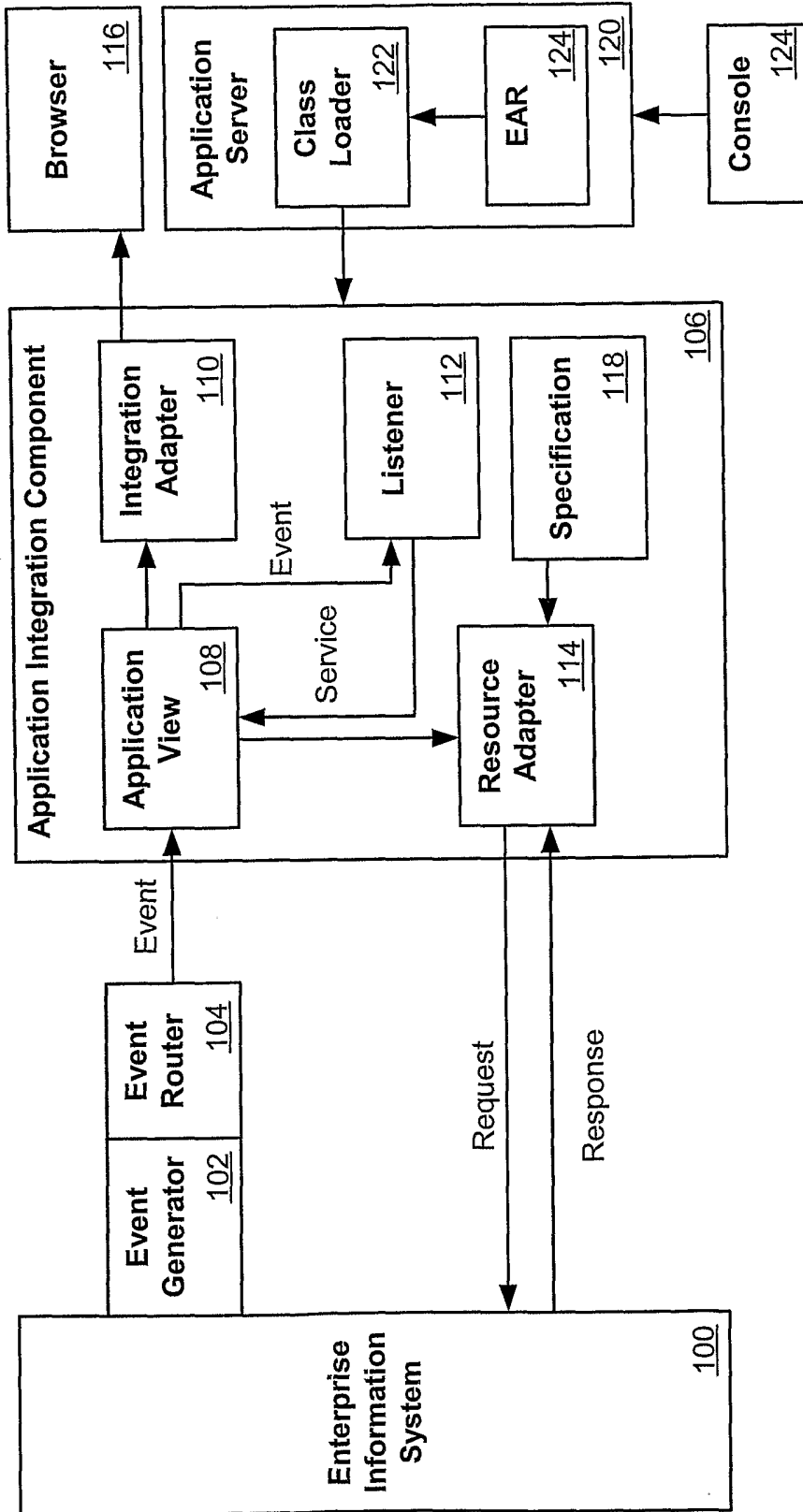
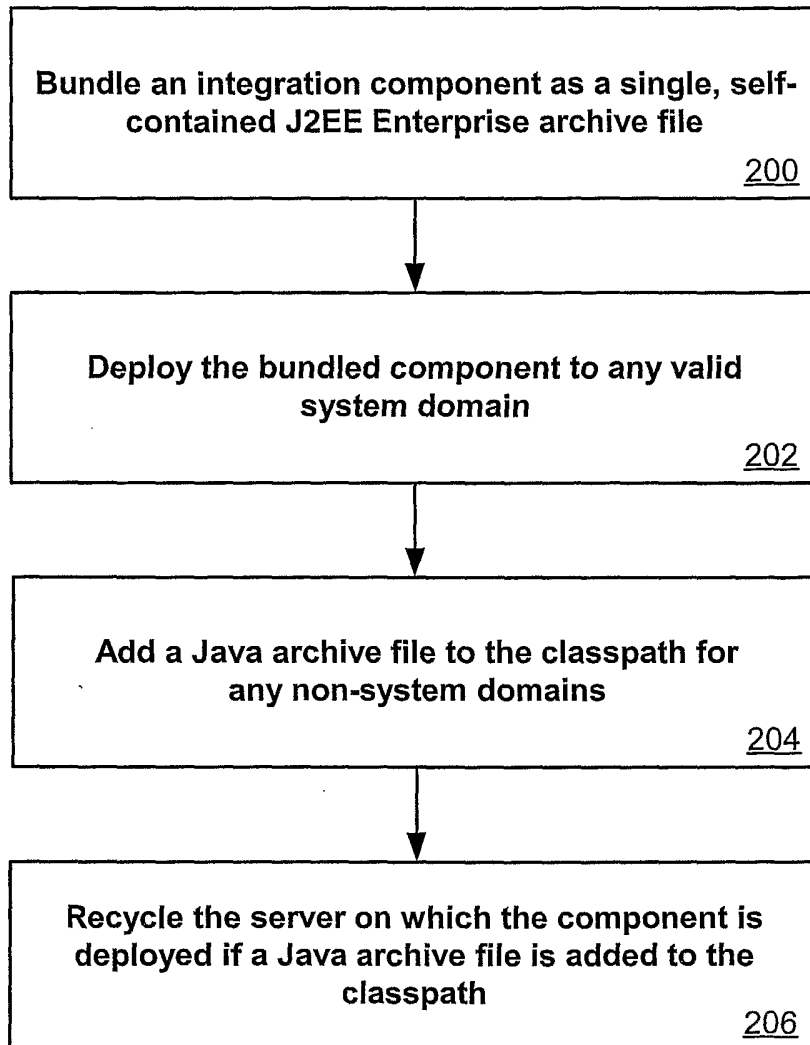


Figure 1

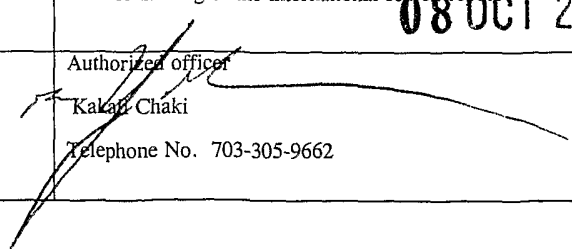


*Figure 2*

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/13953

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
IPC(7) : G06F 9/445 US CL : 717/174, 176, 177, 178		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) U.S. : 717/174, 176, 177, 178		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EAST 1.04 (USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,950,010 A (HESSE et al) 07 Sep 1999 (07.09.1999), Abstract, column 2, lines 9-14 and lines 34-57; column 5, line 66 to column 6, line 20; column 6, line 35 to column 7, line 10; column 11, line 8 to column 12, line 10; column 12, lines 30-67.	1-12
A	US 6,282,711 B1 (HALPERN et al) 28 Aug 2001 (28.08.2001), Abstract, Summary, Figs. 1-3.	1-12
A	US 6,237,135 B1 (TIMBOL) 22 May 2001 (22.05.2001), Abstract, Summary, Fig. 12.	1-12
A, P	US 6,393,605 B1 (LOOMANS) 21 May 2002 (21.05.2002), Abstract, Summary.	1-12
A	US 6,349,408 B1 (SMITH) 19 Feb 2002 (19.02.2002), Abstract, Summary, Figs. 5-11.	1-12
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
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"A"	document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search 17 September 2003 (17.09.2003)		Date of mailing of the international search report <b>08 OCT 2003</b>
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703)305-3230		Authorized officer  Kalaff Chaki Telephone No. 703-305-9662