WebSphere Business Integration Adapters
White paper

WebSphere® software

Unlocking Enterprise Information Systems with WebSphere Business Integration Adapters

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Introduction

As today's businesses transform themselves into on demand e-businesses, responsiveness and flexibility are increasingly high-priority issues. Companies must be able to quickly adapt and respond to a changing marketplace, and the consequences of slow response can be severe. In an effort to support, accelerate and optimize business processes and to meet new business requirements, companies acquire and develop new applications. The integration of these applications within various, disparate systems has itself become a serious challenge.

One aspect of today's business integration requirements is the need to leverage existing enterprise information system (EIS) assets in a heterogeneous, integrated enterprise. Whether you need to share data across disparate EISs; to automate processes across EISs, employees and trading partners; to connect new e-business applications to existing EISs; or to provide users with access to EIS data, there is a common requirement to provide interfaces to EISs.

IBM WebSphere® Business Integration Adapters can help you maximize business agility and investment protection by providing a broad suite of ready-to-use adapters for interfacing to EISs. WebSphere Business Integration Adapters are based on a comprehensive, common framework that allows you to adapt, configure and operate the adapters in a consistent manner, while using them in different deployment configurations within the WebSphere software platform to meet varying business integration needs.

Adapter requirements for enterprise integration

To understand the real value of the IBM WebSphere Business Integration Adapters portfolio, it is important to understand the function they provide and how they differ from other solutions in the marketplace.

In many cases, adapters are either the least visible element in a solution, or they are given exaggerated importance. Frequently, application server vendors or integration broker vendors with weak adapter offerings downplay the role of adapters. They either refer to the Java ™ 2 Platform, Enterprise Edition Connector Architecture (J2EE CA) standard, inferring that it will solve all adapter issues, or they rely upon third-party vendors to provide adapters. In other cases, an integration vendor that focuses primarily on adapters may claim that a true adapter should contain the business logic to transform data from the source application to the target application. This argument tries to compensate for the lack of an integration server that can provide a sophisticated enterprise integration solution. These adapters are commonly used in point solutions to address a tactical need, but they can lack the degree of flexibility and reuse required by an enterprise integration infrastructure.

WebSphere Business Integration Adapters offer a basic communication interface into or out of the application for which they were developed. They also act as a first abstraction layer for the integration server through the representation of business transactions in the form of business objects. WebSphere Business Integration Adapters can be used in simple or complex business integration solutions, providing access to EIS business data for application connectivity, process integration, e-business applications and business portals.

Overview and concepts of WebSphere Business Integration Adapters

IBM WebSphere Business Integration Adapters represent a collection of software programs, tools and application programming interfaces (APIs) an enterprise can use to enable EISs to exchange business data with an integration server. This can include IBM WebSphere Business Integration Server, IBM WebSphere InterChange Server, IBM WebSphere MQ Integrator Broker, IBM WebSphere MQ Integrator and IBM WebSphere Application Server Enterprise. Each EIS requires its own application-specific adapter to participate in the business integration system.

WebSphere Business Integration Adapters include:

- *A connector that links the application to the integration server.*
- *Tools with graphical user interfaces to help the user configure the connector and create the business object definitions needed for the EIS.*
- *An object discovery agent (ODA) for some of the adapters, which introspects EIS metadata to generate business objects.*
- *An adapter development kit (ADK), which provides a framework for developing custom adapters in Java or C++ technology in cases where an adapter for a particular legacy or specialized EIS is unavailable.*

Connectors

A connector mediates interactions between an EIS and the integration server over the network. It can be specific to an application – such as SAP R/3, Version 4 – or to a data format or protocol, such as XML over HTTP. All connectors share certain common behaviors, differing only in the manner in which they interact with applications and with business objects.

Each connector consists of two parts – the adapter framework and the application-specific component (shown in Figure 1):

- *The adapter framework communicates with the integration server by means of the transport layer.*
- *The application-specific component interacts directly with an EIS.*

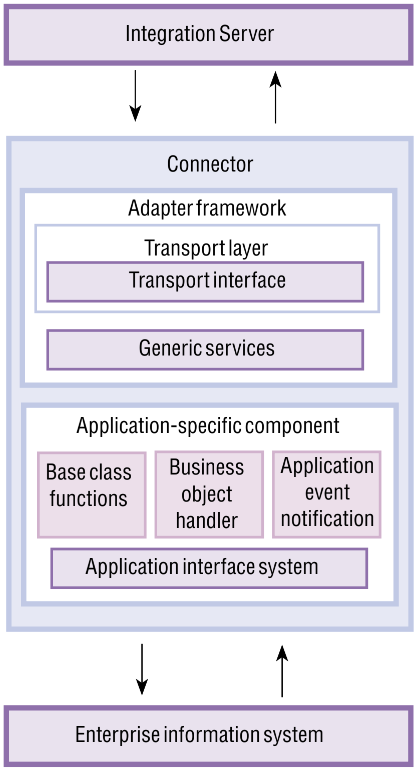

Figure 1. The subcomponents of a connector

WebSphere Business Integration Adapters are built upon a common adapter framework, which provides many features that are consistent across the adapters:

- *Adapter run-time infrastructure, based on Java technology*
- *Business objects, a metadata model for business transactions*
- *Communication with integration servers through the transport layer*
- *Standard interaction patterns for the exchange of business objects*
- *Quality of service for transactions – including assured delivery, fault tolerance and recovery – and failed transaction handling*
- *Vertical and horizontal scalability*
- *Configuration and deployment through common tooling*
- *Administration, monitoring, trace and log facilities*

Each connector can be deployed in a distributed environment, separate from the integration server. The adapter framework communicates with the integration server over a messaging transport, such as WebSphere MQ software. The only exception to this distributed deployment will exist when the adapter can be optionally deployed as a J2EE CA resource adapter within WebSphere Application Server. The connector behaves like a client to the EIS to which it interfaces, and as a consequence, it can reside on any machine on the network from which it can connect to the EIS.

WebSphere Business Integration Adapters offer a basic communication interface into or out of the EIS for which they were developed. They expose business transactions to the integration server in a simple and consistent manner, and they rely upon the integration server to provide transformation, routing and process logic. This lightweight architecture simplifies maintenance and upgrades because the artifacts do not require code changes in the adapter, and the complexity of artifacts within the adapter is minimized. Furthermore, this architecture delivers a very small footprint, providing the flexibility to situate the adapter near or even on the target EIS for optimum performance and quality of service.

Adapter interaction patterns

In the business integration system, data flow—the movement and processing of data sent from one application or entity to another— can occur either as an asynchronous or a synchronous exchange between applications over the network. For instance, an application might need to exchange data with another application to communicate changes in its data store or to obtain data. WebSphere Business Integration Adapters facilitate this flow through the exchange of data between the integration server and adapter in the form of business objects. (See Figure 2.) Business objects are an abstraction of application data structures and their associated operations, and they encapsulate and transmit business data for several purposes. They can convey new or changed data, a request for data or data returned in response to a request or operation. Furthermore, either the integration server or the adapter may originate business objects.

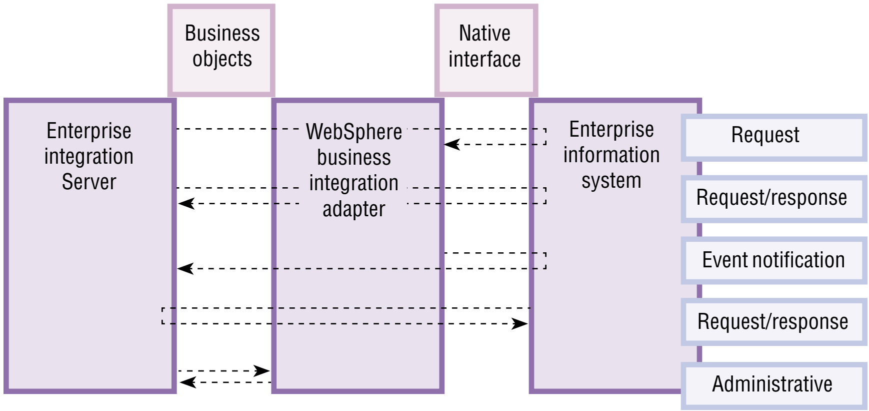

Figure 2. The four interaction patterns for the exchange of business data between the integration server, adapter and EIS.

In an integration server initiated request, the integration server sends a business object message as a request to the adapter framework, instructing it to have the application-specific component insert, change, delete or retrieve data in the EIS.

When the adapter finishes processing a request, it optionally returns a response to the integration server. For example, when an adapter receives a request to create an employee record in the destination EIS, it returns a business object with the created employee data and a status indicator showing that the creation was successful.

A business object can report the occurrence of an EIS event, an operation that affected a data entity in an EIS. The EIS event might be the creation, deletion or change in value of that collection of data. For example, an adapter might poll an application for new employee entities on behalf of the integration server. If the EIS creates a new employee entity, the adapter sends an event business object to the integration server.

In an EIS initiated request, the EIS invokes the adapter synchronously through a call-back mechanism, and the adapter sends a business object to the integration server to represent the operation. The adapter takes the corresponding response business object from the integration server and provides a synchronous response to the EIS. For example, an application may issue a real-time pricing look-up to the integration infrastructure.

In addition to these interactions for the exchange of business data, the adapter and integration server may also exchange administrative messages, such as status changes and administrative operations.

Business object processing

Integration server initiated request processing

The integration server sends requests, in the form of business objects, to the adapter framework. A request can ask the destination application to update EIS data or retrieve data from an EIS and return it to the integration server. For example, the integration server might send an adapter a request message to delete a contract, update a part, create an order or retrieve a customer.

When the adapter framework receives an integration server's request, it converts the message into a business object and forwards it to the application-specific component. (See Figure 3.) The application-specific component determines how to process the request based on the verb of the business object (for example, create, retrieve, update, delete), the data within the business object and the metadata contained in the business object definition. For example, when an application-specific component receives an ApplicationA_Employee business object with an update verb, it executes the appropriate commands to the EIS to update the specific employee data. When the operation is complete, the application-specific component will optionally populate the business object request with data from the EIS and the status of the operation, and forward it to the adapter framework for return to the integration server. This can be the data retrieved from the EIS in a retrieve operation, or it can be data generated by the application, such as object keys or default values, in a create or update operation.

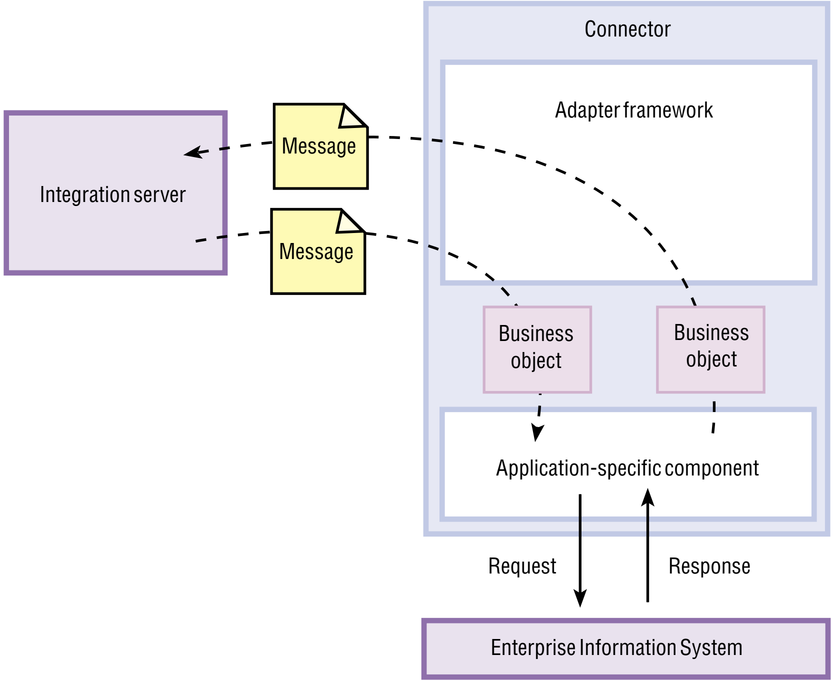

Figure 3. A connector interacts with the integration server and EIS for integration server initiated request processing.

In general, WebSphere Business Integration Adapters can be categorized as either application adapters or technology adapters. Application adapters are designed to interface with a specific API for a specific version of an EIS. These include WebSphere Business Integration Adapters for mySAP.com, Siebel, PeopleSoft and Oracle applications. Technology adapters are designed to generically support a given standard- technology interface to any EIS that supports that same interface. These include WebSphere Business Integration Adapters for JDBC (database), JText (file system) and Web services. However, these are functional distinctions, not architectural differences – all of the adapters are still based on the WebSphere Business Integration Adapter framework.

One minor architectural difference that does exist across adapters arises from the use of data handlers. Some adapters use business object metadata directly to assemble API calls to an EIS. For example, a business object may represent an SAP BAPI, a Siebel business component, a PeopleSoft component interface or a database SQL statement. In these cases, business object handlers provide complete business object processing, as described earlier.

In cases where serial data is used with an EIS interface, adapters frequently make use of data handlers to transform between the serial data and business object. Examples of data handlers include those for EDI, XML, delimited, fixed-width, SWIFT and HL7 data formats. Data handlers are a modular component of adapters that provide flexibility and extensibility to a deployment. An adapter may use different data handlers – for example, WebSphere Business Integration Adapter for JText can be configured to read and write some files containing EDI records and other files containing fixed-width records. Furthermore, the same data handler can be used with different adapters. The delimited data handler can be used to transform data in a WebSphere Business Integration Adapter for JText or the WebSphere Business Integration Adapter for e-mail. Also, new data handlers can easily be developed from the data handler framework for use with adapters.

Several advanced capabilities follow from the metadata-driven nature of the adapters. In many cases, the adapter can handle multiple operations (create, retrieve, update, delete) with the same business object. The adapter can handle multiple business objects because the instructions, which identify the object in the target system, are stored in the object metadata. The adapter framework can also handle synchronous and asynchronous operations in either direction. Business objects, in turn, may be used in either direction. To create a business object, you can use graphical tools and wizards to introspect EIS metadata. Taken together, these features provide a sophisticated yet simple means of accommodating the exchange of business data with an EIS using only one adapter — and without coding.

Enterprise information system event notification

The process of conveying changed EIS data to the integration server is called event notification. Most of today's EISs either do not provide an event notification mechanism for external systems (such as an adapter) or have only rudimentary support for it. To enable automated integration, event notification is an absolute necessity. If the EIS does not provide event notification, the enterprise must either purchase an adapter from a business integration vendor that provides this feature, or it must spend the time, money and development resources (with deep application knowledge) necessary to develop this event notification mechanism for the EIS.

Virtually all WebSphere Business Integration Adapters provide the event notification for the EIS for which the adapter is developed. This event notification mechanism is typically developed with the tools the EIS vendor provides and is certified by the EIS vendor for WebSphere Business Integration Adapters. Many competitive adapter products do not provide this event-detection mechanism for the EIS, and the enterprise must invest its own resources to solve this problem.

The ways in which application-specific components detect and retrieve events differ from one adapter to another. However, the way in which application-specific components send events to the adapter framework and the way in which the adapter framework delivers those events to the integration broker are standard across all adapters. (See Figure 4.) The following describes general concepts regarding the event-notification mechanism of many adapters.

The event notification mechanism is generally composed of the following elements:

- *An event store located within the EIS*
- *A means to populate the event store with EIS events*
- *An event-detection mechanism for the adapter to identify new EIS events in the event store*
- *A means to retrieve new events from the EIS*
- *A means to deliver events to the integration server*

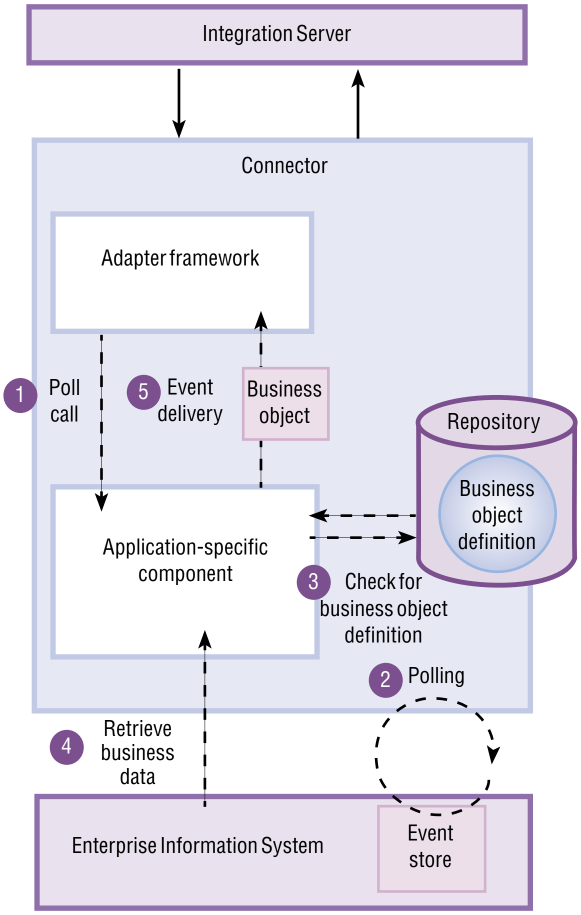

Figure 4. An adapter and its supporting infrastructure detect a change to the EIS data store and construct a business object to convey the changed data to the integration server.

The event store provides a persistent mechanism, such as additional tables in the EIS data store, for logging EIS data changes that pertain to the integration system. The data store provides an ordered list of operations that takes place in the EIS. It might have the physical form of an application event queue, a database table, a directory on the file system or an e-mail inbox. The information in the event store generally includes the business object type, verb (such as, create or update), the key identifying the changed data entity in the EIS data store, timestamp and priority. The event store may also contain the complete data for the event itself. The event store is usually provided with the adapter as an artifact specific to the EIS development environment and is readily imported into the system.

To an adapter, an EIS event is any operation that affects the data of an EIS entity associated with a business object definition. Where an EIS provides a facility for events, the adapter's event-detection mechanism generally leverages it to populate the event store. For such applications, setting up the connector's event-notification mechanism is a normal application setup task. For example, an EIS may allow the installation of a user exit script that executes when a particular type of event occurs, writing an event in the event store. Another EIS might have an internal workflow system that can register an event in the EIS and write to an event store when executed. If an EIS does not provide native support for events, the event notification mechanism can utilize triggers within the EIS database.

An adapter's application-specific component identifies new EIS events through its event detection mechanism, the most common of which is polling for new events in the event store. The adapter framework generally initiates a poll call at periodic intervals, which in turn asks the application-specific component to check for changes to the EIS event store. The interface to the event store may be through the EIS APIs where possible, or it may be provided through database queries to retrieve new events directly from an event table.

After detecting an event, the adapter's application-specific component:

- *Associates the application event with a business object definition and creates an instance of that business object*
- *Sets the verb and key value attributes in the business object*
- *Retrieves application data and populates the business object's attributes, generally by invoking the same business object handler used for integration server initiated requests*
- *Forwards the business object to the adapter framework*
- *Archives the event (optional)*

Once the adapter framework receives the business object from the application-specific component, it delivers the event to the integration server.

Enterprise information system initiated request/response

One business integration scenario that occurs in many situations is an EIS initiated synchronous request. In this case, the EIS issues a request to retrieve or update data outside the bounds of the EIS and expects a synchronous response. One example is a Web application that must check product availability before placing an order. Another is a call-center service application that must access scheduling information before booking a service appointment. In both cases, the EIS user makes an inquiry, which requires real-time access to back-end business data or processes by way of an integration server, so the user can make use of the results before proceeding.

In most cases, this type of synchronous interaction is handled through a standards-based interface – simple XML over HTTP, Web services, request/reply messaging, Common Object Request Broker Architecture (CORBA) or those provided for J2EE technology. The integration server may provide direct interfaces for standards-based synchronous requests, bypassing an adapter altogether. As a consequence, while the WebSphere Business Integration system as a whole provides support for EIS-initiated synchronous request processing across many standard interfaces, only a few of the WebSphere Business Integration Adapters need to provide this support. These primarily include adapters that support open standards for synchronous processing, as well as others designed for specific EISs that conform to their proprietary interfaces.

In general, an adapter that provides EIS-initiated synchronous request processing may have listeners to receive requests, or it may register itself as a server upon startup to be invoked by clients. When the adapter receives a request, it translates it into a business object and forwards it to the adapter framework, which submits a synchronous request to the integration server. When the integration server returns the response business object, the adapter translates it back to the native interface and provides a synchronous response to the originating client.

WebSphere Business Integration Adapters and J2EE Connector Architecture

A significant standard relating to adapters is J2EE Connector Architecture (J2EE CA). J2EE CA was developed to help provide uniform and simplified connectivity with heterogeneous EISs. As an active participant in the Java Community Process and a leading proponent of J2EE for application development, IBM plans to continue developing and encouraging its Business Partners to develop adapters that support the J2EE Connector Architecture (J2EE CA). Furthermore, IBM will continue to be closely involved in the development of the J2EE CA specification through the Java Community Process.

Currently, J2EE CA, Version 1.0 supports only synchronous requests from the application server, which means these adapters are unidirectional. Because WebSphere Business Integration Adapters are bidirectional to accommodate many business integration scenarios—including both synchronous and asynchronous requests originating from either the integration server or the EIS—it is not currently based on J2EE CA, Version 1.0. In order to expose the full capability of the adapters to the J2EE application server, the adapters support interactions with IBM WebSphere Application Server Enterprise through the use of Extensible Markup Language (XML) over Java Messaging Service (JMS). IBM WebSphere Application Developer Integration Edition enables rapid deployment of the adapters through automatic generation of the required run-time components.

In the future, IBM intends to enable the WebSphere Business Integration Adapter Framework to support the J2EE CA specification, allowing WebSphere Business Integration Adapters to run as a J2EE CA resource adapter within the J2EE application server and allowing them to be deployed and utilized within the business integration environment easily through WebSphere

Studio Application Developer. This support of the J2EE CA specification will help extend the existing capability of adapters written on the WebSphere Business Integration Adapter Framework to interoperate with different types of integration servers.

Summary

Using WebSphere Business Integration Adapters as part of your integration infrastructure provides many benefits. WebSphere Business Integration Adapters can provide you with protection of your technology investment with adapters developed to be stand-alone solutions that work with multiple integration servers. You can use WebSphere Business Integration Adapters with WebSphere Business Integration Server, WebSphere InterChange Server, WebSphere MQ Integrator Broker and WebSphere Application Server Enterprise. This flexibility helps protect your business from technology change, enabling you to move to different integration systems as your business integration needs change.

Built on open standards, WebSphere Business Integration Adapters also provide greater interoperability, helping improve your business agility to become more responsive to customers, trading partners and suppliers. These adapters offer your business prebuilt, function-rich products that can be quickly implemented, without extensive coding time or training for underlying applications. The adapters are bidirectional, metadata-driven and include event-management and object-discovery tools, all of which also speed implementation. In addition, these prepackaged adapters improve efficiency when building your integration infrastructure and deliver fast results in deploying production systems. WebSphere Business Integration Adapters offer flexibility and adaptability with a common architecture that provides extensive functionality in event detection, full API support, asynchronous and synchronous messaging and transaction support. And IBM WebSphere Business Integration Adapters are easy to use. The common framework and tooling helps eliminate the need to learn how to install and run multiple architectures – saving your business time and money.

For more information

To learn more about IBM WebSphere Business Integration Adapters, visit:
ibm.com/software/integration/wbiadapters/

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