IBM WebSphere Business Integration Adapters

# Adapter for mySAP.com (for SAP R/3 V. 3.x) User Guide

*Adapter Version 6.0.x*

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**Note!**
Before using this information and the product it supports, read the information in "Notices" on page 325.

**30September2004**

This edition of this document applies to IBM WebSphere Business Integration Adapter for mySAP.com, for SAP R/3 Version 3.x (5724-H01), version 6.0.x.

To send us your comments about IBM WebSphere Business Integration documentation, email doc-comments@us.ibm.com. We look forward to hearing from you.

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# Contents

# About this document

The IBM[R] WebSphere[R] Business Integration Adapter portfolio supplies integration connectivity for leading e-business technologies, enterprise applications, and legacy and mainframe systems. The product set includes tools and templates for customizing, creating, and managing components for business integration.

## What this document includes

This document describes installation, connector property configuration, business object development, and troubleshooting for the IBM WebSphere Business Integration Adapter for mySAP.com.

## What this document does not include

This document does not describe deployment metrics and capacity planning issues such as server load balancing, number of adapter processing threads, maximum and minimum throughputs, and tolerance thresholds.

Such issues are unique to every customer deployment and must be measured within or close to the exact environment where the adapter is to be deployed. You should contact your IBM services representative to discuss the configuration of your deployment site, and for details on planning and evaluating these kinds of metrics, given your specific configuration.

## Audience

This document is for consultants, developers, and system administrators who support and manage the WebSphere business integration system at customer sites. You should be familiar with SAP and connector development.

## Related documents

The complete set of documentation available with this product describes the features and components common to all WebSphere Business Integration adapters installations, and includes reference material on specific components.

This document contains many references to two other documents: the *System Installation Guide for Windows* or *System Installation Guide for UNIX* and the *System Implementation Guide for WebSphere InterChange Server*. If you choose to print this document, you may want to print these documents as well.

You can download, install, and view the documentation at the following sites:

- For general adapter information; for using adapters with WebSphere message brokers (WebSphere MQ Integrator, WebSphere MQ Integrator Broker, WebSphere Business Integration Message Broker); and for using adapters with WebSphere Application Server:
  http://www.ibm.com/websphere/integration/wbiadapters/infocenter
- For using adapters with InterChange Server:
  http://www.ibm.com/websphere/integration/wicserver/infocenter
- For more information about message brokers (WebSphere MQ Integrator Broker, WebSphere MQ Integrator, and WebSphere Business Integration Message

Broker):
http://www.ibm.com/software/integration/mqfamily/library/manualsa/

- For more information about WebSphere Application Server:
  http://www.ibm.com/software/webservers/appserv/library.html

**Note:** Important information about this product may be available in Technical Support Technotes and Flashes issued after this document was published. These can be found on the WebSphere Business Integration Support Web site, http://www.ibm.com/software/integration/websphere/support/. Select the component area of interest and browse the Technotes and Flashes sections. Additional information might also be available in IBM Redbooks at http://www.redbooks.ibm.com/.

## Typographic conventions

This document uses the following conventions:

| | |
|---|---|
| `courier font` | Indicates a literal value, such as a command name, filename, information that you type, or information that the system prints on the screen. |
| **bold** | Indicates a new term the first time that it appears. |
| *italic*, *`italic`* | Indicates a variable name or a cross-reference. |
| *blue outline* | A blue outline, which is visible only when you view the manual online, indicates a cross-reference hyperlink. Click inside the outline to jump to the object of the reference. |
| { } | In a syntax line, curly braces surround a set of options from which you must choose one and only one. |
| `[ ]` | In a syntax line, square brackets surround an optional parameter. |
| `...` | In a syntax line, ellipses indicate a repetition of the previous parameter. For example, `option[,...]` means that you can enter multiple, comma-separated options. |
| `< >` | In a naming convention, angle brackets surround individual elements of a name to distinguish them from each other, as in `<server_name><`*`connector_name`*`>tmp.log`. |
| \ | In this document, backslashes (\) are used as the convention for directory paths. All product pathnames are relative to the directory where the product is installed on your system. |
| *`%text%`* | Text within percent (%) signs indicates the value of the Windows™ `text` system variable or user variable. |
| *ProductDir* | Represents the directory where the product is installed. |

## Naming conventions

In this document the following naming conventions are used:

- The connector for SAP is referred to simply as the connector.
- The "connector" refers to the combination of the vision connector framework and a connector module.
- All references to names of ABAP objects (such as function modules, programs, and tables) are valid for the connector that supports SAP R/3 version 3.x.

# New in this release

This release of this connector and document contains the following new information:

## New in release 6.0.x

This release of the document contains the following new information:

- Certain parts and chapters of this manual have been restructured for editorial clarification.
- The adapter now runs with WebSphere Business Integration Adapter FrameworkV2.6. For details about supported integration broker versions, see "Broker compatibility" on page 3.
- As of version 6.0.x, the adapter for mySAP.com is not supported on Solaris 7, so references to that platform version have been deleted from this guide.
- The adapter is now supported on Solaris 9, Windows 2003, Red Hat Enterprise Linux, SUSE Linux Enterprise Server, and SUSE Linux Standard Server. For details about the various platform versions of each, see "Adapter platforms" on page 4.
- The connector now uses a single business object handler that supports all BAPI calls, rather than multiple BAPI-specific business object handlers, each one supporting a specific BAPI. For details, see Chapter 7, "Overview of the BAPI Module," on page 95.
- The connector and SAPODA support BAPI transaction objects. For details, see "BAPI transaction business objects" on page 63"Business object structure for BAPI transactions" on page 105.
- SAPODA no longer generates custom business object handler templates for the BAPI Module. To create a custom business object handler, you must code it yourself from the templates provided.
- The connector and SAPODA provides ResultSet support for DB2 Information Integrator, and as such uses new standard connector properties. For details, see "ResultSet business objects" on page 67, "Business object structure for BAPI ResultSets" on page 106, Appendix D, "Standard configuration properties for connectors," on page 287.
- SAPODA provides caching support of search results in RFC nodes. The caching service runs in the background whenever you start SAPODA and the cached searches are purged when you end the session. For details, see "Expand nodes and select objects" on page 54.
- Transport files are now installed in the `\connectors\SAP\dependencies\transports_31` directory. For details see "Installing connector transport files" on page 212.
- The connector supports breaking up IDoc messages into smaller units, each of which is a JMS-MQ message that translates into a smaller business object. For details see "Event processing components" on page 122.

## New in release 5.5.x

**June 2004**

The manual has been updated with editorial clarifications.

**February 2004**

A new appendix with quick configuration steps has been added.

**December 2003**

- SAP Notes for memory management
- Information on return status handling
- ALE MQ message header information

## New in release 5.0.x

**Important:** Because the connector has not been internationalized, do not run it against InterChange Server version 4.1.1 if you cannot guarantee that only ISO Latin-1 data will be processed.

**Note:** Patch releases refer to this connector as mySAP.com R/3 Connector.

## New in release 4.8.x

IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x) includes the connector for SAP. This adapter operates with both the InterChange Server (ICS) and WebSphere MQ Integrator (WMQI) integration brokers. An integration broker, which is an application that performs integration of heterogeneous sets of applications, provides services that include data routing.

This adapter includes:

- An application-component specific to SAP R/3 Version 3.x
- SAPODA
- A sample business object, which is located in \connectors\SAP\samples\
- IBM WebSphere Adapter Framework, which consists of:
  - Connector Framework
  - Development tools (including Business Object Designer and Connector Configurator)
  - APIs (including ODK, JCDK, and CDK)

This manual provides information about using this adapter with both integration brokers: InterChange Server (ICS) and WebSphere MQ Integrator (WMQI).

**Important:** Because the connector has not been internationalized, do not run it against InterChange Server version 4.1.1 if you cannot guarantee that only ISO Latin-1 data will be processed.

## New in release 4.7.x

**Note:** Patch releases refer to this connector as `mySAP.com R/3 Connector`.

The connector has replaced the CWSAPGEN utility with SAPODA. For more information, see Chapter 5, “Generating business object definitions using SAPODA,” on page 47.

## New in release 4.6.x

- The connector supports invocation of the ABAP Debugger for the appropriate function module when the connector begins processing a business object. For more information, see “ABAPDebug” on page 313.
- The connector supports updating the status of an ALE event. For more information, see “Configuring SAP to update IDoc status” on page 129.
- This manual documents how to specify ALE Communication Partner information in application-specific information. For more information, see “Parent wrapper business object” on page 145.

## New in release 4.5.x

- This version of the connector contains minor changes to the ALE Module that enabled the connector to be certified by SAP for integration. The changes maintain backwards compatibility with objects generated for use with previous versions of the ALE Module.
- When running the connector multi-threaded, one of the available threads allocated with the `MaxNumConnections` property will be dedicated for polling operations.

## Connector version 4.4.x

- The modules configuration property has been simplified. The new configuration values are shorter and more intuitive. However, for backward compatibility, the previous values are still accepted.
- The new Hierarchical Dynamic Retrieve Module processes hierarchical or flat business objects in response to requests from collaborations configured to work with the connector. For information on this module, see Chapter 17, “Configuring the Hierarchical Dynamic Retrieve Module,” on page 183.
- The ALE Module provides non-invasive event processing. For more information, see Chapter 11, “Configuring the ALE Module,” on page 127.
- The ALE Module uses Transaction IDs (TIDs) to guarantee that each piece of data is delivered or processed once and only once. For more information, see Chapter 11, “Configuring the ALE Module,” on page 127.
- The connector supports multi-threading. For more information, see “NumberOfListeners” on page 317.

  **Important:** BAPI business object handlers generated before the IBM WebSphere InterChange Server Connector for SAP version 4.3.0 are not thread-safe. To guarantee data consistency and integrity when using multi-threading, you must regenerate these business object handlers. The business objects do no require any change.
- The connector running on Solaris now uses SAP’s Java API and fully supports all connector modules. Because IBM WebSphere InterChange Server does not ship the Java API, you must download it from SAP’s website. For more information, see “Installing the SAP JCo” on page 17.
- The connector no longer uses the CharacterEncoding configuration property.

## Connector version 4.3.x

This document contains all patches from the 4.2.x releases.

## Connector version 4.2.x

- With the 4.2.7 release, the IBM WebSphere InterChange Server connector for SAP uses SAP's Java Connector (jCO) API. This is for Windows only. As of the 4.2.7 release, SAP does not support the jCO for UNIX; therefore the 4.2.7 version of the connector does not support jCO for UNIX.
- With the 4.2.7 release, the "RefreshLogonCycle" on page 317 connector-specific configuration property has been changed so that the connector can either log off and then back on after every processed event, or not log off at all.
- The Guide to the IBM WebSphere InterChange Server Connector for SAP Version 3.x contains new information supporting the three new connector modules. Part III describes the ALE Module, Part IV describes the BAPI Module, and Part V describes the RFC Server Module.

  The ALE Module provides a non-invasive solution to sending IDocs into an SAP application. The BAPI Module provides a non-invasive solution to calling BAPIs in an SAP application. The RFC Server Module enables RFC-enabled functions to call the connector.

  The ALE Module enables consumes (service call requests) only. The BAPI Module enables service call requests and event notification. The RFC Server Module enables real-time non-invasive event notification.
- In the ALE Module, simple attributes in a data record business object that use `CxIgnore` or `CxBlank` are now represented with a blank. Previously CxIgnore was interpreted as a forward slash (/). SAP handles forward slash (/) characters differently depending on the function used. For more information see "Attributes: Data record business object" on page 147
- New connector-specific configuration properties that support the new modules are documented. For more information, see gwService, NumberOfListeners, PollQuantity, RefreshLogonCycle,RfcProgramId, and RfcTraceOn.

## Connector version 4.1.x

- New standard connector configuration properties Agent URL, Anonymous Connections, CA Certificate Location, GW Name, and Listener Port were added.

# Part 1. Connector overview and setup

# Chapter 1. Overview of the connector



The connector for mySAP.com is a run time component of the WebSphere Business Integration Adapter for mySAP.com. The mySAP.com Adapter includes a connector, message files, configuration tools, and an Object Discovery Agent (ODA). The connector allows the WebSphere integration broker to exchange business objects with SAP applications.

A connector consists of an application-specific component and the connector framework. The application-specific component contains code tailored to a particular application. The connector framework, whose code is common to all connectors, acts as an intermediary between the integration broker and the application-specific component. The connector framework provides the following services between the integration broker and the application-specific component:

- Receives and sends business objects
- Manages the exchange of startup and administrative messages

This document contains information about the application-specific component and connector framework. It refers to both of these components as the connector.

For more information about the relationship of the integration broker to the connector, see the *System Administration Guide* (if InterChange Server is the integration broker), *Implementing Adapters with WebSphere Message Brokers* (if a message broker is the integration broker), or *Implementing Adapters with WebSphere Application Server* (if WebSphere Application Server is the integration broker).

## Adapter for mySAP.com environment

Before installing, configuring, and using the adapter, you must understand its environment requirements. This section contains the following topics:



### Broker compatibility

This adapter runs with the WebSphere Business Integration Adapter FrameworkV2.6 and requires one of the following:

- WebSphere InterChange ServerV4.2.2,V4.3
- WebSphere MQ IntegratorV2.1
- WebSphere MQ Integrator BrokerV2.1
- WebSphere Business Integration Message BrokerV5.0.1
- WebSphere Application Server EnterpriseV5.0.2, in conjunction with WebSphere Studio Application Developer Integration EditionV5.0.1

- WebSphere Business Integration Server FoundationV5.1.1
- DB2 Information IntegratorV8.2.3 - supported by WebSphere Business Integration Adapters for mySAP.com, Peoplesoft, and Siebel only.

See *Release Notes* for any exceptions.

**Note:** For instructions on installing the integration broker and its prerequisites, see the following documentation.

For WebSphere InterChange Server (ICS), see the *System Installation Guide for UNIX* or *for Windows*.

For message brokers (WebSphere MQ Integrator Broker, WebSphere MQ Integrator, and WebSphere Business Integration Message Broker), see *Implementing Adapters with WebSphere Message Brokers*, and the installation documentation for the message broker. Some of this can be found at the following Web site:

http://www.ibm.com/software/integration/mqfamily/library/manualsa/

For WebSphere Application Server, see Implementing Adapters with WebSphere Application Server and the documentation at

http://www.ibm.com/software/webservers/appserv/library.html

## Adapter platforms

In addition to a broker, this adapter requires one of the following operating systems:

- All operating system environments require the Java compiler (IBM JDK 1.4.2 for Windows 2000) for compiling custom adapters
- **AIX:**
  **AIX 5.1 with Maintenance Level 4**
  **AIX 5.2 with Maintenance Level 1. This adapter supports 32-bit JVM on a 64-bit platform.**
- **Solaris:**
  Solaris 8 (2.8) with Solaris Patch Cluster dated Feb. 11, 2004 or later
  Solaris 9 (2.9) with Solaris Patch Cluster dated February 11, 2004 or later. This adapter supports 32-bit JVM on a 64-bit platform.
- **HP-UX:**
  HP-UX 11.i (11.11) with June 2003 GOLDBASE11i and June 2003 GOLDAPPS11i bundles
- **Linux:**
  Red Hat Enterprise Linux AS 3.0 with Update 1
  Red Hat Enterprise Linux ES 3.0 with Update 1
  Red Hat Enterprise Linux WS 3.0 with Update 1
  SUSE Linux Enterprise Server x86 8.1 with SP3
  SUSE Linux Standard Server x86 8.1 with SP3

  **Note:** The TMTP (Tivoli Monitoring for Transaction Performance) component of the WebSphere Business Integration Adapter FrameworkV2.6 is not supported on Linux Red Hat.
- **Windows:**
  Windows 2000 (Professional, Server, or Advanced Server) with Service Pack 4
  Windows XP with Service Pack 1A, for WebSphere Business Integration Adapter

Framework (administrative tools only)
Windows 2003 (Standard Edition or Enterprise Edition)

## Adapter supported software

The adapter supports SAP applications running on SAP application server version R/3 3.1I.

## Adapter dependencies

Prior to installing the connectorIBM WebSphere Business Integration Adapter for mySAP.com:

- Install the SAP client on the same machine on which you are installing the connector.
- Install the most recent SAP Support Package for your version of SAP.

  SAP delivers Support Packages for: Basis, the R/3 application, ABAP, and HR. They provide bug fixes for the ABAP code in the SAP application. Use an updated SAP kernel. The kernel is the executables, written in C++, that carry out transports, interface with the operating system, communicate with the database, and run the system.
- Set up a CPIC user account in the SAP application. Give this account the necessary privileges to manipulate the data required by the business objects supported by the connector.

  For example, if the connector must perform certain SAP business transactions, the connector's account in the SAP application must have the permissions to perform these transactions. You must set the connector-specific configuration properties `ApplicationUserName` and `ApplicationPassword` using this account information. For more information on how to set these properties, see Appendix D, "Standard configuration properties for connectors," on page 287.
- Set up a user account in SAP with privileges to install and administer the connector. The account should have the following characteristics:
  - A valid SAP user name and password
  - ABAP developer access
  - Table configuration access
  - Administration access for transactions SM21 and SM50 to administer and monitor the connector
- If using the ALE Module, see "Prerequisites to running the ALE Module" on page 127 for additional information on installing MQSeries queues.

After installing the connector:

- Install the SAP Java API.

  SAP calls their Java API the Java Connector (SAP JCo). The SAP adapter currently supports SAPJCo V.2.1.3. If the SAPJCo version mentioned in this document is not available for download from SAP Service Marketplace, please contact your IBM representative.

  SAP JCo pools connections and communicates to the adapter which connection to use to execute the request. All connection properties of the adapter are set in the Connector Configuration file. The JCo.PoolManager manages all configurations for connection pooling in the SAP application.

  For details about installing this connector dependency, see "Installing the SAP JCo" on page 17

For details about connector properties, see Chapter 3, "Configuring the connector," on page 25, Appendix D, "Standard configuration properties for connectors," on page 287, and Appendix E, "Connector-specific configuration properties," on page 311.

## Common Event Infrastructure

This adapter is compatible with IBM's Common Event Infrastructure, a standard for event management that permits interoperability with other IBM WebSphere event-producing applications. If Common Event Infrastructure support is enabled, events produced by the adapter can be received (or used) by another Common Event Infrastructure-compatible application.

For more information refer to the Common Event Infrastructure appendix in this guide.

## Application Response Measurement

This adapter is compatible with the Application Response Measurement application programming interface (API), an API that allows applications to be managed for availability, service level agreements, and capacity planning. An ARM-instrumented application can participate in IBM Tivoli Monitoring for Transaction Performance, allowing collection and review of data concerning transaction metrics.

For more information refer to the Application Response Measurement appendix in this guide.

## Locale-dependent data

The connector has been internationalized so that it can support multi-byte character sets for non-Unicode SAP systems. Note that this does not apply to Unicode-based SAP systems.

When the connector transfers data from a location that uses one character code set to a location that uses a different code set, it performs character conversion to preserve the meaning of the data.

**Note:** The CrossWorlds Station log is available only in English.

The Java runtime environment within the Java Virtual Machine (JVM) represents data in the Unicode character code set. Unicode contains encodings for characters in most known character code sets (both single-byte and multibyte). Most components in the IBM WebSphere business integration system are written in Java. Therefore, when data is transferred between most IBM WebSphere business integration components, there is no need for character conversion.

Because this connector is written in Java, it does not need to convert application data (including data in an IDoc file) written in native encoding. The SAP JCo library converts such application data to Unicode before the connector processes it. Figure 1 on page 7 illustrates the components involved in data conversion.

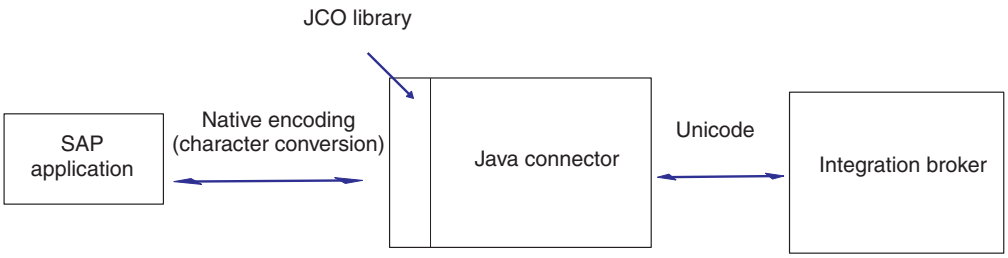



*Figure 1. Configuring agent properties*

This adapter supports the processing of bidirectional script data for the Arabic and Hebrew languages when the adapter is run in a Windows environment. Bidirectional processing is not supported in non-Windows environments. To log error and informational messages in the appropriate language and for the appropriate country or territory, configure the Locale standard configuration property for your environment. For more information on these properties, see Appendix D, "Standard configuration properties for connectors," on page 287.

**Important:** The character code set that SAP applications use for Japanese is SAP-8000. This code set does not support MS932 characters. Also, SJIS maps some characters to non-standard Unicode characters. Therefore, the SAP JCo library cannot handle some characters. If these characters are included in the SAP application or the IBM WebSphere business object, the connector replaces them with the # or ? character. When data contains these characters, it is not processed correctly, and the connector does not report errors.

## Connector components

The connector for SAP is written in Java and consists of two parts: the vision connector framework and connector modules (the connector's application-specific component, the connector framework, and business object handlers). The vision connector framework provides a metadata-driven layer of abstraction to the connector framework used by all WebSphere business integration system adapters.

The vision connector framework extends the methods in the Adapter Framework. The connector modules extend the methods in the vision connector framework and communicate with an SAP application.

Figure 2 illustrates the architecture of the connector and the relationship of the system-wide and vision connector frameworks. The visionConnectorAgent class can implement any number of connector modules.

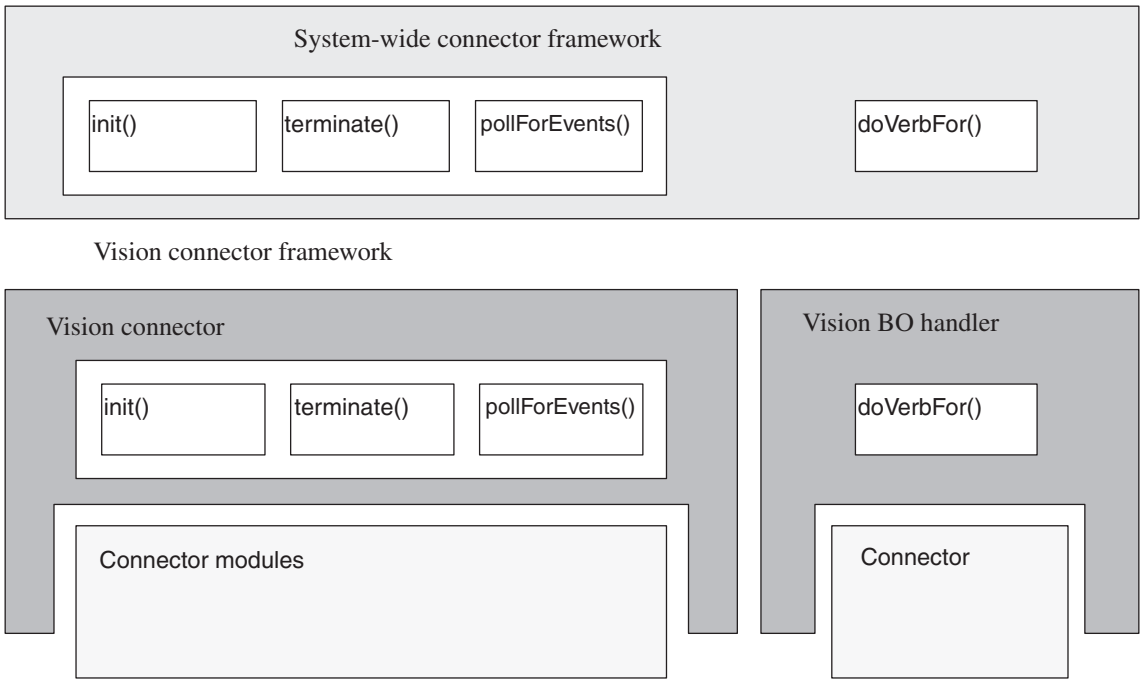



*Figure 2. Architecture of the connector for SAP*

## Vision connector framework

The vision connector framework dynamically routes the initialization, poll, and termination requests to connector modules. It also dynamically routes business objects to business object handlers. A business object handler is a connector module designed specifically to support business objects. To dynamically route requests and business objects, the connector uses the verb application-specific information of a business object and values of certain application-specific connector configuration properties.

The vision connector framework consists of two classes: visionConnectorAgent and visionBOHandler.

Figure 3 illustrates the vision connector framework and its association with connector modules.

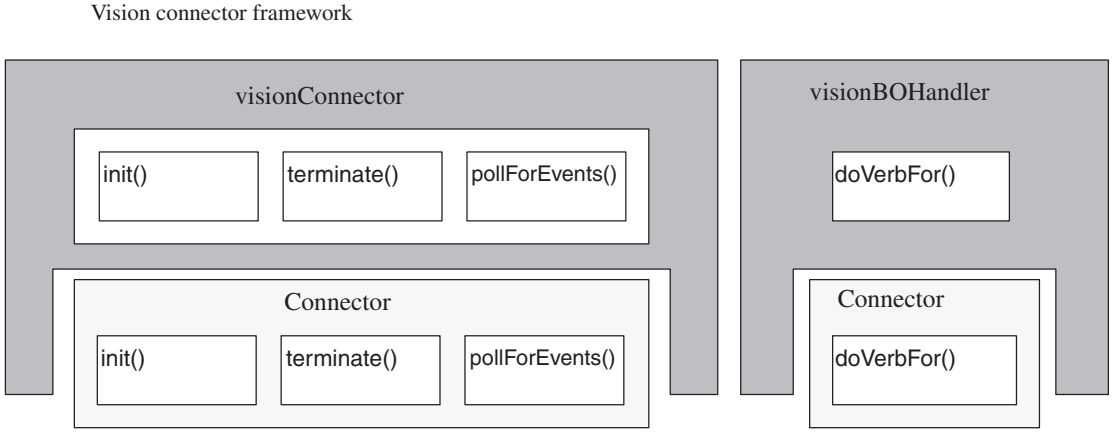



*Figure 3. vision connector framework and connector modules*

The vision connector framework provides the following capabilities for the connector:

- Calls any implementation of the `init()`, `pollForEvents()`, and `terminate()` methods.
- Routes business objects to specific business object handlers based on the verb application-specific information of a business object.

## Connector modules

The connector modules are Java classes that extend the methods in the vision connector framework. They support the vision connector framework by providing specific functionality, such as logging in to the SAP application, processing events and business objects, and terminating the connection to the SAP application. The connector modules carry out requests between the vision connector framework and the SAP application. By default, the vision connector framework uses the `connectors\SAP` directory as the root directory for the connector modules.

Connector modules may not use all of the framework methods. For example, one module might use the `init()` and `terminate()` methods while another module uses only the `pollForEvents()` method. However, every method in the visionConnectorAgent and visionBOHandler classes must be implemented for each connector module. Methods that a connector does not use must be implemented as dummy methods, that is, they do nothing but exit.

# How the vision connector framework works

The connector interacts with an SAP application using connector modules. The connector modules make calls to SAP's Native Interfaces and pass data (business object or event data) to and from an SAP application. The connector's flexible design enables different modules to be used for different tasks such as initializing the connector with the SAP application or passing business object data.

## Communication between the connector and an SAP application

The connector uses SAP's Remote Function Call (RFC) library to communicate with an SAP application. SAP's RFC API allows external programs to call ABAP function modules within an SAP application.

## Processing business objects

The connector is metadata driven. Metadata, in the WebSphere business integration system, is application-specific data that is stored in business objects and that assists a connector module in its interaction with the application. A metadata-driven connector module handles each business object that it supports based on metadata encoded in the business object definition rather than on instructions hard-coded in the connector module.

Business object metadata includes the structure of a business object, the settings of its attribute properties, and the content of its application-specific information. Because connector modules are metadata driven, they can handle new or modified business objects without requiring modifications to the connector-module code.

The vision connector framework uses the value of the verb application-specific information in the top-level business object to call the appropriate connector module to process the business object. The verb application-specific information provides the classname of the connector module.

The verb application-specific information of most top-level business objects must identify the classname of the connector module. The syntax of this verb application-specific information is:

```
AppSpecificInfo = PartialPackageName.ClassName,
```

For example,

```
AppSpecificInfo = sap.sapextensionmodule.VSapBOHandler,
```

In this example, `sap.sapextensionmodule` is the partial package name, and `VSapBOHandler` is the classname. The full package name includes the `com.crossworlds.connectors` prefix, which the WebSphere business integration system adds to the name automatically. In other words, the full text of the example is:

```
com.crossworlds.connectors.sap.sapextensionmodule.VSapBOHandler
```

**Note:** The verb application-specific information of most top-level business objects must use a comma (**,**) delimiter after the connector classname. However, the Server verb, which is used by the RFC Server Module, is delimited instead by a semi-colon (**;**). For information about the Server verb, see "How the RFC Server Module works" on page 161 and "Supported verbs" on page 168.

You need not specify the package name and classname for the verb application-specific information if the business object is used:

- by the ALE Module to process application events; however, when you use the ALE Module to process service call requests, you must specify the package name and classname
- by the ABAP Extension Module, which uses the default business object handler (`sap.sapextensionmodule.VSapBOHandler`)

**Important:** Customer-generated connector modules that process business objects for the RFC Server Module must specify a full package name, which must begin with `bapi`. For example, `bapi.client.Bapi_customer_getdetail2`. The full package name in this example is `bapi.client`, and the classname is `Bapi_customer_getdetail2`.

Most business object processing is specific to each connector module. By default the connector uses the ABAP Extension Module. For more information on business object processing for the ABAP Extension Module, see Chapter 20, “Installing and customizing the ABAP Extension Module,” on page 211 and “Business object data routing to ABAP handlers” on page 221. .

For more information on specifying verb application-specific information for the ALE Module, see “Event processing” on page 12 and “Processing multiple IDocs with a wrapper business object” on page 153.

## Processing multiple concurrent interactions

The Adapter Framework can create separate threads for processing an application event and a business object request. When processing multiple requests from the integration broker, it can create multiple threads to handle multiple business object requests. For example, when InterChange Server is the integration broker, the connector can receive multiple business object requests from multiple collaborations or from a multi-threaded collaboration.

Figure 4 illustrates the multi-threading architecture.

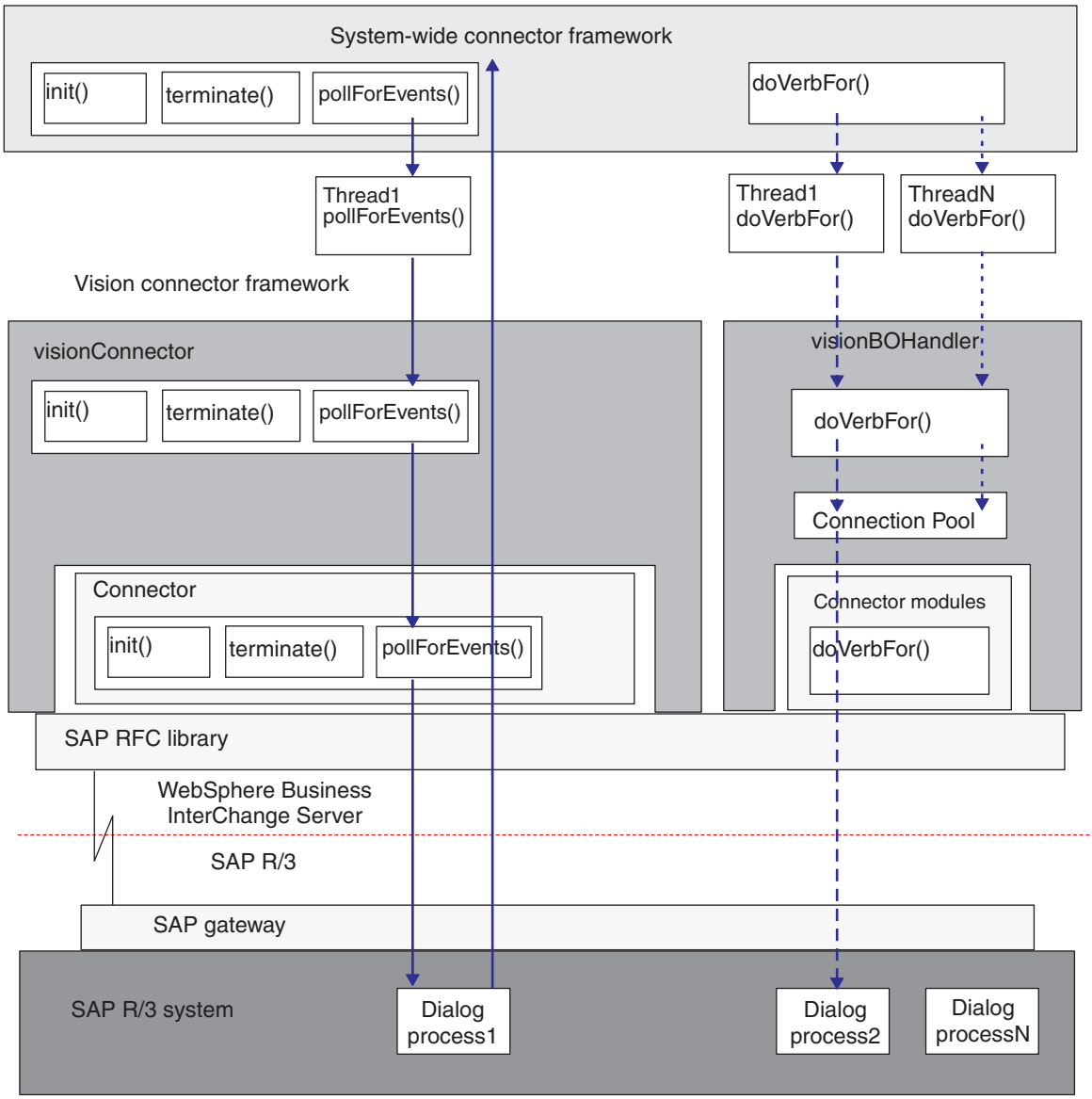



*Figure 4. Multi-Threading Architecture of the Connector for SAP*

## Event processing

The connector performs the following steps when handling a poll call:

1. The Adapter Framework creates a single dedicated thread to handle poll calls. This thread calls the `pollForEvents()` method of the vision connector framework at the frequency specified in the `PollFrequency` configuration property.
2. The thread polls SAP, which uses a dialog process to locate and return the event.

**Note:** If the connector's `MaxNumberOfConnections` configuration property evaluates to a number greater than 1, the vision connector framework dedicates a connection to SAP for polling. If `MaxNumberOfConnections` evaluates to 1, event and service-call request processing share a single connection to SAP.

The polling thread dies only when the connector shuts down.

**Note:** Because the RFC Server connector agent pushes events out of SAP instead of polling for events, it spawns its own threads instead of using threads created by the connector framework. Because the ALE connector agent uses the RFC Server connector agent to access events, it also spawns its own threads instead of using threads created by the connector framework when it processes events.

## Request processing

Independently of polling, the Adapter Framework can create multiple request-processing threads, one for each request business object. Each request thread instantiates the appropriate business object handler.

For example, when processing business object requests from InterChange Server, the number and type of business object handlers depends on the number and type of the collaborations sending the requests:

- If multiple collaborations send business objects, each request thread instantiates a business object handler of the appropriate type.
- If a multi-threaded collaboration sends multiple business objects of the same type, the request threads instantiate an equal number of business object handlers of that type.

If the connector's `MaxNumberOfConnections` configuration property evaluates to a number greater than 1, the vision connector framework dedicates one connection to SAP for polling and allocates the remaining connections to a pool used only for request processing.

As illustrated in Figure 4, the connector performs the following steps when handling a business object request:

1. The Adapter Framework creates a separate thread for each business object request. Each thread calls the `doVerbFor()` method of the Vision business object handler.
2. If the connector's `MaxNumberOfConnections` configuration property evaluates to a number greater than 1, the Vision business object handler checks the vision connector framework's connection pool to determine if a connection handle is available.
   - If the handle is available, the thread sends the request to SAP, which uses a dialog process to handle the request.
   - If the handle is not available, the thread waits until one becomes available. Thread sequencing determines the order in which each business object handler thread claims or waits for an available connection handle.

   If the connector's `MaxNumberOfConnections` configuration property evaluates to 1, the Vision business object handler shares a connection with event processing.
3. SAP releases the dialog process after it completes processing and sends a return code.
4. The connector releases the connection handle after it receives the return code from SAP.

## Setting the number of available connections

Use the `MaxNumberOfConnections` configuration property to specify the maximum number of connection handles available. The number of connections cannot exceed the number of dialog processes.

SAP locks the dialog process while processing an interaction, releasing it only when the interaction completes. Therefore, multiple concurrent requests lock an equal number of dialog processes until processing finishes.

**Important:** Before setting a value for MaxNumberOfConnections, contact your SAP BASIS administrator to determine an appropriate value to maximize throughput without negatively affecting performance on the application server.

## Support for multiple connections

By default the connector supports multiple-threads.

# Chapter 2. Installing the connector

This chapter describes the installation and configuration of the connector component of the IBM WebSphere Business Integration adapter for mySAP.com (SAP R/3 Version 3.x). This chapter assumes that all the necessary files were installed when the WebSphere business integration system was installed.

This chapter contains the following sections:



**Important:** If you are upgrading versions of the connector, you must replace the connector Java Archive files (`.jar`). You also need to upgrade the connector transport files as well as any business object transports that you have previously installed. Depending on changes made to the connector, you may need to load a new copy of the `SAPConnector.txt` file into your repository. See the Release Notes for more information.

## Installation tasks

To install the connector for mySAP.com, you must confirm that the necessary connector prerequisites exist in your environment, install the integration broker, and run the connector installation.

### Confirming adapter prerequisites

Before you install the adapter, confirm that all the environment prerequisites for installing and running the connector are on your system. For details, see "Adapter for mySAP.com environment" on page 3.

### Installing the integration broker

Installing the integration broker, a task that includes installing the WebSphere business integration system and starting the broker, is described in the documentation for your broker. For details about the brokers that the connector for supports, see "Broker compatibility" on page 3.

For details about installing the broker, see the appropriate implementation documentation of the broker you are using.

### Installing the connector

For information on installing WebSphere Business Integration adapter products, refer to the *Installing WebSphere Business Integration Adapters* guide located in the WebSphere Business Integration Adapters Infocenter at the following site:

http://www.ibm.com/websphere/integration/wbiadapters/infocenter

## Installing the connector

After your WebSphere business integration system has been installed, you can install additional adapters from the product CD at any time. To do this, insert the product CD, run the installation program, and choose the adapters that you want to install.

**Note:** Unless otherwise indicated, the remaining sections in this chapter apply to both Windows and UNIX installations of the connector.

The IBM WebSphere Business Integration Adapter for mySAP.com connector can be installed on a UNIX or Windows machine. The connector consists of three parts that need to be installed: the connector's application-specific component, SAP's RFC library, and any SAP transport files delivered with the product and required to support the connector.

After you have installed the required connector files, you must download and install the Java Connector (SAPJCo) files. For more information on downloading the SAPJCo files, see see "Installing the SAP JCo" on page 17. For more information on installing the SAPJCo files, see "Installing the SAP JCo" on page 17.

### Installing on a UNIX system

To install the connector on a UNIX system, run the Installer for IBM WebSphere business integration adapter, and select mySAP.com IBM WebSphere Business Integration Adapter for mySAP.com. Table 1 lists the files used by the connector that runs in a UNIX environment.

*Table 1. WBIA: UNIX file structure*

| Directory/Filename | Description |
|---|---|
| `connectors/SAP/bapi/client` | Directory containing the BAPI Module business object handler files |
| `connectors/SAP/bapi/server` | Directory containing the RFC Server Module business object handler files |
| `connectors/SAP/dependencies` | Directory containing all version-specific transport files |
| `connectors/SAPmessages` | Directory containing the `SAPConnector.txt` file |
| `connectors/SAP/samples` | Directory containing sample ABAP objects |
| `connectors/SAP/utilities` | Directory containing the `generatedfiles` subdirectory, into which you can put files generated by SAPODA |
| `connectors/SAP/CWSAP.jar` | Connector class files |
| `connectors/SAP/start_SAP.sh` | System startup script for the connector.<br><br>This script is called from the generic connector manager script. The product installer creates a customized wrapper for this connector manager script.<br><br>When the connector works with WebSphere InterChange Server, use this customized wrapper to start and stop the connector. When the connector works with WebSphere MQ message brokers, use this customized wrapper only to start the connector; use `mqsiremotestopadapter` to stop the connector |
| `repository/SAP` | Directory containing the `sap_idoccontrol.xsd` file |
| `/lib` | Contains the `WBIA.jar` file |
| `/bin` | Contains the `CWConnEnv.sh` file |
| `/bin/Data/app` | Contains the `SAPConnectorTemplate` file |

Before you can use the connector, you must configure the connector from the installer's Connector Configuration screen. From this screen:

- Choose SAP from the Select Connector Name list.
- Click Install to have Installer generate the customized SAP wrapper, `connector_manager_SAP`.

**Note:** For more information on installing the connector component, refer to the *WebSphere Business Integration Adapters Installation Guide*.

## Installing on a Windows system

To install the connector on a Windows system, run Installer for IBM WebSphere Business Integration Adapter, and select mySAP.comIBM WebSphere Business Integration Adapter for mySAP.com. The installer installs standard files associated with the connector. Table 2 lists the standard files installed in a Windows environment.

*Table 2. WebSphere Business Integration Adaptor: Windows file structure*

| Directory/filename | Description |
|---|---|
| `connectors\SAP\bapi\client` | Directory containing the BAPI Module business object handler files |
| `connectors\SAP\bapi\server` | Directory containing the RFC Server Module business object handler files |
| `connectors\SAP\dependencies` | Directory containing all version-specific transport files |
| `connectors\SAPmessages` | Directory containing the `SAPConnector.txt` file |
| `connectors\SAP\samples` | Directory containing sample ABAP objects |
| `connectors\SAP\CWSAP.jar` | Connector class file |
| `connectors\SAP\start_SAP.bat` | Batch file used to start the connector |
| `repository\SAP` | Directory containing the `CN_SAPSAP.txt` file |
| `\lib` | Contains the `WBIA.jar` file |
| `\bin` | Contains the `CWConnEvn.bat` file |

The installer adds a menu option for the connector's application-specific component to the IBM WebSphere business integration adapters menu. For a fast way to start the connector, create a shortcut to this component on the desktop.

**Note:** For more information on installing the connector component, refer to the *WebSphere Business Integration Adapters Installation Guide*.

## Installing the SAP JCo

After you install the connector and confirm that all the files have been installed to the appropriate directories, you must download and install the SAP JavaAPI. This is a prerequisite for the SAPODA, which is described in Chapter 5, "Generating business object definitions using SAPODA," on page 47.

SAP calls their Java API the Java Connector (SAP JCo). The connector for SAP currently supports SAP JCo V.2.1.3.

1. Download the SAP JCo for the operating system on which your connector is running. The SAP JCo is available for download from SAP's website at `http://service.sap.com/connectors`. You must have an SAPNet account to access the SAP JCo (if you do not already have one, contact your local SAP Basis administrator).

If the SAP JCo version that the connector supports is not available for download from SAP Service Marketplace, please check the most current adapter patch notes for the latest version of JCo that is supported or contact your IBM representative.

2. Copy the following unzipped SAP JCo files into your environment:

   **UNIX:**

   From the zipped file, extract the executable jar file (`sapjco.jar`) and the runtime libraries (`librfccm` and `libsapjcorfc`).

   If you have already followed instructions for installing the adapter on the same machine on which you install SAPODA, copy these files from the `\connectors\SAP` directory to the `\ODA\SAP` directory. If you install SAPODA on a different machine from the connector, after you unzip the SAP JCo files, copy these three files to the `\ODA\SAP` directory.

   **Windows:**

   From the zip file, extract the executable jar file, (`.jar` extension) and the runtime libraries (`.dll` extension). If you have already followed instructions for installing the adapter on the same machine on which you install SAPODA, copy these files from the `\connectors\SAP` directory to the `\ODA\SAP` directory.

   If you install SAPODA on a different machine from the connector, after you unzip the SAP JCo files, copy these three files (`librfc32.dll`, `sapjco.jar`, and `sapjcorfc.dll`) to the `\ODA\SAP` directory. For Windows, the `librfc32.dll` requires one or more C runtime dlls. The C runtime dlls depend on the version of the SAP release being used.

## Installing connectors on remote machines

You can install and run the connector on a remote machine. Install the integration broker on one machine and the connector on another machine. It is recommended but not required that both machines be on the same subnet.

## Installing multiple connectors

To enable the integration broker to handle multiple business objects for SAP at the same time, you may want to install and configure multiple connector components for an SAP system and customize each connector to handle specific business objects.

Each connector component can subscribe to certain business objects depending on their type (such as Customer or Purchase Order). Because you can have multiple connectors accessing the same SAP application, each connector can process events and pass them on to the integration broker. In addition, multiple connectors can support multiple business object requests at the same time. This increases throughput and speeds up the transfer of data into and out of the SAP application.

It is recommended that you choose a unique naming convention for each connector component. For example, if you are using two connectors you could name them `SAP1Connector` and `SAP2Connector`.

To install and set up multiple connector components, do the following:

1. Install each of the connectors as described in this chapter. This includes the connector shared library files. Give a unique name to each connector you install, and verify that you have the supporting connector files.

   If you are installing multiple connectors on the same machine, you need only make a copy of the shared library files and rename them. You do not need to install the transports again.

2. Create a copy of the startup script:
   - On UNIX, make a copy of the existing `connector_manager_SAP` file for starting the connector, and rename the file to match the name of the connector.
   - On Windows, make a copy of the existing shortcut to the `start_SAP.bat` file, and rename the shortcut file to match the name of the connector. Add the name of the connector as a parameter of the connector shortcut.
3. Make a copy of the connector template, rename it to match the new connector name, and then copy it to the `repository` directory (if IBM WebSphere MQ Integrator is the integration broker), or load it into the IBM WebSphere repository (if the IBM WebSphere InterChange Server is the integration broker).
4. Make a copy of the connector class file, `CWSAP.jar`and rename it to the unique connector name, such as `CWSAP1.jar`.
5. Initialize the connector configuration properties so that all connectors poll the same SAP application for events.
6. Only if the IBM WebSphere InterChange Server is the integration broker, add map references for each connector.
7. Specify the business objects supported by each connector.
8. Only if WebSphere InterChange Server is the integration broker, assign collaborations to the appropriate connectors. Currently, a collaboration can be handled by only one connector. If collaborations are already set up, you may need to stop them and then rebind the ports.
9. If you are using the ABAP Extension Module for business object handing, set up the distribution of events to each connector that you install. Use IBM CrossWorlds Station (transaction `/nYXR1`). See “Setting up event distribution” on page 214 for instructions on setting up event distribution for each combination of business object, integration broker, and connector.

**Important:** If a business object is not configured to go to a particular connector, the business object is sent to the next connector that polls for events. If a business object is configured to go to a particular connector, as for example during the testing phase, but the connector is not used in the production phase, the event queue for the connector fills up. To remedy this situation, delete the connector/business object configuration in the Event Distribution window (transaction YXRH).

## Upgrading the connector

This section describes how to upgrade the connector:

- “Upgrading the connector for the ALE Module’s management of TIDs”
- “Upgrading to the Java-based connector” on page 21

### Upgrading the connector for the ALE Module’s management of TIDs

The ALE Module persistently stores IDoc objects and Transaction IDs (TIDs) for every transaction it receives from the SAP application. In releases of the connector prior to version 4.8.x, the connector used IBM WebSphere collaborations, business objects, and maps to store the data in the repository. Version 4.8.x of the connector replaces the previous way of TID management with the use of MQSeries queues.

**Attention:** To enable the ALE Module to process IDocs to and from the SAP application, you must upgrade the connector. However, it is imperative that you allow the current IDoc processing cycle to complete before upgrading the connector.

Before you upgrade the connector to enable the ALE Module to process IDocs, you must complete the processing of current files in the event and WIP directories. Also, check the archive directory for failed and unsubscribed events.

To complete the processing of current files in the event and WIP directories:

- Temporarily halt the transmission of IDocs both to and from the connector.
- Verify that there are no IDocs (files) in the following directories when you upgrade:

**UNIX**

```
$CROSSWORLDS/connectors/SAP/ale/events
$CROSSWORLDS/connectors/SAP/ale/wip
```

**Windows**

```
%CROSSWORLDS%\connectors\SAP\ale\events
%CROSSWORLDS%\connectors\SAP\ale\wip
```

To complete processing of any failed and unsubscribed events:

- Temporarily halt the transmission of IDocs both to and from the connector.
- Verify the status of the IDocs (files) in the following directory when you upgrade:

**UNIX**

```
$CROSSWORLDS/connectors/SAP/ale/archive
```

**Windows**

```
%CROSSWORLDS%\connectors\SAP\ale\archive
```

- Correct any errors to the failed or unsubscribed events.
- Move the corrected file to the event directory for processing.

**Note:** If, when using transaction SM58, you find unsuccessfully processed IDocs in the SAP system, wait until the connector is upgraded to resubmit these IDocs. After you complete the upgrade of the connector, correct the errors and resubmit the IDocs for processing through the MQSeries queues using the new TID management.

Once these directories are clear, apply the upgrade and follow the configuration instructions in:

- "Connector-specific configuration properties" on page 311
- Chapter 10, "Overview of the ALE Module," on page 121.
- Chapter 11, "Configuring the ALE Module," on page 127

## Upgrading to the Java-based connector

The *IBM WebSphere Business Integration Adapter for mySAP.com* is delivered as a Java-based connector (connector version 4.0.0 and later). In previous releases, the connector was written in C++. The directory structure is `\connectors\SAP`.

The following procedure is for upgrading a C++ version of the connector to the Java version of the connector.

1. Rename the current connector directory.

   For example, `\connectors\SAP` becomes `connectors\SAP.old`.
2. Rename the connector message file.

   For example, `\connectors\messages\SAPconnector.txt` becomes `\connectors\messages\SAPconnector.txt.old`.
3. Copy the new connector directory and files to the `\connectors` directory.
4. Copy the new connector message file to the `\connectors\messages` directory.

**Windows**

Modify the connector shortcut to point to the `start_SAP.bat` file in the connector directory. For example, if you are using the connector that supports SAP R/3 version 4.x, modify the shortcut to point to the connector startup file `\connectors\SAP\start_SAP.bat`.

## Comprehensive install and uninstall information

The information in this section describes how to install WebSphere Business Integration adapters.

Install the WebSphere Business Integration adapter by running a platform-specific executable for the installer. Table 3 lists the installer executable for each operating system. The installer executables are located in the `WebSphereBI` directory on the product CD.

*Table 3. Platform-specific executables for WebSphere Business Integration adapter installer*

| Operating system | WBIA Installer executable file |
|---|---|
| Windows | `setupwin32.exe` |
| AIX | `setupAIX.bin` |
| Solaris | `setupsolarisSparc.bin` |
| HP-UX | `setupHP.bin` |

**Note:** These procedures assume that you are installing from a product CD. If you obtain your software from Passport Advantage, make sure you have downloaded it. Refer to your Passport Advantage information for those downloading instructions.

**Note:** If you are installing the adapters to communicate with InterChange Server, you must install the broker first. See the installation guide for InterChange Server on the appropriate platform for information on how to install the broker.

**Important:** Make sure you are logged in as the WebSphere business integration system administrator before you install the adapters. When you install

on a UNIX computer, the permissions of the folders and files that are created are set based on the permissions of the user account that performs the installation.

**Important:** You must not install WBIA as root. The entry that is added to the Object Data Manager (ODM) when installing as root prevents you from using SMIT to uninstall other applications, so you should not install WBIA as root.

## Invoking the graphical WBIA Installer

The graphical WBIA installer presents you with a wizard that allows you to make choices about the installation of the WBIA product. Although the installer is Java-based and therefore platform-independent, there are different ways of invoking the installer for each platform. This section describes the approaches for both Windows and UNIX computers.

### Invoking Installer in a Windows environment

To invoke Installer in a Windows environment, navigate to the `WebSphereBI` directory of the product CD and execute `setupwin32.exe`.

### Invoking Installer in a UNIX environment

The WBIA installer in a UNIX environment is invoked through a `.bin` file specific to the platform, located in the `WebSphereBI` directory. Table 3 on page 21 provides the name of the `.bin` file for each platform.

Follow the steps in one of the following sections to invoke the installer depending on how you are working with the UNIX computer:

- "If you are running CDE on the UNIX computer"
- "If you are connecting to the UNIX computer through X emulation software"

**If you are running CDE on the UNIX computer:** If you are running the Common Desktop Environment (CDE) and working on the UNIX computer directly then you can navigate to the `WebSphereBI` directory of the product CD and double-click the `.bin` file specific to the operating system.

You can also navigate to the `WebSphereBI` directory of the product CD and execute the `.bin` file at the command line. The following example shows how to do so on a Solaris computer:

```
# ./setupsolarisSparc.bin
```

**If you are connecting to the UNIX computer through X emulation software:** If you are using a Windows computer to connect to the UNIX computer through X emulation software do the following to invoke the installer:

1. Determine the IP address of the Windows computer that you are using to connect to the UNIX computer.

   You can execute the `ipconfig` command at the Windows command line interface to display the IP address of the Windows computer.
2. Set the `DISPLAY` environment variable on the UNIX computer to the IP address determined in step 1.

   You must be sure to follow the IP address with a colon and the identifier for the monitor or display on the Windows client computer. If the Windows client computer only has a single monitor then the display value is `0.0`.

   The following example shows the `DISPLAY` environment variable being set to the single monitor on a Windows computer whose IP address is `9.26.244.30`:

```
DISPLAY=9.26.244.30:0.0
```

3. Export the DISPLAY environment variable by executing the following command:

   ```
   export DISPLAY
   ```

4. Start the X emulation client on the Windows computer and connect to the UNIX computer.
5. Navigate to the WebSphereBI directory of the product CD at the command line of the X emulation client.
6. Execute the .bin file specific to the operating system. For example, if the UNIX computer was running AIX then you would execute the following command:

   ```
   # ./setupAIX.bin
   ```

   The graphical installer starts on the Windows computer that you are using to connect to the UNIX computer.

# Chapter 3. Configuring the connector

This chapter describes the installation and configuration of the connector component of the IBM WebSphere Business Integration adapter for mySAP.com (SAP R/3 Version 3.x). This chapter assumes that all the necessary files were installed when the WebSphere business integration system was installed.

## Overview of Connector Configurator

Connector Configurator allows you to configure the connector component of your adapter for use with these integration brokers:

- WebSphere InterChange Server (ICS)
- WebSphere MQ Integrator, WebSphere MQ Integrator Broker, and WebSphere Business Integration Message Broker, collectively referred to as the WebSphere Message Brokers (WMQI)
- WebSphere Application Server (WAS)

If your adapter supports DB2 Information Integrator, use the WMQI options and the DB2 II standard properties (see the Notes column in the standard properties appendix.)

You use Connector Configurator to:

- Create a **connector-specific property template** for configuring your connector.
- Create a **connector configuration file**; you must create one configuration file for each connector you install.
- Set properties in a configuration file.
  You may need to modify the default values that are set for properties in the connector templates. You must also designate supported business object definitions and, with ICS, maps for use with collaborations as well as specify messaging, logging and tracing, and data handler parameters, as required.

The mode in which you run Connector Configurator, and the configuration file type you use, may differ according to which integration broker you are running. For example, if WMQI is your broker, you run Connector Configurator directly, and not from within System Manager (see "Running Configurator in stand-alone mode" on page 26).

Connector configuration properties include both standard configuration properties (the properties that all connectors have) and connector-specific properties (properties that are needed by the connector for a specific application or technology).

Because **standard properties** are used by all connectors, you do not need to define those properties from scratch; Connector Configurator incorporates them into your configuration file as soon as you create the file. However, you do need to set the value of each standard property in Connector Configurator.

The range of standard properties may not be the same for all brokers and all configurations. Some properties are available only if other properties are given a specific value. The Standard Properties window in Connector Configurator will show the properties available for your particular configuration.

For **connector-specific properties**, however, you need first to define the properties and then set their values. You do this by creating a connector-specific property template for your particular adapter. There may already be a template set up in your system, in which case, you simply use that. If not, follow the steps in "Creating a new template" on page 27 to set up a new one.

### Running connectors on UNIX

Connector Configurator runs only in a Windows environment. If you are running the connector in a UNIX environment, use Connector Configurator in Windows to modify the configuration file and then copy the file to your UNIX environment.

Some properties in the Connector Configurator use directory paths, which default to the Windows convention for directory paths. If you use the configuration file in a UNIX environment, revise the directory paths to match the UNIX convention for these paths. Select the target operating system in the toolbar drop-list so that the correct operating system rules are used for extended validation.

## Starting Connector Configurator

You can start and run Connector Configurator in either of two modes:

- Independently, in stand-alone mode
- From System Manager

### Running Configurator in stand-alone mode

You can run Connector Configurator without running System Manager and work with connector configuration files, irrespective of your broker.

To do so:

- From **Start>Programs**, click **IBM WebSphere InterChange Server>IBM WebSphere Business Integration Tools>Connector Configurator**.
- Select **File>New>Connector Configuration**.
- When you click the pull-down menu next to **System Connectivity Integration Broker**, you can select ICS, WebSphere Message Brokers or WAS, depending on your broker.

You may choose to run Connector Configurator independently to generate the file, and then connect to System Manager to save it in a System Manager project (see "Completing a configuration file" on page 31.)

## Running Configurator from System Manager

You can run Connector Configurator from System Manager.

To run Connector Configurator:

1. Open the System Manager.
2. In the System Manager window, expand the **Integration Component Libraries** icon and highlight **Connectors**.
3. From the System Manager menu bar, click **Tools>Connector Configurator**. The Connector Configurator window opens and displays a **New Connector** dialog box.
4. When you click the pull-down menu next to **System Connectivity Integration Broker**, you can select ICS, WebSphere Message Brokers or WAS, depending on your broker.

To edit an existing configuration file:

- In the System Manager window, select any of the configuration files listed in the Connector folder and right-click on it. Connector Configurator opens and displays the configuration file with the integration broker type and file name at the top.
- From Connector Configurator, select **File>Open**. Select the name of the connector configuration file from a project or from the directory in which it is stored.
- Click the Standard Properties tab to see which properties are included in this configuration file.

## Creating a connector-specific property template

To create a configuration file for your connector, you need a connector-specific property template as well as the system-supplied standard properties.

You can create a brand-new template for the connector-specific properties of your connector, or you can use an existing connector definition as the template.

- To create a new template, see "Creating a new template" on page 27.
- To use an existing file, simply modify an existing template and save it under the new name. You can find existing templates in your `\WebSphereAdapters\bin\Data\App` directory.

### Creating a new template

This section describes how you create properties in the template, define general characteristics and values for those properties, and specify any dependencies between the properties. Then you save the template and use it as the base for creating a new connector configuration file.

To create a template in Connector Configurator:

1. Click **File>New>Connector-Specific Property Template**.
2. The **Connector-Specific Property Template** dialog box appears.
   - Enter a name for the new template in the **Name** field below **Input a New Template Name.** You will see this name again when you open the dialog box for creating a new configuration file from a template.
   - To see the connector-specific property definitions in any template, select that template's name in the **Template Name** display. A list of the property definitions contained in that template appears in the **Template Preview** display.
3. You can use an existing template whose property definitions are similar to those required by your connector as a starting point for your template. If you do not see any template that displays the connector-specific properties used by your connector, you will need to create one.
   - If you are planning to modify an existing template, select the name of the template from the list in the **Template Name** table below **Select the Existing Template to Modify: Find Template.**
   - This table displays the names of all currently available templates. You can also search for a template.

## Specifying general characteristics

When you click **Next** to select a template, the **Properties - Connector-Specific Property Template** dialog box appears. The dialog box has tabs for General characteristics of the defined properties and for Value restrictions. The General display has the following fields:

- **General:**
  Property Type
  Property Subtype
  Updated Method
  Description
- **Flags**
  Standard flags
- **Custom Flag**
  Flag

The **Property Subtype** can be selected when **Property Type** is a String. It is an optional value which provides syntax checking when you save the configuration file. The default is a blank space, and means that the property has not been subtyped.

After you have made selections for the general characteristics of the property, click the **Value** tab.

## Specifying values

The **Value** tab enables you to set the maximum length, the maximum multiple values, a default value, or a value range for the property. It also allows editable values. To do so:

1. Click the **Value** tab. The display panel for Value replaces the display panel for General.
2. Select the name of the property in the **Edit properties** display.
3. In the fields for **Max Length** and **Max Multiple Values**, enter your values.

To create a new property value:

1. Select the property in the **Edit properties** list and right-click on it.
2. From the dialog box, select **Add**.
3. Enter the name of the new property value and click OK. The value appears in the **Value** panel on the right.

The **Value** panel displays a table with three columns:

The **Value** column shows the value that you entered in the **Property Value** dialog box, and any previous values that you created.

The **Default Value** column allows you to designate any of the values as the default.

The **Value Range** shows the range that you entered in the **Property Value** dialog box.

After a value has been created and appears in the grid, it can be edited from within the table display.

To make a change in an existing value in the table, select an entire row by clicking on the row number. Then right-click in the **Value** field and click **Edit Value**.

### Setting dependencies

When you have made your changes to the **General** and **Value** tabs, click **Next**. The **Dependencies - Connector-Specific Property Template** dialog box appears.

A dependent property is a property that is included in the template and used in the configuration file *only if* the value of another property meets a specific condition. For example, `PollQuantity` appears in the template only if JMS is the transport mechanism and `DuplicateEventElimination` is set to `True`.
To designate a property as dependent and to set the condition upon which it depends, do this:

1. In the **Available Properties** display, select the property that will be made dependent.
2. In the **Select Property** field, use the drop-down menu to select the property that will hold the conditional value.
3. In the **Condition Operator** field, select one of the following:

   == (equal to)

   != (not equal to)

   > (greater than)

   < (less than)

   >= (greater than or equal to)

   <=(less than or equal to)
4. In the **Conditional Value** field, enter the value that is required in order for the dependent property to be included in the template.
5. With the dependent property highlighted in the **Available Properties** display, click an arrow to move it to the **Dependent Property** display.
6. Click **Finish**. Connector Configurator stores the information you have entered as an XML document, under `\data\app` in the `\bin` directory where you have installed Connector Configurator.

### Setting pathnames

Some general rules for setting pathnames are:

- The maximum length of a filename in Windows and UNIX is 255 characters.
- In Windows, the absolute pathname must follow the format [Drive:][Directory]\filename: for example, C:\WebSphereAdapters\bin\Data\Std\StdConnProps.xml
  In UNIX the first character should be /.
- Queue names may not have leading or embedded spaces.

## Creating a new configuration file

When you create a new configuration file, you must name it and select an integration broker.

- In the System Manager window, right-click on the **Connectors** folder and select **Create New Connector**. Connector Configurator opens and displays the **New Connector** dialog box.
- In stand-alone mode: from Connector Configurator, select **File>New>Connector Configuration**. In the New Connector window, enter the name of the new connector.

You also need to select an integration broker. The broker you select determines the properties that will appear in the configuration file. To select a broker:

- In the **Integration Broker** field, select ICS, WebSphere Message Brokers or WAS connectivity.
- Complete the remaining fields in the **New Connector** window, as described later in this chapter.

## Creating a configuration file from a connector-specific template

Once a connector-specific template has been created, you can use it to create a configuration file:

1. Click **File>New>Connector Configuration**.
2. The **New Connector** dialog box appears, with the following fields:
   - **Name**

     Enter the name of the connector. Names are case-sensitive. The name you enter must be unique, and must be consistent with the file name for a connector that is installed on the system.

     **Important:** Connector Configurator does not check the spelling of the name that you enter. You must ensure that the name is correct.
   - **System Connectivity**

     Click ICS or WebSphere Message Brokers or WAS.
   - **Select Connector-Specific Property Template**

     Type the name of the template that has been designed for your connector. The available templates are shown in the **Template Name** display. When you select a name in the Template Name display, the **Property Template Preview** display shows the connector-specific properties that have been defined in that template.

     Select the template you want to use and click **OK**.
3. A configuration screen appears for the connector that you are configuring. The title bar shows the integration broker and connector name. You can fill in all the field values to complete the definition now, or you can save the file and complete the fields later.
4. To save the file, click **File>Save>To File** or **File>Save>To Project**. To save to a project, System Manager must be running.
   If you save as a file, the **Save File Connector** dialog box appears. Choose `*.cfg` as the file type, verify in the File Name field that the name is spelled correctly and has the correct case, navigate to the directory where you want to locate the file, and click **Save**. The status display in the message panel of Connector Configurator indicates that the configuration file was successfully created.

   **Important:** The directory path and name that you establish here must match the connector configuration file path and name that you supply in the startup file for the connector.
5. To complete the connector definition, enter values in the fields for each of the tabs of the Connector Configurator window, as described later in this chapter.

# Using an existing file

You may have an existing file available in one or more of the following formats:

- A connector definition file.
  This is a text file that lists properties and applicable default values for a specific connector. Some connectors include such a file in a `\repository` directory in their delivery package (the file typically has the extension `.txt`; for example, CN_XML.txt for the XML connector).
- An ICS repository file.
  Definitions used in a previous ICS implementation of the connector may be available to you in a repository file that was used in the configuration of that connector. Such a file typically has the extension `.in` or `.out`.
- A previous configuration file for the connector.
  Such a file typically has the extension *.cfg.

Although any of these file sources may contain most or all of the connector-specific properties for your connector, the connector configuration file will not be complete until you have opened the file and set properties, as described later in this chapter.

To use an existing file to configure a connector, you must open the file in Connector Configurator, revise the configuration, and then resave the file.

Follow these steps to open a *.txt, *.cfg, or *.in file from a directory:

1. In Connector Configurator, click **File>Open>From File**.
2. In the **Open File Connector** dialog box, select one of the following file types to see the available files:
   - Configuration (`*.cfg`)
   - ICS Repository (`*.in`, `*.out`)

     Choose this option if a repository file was used to configure the connector in an ICS environment. A repository file may include multiple connector definitions, all of which will appear when you open the file.
   - All files (*.*)

     Choose this option if a `*.txt` file was delivered in the adapter package for the connector, or if a definition file is available under another extension.
3. In the directory display, navigate to the appropriate connector definition file, select it, and click **Open**.

Follow these steps to open a connector configuration from a System Manager project:

1. Start System Manager. A configuration can be opened from or saved to System Manager only if System Manager has been started.
2. Start Connector Configurator.
3. Click **File>Open>From Project**.

## Completing a configuration file

When you open a configuration file or a connector from a project, the Connector Configurator window displays the configuration screen, with the current attributes and values.

The toolbar has a droplist called **Target System** that allows you to select the target operating system for extended validation of the properties. The available options are: Windows, UNIX, Other (if not Windows or UNIX), and None-no extended validation (switches off extended validation). The default on startup is Windows.

The title of the configuration screen displays the integration broker and connector name as specified in the file. Make sure you have the correct broker. If not, change the broker value before you configure the connector. To do so:

1. Under the **Standard Properties** tab, select the value field for the `BrokerType` property. In the drop-down menu, select the value `ICS`, `WMQI`, or `WAS`.
2. The Standard Properties tab will display the connector properties associated with the selected broker. The table shows **Property name**, **Value**, **Type** and **Subtype** (if the Type is a string).
3. You can save the file now or complete the remaining configuration fields, as described in "Specifying supported business object definitions" on page 34..
4. When you have finished your configuration, click **File>Save>To Project** or **File>Save>To File**.

   If you are saving to file, select `*.cfg` as the extension, select the correct location for the file and click **Save**.

   If multiple connector configurations are open, click **Save All to File** to save all of the configurations to file, or click **Save All to Project** to save all connector configurations to a System Manager project.

   Before it saves the file, Connector Configurator checks that values have been set for all required standard properties. If a required standard property is missing a value, Connector Configurator displays a message that the validation failed. You must supply a value for the property in order to save the configuration file.

## Setting the configuration file properties

When you create and name a new connector configuration file, or when you open an existing connector configuration file, Connector Configurator displays a configuration screen with tabs for the categories of required configuration values.

Connector Configurator requires values for properties in these categories for connectors running on all brokers:

- Standard Properties
- Connector-specific Properties
- Supported Business Objects
- Trace/Log File values
- Data Handler (applicable for connectors that use JMS messaging with guaranteed event delivery)

**Note:** For connectors that use JMS messaging, an additional category may display, for configuration of data handlers that convert the data to business objects.

For connectors running on **ICS**, values for these properties are also required:

- Associated Maps
- Resources
- Messaging (where applicable)

**Important:** Connector Configurator accepts property values in either English or non-English character sets. However, the names of both standard and connector-specific properties, and the names of supported business objects, must use the English character set only.

Standard properties differ from connector-specific properties as follows:

- Standard properties of a connector are shared by both the application-specific component of a connector and its broker component. All connectors have the same set of standard properties. These properties are described in Appendix A of each adapter guide. You can change some but not all of these values.
- Application-specific properties apply only to the application-specific component of a connector, that is, the component that interacts directly with the application. Each connector has application-specific properties that are unique to its application. Some of these properties provide default values and some do not; you can modify some of the default values. The installation and configuration chapters of each adapter guide describe the application-specific properties and the recommended values.

The fields for **Standard Properties** and **Connector-Specific Properties** are color-coded to show which are configurable:

- A field with a grey background indicates a standard property. You can change the value but cannot change the name or remove the property.
- A field with a white background indicates an application-specific property. These properties vary according to the specific needs of the application or connector. You can change the value and delete these properties.
- Value fields are configurable.
- The **Update Method** field is displayed for each property. It indicates whether a component or agent restart is necessary to activate changed values. You cannot configure this setting.

## Setting standard connector properties

To change the value of a standard property:

1. Click in the field whose value you want to set.
2. Either enter a value, or select one from the drop-down menu if it appears.
3. After entering all the values for the standard properties, you can do one of the following:
   - To discard the changes, preserve the original values, and exit Connector Configurator, click **File>Exit** (or close the window), and click **No** when prompted to save changes.
   - To enter values for other categories in Connector Configurator, select the tab for the category. The values you enter for **Standard Properties** (or any other category) are retained when you move to the next category. When you close the window, you are prompted to either save or discard the values that you entered in all the categories as a whole.
   - To save the revised values, click **File>Exit** (or close the window) and click **Yes** when prompted to save changes. Alternatively, click **Save>To File** from either the File menu or the toolbar.

To get more information on a particular standard property, move the mouse over the entry in the Description column for that property in the Standard Properties tabbed sheet. If you have Extended Help installed, a Help window will open and display details of the standard property.

For the location of the Extended Help files, refer to the `AdapterHelpName` property in the standard properties appendix.

## Setting connector-specific configuration properties

For connector-specific configuration properties, you can add or change property names, configure values, delete a property, and encrypt a property. The default property length is 255 characters.

1. Right-click in the top left portion of the grid. A pop-up menu bar will appear. Click **Add** to add a property. To add a child property, right-click on the parent row number and click **Add child**.
2. Enter a value for the property or child property.
3. To encrypt a property, select the **Encrypt** box.
4. Choose to save or discard changes, as described for "Setting standard connector properties" on page 33.

The Update Method displayed for each property indicates whether a component or agent restart is necessary to activate changed values.

**Important:** Changing a preset application-specific connector property name may cause a connector to fail. Certain property names may be needed by the connector to connect to an application or to run properly.

### Encryption for connector properties

Application-specific properties can be encrypted by selecting the **Encrypt** check box in the Connector-specific Properties window. To decrypt a value, click to clear the **Encrypt** check box, enter the correct value in the **Verification** dialog box, and click **OK**. If the entered value is correct, the value is decrypted and displays.

The adapter user guide for each connector contains a list and description of each property and its default value.

If a property has multiple values, the **Encrypt** check box will appear for the first value of the property. When you select **Encrypt**, all values of the property will be encrypted. To decrypt multiple values of a property, click to clear the **Encrypt** check box for the first value of the property, and then enter the new value in the **Verification** dialog box. If the input value is a match, all multiple values will decrypt.

### Update method

Refer to the descriptions of update methods found in the *Standard configuration properties for connectors* appendix, under "Configuration property values overview" on page 288.

## Specifying supported business object definitions

Use the **Supported Business Objects** tab in Connector Configurator to specify the business objects that the connector will use. You must specify both generic business objects and application-specific business objects, and you must specify associations for the maps between the business objects.

**Note:** Some connectors require that certain business objects be specified as supported in order to perform event notification or additional configuration (using meta-objects) with their applications. For more information, see the *Connector Development Guide for C++* or the *Connector Development Guide for Java*.

## If ICS is your broker

To specify that a business object definition is supported by the connector, or to change the support settings for an existing business object definition, click the **Supported Business Objects** tab and use the following fields.

**Business object name:** To designate that a business object definition is supported by the connector, with System Manager running:

1. Click an empty field in the **Business Object Name** list. A drop list displays, showing all the business object definitions that exist in the System Manager project.
2. Click on a business object to add it.
3. Set the **Agent Support** (described below) for the business object.
4. In the File menu of the Connector Configurator window, click **Save to Project**. The revised connector definition, including designated support for the added business object definition, is saved to an ICL (Integration Component Library) project in System Manager.

To delete a business object from the supported list:

1. To select a business object field, click the number to the left of the business object.
2. From the **Edit** menu of the Connector Configurator window, click **Delete Row**. The business object is removed from the list display.
3. From the **File** menu, click **Save to Project**.

Deleting a business object from the supported list changes the connector definition and makes the deleted business object unavailable for use in this implementation of this connector. It does not affect the connector code, nor does it remove the business object definition itself from System Manager.

**Agent support:** If a business object has Agent Support, the system will attempt to use that business object for delivering data to an application via the connector agent.

Typically, application-specific business objects for a connector are supported by that connector's agent, but generic business objects are not.

To indicate that the business object is supported by the connector agent, check the **Agent Support** box. The Connector Configurator window does not validate your Agent Support selections.

**Maximum transaction level:** The maximum transaction level for a connector is the highest transaction level that the connector supports.

For most connectors, `Best Effort` is the only possible choice.

You must restart the server for changes in transaction level to take effect.

## If a WebSphere Message Broker is your broker

If you are working in stand-alone mode (not connected to System Manager), you must enter the business object name manually.

If you have System Manager running, you can select the empty box under the **Business Object Name** column in the **Supported Business Objects** tab. A combo

box appears with a list of the business object available from the Integration Component Library project to which the connector belongs. Select the business object you want from the list.

The **Message Set ID** is an optional field for WebSphere Business Integration Message Broker 5.0, and need not be unique if supplied. However, for WebSphere MQ Integrator and Integrator Broker 2.1, you must supply a unique **ID**.

### If WAS is your broker

When WebSphere Application Server is selected as your broker type, Connector Configurator does not require message set IDs. The **Supported Business Objects** tab shows a **Business Object Name** column only for supported business objects.

If you are working in stand-alone mode (not connected to System Manager), you must enter the business object name manually.

If you have System Manager running, you can select the empty box under the Business Object Name column in the Supported Business Objects tab. A combo box appears with a list of the business objects available from the Integration Component Library project to which the connector belongs. Select the business object you want from this list.

## Associated maps (ICS)

Each connector supports a list of business object definitions and their associated maps that are currently active in WebSphere InterChange Server. This list appears when you select the **Associated Maps** tab.

The list of business objects contains the application-specific business object which the agent supports and the corresponding generic object that the controller sends to the subscribing collaboration. The association of a map determines which map will be used to transform the application-specific business object to the generic business object or the generic business object to the application-specific business object.

If you are using maps that are uniquely defined for specific source and destination business objects, the maps will already be associated with their appropriate business objects when you open the display, and you will not need (or be able) to change them.

If more than one map is available for use by a supported business object, you will need to explicitly bind the business object with the map that it should use.

The **Associated Maps** tab displays the following fields:

- **Business Object Name**

  These are the business objects supported by this connector, as designated in the **Supported Business Objects** tab. If you designate additional business objects under the Supported Business Objects tab, they will be reflected in this list after you save the changes by choosing **Save to Project** from the **File** menu of the Connector Configurator window.

- **Associated Maps**

  The display shows all the maps that have been installed to the system for use with the supported business objects of the connector. The source business object for each map is shown to the left of the map name, in the **Business Object Name** display.

- **Explicit**

  In some cases, you may need to explicitly bind an associated map.

  Explicit binding is required only when more than one map exists for a particular supported business object. When ICS boots, it tries to automatically bind a map to each supported business object for each connector. If more than one map takes as its input the same business object, the server attempts to locate and bind one map that is the superset of the others.

  If there is no map that is the superset of the others, the server will not be able to bind the business object to a single map, and you will need to set the binding explicitly.

  To explicitly bind a map:

  1. In the **Explicit** column, place a check in the check box for the map you want to bind.
  2. Select the map that you intend to associate with the business object.
  3. In the **File** menu of the Connector Configurator window, click **Save to Project**.
  4. Deploy the project to ICS.
  5. Reboot the server for the changes to take effect.

## Resources (ICS)

The **Resource** tab allows you to set a value that determines whether and to what extent the connector agent will handle multiple processes concurrently, using connector agent parallelism.

Not all connectors support this feature. If you are running a connector agent that was designed in Java to be multi-threaded, you are advised not to use this feature, since it is usually more efficient to use multiple threads than multiple processes.

## Messaging (ICS)

The **Messaging** tab enables you to configure messaging properties. The messaging properties are available only if you have set MQ as the value of the `DeliveryTransport` standard property and ICS as the broker type. These properties affect how your connector will use queues.

### Validating messaging queues

Before you can validate a messaging queue, you must:

- Make sure that WebSphere MQ Series is installed.
- Create a messaging queue with channel and port on the host machine.
- Set up a connection to the host machine.

To validate the queue, use the Validate button to the right of the Messaging Type and Host Name fields on the Massaging tab.

## Security levels (ICS)

You can use the **Security** tab in Connector Configurator to set various privacy levels for a message. You can only use this feature when the DeliveryTransport property is set to JMS.

By default, Privacy is turned off. Check the **Privacy** box to enable it.

The **Keystore Target System Absolute Pathname** is:

- For Windows:
  `<ProductDir>\connectors\security\<connectorname>.jks`
- For UNIX:
  `opt/IBM/WebSphereAdapters/connectors/security/<connectorname>.jks`

This path and file should be on the same system as the Connector Configurator.

You can use the Browse button at the right only if the target system is the one currently running. It is greyed out unless **Privacy** is enabled and the **Target System** in the menu bar is set to Windows.

The **Message Privacy Level** may be set as follows for the three messages categories (All Messages, All Administrative Messages, and All business Object Messages):

- "" is the default; used when no privacy levels for a message category have been set.
- none
  Not the same as the default: use this to deliberately set a privacy level of none for a message category.
- integrity
- privacy
- integrity_plus_privacy

The **Key Maintenance** feature lets you generate, import and export public keys for the server and adapter.

- When you select **Generate Keys**, the Generate Keys dialog box appears with the defaults for the keytool that will generate the keys.
- The keystore value defaults to the value you entered in **Keystore Target System Absolute Pathname** on the Security tab.
- When you select OK, the entries are validated, the key certificate is generated and the output is sent to the Connector Configurator log window.

Before you can import a certificate into the adapter keystore, you must export it from the server keystore. When you select **Export Adapter Public Key**, the Export Adapter Public Key dialog box appears.

- The export certificate defaults to the same value as the keystore, except that the file extension is <filename>.cer.
-

When you select **Import Adapter Public Key**, the Import Adapter Public Key dialog box appears.

- The import certificate defaults to <*ProductDir*>\bin\ics.cer (if the file exists on the system).
- The import Certificate Association should be the server name. If a server is registered, you can select it from the droplist.

The **Adapter Access Control** feature is enabled only when the value of DeliveryTransport is IDL. By default, the adapter logs in with the guest identity. If the **Use guest identity** box is not checked, the **Adapter Identity** and **Adapter Password** fields are enabled.

## Setting trace/log file values

When you open a connector configuration file or a connector definition file, Connector Configurator uses the logging and tracing values of that file as default values. You can change those values in Connector Configurator.

To change the logging and tracing values:

1. Click the **Trace/Log Files** tab.
2. For either logging or tracing, you can choose to write messages to one or both of the following:
   - To console (STDOUT):
     Writes logging or tracing messages to the STDOUT display.

     **Note:** You can only use the STDOUT option from the **Trace/Log Files** tab for connectors running on the Windows platform.
   - To File:
     Writes logging or tracing messages to a file that you specify. To specify the file, click the directory button (ellipsis), navigate to the preferred location, provide a file name, and click **Save**. Logging or tracing message are written to the file and location that you specify.

     **Note:** Both logging and tracing files are simple text files. You can use the file extension that you prefer when you set their file names. For tracing files, however, it is advisable to use the extension `.trace` rather than `.trc`, to avoid confusion with other files that might reside on the system. For logging files, `.log` and `.txt` are typical file extensions.

## Data handlers

The data handlers section is available for configuration only if you have designated a value of JMS for DeliveryTransport and a value of JMS for ContainerManagedEvents. Not all adapters make use of data handlers.

See the descriptions under `ContainerManagedEvents` in Appendix A, Standard Properties, for values to use for these properties. For additional details, see the *Connector Development Guide for C++* or the *Connector Development Guide for Java.*

# Saving your configuration file

When you have finished configuring your connector, save the connector configuration file. Connector Configurator saves the file in the broker mode that you selected during configuration. The title bar of Connector Configurator always displays the broker mode (ICS, WMQI or WAS) that it is currently using.

The file is saved as an XML document. You can save the XML document in three ways:

- From System Manager, as a file with a `*.con` extension in an Integration Component Library, or
- In a directory that you specify.
- In stand-alone mode, as a file with a `*.cfg` extension in a directory folder. By default, the file is saved to `\WebSphereAdapters\bin\Data\App`.
- You can also save it to a WebSphere Application Server project if you have set one up.

For details about using projects in System Manager, and for further information about deployment, see the following implementation guides:

- For ICS: *Implementation Guide for WebSphere InterChange Server*
- For WebSphere Message Brokers: *Implementing Adapters with WebSphere Message Brokers*
- For WAS: *Implementing Adapters with WebSphere Application Server*

## Changing a configuration file

You can change the integration broker setting for an existing configuration file. This enables you to use the file as a template for creating a new configuration file, which can be used with a different broker.

**Note:** You will need to change other configuration properties as well as the broker mode property if you switch integration brokers.

To change your broker selection within an existing configuration file (optional):

- Open the existing configuration file in Connector Configurator.
- Select the **Standard Properties** tab.
- In the **BrokerType** field of the Standard Properties tab, select the value that is appropriate for your broker.
  When you change the current value, the available tabs and field selections on the properties screen will immediately change, to show only those tabs and fields that pertain to the new broker you have selected.

## Completing the configuration

After you have created a configuration file for a connector and modified it, make sure that the connector can locate the configuration file when the connector starts up.

To do so, open the startup file used for the connector, and verify that the location and file name used for the connector configuration file match exactly the name you have given the file and the directory or path where you have placed it.

## Using Connector Configurator in a globalized environment

Connector Configurator is globalized and can handle character conversion between the configuration file and the integration broker. Connector Configurator uses native encoding. When it writes to the configuration file, it uses UTF-8 encoding.

Connector Configurator supports non-English characters in:

- All value fields
- Log file and trace file path (specified in the **Trace/Log files** tab)

The drop list for the `CharacterEncoding` and `Locale` standard configuration properties displays only a subset of supported values. To add other values to the drop list, you must manually modify the `\Data\Std\stdConnProps.xml` file in the product directory.

For example, to add the locale `en_GB` to the list of values for the `Locale` property, open the `stdConnProps.xml` file and add the line in boldface type below:

```
<Property name="Locale"
isRequired="true"
updateMethod="component restart">
                <ValidType>String</ValidType>
            <ValidValues>
                                <Value>ja_JP</Value>
                                <Value>ko_KR</Value>
                                <Value>zh_CN</Value>
                                <Value>zh_TW</Value>
                                <Value>fr_FR</Value>
                                <Value>de_DE</Value>
                                <Value>it_IT</Value>
                                <Value>es_ES</Value>
                                <Value>pt_BR</Value>
                                <Value>en_US</Value>
                                <Value>en_GB</Value>
                    <DefaultValue>en_US</DefaultValue>
            </ValidValues>
    </Property>
```

# Chapter 4. Running the connector

This chapter describes running connector component of the IBM WebSphere Business Integration adapter for mySAP.com (SAP R/3 Version 3.x). This chapter assumes that you have installed the connector, as described in Chapter 2, "Installing the connector," on page 15.

This chapter contains the following sections:

- "Starting the connector"
- "Taking advantage of load balancing" on page 44

**Important:** If you are upgrading versions of the connector, you must replace the connector Java Archive files (`.jar`). You also need to upgrade the connector transport files as well as any business object transports that you have previously installed. Depending on changes made to the connector, you may need to load a new copy of the `SAPConnector.txt` file into your repository. See the Release Notes for more information.

## Starting the connector

A connector must be explicitly started using its **connector start-up script**. On Windows systems the startup script should reside in the connector's runtime directory:

*ProductDir*\connectors*connName*

where *connName* identifies the connector.

On UNIX systems the startup script should reside in the *ProductDir*/bin directory.

The name of the startup script depends on the operating-system platform, as Table 4 shows.

*Table 4. Startup scripts for a connector*

| Operating system | Startup script |
|---|---|
| UNIX-based systems | `connector_manager` |
| Windows | `start_`*`connName`*`.bat` |

When the startup script runs, it expects by default to find the configuration file in the *Productdir* (see the commands below). This is where you place your configuration file.

**Note:** You need a local configuration file if the adapter is using JMS transport.

You can invoke the connector startup script in any of the following ways:

- On Windows systems, from the **Start** menu

  Select **Programs>IBM WebSphere Business Integration Adapters>Adapters>Connectors**. By default, the program name is "IBM WebSphere Business Integration Adapters". However, it can be customized. Alternatively, you can create a desktop shortcut to your connector.
- From the command line

– On Windows systems:

```
start_connName connName brokerName [-cconfigFile ]
```

– On UNIX-based systems:

```
connector_manager -start connName brokerName [-cconfigFile ]
```

where *connName* is the name of the connector and *brokerName* identifies your integration broker, as follows:

– For WebSphere InterChange Server, specify for *brokerName* the name of the ICS instance.

– For WebSphere message brokers (WebSphere MQ Integrator, WebSphere MQ Integrator Broker, or WebSphere Business Integration Message Broker) or WebSphere Application Server, specify for *brokerName* a string that identifies the broker.

**Note:** For a WebSphere message broker or WebSphere Application Server on a Windows system, you *must* include the `-c` option followed by the name of the connector configuration file. For ICS, the `-c` is optional.

- From Adapter Monitor (available only when the broker is WebSphere Application Server or InterChange Server), which is launched when you start System Manager

  You can load, activate, deactivate, pause, shutdown or delete a connector using this tool.

- From System Manager (available for all brokers)

  You can load, activate, deactivate, pause, shutdown or delete a connector using this tool.

- On Windows systems, you can configure the connector to start as a Windows service. In this case, the connector starts when the Windows system boots (for an Auto service) or when you start the service through the Windows Services window (for a Manual service).

For more information on how to start a connector, including the command-line startup options, refer to one of the following documents:

- For WebSphere InterChange Server, refer to the *System Administration Guide*.
- For WebSphere message brokers, refer to *Implementing Adapters with WebSphere Message Brokers*.
- For WebSphere Application Server, refer to *Implementing Adapters with WebSphere Application Server*.

## Taking advantage of load balancing

Load balancing at logon increases the efficiency of defined workgroups by:

- Improving performance
- Decreasing consumption of system resources
- Distributing users across available application servers based on requirements for workgroup service and load sensitivity

Starting the connector with the load balancing feature initiates communication with the message server specified by the Hostname property. The message server then finds the application server with the least load. Once this application server is determined, the message server routes all future RFC communication with the connector through this one application server. The connector is considered as one dialog user with the message server.

The load balancing feature works best in an SAP environment where the connector processes low volumes and the number of users is large. For high volumes consider connecting directly to one of your larger application servers.

For information on configuring the connector for load balancing, see the description of the following connector properties:

- "ApplicationPassword" on page 315
- "ApplicationUserName" on page 315
- "Client" on page 316
- "Group" on page 316
- "Hostname" on page 316
- "SAPSystemID" on page 318

# Chapter 5. Generating business object definitions using SAPODA

This chapter describes SAPODA, an object discovery agent (ODA), that generates business object definitions for the Adapter for mySAP.com (R/3 V.3.x). Because the connector works with objects that are based on IDoc types, BAPIs, RFC-enabled function modules defined in an SAP system, and SAP tables representing a business process, SAPODA uses these objects to discover business object requirements specific to its SAP data source.

**Note:** Familiarity with IDoc types, BAPIs, RFC-enabled function modules within an SAP system, and SAP tables can aid in understanding how SAPODA operates.

**Important:** Business object names like attribute name or verb name, must use only characters defined in the code set associated with the U. S. English locale (`en_US`). For additional information see the *Business Object Development Guide.*

This chapter contains the following sections:



## Installation and usage

The following section describes the installation and usage of SAPODA.

### Installing SAPODA

To install SAPODA, use Installer for IBM WebSphere Business Integration Adapters. Follow the instructions in the *Implementation Guide for WebSphere InterChange Server, Implementing Adapters with WebSphere Brokers, Implementing Adapter with WebSphere Interchange Server, Adapter for WebSphere MQ Integrator Broker, System Installation Guide for Windows* or *for Unix*. When the installation is complete, the following files are installed in the product directory on your system:

- `ODA\SAP\SAPODA.jar`
- `ODA\messages\SAPODAAgent.txt`
- ODA\messages\SAPODAAgent_*ll_TT*.txt (message files specific to a to a language (_*ll*)country or territory (_*TT*))
- `ODA\SAP\start_SAPODA.bat` (Windows only)
- `ODA/SAP/start_SAPODA.sh` (UNIX only)

**Note:** In this document, backslashes (\) are used as the convention for directory paths. For UNIX installations, substitute slashes (/) for backslashes. All product path names are relative to the directory where the product is installed on your system.

# Before using SAPODA

This section contains the following sections:

- "Before running SAPODA"
- "Before using SAPODA to create definitions for the ALE or ABAP Extension Module"
- "How to Use SAPODA"

## Before running SAPODA

Before you can run SAPODA, you must:

- Have a valid logon ID to the SAP system
- Download the SAP Java API, which SAP calls their Java Connector (SAP JCo). This step should be performed as part of the connector installation process, and is described in "Installing the SAP JCo" on page 17.

## Before using SAPODA to create definitions for the ALE or ABAP Extension Module

You can use SAPODA to generate business object definitions for the ABAP Extension Module and the ALE Module based upon an IDoc (Intermediate Document):

- Extracted to a file
- Defined in the SAP system

**Important:** Before using SAPODA to generate a business object definition from an SAP IDoc definition file, you must create the IDoc definition file for each IDoc type you want supported. This step is required only when using an extracted IDoc definition file as the template for a business object definition. For more information, see "Creating the IDoc definition file" on page 141.

## How to Use SAPODA

After installing SAPODA, you must do the following to generate business objects:

1. Launch the ODA.
2. Launch Business Object Designer.
3. Follow a six-step process in Business Object Designer to configure and run the ODA.

The following sections describe these steps in detail.

# Launching SAPODA

You can launch SAPODA by running the appropriate file:

**UNIX**

start_SAPODA.sh

**Windows**

start_SAPODA.bat

You configure and run SAPODA using Business Object Designer. Business Object Designer locates an ODA using the Agent's host and the port. The Agent's name is

specified in the AGENTNAME variable of each script or batch file. The default ODA name for this connector is SAPODA. For more on ODAs and business object definitions and how to configure, start and use ODAs, see the *IBM WebSphere Business Object Development Guide*.

## Working with error and trace message files

Error and trace message files (the default is SAPODAAgent.txt) are located in \ODA\messages\, which is under the product directory. These files are language and country or territory specific and use the following naming convention:

*AgentName*Agent_ll_TT.txt

Where _ll is the language, and _TT is the country or territory.

For instance, a Chinese mainland file name would be:
SAPODAAgent_zh_CN.txt.

The same file name for Taiwan would be:
SAPODAAgent_zh_TW.txt.

The Business Object Designer uses this information when selecting a message file. The default search order is to first look for the locale-specific file that matches the locale in which the Business Object Designer is running. If that is not found, the Business Object Designer defaults to the English-US (en_US) version, and finally, the Business Object Designer looks for the file name without any locale or language information.

Although not required, if you create multiple instances of the ODA script or batch file and provide a unique name for each represented ODA, you can have a message file for each ODA instance. Alternatively, you can have differently named ODAs use the same message file. There are two ways to specify a valid message file:

- If you change the name of an ODA and do not create a message file for it, you must change the name of the message file in Business Object Designer as part of ODA configuration. Business Object Designer provides a name for the message file but does not actually create the file. If the file displayed as part of ODA configuration does not exist, change the value to point to an existing file.
- You can copy the existing message file for a specific ODA, and modify it as required. Business Object Designer assumes you name each file according to the naming convention. For example, if the AGENTNAME variable specifies SAPODA1, the tool assumes that the name of the associated message file is SAPODA1Agent.txt. Therefore, when Business Object Designer provides the filename for verification as part of ODA configuration, the filename is based on the ODA name. Verify that the default message file is named correctly, and correct it as necessary.

The MessageFile property does not display in the Configure agent properties window of Businteess Object Designer if you use the deployment descriptor odk_dd.xml file that exists in the ODA root directory.

**Note:** If a non-English locale is required, the same naming convention is still applicable; for example, SAPODA1Agent_zh_TW.txt.

**Important:** Failing to correctly specify the message file's name when you configure the ODA causes it to run without messages. For more information on specifying the message file name, see "Configure initialization properties" on page 51

During the configuration process, you specify:

- The name of the file into which SAPODA writes error and trace information
- The name of the message file
- The level of tracing, which ranges from `0` to `5`.

Table 5 describes the tracing level values.

*Table 5. Tracing levels*

| Trace level | Description |
|---|---|
| 0 | Logs all errors |
| 1 | Traces all entering and exiting messages for method |
| 2 | Traces the ODA's properties and their values |
| 3 | Traces the names of all business objects |
| 4 | Traces details of all spawned threads |
| 5 | • Indicates the ODA initialization values for all of its properties<br>• Traces a detailed status of each thread that SAPODA spawned<br>• Traces the business object definition dump |

For information on where you configure these values, see "Configure initialization properties" on page 51.

## Using SAPODA in Business Object Designer

This section describes how to use SAPODA in Business Object Designer to generate business object definitions. For information on launching Business Object Designer, see the *IBM WebSphere InterChange Server Business Object Development Guide*.

After you launch an ODA, you must launch Business Object Designer to configure and run it. There are six steps in Business Object Designer to generate a business object definition using an ODA. Business Object Designer provides a wizard that guides you through each of these steps.

After starting the ODA, do the following to start the wizard:

1. Open Business Object Designer.
2. From the File menu, select the New Using ODA... submenu.

   Business Object Designer displays the first window in the wizard, named Select Agent. Figure 5 on page 51 illustrates this window.

To select, configure, and run the ODA, follow these steps:

1. "Select the ODA" on page 51.
2. "Configure initialization properties" on page 51.
3. "Expand nodes and select objects" on page 54.
4. "Confirm selection of objects" on page 57.

5. "Generate the definition" on page 57 and, optionally, "Provide additional information" on page 58.
6. "Save the definition" on page 76.

## Select the ODA

Figure 5 illustrates the first dialog box in Business Object Designer's six-step wizard. From this window, select the ODA to run.

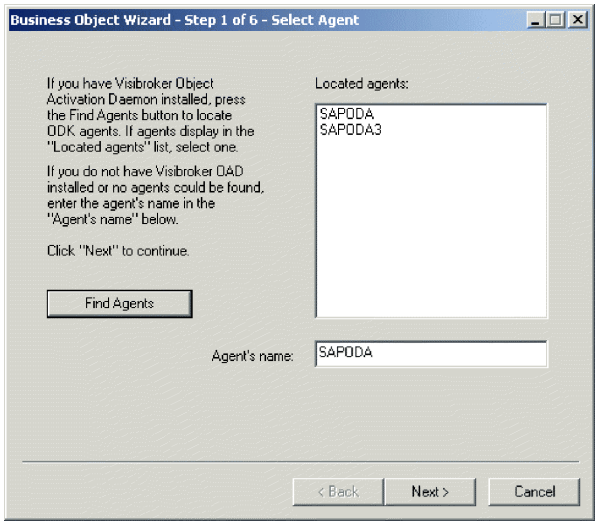



*Figure 5. Selecting the ODA*

To select the ODA:

1. Click the Find Agents button to display all registered or currently running ODAs in the Located agents field.

   **Note:** If Business Object Designer does not locate your desired ODA, enter the host and port into their respective fields.
2. Select the desired ODA from the displayed list.

## Configure initialization properties

The first time Business Object Designer communicates with SAPODA, it prompts you to enter a set of initialization properties. You can save these properties in a named profile so that you do not need to re-enter them each time you use SAPODA. For information on specifying an ODA profile, see the *IBM WebSphere Business Object Development Guide*.

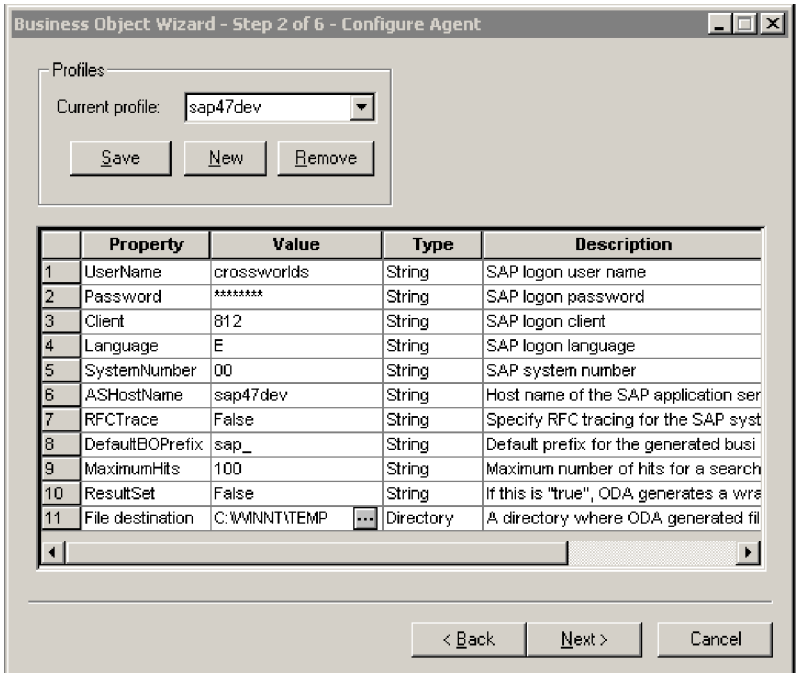



*Figure 6. Configuring agent properties*

Configure the SAPODA properties described in Table 6..

*Table 6. SAPODA properties*

| Property name | Property type | Description |
|---|---|---|
| `UserName` | String | SAP logon user name (not required when generating a definition only from an extracted IDoc definition file) |
| `Password` | String | SAP logon password (not required when generating a definition only from an extracted IDoc definition file) |
| `Client` | String | SAP logon client number (not required when generating a definition only from an extracted IDoc definition file) |
| `Language` | String | SAP logon language (not required when generating a definition only from an extracted IDoc definition file). Default is `E` for English. |
| `SystemNumber` | String | SAP system number (not required when generating a definition only from an extracted IDoc definition file) |
| `ASHostName` | String | Host name of the SAP application server (not required when generating a definition only from an extracted IDoc definition file) |
| `RFCTrace` | True/False boolean | RFC tracing for the SAP system |
| `DefaultBOPrefix` | String | Text that is prepended to the name of the business object to make it unique.<br><br>You can change this later, if required, when Business Object Designer prompts you for business object specific properties. |
| `MaximumHits` | String | Maximum number of objects returned during a node search. For more information, see “Expand nodes and select objects” on page 54.<br><br>Default is: `100` |

*Table 6. SAPODA properties (continued)*

| Property name | Property type | Description |
|---|---|---|
| TraceFileName | String | Name of the trace file. If the file does not exist, SAPODA creates it in the \ODA\SAP directory. If the file already exists, SAPODA appends to it.<br><br>SAPODA names the file according to the naming convention. For example, if the agent is named SAPODA, it generates a trace file named SAPODAtrace.txt.<br><br>Use this property to specify a different name for this file.<br><br>**Note**: The Configure Agent screen does not display this property if you use the deployment descriptor odk_dd.xml file that exists in the ODA root directory. |
| TraceLevel | Integer | Level of tracing enabled for SAPODA.<br><br>For more information on tracing, see "Working with error and trace message files" on page 49.<br><br>**Note**: The Configure Agent screen does not display this property if you use the deployment descriptor odk_dd.xml file that exists in the ODA root directory. |
| MessageFile | String | Name of the error and message file.<br><br>SAPODA names the file according to the naming convention. For example, if the agent is named SAPODA, it names the message file SAPODAAgent.txt. For more information, see "Working with error and trace message files" on page 49.<br><br>**Important**: The error and message file must be located in the \ODA\messages directory.<br><br>Use this property to verify or specify an existing file.<br><br>**Note**: The Configure Agent screen does not display this property if you use the deployment descriptor odk_dd.xml file that exists in the ODA root directory. |
| ResultSet | True/False boolean | When set to True, SAPODA generates a wrapper business object for Information Integrator support.<br><br>If you do not want to generate ResultSet objects, set to False. |
| File destination | Directory | Directory where ODA-generated files (business objects and class files) are stored. Note that you can explicitly save business objects to a different directory after the objects have been generated and placed in this directory.<br><br>Default is the default directory on the Windows system. It is recommended that you change the default setting to the \connectors\SAP\utilities\generatedfiles directory.<br><br>**Note**: If running SAPODA on the same machine as Business Object Designer, do not use the directory ODA\SAP as your File destination. Business Object Designer uses this directory as a temporary location for remote ODAs. |

**Important:** Correct the name of the message file if the default value displayed in Business Object Designer represents a non-existent file. If the name is not correct when you move forward from this dialog box, Business Object Designer displays an error message in the window from which

the ODA was launched. This message does not popup in Business Object Designer. Failing to specify a valid message file causes the ODA to run without messages. For more information, see "Working with error and trace message files" on page 49.

## Expand nodes and select objects

After you configure all properties for SAPODA, Business Object Designer displays a tree with the following the initial nodes:

- IDoc types—You can:
  - browse for extracted IDoc definition files
  - select IDocs in the SAP system (Basic IDoc Types and Extension Types)

    **Note:** Extension Types are customer-defined IDoc Types.
- BOR—select objects that represent BAPIs from the SAP application
- RFC—select objects that represent RFC-enabled functions from the SAP application
- Dynamic Transaction and Retrieve—select the definitions that represent objects from the dynamic transaction and dynamic retrieve metadata tables
  - HDR—select the tables required to represent an entity for SAP transactions processed by the Hierarchical Dynamic Retrieve Module

The nodes whose names are preceded by a plus sign (+) are expandable. Click on them to display more nodes or leaves. SAPODA generates business object definitions only from leaves.

Figure 7 on page 55 illustrates this dialog box as originally displayed and with some nodes expanded.

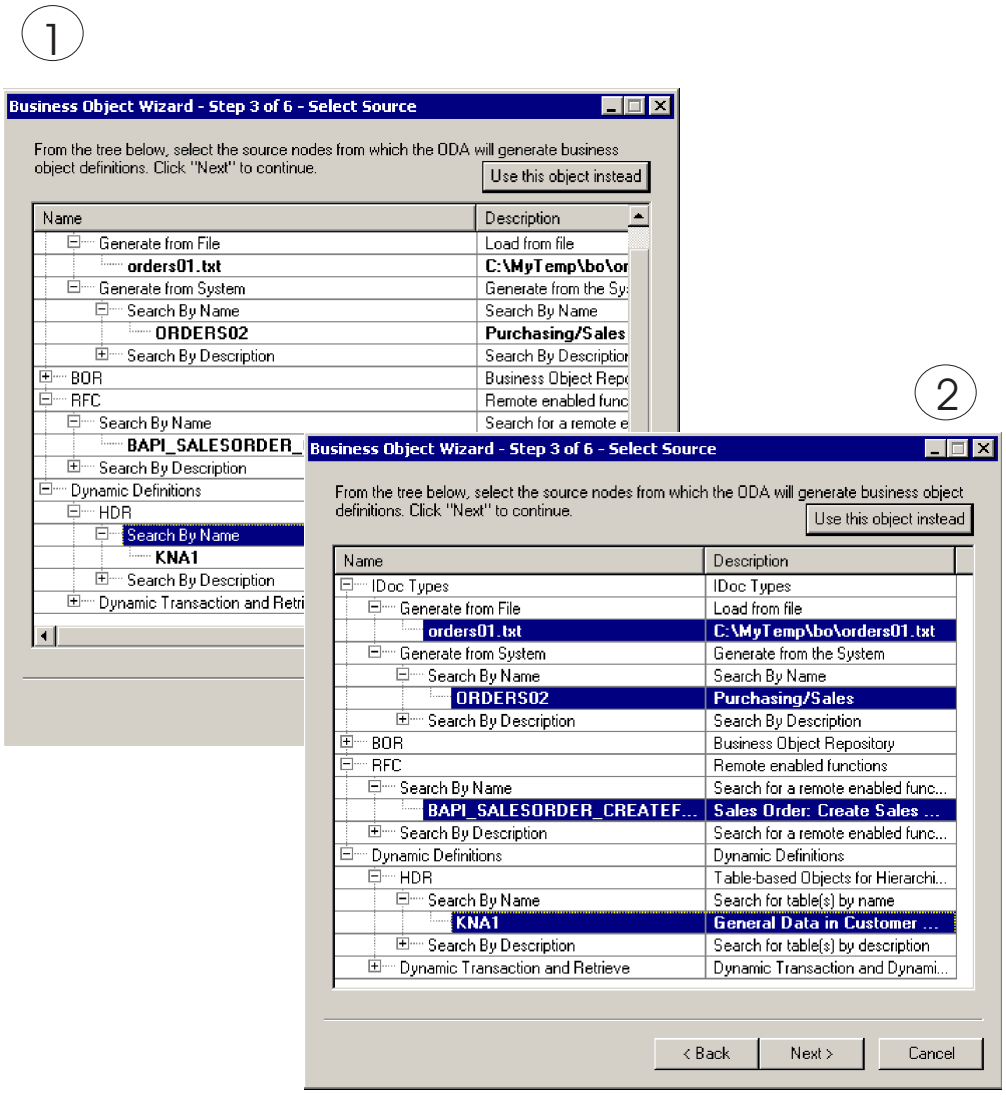



*Figure 7. Tree with expanded nodes*

When a leaf's name is displayed in bold type, you can select the leaf as the basis for its business object to be generated. Use standard Windows procedures to select multiple leaves. In other words, depress the CTRL key while you use the mouse to select multiple leaves.

**Important:** On a Windows system, if Business Object Designer cannot find required library files in the Path environment variable or the files are not on the system, it displays an empty Agent notification window. For information about these files, see "Before running SAPODA" on page 48.

SAPODA uses a polymorphic node type that allows you to associate a flat file with a node. Initially the node displays without any leaves. You can browse a file system and select files to add to that node. The node is called **polymorphic** because its nature changes from a leaf to a branch when you associate it to one or more files.

Note that if you expand the RFC node, the following message appears indicating that search results in RFC nodes are cached. This caching service provides a

smaller number of leaf nodes and thus enables SAPODA to generate ResultSet and BAPI transaction business objects more efficiently. Search results are sorted and then displayed. The caching service runs in the background whenever you start SAPODA and the cached searches are purged when you end the session. The number of search results that can be cached is determined by the value of the `MaximumHits` property set in the Configure agent properties window, shown in Figure 6 on page 52.


*Figure 8. Caching notification*

Figure 9 illustrates two ways of limiting the number of leaves that Business Object Designer returns:

- A context-sensitive menu that allows you to open a window for browsing files. From this window, you can select which files to associate.
- A wizard that allows you to specify search characters in an object's name or description.

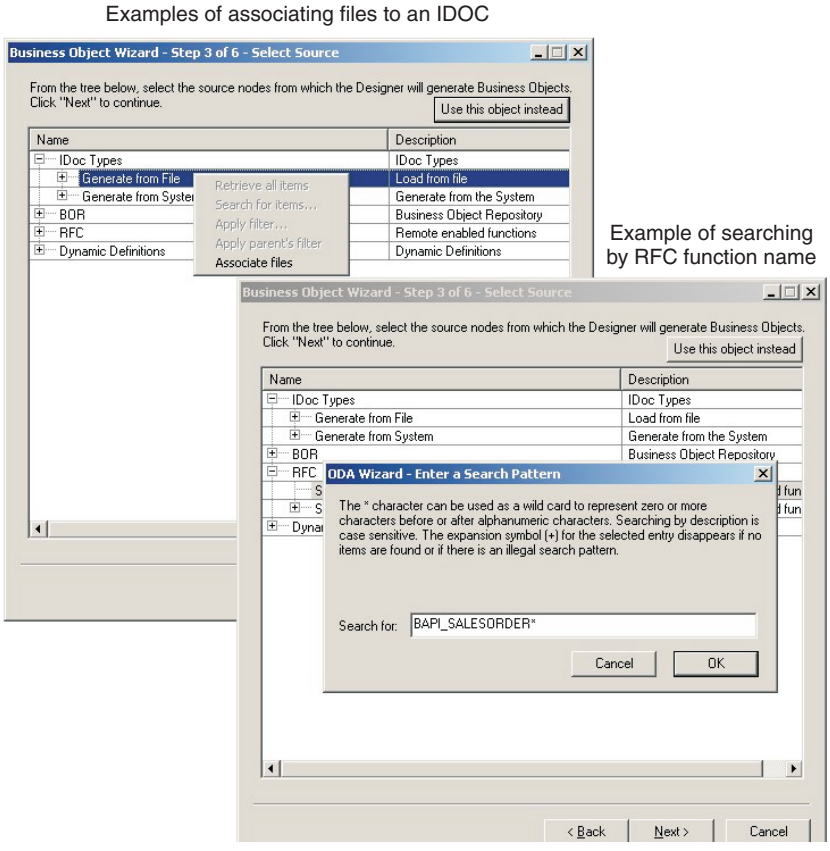



*Figure 9. Associating a file and entering search criteria*

After you have selected all desired leaves for object generation, click the Next button. For information on how to filter the objects returned, see the *Business Object Development Guide*.

## Confirm selection of objects

After you identify all the objects to be associated with generated business object definitions, Business Object Designer displays the dialog box with only the selected leaves and their node paths. Figure 10 illustrates this dialog box.

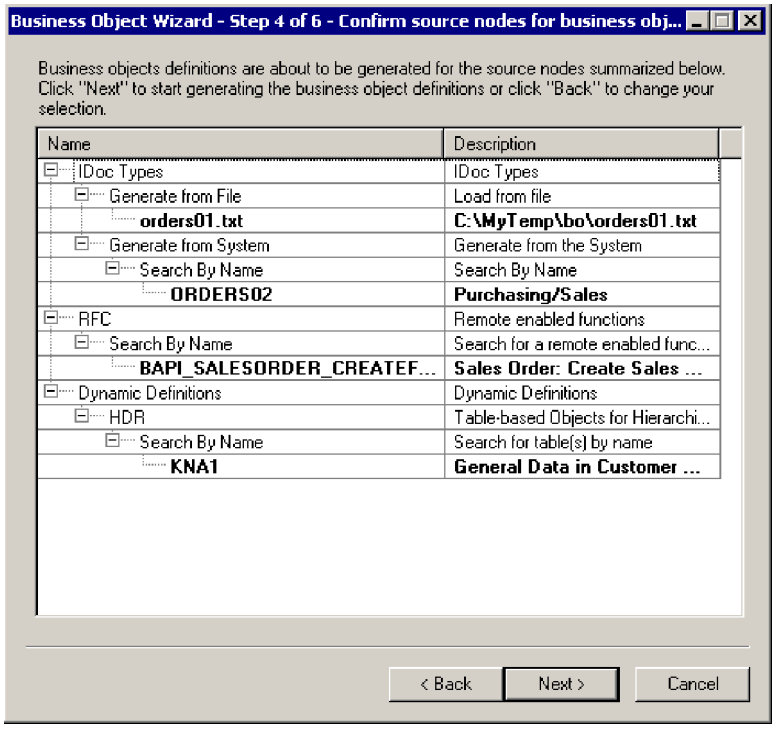



*Figure 10. Confirming selection of nodes and leaves*

This window provides the following options:

- To confirm the selection, click Next.
- If the selection is not correct, click Back to return to the previous window and make the necessary changes. When the selection is correct, click Next.

## Generate the definition

After you confirm the selected objects, the next dialog box informs you that Business Object Designer is generating the definitions.

Figure 11 on page 58 illustrates this dialog box.

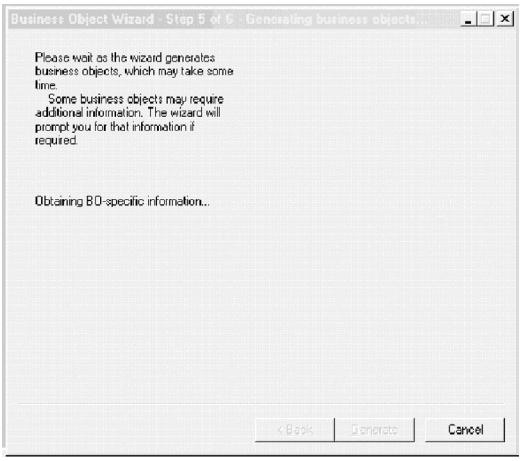



*Figure 11. Generating the definition*

## Provide additional information

SAPODA prompts for additional information. The type of the top-level node (IDoc types, BOR, RFC, or Dynamic Definitions) determines:

- The set of properties that Business Object Designer displays in the BO Properties window.
- Whether Business Object Designer displays a second window that prompts you for additional object generation information.

### IDoc Type: Providing additional information

SAPODA displays the BO Properties window to enable you to specify information required for business objects based on IDoc types. The properties displayed in this window differ depending on the source of the IDoc (an extracted file or a definition in the SAP system) and whether the definition is being defined for the ABAP Extension Module. This section describes the following topics:

- "The BO Properties Window—Common Properties"
- "The BO properties window—Property for IDoc defined in the SAP System" on page 59
- "The BO Properties window—Specifying a function module for the ABAP handler" on page 59

**The BO Properties Window—Common Properties:** Regardless of whether SAPODA is generating the business object definition from an IDoc file or an IDoc defined in the SAP system, the BO Properties window for an IDoc type allows you to specify or change:

- Prefix information.

  The prefix is text prepended to the name of the business object to make it unique. If you are satisfied with the value you entered for the DefaultBOPrefix property in the Configure Agent window, you do not need to change the value here.

- Module type

  The module type choices are ALE or Extension. Because the ALE and the ABAP Extension Modules have different requirements for their business object definitions, it is important to specify which module will be using the business object.

**Note:** If there are multiple segments at the top-level of the IDoc, when SAPODA generates the business object definition for the ABAP Extension Module, it uses the first IDoc segment to represent the top-level business object. SAPODA represents the other top-level segments as child business objects.

- UseFieldName

  Generate the attribute name from either the SAP field name or the SAP field description, the default being the SAP field description.

**The BO properties window—Property for IDoc defined in the SAP System:** In addition to the prefix and module properties, the BO properties window representing an IDoc defined in the SAP system also displays the Release property. You can use this property to identify an earlier version of the IDoc type.

**Important:** If the earlier version of the IDoc type has fewer segments than the current version, SAPODA might create a definition with missing segments or SAPODA might display an error indicating that the generation of the business object definition was unsuccessful. This inconsistency is due to different versions of SAP requiring different API calls.

Figure 12 illustrates the two versions of the BO properties window, one for an extracted IDoc Type definition file and one for an IDoc defined in the SAP system.

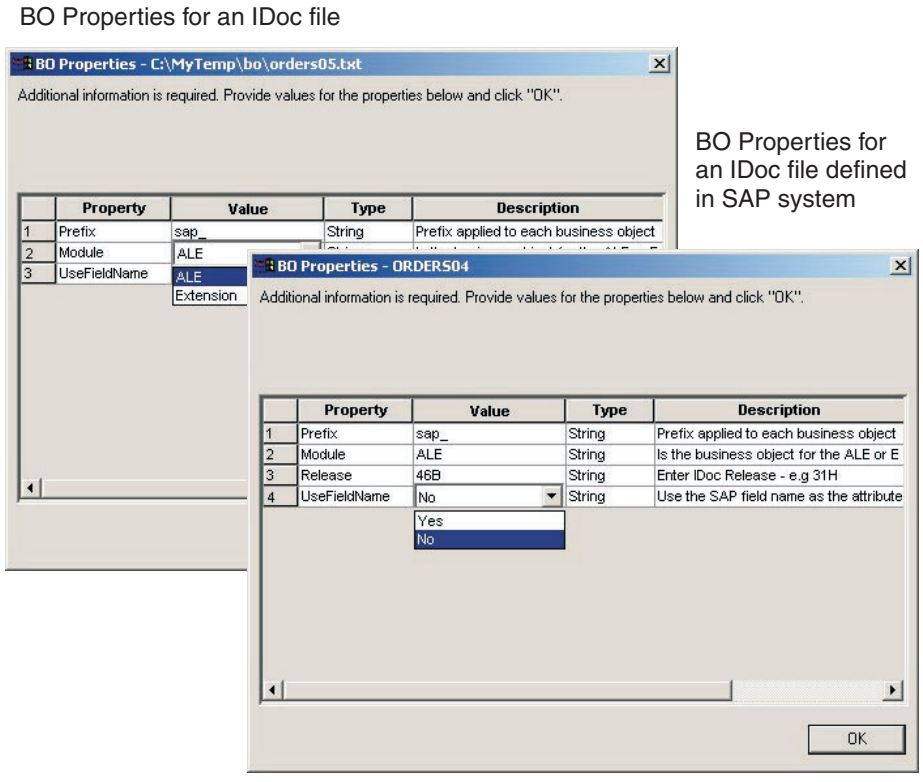



*Figure 12. Providing additional information for an IDoc type business object*

**The BO Properties window—Specifying a function module for the ABAP handler:** If you select `Extension` as the module type, SAPODA prompts whether you want to enter function module names for any of the default verbs.

By default, when generating a definition for the ABAP Extension Module, SAPODA specifies the following text for verb application-specific information at the business object level of the top-level business object:

```
:Y_XR_IDOC_HANDLER
```

If you already know the function module names to pass to the ABAP handler, select `Yes` at this prompt. SAPODA displays the window illustrated in Figure 13..

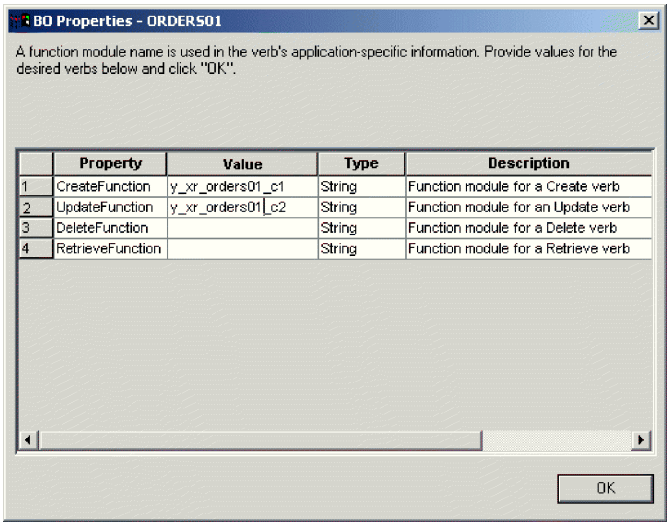



*Figure 13. Specifying function modules for the ABAP handler*

Figure 13 illustrates a BO Properties window in which two function modules have been specified.

**Note:** If many IDoc types are in a definition file, the Function module BO Properties window is provided for each IDoc type in the file. The General IDoc type BO properties window is provided only once.

After you save the business object definition, the General tab in Business Object Designer displays the required application-specific information at the business object level of the topmost business object. Figure 14 on page 61 illustrates such a window with the two specified function modules.

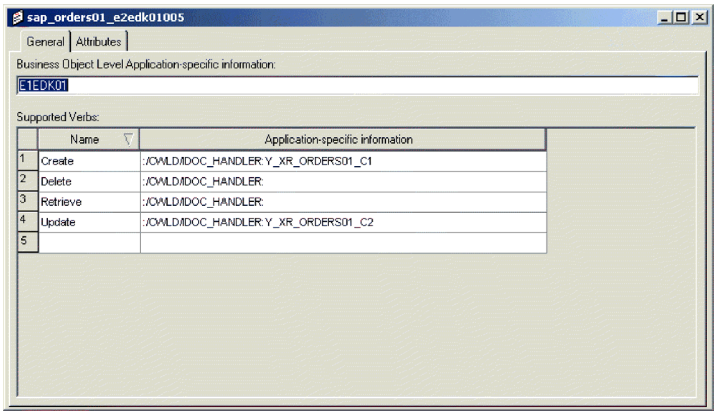



*Figure 14. Specifying the ABAP handler in business object designer*

For more information about the ABAP handler, see "Business object data routing to ABAP handlers" on page 221.

## BOR or RFC: Providing additional information

SAPODA creates the following types of objects:

- Single BAPI business objects
- BAPI transaction top-level business objects
- ResultSet business objects

**Single BAPI business objects:** When the `ResultSet` property on the Configure Agent window is set to `False`, as illustrated in Figure 6 on page 52, you can use SAPODA to create a single BAPI transaction business objects or a BAPI transaction business object that contains multiple BAPI calls. This section provides details about business objects for Single BAPI calls.

For details about creating business objects for BAPI transactions, see "BAPI transaction business objects" on page 63. For details about creating business objects for ResultSets, see "ResultSet business objects" on page 67.

There are two BO Properties windows for a single BAPI object of BOR or RFC type. The properties displayed in the first window allow you to specify or change:

- `Prefix` —If you are satisfied with the value you entered for the `DefaultBOPrefix` property in the Configure Agent window (Figure 6 on page 52), you do not need to change the value here.
- `Verb` —Specify the verb.
- `Server Support`—If the definition is to be generated for the connector's RFC Server Module, specify `yes`. If the definition is to be generated for the connector's BAPI Module, specify `no`.
- UseFieldName—Generate the attribute name from either the SAP field name or the SAP field description, the default being the SAP field description.

After you click OK to move forward from the first BO Properties window, SAPODA gives you the opportunity to reduce the size of the generated definition. You are prompted whether you want to remove from the definition any attributes that represent optional parameters. This prompt displays only if there are optional parameters to remove. Reducing the size of the definition can enhance performance later when the connector processes instances of the business object.

Figure 15 illustrates the properties displayed for a BOR or RFC-type object and the prompt that displays after you click OK. Note that this prompt appears for as many individual BAPI calls you select to create single BAPI call objects.

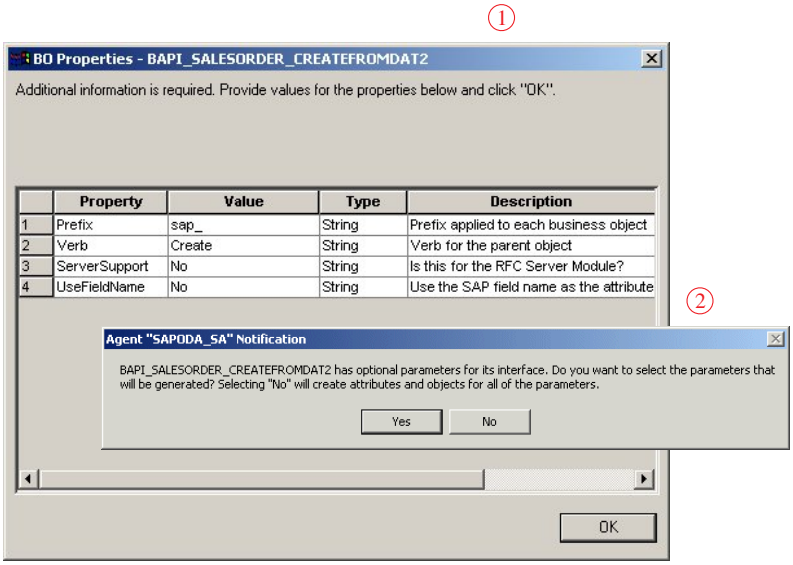



*Figure 15. Providing additional information for BOR or RFC business objects*

If you click **Yes** in the prompt illustrated above, the second BO Properties window displays. You can specify removal of each optional parameter of a BAPI/RFC interface by changing its Value from `Yes` (include a corresponding attribute in the generated definition) to `No` (do not include an attribute).

If you click **No** in the prompt illustrated above, the final wizard displays. For more information, see "Save the definition" on page 76.

Figure 16 on page 63 illustrates the second BO properties window.

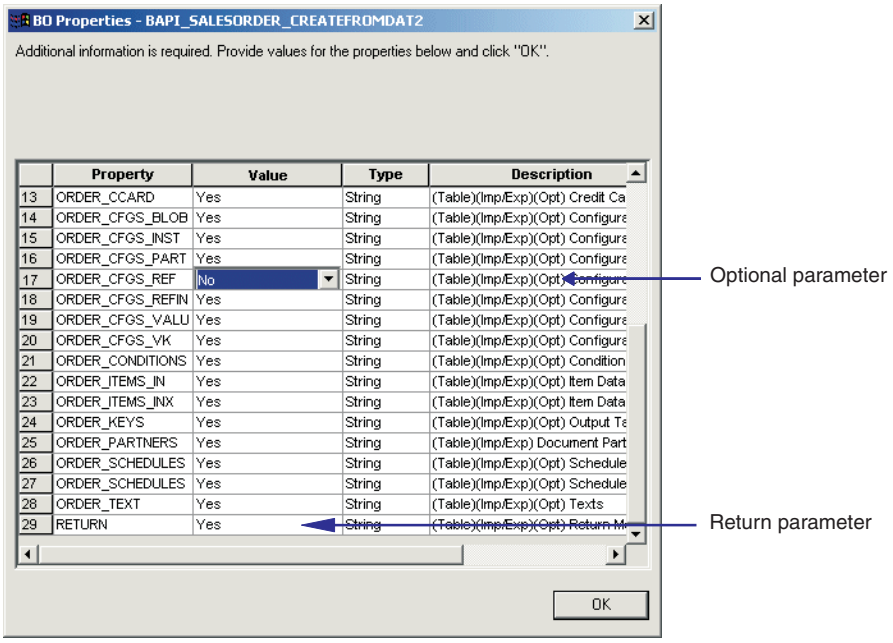



*Figure 16. Specifying attributes for removal from the definition*

**Important:** A business object definition for a RFC-enabled function beginning with "`Bapi`" must have an attribute that represents a business object corresponding to a return structure or table. If a definition lacks such an attribute, an error occurs when its corresponding generated code is compiled. If you get this compile error, examine the BAPI to determine if SAP was using a different return structure. In this case, change the generated Java code to point to the proper parameter.

In addition to the specifications you provide in SAPODA, when you create a definition for the RFC Server Module, you may want to modify application-specific information after you save the business object definition. For more information, see Chapter 14, "Developing business objects for the RFC Server Module," on page 165.

**BAPI transaction business objects:** When the `ResultSet` property on the Configure Agent window is set to `False`, as illustrated in Figure 6 on page 52, you can use SAPODA to create BAPI transaction business objects. BAPI transaction business objects contain multiple BAPI business objects.

With the `ResultSet` property on the Configure Agent window set to `False`, click **Next** to proceed to the caching notification window (Figure 17) and then click **OK**.


*Figure 17. Caching notification*

Figure 18 on page 64 illustrates the next window that appears, which allows you to specify the criteria that SAPODA will use to search for and display BAPI calls. For

the example used in this section, the criteria is all BAPI calls starting with the text "BAPI_SALESORDER."

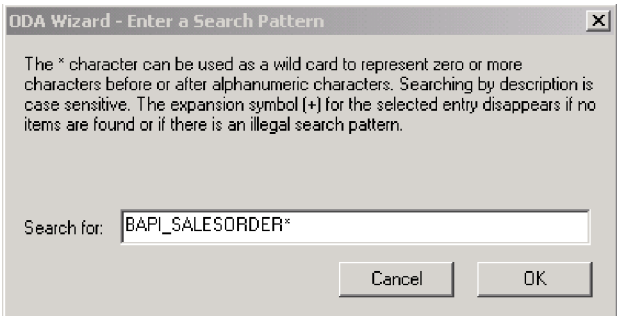



*Figure 18. Enter a Search Pattern*

After you specify the search criteria on the Enter a Search Pattern window, click **OK** to set the criteria. Figure 19 illustrates the search results tree with the RFC node expanded. On this window, select the BAPI calls that SAPODA will use to create the attributes of the BAPI transaction business object. In this example, the BAPI calls selected are `BAPI_SALESORDER_CHANGE` and `BAPI_SALESORDER_CONFIRMDELVRY`.

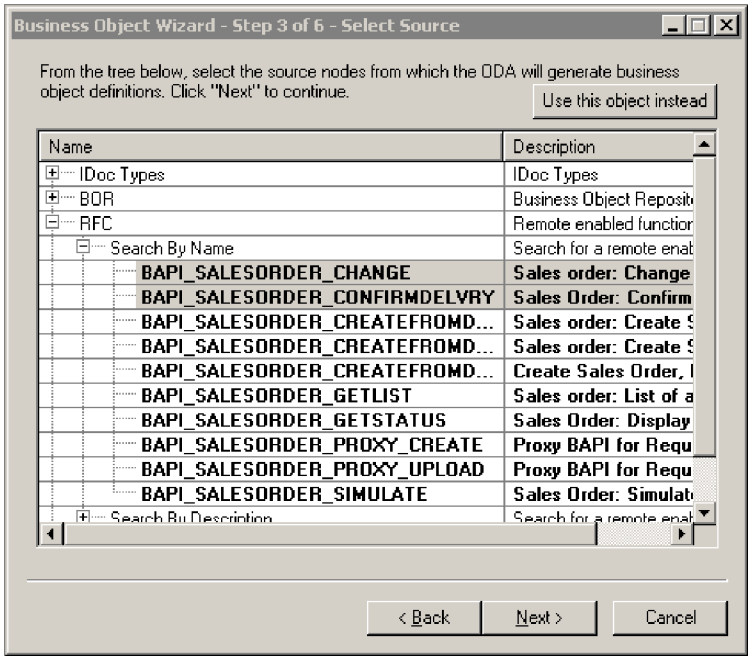



*Figure 19. Search results tree expanded for RFC node*

Click **Next** to proceed to the confirmation window, illustrated in Figure 20 on page 65. The two BAPI calls selected in Figure 19 are listed.

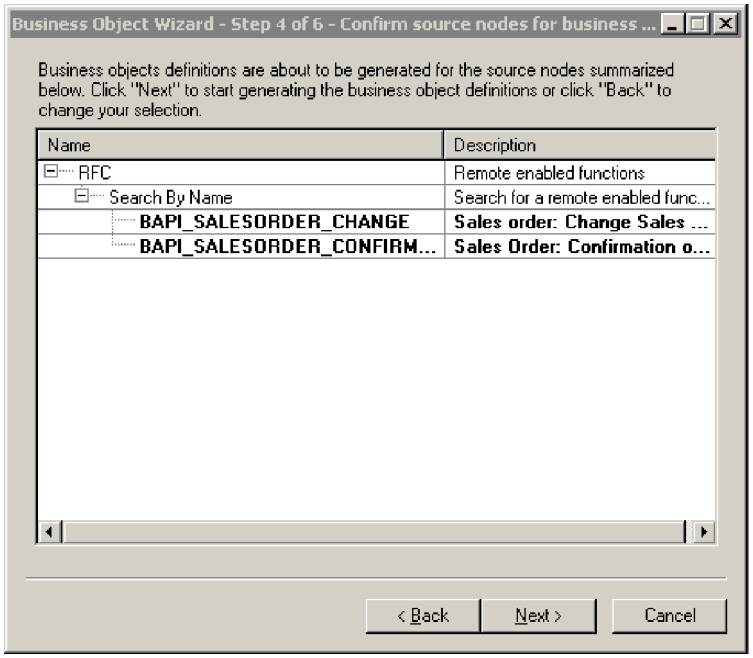



*Figure 20. Confirm source nodes for BAPI calls in the transaction*

Click **Next** on this screen. A message window appears notifying you that you have selected more than one BAPI call. Click **Yes** to indicate that your intention is to create a BAPI transaction business object from these multiple BAPI calls.


*Figure 21. Multiple BAPI call selection message*

The next screen allows you to apply a prefix and a name to the BAPI transaction object. In this example, the prefix entered is `sap_`, and the name for the transaction object is `salesorder_txn`. The `UseFieldName` property determines whether the attribute name will be generated using the field name in SAP or the field description.

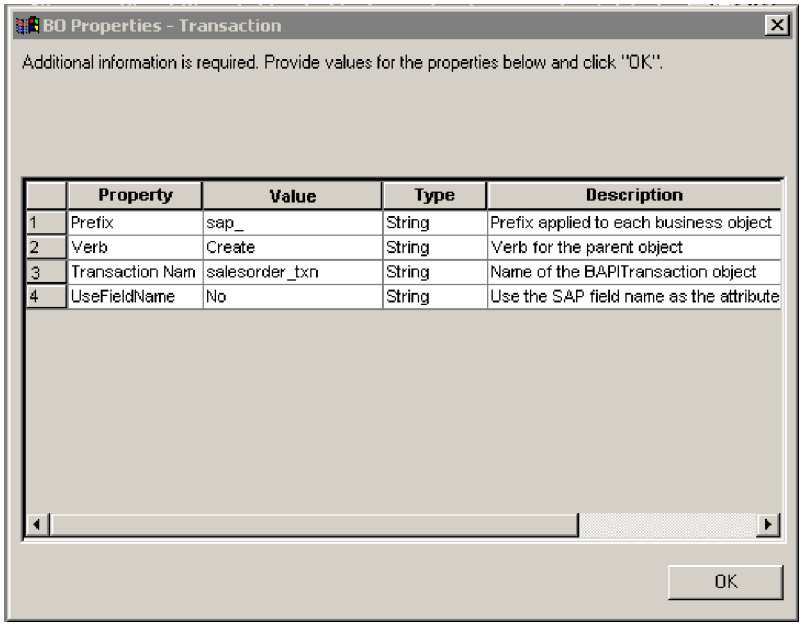



*Figure 22. Assign a prefix and business object name to the transaction*

Next, indicate the order in which the selected BAPI calls should be executed when the transaction object is processed. In this example, the `BAPI_SALESORDER_CHANGE` call is executed first, followed by the `BAPI_SALESORDER_CONFIRMDELVRY` call. You can apply a `COMMIT` after any BAPI you wish to commit within the transaction. SAPODA assumes a `COMMIT` as the final step of the transaction.

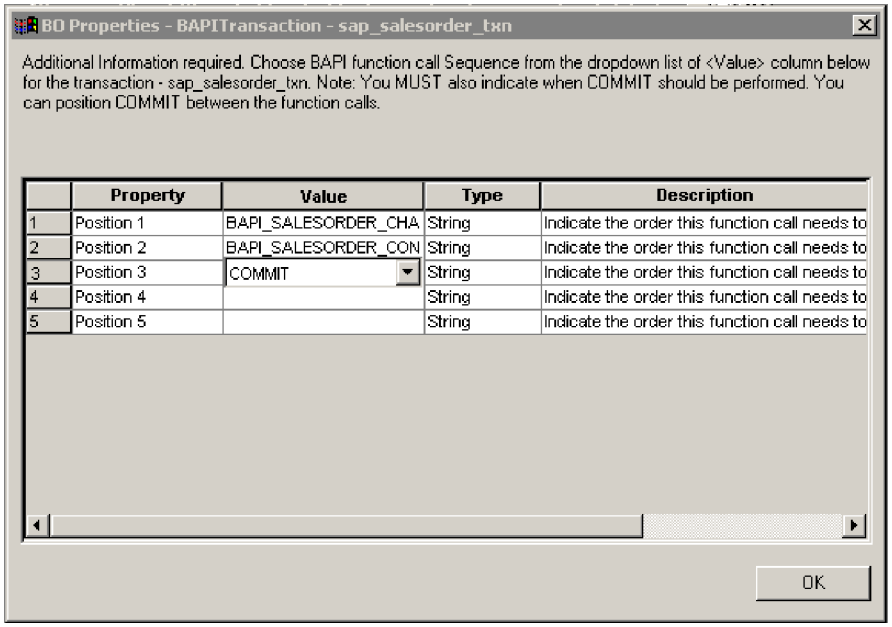



*Figure 23. Assign a BAPI call sequence within the BAPI transaction object*

The following message appears for each BAPI call in the sequence that has optional parameters. Figure 24 on page 67 illustrates this message for the first BAPI call in the sequence (`BAPI_SALESORDER_CHANGE`).

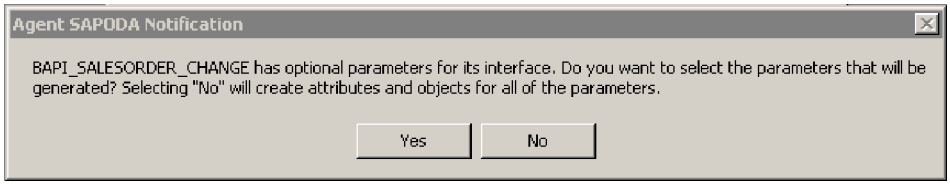



*Figure 24. Optional BAPI call parameters message*

Click **Yes** to pick and choose which optional parameters you want to add as attributes of the individual BAPI business object that will be contained within the BAPI transaction object. If you click **No**, all the optional parameters will be applied as attributes of the individual BAPI object within the BAPI transaction object.

After you have created BAPI object attributes for each BAPI call within the BAPI transaction object, the Business Object wizard displays the object tree of the BAPI transaction object. Figure 25 illustrates the **Attributes** tab for the `sap_salesorder_txn` business object created in this example.

General | Attributes

| | Pos | Name | Type | Key | Foreign Key | Required | Cardinal | Maximum Length | Default | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | ⊞ sap_bapi_salesorder_change_txn | sap_bapi_salesorder_change_txn | ☑ | ☐ | ☐ | 1 | | | |
| 2 | 2 | ⊟ sap_bapi_salesorder_confirmdelvry_txn | sap_bapi_salesorder_confirmdelvry_txn | ☐ | ☐ | ☐ | 1 | | | |
| 2.1 | 2.1 | Sales_Document | String | ☑ | ☐ | ☐ | | 10 | | ISALESDOCUMENT: |
| 2.2 | 2.2 | ⊞ sap_dlvitem_txn | sap_dlvitem_txn | ☐ | ☐ | ☐ | n | | | IDLVITEM:EDLVITEM |
| 2.3 | 2.3 | ⊞ sap_dlvitemdata_txn | sap_dlvitemdata_txn | ☐ | ☐ | ☐ | n | | | IDLVITEMDATA:EDLVITEM |
| 2.4 | 2.4 | ⊞ sap_return_txn | sap_return_txn | ☐ | ☐ | ☐ | n | | | IRETURN:ERETURN |
| 2.5 | 2.5 | ⊞ sap_tokenreference_txn | sap_tokenreference_txn | ☐ | ☐ | ☐ | n | | | ITOKENREFERENCE:ETOKI |
| 2.6 | 2.6 | ObjectEventId | String | | | | | | | |
| 3 | 3 | ObjectEventId | String | | | | | | | |
| 4 | 4 | | | ☐ | ☐ | ☐ | | 255 | | |

*Figure 25. Attributes tab for the sap_salesorder_txn business object*

Notice the two BAPI call attributes: `sap_salesorder_change_txn` and `sap_salesorder_confirmdelvry_txn`. Each of these attributes contains a single BAPI call object within the BAPI transaction object wrapper. The `sap_salesorder_change_txn` attribute contains a business object that corresponds to the `BAPI_SALESORDER_CHANGE` call, which is executed first in the transaction flow (as specified in Figure 23 on page 66). The `sap_salesorder_confirmdelvry_txn` attribute contains a business object that corresponds to the `BAPI_SALESORDER_CONFIRMDELVRY` BAPI call. Notice that the attributes have the suffix `_txn`, added by SAPODA. This suffix ensures that business objects created in previous versions of the connector are not overwritten by new business objects that might have the same name.

**ResultSet business objects:** When the `ResultSet` property on the Configure Agent window is set to `True`, as illustrated in Figure 26 on page 68, SAPODA creates top-level ResultSet business objects. ResultSet business objects enable Information Integrator support for DB2.

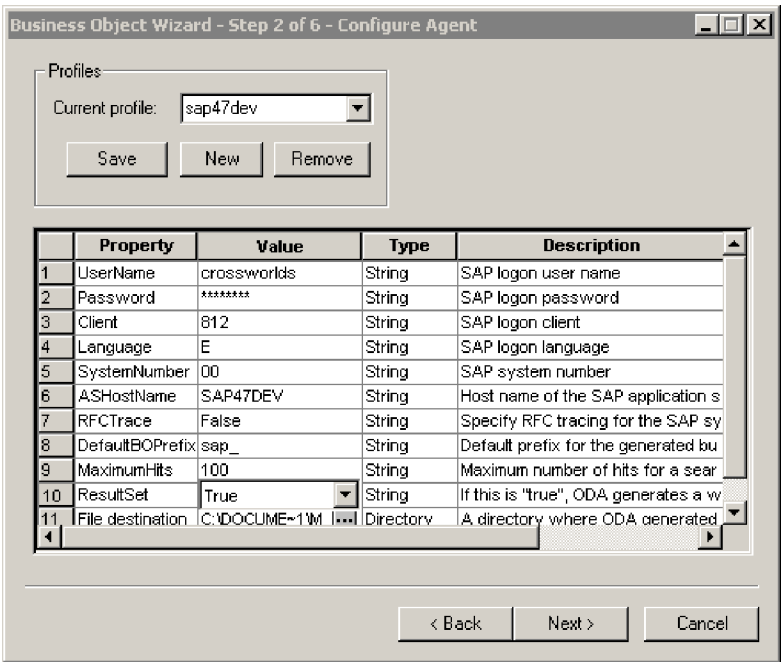



*Figure 26. Configure Agent window with ResultSet property set to True*

Click **Next** on the Configure Agent window and then click **OK** on the caching notification window (Figure 27).


*Figure 27. Caching notification*

The next window in the wizard allows you to specify the criteria that SAPODA will use to search for and display BAPI calls. In this example, the asterisk, which is a wildcard, indicates that the criteria is all BAPI calls starting with the text "BAPI_CUSTOMER_GET."

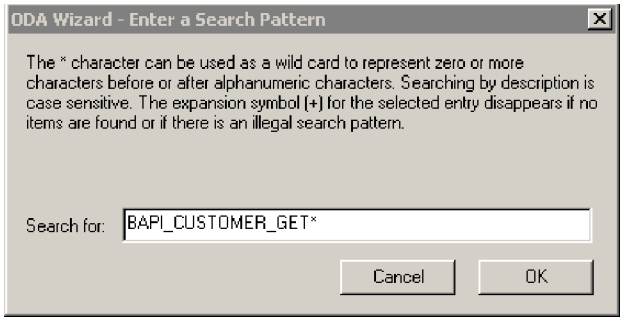



*Figure 28. Search criteria for ResultSets*

Click **OK** to set the criteria. Figure 29 illustrates the search results tree with the RFC node expanded. On this window, select the BAPI calls that SAPODA will use to create the attributes of the ResultSet business object.

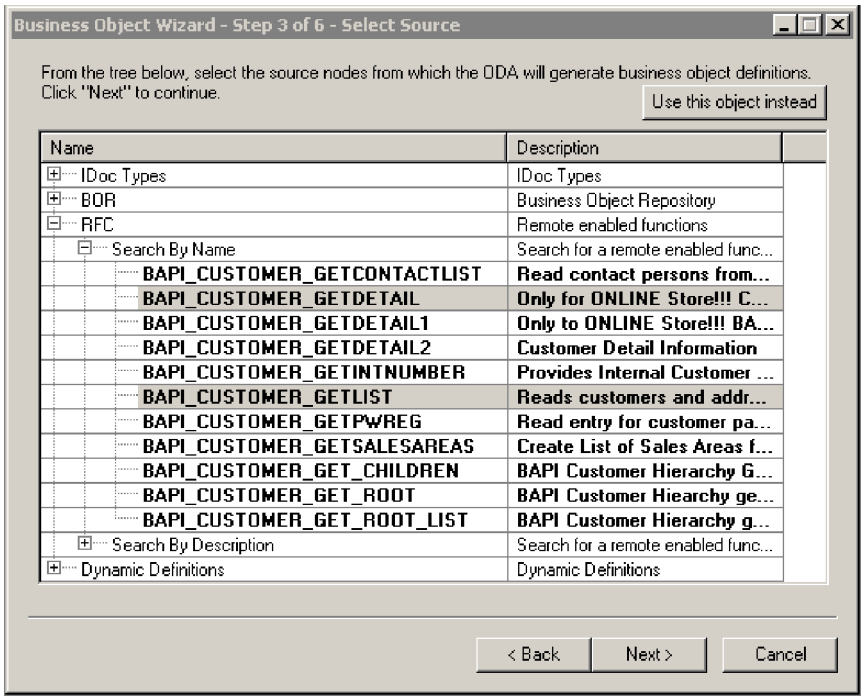



*Figure 29. Search results tree expanded for RFC node*

A ResultSet object has two attributes: Query (of type query object), and Result (of type result object). The Query attribute is typically generated from the `GETLIST` BAPI call, while the Result attribute is generated from `GETDETAIL` BAPI call.

Therefore, as Figure 29 illustrates, you select the corresponding BAPI calls, in this case `BAPI_CUSTOMER_GETDETAIL` and `BAPI_CUSTOMER_GETLIST`, from the expanded RFC node. Since the `ResultSet` property on the Configure Agent window is set to `True`, as illustrated in Figure 26 on page 68, you are only permitted to select two BAPI calls.

Click **Next** to proceed to the confirmation window, illustrated in Figure 30 on page 70, which allows you to confirm the source BAPI calls for the business object's attributes.

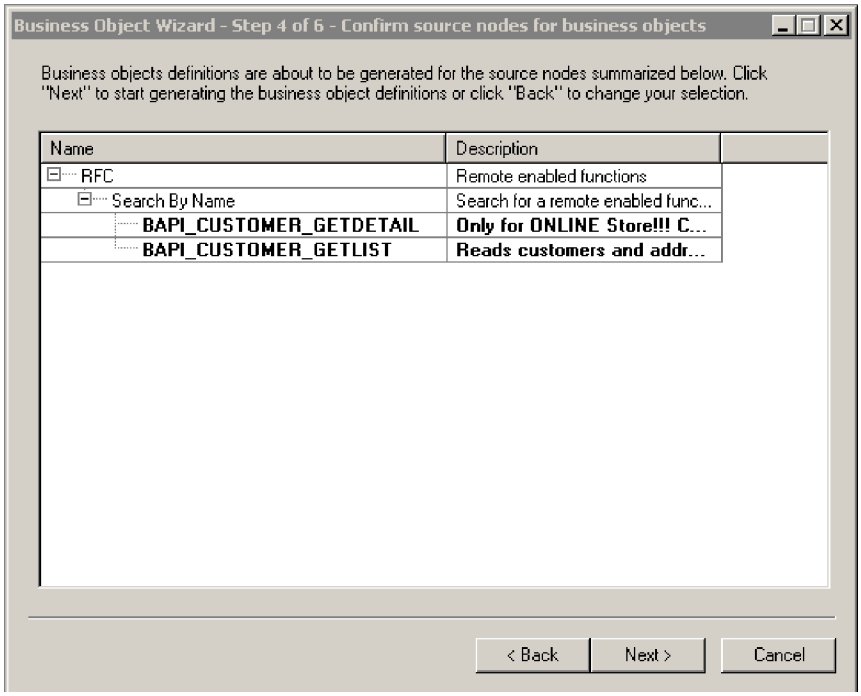



*Figure 30. Confirm source nodes for attributes*

As Figure 31 illustrates, the Business Object wizard requires you to specify the business object name prefix (in this example, `sap_`) and the name of the BAPI ResultSet object (in this example, `customer_rs`) that SAPODA will apply to the business object. The `UseFieldName` property determines whether the attribute name will be generated using the field name in SAP or the field description.

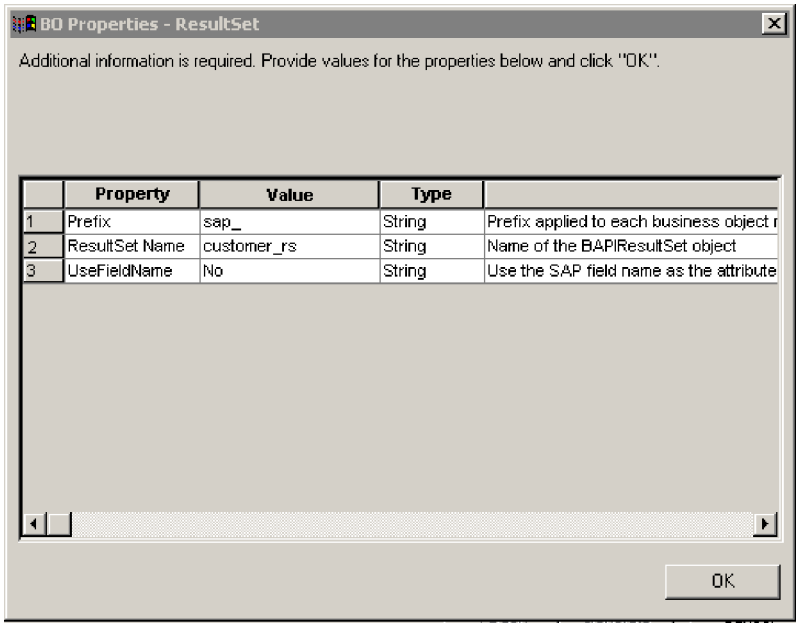



*Figure 31. Provide business object name information*

The Business Object wizard also requires you to indicate which BAPI call that you selected in Figure 29 on page 69 should be used for the Query attribute. From the drop-down list, select the `GETLIST` BAPI call, as illustrated in Figure 32 on page 71.

SAPODA automatically treats the other selected call as the Result attribute of the ResultSet object.

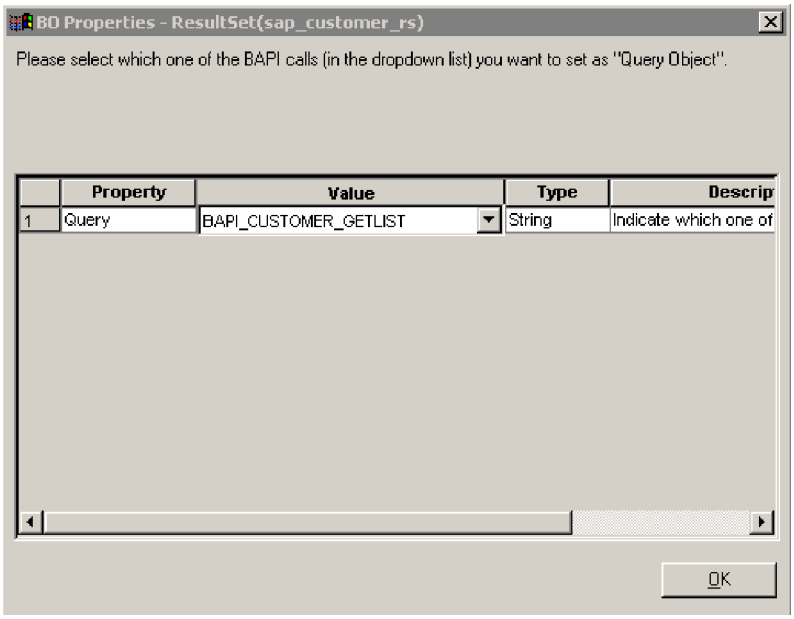



*Figure 32. Specify the Query attribute of the business object*

Click **OK** to proceed to the next window, on which you specify the Query parameter (primary key) of the Query BAPI you selected in Figure 32. In this example, the BAPI call is `GETLIST`.

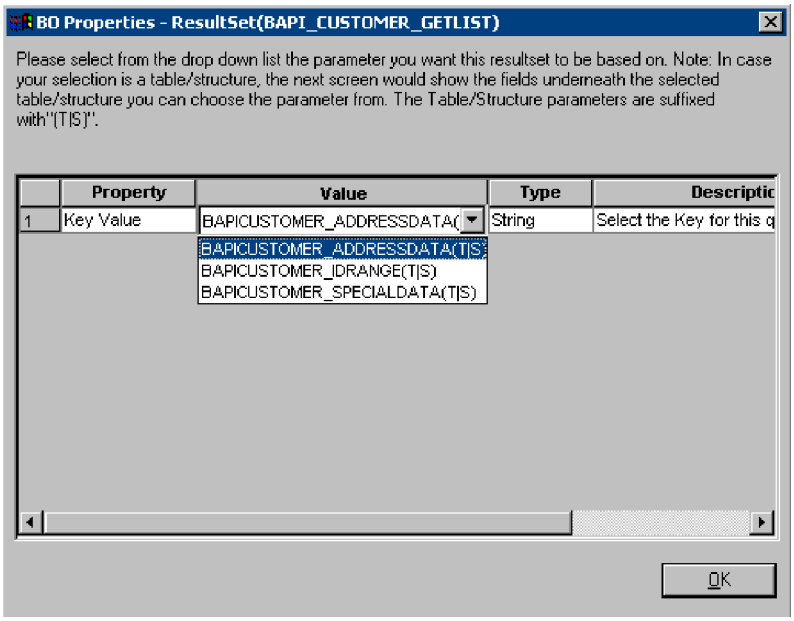



*Figure 33. Select the primary key*

If on the previous window, you chose a value that is a table/structure (identified by `T|S`), the window that appears next allows you to select a specific field on the table/structure as the primary key. In this example, the field selected is `CUSTOMER`.

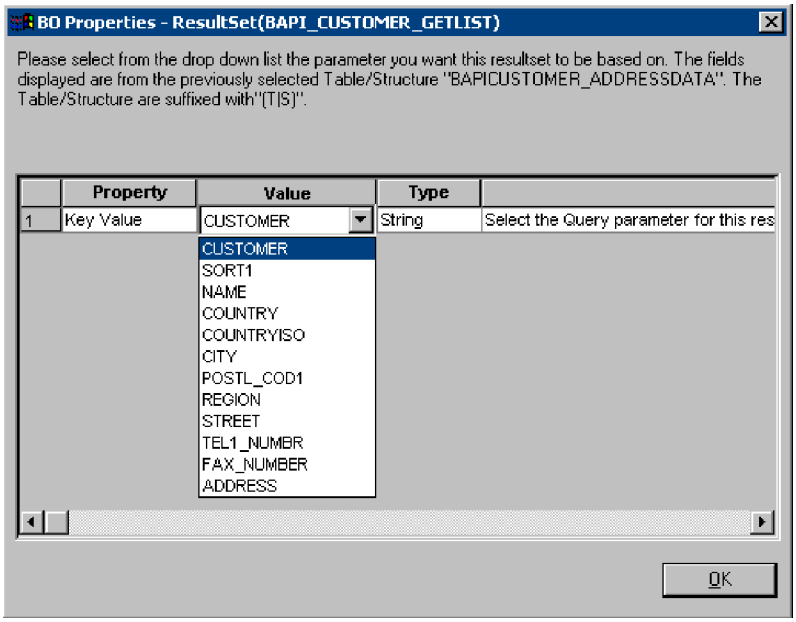



*Figure 34. Select a field on the table/structure*

A message window appears indicating the full path of the Query parameter, as illustrated in Figure 35. The path includes the BAPI call parameters selected in the previous two windows, in this example `BAPICUSTOMER_ADDRESSDATA` and `CUSTOMER`.


*Figure 35. Notification of Query attribute name*

You must also specify the foreign key for the ResultSet object, as illustrated in Figure 36 on page 73. The foreign key establishes the relationship between the Query attribute and Result attribute of the ResultSet object.

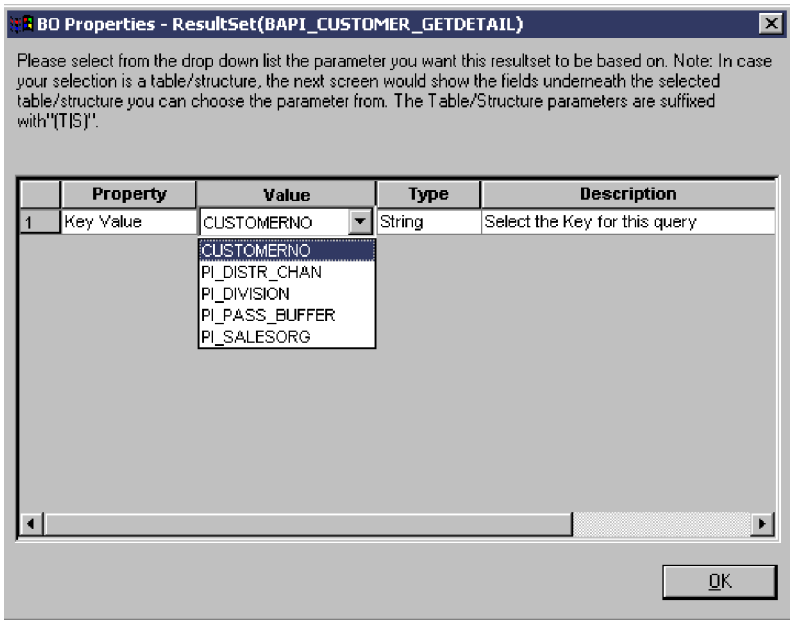



*Figure 36. Select the foreign key*

The Business Object wizard provides a message confirming the full path to the foreign key, in this case `BAPI_CUSTOMER_GETDETAIL.CUSTOMERNO`, as illustrated in Figure 37.


*Figure 37. Foreign key path confirmation*

The following window indicates that the `GETLIST` BAPI has optional parameters and that you can pick and choose from these optional parameters to create corresponding attributes on the business object. Choosing **No**, as in this example, means that the wizard generates business object attributes for all the parameters.

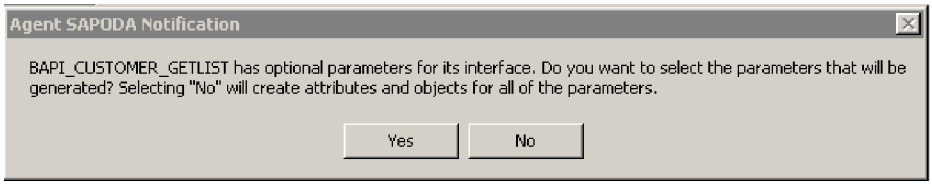



*Figure 38. Optional parameters notification for the GETLIST BAPI*

The next screen, illustrated in Figure 39 on page 74, allows you to set property values for the ResultSet object.

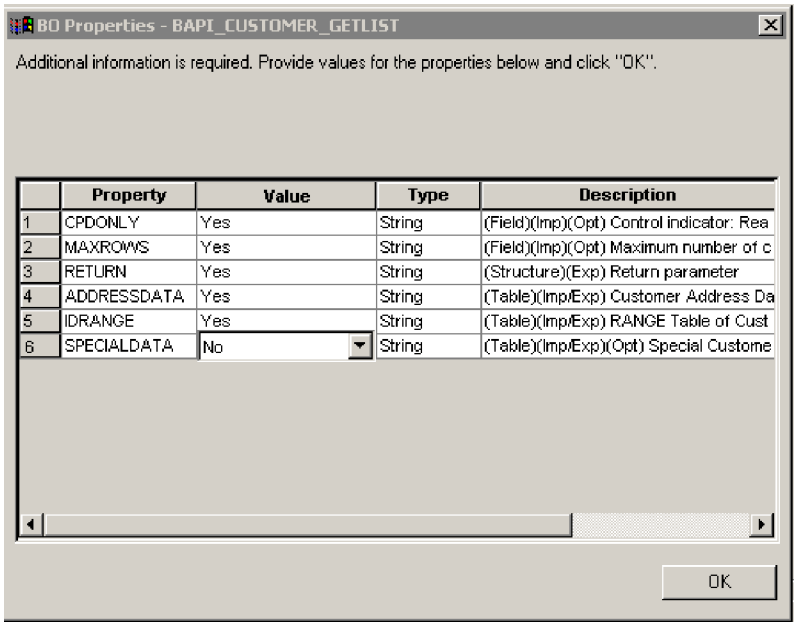



*Figure 39. Set property values for the ResultSet object.*

The following window indicates that the GETDETAIL BAPI has optional parameters and that you can pick and choose from these optional parameters to create corresponding attributes on the business object. Choosing **No**, as in this example, means that the wizard generates business object attributes for all the parameters.

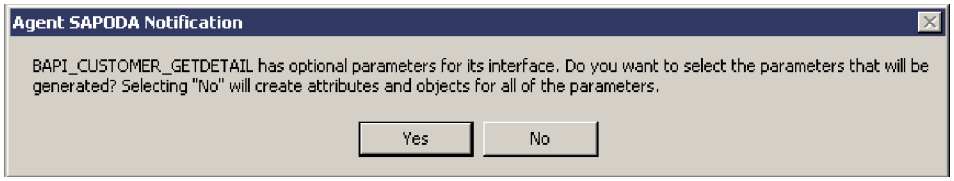



*Figure 40. Optional parameters notification for the GETDETAIL BAPI*

Figure 41 illustrates the **Attributes** tab in Business Object Designer, which lists the two attributes, BAPI_Query and BAPI_Result, of the ResultSet business object. You can expand the business object tree to display the hierarchy of each attribute. Notice that the attributes have the suffix _rs, added by SAPODA. This suffix ensures that business objects created in previous versions of the connector are not overwritten by new business objects that might have the same name.

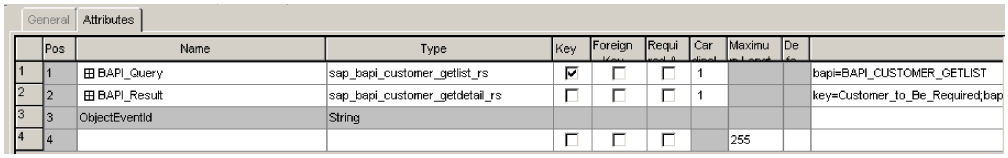



*Figure 41. Attributes tab of the ResultSet object*

## HDR: Providing additional information

There are two BO Properties window for an HDR table-based object. The property displayed in the first window allows you to specify or change the business object's

prefix. If you are satisfied with the value you entered for the DefaultBOPrefix property in the Configure Agent window, you do not need to change the value here.

Figure 42 Illustrates this window.

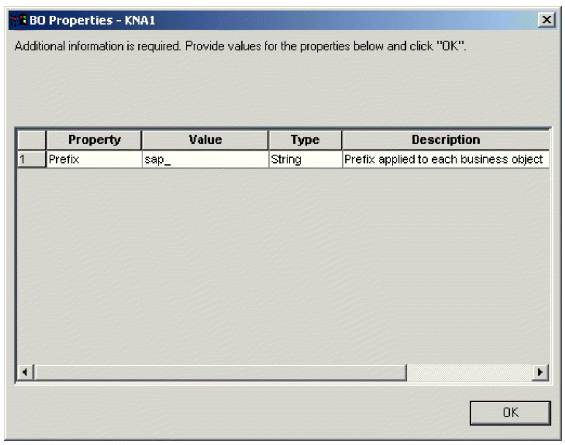



*Figure 42. Providing additional information for an HDR business object*

In addition, only 512 bytes of information from a table can be returned. When a table returns more than 512 bytes, you will be presented with the dialog found in Figure 43.. Answering “No” returns attributes (column descriptions) from the beginning of the table until the 512 byte maximum is reached.

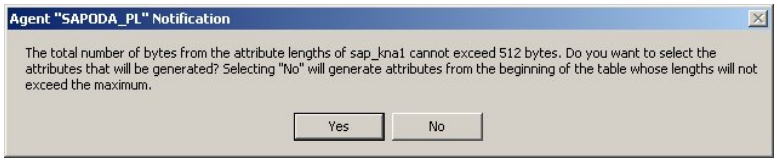



*Figure 43. 512 byte warning*

Answering “Yes” displays the second BO properties windows noted in Figure 44 on page 76.. The length in bytes for each attribute is provided in the window description. You can specific the inclusion or exclusion of an attribute for the business object by toggling its value between “Yes” and “No.”

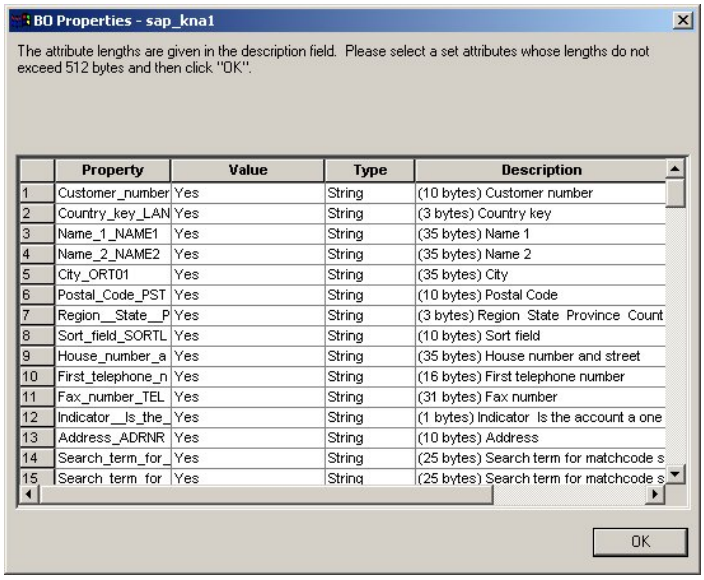



*Figure 44. Size and type of BO properties for an HDR business object*

## Save the definition

After you provide all required information in the BO Properties dialog box and click OK, Business Object Designer displays the final dialog box in the wizard. Here, you can save the definition to the server or to a file, or you can open the definition for editing in Business Object Designer. For more information, and to make further modifications, see the *Business Object Development Guide*.

Figure 45 Illustrates this dialog box.

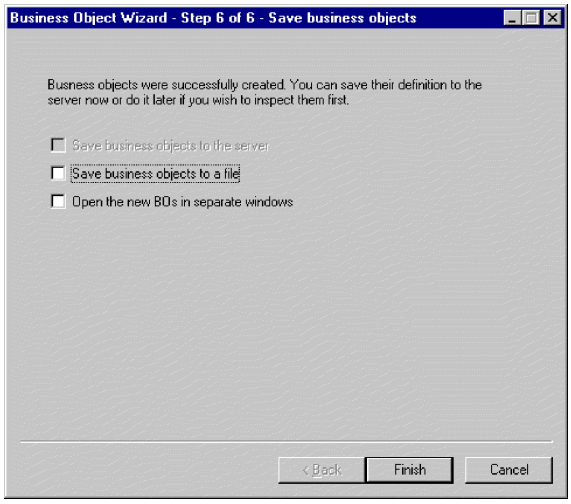



*Figure 45. Saving business object definition*

## After using SAPODA

The business object definition that SAPODA generates from an IDoc type, BAPIs, RFC-enabled function modules, or SAP tables representing a business process may not contain all the information required for the connector to process the business object. Therefore, after SAPODA finishes generating the definition, you must add all required information to the definition. Use Business Object Designer to examine and modify the business object definition, and to reload or copy a revised definition into the repository.

When saving a business object to the file system for the ALE Module with Business Object Designer, you need to load the `sap_idoccontrol` object first. This object is delivered and not generated by SAP ODA but is required before saving the parent business object to the file system.

For information on modifying a business object definition, see the *Business Object Development Guide*. For information on the business object definition that a specific connector module requires, and the modifications you must make before the connector can process it, see the appropriate module's documentation:

- Chapter 22, "Developing business objects for the ABAP Extension Module," on page 229
- Chapter 12, "Developing business objects for the ALE Module," on page 141
- Chapter 9, "Developing business objects for the BAPI Module," on page 103
- Chapter 14, "Developing business objects for the RFC Server Module," on page 165
- Chapter 18, "Developing business objects for the Hierarchical Dynamic Retrieve Module," on page 185

# Chapter 6. Troubleshooting the connector

The chapter describes problems that you may encounter when starting up or running the connector component of the Adapter Guide for mySAP.com (R/3 V.3.x).

This chapter contains the following sections:



## Generic troubleshooting

This section describes problems that you may encounter when starting up or running any module of the IBM WebSphere Business Integration Adapter for mySAP.com. It covers three troubleshooting areas:



### Startup problems

The following subsections provide suggestions for common startup problems.

#### Connector fails to start

If you encounter difficulties when trying to start the connector:

- Check to make sure that the integration broker is up and running.
- Check that the SAP application is running.
- Verify that the standard and connector-specific configuration properties are set properly. For more information, see Chapter 3, "Configuring the connector," on page 25, and Chapter 6, "Troubleshooting the connector," on page 79.

#### Connector cannot log on to the SAP application

If the connector cannot log on to the SAP application:

- Check that the SAP application is available.
- Ensure that you have properly set the standard and connector-specific connector configuration properties by checking the `Sysnr`, `Client`, `Hostname`, and `Modules` properties. For more information, see Chapter 3, "Configuring the connector," on page 25 and Appendix D, "Standard configuration properties for connectors," on page 287.
- Verify that the user name and password set up for the connector has the appropriate level of privileges.

### Connector logs on and the session closes

If the connector successfully logs on to the SAP application and then the session closes immediately, there may be a database problem. Check that `PSAPUSER1D` and `PSAPUSER1I` tablespaces have sufficient space allocated to them. By default, the SAP system provides minimal space for these two tablespaces. The connector requires more than the default amount of space. For more information, see "Increasing log tablespace size" on page 215..

**Note:** This problem is relevant to all connector modules except the RFC Server Module.

## Connector dies

If the connector dies with a message "`connection to the SAP application is lost`"or you get an RFC system exception, then you may have a network problem. Check the short dump for the connector user or the time when the error occurred. Use the IBM CrossWorlds Station tool or go to transaction ST22. If you still need more information, check the system log by going to transaction SM21.

## Default values are not being set

Default values have been set in a business object but the connector is not picking up the values. This is a configuration issue. For default values to be used, the `UseDefaults` connector property needs to be set to true and each attribute requiring a default value needs to be marked as required in the business object definition.

## Collaborations not subscribing to business objects (WebSphere InterChange Server only)

If a collaboration is not subscribing to a particular business object on a specified WebSphere InterChange Server, then:

- Check that the collaboration is configured to subscribe to that particular business object.
- Verify that the collaboration is running.
- Verify that the map references have the correct business object specified as the source business object.

## Encoding binary data (MQ Integrator Broker only)

For fields with binary data (RAW data type in an SAP system), the adapter will encode the value for the fields in hexadecimal rather than the more typical base64 encoding in the XML MQ message. In addition, the adapter expects data from a service call request to be in hexadecimal encoding in the XML MQ message.

# WBI performance tuning and memory management

Java Virtual Machines (JVMs) externalize multiple tuning knobs which may be used to improve WebSphere Business Integration application performance. These knobs control issues related to garbage collection, heap size, threading, and locking. Because the ICS server and its components (maps, collaborations) as well as most of the adapters are written in Java, the performance of the JVM has a significant impact on the performance delivered by an ICS application.

For a detailed description of performance considerations for WebSphere business integration, navigate to the IBM software support site and search on "WBI performance tuning," or consult the following document, which is updated regularly:

http://www-1.ibm.com/support/docview.wss?rs=203&context=SW000&q1=wbi+performance+tuning&uid=swg21173114&loc=en_US&cs=utf-8&lang=en

The following URL provides a useful summary of JVM options:
http://java.sun.com/docs/hotspot/VMOptions.html

The following URL provides a useful FAQ about the HotSpot Engine:
http://java.sun.com/docs/hotspot/PerformanceFAQ.html#20

# Troubleshooting for the ABAP Extension Module

This section describes problems that you may encounter when starting up or running the ABAP Extension Module. It covers three troubleshooting areas:

- "Transport files"
- "Startup problems"
- "Event handling" on page 82
- "Event distribution problem on Microsoft Windows (connector version 4.2.7 only)" on page 82

## Transport files

If you get errors when installing the adapter's transport files for the ABAP Extension Module:

- Verify that you installed the correct transport file. Transport files are installed in their own directories that vary according to the version of the SAP application. For details about the transport files and their installation directories, see "Transport files" on page 211.
- Verify that you installed the transports in the correct order. Some transport files have dependencies such as existing tables.

  For example, one transport file creates a data element for a table and another transport creates a table for that data element. If the table is not created first, the system returns an error.
- Verify that all of the necessary transport files were installed properly. Each transport file adds specific functionality for the connector. For more information, see "Connector transport file installation" on page 211..

## Startup problems

If the connector logs in to the SAP application successfully, but the connector's log in the SAP application is empty:

- Check that logging is turned on. If logging is turned off, use IBM CrossWorlds Station to turn it on. By default, logging is set to 1. For more information, see Chapter 25, "Managing the ABAP Extension Module," on page 259.
- Check that the connector is logged on to the same machine where you are viewing the connector log file.
- Check that the `Namespace` configuration property is set to `true`. If you have upgraded to the connector's namespace from the previous `YXR` environment, the connector may still be logging into the `YXR` environment. If this is the case, set the `Namespace` configuration property to `true`. For more information, see the "Namespace" on page 317 property in the "Connector-specific configuration properties" on page 311.

- Check that the number range in the connector log is in sync. If you have upgraded the NumberRange transport number, then number range intervals may be out of sync. Verify that the number range object number is lower than the first number in the connector log.

  To check the number ranges, go to transaction SNRO and enter `YXR_LOG` in the Number Range Object field. Click the Number Ranges button, click the Display Intervals button, and note the number range object number. Open the connector log and note the number of the first entry. If this number is higher than the number range object number, then the log entry number in the connector log needs to be modified to be one number higher. For more information, see "Verifying number ranges for transport objects" on page 216..

## Event distribution problem on Microsoft Windows (connector version 4.2.7 only)

After upgrading to the IBM CrossWorlds Connector for SAP Version 4.2.7 on Windows, events remain in the event table and are not picked up and processed by the connector in the following circumstances:

- You configured event distribution across multiple connectors.
- The connector is running against an SAP 3.x system that loaded the NON-namespace (`yxr`).

This problem is caused by a change SAP has made in their java API (SAPJCo).

To fix the problem, load a patch transport that changes only the event request and event return function modules provided by the IBM WebSphere Business Integration Adapter for mySAP.com. Load this patch transport in 4.0 and 4.5 SAP systems that do *not* have the namespace (`/CWLD/`) infrastructure.

**Note:** The namespace ABAP infrastructure does not have this problem.

## Event handling

The following subsections provide suggestions for event handling problems.

### ABAP Extension Module is not invoked by subscribing business objects

If a subscribing business object is not being processed by the ABAP Extension Module, then:

- Check that the vision connector framework is set to call the ABAP Extension Module. The `Modules` property must be set to `Extension`.
- Check that the connector subscribes to the business object.

### Connector is not picking up events

If your connector is not picking up events from the SAP application:

- Check the connector's event table in the SAP application to see if the event is queued for your connector.
- In a multiple connector environment, if the event is not queued, make sure there is an entry in the Event Distribution table (`YXR_EVTDIS`) for the combination of your connector and business object. Check to see that this combination is unique.

  If you have multiple connectors subscribed to the same business object, then one connector might be processing the wrong events.
- If you have a lock object for an event in the SAP application, then the SAP application may not finish processing the save process for that event.

Check the connector's event table in the SAP application to see if the event has a status of L (Locked). If the status is L, then you most likely have a problem in the SAP application and not the connector.

- The connector might have died while processing the event. Check the status of the event in the connector's event table in the SAP application. If the status is R (Retrieved), then the event has not been moved to the archive table. If the event's status is R, verify that the event did not make it to the destination.

  If the event did not make it to the destination, change the status from R to Q (Queued). Events with a status of Q are picked up by the connector at the next poll interval. To change the status from R to Q, go to the event table, select the event, and then click the Edit button. In the window that appears, change the Event Status field from R to Q.

## Business object fails to process

If a business object fails to process successfully, check the connector log in the SAP application. Entries for failed events appear in red. Reprocess events using the reprocessing tool, which enables you to set breakpoints in the code as you step through the transaction.

**Attention:** Do not use the reprocessing tool in a production environment, because it causes the WebSphere business integration system and the SAP application to be out of sync.

## Deadlock with Event Table

The current event table and the future event table, may encounter a deadlock situation if there are many events being added at one time. This situation occurs if the provided indices for the event table are not used because of database tuning. Tuning normally occurs during off-peak hours when there are few or no events in the event table. When a database table has no or few entries, it is more efficient not to use an index for reading the table. To avoid a deadlock situation, exclude the current event and future event tables when running a database tuning utility.

## Large Objects

Large objects may require additional changes to process successfully. ABAP Extension Module objects are converted to a flat structure before passing the data to the SAP application or converted from a flat structure when receiving the data from the SAP application. See "Business object conversion to a flat structure" on page 218 for more information. This flat structure is held in memory with each attribute for an object instance being a row in the structure. For each attribute, 373 bytes of data are passed between the connector and the SAP application. The number of attributes multiplied by 373 gives an approximation of the size of the flat structure. As well, an instance of the object is also in memory. Therefore, an object with many child objects (segments) may require a change to the Java heap size in the startup script for the connector's Java process in order to avoid an out-of-memory error.

**Windows**

In the start_SAP.bat script, change the -mx128m Java heap size options parameter default value to a value large enough to handle the flat structure and the instance of the object. A value larger than the available memory on the machine running the Java process will also result in an out-of-memory error. The 128m represents a maximum Java heap size of 128 MB.

**Unix:**

The SAP application may also require changes to the ABAP timeout parameter to process a large object successfully.

# Troubleshooting for the BAPI Module

This section describes problems that you may encounter when running the BAPI Module.

## Request process handling

The following subsections provide suggestions for common request process handling problems.

### BAPI Module is not invoked by subscribing business objects

If a subscribing business object is not being processed by the BAPI Module, then:

- Check that the vision connector framework is set to call the BAPI Module. The `Modules` property must be set as follows: `Bapi`.
- Check that the connector subscribes to the business object.
- Check that any custom business object handler files are in the `\bapi\client` directory. If the class file is not in this directory, then the custom business object handler is not invoked to process the business object. For more information, see "Using generated business objects and business object handlers" on page 173..
- Check that the custom business object handler name in the business object verb application-specific information is correct. For more information, see "Business object application-specific information" on page 108..
- Ensure that when you generated the custom business object handler, you specified the appropriate verb to match the BAPI.

### Business object fails to process

If a business object fails to process successfully:

- Check that the BAPI you are using has a return business object. The BAPI Module looks in the return business object for messages with the key `e` (error) or `a` (abort). If the module finds one of these keys, then it notes that the event has failed. If the BAPI does not have a return business object, make sure you implement your own error handling.
- Use transaction SE37 to test the BAPI associated with the failed event. This should enable you to reproduce the failure.

  If this does not work, then you may have a problem in the conversion from internal formats to external formats. Check that you are specifying values in the correct format. For example, for dates, SAP's internal format is YYYYMMDD and you may be specifying the format MMDDYYYY. This causes the BAPI to fail, because the specified format is not understood.
- Check that the application-specific information of each attribute is correct. If these values are not correct, then the BAPI Module does not populate the object correctly before sending it back to the SAP application.
- Check that the I and E parameters are specified properly. Remember that `I` identifies the import parameter and `E` identifies the export parameter. For more information, see "Business object fails to process" on page 86.

### Connector appears to be polling but events are not being picked up

The BAPI Module includes a dummy implementation of the `pollForEvents()` method. The connector appears to be polling because it returns a polling message. The BAPI Module does not support polling, so ignore these messages.

If you want to implement polling for the BAPI Module, you must use the polling capabilities in the ABAP Extension Module. For more information, see Chapter 19, “Overview of the ABAP Extension Module,” on page 199..

## Troubleshooting for the RFC Server Module

This section describes problems that you may encounter when starting up or running the RFC Server Module. It covers:



### Startup problems

If the connector cannot register with the SAP application:

- Check that the SAP application is available.
- Check that you have properly set the standard and connector-specific connector configuration properties. Specifically, check the `gwService,`, `Hostname,`, `RfcProgramId,`, and `Modules`, properties. For more information, see Chapter 3, “Configuring the connector,” on page 25, Appendix D, “Standard configuration properties for connectors,” on page 287and Chapter 6, “Troubleshooting the connector,” on page 79.

### Connector dies

If your connector dies, check the following:

- Check that threads are being spawned by the RFC Server Module. Verify that the NumberOfListeners property is set properly. For more information, see the “NumberOfListeners” on page 317..
- Verify that the RFC program ID is set up so that the RFC Server Module registers itself with the SAP Gateway. For more information, see the “RfcProgramId” on page 317 and “Registering the RFC Server Module with the SAP Gateway” on page 177..

### Event handling

The following subsections provide suggestions for common event handling problems.

#### RFC Server Module is not invoked by subscribing business objects

If a subscribing business object is not being processed by the RFC Server Module, then:

- Check that the vision connector framework is set to call the RFC Server Module. The `"Modules" on page 316` property must be set as follows: `RfcServer`.
- Check that the connector subscribes to the business object.
- Check that the SAPODA-generated BAPI-specific business object handler class file is in the `\bapi\server` directory. If the class file is not in this directory, then the BAPI business object handler is not invoked to process the business object. For more information, see “Using generated business objects and business object handlers” on page 173.
- Check that the BAPI business object handler name in the business object verb application-specific information is correct. For more information, see “Business object fails to process” on page 83.

- Check that the specified verb for your BAPI-specific business object handler is correct for the type of processing you need. Specifically, make sure that when you generated the business object handler, you specified the appropriate verb to match the BAPI. For more information, see "Using generated business objects and business object handlers" on page 173.

### Business object fails to process

If a business object fails to process successfully:

- Check that the BAPI you are using has a return business object. The RFC Server Module looks in the return business object. for messages with the key `e` (error) or `a` (abort). If the module finds one of these keys, then it notes that the event has failed. If the BAPI does not have a return business object., make sure you implement your own error handling.
- Use transaction SE37 to test the BAPI associated with the failed event. This should enable you to reproduce the failure.

  If this does not work, then you may have a problem in the conversion from internal formats to external formats. Check that you are specifying values in the correct format. For example, for dates, SAP's internal format is YYYYMMDD and you may be specifying the format MMDDYYYY. This causes the BAPI to fail, because the specified format is not understood.
- Check that the application-specific information of each attribute is correct. If these values are not correct, then the RFC Server Module does not populate the object correctly before sending it back to the SAP application.
- Check that the I and E parameters are specified properly. The I parameter identifies the import parameter and the E parameter identifies the export parameter. For more information, see "Business object fails to process" on page 84.

## Troubleshooting for the ALE Module

This section describes problems that you may encounter when starting up or running the ALE Module. It covers the following subjects:



## Startup problems

The following subsections provide suggestions for common startup problems.

### Connector cannot log on to or register with the SAP application

If the connector cannot log on to or register with the SAP application:

- Check that the SAP application is available.
- Check that you have properly set the standard and connector-specific connector configuration properties:
  - Check that the required MQSeries queues have been created and that their corresponding configuration property correctly specifies their name.
  - For request processing, check the Sysnr, Client, Hostname, and Modules properties.
  - For event processing, check the gwService, Hostname, RfcProgramId, and Modules properties.

For more information, see Chapter 3, “Configuring the connector,” on page 25 and Chapter 6, “Troubleshooting the connector,” on page 79.

- Verify that the user name and password set up for the connector has the appropriate level of privileges.

### Connector is not polling events

If your connector is not polling events from the SAP application:

- Check that the verb application-specific information for the desired verb has been modified to have the correct message type, message code, and message function.
- Check that the verb AleOutboundVerbs exists and has a list of valid verbs.

### Connector appears to be polling but events are not being picked up

- Check that the event queues (`SAPALE_Event_Queue` and `SAPALE_Wip_Queue`) have been created correctly and that polling is being done on the `event` queue.
- Verify that the following are running on your system:
  - MQSeries
  - TCP/IP
- Verify that the ALE configuration within the SAP application is correct; for more information see, Chapter 10, “Overview of the ALE Module,” on page 121.
- Check that the connector has made at lease one poll call; doing so installs the function modules for event processing.
- Check that a message has been written to the `wip` queue and has been moved to the `event` queue.

## Event handling

The connector logs information about successfully processed IDocs in a JMS-MQ event message (in the queue specified in the `SAPALE_Event_Queue` configuration property) to the `EventState.log` file. This file is located in the directory specified in the `AleEventDir` configuration property.

**Note:** Each event message can contain multiple IDocs, each of which represents a business object.

If the connector goes down before it processes all IDocs in the current event message, it uses the `EventState.log` file during recovery to ensure that it sends each IDoc only once to the integration broker.

**Important:** The connector does not create the log file automatically the first time it processes an event. You must create this file for before you run the connector for the first time.

The format of the log file is:

```
TID: 0S, 1S, 2F, 3U
```

where <*TID*> is the current transaction ID being processed, and each number represents the sequence number of all work units in the event message.

For example, if the connector has successfully processed three of the first four IDocs in the current event message, the second IDoc failed processing, and the connector has not yet finished processing the current event message the `EventState.log` file might show:

```
<TID> :: 0S, 1F, 2S, 3S
```

If the connector went down before processing the entire event message, at startup the connector will use the information in the log file to resume processing the events in the message at the point where it had stopped processing. The connector reads the log to get the transaction ID of the event to be recovered, the latest work unit, and the status of each work unit. Then the connector begins sending to the integration broker the business objects that represent each IDoc in the event message with a sequence number greater than the last number in the log file. In the previous example, the connector will processing the fifth IDoc in the current event message.

The connector keeps the contents of the log file in memory to enhance performance. It accesses the file on disk only to update it with a new entry. The connector reads the log file only at recovery time.

For information on how the connector uses the `EventState.log` file in the recovery process, see "Failure recovery."

## Failure recovery

**Note:** These recovery steps do not apply if a disk failure occurs or if a disk is full.

To recover from failures during event notification, the connector:

1. The connector processes IDocs from the JMS-MQ message in the `event` queue (specified in the `SAPALE_Event_Queue` configuration property). When it successfully processes a IDoc, the connector logs an entry in the `EventState.log` file.
   - If none of the work units in the event message fails processing, the connector moves the event message to the archive queue with an `IDocProcessStatus` value of success.
   - If any of the work units in the event queue message fails processing, the connector will move the event message to the archive queue and update the `IDocProcessStatus` value of partial.
2. After the connector processes all IDocs in an event message, it clears the `EventState.log` file and begins writing entries to it for the next event message.
3. If the connector goes down before it processes all IDocs in an event message, it uses the information in `EventState.log` to determine where to begin processing during the recovery process. When it comes back up, the connector checks whether there are any entries in the log file.
   - If there are no entries, the connector sends all IDocs in the event message to the integration broker.
   - If there are entries, the connector will use this information to resume processing an event message at the point where it had stopped processing. The connector reads the log to get the name of the event message to be recovered and the latest IDoc sequence number. Then the connector sends to the integration broker each IDoc in the event message with a sequence number greater than the last number in the log file. In this example, the event message is moved to the archive queue and the `IDocProcessStatus` is updated according to the status of each work unit in the `EventState.log`.

     Using the log file prevents the connector from sending the same IDoc multiple times to the integration broker. The connector keeps the log file in

memory to enhance performance. The connector accesses the file on disk only to update it with a new entry, and reads the log file only at recovery time.

**Note:** If there is no IDoc in the event message whose sequence number is greater than the last number in the log file, the connector went down after processing the last event but before archiving the event file. In this case, the event message is moved to the archive queue and the `IDocProcessStatus` is updated according to the status of each work unit in the `EventState.log`.

### Recovery from business object creation errors

If the connector has created only the header portion of the message in the WIP queue but not the data portion, this procedure will recover the data portion of the message.

1. Examine the SAP connector log for error messages pertaining to the business object's name, message type, or verb.
2. Make the appropriate corrections to the business object definition or the connector configuration.

   **Note:** Configuration changes may include changes to MQSeries queues. For more information, see "Prerequisites to running the ALE Module" on page 127..
3. Restart the connector.

## Request processing

If a subscribing business object is not being processed by the ALE Module, then:

- Check that the vision connector framework is set to call the ALE Module. The Modules property must be set to `ALE`.
- Check that the connector subscribes to the business object.

# Troubleshooting the Hierarchical Dynamic Retrieve Module

This section describes problems that you may encounter when starting up or running the Hierarchical Dynamic Retrieve Module. It covers the following areas:

- "Error handling and logging"
- "SQL SELECT fails" on page 91

## Error handling and logging

The connector logs an error message when it encounters a condition that causes the retrieval to fail. When such an error occurs, the connector also prints a textual representation of the failed business object as it was received from the integration broker. It writes the text to the connector log file or the standard output stream, depending on its configuration. You can use the text to find the source of the error.

### Error types

Table 7 on page 90 describes the types of tracing messages that the Hierarchical Dynamic Retrieve Module outputs at each trace level. These messages are in addition to any tracing messages output by the WebSphere business integration system's architecture, such as the Java connector execution wrapper and the WebSphere MQSeries message interface.

*Table 7. Connector tracing messages*

| Tracing level | Tracing messages |
|---|---|
| Level 0 | Message that identifies the connector version.<br><br>No other tracing is done at this level. |
| Level 1 | Function module entry and exit messages. These messages are written whenever the connector execution thread enters or exits from a function. The messages help to trace the process flow of the connector. |
| Level 2 | Business object handler messages that contain information such as the arrays and child business objects that the connector encounters or retrieves during the processing of a business object |
| Level 3 | • Foreign key processing messages that contain such information as when the connector has found or has set a foreign key in a business object<br>• Messages that provide information about business object processing. For example, these messages are delivered when the connector finds a match between business objects, finds a business object in an array of child business objects, or removes child business objects during a retrieval. |
| Level 4 | • Application-specific information messages, for example, messages showing the values returned by the functions that parse the business object's application-specific information properties<br>• Messages that identify when the connector enters or exits a Java method, which helps trace the process flow of the connector<br>• SQL statements. At this level and above, the connector prints out all SQL statements that it executes.<br>• Changes to an attribute value during a retrieve. At this level and above, the connector prints out the name of the attribute and its new value. |
| Level 5 | • Messages that indicate connector initialization, for example, messages showing the value of each configuration property retrieved from the integration broker<br>• Messages that comprise a business object dump<br>• Messages that comprise a representation of a business object before the connector begins processing it (displaying its state as the connector receives it from the integration broker) and after the connector has completed its processing (displaying its state as the connector returns it to the integration broker) |

## Connector message file

Error messages that the connector generates are stored in a message file named `SAPConnector.txt`. Each error has an error number followed by the error message. For example:

```
1210

SAP Hierarchical Dynamic Retrieve module unable to initialize.

1211

SAP Hierarchical Dynamic Retrieve module failed to locate...
```

## Fails to call RFC_READ_TABLE

The SAP `RFC_READ_TABLE` function doesn't handle character-based data types. The module may fail while retrieving data if the fields use the following data types:

- CURR

- DEC
- FLTP
- INT1
- INT2
- INT4
- LRAW
- RAW
- RAWSTRING

### SQL SELECT fails

If a `SELECT` statement fails, check whether any simple attribute that is marked as key or is used as a foreign key contains a single quotation mark (’). If so, revise the business object’s map to convert the single quotation mark (’) to two single quotation marks (’’).

## Troubleshooting SAPODA

There are two known problems you might encounter when using SAPODA:

- SAPODA runs without messages.

  If the message file specified for the ODA does not exist, the ODA runs without messages. This problem is caused during configuration of the ODA when Business Object Designer displays a default name for the message file. The default name follows the naming convention:

  *AgentName*`Agent.txt`

  If the name of the actual message file does not follow this convention and the default value is not overwritten with the actual value, Business Object Designer displays an error message in the window from which the ODA was launched. This message does not pop up in Business Object Designer.

  For more information, see“Working with error and trace message files” on page 49.

- On a Windows system, if Business Object Designer cannot find required library files in the Path environment variable or the files are not on the system, it displays a CORBA Exception while attempting to get the tree nodes. For information about these files, see“Before using SAPODA” on page 48..

# Part 2. BAPI Module

# Chapter 7. Overview of the BAPI Module



This chapter introduces the BAPI Module of the IBM WebSphere Business Integration Adapter for mySAP.com. The BAPI Module enables an integration broker to send business objects to an SAP application using BAPIs.

BAPIs are SAP's standardized Business Application Programming Interfaces that enable third parties to interact with SAP applications. They are implemented as RFC-enabled function modules for an SAP business object's methods.

**Note:** A BAPI is simply an RFC-enabled function in an SAP application. In addition to BAPIs, the BAPI Module can be used to support any RFC-enabled function.

## BAPI Module components

The BAPI Module is a connector module written in Java that supports native BAPI calls directly to an SAP application. It extends the Vision Connector Framework by implementing the VisionConnectorAgent and VisionBOHandler classes. The BAPI Module uses the SAP RFC libraries written in Java and C, which enable external programs to communicate with an SAP application.

Figure 46 illustrates the overall architecture of the BAPI Module. The BAPI Module is made up of the connector framework, the connector's application-specific component for BAPI, and a single BAPI business object handler to support all BAPI calls, as well as the SAP RFC Library. In addition to the single BAPI business object handler provided by the BAPI Module, you can create custom business object handlers, as described in "Using custom business object handlers" on page 114.

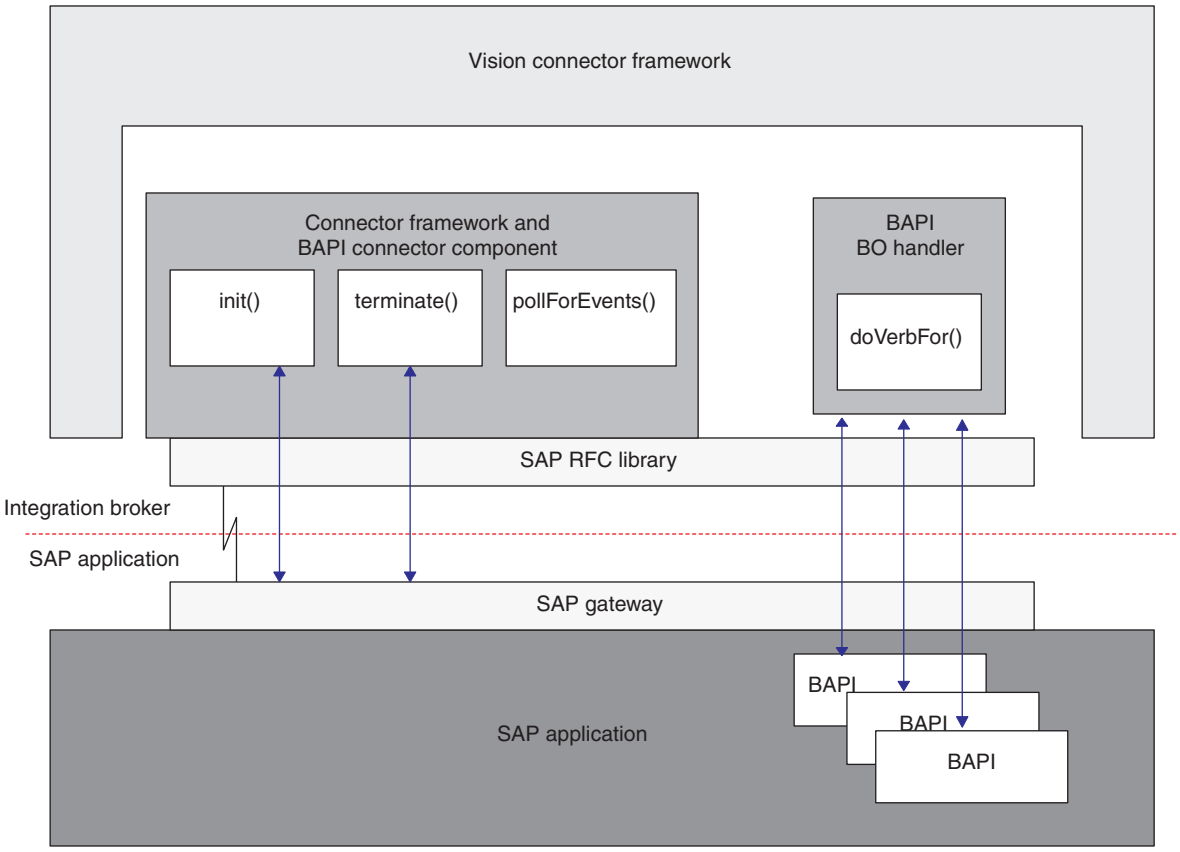



*Figure 46. BAPI Module architecture*

The BAPI Module components:

- Open an RFC connection to the SAP application using the SAP RFC library and the SAP Gateway.
- Handle requests from the integration broker and call BAPIs in an SAP application.
- Terminate connections to the SAP application.

## How the BAPI Module works

The BAPI Module implements the `init()`, `terminate()`, `pollForEvents()`, and the `doVerbFor()` method. However, the `pollForEvents()` method is not used because the BAPI Module supports request operations only.

### Initialization and termination

The `init()` method opens an RFC connection with the SAP application through the SAP Gateway. If the connector fails to initialize, it terminates using the `terminate()` method. The connector terminates by disconnecting the connection to the SAP Gateway.

### Business object processing

A single implementation of the `doVerbFor()` method in the vision connector framework's business object handler initiates all business object requests. The vision business object handler processes all of the business objects passed between the BAPI Module and the integration broker. In the BAPI Module, a single BAPI business object handler supports all BAPI calls.

Figure 47 illustrates business object processing for the BAPI Module.

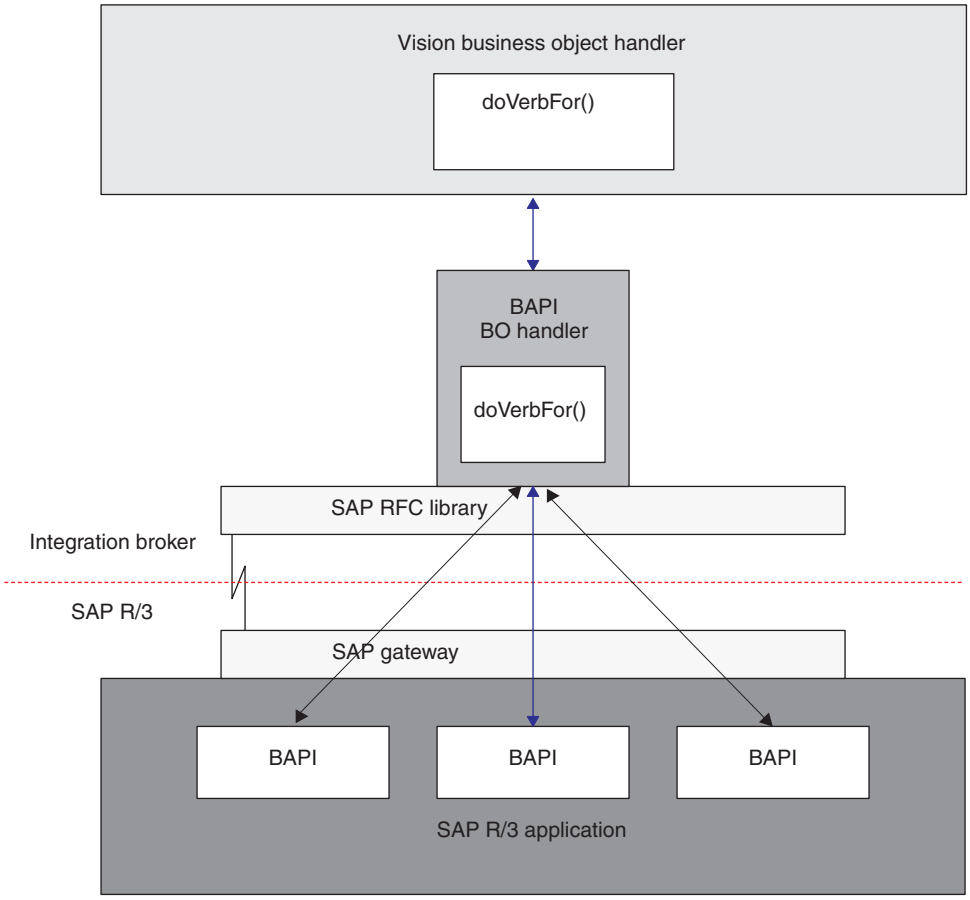



*Figure 47. Business object processing for the BAPI Module*

Once invoked by the Vision business object handler, the BAPI business object handler executes in the following manner:

1. Receives the WebSphere business object for SAP from the Vision business object handler.
2. Populates the BAPI parameters with business object data.
3. Executes a BAPI call using RFC and passes the BAPI parameters to the SAP application. The business object handler waits for the business object data to be returned.
4. Receives the business object data (BAPI parameters).
5. Converts the BAPI parameters back to WebSphere business object data.
6. Passes the business object to the Vision business object handler and ultimately to the integration broker.

**Note:** If a BAPI Module has a Return Structure or Return Table, the connector checks for the message types `A` (abort) and `E` (error) to determine if the event processed successfully. A message type `A` or `E` indicates that the event failed to process. If a BAPI does not have a Return Structure or Return Table, you must implement your own error handling. When a message broker is the integration broker, events that fail in the Connector Framework are moved to the fault queue; events that fail in the message broker environment are handled by the MQ message flow. When InterChange Server (ICS) is the

integration broker, you can resubmit failed events using WebSphere InterChange Server System Manager (CSM).

## Supporting BAPIs

IBM WebSphere Business Integration Adapter for mySAP.com includes a tool, SAPODA, that generates business object definitions that support BAPIs. SAPODA interprets the interface of a BAPI, maps its parameters to the business object attributes, and adds the application-specific information for each attribute.

**Note:** Some BAPIs do not have single field parameters that correspond to simple attributes in the WebSphere business object. The connector requires every top-level business object to have a simple attribute that serves as the key attribute. Therefore, when generating a business object and business object handler from a BAPI without a single field parameter, SAPODA creates a key attribute named Dummy_key in the top-level business object, marks it as the key attribute, and adds `dummy_key` as the application-specific information of this attribute. Dummy_key provides the connector with a key attribute so that it can process the business object. However, the connector ignores the value of the Dummy_key attribute when modifying application data.

## Supporting BAPI transactions

The connector and SAPODA support SAP BAPI transactions (also referred to as Logical Units of Work). A BAPI transaction consists of a set of BAPIs that are executed in a sequence so as to complete the entire transaction. The sequence of multiple BAPIs is invoked using the same JCo client connection.

To support BAPI transactions, SAPODA generates a top-level business object that acts as a wrapper of a set of child business objects, each one representing a single BAPI call in the transaction sequence. The BAPI transaction wrapper object represents the complete transaction. Each second-level child business object represents a structure parameter or table parameter of the method. Simple attributes correspond to the simple parameters of the method.

The BAPI business object handler returns SUCCESS when all the BAPI calls in the transaction process successfully. The business object handler also provides error handling in case of failures. If a BAPI call in the transaction fails processing, the subsequent calls in the transaction terminate and, depending on the error code, BAPI_RETURN returns either FAIL or APPRESPONSETIMEOUT.

The BAPI interface does not provide a rollback mechanism for transactions. You can achieve rollback in one of the following ways:

- By terminating all subsequent BAPI calls, thus terminating the transaction before COMMIT occurs. The connector terminates the transaction when an error is detected. If there is no intrinsic COMMIT in the BAPIs that are already invoked, no further steps are required.
- By calling another BAPI that can roll back work that has already been commited in the case of BAPIs that have an intrinsic COMMIT.

Note that rollback needs to be handled by the business process logic.

For details about the strucutre of BAPI transaction business objects, see Chapter 9, “Developing business objects for the BAPI Module,” on page 103.

## Supporting BAPI ResultSets

The connector and SAPODA provide ResultSet support for DB2 Information Integrator (DB2 II). SAPODA generates a ResultSet object that is a wrapper business object. This object contains two attributes, `BAPI_Query` and `BAPI_Result`, that represent Query BAPI and Result BAPI objects. For details about the structure of BAPI ResultSet objects, see "Business object structure for BAPI ResultSets" on page 106.

# Chapter 8. Configuring the BAPI Module



This chapter describes how to configure the BAPI Module after you have installed the connector. For more information on installing the connector, see Chapter 2, "Installing the connector," on page 15.

## BAPI Module directories and files

The BAPI Module directory and files are contained in the `\connectors\SAP\` directory. Table 8 lists the directory and file used by the BAPI Module.

*Table 8. BAPI Module directory and file*

| Directory/Filename | Description |
|---|---|
| `\bapi\client` | Directory containing the runtime files for the connector. You can copy to this directory any custom business object handlers you create. |
| `CWSAP.jar` | Connector class file |

## BAPI Module configuration properties

You must configure the BAPI Module before it can start operating. To configure the BAPI Module, set the standard and connector-specific connector configuration properties. For more information on configuring the connector configuration properties, see Chapter 3, "Configuring the connector," on page 25 and Appendix D, "Standard configuration properties for connectors," on page 287.

# Chapter 9. Developing business objects for the BAPI Module



This chapter describes the three kinds of business objects processed by the BAPI Module: business objects for single BAPI calls, business objects for BAPI transactions, and BAPI ResultSet objects.

It also discusses how the business object generation utility, SAPODA, generates the definitions. The chapter assumes you understand how the connector processes business objects. For more information on business object processing in the BAPI Module, see Chapter 7, "Overview of the BAPI Module," on page 95.

**Note:** This chapter describes business objects that support BAPIs; however, the BAPI Module can be used to support any RFC-enabled function.

## Background information

Business object development for the BAPI Module requires configuring application-specific information at the business object level. A single business object handler supports all BAPIs. SAPODA uses the SAP application's native definitions as a template when generating business object definitions for the integration broker.

SAP supports many methods that can be mapped to the standard verbs (Create, Update, Delete, and Retrieve) that the connector supports. You can develop business objects and business object handlers to support any method used by BAPIs.

SAPODA facilitates the process of developing business objects. SAPODA uses the SAP application's native definitions as a template when generating business object definitions for the IBM WebSphere Business Integration Adapter for mySAP.com.

**Important:** SAPODA must have access to the BAPI in an SAP system to retrieve the BAPI interface.

## Business object naming conventions

A BAPI interface consists of simple, structure, return and table parameters, where:

- Structure, simple, and return (importing) parameters are passed to the BAPI.
- Structure, simple, and return (exporting) parameters are passed from the BAPI.
- Table (exporting/importing) parameters are passed in either direction.

Some BAPIs may not have all of the types of parameters. For example, a BAPI may have importing and table parameters only.

SAPODA automatically maps the BAPI structure and table parameters to child business objects, and BAPI simple parameters to the corresponding simple attribures on WebSphere business objects for SAP as described in Table 9..

*Table 9. Naming Conventions: WebSphere business objects for SAP*

| Business Object | BAPI Interface |
|---|---|
| Top-level business object | `BOprefix_BAPIname`<br>**Note**: The illustrations in this chapter use `SAP_` or `sap_` as the business object prefix. You can specify your own meaningful prefix when you create your business object definitions. |
| Attribute | `FieldDescription` |
| Child business object | `BOprefix_BAPIParameterName` |

SAPODA guarantees that all attribute names in the business object definition are unique. If a BAPI has multiple parameters with the same field description, SAPODA adds a counter as the suffix to the generated attribute name.

You can modify the attribute names at any time after you generate the business object definition. However, when you modify an attribute name, ensure that you do not modify the application-specific information. The connector uses this information to identify the BAPI parameter to which the attribute corresponds. For more information on the application-specific information, see "AppSpecificInfo for attributes" on page 109.

# Business object structure

The connector supports three kinds of BAPI business objects: business objects for single BAPI calls, business objects for BAPI transactions, and BAPI ResultSet objects.

## Business object structure for single BAPI calls

A business object for a single BAPI call reflects a method on the BAPI interface. The business object uses the BAPI business object handler to map each business object attribute to a BAPI parameter. The connector, each business object, and the BAPI business object handler are metadata-driven. The application-specific information provided in the metadata of each business object and the business object handler allows you to add connector support for a new business object and the business object handler without modifying connector code. Instead:

- The connector uses the verb application-specific information of the top-level business object to instantiate the appropriate business object handler.
- The business object handler uses the verb ASI to determine the correct BAPI to call.

The business object handler supports both single- and multiple-cardinality relationships between business objects.

A business object based on a BAPI can contain no more than two levels of hierarchy. Therefore, all BAPI simple parameters correspond to attributes of the top-level business object, and BAPI structure and table parameters correspond to child business objects.

*Table 10. Correspondence between BAPIs and business objects for SAP*

| BAPI interface parameter | WebSphere business object for SAP |
|---|---|
| Simple field | Attribute of the top-level business object |
| Structure | Single-cardinality child business object |
| Table | Multiple-cardinality child business objects |

**Note:** Importing and exporting parameters can be simple field or structure parameters.

Figure 48 illustrates the association between a business object and a BAPI. The figure illustrates a fragment of the sap_bapi_salesorder_createfromdat2 business object, which corresponds to the `BAPI_SALESORDER_CREATEFROMDAT2` BAPI.

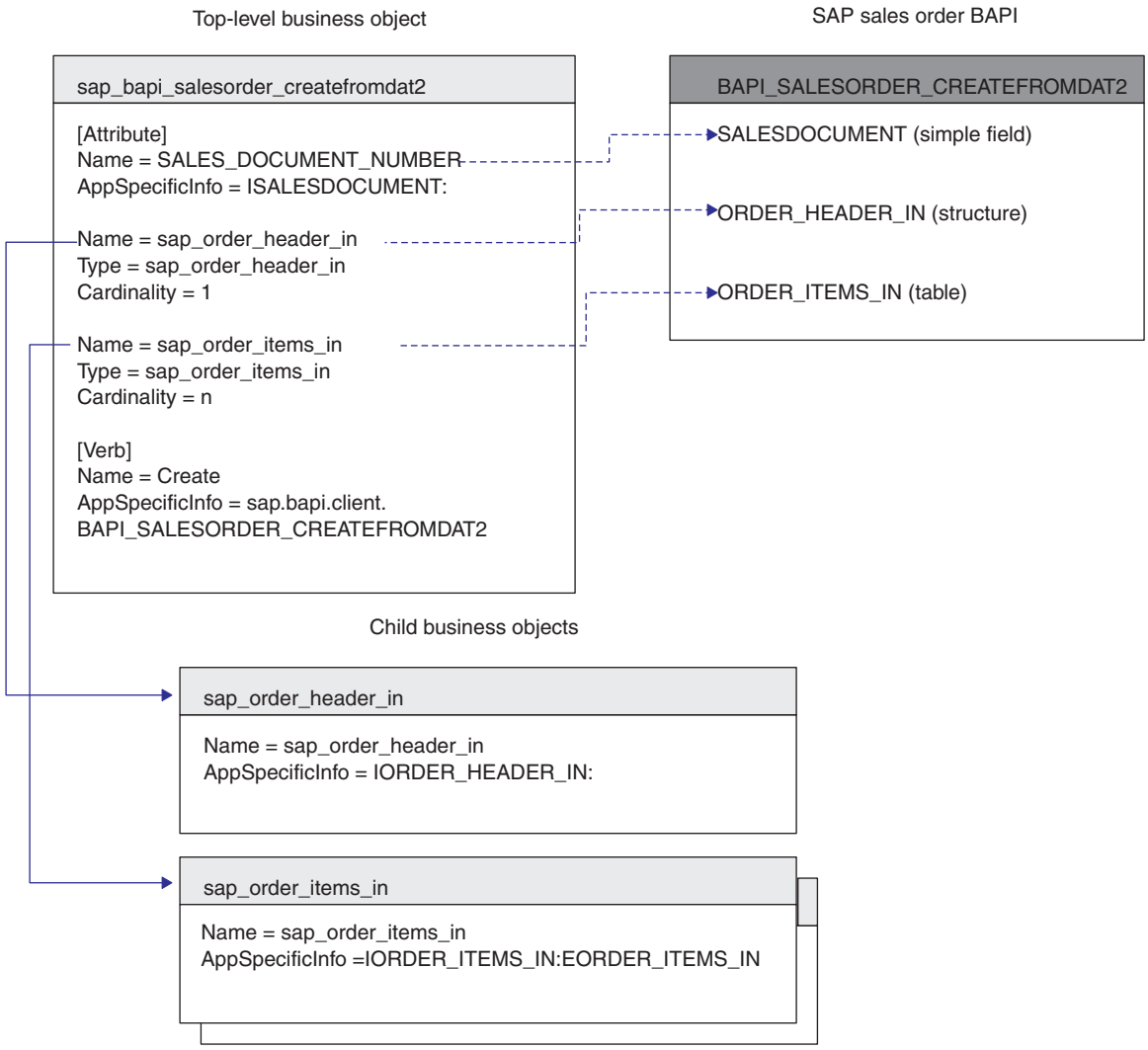



*Figure 48. Mapping between a business object and a BAPI*

## Business object structure for BAPI transactions

A business object representing a BAPI transaction is a wrapper object that contains multiple BAPI objects as children. Each individual child BAPI object within the wrapper BAPI transaction object represents the parameters of a single BAPI call.

Note that SAPODA always adds a suffix of _txn to the BAPI transaction object names. For example, sap_BAPI_salesorder_txn.

### Business object structure for BAPI ResultSets

A business object that represents a BAPI ResultSet is a wrapper object used for ResultSet support with DB2 Information Integrator. When performing a RetrieveByContent verb operation, the connector returns an array of multiple result business objects that match certain selection criteria. The ResultSet wrapper object corresponds to the array.

The wrapper business object contains two attributes of the object type: BAPI_Query and BAPI_Result. The BAPI_Query attribute represents the Get List BAPI on the ASI parameter. For example, bapi=BAPI_CUSTOMER_GETLIST. The BAPI_Result attribute represents the Get Detail BAPI on the ASI parameter. Note that SAPODA always adds a suffix of _rs to the name of the child business objects of the BAPI_Query and BAPI_Result. For example, sap_BAPI_addressdata_rs.

For details about the attribute-level ASI of a BAPI ResultSet object, see "Attribute-level ASI for BAPI ResultSets" on page 111.

For more information about ResultSet processing, consult the DB2 Information Integrator documentation.

## Supported verbs

The BAPI Module supports the standard verbs (Create, Update, Delete, and Retrieve) used by the WebSphere business integration system. For each supported verb, a BAPI can have an associated method. The verb is given meaning by the BAPI method. In other words, a BAPI call has inherent functionality, independent of the verb associated with it. Most BAPIs support one of the following operations: create, retrieve, update, and delete.

## Business object attribute properties

The properties of the attributes of a top-level business object differ depending on whether the attribute represents a simple value, or a child or an array of child business objects.

- Table 11 lists and describes the properties of simple attributes of a top-level business object.
- Table 12 lists and describes the attributes that represent a child or array of child business objects.

SAPODA generates the attribute properties as described in each table.

*Table 11. Simple attributes properties: Top-level business object*

| Property Name | Description |
|---|---|
| Name | Derived from the description of the BAPI parameter. SAPODA replaces special characters (such as periods, slashes, and spaces) with underscores. |
| Type | Specifies the type of data. SAPODA sets the value to String. |
| MaxLength | Specifies the field length of the BAPI parameter. |

*Table 11. Simple attributes properties: Top-level business object (continued)*

| Property Name | Description |
|---|---|
| IsKey | Specifies whether the attribute is the key. The first simple attribute of a business object defaults to the key attribute. For a single BAPI object, SAPODA inserts the `Dummy_key` attribute as the first attribute, marks it as the key attribute, and sets appropriate values. For BAPI transactions and ResultSets, SAPODA uses the first attribute as the key. For more information, see "Supporting BAPIs" on page 98. |
| IsForeignKey | SAPODA sets the value to `false`. |
| IsRequired | Specifies whether an attribute must contain a value. SAPODA sets the value to `false`. |
| AppSpecificInfo | Contains the name of the BAPI parameter that corresponds to the associated attribute. The format is: *I`ABAPFieldName`*`:`*E`ABAPFieldName`*For more information on the application-specific information, see "Business object application-specific information" on page 108. |
| DefaultValue | Specifies the value to assign to this attribute if there is no run-time value. SAPODA does not set a value for this property. |

Table 12 lists and describes the attributes that represent a child or array of child business objects. SAPODA generates the properties described below.

*Table 12. Properties of an attribute that represents a child or children*

| Property Name | Description |
|---|---|
| Name | The value is the name of the structure or table parameter. The format is: `BOprefix_BAPIParameterName`. Any special characters that exist in the business object name will be replaced with an underscore character _. |
| Type | The value is the type of child business object; in other words, the type is `BOprefix_BAPIParameterName`. |
| ContainedObjectVersion | SAPODA sets the value to `3.0.0`. |
| Relationship | SAPODA sets the value to `containment`. |
| IsKey | For a BAPI transaction or ResultSet, SAPODA sets the value of the first attribute to `true`, and the value of all other attributes to `false`. |
| IsForeignKey | SAPODA sets the value to `false`. |
| IsRequired | Specifies whether an attribute must contain a value. SAPODA sets the value to `false`. |
| AppSpecificInfo | Contains the name of the BAPI parameter that corresponds to the associated attribute. The format is: *I`BAPIParameterName`*`:`*E`BAPIParameterName`*For more information on the application-specific information, see "AppSpecificInfo for attributes" on page 109. |
| Cardinality | BAPI structure parameters have single cardinality (`1`) and BAPI table parameters have multiple cardinality (`n`). |

**Important:** Simple attributes can have two special values: `CxIgnore` and `CxBlank`. When a business object is sent to the BAPI Module as a service call request and the business object has simple attributes set to `CxIgnore` or `CxBlank`, it is as if those attributes are invisible to the BAPI Module. However, the SAP application initializes such an attribute to its ABAP data type. The BAPI Module converts all returned blank values to `CxIgnore`.

## Initializing attribute values

Every field in SAP has an initial value. When the connector receives a service call request, the business object handler populates most of the BAPI interface parameters with the values listed in Table 13. The one exception is the character data type. The business object handler converts a `CxIgnore` in the business object attribute to a space in the SAP field. If you want any other value to be converted to `CxIgnore`, the component that creates the business object must perform the conversion. For example, when ICS is the integration broker, modify the map to handle this conversion.

Table 13 provides initial values set by the business object handler.

*Table 13. Initial Field Values in SAP*

| Data Type | Description | Initial Value Set by Business Object Handler |
|---|---|---|
| `C` | Character | `space` |
| `N` | Numeric string | *000...* |
| `D` | Date (YYYYMMDD) | `00000000` |
| `T` | Time (HHMMSS) | `000000` |
| `X` | Byte (hexadecimal) | `X00` |
| `I` | Integer | `0` |
| `P` | Packed number | `0` |
| `F` | Floating point number | `0.0` |

# Business object application-specific information

Application-specific information (ASI) in business object definitions provides the BAPI Module with application-dependent instructions on how to process business objects. These instructions are specified at the following levels:

- Business object-level for single BAPI call objects, BAPI transaction objects, and ResultSet objects
- Verb-level for single BAPI call objects, BAPI transaction objects, and custom business object handlers (CBOH).
- Attribute-level for the following:
  - Simple attributes
  - Attributes that represent child objects
  - Attributes that represent an array of child objects (ResultSet object)

## Business object-level ASI

The business object-level ASI should be set for each type of object as described in Table 14.

*Table 14. Business object-level ASI*

| Object type | Application specific information |
|---|---|
| Objects representing single BAPI calls | `type=bapi` |
| Objects representing BAPI transactions | `type=bapi_txn` |
| Objects representing BAPI ResultSets | `type=bapi_resultset` |

## Verb-level ASI

The verb-level ASI should be set for each type of object as described in Table 15 on page 109. Note that there is no verb ASI for BAPI ResultSet business objects.

*Table 15. Verb-level ASI*

| Object type | Verb ASI |
|---|---|
| Objects representing single BAPI calls | `verb ASI=NameOfBAPI` |
| Objects representing BAPI transactions | `verb ASI=NameOfBAPI1;NameOfBAPI2;NameOfBAPI3` |
| Objects representing custom business object handlers | `CBOH=bapi.client.customBOHandlerName` |

### Backward compatibility for objects representing single BAPI calls

Note that the connector supports verb ASI formats of business objects from earlier releases, where the value of the AppSpecific property captures the classname of the BAPI-specific business object handler (`verb ASI= bapi.client.BOHandlerName`, where `bapi.client` is the WebSphere Business Integration qualifier of the BAPI-specific business object handler name and *BOHandlerName* is the name of the class). You must include the value `client` before the business object handler name to identify that the business object handler acts as a client. Note that while the connector supports these earlier formats, SAPODA does not automatically generate them and therefore you must explicitly specify them by name in the verb ASI.

For example, if you are supporting the `SALES_ORDER_CREATEFROMDAT2` BAPI from an earlier release, then the application-specific information is as follows:

```
AppSpecificInfo = bapi.client.sales_order_createfrom dat2
```

### Verb ASI for objects representing custom business object handlers

For custom business object handlers, the verb ASI should be explicitly set (since it is not generated by SAPODA) and fully qualified with the package name, where *bapi.client* represents the package name.

## AppSpecificInfo for attributes

The connector uses the value of an attribute's application-specific information to determine which importing, exporting, and table parameters to use. The value of this property contains the prefix `I` (for importing parameters) or `E` (for exporting parameters). The prefix indicates whether the attribute value is used to pass data into or out from the SAP application.

Because structure parameters can be either importing or exporting, they use either an `I` or an `E` before the parameter value. Because table parameters can pass data to and return data from a BAPI, they can have both `I` and `E` parameter values.

**Important:** Always use a colon (**:**) separator when you specify parameter values with `I` and `E`. If specifying only an importing value, the colon must follow the value. If specifying only an exporting value, the colon must precede the value. If specifying both values, the colon follows the importing value and precedes the exporting value.

Figure 49 illustrates the correspondence between a business object and an example BAPI named `BAPI_EXAMPLE`. In the example, the simple attributes (Attribute_1, Attribute_2, and Attribute_3) specify only an importing or exporting parameter. The attribute that represents a child business object (Child_1) corresponds to an exporting structure parameter. The attribute that represents an array of child business objects (Child_2) corresponds to a table parameter.

Each child business object has a simple attribute that corresponds to a field of the corresponding structure or table (Attribute_11 and Attribute_14, respectively). You can find these fields by looking at the details of the BAPI.

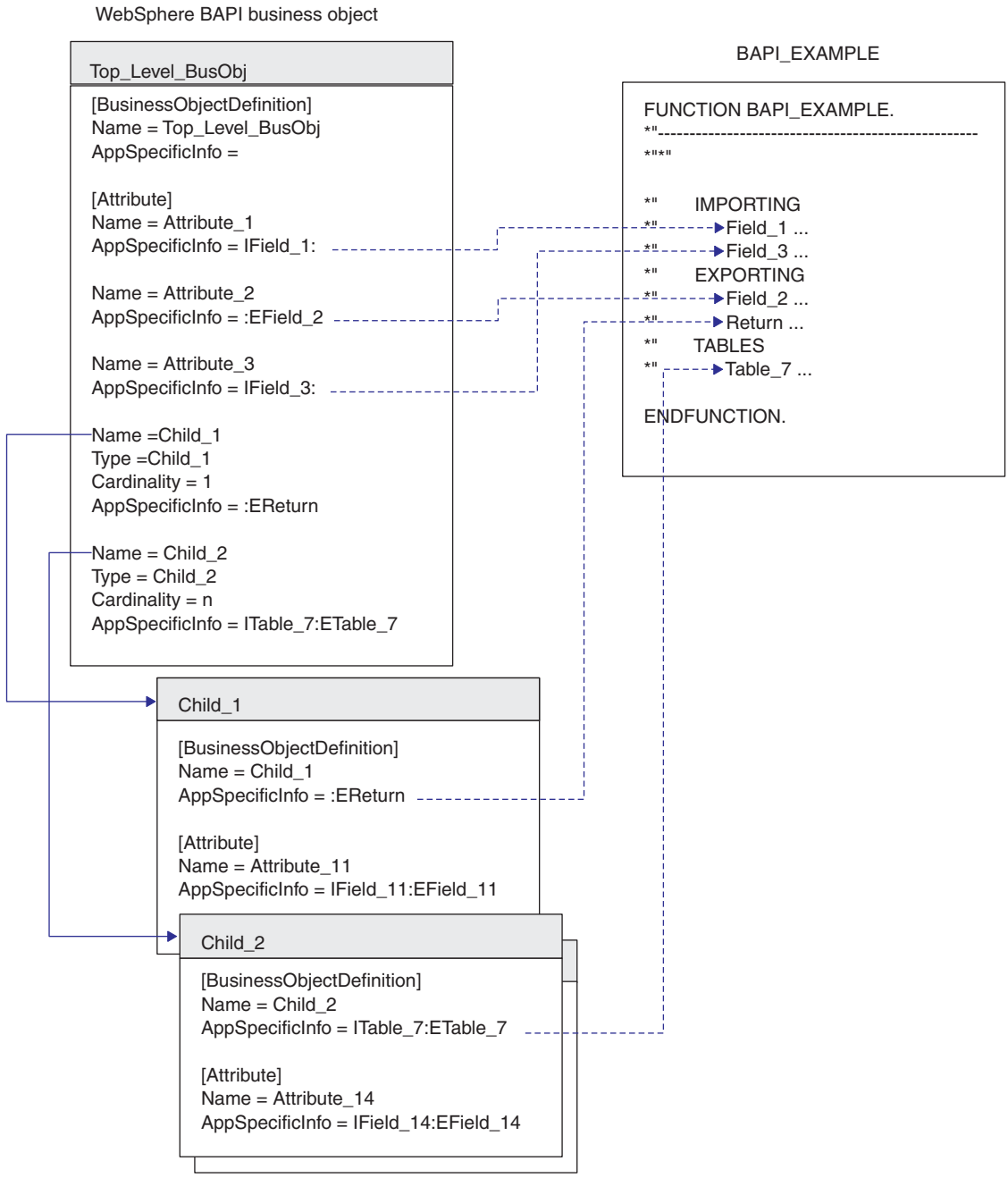



*Figure 49. Correspondence between a business object and an example BAPI*

Table 16 identifies the format of the ASI for specific kinds of attributes.

*Table 16. ASI format for specific kinds of attributes*

| AppSpecificInfo Format | Attribute Type |
|---|---|
| I*ParameterName*:E*ParameterName* | Simple |
| I*TableName*:E*TableName* | Represents a child business object mapped to a table parameter |

*Table 16. ASI format for specific kinds of attributes (continued)*

| AppSpecificInfo Format | Attribute Type |
|---|---|
| I*StructureName*:E*StructureName* | Represents a child business object mapped to a structure parameter |
| I*FieldName*:E*FieldName* | Represents an attribute of a child business object mapped to a field in a table or structure parameter |

SAPODA automatically generates the appropriate application-specific information for the business object definition. It is recommended that you do not change the parameter names of the generated application-specific information.

## Attribute-level ASI for BAPI ResultSets

As explained in "Business object structure for BAPI ResultSets" on page 106, a BAPI ResultSet is a wrapper object that contains two attributes of the object type: `BAPI_Query` and `BAPI_Result`. `BAPI_Query` represents the Get List BAPI, while `BAPI_Result` represents the Get Detail BAPI. The attribute-level ASI for these two attributes is described in Table 17.

*Table 17. Attribute-level ASI for ResultSets*

| ResultSet attribute | Application-specific information |
|---|---|
| `BAPI_Query` | `bapi=`*`name_Of_GetListBAPI`* |
| `BAPI_Result` | `key=`*`key_field`*`;bapi=`*`name_Of_GetDetailBAPI`* |

The `Key` attribute of the BAPI_Result object is identified using the attribute-level ASI `key=`*`name_Of_KeyAttribute`*. The business object handler uses this information for performance optimization.

The `Foreign Key` attribute of the BAPI Result object captures the relationship between BAPI_Result and BAPI_Query objects. It is identified using the attribute level ASI `FK=BAPI_Query:`*`Name of child object of BAPI_Query that contains the key attribute:name of key attribute`*.

For example, `FK=Query:sap_addressdata:Customer_number`. The BAPI business object handler uses this information for setting key values from a BAPI query object into BAPI Result object key attributes, for then retrieving Detail Result objects for each key.

# Using generated business object definitions

Use SAPODA to generate business object definitions for each RFC-enabled function that you want to support. You can use the generated objects without any modifications. However, you can manually edit these objects to refine the functionality.

After the objects are generated, you must add the business object definition and to your WebSphere business integration system's runtime environment. Use Business Object Designer to copy the business object definition into your repository. Alternatively, if InterChange Server (ICS) is the integration broker, you can use the `repos_copy` command to copy the definition into the repository.

**Important:** You can modify the name of the generated business object as well as the name of its child business objects. To do so, you must edit the definition as a text file rather than in Business Object Designer. If you

do change a business object's name, ensure that you also modify all references to the names that you change.

## Tips and tricks

This section describes the following tips and tricks for developing business objects:

- "Multiple business objects contain the same return business object"
- "Generated business object definition contains unnecessary attributes and child business objects"
- "Generated business object names are too long or fail your naming conventions" on page 113
- "Generated AppSpecificInfo for table parameters specify unnecessary parameters" on page 113

### Multiple business objects contain the same return business object

Most BAPIs use the same name for the return object. When SAPODA generates a business object definition, it creates a child business object to represent this return object. If multiple business object definitions contain an identically named child business object, you can add that child business object into the repository only once, or copy only a single definition file into the repository directory.

To enable multiple business objects to contain the return business object, you must modify the name of the return business object to be unique for each business object.

To rename the return business object, modify the definition of each business object definition that contains it. The definition of the child business object is contained in the same definition file as its parent.

To rename the child, do the following:

1. Open the definition file for the top-level business object in a text editor.
2. Locate the definition of the `BOprefix_return` child business object.
3. Change the child's name to be unique. For example, append a number to the text (`sap_return_2`).
4. Change all references in the definition to refer to the newly named child. For example, change the value of the Type property for every attribute that represents the child business object.
5. Save the changed definition file.
6. Use System Manager (CSM) to load the newly named child business object into the repository.

   **Note:** Alternatively, if InterChange Server is the integration broker, you can use the `repos_copy` command to load the definition into the repository.

### Generated business object definition contains unnecessary attributes and child business objects

SAPODA interprets all BAPI interface parameters and, for each one, it creates a corresponding business object attribute or child business object. To increase performance of business object processing, remove all unrequired attributes and business objects from the business object definition.

**Note:** SAPODA facilitates graphically removing all optional attributes and child business objects before definition generation. For more information, see "Provide additional information" on page 58.

To increase performance of business object processing, you can also remove all unrequired importing and exporting table parameter values from the application-specific information.

After definition generation, you can use Business Object Designer to manually edit the business object definition if you require other changes. However, be careful that you remove only attributes that you absolutely will not be using.

## Generated business object names are too long or fail your naming conventions

SAPODA uses the name of the BAPI function Module to generate the name of the business object definition. You can use a text editor to modify a business object's name.

**Important:** If you do change the name, ensure that you modify all references to the name as well. However, do not modify the parameter names of the generated application-specific information.

To change a generated business object's name:

1. Save the definition to a file.
2. Use a text editor to shorten or change the name.
3. Use System Manager (CSM) to load the newly named child business object into the repository.

   **Note:** Alternatively, if Interchange Server is the integration broker, you can use the `repos_copy` command to load the definition into the repository.

## Generated AppSpecificInfo for table parameters specify unnecessary parameters

Table parameters can be both importing and exporting parameters. If you do not require importing or exporting of values for a table parameter, you can remove it from the application-specific information.

For example, for a create operation, if you do not need to return the table data from the SAP application after the create operation has completed, you can remove the exporting parameter value (such as E*table name*).

For a retrieve operation, you do not need to specify any importing table parameters. Therefore, you can remove the importing parameter value (such as I*table name*).

**Note:** You must remove the unrequired value from the `AppSpecificInfo` of the attribute in the parent that represents the child as well as from the `AppSpecificInfo` at the business-object level of the child business object. Do not remove the colon (`:`).

For example, to remove the `ETable_7` exporting parameter in Figure 49 on page 110, you would do the following:

1. In the Child_2 attribute of the Top_Level_BusObj business object, change the attribute's AppSpecificInfo value to:

   ```
   ITable_7:
   ```

2. In the AppSpecificInfo at the business-object level of the Child_2 business object, change the value to:

   `ITable_7:`

3. In the AppSpecificInfo for each attribute of the child business object, using Attribute_14 as an example, change the value to:

   `IField_14:`

# Using custom business object handlers

It is recommended that you use the BAPI business object handler delivered with the connector as a template (for details, see "Business object processing" on page 96), rather than write your own business object handler. Reasons for using custom business object handlers include the following:

- Implementing custom error handling.
- Supporting business objects created in an earlier release, rather than regenerating them in SAPODA of this release. For details about backward compatibility of business objects, see "Backward compatibility for objects representing single BAPI calls" on page 109.

## Creating custom business object handlers

If you decide to create a custom business object handler, consider the following example as a guide for how to code it. Note that SAPODA does not generate the code for you.

```
package bapi.client ;


import AppSide_Connector.JavaConnectorUtil;
import CxCommon.BusinessObjectInterface;
import CxCommon.CxMsgFormat;
import CxCommon.CxStatusConstants;
import CxCommon.ReturnStatusDescriptor;
import com.crossworlds.connectors.sap.codegen.BapiBOHandlerBase;
import com.crossworlds.connectors.sap.codegen.exception.CwBoHandlerAppResponseTimeout;
import com.crossworlds.connectors.sap.codegen.exception.CwBoHandlerProcessingFailed;
import com.crossworlds.connectors.sap.visionframework.VisionBOHandlerInterface;
import com.crossworlds.connectors.sap.visionframework.VisionConnectorAgent;
import com.sap.mw.jco.IRepository;
import com.sap.mw.jco.JCO;


public class Bapi_customer_getlist extends BapiBOHandlerBase implements VisionBOHandlerInterface {

  private static VisionConnectorAgent vca = VisionConnectorAgent.getCWSapConnManager();
  private IRepository repository = getRepository();
  private JCO.Function bapicommit = new JCO.Function(repository.
     getFunctionTemplate("BAPI_TRANSACTION_COMMIT"));
  private int checkBapiReturn = CxStatusConstants.SUCCEED;

  public Bapi_customer_getlist()
  {
  }


  public int doVerbForVision(BusinessObjectInterface theObj, ReturnStatusDescriptor rtn)
  {
     JCO.Function function = new JCO.Function(repository.getFunctionTemplate("BAPI_CUSTOMER_GETLIST"));

     //Default processing to failure
     int    mReturnCode = CxStatusConstants.FAIL;
     JCO.Client theClient = null;

     try
     {
     traceMessage(JavaConnectorUtil.LEVEL1, 27025, CxMsgFormat.XRD_INFO, theObj.getName(), theObj.getVerb(),
 null, null);

     // get defaults and check for required fields for Create and Update only
     if ((theObj.getVerb().equalsIgnoreCase("Create")) || (theObj.getVerb().equalsIgnoreCase("Update")))
     {
       traceMessage(JavaConnectorUtil.LEVEL4, 27021, CxMsgFormat.XRD_INFO, theObj.getName(),
  null, null, null);
       JavaConnectorUtil.initAndValidateAttributes(theObj);
```

```
}

// get a new connection to Sap
theClient = this.getClient();

//   populate Rfc interface parameters
mReturnCode = doBusObjtoRfcData(theObj, function, function.getImportParameterList(),"I",false);
if (mReturnCode != CxStatusConstants.SUCCEED)
{
  if (theClient != null) vca.releaseClient(theClient);
  return CxStatusConstants.FAIL;
}

// Execute Rfc Call
this.callBapi(theClient,function);

try {
// After successful RfcCall: check Structure/Table RETURN for Bapi Return Codes E or A that
// indicate failure
  this.checkBapiRc(function);

// After successful Bapi Call: call BAPI_TRANSACTIOM_COMMIT
  this.callBapiCommit(theClient);

} catch (CwBoHandlerProcessingFailed cwpf) {
  rtn.setErrorString(cwpf.getMessage());
  rtn.setStatus(CxStatusConstants.FAIL);
  checkBapiReturn = CxStatusConstants.FAIL;
}
// Now create CW Business Object
mReturnCode = doRfcDatatoBusObj(theObj, function , function.getExportParameterList(), "E");
if (mReturnCode != CxStatusConstants.SUCCEED || checkBapiReturn != CxStatusConstants.SUCCEED)
{
  if (theClient != null) vca.releaseClient(theClient);
  return CxStatusConstants.FAIL;
}

// Clean up
if (theClient != null) vca.releaseClient(theClient);

// Finally, return success to ICS
traceMessage(JavaConnectorUtil.LEVEL1, 27034, CxMsgFormat.XRD_INFO, theObj.getName(),
   null, null, null);
return CxStatusConstants.VALCHANGE;
}//end of try

catch (CxCommon.Exceptions.SetDefaultFailedException sdfe)
{
  if (theClient != null) vca.releaseClient(theClient);
  String msg = logMessage(20059, CxMsgFormat.XRD_INFO, theObj.getName(), null, null, null);
  rtn.setErrorString(msg);
  rtn.setStatus(CxStatusConstants.FAIL);
  return CxStatusConstants.FAIL;
}
catch (CxCommon.Exceptions.BusObjSpecNameNotFoundException c)
{
  if (theClient != null) vca.releaseClient(theClient);
  String msg = logMessage(20059, CxMsgFormat.XRD_INFO, theObj.getName(), null, null, null);
  rtn.setErrorString(msg);
  rtn.setStatus(CxStatusConstants.FAIL);
  return CxStatusConstants.FAIL;
}
catch (CwBoHandlerAppResponseTimeout art)
{
  if (theClient != null) vca.releaseClient(theClient);
  rtn.setErrorString(art.getMessage());
  rtn.setStatus(CxStatusConstants.APPRESPONSETIMEOUT);
  return CxStatusConstants.APPRESPONSETIMEOUT;
}
catch (CwBoHandlerProcessingFailed cwpf)
{
  if (theClient != null) vca.releaseClient(theClient);
   rtn.setErrorString(cwpf.getMessage());
  rtn.setStatus(CxStatusConstants.FAIL);
  return CxStatusConstants.FAIL;
}
catch (Exception e)
{
  if (theClient != null) vca.releaseClient(theClient);
   rtn.setErrorString(e.getMessage());
  rtn.setStatus(CxStatusConstants.FAIL);
  return CxStatusConstants.FAIL;
}
catch ( OutOfMemoryError merr ){                // CR 30185
  String msg = logMessage(23060, JavaConnectorUtil.XRD_ERROR,
    "doVerbForVision()", merr.toString(), null, null);
  rtn.setErrorString(msg);
  rtn.setStatus(CxStatusConstants.APPRESPONSETIMEOUT);
```

```
      return CxStatusConstants.APPRESPONSETIMEOUT;
    }
    catch ( StackOverflowError serr ){                // CR 30185
      String msg = logMessage(23060, JavaConnectorUtil.XRD_ERROR,
         "doVerbForVision()", serr.toString(), null, null);
      rtn.setErrorString(msg);
      rtn.setStatus(CxStatusConstants.APPRESPONSETIMEOUT);
      return CxStatusConstants.APPRESPONSETIMEOUT;
    }
    catch (Throwable ex) {
      // 23046 EXception raised in: {1} : ErrorMessage: {2}.
      String msg = logMessage(23046, JavaConnectorUtil.XRD_ERROR,
        "doVerbForVision()",ex.toString(), null, null);
      return CxStatusConstants.FAIL;
    }
  }// end of doVerbforVision

public int callBapiCommit(JCO.Client theClient) throws
    CwBoHandlerProcessingFailed, CwBoHandlerAppResponseTimeout
{

  int mStatus = CxStatusConstants.FAIL;
  try {
  traceMessage(JavaConnectorUtil.LEVEL3, 27032, CxMsgFormat.XRD_INFO, null, null, null, null);
  try
  {
     theClient.execute(bapicommit);
  }
  catch (JCO.Exception e)
  {
     String msg = logMessage(27019, CxMsgFormat.XRD_ERROR, null, null,
      null, null);
     throw new CwBoHandlerProcessingFailed(msg);
  }
  //  Read Return
  readBapiRc(bapicommit.getExportParameterList().getStructure("RETURN"));
  }// end of try
  catch (Exception e)
  {
     String msg = logMessage(27019, CxMsgFormat.XRD_ERROR, null, null,
       null, null);
     throw new CwBoHandlerProcessingFailed(e.getMessage());
  }

  // Return Success
  return CxStatusConstants.SUCCEED;
}


public void checkBapiRc(JCO.Function function) throws CwBoHandlerProcessingFailed
{

  try
  {
     JCO.ParameterList p = function.getTableParameterList();
       this.readBapiRc(p.getTable("RETURN"));
     }
     catch (CwBoHandlerProcessingFailed cw)
     {
       throw cw;
     }
     catch (Exception e)
     {
       try
       {
       JCO.ParameterList p = function.getExportParameterList();
       if (p != null)
       this.readBapiRc(p.getStructure("RETURN"));
       else
       {
       String msg = logMessage(27045, CxMsgFormat.XRD_INFO, null,null, null, null);
       throw new CwBoHandlerProcessingFailed(msg);
       }
       }//end try
       catch (JCO.Exception o)
       {
       String msg = logMessage(27045, CxMsgFormat.XRD_INFO, null,null, null, null);
       throw new CwBoHandlerProcessingFailed(msg);
       }
  }

}// end of checkBapiRc


public void readBapiRc(JCO.Structure Return) throws CwBoHandlerProcessingFailed
{
  String type = null;
  String no = null;
```

```
  String message = null;
  traceMessage(JavaConnectorUtil.LEVEL4, 27033, CxMsgFormat.XRD_INFO, null, null, null, null);
  if (Return.getString("TYPE") != null)
  {
     // Depending on RETURN ddic structure, number field is either "NUMBER" or "CODE".
     try
     {
       no = Return.getString("NUMBER");
     }
     catch (JCO.Exception o)
     {
       no = Return.getString("CODE");
     }
     message = Return.getString("MESSAGE");
     type = Return.getString("TYPE");
     if ((type.equalsIgnoreCase("A")) || (type.equalsIgnoreCase("E")))
     {
       String msg = logMessage(27015, CxMsgFormat.XRD_ERROR, type, no,
         message, null);
       throw new CwBoHandlerProcessingFailed(msg);
     }
     else
     {
     traceMessage(JavaConnectorUtil.LEVEL1, 27016, CxMsgFormat.XRD_INFO,
       type, no, message, null);
     return;
     }
  }
  // If structure Return is empty, it will be assumed that processing was
     successful
  traceMessage(JavaConnectorUtil.LEVEL1, 27036, CxMsgFormat.XRD_INFO, type, no, message, null);
}



public void readBapiRc(JCO.Table Return) throws CwBoHandlerProcessingFailed
{
  String type = null;
  String no = null;
  String message = null;
  String msg = null;
  String errorMsg = "";
  int mStatus = CxStatusConstants.SUCCEED;

  traceMessage(JavaConnectorUtil.LEVEL4, 27033, CxMsgFormat.XRD_INFO, null, null, null, null);
  for (int i=0; i<Return.getNumRows(); i++)
  {
  try
  {
  Return.setRow(i);
  if (Return.getString("TYPE") != null)
  {
     type = Return.getString("TYPE");
     // Depending on RETURN ddic structure, number field is either "NUMBER" or "CODE".
     try
     {
       no = Return.getString("NUMBER");
     }
     catch (JCO.Exception e)
     {
       no = Return.getString("CODE");
     }
     message = Return.getString("MESSAGE");
     }//end if
     }//end try
     catch (Exception o)
     {
  // Could not interprete Return structure ==> Failing event
       msg = logMessage(27043, CxMsgFormat.XRD_ERROR, type, no,
        message, null);
       throw new CwBoHandlerProcessingFailed(msg);
     }
     if  (type != null)
     {
     if ((type.equalsIgnoreCase("A")) || (type.equalsIgnoreCase("E")))
     {
       msg = logMessage(27015, CxMsgFormat.XRD_ERROR, type, no,
        message, null);
       mStatus = CxStatusConstants.FAIL;
     }//end if
     else
     {
     traceMessage(JavaConnectorUtil.LEVEL1, 27044, CxMsgFormat.XRD_INFO,
          type, no, message, null);
     }
     }//end if type != null
  }//end of for
```

```
  if (mStatus == CxStatusConstants.FAIL)
     {
       logMessage(27046, CxMsgFormat.XRD_ERROR, msg, null, null, null);
       throw new CwBoHandlerProcessingFailed(msg);
     }
  // If Return is empty, it will be assumed that processing was successful
  if (Return.getNumRows() <= 0)
     traceMessage(JavaConnectorUtil.LEVEL1, 27036, CxMsgFormat.XRD_INFO, type, no, message, null);
  else
  traceMessage(JavaConnectorUtil.LEVEL1, 27011, CxMsgFormat.XRD_INFO, null, null, null, null);
}//end of ReadBapiRc


};
```

The following example illustrates a script for compiling the custom BOHandler on the Windows platform. Note that to run this script, the JDK must be installed on your machine.

```
REM @echo off REM

REM init environment
call "%CROSSWORLDS%"\bin\CWODAEnv.bat
setlocal

REM set classpaths
set WBIA=%CROSSWORLDS%"\lib\WBIA\4.2.0\WBIA.jar
set CWLIB=%CROSSWORLDS%"\lib\CrossWorlds.jar
set AGENT="%CROSSWORLDS%"\ODA\SAP\SAPODA.jar
set JCO_JAR="%CROSSWORLDS%"\ODA\SAP\sapjco.jar

set JCLASSES=%AGENT%;%JCO_JAR%;%CWLIB%;%WBIA%
echo classpath = %JCLASSES%

REM compile the BAPI BOHandler passed as argument
javac -verbose -classpath %JCLASSES% %1

endlocal
pause
```

**Note:** The connector provides full-backward compatibility for existing installations that use generated (non-custom) business object handlers.

# Part 3. ALE Module

# Chapter 10. Overview of the ALE Module

This chapter describes the ALE (Application Link Enabling) Module of the Adapter Guide for mySAP.com (R/3 V.3.x). ALE is part of the integration layer within SAP's business framework. The ALE Module enables business process integration and asynchronous data communication between two or more SAP systems or between SAP and external systems.

This chapter contains the following sections:



## Overview of ALE technology

The ALE Module is best used for objects such as batch objects, that are asynchronous in nature. It uses push technology that requires that there be a server listening for events. Processes called registering and installing notify the server what to listen to and from whom to expect information. Registering involves using a program identifier to give the SAP Gateway a communication point with listener threads (servers). Function module definitions within the server interpret data that is pushed out of SAP by providing a template for this data.

The ALE Module uses the RFC Server Module for event handling. The ALE Module uses MQ Series queues for Transaction ID (TID) and IDocs management. The connector checks for subscriptions when processing the data from SAP to the connector, resulting in transactions remaining in SAP until the collaboration is started.

- The integration broker sends a WebSphere Business Integration Adapter business object for SAP. The business object's data represents a processing request to the connector. The connector converts the business object to a table format compatible with the SAP Intermediate Document (IDoc) format. The connector uses Remote Function Calls (RFCs) to the ALE interface to pass the IDoc data to the SAP system.
- The connector receives data representing an application event from SAP in IDoc table format. It converts the data to a WebSphere Business Integration Adapter business object for SAP before sending it to the integration broker. The connector uses RFCs to the ALE Module to receive the data from the ALE interface.

**Important:** In releases of the connector prior to version 4.8.2, the connector used collaborations, business objects, and maps to store Transaction IDs (TIDs) and their status in the repository, and used the local file system to store IDoc data. Version 4.8.2 of the connector replaces the previous management of TIDs and IDoc data with the use of MQSeries queues.

**Note:** Because the ALE Module uses asynchronous communication, it cannot be used when cross-referencing is required.

## ALE Module components

The ALE Module is written in Java and extends the vision connector framework. The module consists of:

- Connector framework
- Connector's application-specific component for ALE
- Two ALE business object handler classes (one for event processing and one for request processing)
- SAP RFC libraries
- SAP SAPJCo connector
- Application-specific component for the RFC Server (used for event processing only).

  The ALE Module uses the RFC Server connector component because the similarities for event processing both support RFC calls directly from the SAP application.

SAP delivers the RFC libraries in Java and C. The connector is delivered and run as a Java archive (JAR) file.

Figure 50 illustrates the architecture of the ALE Module.

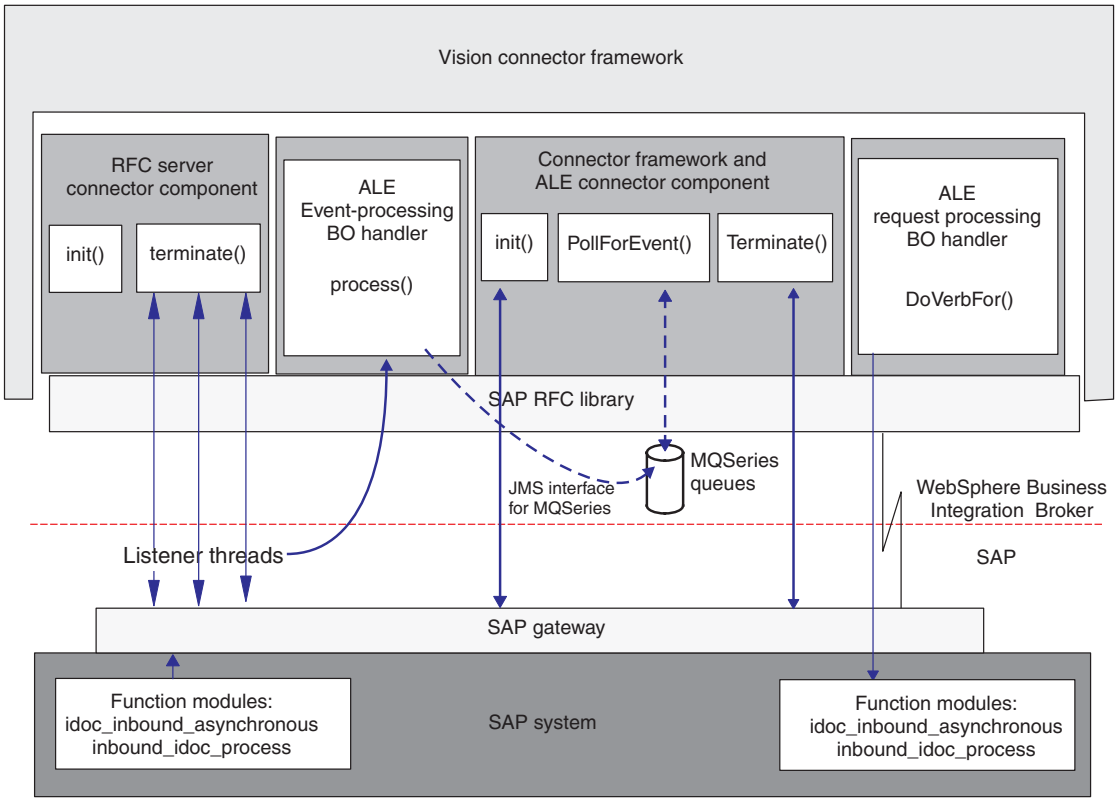



*Figure 50. ALE Module architecture*

## Event processing components

When processing events from SAP, the connector uses the components illustrated in Figure 50 in the following ways:

- The vision connector framework starts the RFC Server connector component, which spawns listener threads. Each listener thread uses the RFC library and the SAP gateway to register a single handle to the SAP application.
- The listener thread processes events from the SAP application.

  An **event** is the execution of an ABAP function that transfers data to the listener. The event data sent by SAP may represent one or more such heterogeneous executions.

  Each event from SAP is considered a transaction. The connector uses a two-step process with a Transaction ID (TID) to handle each event, guaranteeing once-only delivery of data from SAP to the connector.
- MQSeries queues persistently store a JMS-MQ message for each event. Each JMS-MQ message stores the TID identifying the event, the status of the TID, the IDoc data associated with the event, and the processing status of the IDoc.
- The connector's polling process creates WebSphere business objects from the stored event message, and sends the business objects to the integration broker. The connector provides support for large IDoc messages that result in large business objects.

  For more efficient processing performance, the connector breaks up a large IDoc into smaller parts, each of which is a JMS-MQ message that translates into a smaller business object. Each of these messages contains a `MultiPartMessage` property, that identifies it with the appropriate part of the larger message. For example, assuming the original larger IDoc is partitioned into 8 JMS-MQ messages, then the value of the `MultiPartMessage` property of each part is `1 of 8`, `2 of 8`, and so on for each message. To associate all the message parts with one another, the connector sets the `CorrelationID` header property of each message part other than the first message to the value of the `JMSMessageID` property of the first part. In turn, the `CorrelationID` property of the first part is always set to the value of that property in the first JMS-MQ message that corresponds to the original large IDoc. For details about JMS-MQ message properties, see Table 20 on page 133.
- The business integration system tracks unprocessed events to handle their recovery in case the integration broker or the connector goes down. When the integration broker or the connector is restored, the connector automatically resubmits these events.

## Request processing components

When processing requests from the integration broker, the connector uses the components illustrated in Figure 50 in the following ways:

- The ALE Module uses the SAP RFC library and the SAP Gateway to open an RFC connection to the SAP application.
- The ALE request-processing business object handler processes requests from the integration broker, converting them from business object format to IDoc data based on the SAP IDoc format:
- For every request sent to the application, the ALE Module persistently stores Transaction IDs (TIDs) in a TID queue in a JMS-MQ message. The TID guarantees that the request is delivered once and only once. However, if the integration broker sends an object that has the same value in the transaction ID attribute, this object will be processed again. Once an object has been successfully sent the expectation is that the integration broker will not send the object again.
- The ALE Module releases the connection to the SAP application.

## Listener threads

Listener threads handle all of the ALE-specific RFC calls between the ALE Module and the SAP application. When the connector starts up, the `init()` method of the RFC Server Module creates a main thread that spawns a configurable number of listener threads. Each listener thread opens a handle to the SAP Gateway.

The listener threads do the following:

- Use a program identifier to register with the SAP Gateway.
- Identify to the SAP Gateway the ALE-specific RFC-enabled functions that they support. These functions are `idoc_inbound_asynchronous` and `inbound_idoc_process`.
- Receive events from the ALE-specific function.
- Instantiate the event-processing ALE business object handler.

A thread listens continuously in a synchronous manner for events from the ALE-specific functions that it supports.

## Transaction IDs

SAP uses a transaction and its corresponding ID to frame an event, guaranteeing that each piece of data is delivered once and only once from SAP. SAP sends a Transaction ID (TID) with the event data. To manage the TIDs centrally for event and request processing, the connector stores each TID as a JMS-MQ message on an MQSeries queue. When processing events, it also stores the associated IDoc data as the message body. The connector stores the TID, TID status, and the IDoc's processing status in the message header.

## ALE-specific business object handlers

Two ALE-specific business object handlers are provided, one for event processing and one for request processing.

### Event-processing business object handler

A listener thread instantiates the event-processing business object handler, which does the following:

- Retrieves the RFC event data from SAP.
- Creates a JMS-MQ message to persistently store and manage the transaction ID that SAP sends with the event.
- Stores the data of the one or more IDocs received from SAP in the JMS-MQ message.
- Returns a response to the ALE-specific function through the SAP Gateway. The response indicates that the transaction has been completed.

### Request-processing business object handler

The vision connector framework instantiates the ALE request-processing business object handler, which checks for a value in the TransactionId attribute in the WebSphere business object for SAP. If this value exists, it continues with the following steps.

1. Obtains a TID either from the JMS-MQ message or from SAP.
2. Converts the business object data to the IDoc data format defined by the desired function module interface for the RFC call into SAP.
3. Makes the RFC call to the ALE interface.
4. Updates the status of the TID for this request in the JMS-MQ message.

5. Returns a success response to the integration broker.

## Structure of the business object for SAP

A WebSphere business object for SAP represents each IDoc as a parent wrapper business object that contains two child business objects: a control record business object and a data record business object. The control record business object contains the metadata required by the connector to process the business object. The data record business object contains the actual business object data to be processed by the SAP application, and the metadata required for the connector to convert it to an IDoc structure for the RFC call.

The connector includes a business object definition for the control record. The definition file, `SAP_idoccontrol.xsd`, is located in the `\repository\SAP` directory.

The `TABNAM` attribute in the control record business object indicates which SAP function module the parent wrapper business object calls:

- A value of `EDI_DC40` indicates the `idoc_inbound_asynchronous` function module, which the connector uses only for SAP 4x.
- A value of `EDI_DC` indicates the `inbound_idoc_process` function module, which is provided for backward compatibility with SAP 3x.

In addition, the following attributes must have values for SAP to properly process the object in ALE. These values are based on your ALE configuration:

- `Name_of_table_structure`
- `Client`
- `Name_of_basic_type`
- `Logical_message_type`
- `Partner_type_of_sender`
- `Partner_number_of_sender`
- `Partner_type_of_recipient`
- `Partner_number_of_recipient`

The `DOCNUM` attribute in both business objects establishes the relationship between the data record business object and the control record business object.

When processing service call requests, the ALE Module can handle multiple IDocs in a single business object. Before it can do so, however, you must add another multiple-IDoc wrapper business object around two or more parent wrapper business objects. This top-level multiple IDoc wrapper business object contains an attribute that represents an array of parent wrapper business objects. For more information, see “Parent wrapper business object” on page 145.

The adapter includes a business object generation tool, SAPODA. This tool uses an IDoc definition text file to generate business object definitions for the ALE Module. For more information on developing business objects for the ALE Module, see Chapter 12, “Developing business objects for the ALE Module,” on page 141 and Chapter 5, “Generating business object definitions using SAPODA,” on page 47.

# Chapter 11. Configuring the ALE Module

This chapter describes the configuration and use of the ALE Module. The connector component of the Adapter Guide for mySAP.com (R/3 V.3.x) should be installed before performing the configuration tasks described in this chapter.

This chapter contains the following sections:



## Prerequisites to running the ALE Module

To enable the connector to store the TID and IDoc data persistently during event processing, and to store the TIDs persistently during request processing, you must do the following:

- Verify that the following are installed and running on your system:
  - WebSphere MQ (not included)
  - TCP/IP
- For event processing, create the following WebSphere MQ queues, whose names are specified by the corresponding connector-specific configuration properties:
  - Archive (`SAPALE_Archive_Queue` property)
  - Event (`SAPALE_Event_Queue` property)
  - Work-in-Progress (WIP) (`SAPALE_Wip_Queue` property)
  - Errors (`SAPALE_Error_Queue` property)
  - Unsubscribed (`SAPALE_UnSubscribed_Queue` property)
  - TID (`SAPtid_Queue` property)

  For information about how the connector uses these queues, see "Running the ALE Module" on page 130.
- To use the ALE Module to process large IDocs or IDoc Packets:
  - Increase the Maximum Message Length of the MQSeries Queue Manager and its queues. This length defaults to 4194304 bytes
  - Increase the log file size and the number of log files when you create the Queue Manager
  - If Channels are used for the WebSphere MQ Queue Manager, then increase the Maximum Message Length of the channel

    Refer to the MQSeries System Administration publication for more information on configuring the log files.

## ALE Module directories and files

Table 18 on page 128 lists the directories and files used by the ALE Module.

*Table 18. ALE Module directories and files*

| Filename | Events | Requests | Description |
|---|---|---|---|
| sap_idoccontrol.txt | Yes | Yes | Control record business object definition file. Located in the \repository\SAP directory. |
| EventState.log file | Yes | No | Located in the directory specified in the AleEventDir configuration property, the connector logs information to this file about successfully processed IDocs in a JMS-MQ event message. Note: The connector does not create the log file automatically the first time it processes an event. You must create this file for before you run the connector for the first time. |

**Note:** In this document backslashes (\) are used as the convention for directory paths. For UNIX installations, substitute slashes (/) for backslashes (\). All file pathnames are relative to the directory where the product is installed on your system.

## Configuring the ALE Module

Before you can use the ALE Module, you must:

- Add the module name for the ALE Module to the module's property. The module name is ALE.
- To enable event-processing with TID management, you must configure the appropriate connector-specific properties.
- To cause the connector to update a standard SAP status code after the ALE Module has retrieved an IDoc for event processing, configure the specific properties and inbound parameters of the Partner Profile of the Logical System in SAP to receive the ALEAUD message type. For more information and a full listing of relevant properties, see "Configuring SAP to update IDoc status" on page 129.
- Set the remaining required standard and connector-specific configuration properties.

  To set the connector configuration properties, use Connector Configurator. For more information on setting the connector configuration properties, see Chapter 3, "Configuring the connector," on page 25 and Appendix D, "Standard configuration properties for connectors," on page 287.

**Important:** Connector polling is required for this module to manage errors properly when it processes application events. Therefore, do not set the value of the connector's PollFrequency property to key or to no. Do not allow the SAP application to trigger events to the connector until you have verified that the connector's log displays the installation of the required RFC functions.

## Checking the SAP configuration

Before running the ALE Module, verify that the SAP system is properly configured to process business objects:

- Check that the logical systems are defined and assigned for the SAP system and external system (transaction code SALE).

- Check that the distribution model has been maintained, and that the required message types have been added to the model (transaction code BD64).
- Check that there are partner profiles for the logical system or distribution model (transaction code WE20).

## Checking MQ configuration

Verify that message queues are properly configured.

For event processing:

- Check that the SAP application (transaction code SM59) matches the program ID specified in the `RfcProgramId` configuration property. For more information on setting up a TCP/IP port see "Registering the RFC Server Module with the SAP Gateway" on page 177.
- Check that the WIP (`SAP_Wip_Queue`), Event (`SAP_Event_Queue`), Error (`SAP_Error_Queue`), Unsubscribed(`SAP_Unsubscribed_Queue`), and Archive queues (`SAP_Archive_Queue`) are defined and running in MQSeries.

For request processing, check that the request queue (`SAPtid_Queue`) is defined and running in MQSeries.

## Configuring SAP to update IDoc status

To cause the connector to update a standard SAP status code after the ALE Module has retrieved an IDoc for event processing:

- Set the `AleUpdateStatus` configuration property to `true` and set values for the `AleSuccessCode` and `AleFailureCode` configuration properties.
- Configure the inbound parameters of the Partner Profile of the Logical System in SAP to receive the `ALEAUD` message type.

For more information, see "Updating the IDoc status in SAP" on page 135.

### Configuring SAP

Configure the inbound parameters of the partner profile of the logical system to receive the `ALEAUD` message type. Set the following properties to the specified values:

*Table 19. Configuring SAP to receive IDoc status*

| SAP Property | Value |
|---|---|
| Basic Type | `ALEAUD01` |
| Logical Message Type | `ALEAUD` |
| Function module | `IDOC_INPUT_ALEAUD` |
| Process Code | `AUD1` |

### Setting connector-specific configuration properties

Set the following required connector-specific configuration properties to return IDoc status:

- "AleUpdateStatus" on page 314
- "AleSuccessCode" on page 315
- "AleFailureCode" on page 315

Set the following required connector-specific configuration properties to process events and requests:

- "SAPtid_MQChannel" on page 318
- "SAPtid_MQPort" on page 319
- "SAPtid_QueueManager" on page 319
- "SAPtid_QueueManagerHost" on page 319
- "SAPtid_QueueManagerLogin" on page 319
- "SAPtid_QueueManagerPassword" on page 319

You may also set the following optional connector-specific configuration properties:

- "AleSelectiveUpdate" on page 314
- "AleStatusMsgCode" on page 315
- "AleSuccessText" on page 315
- "AleFailureText" on page 315

### Connecting to remote queue managers

Set the following required connector-specific configuration properties for remote queue managers:

- "SAPtid_MQChannel" on page 318
- "SAPtid_MQPort" on page 319
- "SAPtid_QueueManager" on page 319
- "SAPtid_QueueManagerHost" on page 319
- "SAPtid_QueueManagerLogin" on page 319
- "SAPtid_QueueManagerPassword" on page 319

## Running the ALE Module

When processing application events, the ALE Module receives events that the SAP application pushes to the connector. When processing requests, the ALE Module receives business object requests from the integration broker and sends them to the SAP application.

### Initialization and termination

The `init()` method opens an RFC connection to the SAP application through the SAP Gateway. If the connector fails to initialize, it terminates the connection using the `terminate()` method. The connector terminates by disconnecting from the SAP Gateway.

When processing application events or business object requests, the connector's initialization process performs the following tasks:

1. Registers with the SAP Gateway the Program ID specified in the `RfcProgramID` connector configuration property. For information on setting the Program ID as a TCP/IP port see "Registering the RFC Server Module with the SAP Gateway" on page 177..
2. Opens an MQSeries session to the queues configured for the connector.
3. Verifies that the required MQSeries queues for event and request processing have been created. If they have not been created, the process terminates the connector.

Because the connector supports multi-threading, when the ALE Module processes requests from the integration broker, it uses SAP's Java Connector (SAPJCo) connection pool of such handles.

**Important:** When you use the ALE Module to process application events, connector polling is required to properly initialize the module (to install the RFC functions on the server), and for it to properly manage errors. Therefore, do not set the value of the PollFrequency property to `key` or to `no`. Do not allow the SAP application to trigger events to the connector until you have verified that the connector's log displays the installation of the required RFC functions.

## Processing business objects

The ALE Module's processing of WebSphere business objects for SAP is initiated either through event processing or request processing.

When business object data is returned from SAP's Java Connector (SAPJCo) API, the ALE Module receives values for DATS and TIMS fields in the following formats: `YYYY-MM-DD` (the hyphens are included) for the DATS data element, and `HH:mm:ss` (the colons are included) for the TIMS data element. The capitalized `HH` denotes 24-hour time, and not 12-hour time. When processing events, the ALE Module changes these formats to fit the 8-character and 6-character maximum size of their corresponding business object attributes. The connector shortens the length of the value by removing the hyphens from the date data and the colons from the time data.

### Event processing

Two RFC-enabled functions in an SAP application initiate all event processing for the ALE Module. The ALE's business object handler for event processing supports the functions `idoc_inbound_asynchronous` and `inbound_idoc_process`.

When processing events, this business object handler persistently stores business objects in an MQSeries queue. The connector maintains the Transaction IDs (TIDs) associated with the RFC call to guarantee that each piece of data is delivered once and only once.

**Important:** A single RFC call can send the data for one or more IDocs. Therefore, an MQSeries queue may contain a JMS-MQ message that represents multiple IDocs, each of which represents a business object. Each RFC call is associated with a single TID.

**Processing events in the MQSeries queue:** Figure 51 on page 132 illustrates how the ALE Module processes the MQSeries queue.

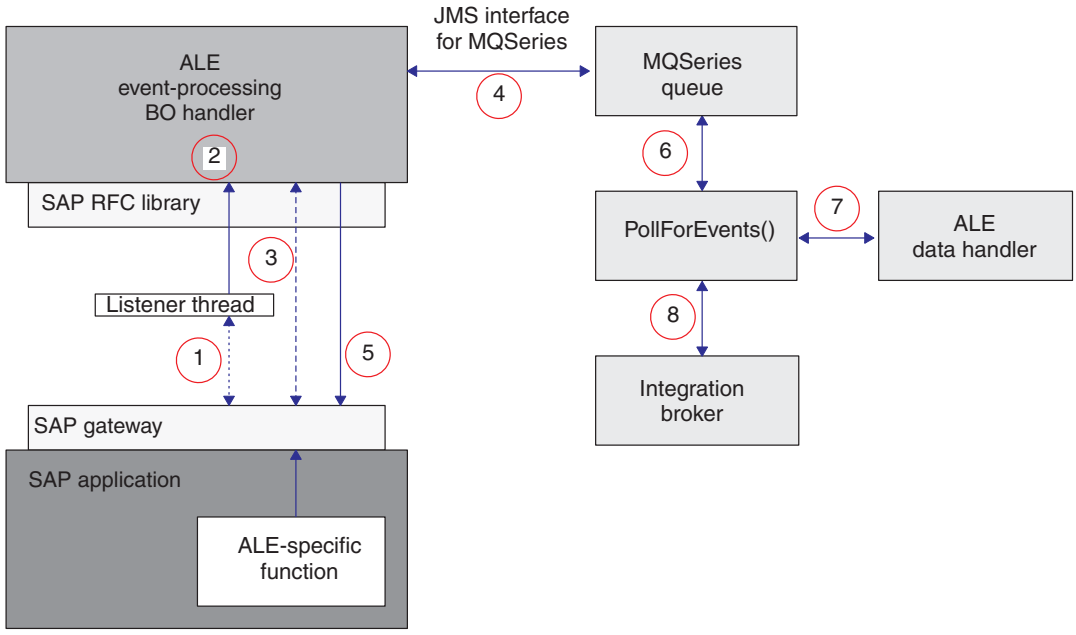



*Figure 51. Business object event processing*

Business-object event processing for the ALE Module executes in the following manner:

1. An RFC function pushes event data to the SAP Gateway, where a listener thread picks up events. The thread checks the TID associated with the event to determine whether a JMS-MQ message exists for the TID:
   - If the TID has not been sent previously, the connector continues to 2.
   - If the TID has been sent previously, the connector's behavior depends on the state of the previous transaction. If TidStatus is `CREATED`, the connector removes the IDoc data from the message. If the status is `ROLLBACK`, the connector changes the status to `CREATED`, and if IDoc data exists in the message, the connector removes the IDoc data from the message. If the status is `EXECUTED`, the connector returns control to SAP.
2. The listener thread instantiates the ALE event-processing business object handler, which retrieves the RFC-interface data from the SAP Gateway.
3. The business object handler formats each transaction into a JMS-MQ message, which it stores persistently in the queue specified by the `SAPALE_Wip_Queue` configuration property.

   Each JMS-MQ message represents a single RFC call. Each RFC call can represent one or more business objects associated with a single TID. The connector stores the TID in the message's CorrelationID property, sets the TidStatus to `CREATED`, and sets the IDocProcessStatus to `unknown`. The connector uses the message body to store IDoc data.

   For a large object, the connector breaks up the object into multiple messages so as to enable more efficient processing. For details about how to enable this support, see "Event processing components" on page 122 and Table 20 on page 133.
4. After each transaction completes, the connector changes the value of TidStatus and sends a confirmation back to SAP indicating that the transaction is complete. After SAP receives the confirmation, it removes the TID and its associated data from the SAP application.

If the AleUpdateStatus configuration property evaluates to `true`, the connector updates the status of the IDoc in SAP. If it retrieves a packet of IDocs, it updates the status of all IDocs in the packet. For more information, see "Updating the IDoc status in SAP" on page 135.

5. The connector moves the JMS-MQ message from the WIP queue to the queue specified by the `SAPALE_Event_Queue` configuration property.
6. The ALE Module's polling thread picks up the event message from the Event queue.
7. The connector instantiates an ALE data handler that will convert the data in the message body to business objects for posting to the integration broker.
8. The connector attempts to post each business object to the integration broker. If the integration broker is WebSphere Interchange Server, the connector first checks if there are subscriptions for the business object. After processing all the business objects in the message body, the message's IDocProcessingStatus and BOProcessingStatus are updated and the message is moved to the queue specified by the SAPALE_Archive_Queue property. For more information on IDocProcessingStatus see, ″Creating archive messages″ and on BOProcessingStatus see, ″Structure of JMS-MQ message for event and archive processing″.

The ALE Module uses FIFO (First In, First Out) to maintain the processing order when reading the messages from the Event queue.

**Important:** Connector polling is required for this module to manage errors properly when it processes application events. Therefore, do not set the value of the connector's `PollFrequency` property to `key` or to `no`. Do not allow the SAP application to trigger events to the connector until you have verified that the connector's log displays the installation of the required RFC functions.

**Resubmitting events:** Events that have been placed in the SAPALE_Unsubscribed_Queue and the SAPALE_Error_Queue can be resubmitted using a command line utility (`BIA_AleEventUtil.bat` for Windows, and `BIA_AleEventUtil.sh` for Unix) located in the following directory: *ProductDir*`/connectors/SAP/utilities/ALEEventUtil/`, where *ProductDir* represents the directory where the connector is installed. For more information, see "ALE Module Queue Management utility for event processing" on page 136.

**Structure of JMS-MQ message for event and archive processing:** Table 20 describes the structure of the message that the connector sends to the Event and Archive queues.

*Table 20. Structure of JMS-MQ message for event and archive processing*

| JMS Message Header Property | Description |
|---|---|
| `CorrelationId` | The connector sets the value of this property from the Transaction ID (TID) sent by SAP.<br><br>When breaking up a large IDoc into smaller message parts, this property identifies to which larger message the part pertains. The connector sets this value to the `JMSMessageID` of the first part in the set. Note that the `CorrelationID` of the first part is always that of the first JMS-MQ message associated with the large IDoc. For details about breaking up an IDoc into smaller message parts, see "Event processing components" on page 122. |

*Table 20. Structure of JMS-MQ message for event and archive processing (continued)*

| JMS Message Header Property | Description |
|---|---|
| JMSMessageID | The unique ID of the message. When breaking up a large IDoc into smaller message parts, the connector sets the value of this property for all parts other than the first one to the JMSMessageID of the first part. For details about breaking up an IDoc into smaller message parts, see "Event processing components" on page 122. |
| MutliPartMessage | When breaking up a large IDoc into smaller message parts, the connector uses this property to identify the message with the appropriate part of the larger message. For example, assuming the original larger IDoc message is partitioned into 8 JMS-MQ messages, then the value of the MultiPartMessage property of each part is 1 of 8, 2 of 8, and so on for each message. For details about breaking up an IDoc into smaller message parts, see "Event processing components" on page 122. |
| TidStatus | Maintains the status of the TID. |
| IDocProcessStatus | Maintains the status of the IDoc object during event processing. |
| BOProcessingStatus | Maintains the status of all IDocs in the message using the format, <CID> :: <IDoc sequence number><Status symbol>. Possible status symbols are S for Success, F for fail and U for unsubscribed. For example "<CID> :: 0S, 1F, 2U" means the first IDoc was successful, second failed, and third was unsubscribed for CorrelationId = <CID>. |

Table 21 describes the possible values for the IDocProcessStatus property after an event is moved to the Archive queue.

*Table 21. Archive queue values for the IDocProcessStatus message property*

| IDocProcessStatus property value | Event status | Description |
|---|---|---|
| success | Success | All business objects in the message have been posted with no errors. |
| partial | Partial success | One or more but not all business objects in the message have been posted with an error. If the integration broker is WebSphere Interchange Server, one or more but not all business objects in the message have been posted with an error or are unsubscribed. |
| unsubscribed | Unsubscribed | If the integration broker is WebSphere Interchange Server, all business objects in the message are unsubscribed. |
| fail | Fail | All business objects in the message have been posted with an error. |

**Creating archive messages:** When the message is moved from the Event queue to the Archive queue, the IDocProcessingStatus and BOProcessingStatus are updated. The message body remains unchanged.

For example, assume the connector processes an event message with four IDocs, each of which it transforms or attempts to transform into a business object, with the results illustrated in Table 22:

*Table 22. Archive message creation*

| Status of IDoc or business object | Resulting archive message |
|---|---|
| Successfully transforms the first IDoc, and posts the business object to the integration broker | The IDocProcessStatus is updated to success and the BOProcessingStatus is `<CID> :: 0S` |
| Fails to transform the second IDoc into a business object | The IDocProcessStatus is updated to partial and the BOProcessingStatus is `<CID> :: 0S, 1F` |
| Successfully transforms the third IDoc, and posts the business object to the integration broker | The IDocProcessStatus is set to partial and the BOProcessingStatus is `<CID> :: 0S, 1F, 2S` |
| Successfully transforms the fourth IDoc, but the business object created is not subscribed in the integration broker | • The IDocProcessStatus is set to partial and the BOProcessingStatus is `<CID> :: 0S, 1F, 2S, 3U`<br>• After processing the last IDoc, moves the message from the Event queue to the Archive queue and gives it IDocProcessStatus of partial and BOProcessingStatus of `<CID> :: 0S, 1F, 2S, 3U` |

**Supporting multiple message types for event processing:**

You can use the same instance of the connector for different message types that refer to the same IDoc type, however a different business object definition is required for each message type. To create a different business object definition, copy and rename the business object definition of the IDoc type. Make sure you configure the correct MsgType in the verb ASI of the appropriate verb.

**Updating the IDoc status in SAP:** To cause the connector to update a standard SAP status code after the ALE Module has retrieved an IDoc for event processing, you must:

- Set the `AleUpdateStatus` configuration property to `true` and set the value of the `AleSuccessCode` and `AleFailureCode` configuration properties.
- Configure the inbound parameters of the Partner Profile of the Logical System in SAP to receive the `ALEAUD` message type.

If `AleUpdateStatus` evaluates to `true`, the connector sends the `ALEAUD` IDoc to SAP with status code information and descriptive text. The `ALEAUD` IDoc calls the `IDOC_INPUT_ALEAUD` function module. The connector supports sending the following status codes to this function module:

- IDoc has been completely posted in the business integration system.

  The `AleSuccessCode` connector-specific configuration property can have a value of `52` or `53`. SAP converts this value to `41`.
- IDoc cannot be processed in the business integration system.

  The `AleFailureCode` connector-specific configuration property can have a value of `68`. SAP converts this value to `40`.

In both of the cases above, the business integration system does not send further status codes that would indicate further processing.

For information on setting the connector-specific configuration properties that are required to return IDoc status, see:

- "AleUpdateStatus" on page 314
- "AleSuccessCode" on page 315
- "AleFailureCode" on page 315

For information on setting the connector-specific configuration properties that are optional to return IDoc status, see:

- "AleSelectiveUpdate" on page 314
- "AleStatusMsgCode" on page 315
- "AleSuccessText" on page 315
- "AleFailureText" on page 315

## ALE Module Queue Management utility for event processing

Use this command-line utility for maintenance of MQ queues used by the WebSphere Business Integration adapter for mySAP.com's (v. 5.3.2) ALE Module. The utility resubmits event messages, dumps event messages to a file system for viewing, and archives messages to a file system.

An IDoc is processed in a unit of work called a transaction. An SAP transaction containing more than one IDoc is called a transaction packet. The adapter processes transactions and transaction packets by using an MQ message to hold the IDoc or IDocs. The adapter converts the IDoc into its corresponding business object. The ALE Module handles processing of IDocs in a two-step process: SAP to the adapter, then the adapter to the broker. Exceptions are handled differently for each step.

For more information about MQ messages, see the WebSphere Business Integration Library: http://www.ibm.com/software/integration/wmq/library/.

**Processing IDocs from SAP to the adapter:** If the adapter detects unsubscribed or unsupported business objects or raises any exceptions during IDoc transmission, the adapter will fail the SAP transaction. Failed transactions can be viewed and resubmitted from SAP transaction SM58. Before resubmitting the transaction, address the exception:

- `Unsupported`: add agent support for the business object.
- `Unsubscribed`: restart the collaboration for the business object.
- Other exceptions: view the adapter logs to determine the exception and make the necessary correction.

Once this step executes successfully, the transaction with SAP is complete.

**Important:** To prevent duplicate event delivery, do not resubmit a corrected IDoc transaction or individual IDoc within a transaction packet.

**Processing IDocs from the adapter to the broker:** If an MQ message contains a single business object and is unsubscribed, the MQ message will be moved to the unsubscribed queue. Each unsubscribed business object within a transaction packet will persist as its own MQ message on the unsubscribed queue. The original MQ message remains intact and contains the processing status of the individual IDocs. Once the transaction packet for the MQ message is completely processed, it is moved to the archive queue.

Before resubmitting the transaction, address the exception:

- `Unsubscribed`: restart the collaboration for the business object.

- Other exceptions: view the adapter logs to determine the exception and make the necessary correction.

After you complete the correction, use the command utility `AleEventUtil` to move the MQ message back to the event queue, resubmitting the event.

When an IDoc contains malformed data or contains 'nodata', the IDoc is moved to the Error Queue as its own message.

**Installing and configuring the ALE Module Queue utility:** The ALE Module Queue utility is packaged with the SAP adapter. When installed, it has the following directory structure:

```
\Connectors\SAP\BIA_AleEventUtil.jar

\Connectors\SAP\BIA_AleEventUtil.bat

\Connectors\SAP\BIA_AleEventUtil_readme.txt
```

Modify the start script file, `BIA_AleEventUtil.bat`, to capture the following parameters. To access local queue managers, you need only configure `MQQueueManager`.

| Variable | Description | Comments |
|---|---|---|
| `MQQueueManager` | Name of the Queue Manager | Required parameter. |
| `MQChannel` | Server connection channel name | Required for accessing remote queue manager. |
| `MQPort` | Port on which the channel is listening | Required for accessing remote queue manager. |
| `MQHost` | Host name or IP address on which the Queue Manager is running | Required for accessing remote queue manager. |
| `MQUser` | Valid username on MQHost | Required for accessing remote queue manager. |
| `MQPassword` | User password | Required for accessing remote queue manager. Value not encrypted. |

**Running the MQ management utility:** After installing and configuring the utility, navigate to the directory where the ALE Module Queue Management Utility is installed. Valid commands for the utility are:

```
-c <choice> (valid options are [move, archive, dump, replicate])

-i <inputq>

-o <outputq>

-f <outputfile>

-d <date>

-u <unique message ID>

-n <replication count>
```

**Note:** When there is an existing file with the same name, the `archive` command will raise an exception but the `dump` command will overwrite the file.

To dump the contents of a message to a file, from a command prompt change to the directory where the utility is installed and run the following command:

```
BIA_AleEventUtil -cdump -i<QueueName> -f<OutputFileName>
```

To move messages from one queue to another, run the following command. This command will move all the messages in the queue:

```
BIA_AleEventUtil -cmove -i<FromQueue> -o<ToQueue>
```

To move a single message, use the additional parameter of `MessageIdByte` corresponding to the message ID of the desired message:

```
BIA_AleEventUtil -cmove -i<FromQueue> -o<ToQueue> -u<MessageIdByte>
```

To move all the messages equal to or earlier than a specified date, add the `Date` parameter:

```
BIA_AleEventUtil -cmove -i<FromQueue> -o<ToQueue> -d<date(YYYYMMDD)>
```

To archive messages from a queue to a file, removing all messages equal to or earlier than a specified date, use this command:

```
BIA_AleEventUtil -carchive -i<QueueName> -f<ArchiveFileName>
-d<date(YYYYMMDD)>
```

## Request processing

The vision connector framework uses the value of the verb `AppSpecificInfo` property of the top-level business object to instantiate the ALE request-processing business object handler. The `doVerbFor()` method in the request-processing business object handler initiates all business object requests.

The business object handler converts the business object data into two tables that represent the IDoc format and its metadata component, the control record. Once the data is in IDoc format, the business object handler makes an RFC call to the appropriate SAP function module: either `idoc_inbound_asynchronous` or `inbound_idoc_process`. Because ALE is asynchronous, the connector does not wait for a return response.

**Important:** By default, parent wrapper business objects generated by SAPODA contain a TransactionId attribute. A value in this attribute causes the connector to manage TIDs when processing service call requests. If you do not want TID management for request processing, do not set a value for this attribute. For more information, see "Parent wrapper business object" on page 145.

**Note:** The value of the TransactionId attribute must be a unique identifier. The value is not the equivalent of a TID in the SAP application. These values are stored in a table within the JMS_MQ message in the queue specified by the `SAPtid_Queue` configuration property.

If the TransactionId attribute does not have a value, the ALE Module sends the request directly to SAP. If the TransactionId attribute has a value, the ALE Module does the following:

1. The connector checks whether the JMS-MQ message in the queue specified by the SAPtid_Queue configuration property has this value.
   - If the value of the business object's TransactionId attribute, ObjectID, does not exist in the table of the JMS_MQ message, a new entry is created in the table. ObjectID becomes the key to the table entry. Then the connector retrieves a new TID from SAP and that TID is assigned to this ObjectID. The connector also sets the TidStatus for this ObjectID to CREATED
   - If ObjectID does exist in the table, the connector's behavior depends upon the TidStatus for this OjbectID. If TidStatus is CREATED, the connector continues to 2. If TidStatus is ROLLBACK, the connector changes the value to CREATED, and continues to 2. If TidStatus is EXECUTED, the key is removed and archived.
2. The connector converts the business object to RFC tables and makes an RFC call to SAP.
   - If the call posts successfully, the connector updates the key's TidStatus to EXECUTED.
   - If the call fails to post to SAP or raises an exception, the connector updates the key's TidStatus to ROLLBACK.
3. After SAP acknowledges receipt of the RFC call, the connector removes the key from the table, archives the key, and returns a success status to the integration broker.

**Archiving:** After successfully processing a service call request, the corresponding entry in the table of the JMS-MQ message in the SAPtid_Queue is removed and archived to a directory. A file is created in the \ale\request subdirectory for WINNT or /ale/request for Unix systems. The ale subdirectory is located in the directory where the adapter is started. The entry that has been removed from the table will be used to create the new file. The file name will have the following format: <ObjectID>_<TID><timestamp>.executed where ObjectID is the value from the TransactionId attribute, TID is the transaction ID from SAP, and timestamp is the time stamp of when the file was created.

The adapter itself manages the deletion of these archive files using the connector configuration property ArchiveDays. The value in the connector configuration property, ArchiveDays, determines the amount of days these archived files will persist in the ale\request sub-directory. Any files older than the number of days specified in ArchiveDays will be deleted. If this property is not configured, the default value for ArchiveDays is seven days. These archive files can also managed manually by deleting the files yourself.

**Resubmitting failed requests:** For all failed requests indicated by the integration broker, check whether an archive file has been created for the request. If the archive file exists for the Object ID in the request then do not resubmit the request from the integration broker. Resubmit the request if there is no archive file for that ObjectID. Ensure the ArchiveDays connector configuration property is set to a value that will allow for verification of resubmitted requests.

**Columns in the table of the JMS MQSeries message for request processing:** Table 23 describes the columns of the JMS-MQSeries message that the connector gets from the SAPtid_Queue:

*Table 23. Columns of JMS-MQ message for request processing*

| Column name | Description |
|---|---|
| ObjectID | The value that is in the TransactionID attribute of the requested business object. This value is used as the key for the table |
| TID | The transaction ID obtained from SAP |
| TidStatus | Status of the transaction |

**Supporting multiple message types for request processing:**

For event processing, you can use the following mechanisms:

- Using the same business object to represent an IDoc type, the verb ASI metadata is configured with different combinations of MsgType / MsgCode / MsgFunction. The combination of values specified for each verb should be different. For example, configure the ASI as follows for the different verbs:

  ```
  Verb=Create   VerbASI : MsgType=ORDERS; MsgCode=MC01;MsgFunction=MF01
  Verb=Update   VerbASI : MsgType=ORDERS;MsgCode=MC02;MsgFunction=MF02
  Verb=Delete    VerbASI : MsgType=ORDERS;MsgCode=MC03;MsgFunction=MF03
  ```

  Note that two different verbs cannot use the same combination of MsgType/MsgCode/MsgFunction values.

  Or, you can have a different message type for each verb:

  ```
  Verb=Create   VerbASI :  MsgType=ORDERS;MsgCode=;MsgFunction=
  Verb=Update   VerbASI :  MsgType=ORDCHG;MsgCode=;MsgFunction=
  Verb=Delete    VerbASI :  MsgType=;MsgCode=;MsgFunction=
  ```

- If you need to use the same business object and verb combination for different message types, create copies of the same IDoc type business object with different names. For example, the business objects sap_orders_05_ORDERS and sap_orders_05_QUOTES both refer to the same IDoc type definition and are copies of the same business object. The ASI for each object is configured as follows:

  **Verb ASI for sap_orders_05_ORDERS**

  ```
  Verb=Create  VerbASI : MsgType=ORDERS;MsgCode=;MsgFunction=
  ```

  **Verb ASI for sap_orders_05_QUOTES**

  ```
  Verb=Create  VerbASI :  MsgType=QUOTES;MsgCode=;MsgFunction=
  ```

# Chapter 12. Developing business objects for the ALE Module

This chapter describes the business objects required for the ALE Module. It also discusses how the business object generation utility, SAPODA, generates the definitions. The chapter assumes you are familiar with how the connector processes business objects. For more information on the ALE Module, see Chapter 10, "Overview of the ALE Module," on page 121.

Use SAPODA to generate business object definitions for this module. SAPODA uses the SAP application's native IDoc (Intermediate Document) definitions as templates for business object definitions for the ALE Module. After creating the definitions, you can use Business Object Designer or a text editor to modify them. You can use SAPODA to generate business object definitions for the ALE Module based upon an IDoc:

- Extracted to a file
- Defined in the SAP system

IDocs must adhere to a specific format for SAP to process them correctly. Therefore, when you develop a business object definition for the ALE Module, ensure that the definition follows the IDoc Structure as defined in SAP.

For information on using SAPODA, see Chapter 5, "Generating business object definitions using SAPODA," on page 47.

This chapter contains the following sections:



## Creating the IDoc definition file

Before using SAPODA to generate a business object definition from an IDoc definition file, you must create the IDoc definition file for each IDoc you want to support. SAPODA uses this file as input. Use transaction `WE63` in SAP to create the IDoc definition file.

**Note:** If you use SAPODA to generate the definition from an IDoc defined in the SAP system, you do not need to create this IDoc definition file.

To create the IDoc definition file:

1. In SAP, select transaction WE63 by entering `/oWE63`.
2. Deselect the Output IDoc record's check box.
3. Select the Output IDoc type's check box.
4. In the IDoc type's field, enter the basic IDoc type or the custom IDOC type.
5. Select the Output Segment Fields' check box.
6. Click the Execute icon at the top of the screen. The IDoc definition is displayed on the screen.
7. Save the definition to a local directory.

**Important:** You must log on to the SAP system in English to generate business object definitions from IDoc files. Because SAPODA uses a text field in the IDoc's definition to generate attribute names, and because attribute names must be in English, it is important that you generate definitions from English-language files.

## Business object structure

The WebSphere business object for SAP for the ALE Module is made up of a top-level parent wrapper object and two child objects: the control record object and the data record object. This section describes the following:



### Illustration of business object structure

Figure 52 illustrates the structure of a WebSphere business object for the ALE Module.

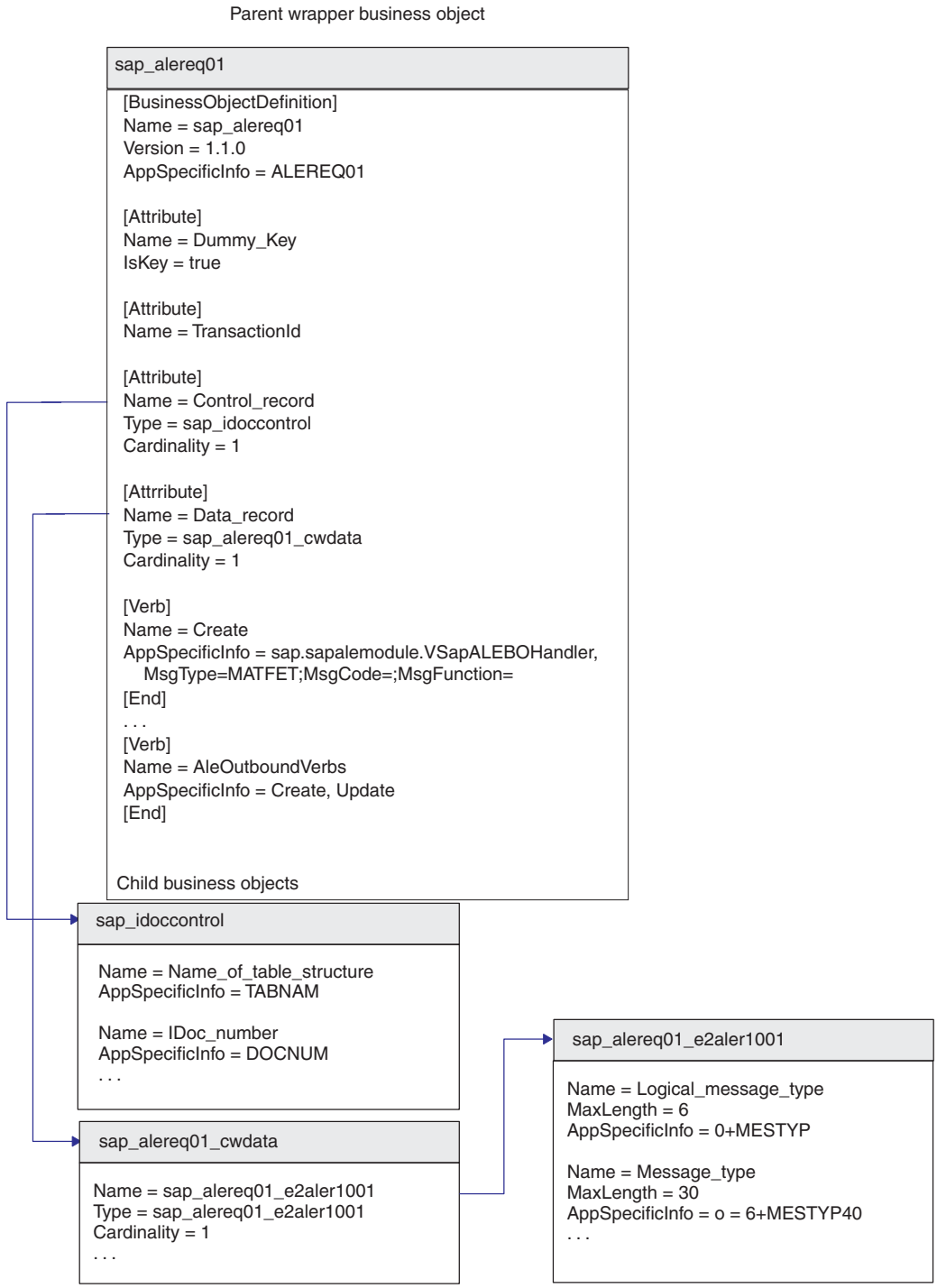



*Figure 52. Relationship of WebSphere business objects for SAP and an IDoc*

## Business object naming conventions

This section describes the following:

## Standard naming conventions

The ALE Module requires its business objects to follow the naming conventions described in Table 24. SAPODA, which generates all but the control record business object, derives the business object and attribute names from the IDoc definition in accordance with these conventions.

*Table 24. IBM WebSphere SAP business object naming conventions*

| IBM WebSphere business object or attribute | Name | Type |
|---|---|---|
| Parent wrapper business object | *BOprefix_BasicIDocType*<br>**Note:** The illustrations in this chapter use SAP_ or sap_ as the business object prefix. You can specify your own meaningful prefix when you create your business object definitions. | n/a |
| Control Record business object | Control_record | sap_idoccontrol |
| Data Record business object | Data_record | *BOprefix_BasicIDocType*_cwdata |
| Data Record child business object | *BOprefix_BasicIDocType_ IDocSegmentName* | *BOprefix_BasicIDocType_ IDocSegmentName* |
| Data Record attribute | *IDocFieldName* or IDoc Field Description | When generating the business objects, the user has the choice to either choose IDoc segment field names or field descriptions as the BO attribute names. |

Component names in the WebSphere business integration system support only alphanumeric characters and the underscore character (_). Therefore, when naming components in a generated business object definition, SAPODA replaces special characters in the IDoc segment field descriptions or field names with underscore characters. For example, SAPODA changes the spaces, parentheses, and periods in the following SAP description to underscores in the corresponding attribute name:

```
Partner function (e.g. sold-to party, ship-to party)
```

SAPODA represents the above description in the generated business object definition as:

```
Partner_function__e_g__sold_to_party__ship_to_party__
```

SAPODA guarantees that all attribute names in the business object definition are unique. If an IDoc has multiple fields with the same field descriptions, then SAPODA adds a counter suffix to the generated attribute name.

When naming an attribute, SAPODA prepends a string to the attribute name when the changed attribute name:

- Begins with a digit—prepends A_
- Begins with the underscore character (_)—prepends A

**Important:** You can modify attribute names at any time after you generate the business object. However, when you modify an attribute name, do not modify its application-specific information. The connector uses this text to identify the IDoc field to which the business object attribute corresponds. For more information, see "Application-specific information: Data record business object" on page 149.

## Using IDoc extensions/types

You can generate a business object definition based on a a custom IDoc type that has been created from the combination of a basic IDoc type and an Extension type. SAPODA names the parent wrapper business object that it generates in the following format:

sap_*IDocType*

**Important:** When loading a business object definition for an IDoc extension into the InterChange Server repository, you might encounter conflicts if a business object definition for the basic IDoc Type already exists in the repository and its name matches the basic IDoc Type plus extension. You must manually resolve these conflicts.

## Parent wrapper business object

The name of the parent wrapper business object is the basic IDoc type prefixed by a user-defined prefix followed by an underscore (_), for example sap_. The parent wrapper business object contains four attributes: Dummy_key, Control_record, Data_record, and TransactionId.

The IDoc top-level object Dummy_key attribute is used to map key fields from the Control and Data records to the Dummy_key in the top-level object. The connector handles Dummy_key mapping in the following manner:

1. The attribute level ASI for the Dummy_key attribute is configured as the path of the attribute from which the value is set. In other words, the attribute level ASI is set to the path within the business object tree of the attribute that is being mapped to the top-level object. The delimiter for value pairs is ; (semicolon). The delimiter for the path to the key attribute from the child is : (colon). The absolute path should be specified for the foreign key (FK).

   For example,
   DummyKey;FK=Data_record:sap_orders05_e2edk01005:IDOC_document_number"
2. If the connector detects multi-cardinality objects in this path, it uses the first child instance from this container. This is true for all the multi-cardinality objects wherever they occur in the business object tree.
3. If the ASI is incorrect or if the mapped attribute value is empty, the connector fails the event and places it in the SAPALE_Error_Queue. This is also the case when the ASI is configured to set the object type value as the Dummy_key. Note that the Dummy_key attribute can only hold values from simple type attributes.

The Control_record and Data_record attributes represent single-cardinality child business objects.

The type of the Control_record attribute is sap_idoccontrol. This business object definition is provided with the ALE Module.

The type of the Data_record attribute is *BOprefix_BasicIDocType*_cwdata. This business object definition contains one or more child business objects, depending on the IDoc segment definition of a basic IDoc type from the SAP application.

The value in the TransactionId attribute determines whether the connector manages TIDs when processing service call requests. If you do not want TID management for request processing, do not set the value for the TransactionID attribute.

The application-specific information of the parent wrapper business object indicates:

- The type of IDoc to be created
- The IDoc extension—Set only if the business object is generated from a customization of a basic IDoc type. For more information on generating the IDoc definition file, see "Before using SAPODA" on page 48.
- ALE Communication Partner information—Set only if your data requires more than one Partner type, Partner number, or Partner function.

### Syntax

The AppSpecificInfo property of the parent wrapper object has the following syntax:

```
BasicIDocType [,Pn=PartnerNumberOfRecipient [,Pt=
PartnerTypeOfRecipient[,Pf=PartnerFunctionOfRecipient
]]
```

### Explanation of syntax

*BasicIDocType*
: Specifies the basic IDoc type

`Ext`
: Specifies the extension type

`Pn`
: Specifies the Partner number of the recipient

`Pt`
: Specifies the Partner type of the recipient

`Pf`
: Specifies the Partner function of the recipient

### Example

```
AppSpecificInfo = ALEREQ01,Pn=ALESYS2,Pt=LS,Pf=EL
```

## Control record business object

The ALE Module uses a generic control record business object definition for all IDocs. It contains a superset of attributes that are present in the 3.x version (SAP structure `EDI_DC`) and the 4.x version (SAP structure `EDI_DC40`) of the control record. The control record business object definition is provided with the ALE Module, and must be loaded into the business object repository. Use Business Object Designer to load the business object into the repository.

**Note:** Alternatively, if the IBM WebSphere InterChange Server is the integration broker, you can use the `repos_copy` command.

Table 25 lists the simple attribute properties of the control record business object.

*Table 25. Properties of simple attributes in the control record business object*

| Property name | Description |
|---|---|
| Name | The value of the `Name` property is the modified value of the `TEXT` field in the IDoc definition. SAPODA replaces special characters (such as periods, slashes, and spaces) with underscores so that the name contains only alphanumeric characters and the underscore character (_), as described in "Business object naming conventions" on page 143 |
| Type | Specifies the type of data. SAPODA sets the value to `String`. |
| MaxLength | SAPODA derives the value of `MaxLength` from the `LENGTH` field in the IDoc definition. |

*Table 25. Properties of simple attributes in the control record business object (continued)*

| Property name | Description |
|---|---|
| IsKey | SAPODA sets this property to `true` on the first attribute of a business object. |
| IsForeignKey | SAPODA sets the value to `false`. |
| IsRequired | The `IsRequired` property specifies whether an attribute must contain a value. SAPODA set this property to `true` only on the `Name_of_table_structure` attribute in the control record object. |
| AppSpecificInfo | SAPODA derives the value from the NAME field in the IDoc definition. |
| DefaultValue | Specifies the value to assign to this attribute if there is no run-time value. SAPODA does not set a value for this property. |

**Important:** When an attribute's value is set to either `CxIgnore` or `CxBlank` in the control record business object, the connector sets the value to a blank space for the IDoc control record.

## Data record business object

An IDoc definition file has information about the structure of the IDoc, the IDoc segment hierarchy, and the fields that make up the segments. SAPODA uses the IDoc as input to generate the data record business object and its child business objects. The number of children depends on the IDoc segment definition of the basic IDoc type from the SAP application.

The top level of the data record business object corresponds to the basic IDoc type. This top-level business object contains an attribute that represents a child business object or an array of child business objects (one for each IDoc segment). The structure and hierarchy of the child business objects match that of the IDoc segments in the basic IDoc type.

Generating an IDoc from the system using SAPODA creates the data record object and its child business objects by making calls into the SAP system itself. Fields from an IDoc definition file are used in this section to help illustrate how different properties of a business object are set. Generating an IDoc from the system uses corresponding fields from the calls made into the SAP system.

This section describes:

- "Attributes: Data record business object"
- "Application-specific information: Data record business object" on page 149
- "Illustration of the relationship between business object and IDoc" on page 150

### Attributes: Data record business object

Table 26 describes the properties of each simple attribute in the data record business object. SAPODA generates the properties described below.

*Table 26. Simple attributes: data record business object*

| Property name | Description |
|---|---|
| Name | The value of the Name property is the modified value of the NAME or TEXT field in the IDoc definition. SAPODA replaces special characters (such as periods, slashes, and spaces) with underscores so that the name contains only alphanumeric characters and the underscore character (_), as described in "Business object naming conventions" on page 143. |
| Type | Specifies the type of data. SAPODA sets the value to String. |
| MaxLength | SAPODA derives the value of MaxLength from the LENGTH field in the IDoc definition. |
| IsKey | SAPODA sets this property to true on the first attribute in each business object. For every other attribute, SAPODA sets the value to false. |
| IsForeignKey | SAPODA sets the value to false. |
| IsRequired | Specifies whether an attribute must contain a value. SAPODA sets the value to false. |
| AppSpecificInfo | SAPODA sets the value of the AppSpecificInfo property to the value of the Name field in the IDoc definition prepended by the offset value and the + character; for example, for a segment field named SIGN with an offset of 40, it sets the following value for AppSpecificInfo: 40+SIGNFor more information, see "Application-specific information: Data record business object" on page 149. |
| DefaultValue | Specifies the value to assign to this attribute if there is no run-time value. SAPODA does not set a value for this property. |

**Important:** Simple attributes in the data record business object can have two special values: CxIgnore and CxBlank. Simple attributes set to CxIgnore or CxBlank are represented by blank spaces in the segment data string. SAP processes these attributes by placing one space character in the application field.

Table 27 describes the properties of each attribute in the data record business object that represents a child or array of child business objects. SAPODA generates the properties described below.

*Table 27. Attributes that represent child business objects*

| Property name | Description |
|---|---|
| Name | SAPODA sets the value to BOprefix_BasicIDocTypeIdocSegmentName; for example, SAP_E2ALER1001 |
| Type | SAPODA sets the value to: BOprefix_BasicIDocTypeIdocSegmentName |
| ContainedObjectVersion | SAPODA sets the value to 1.0.0. |
| Relationship | SAPODA sets the value to containment. |
| IsKey | SAPODA sets the value to false. |
| IsForeignKey | SAPODA sets the value to false. |
| IsRequired | The IsRequired property specifies whether a child business object must exist. SAPODA sets the value to false if the value of the STATUS field for the corresponding segment in the IDoc definition has a value of OPTIONAL. SAPODA sets this property to true if the STATUS field in the IDoc definition has a value of MANDATORY. |

*Table 27. Attributes that represent child business objects (continued)*

| Property name | Description |
|---|---|
| AppSpecificInfo | The AppSpecificInfo property contains information on the hierarchy level and minimum and maximum number of allowed occurrences of a segment. For more information, see "Application-specific information in attributes that represent children" on page 150. |
| Cardinality | If the value of the LOOPMAX field in the IDoc definition is 1, SAPODA sets the value to 1. If the value of LOOPMAX is greater than 1, SAPODA sets the value to n. |

## Application-specific information: Data record business object

This section describes how connector uses the value of the AppSpecificInfo property:

- "Application-specific information at the business-object Level"
- "Application-specific information in simple attributes"
- "Application-specific information in attributes that represent children" on page 150

**Application-specific information at the business-object Level:** The connector uses the value of the AppSpecificInfo property at the business-object level of the data record and each of its children to obtain the name of the associated Idoc and its segments:

- The syntax of the application-specific information on the data record business object is:

  *IDocType*_CWDATA

  For example, given an IDoc named ALERQ01, SAPODA creates the value of the AppSpecificInfo property as ALERQ01_CWDATA.
- The value of the application-specific information on the children of the data record business object is the corresponding segment name. For example, given IDoc ALERQ01 with two segments named E2ALER1001 and E2ALEQ1, SAPODA automatically creates the value of the AppSpecificInfo property for the two child business objects as:
  - First child: E2ALER1001
  - Second child: E2ALEQ1

**Application-specific information in simple attributes:** The connector uses the value of the AppSpecificInfo property of simple attributes to obtain the field name in SAP and its position (offset) in the data string.

The offset value is the position of the first character of the attribute value in the data string. The offset value is calculated by subtracting the value in the BYTE_FIRST value of the first field in the IDoc definition from the BYTE_FIRST value of the given attribute. This value is used with the MaxLength property to build the data string for the IDoc segment.

The syntax of the AppSpecificInfo property of simple attributes is:

*OffsetNumber*+IDoc*FieldName*

For example, a segment field named SIGN with an offset of 40 has the following value for AppSpecificInfo:

40+SIGN

**Application-specific information in attributes that represent children:** The connector uses the value of the `AppSpecificInfo` property of attributes that represent a child or array of child business objects to obtain information on the hierarchy level and minimum and maximum number of allowed occurrences of a segment. SAPODA sets the `AppSpecificInfo` property for these attributes by obtaining information from the `LEVEL`, `LOOPMIN` and `LOOPMAX` fields in the IDoc definition.

## Illustration of the relationship between business object and IDoc

Figure 53 illustrates the relationship between the WebSphere data record business object and the IDoc definition from an SAP application.

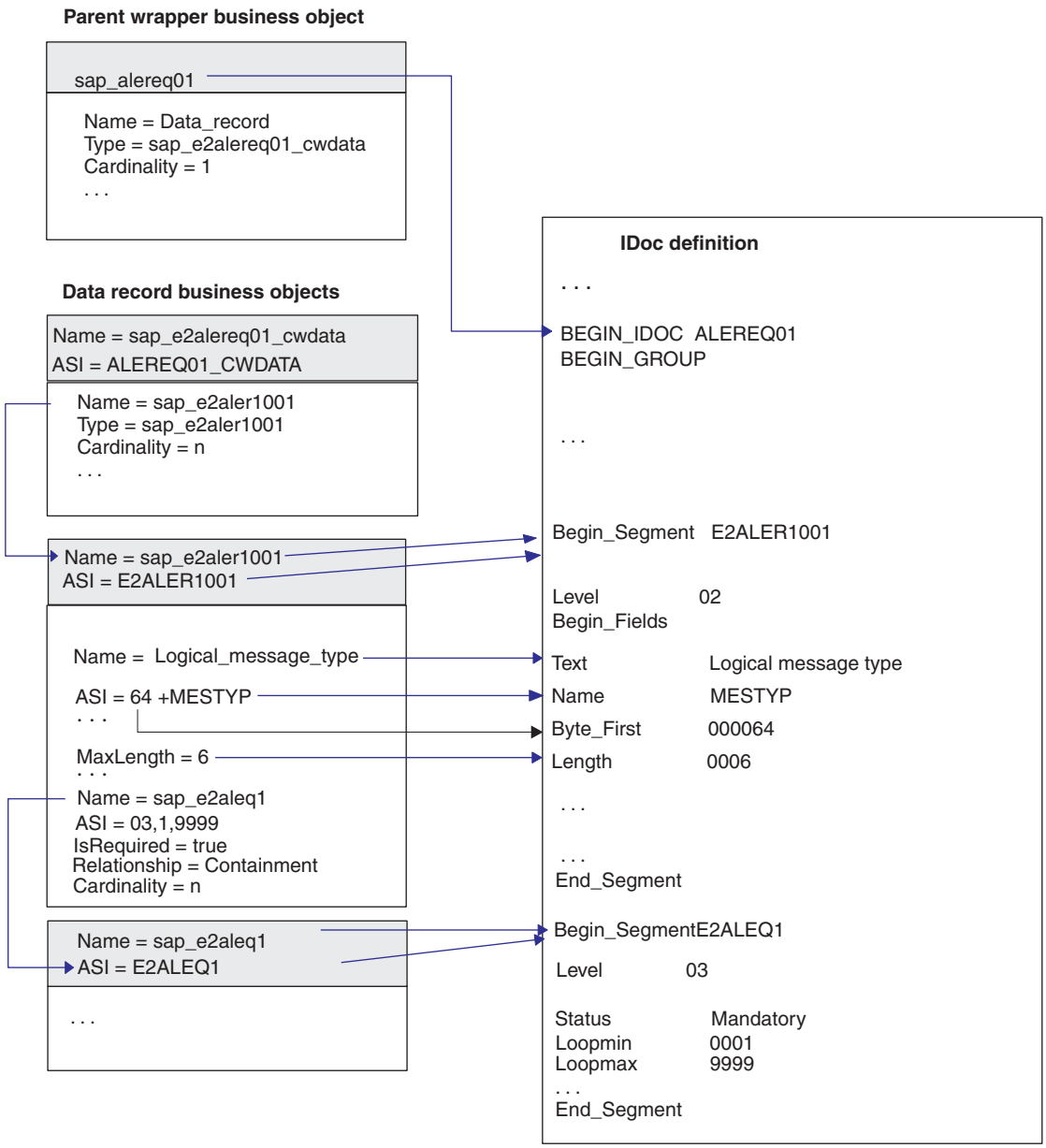



*Figure 53. Relationship Between data record business object and IDoc Definition fields*

## Supported verbs

Verb support for the ALE Module is limited by the verbs that SAP supports through its ALE interface. SAPODA generates the Create, Update, Delete, and Retrieve verbs in the business object definition. Implementation of each verb requires knowledge of the ALE configuration within SAP.

SAPODA generates the `AppSpecificInfo` for the verbs and the `AleOutboundVerbs` meta-verb on the parent wrapper business object. However, it populates only one of the parameters of the `AppSpecificInfo` with values: it specifies the business object handler to use for service-call request processing. For all other processing, you must manually modify the business object definition to add or remove specific information:

- When using the business object for event processing, you must specify values for the following the `AppSpecificInfo` properties:
  - Parent wrapper business object's verb—specify a value for those parameters that uniquely identify the verb. Depending on the requirements of your ALE configuration, specify the message type, message code, and message function. Make these changes after you import the business object definition into your repository.

    **Important:** SAPODA inserts the `AppSpecificInfo` value that specifies the business object handler, which the connector uses only for request processing. SAPODA does not insert values for the message parameters. If you are using the ALE Module for event processing, you must manually add the values for the message parameters.
  - Parent wrapper business object's `AleOutboundVerbs` meta-verb—a comma-separated list of verbs supported for event processing.
- When using the business object for request processing, you must specify a value for the following the `AppSpecificInfo` properties:
  - Parent wrapper business object's verb—specify the package and classname of the business object handler so that the connector can determine the appropriate business object handler. SAPODA inserts the following value into the `AppSpecificInfo` property of each standard verb: `AppSpecificInfo = sap.sapalemodule.VSapALEBOHandler`.
  - When using a wrapper business object to process multiple IDoc parent business objects, you must add the package and classname of the business object handler to the `AppSpecificInfo` property of each verb in the multiple IDoc wrapper business object.

  For each parent wrapper business object, SAPODA generates the Create, Retrieve, Update, and Delete verbs. For each of these verbs, it generates the following `AppSpecificInfo` values:

  ```
  sap.sapalemodule.VSapALEBOHandler,MsgType=;MsgCode=;MsgFunction=
  ```

## AppSpecificInfo property: Parent wrapper verb

The syntax of the `AppSpecificInfo` property of the parent wrapper business object's verb differs depending on whether the business object represents an application event or a service call request:

### Application event syntax

```
[BOHandler],MsgType=messageType;MsgCode=[messageCode];MsgFunction=[messageFunction]
```

**Note:** The connector matches the values in the control record with the values specified in the verb's AppSpecificInfo property to determine the verb.

### Service call request syntax

*BOHandler*[,MsgType=*messageType*;MsgCode=[*messageCode*];MsgFunction=[*messageFunction*]]

### Explanation of syntax

| | |
|---|---|
| *BOHandler* | Specifies the request-processing business object handler; the value defaults to the following: sap.sapalemodule.VSapALEBOHandler |
| MsgType | Specifies the message type configured for the IDoc in ALE |
| MsgCode | Specifies the message code configured for the IDoc in ALE; the connector requires a value only if MsgType does not uniquely identify the verb; however, specify a value if required by your ALE configuration |
| MsgFunction | Specifies the message function configured for the IDoc in ALE; the connector requires a value only if MsgType and MsgCode do not uniquely identify the verb; however, specify a value if required by your ALE configuration |

## AppSpecificInfo property: Parent wrapper meta-verb

In the AppSpecificInfo property of the parent wrapper business object's AleOutboundVerbs verb, specify those verbs the connector should support for application-event processing, separating verbs with a comma.

**Important:** SAPODA generates values for the Create, Retrieve, Update, and Delete verbs. After the definition has been generated, you must manually delete those verbs that you do not want the connector to support.

The following example instructs the connector to support the Create and Update verbs for processing application events:

```
[Verb]
Name = AleOutboundVerbs
AppSpecificInfo = Create, Update
[End]
```

# Processing multiple IDocs with a wrapper business object

**Note:** This section is applicable only to service-call request processing.

When processing multiple IDocs, the ALE Module requires a wrapper business object as the top-level business object. The multiple IDoc wrapper business object contains an attribute that represents an array of IDoc parent wrapper business objects.

For each parent wrapper business object, SAPODA generates the Create, Retrieve, Update, and Delete verbs. For each of these verbs, it generates the following AppSpecificInfo values:

```
sap.sapalemodule.VSapALEBOHandler,MsgType=;MsgCode=;MsgFunction=
```

Figure 54 illustrates the relationship between a top-level wrapper object and it's child IDoc business objects.

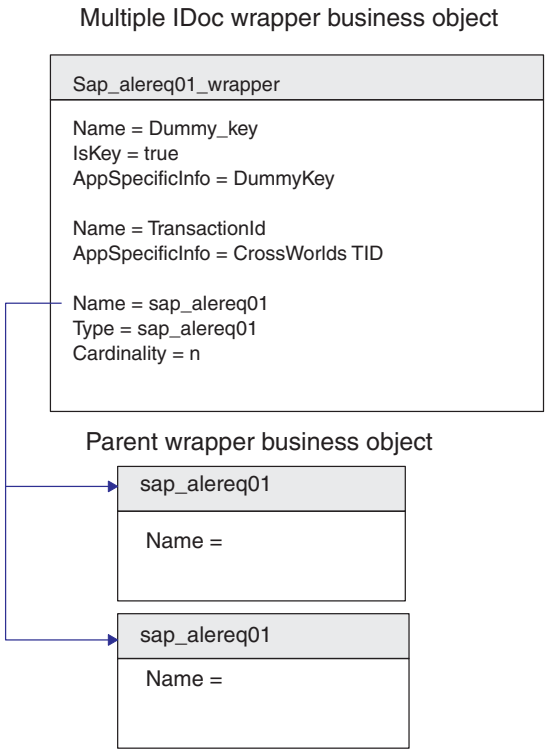



*Figure 54. Wrapper business object containing child business objects*

## Multiple IDoc wrapper object example

The following is a sample definition of a multiple IDoc wrapper business object:

```
[BusinessObjectDefinition]
Name = sap_alereq01_wrapper
Version = 1.0.0
AppSpecificInfo =

[Attribute]
Name = Dummy_key
Type = String
Cardinality = 1
MaxLength = 1
IsKey = true
IsForeignKey = false
IsRequired = true
AppSpecificInfo = DummyKey
DefaultValue =
[End]

[Attribute]
Name = TransactionId
Type = String
Cardinality = 1
MaxLength = 1
IsKey = false
IsForeignKey = false
IsRequired = false
AppSpecificInfo = CrossWorlds TID
DefaultValue =
[End]

[Attribute]
```

```
Name = sap_alereq01
Type = sap_alereq01
ContainedObjectVersion = 1.0.0
Relationship = Containment
Cardinality = n
MaxLength = 255
IsKey = false
IsForeignKey = false
IsRequired = false
AppSpecificInfo =
DefaultValue =
[End]

[Verb]
Name = Create
AppSpecificInfo = sap.sapalemodule.VSapALEBOHandler,MsgType=;MsgCode=;MsgFunction=
[End]

[Verb]
Name = Retrieve
AppSpecificInfo = sap.sapalemodule.VSapALEBOHandler,MsgType=;MsgCode=;MsgFunction=
[End]

[Verb]
Name = Update
AppSpecificInfo = sap.sapalemodule.VSapALEBOHandler,MsgType=;MsgCode=;MsgFunction=
[End]

[Verb]
Name = Delete
AppSpecificInfo = sap.sapalemodule.VSapALEBOHandler,MsgType=;MsgCode=;MsgFunction=
[End]
```

## Multiple IDoc wrapper: Attribute that represents the child business object

Table 28 lists and describes the properties of the attribute that represents the child business object in the multiple IDoc wrapper business object.

*Table 28. Multiple IDoc wrapper: attribute that represents child business object*

| Property name | Description |
|---|---|
| Name | Set the value to the name of the parent business object generated by SAPODA. |
| Type | Set the value to the name of the parent business object generated by SAPODA. |
| ContainedObjectVersion | Set the value to `1.0.0`. |
| Relationship | A child business object is contained by a parent business object; therefore, the value is `containment`. |
| IsKey | Set the value to `false`. |
| IsForeignKey | Set the value to `false`. |
| IsRequired | Set the value to `false`. |
| AppSpecificInfo | This property is not used for the attribute that represents child business objects in the ALE Module. |
| Cardinality | Set the value of the attribute in the top-level wrapper business object that represents the IDoc parent business object to cardinality `n`. |

# Part 4. RFC Server Module

# Chapter 13. Overview of the RFC Server Module



This chapter introduces the RFC Server Module of the IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x). The RFC Server Module enables the integration broker to receive business objects from SAP R/3 application version 3.1H or 3.1I applications that support RFC calls. It supports all SAP applications that use RFC-enabled functions by acting as a server to those applications.

## RFC Server Module components

The RFC Server Module is a connector module written in Java that supports RFC calls directly from an SAP application. It extends the Vision Connector Framework by implementing the VisionConnectorAgent class. The RFC Server Module uses the SAP RFC libraries that are written in Java and C, which enables external programs to communicate with an SAP application.

Figure 55 illustrates the overall architecture of the RFC Server Module. The RFC Server Module is made up of the connector framework, the connector's application-specific component for RFC Server, RFC Server-specific business object handlers, listener threads, and the SAP RFC Library.

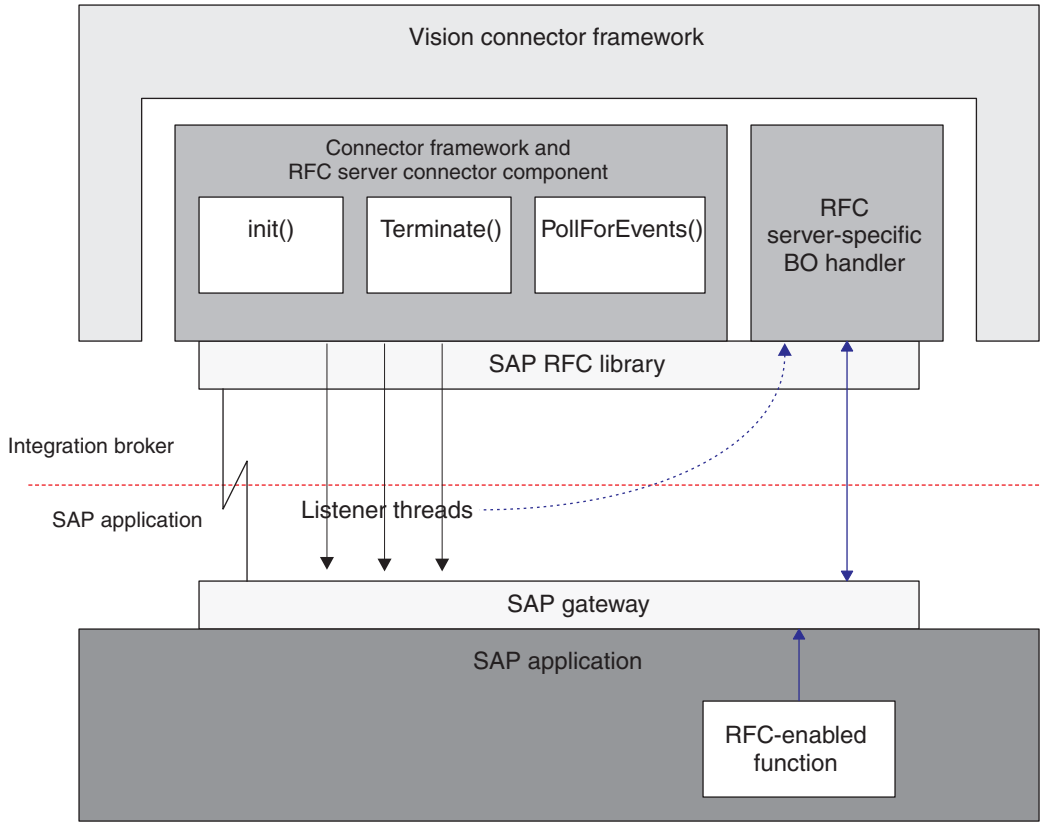



*Figure 55. RFC Server Module Architecture*

The RFC Server Module components:

- Spawn listener threads that open handles to the SAP application using the SAP RFC library and the SAP Gateway. Each listener thread opens a single handle to the SAP application.
- Process requests from RFC-enabled functions in the SAP application.
- Terminate connections to the SAP application.

## Listener Threads

Listener threads handle all of the RFC calls between the RFC Server Module and the SAP application. When the connector starts up, it spawns a configurable number of listener threads. Each listener thread opens a handle to the SAP Gateway.

The listener threads:

- Register with the SAP Gateway using a program identifier.
- Identify to the SAP Gateway the RFC-enabled functions that they support.
- Use the first available thread to pick up an event from a supported RFC-enabled function.
- Instantiate an RFC Server-specific business object handler based on the server verb in the corresponding business object, and then retrieve the event data from the SAP Gateway.
- Populate business objects with RFC event data, and then convert returned business object data to RFC event data.
- Return a response to the RFC-enabled function through the SAP Gateway.

**Note:** A thread listens continuously in a synchronous manner for events from RFC-enabled functions that it supports.

## RFC Server-specific business object handlers

The RFC Server-specific business object handlers are unique to each RFC-enabled function in the SAP application. Each business object handler is instantiated by a listener thread and invokes an associated business object.

Because the RFC Server Module acts as a server to the SAP application, it "pushes" or sends events from the SAP application to the integration broker. This behavior is very different from other modules, which poll the application for events. Because of this difference, RFC Server-specific business object handlers perform different tasks from other business object handlers.

Once instantiated, the RFC Server-specific business object handler:

- Retrieves the RFC event data and populates the associated WebSphere business object for SAP.
- Passes the business object to the integration broker and receives a business object in return.

  The business object handler uses the application-specific information of the business object's server verb to determine which collaboration should process the business object data.

  – When InterChange server (ICS) is the integration broker, the business object's server verb must specify a valid collaboration. Because a collaboration cannot explicitly subscribe to an event that is pushed to the connector, the RFC Server-specific business object handler must determine the appropriate collaboration, and then instantiate it

  - When a message broker is the integration broker, the business object's server verb must contain a dummy value.
- Converts the returned business object data back to RFC event data.
- Returns the RFC event data back to the SAP application.

# How the RFC Server Module works

The RFC Server Module implements the `init()`, `terminate()`, `pollForEvents()`, and `process()` methods.

This section describes:

- "Initialization and termination"
- "Business object processing" on page 161
- "Supporting RFC-Enabled Functions" on page 162

## Initialization and termination

The `init()` method creates a main thread that spawns a configurable number of listener threads which open a handle to the SAP Gateway. If the connector fails to initialize, it terminates using the `terminate()` method. The connector terminates by disconnecting the connection to the SAP Gateway.

During the initialization process, the RFC Server Module registers with the SAP Gateway using a specified Program ID. This Program ID must be set using the RfcProgramID connector configuration property and set up as a TCP/IP port in the SAP application. For more information on setting up a TCP/IP port, see "Registering the RFC Server Module with the SAP Gateway" on page 177.

## Business object processing

All processing of WebSphere business objects for the RFC Server Module is initiated by an RFC-enabled function in an SAP application. In the RFC Server Module, an RFC Server-specific business object handler supports only one RFC-enabled function; therefore, for each supported function in the SAP application, you must have an associated RFC Server-specific business object handler. In addition, you must have an associated business object for each RFC Server-specific business object handler.

Figure 56 illustrates business object processing for the RFC Server Module.

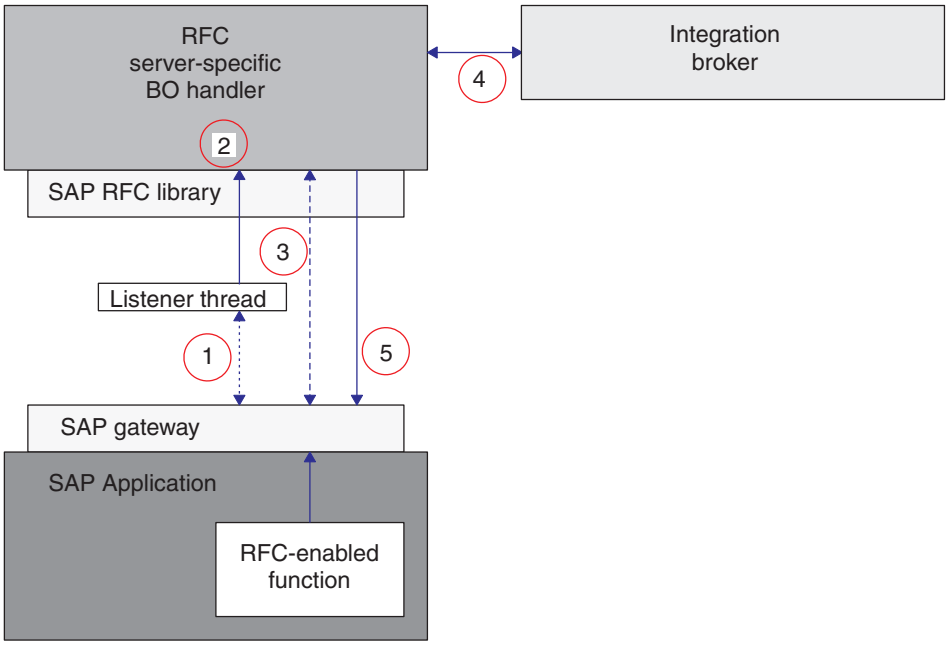



*Figure 56. Business object processing*

Business object processing for the RFC Server Module executes in the following manner:

1. A listener thread picks up a subscribed event from the SAP Gateway and matches the name of the corresponding RFC-enabled function with an RFC Server-specific business object handler.
2. The listener thread instantiates the appropriate RFC Server-specific business object handler based on data from the RFC event on the SAP Gateway, and then creates an instance of the corresponding business object.
3. The RFC Server-specific business object handler retrieves the RFC interface data from the SAP Gateway and populates the WebSphere business object for SAP.
4. The RFC Server-specific business object handler passes the business object to the integration broker.
5. The business object handler receives the returned business object from the integration broker, converts it back to the RFC interface, and then returns it to the SAP Gateway.

The RFC Server Module uses the SAP Gateway to maintain the processing order of events and to maintain the status of events. Since the listener threads make synchronous calls, an event must return to the SAP Gateway before it can be considered successfully processed.

**Note:** If an RFC-enabled function module has a Return Structure or Return Table, the connector checks for the message types `A` (abort) and `E` (error) to determine if the event processed successfully. A message type `A` or `E` indicates that the event failed to process. If an RFC-enabled function module does not have a Return Structure or Return Table, you must implement your own error handling.

## Supporting RFC-Enabled Functions

IBM WebSphere Business Integration Adapter for mySAP.com includes a tool, SAPODA, that generates business object definitions based on an RFC-enabled

function. SAPODA interprets the interface of an RFC-enabled function, maps its interface parameters to the business object attributes, and adds the application-specific information for each attribute.

For each business object definition, you must generate an associated RFC Server-specific business object handler, which invokes the corresponding business object. For more information on developing business objects and RFC Server-specific business object handlers, see Chapter 14, "Developing business objects for the RFC Server Module," on page 165.

**Note:** Some RFC-enabled functions do not have single field parameters that correspond to simple attributes in the WebSphere business object. The connector requires every top-level business object to have a simple attribute that serves as the key attribute. Therefore, when generating a business object and business object handler from a RFC-enabled function without a single field parameter, SAPODA creates a key attribute named Dummy_key in the top-level business object, marks it as the key attribute, and adds `dummy_key` as the application-specific information of this attribute. Dummy_key provides the connector with a key attribute so that it can process the business object. However, the connector ignores the value of the Dummy_key attribute when modifying application data.

# Chapter 14. Developing business objects for the RFC Server Module



This chapter describes business objects and business object handlers required for the RFC Server Module. It provides background information and discusses how the business object generation utility, SAPODA, generates the definitions.The chapter assumes you are familiar with how the connector processes business objects. For more information on business object processing in the RFC Server Module, see Chapter 13, "Overview of the RFC Server Module," on page 159.

**Note:** Once you have created business objects and RFC Server-specific business object handlers, you must make sure that you register the RFC Server Module with the SAP Gateway. For more information, see "Registering the RFC Server Module with the SAP Gateway" on page 177.

## Background information

Business object development for the RFC Server Module consists of creating an application-specific business object definition and an associated RFC Server-specific business object handler for each RFC-enabled function that you want to support. Because SAPODA uses the SAP application's native definitions as a template when generating definitions for each of these, it is recommended that you use SAPODA to generate these definitions.

**Note:** SAP supports many methods that can be mapped to the standard verbs (Create, Update, Delete, and Retrieve) that the connector supports. You can develop business objects and RFC Server-specific business object handlers to support any method used by RFC-enabled functions.

## Business object naming conventions

An RFC-enabled function interface consists of importing, exporting, and table parameters, where:

- Importing parameters are passed to the RFC-enabled function.
- Exporting parameters are returned from the RFC-enabled function.
- Table parameters are passed in either direction.

Some RFC-enabled functions may not have all of the types of parameters. For example, an RFC-enabled function may have importing and table parameters only.

SAPODA automatically maps the RFC-enabled function importing, exporting, and table parameters to IBM WebSphere attributes as described in Table 29.

*Table 29. Naming Conventions: WebSphere Business Objects for SAP*

| Business object | Rfc-Enabled Function Interface |
|---|---|
| Top-level business object | `BOprefix_FunctionName`**Note**: The illustrations in this chapter use `SAP_` or `sap_` as the business object prefix. You can specify your own meaningful prefix when you create your business object definitions. |
| Attribute | `Field Description` |
| Child business object | `BOprefix_FunctionParameterName` |

SAPODA guarantees that all attribute names in the business object definition are unique. If an RFC-enabled function has multiple parameters with the same field description, SAPODA adds a counter as the suffix to the generated attribute name.

You can modify the attribute names at any time after you generate the business object definition. However, when you modify an attribute name, ensure that you do not modify the application-specific information. The connector uses this information to identify the RFC-enabled function parameter to which the attribute corresponds. For more information on the application-specific information, see "AppSpecificInfo for attributes" on page 170.

## Business object structure

The connector uses an RFC Server-specific business object handler to map each business object attribute to an RFC-enabled function's parameter. The connector, each business object, and each RFC Server-specific business object handler are metadata-driven. The application-specific information provided in the metadata of each business object and business object handler allows you to add connector support for a new business object and its handler without modifying connector code. Instead:

- The connector uses the verb application-specific information of the top-level business object to instantiate the appropriate RFC Server-specific business object handler.

  **Important:** The RFC Server Module differs from other modules in that it does not poll SAP for events. Instead, SAP pushes event data to the connector. Because this module does not use standard polling procedures, the RFC Server-specific business object handler checks every business object that represents an event for the name of the collaboration that will process it. When InterChange Server (ICS) is the integration broker, the RFC Server-specific business object handler uses the value obtained to instantiate the appropriate collaboration. When a message broker is the integration broker, a dummy value must be provided for the RFC Server-specific business object handler to process the event successfully.
- The business object handler uses the attribute application-specific information of each business object to map between each attribute and its parameter.

Each RFC Server-specific business object handler supports both single- and multiple-cardinality relationships between business objects.

A WebSphere business object based on an RFC-enabled function can contain no more than two levels of hierarchy. Therefore, all simple parameters correspond to attributes of the top-level business object, and structure and table parameters correspond to child business objects.

*Table 30. Correspondence between RFC-Enabled Functions and Business Objects*

| RFC-enabled function Interface Parameter | WebSphere Business Object for SAP |
|---|---|
| Simple field | Attribute of the top-level business object |
| Structure | Single-cardinality child business object |
| Table | Multiple-cardinality child business objects |

**Note:** Importing and exporting parameters can be simple field or structure parameters.

Figure 57 illustrates the association between a WebSphere business object and an RFC-enabled function (BAPI). The figure illustrates a fragment of a user-defined sap_bapi_po_create business object, which corresponds to the `BAPI_PO_CREATE` BAPI.

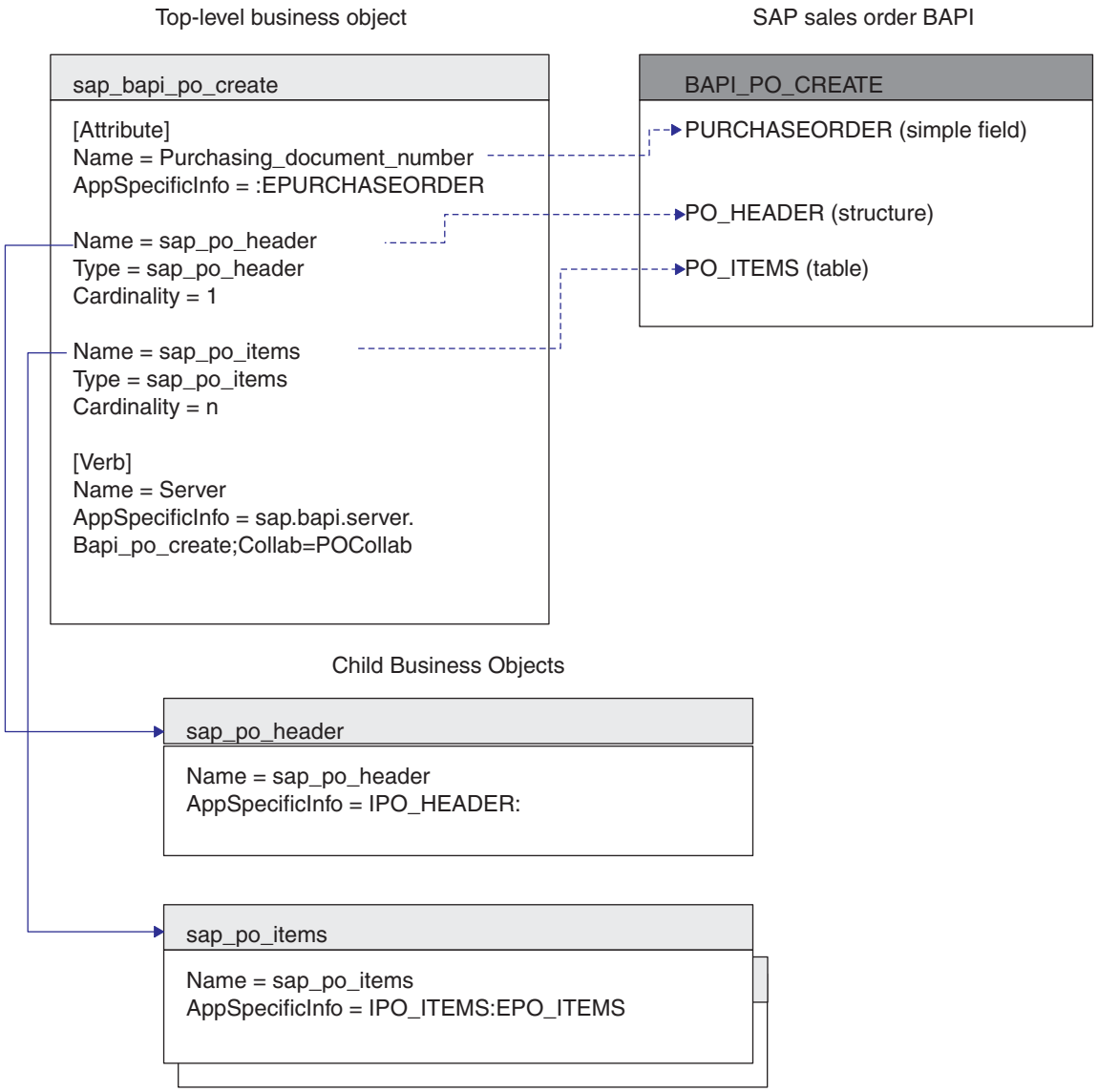



*Figure 57. Mapping between a business object and a BAPI*

## Supported verbs

The RFC Server Module supports the standard verbs (Create, Update, Delete, and Retrieve) used by the WebSphere business integration system. For each supported verb, an RFC-enabled function can have an associated method. Most RFC-enabled functions support one of the following operations: create, retrieve, update, and delete.

## Business object attribute properties

The properties of the attributes of a top-level business object differ depending on whether the attribute represents a simple value, or a child or an array of child business objects.

- Table 31 lists and describes the properties of simple attributes of a top-level business object.
- Table 32 lists and describes the attributes that represent a child or array of child business objects.

SAPODA generates the attribute properties as described in each table.

*Table 31. Simple Attributes: Top-Level Business Object*

| Property Name | Description |
|---|---|
| Name | Derived from the description of the RFC-enabled function parameter. SAPODA replaces special characters (such as periods, slashes, and spaces) with underscores. |
| Type | Specifies the type of data. SAPODA sets the value to `String`. |
| MaxLength | Specifies the field length of the RFC-enabled function parameter. |
| IsKey | Specifies whether the attribute is the key. The first simple attribute of a business object defaults to the key attribute. The connector does not support using an attribute that represents a child business object or an array of a child business objects as a key attribute. Therefore, if the function provides only structure and table parameters, you must insert a simple attribute as the first attribute. SAPODA inserts the Dummy_key attribute as the first attribute, marks it as the key attribute, and sets appropriate values. Do not modify those values. For more information, see "Supporting BAPIs" on page 98. |
| IsForeignKey | SAPODA sets the value to `false`. |
| IsRequired | Specifies whether an attribute must contain a value. SAPODA sets the value to `false`. |
| AppSpecificInfo | Contains the name of the RFC-enabled function that corresponds to the associated attribute. The format is: I*RFCFunctionParameterName*:E*RFCFunctionParameterName*For more information on the application-specific information, see "Business object application-specific information" on page 169. |
| Default Value | Specifies the value to assign to this attribute if there is no run-time value. SAPODA does not set a value for this property. |

Table 32 lists and describes the attributes that represent a child or an array of child business objects. SAPODA generates the properties described in the table below.

*Table 32. Properties of an Attribute that Represents a Child or Children*

| Property Name | Description |
|---|---|
| Name | The value is the name of the structure or table parameter name. The format is: `BOprefix_FunctionParameterName` |
| Type | The value is the type of child business object; in other words, the type is `BOprefix_FunctionParameterName` |
| ContainedObjectVersion | SAPODA sets the value to `1.0.0`. |
| Relationship | SAPODA sets the value to `containment`. |
| IsKey | SAPODA sets the value to `false`. |
| IsForeignKey | SAPODA sets the value to `false`. |
| IsRequired | Specifies whether an attribute must contain a value. SAPODA sets the value to `false`. |
| AppSpecificInfo | Contains the name of the BAPI parameter that corresponds to the associated attribute. The format is: `I`*`FieldName`*`:E`*`FieldName`*For more information on the application-specific information, see "Business object application-specific information" on page 169. |
| Cardinality | Structure parameters have single cardinality (1) and table parameters have multiple cardinality (`n`). |

## Initializing attribute values

Every field in SAP has an initial value, as listed in Table 33. When the connector receives an event, the RFC Server-specific business object handler moves these values from each SAP field to its corresponding business object attribute. The business object handler retains initial values from SAP with one exception: the character data type. The business object handler converts a space in the SAP field to `CxIgnore` in the business object attribute. If you want any other value to be converted to `CxIgnore`, the component that creates the business object must perform the conversion. For example, when ICS is the integration broker, modify the map to handle this conversion.

*Table 33. Initial Field Values in SAP*

| Data Type | Description | Initial Value Set by Business Object Handler |
|---|---|---|
| `C` | Character | `space` |
| `N` | Numeric string | *000...* |
| `D` | Date (YYYMMDD) | `00000000` |
| `T` | Time (HHMMSS) | `000000` |
| `X` | Byte (hexadecimal) | `X00` |
| `I` | Integer | `0` |
| `P` | Packed number | `0` |
| `F` | Floating point number | `0.0` |

# Business object application-specific information

Application-specific information in business object definitions provides the RFC Server Module with application-dependent instructions on how to process business objects. These instructions are specified at the business-object level, at the attribute level (both for simple attributes and for attributes that represent a child or array of child business objects), and for verbs.

## AppSpecificInfo for the server verb of the top-level business object

The connector uses the value of the server verb's application-specific information in the top-level business object to call the appropriate RFC Server-specific business object handler and to determine the destination collaboration for event processing. The value of the `AppSpecificInfo` property for the server verb specifies:

- the package and classname for the RFC Server-specific business object handler
- the destination collaboration

The format is as follows:

`AppSpecificInfo = bapi.server.`*`BOHandler;`*`Collab=`*CollaborationName*

where `BOHandler` is the name of the class and *CollaborationName* is the name of the destination collaboration.

SAPODA automatically adds the application-specific information for the server verb in top-level business object. For the value of the business object handler's classname, it uses the name of the RFC-enabled function. It does not provide a value for the collaboration name parameter. Therefore, you must manually add the name of the collaboration.

**Important:** When a message broker is the integration broker, a dummy value must be provided for the collaboration name parameter. The RFC Server-specific business object handler requires a value for this parameter to process the event successfully.

**Note:** There is a one-to-one relationship between the WebSphere business object for SAP and the RFC Server-specific business object handler. The business object handler class files must exist in the `\connectors\SAP\bapi\server` directory.

**Important:** You must include the value `server` before the business object handler name to identify that the RFC Server-specific business object handler acts as a server.

For example if you are supporting the `BAPI_PO_CREATE` RFC-enabled function and the destination collaboration is called `POCollab`, then the verb application-specific information is as follows:

```
AppSpecificInfo =bapi.server.Bapi_po_create;Collab=POCollab
```

## AppSpecificInfo for attributes

The connector uses the value of an attribute's application-specific information to determine which importing, exporting, and table parameters to use. The value of this property contains the prefix `I` (for importing parameters) or `E` (for importing parameters). The prefix indicates whether the attribute value is used to pass data into or out from the SAP application.

Because structure parameters can be either importing or exporting, they use either an `I` or an `E` before the parameter value. Because table parameters can pass data to and return data from a RFC-enabled function, they can have both `I` and `E` parameter values.

**Important:** Always use a colon (**:**) separator when you specify parameter values with `I` and `E`. If specifying only an importing value, the colon must follow the value. If specifying only an exporting value, the colon must precede the value. If specifying both values, the colon follows the importing value and precedes the exporting value.

Figure 58 illustrates the mapping between a business object and an example RFC-enabled function named `BAPI_EXAMPLE`. In the example, the simple attributes (Attribute_1, Attribute_2, and Attribute_3) specify only an importing or exporting parameter. The attribute that represents a child business object (Child_1) maps to an exporting structure parameter. The attribute that represents an array of child business objects (Child_2) maps to a table parameter.

Each child business object has a simple attribute that maps to a field of the corresponding structure or table (Attribute_11 and Attribute_14, respectively). You can find these fields by looking at the details of the BAPI.

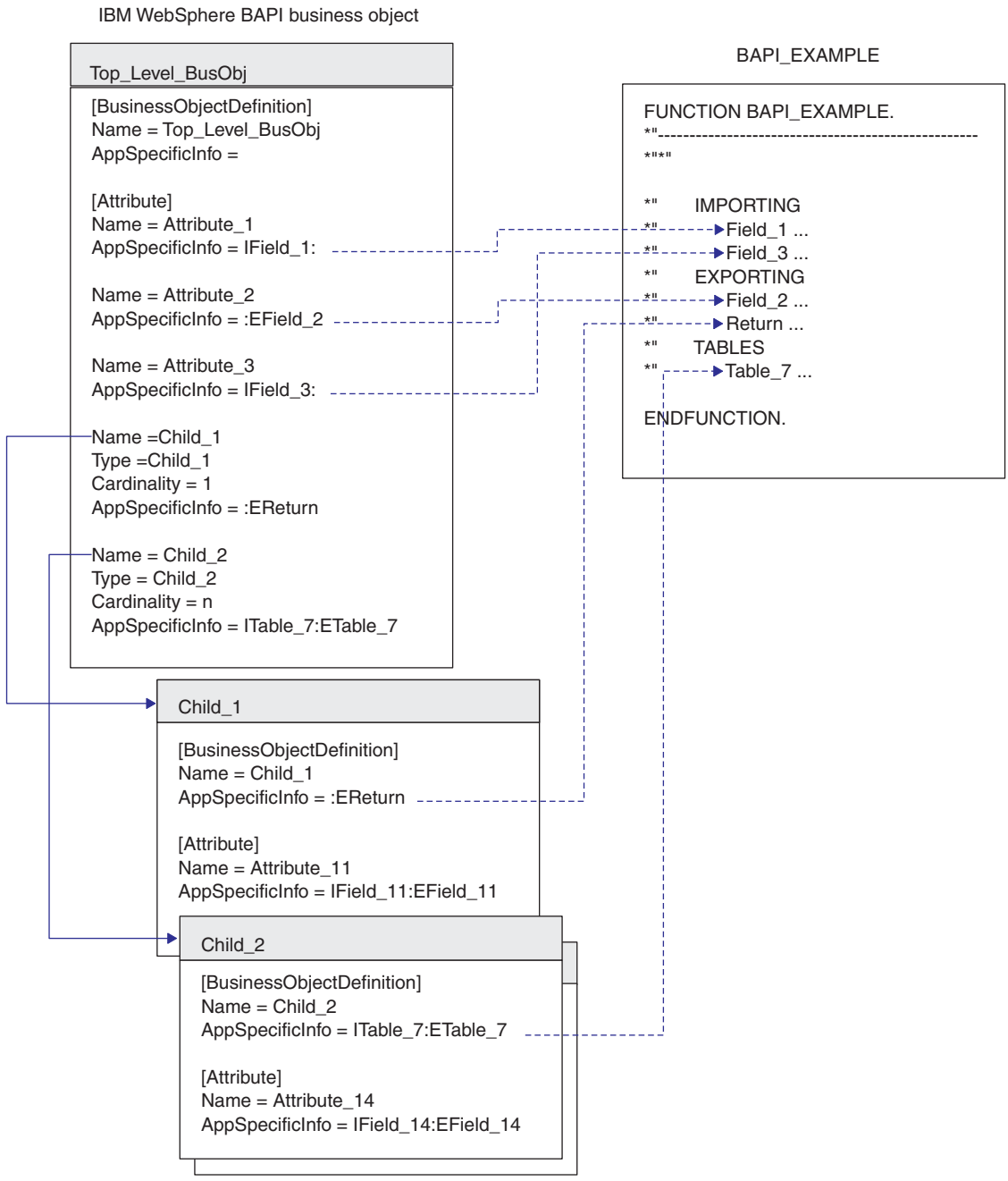



*Figure 58. Mapping between a business object and an example BAPI*

Table 34 identifies the format of the application-specific information for specific kinds of attributes.

*Table 34. AppSpecificInfo format for specific kinds of attributes*

| AppSpecificInfo Format | Attribute Type |
|---|---|
| I*ParameterName*:E*ParameterName* | Simple |
| I*TableName*:E*TableName* | Represents a child business object mapped to a table parameter |
| I*StructureName*:E*StructureName* | Represents a child business object mapped to a structure parameter |
| I*FieldName*:E*FieldName* | Represents an attribute of a child business object mapped to a field in a table or structure parameter |

SAPODA automatically generates the appropriate application-specific information for your business object definition. It is recommended that you do not change the parameter names of the generated application-specific information.

## Using generated business objects and business object handlers

Use SAPODA to generate RFC-enabled function-specific business object definitions and RFC Server-specific business object handlers for each RFC-enabled function you want to support. You can use the generated files with minimal modifications.

The only edit you must make is specifying the name of the destination collaboration in the verb application-specific information of the server verb.

- When InterChange server (ICS) is the integration broker, this information is required because a collaboration cannot explicitly subscribe to an event that is pushed to the connector. Therefore, the RFC Server-specific business object handler must determine the appropriate destination collaboration from the business object's metadata, and then instantiate the collaboration.
- When a message broker is the integration broker, a dummy value is required for the RFC Server-specific business object handler to process the event correctly.

**Important:** If the RFC-enabled function that you are using does not contain a simple field attribute, and SAPODA has created a Dummy_key attribute as the key attribute, do not modify the values of this attribute.

After the business object definition and its corresponding RFC Server-specific business object handler are generated, you must add the business object definition to your WebSphere business integration system's runtime environment.

- Use Business Object Designer to load the business object definition into your repository.

  **Note:** Alternatively, if InterChange server (ICS) is the integration broker, you can use the `repos_copy` command to load the definition into the repository.
- Use a system command to copy the RFC Server-specific business object handler files to the following directory under the product directory:

  `\connectors\SAP\bapi\server`

The RFC Server-specific business object handler files are:

- *RFC-EnabledFunctionName*`.java`
- *RFC-EnabledFunctionName*`.class`

For example, given the `BAPI_PO_CREATE` RFC-enabled function and a user-specified prefix of `sap_`, SAPODA generates the following:

- `sap_bapi_po_create` (business object definition that includes all child business objects)
- `Bapi_po_create.java`
- `Bapi_po_create.class`

**Important:** You can modify the name of the generated business object as well as the name of its child business objects. To do so, you must edit the definition as a text file rather than in Business Object Designer. If you do change a business object's name, ensure that you also modify all references to the names that you change. Also, if you modify the names of the generated `.class` file for the business object handler, you

must maintain the changes for the server verb application-specific information for the associated business object.

## Tips and tricks

The following are tips and tricks for developing business objects and RFC Server-specific business object handlers.

- "Multiple business objects contain the same return business object"
- "Generated business object definition contains unnecessary attributes and child business objects"
- "Generated business object names are too long or fail your naming conventions" on page 175
- "Generated AppSpecificInfo for table parameters specify unnecessary parameters" on page 175

### Multiple business objects contain the same return business object

Most RFC-enabled functions use the same name for the return object. When SAPODA generates a business object definition, it creates a child business object to represent this return object. If multiple business object definitions contain an identically named child business object, you can add the definition for child business object into the repository only once.

To enable multiple business objects to contain the return business object, you must modify the name of the return business object to be unique for each business object.

To rename the return business object, modify the definition of each business object definition that contains it. The definition of the child business object is contained in the same definition file as its parent.

To rename the child, do the following:

1. Open the definition file for the top-level business object in a text editor.
2. Locate the definition of the `BOprefix_return` child business object.
3. Change the child's name to be unique. For example, append a number to the text (`sap_return_2`).
4. Change all references in the definition to refer to the newly named child. For example, change the value of the Type property for every attribute that represents the child business object.
5. Save the changed definition file.
6. Use Business Object Designer to load the newly named child business object into the repository.

   **Note:** Alternatively, if ICS is the integration broker, you can use the `repos_copy` command to load the definition into the repository.

### Generated business object definition contains unnecessary attributes and child business objects

SAPODA interprets all RFC-enabled function interface parameters and, for each one, it creates a corresponding WebSphere business object attribute or child business object. To increase performance of business object processing, remove all unrequired attributes and business objects from the business object definition.

**Note:** SAPODA facilitates graphically removing all optional attributes and child business objects before definition generation. For more information, see "Provide additional information" on page 58.

To increase performance of business object processing, you can also remove all unrequired importing and exporting table parameter values from the application-specific information.

After definition generation, you can use Business Object Designer to manually edit the business object definition if you require other changes. However, be careful that you remove only attributes that you absolutely will not be using.

## Generated business object names are too long or fail your naming conventions

SAPODA uses the name of the RFC-enabled function module to name the generated business object. You can use a text editor to modify a business object's name.

**Important:** If you do change the name, ensure that you modify all references to the name as well. However, do not modify the parameter names of the generated application-specific information.

To change a generated business object's name:

1. Save the definition to a file.
2. Use a text editor to shorten or change the name.
3. Use Business Object Designer to copy the newly named child business object into the repository.

   **Note:** Alternatively, if ICS is the integration broker, you can use the `repos_copy` command to load the definition into the repository.

## Generated AppSpecificInfo for table parameters specify unnecessary parameters

Table parameters can be both importing and exporting parameters. If you do not require importing or exporting of values for a table parameter, you can remove it from the application-specific information.

For example, for a create operation, if you do not need to return the table data from the SAP application after the create operation has completed, you can remove the exporting parameter value (such as E*table name*).

For a retrieve operation, you do not need to specify any importing table parameters. Therefore, you can remove the importing parameter value (such as I*table name*).

**Note:** You must remove the unrequired value from the `AppSpecificInfo` of the attribute in the parent that represents the child as well as from the `AppSpecificInfo` at the business-object level of the child business object. Do not remove the colon (`:`).

For example, to remove the `ETable_7` exporting parameter in Figure 58 on page 172, you would do the following:

1. In the Child_2 attribute of the Top_Level_BusObj business object, change the attribute's AppSpecificInfo value to:

   ```
   ITable_7:
   ```

2. In the AppSpecificInfo at the business-object level of the Child_2 business object, change the value to:

   ```
   ITable_7:
   ```

3. In the AppSpecificInfo for each attribute of the child business object, using Attribute_14 as an example, change the value to:

   ```
   IField_14:
   ```

# Chapter 15. Configuring the RFC Server Module



This chapter describes the configuration of the RFC Server Module and assumes that all of the necessary files were installed when the IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x) was installed. For more information on installing the connector, see Chapter 4, "Running the connector," on page 43.

## RFC Server Module directories and files

The RFC Server Module directory and files are contained in the `\connectors\SAP\` directory. Table 35 lists the directory and file used by the RFC Server Module.

*Table 35. RFC Server Module directory and file*

| Directory/Filename | Description |
|---|---|
| `\bapi\server` | Directory containing the runtime files for the connector. All RFC Server-specific BOHandler class files must be copied into this directory. |
| `CWSAP.jar` | Connector class file |

## RFC Server Module configuration properties

You must configure the RFC Server Module before it can start operating. To configure the RFC Server Module, set the standard and connector-specific connector configuration properties. For more information on configuring the connector configuration properties, see Chapter 3, "Configuring the connector," on page 25 and Appendix D, "Standard configuration properties for connectors," on page 287.

## Registering the RFC Server Module with the SAP Gateway

During initialization, the RFC Server Module registers with the SAP Gateway. It uses the value set for the `RfcProgramId` connector-specific configuration property. This value must match the value set in the SAP application. You must configure the SAP application so that the RFC Server Module can create a handle to it.

To register the RFC Server Module as an RFC destination:

1. In the SAP application, go to transaction SM59.
2. Expand the TCP/IP connections directory.
3. Click Create (F8).
4. In the RFC destination field, enter the name of the RFC destination system. It is recommended that you use `RFCSERVER`.
5. Set the connection type to T (Start an external program via TCP/IP).
6. Enter a description for the new RFC destination, and then click Save.
7. Click the Registration button for the Activation Type.

8. Set the Program ID. It is recommended that you use the same value as the RFC destination (`RFCSERVER`), and then click Enter.

**Important:** Ensure that the connector-specific configuration property `RfcProgramID` is set to the same value as the Program ID value in the SAP application. If the values do not match, business object processing will fail.

# Part 5. Hierarchical Dynamic Retrieve Module

# Chapter 16. Overview of the Hierarchical Dynamic Retrieve Module

This chapter describes the Hierarchical Dynamic Retrieve ModuleIBM WebSphere Business Integration Adapter for mySAP.com. The Hierarchical Dynamic Retrieve Module processes hierarchical or flat business objects. To process these requests, the connector retrieves data from the SAP application versions 4.0, 4.5, and 4.6.

This chapter contains the following sections:



## Hierarchical Dynamic Retrieve Module components

The Hierarchical Dynamic Retrieve Module is written in Java and extends the vision connector framework. Because the module does not have its own application-specific component, it uses the application-specific component for BAPI. Therefore, the module consists of the connector framework, the application-specific component for BAPI, the vDynRetBOH business object handler, and the SAP RFC libraries. SAP delivers the RFC libraries in Java and C. The connector is delivered and runs as a Java archive (JAR) file.

Figure 59 illustrates the architecture of the Hierarchical Dynamic Retrieve Module.

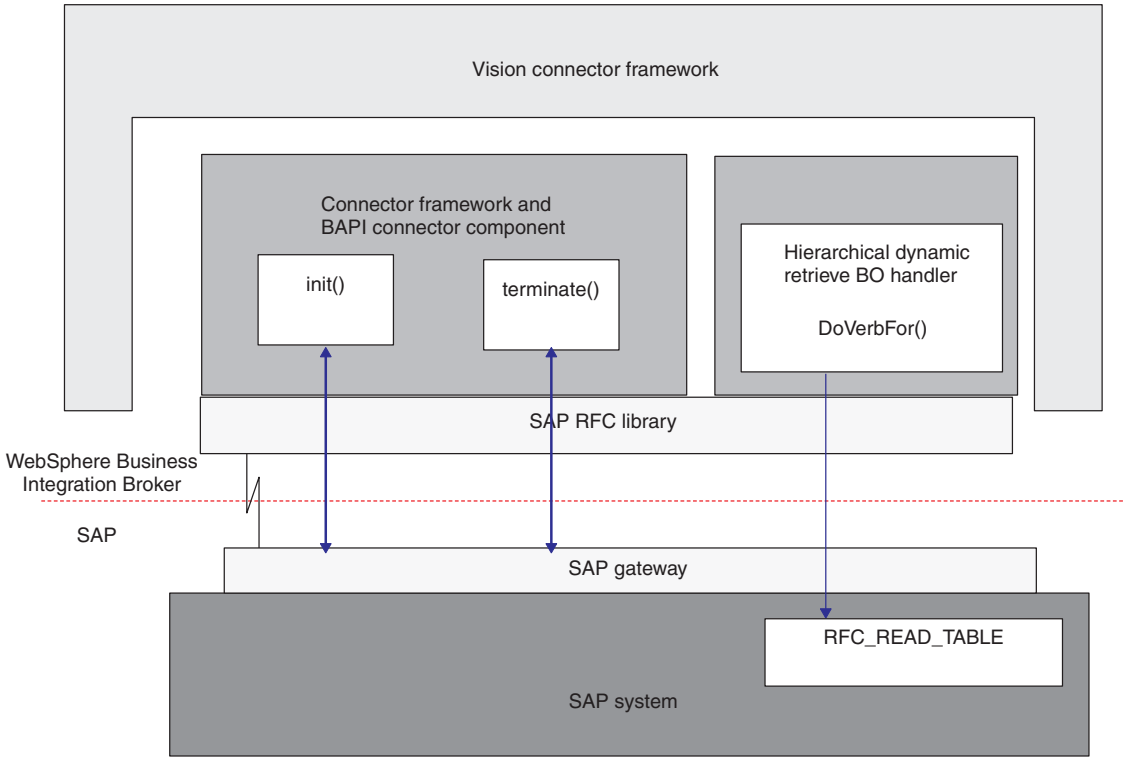



*Figure 59. Hierarchical Dynamic Retrieve Module architecture*

## How the connector works

The connector gets a business object's processing information from metadata specified in the business object rather than from information hard-coded into the connector. To obtain processing information from the business object, the connector makes assumptions about the following:

- The business object structure
- The relationships between parent and child business objects
- The possible database representations of business objects

For information, see "Processing business objects" on page 10, and Chapter 18, "Developing business objects for the Hierarchical Dynamic Retrieve Module," on page 185.

When the connector receives a request from the integration broker to perform an application operation, it obtains processing information from the verb specified for the top-level business object.

The connector processes hierarchical business objects recursively; that is, it performs the same steps for each child business object until it has processed all individual business objects.

**Note:** The term **hierarchical** business object refers to a complete business object, including all the child business objects that it contains at any level. The term **individual** business object refers to a single business object, independent of any child business objects it might contain or that contain it. The term **top-level** business object refers to the individual business object at the top of the hierarchy that does not itself have a parent business object.

When the integration broker sends a hierarchical business object with a Retrieve verb, the connector attempts to return a business object to the integration broker that exactly matches the current database representation of that business object. In other words, the value of each simple attribute of every individual business object that the connector returns matches the value of its corresponding field in the database. Also, the number of individual business objects in each array of the returned business object match the number of children in the database for that array (unless the application-specific information limits the children to a subset).

To perform such a retrieval, the connector uses the primary key values in the top-level business object to recursively descend through the corresponding data in the database.

# Chapter 17. Configuring the Hierarchical Dynamic Retrieve Module



This chapter describes the configuration of the Hierarchical Dynamic Retrieve Module of the IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x). The SAP connector should be installed before performing the configuration tasks described in this chapter. For more information on installing the connector, see Chapter 4, "Running the connector," on page 43.

## Hierarchical Dynamic Retrieve Module configuration properties

Before you can run the Hierarchical Dynamic Retrieve Module, you must set the standard and connector-specific configuration properties. At a minimum, you must add the name of the BAPI Module to the `Modules` property. The name of the BAPI Module is `Bapi`.

The Hierarchical Dynamic Retrieve Module only performs service call requests, so the business object handler is invoked through the meta-data in the business object being sent. However, by setting the value of `Modules` to `Bapi`, you establish a connector thread, thus allowing initialization and termination of the connector. Then, if any issues arise during Hierchical Dynamic Retrieve Module processing, you can easily shut down the connector by calling the `terminate()` method on the running connector thread.

For more information on configuring the connector configuration properties, see Chapter 3, "Configuring the connector," on page 25 and Appendix D, "Standard configuration properties for connectors," on page 287.

# Chapter 18. Developing business objects for the Hierarchical Dynamic Retrieve Module



This chapter describes how the Hierarchical Dynamic Retrieve Module processes business objects and describes the assumptions the connector makes when retrieving data. You can use this information as a guide to modifying existing business objects or as suggestions for implementing new ones.

For a description of the Hierarchical Dynamic Retrieve Module, see Chapter 16, "Overview of the Hierarchical Dynamic Retrieve Module," on page 181.

## Business object structure

The connector assumes that every individual business object is represented by one or more database tables, and that each **simple attribute** (that is, an attribute that represents a single value, such as a `String` or `Integer` or `Date`) within the business object is represented by a column in one of those tables. The following situations are valid:

- The database tables might have more columns than the corresponding individual business object has simple attributes (that is, some columns in the database are not represented in the business object). Include in your design only those columns needed for the business object processing.
- The individual business object might have more simple attributes than the corresponding database tables have columns (that is, some attributes in the business object are not represented in the database). The attributes that do not have a representation in the database have no application-specific information.
- Due to a restriction in the SAP API, the total number of characters for all of the desired columns in each table represented by a single a business object cannot exceed 512. For more information, see "Handling long data rows" on page 188.

WebSphere business objects for SAP can be flat or hierarchical. All the attributes of a **flat** business object are simple and represent a single value.

A hierarchical business object has attributes that represent a single child business object, an array of child business objects, or a combination of both. In turn, each child business object can contain a single child business object or an array of business objects, and so on.

### Business object relationships

The Cardinality property of the attribute that represents the child or array determines the type of relationship between parent and child:

- A **single-cardinality relationship** occurs when the attribute in the parent business object represents a child business object with cardinality 1.
- A **multiple-cardinality relationship** occurs when an attribute in the parent business object represents an array of child business objects with cardinality `n`.

The connector does not process a single-cardinality relationship differently from a multiple-cardinality relationship. However, there is a structural difference in foreign-key relationships when database tables have single-cardinality or multiple-cardinality relationships:

- In a single-cardinality relationship, the foreign key is determined by the primary key in the child referencing a **non- key** attribute in the parent as its foreign key. Each child has at least one simple attribute that references a non-primary key attribute in its parent as a foreign key. Figure 60 provides an example.
- In a multiple-cardinality relationship, the foreign key is determined by the primary key in the child referencing the **primary key** attribute in the parent. Each child has at least one simple attribute that contains the parent's primary key as a foreign key. The child has as many foreign-key attributes as the parent has primary-key attributes. Figure 62 provides an example.

In each case, the foreign-key relationship between the parent and child business objects is specified by the application-specific information of the key attributes of the child business object. For more information, see "Business object attribute properties" on page 191 and "Application-specific information for simple attributes" on page 193.

The next sections describe the following relationships among business objects:

- "Single-cardinality relationship example"
- "Multiple-cardinality relationship example" on page 187

## Single-cardinality relationship example

Figure 60 provides an example of a simple WebSphere business object developed to process customer objects in SAP. This example SAP_Customer has a single-cardinality relationship to the example address object that it contains (the `addr_data[1]` attribute has cardinality 1). The primary key attribute (`address_id`) in the child business object references a non-primary key (`address_id`) in the parent business object.

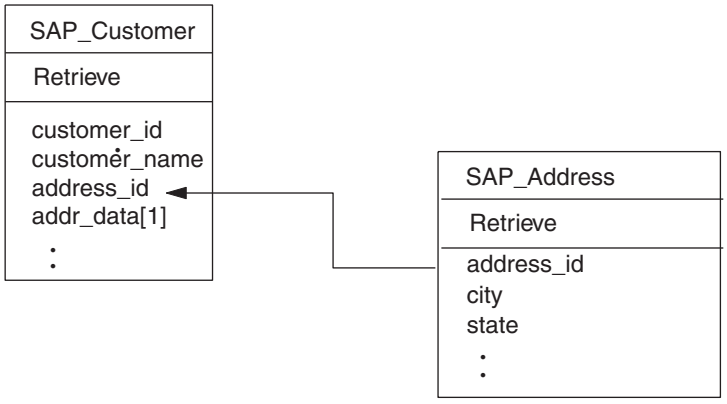



*Figure 60. Example customer and address relationship*

The following `SELECT` statements and their output illustrate retrieval of data from the tables represented by the business objects above:

```
SELECT * FROM KNA1

KUNNR          NAME1          ADRNR
-----          -------------  ----------
10254          JOE'S PIZZA          2208
10255          LARRY'S HARDWARE     2209
```

```
SELECT * FROM ADRC

ADDRNUMBER          CITY1          REGION
----------          ----           -----
2208                BURLINGAME     CA
2209                SAN FRANCISCO  CA
```

In the example above, each customer (Joe's Pizza and Larry's Hardware) has a single address. If the KUNNR and ADDRNUMBER columns are defined as primary key constraints for their respective tables, the above structure ensures that each customer can have only one associated address.

**Note:** For the sake of simplicity, the illustrations in this document do not display the application-specific information used by the connector to determine the tables and fields in the SAP application's database.

## Multiple-cardinality relationship example

Figure 61 illustrates a multiple-cardinality relationship. In the example, `ID=ABC` is the simple attribute with the parent's primary key, and `child[n]` is the attribute that represents the array of child business objects.

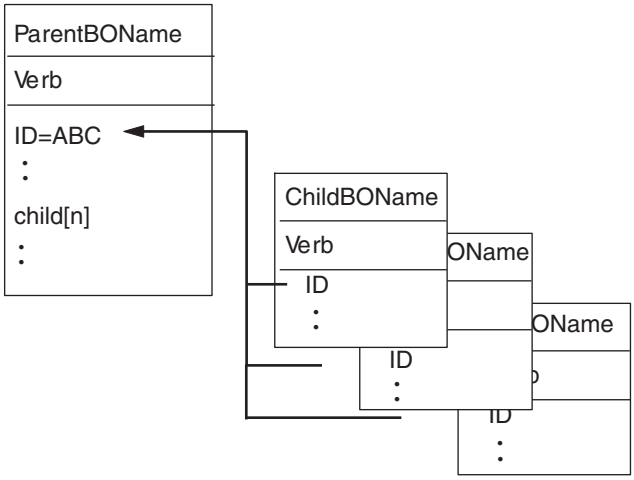



*Figure 61. Multiple-cardinality business object relationship*

Figure 62 provides an example of a different WebSphere business object developed to process customer objects in SAP. This example SAP_Customer has a multiple-cardinality relationship to the example sales view object that it contains (the `sales_view_data[n]` attribute has cardinality `n`). The primary key attribute (`customer_id`) in the child business object references the primary key (`customer_id`) in the parent business object.

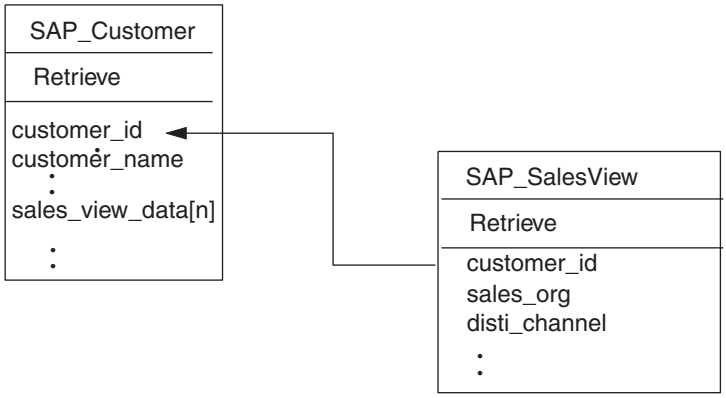



*Figure 62. Example customer and sales view relationship*

The following SELECT statements and their output illustrate retrieval of data from each of these tables:

```
SELECT * FROM KNA1

KUNNR          NAME1
-----          -------------
10254          JOE'S PIZZA
10255          LARRY'S HARDWARE

SELECT * FROM KNVV

KUNNR          VKORG          VTWEG          SPART
----------     -----          -----          -----
10254          EURP           01             12
10255          EURP           01             09
10255          USA            01             13
10255          USA            01             14
```

In this example, Joe's Pizza has one associated sales view record, whereas Larry's Hardware has three associated sales view records. The above structure allows each customer to have zero or more associated sales view records.

## Handling long data rows

SAP's RFC_READ_TABLE function limits data retrieval to 512 bytes per row of data. Many SAP tables have more than 512 bytes of data per row. However, most business objects represent a small subset of all the database fields. Therefore, the total length of all attributes in a business object rarely exceeds the 512 byte maximum.

In those cases that require the connector to retrieve more than 512 bytes of data from a single database table, the additional fields must be represented in separate single-cardinality child business objects. For example, if a business object must represent 1500 bytes of data from a single table, the top-level business object contains at least two single-cardinality child business objects. Neither the parent nor either child has attributes whose total length (that is, the sum of their maximum length) exceeds 512 bytes.

**Note:** If a business object represents more than one database table, the total length of the values in the attributes that represent each table cannot exceed 512 bytes. However, this limit does not pertain to the total length of the values of all attributes. For example, if a business object represents data from the tables that store information about Customers and CustomerPartners, the

value of those attributes representing Customers cannot exceed 512 bytes, and the value of those attributes representing CustomerPartners cannot exceed 512 bytes, but the combined value of these attributes can exceed 512 bytes.

# Business object verb processing

This section outlines the steps the connector takes to handle a business object request with the Retrieve verb. The connector processes hierarchical business objects recursively; that is, it performs the same steps for each child business object until it has processed all individual business objects.

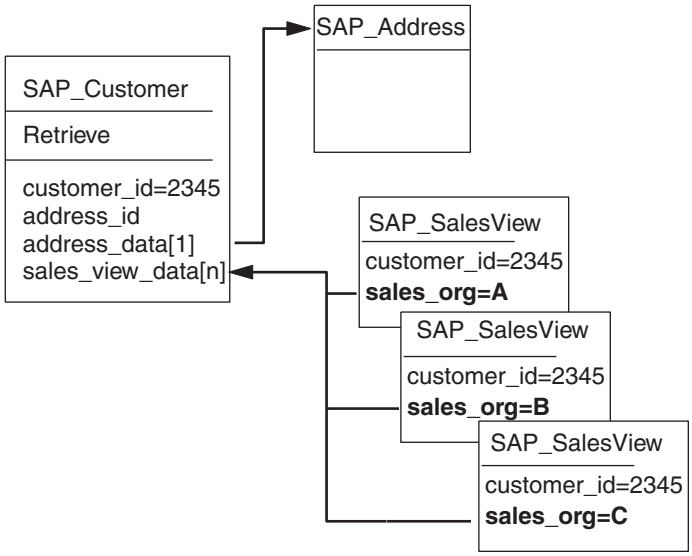
## Business object comparison

When processing a retrieval request from the integration broker, the connector tries to return a business object that matches the current database representation of that object. In other words:

- The value of each simple attribute in all individual business objects returned to the integration broker matches the value of its corresponding field in the database.
- The number of individual business objects in each array of the returned business object matches the corresponding number of children in the database.

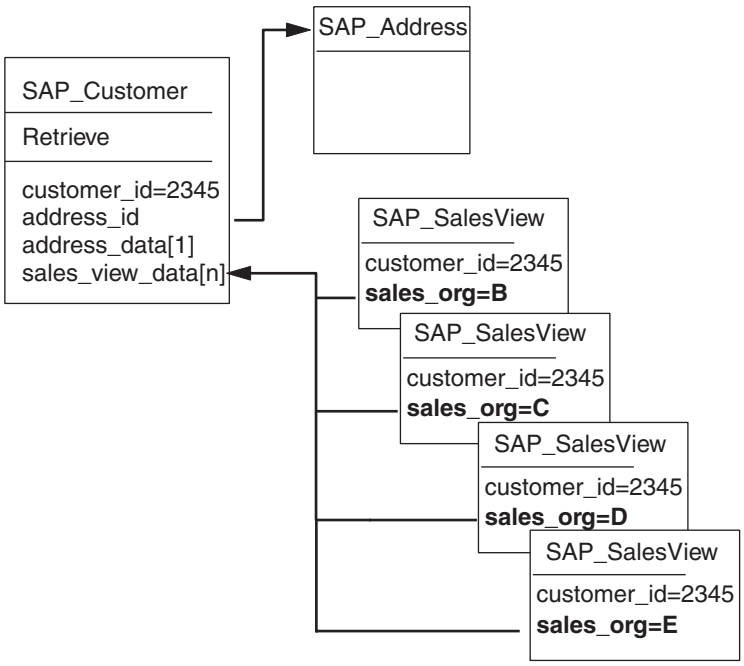
Therefore, when the Hierarchical Dynamic Retrieve Module receives a business object request with the Retrieve verb, it creates a response business object by recursively descending the entire object in the application and retrieving the current database representation. To perform the retrieval, the connector uses the specified key values in the top-level request business object. Therefore, the response business object, which contains all the children of that top-level parent, may have different values for simple attributes and different child business objects from the request business object.

For example, assume the integration broker passed the following SAP_Customer business object to the Hierarchical Dynamic Retrieve Module:




If, in the current database representation, the array of SAP_SalesView child business objects contained by SAP_Customer 2345 does not include sales_org A, the connector's response business object does not contain that child. Moreover, if

the current database representation of SAP_Customer 2345 includes sales_org D and sales_org E, the connector includes those children in the response business object. The business object that the SAP Hierarchical Dynamic Retrieve Module returns to the integration broker at the end of retrieval is:




**Note:** If the connector reads from multiple tables when creating a particular response business object, the business object does not match a single database object. Instead, it matches selected fields from the specified tables.

## Retrieve operation

When retrieving a business object, the connector returns a status of either `VALCHANGE` if the operation was successful (regardless of whether the operation caused changes to the business object), or `FAIL` if the operation failed.

The connector performs the following steps when retrieving a hierarchical business object:

1. Removes all child business objects from the top-level business object that it received from the integration broker.
2. Calls the RFC_READ_TABLE function to retrieve the **top-level business object** from the database.

   The connector uses key values in the request business object to build the `SELECT` statement's `WHERE` clause. The result of the retrieval causes one of the following actions:

   - If the `SELECT` statement returns one record, the connector continues processing the children and returns `VALCHANGE` (regardless of whether any attribute changed value).
   - If the `SELECT` statement returns no records, indicating that the top-level business object does not exist in the database, the connector returns `BO_DOES_NOT_EXIST`.
   - If the `SELECT` statement returns more than one record, the connector continues processing the children and returns `VALCHANGE`.

3. Recursively retrieves all **child business objects** (single-cardinality and multiple-cardinality).

   The connector calls the RFC_READ_TABLE function, which uses the appropriate foreign-key values to build the `SELECT` statement's `WHERE` clause. The connector handles attributes marked as required in the following way:

   - If the business object's definition specifies that the child is required, the retrieval must return a record. If not, the connector returns `FAIL`.
   - If the child is not required and the retrieval returns no records, indicating that the child does not exist in the application, the connector leaves the parent's attribute empty.

   For each record returned, the connector performs the following actions:

   a. Creates a new individual business object of the correct type.
   b. Sets all of the current business object's attributes based on the values in the returned row.
   c. Recursively retrieves all of the current business object's children.

      **Attention:** If the retrieval of a single-cardinality child returns more than one record, the connector returns only the first record.
   d. Inserts the current business object with all of its children into the appropriate single-cardinality attribute or array attribute of the parent.

**Note:** A business object can have attributes that do not correspond to any database column, such as placeholder attributes. During retrieval, the connector does not change such attributes in the top-level business object; they remain set to the values received from the integration broker. The application-specific information for these attributes must be blank.

## Business object attribute properties

Business object architecture defines various properties that apply to attributes. This section describes how the connector interprets these properties and describes how to set them when modifying a business object.

### Name property

Each business object attribute must have a unique name.

### Type property

Each business object attribute must be of type `String`, or the type of a child business object or an array of child business objects.

### Cardinality property

Each business object attribute has the value of `1` or `n` in this property. All attributes that represent a child business object or an array of child business objects also have a `ContainedObjectVersion` property (which specifies the child's version number) and a `Relationship` property (which specifies the value `Containment`).

### Max length property

The connector does not use this property. Although Advanced Outbound Wizard populates this property when it generates the business object, it does so only to provide information.

## Key property

At least one simple attribute in each business object must be specified as the key. To define an attribute as a key, set this property to `true`.

**Important:** The connector does not support specifying an attribute that represents a child business object or an array of child business objects as a key attribute.

If the key property is set to `true` for a simple attribute, the connector adds that attribute to the `WHERE` clause of the `SELECT` SQL statement that it generates while processing the business object.

To maximize performance, it is recommended that you provide data for as many key fields as possible.

To retrieve a child business object or children from an array of business objects, the connector uses foreign keys in the `WHERE` clause of the `SELECT` statement. It does not use the Key property of attributes in child business objects. For information on how to specify an attribute in a child business object as a foreign key, see "Application-specific information for simple attributes" on page 193.

## Foreign key property

The connector does not use this property. The connector obtains foreign-key information from application-specific information. For more information, see "Application-specific information for simple attributes" on page 193.

## Required property

The `Required` property specifies whether an attribute must contain a value.

- If an attribute that represents a child business object or an array of child business objects is marked as required and the connector fails to retrieve any child from the application, the retrieve operation fails.
- If a simple attribute is marked as required and the connector fails to retrieve the corresponding row from the database, the retrieve operation fails. For example, if the connector reads from multiple tables for a business object and it fails to retrieve a row for a required simple attribute that represents a value in one of the tables, the entire retrieve fails.

## AppSpecificInfo

For information on this property, see "Application-specific information for simple attributes" on page 193.

## Default value property

This property specifies a default value that the connector uses when generating the `WHERE` clause of a `SELECT` statement. This property is relevant only to simple attributes that have been specified as key. For example, to cause the connector to use the default value specified for the Language attribute, you must specify the Language attribute as key.

### Special value for simple attributes

Simple attributes in business objects can have the special value, `CxIgnore`. When it receives a business object from the integration broker, the connector ignores all attributes with a value of `CxIgnore`. It is as if those attributes were invisible to the connector.

When the connector retrieves data from the database and the `SELECT` statement returns a blank value for an attribute, the connector sets the value of that attribute to `CxBlank` by default.

Because the connector requires every business object to have at least one key attribute, make sure that business objects passed to the connector have at least one primary or foreign key that is not set to `CxIgnore`.

## Business object application-specific information

Application-specific information in business object definitions provides the connector with application-dependent instructions on how to process business objects. This information includes:

- The class for the vDynRetBOH business object handler, which is provided in the application-specific information for the verb of the top-level business object. This value is identical for all business objects that this module processes.
- Database and query information, which is provided in the application-specific information for simple attributes. The connector parses this information to generate `SELECT` queries.

If you extend or modify an application-specific business object, make sure that the application-specific information in the business object definition matches the syntax that the connector expects.

The following sections discuss this functionality in more detail.

### Application-specific information for the top-level business object's verb

The verb of the top-level business object specifies the class for the vDynRetBOH business object handler. This application-specific information should always be the following:

```
sap.bapi.vDynRetBOH
```

### Application-specific information for simple attributes

The application-specific information for attributes specifies the following information:

- The name of the corresponding database table
- The name of the corresponding database column
- The foreign key relationship between an attribute in the current business object and a parent or child business object
- The operand

The application-specific information format consists of four name-value parameters, each of which includes the parameter name and its value. Each parameter set is delimited from the next by a colon (:).

The format of attribute application-specific information is shown below. Square brackets ([ ]) surround an optional parameter. A vertical bar (|) separates the members of a set of options. Reserve the colon as a delimiter.

```
TN=TableName:CN=ColumnName:[FK=[..]fk_attributeName]:[OP=GT|GE|EQ|NE|LE|LT|LIKE]
```

Figure 60 describes each name-value parameter.

*Table 36. Name-Value Parameters in Attribute Application-Specific Information*

| Parameter | Description |
|---|---|
| TN=TableName | The name of the database table |
| CN=ColumnName | The name of the database table column (field) |
| FK=[..]fk_attribute Name | The value of this property depends on whether the foreign-key relationship is stored in the parent business object or the current business object:<br>• *attributeName*—specifies an attribute in the current business object; for more information, see "Example: Current business object stores the foreign key" on page 194<br>• ..attributeName—specifies an attribute in the parent business object<br>If an attribute is not a foreign key, do not include this parameter in the application-specific information. |
| OP=GT\|GE\|EQ\|NE\|LE\|LT\| LIKE | The operand options are:<br>• GT—Greater Than<br>• GE—Greater than or Equal to<br>• EQ—EQual to (default option)<br>• NE—Not Equal to<br>• LE—Less than or Equal to<br>• LT—Less Than<br>• LIKE—Like<br>It is recommended that you specify EQ to maximize performance. If no operand is specified, the connector uses EQ. |

The required parameters for each simple attribute are the table name and column name. The operand defaults to EQ (equals). The following example illustrates the basic format:

```
TN=KNA1:CN=KUNNR
```

**Important:** Case is significant when specifying values for these parameters.

It is permissible for simple attributes within a business object to have no value specified (that is, zero length) for application-specific information fields. The connector ignores such attributes. This is a convenient way to ensure that the connector does not process placeholder attributes used to separate adjacent arrays of child business objects.

If none of the application-specific information in any of a business object's attributes provide sufficient information for the connector to build or execute a query, the connector returns a failure.

## Example: Current business object stores the foreign key

Figure 63 provides an example of a WebSphere business object with two foreign keys that reference attributes within the business object. In this case, the business object represents data in two tables, one containing address data and the other

containing lookup data for state/province and country abbreviations. To process this data, the connector performs two table reads.

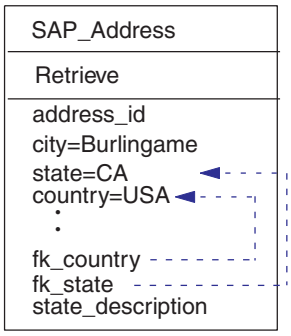



*Figure 63. Example: Current business object stores the foreign key*

**Attribute Information:** Table 37 documents the table name, column name, key, and foreign-key for each attribute in the example SAP_Address:

*Table 37. Description of example business object attributes*

| Attribute | Table name | Column name | Key | Foreign key | Default |
|---|---|---|---|---|---|
| address_id | ADRC | ADDRNUMBER | true | | |
| city | ADRC | CITY1 | false | | |
| state | ADRC | REGION | false | | |
| country | ADRC | LAND1 | false | | |
| language | T005U | SPRAS | true | | E |
| fk_country | T005U | LAND1 | false | FK=country | |
| fk_state | T005U | BLAND | false | FK=state | |
| state_description | T005U | BEZEI | false | | |

**Attribute Application-Specific Information:** Given the information in Table 37, the application-specific information for the fk_state attribute is:

```
TN=T005U:CN=BLAND:FK=state
```

The application-specific information for the fk_country attribute is:

```
TN=T005U:CN=LAND1:FK=country
```

**SQL Queries:** The following `SELECT` statements illustrate the `WHERE` clause that the connector builds to retrieve data from the tables represented by SAP_Address:

```
SELECT * FROM ADRC WHERE ADDRNUMBER = address_idValue
SELECT * FROM T005U WHERE SPRAS = 'E' AND LAND1 = countryValue
AND BLAND = stateValue
```

# Part 6. ABAP Extension Module

# Chapter 19. Overview of the ABAP Extension Module



This chapter describes the ABAP Extension Module of the IBM WebSphere Business Integration Adapter for mySAP.com. The ABAP Extension Module enables an integration broker to send business objects to and receive events from SAP application.

## ABAP Extension Module components

The ABAP Extension Module consists of components written in Java and ABAP. The Java components consist of the connector module and the SAP RFC libraries. SAP delivers their RFC libraries in Java and C. The ABAP components consists of various SAP application function modules, database tables, and programs. Some of these ABAP components are developed and delivered as part of the adapter and some are native to every SAP installation

Figure 64 illustrates the overall architecture of the ABAP Extension Module.

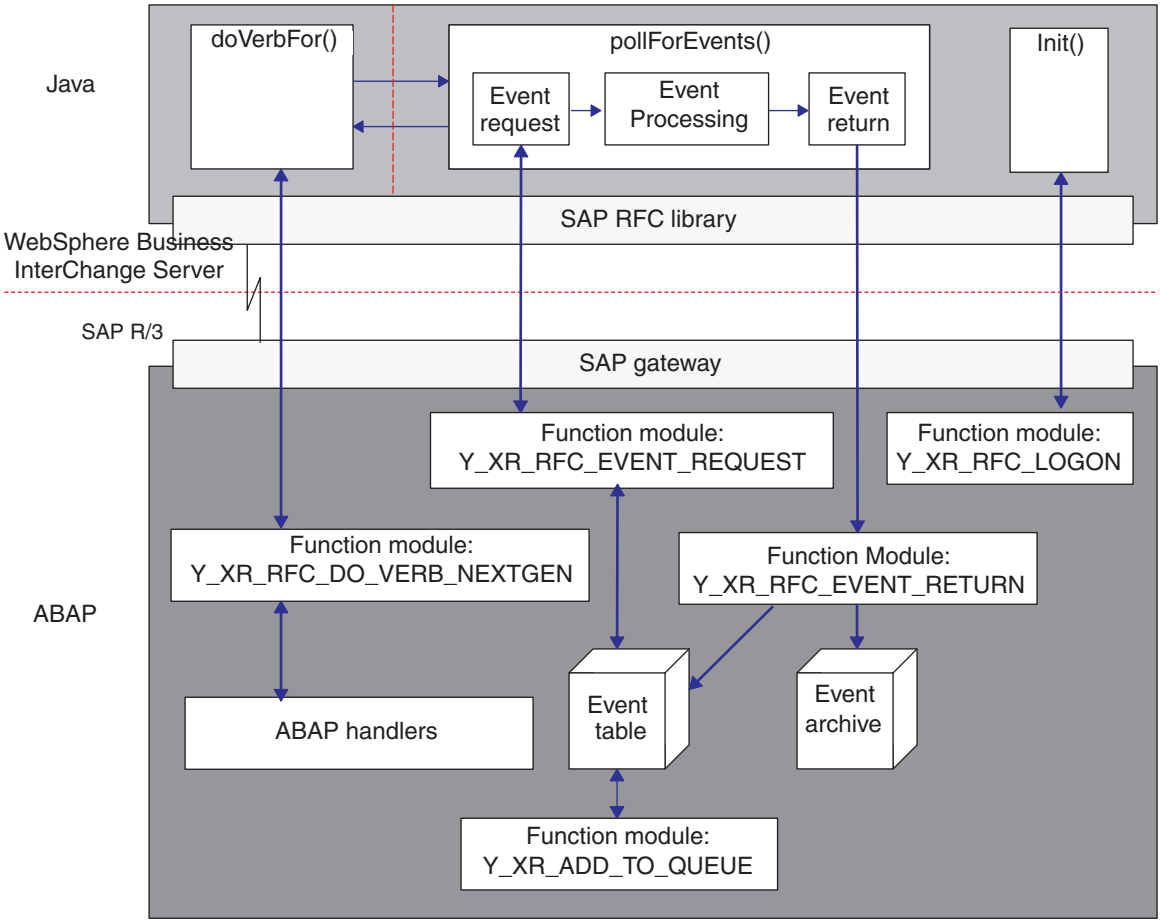



*Figure 64. ABAP Extension Module architecture*

## Java components

The connector is delivered and run as a Java Archive (JAR) file. It handles the event delivery and event business object request processes. The SAP RFC library is delivered and run as a JAR file as well. It enables external programs to execute ABAP function modules within an SAP application.

The Java components:

- Open an RFC connection to the SAP application using the SAP RFC library and the SAP Gateway.
- Handle requests from the integration broker and pass the requests to an ABAP component of the connector.
- Poll the SAP application for events.

## ABAP components

The ABAP components of the connector are function modules, programs, and database tables. These elements handle the event delivery and business object request processes initiated by the Java component. The ABAP components are delivered in connector transport files to be loaded into an SAP application; once loaded, they run as ABAP repository objects.

The ABAP components:

- Handle business object requests from the Java component by calling the appropriate function modules designed to handle a particular business object type and verb.
- Detect, trigger, and store events in the event table.
- Handle event requests and their subsequent return (event status update) from the Java component.

# How the ABAP Extension Module works

Most of the functionality provided by the ABAP Extension Module occurs inside of the SAP application. For most of the virtual functions that every connector must implement, there is a corresponding ABAP function module in the SAP application. However, SAP does not provide ABAP function modules that support the specific requirements of the `init()`, `doVerbFor()`, and `pollForEvents()` methods, so these function modules have been developed and delivered as part of the connector module. While the Java components provide some functionality, the majority of the processing for these methods is done by the ABAP components in the SAP application.

Table 38 shows the virtual Java methods that the connector module implements and their corresponding ABAP components. Keep in mind that this table does not provide a complete list of the ABAP components used by the connector.

*Table 38. Java components and their corresponding ABAP components*

| Java components | ABAP components |
|---|---|
| `doVerbFor()` | `Y_XR_RFC_DO_VERB_NEXTGEN` |
| `getVersion()` | No implementation required |
| `getBOHandlerForBO` | No implementation required |
| `init()` | `Y_XR_RFC_LOGON` |
| `pollForEvents()` | `Y_XR_RFC_EVENT_REQUEST`<br>`Y_XR_RFC_EVENT_RETURN` |
| `terminate()` | No implementation required |

Together, these ABAP function modules are the core of the ABAP Extension Module. The following sections describe connector initialization, business object processing, and how the connector handles event notification.

The implemented functions are discussed in the rest of this chapter.

## Initialization

The `init()` method calls the ABAP function module `Y_XR_RFC_LOGON` to validate that the destination SAP application is running and that the RFC library can be used to execute ABAP function modules. If the function module does not execute successfully, the connector terminates.

## Business object processing

All service call requests for SAP are initiated by the `doVerbFor()` method in the Java component of the connector module. The connector's ABAP function module `Y_XR_RFC_DO_VERB_NEXTGEN` and an ABAP handler in the ABAP component of the connector module handle the requests.

Figure 65 illustrates business object processing.

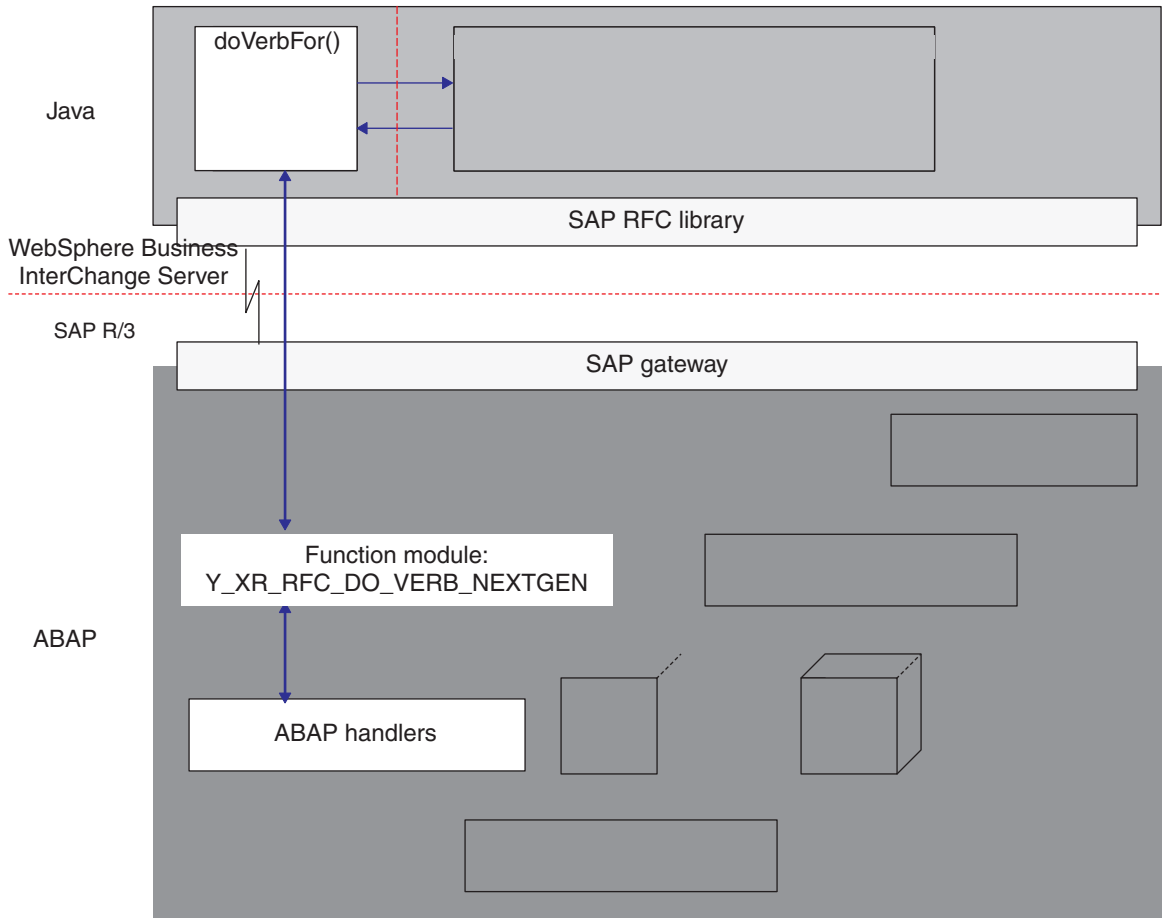



*Figure 65. Business object processing of doVerbFor()*

## doVerbFor()

In the Java component of the connector module, the doVerbFor() method of a single business object handler implementation handles all of the business object requests from the integration broker and all business object events from the pollForEvents() method. In either case, doVerbFor() executes in the following manner:

1. Converts an instance of a WebSphere business object for SAP to a single, predefined flat structure that contains the business object data.
2. Calls the ABAP function module Y_XR_RFC_DO_VERB_NEXTGEN, passes the business object data to it, and then waits for business object data to be returned.
3. Converts the returned business object data back into a WebSphere business object.

The doVerbFor() method passes business object data to function module Y_XR_RFC_DO_VERB_NEXTGEN and then creates an entirely new business object structure from the returned business object data.

## Y_XR_RFC_DO_VERB_NEXTGEN

In the ABAP component of the connector module, the connector's ABAP function module Y_XR_RFC_DO_VERB_NEXTGEN is responsible for handling all WebSphere business object processing in the SAP application. Specifically, it routes business object data to the appropriate ABAP handler. In this sense, function module Y_XR_RFC_DO_VERB_NEXTGEN can be thought of as a business object router. It always executes in the following manner:

1. Receives a business object.
2. Dynamically calls an ABAP handler to process the business object data and passes the business object data as a parameter.
3. Receives business object data from an ABAP handler and returns it back to the requesting call.

Y_XR_RFC_DO_VERB_NEXTGEN uses ABAP handlers to fulfill each object type and verb-specific request. Y_XR_RFC_DO_VERB_NEXTGEN uses the value in a business object's verb application-specific information to determine which ABAP handler to call. Y_XR_RFC_DO_VERB_NEXTGEN can be thought of as a router from the doVerbFor() method to an ABAP handler.

## ABAP handlers

ABAP handlers are unique to the connector module in that they extend the business object handler functionality from the Java component of the connector module. ABAP handlers reside in the SAP application as ABAP function modules and communicate directly with Y_XR_RFC_DO_VERB_NEXTGEN. ABAP handlers are needed to get business object data into or out of the SAP application database.

Figure 66 illustrates the business object processing components of the ABAP Extension Module and their relationship to one another. Notice that for a single business object handler (doVerbFor()) and business object router (Y_XR_DO_VERB_NEXTGEN) there are multiple ABAP handlers.

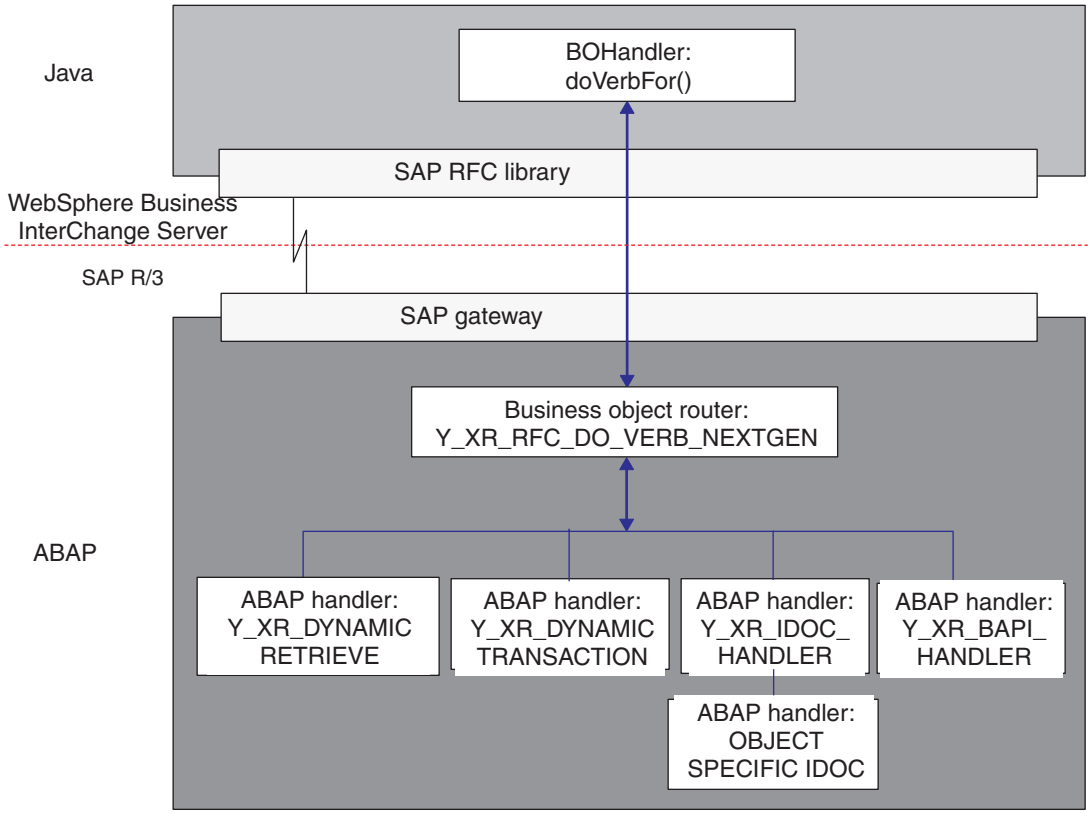



*Figure 66. Adapter-provided business object processing components*

ABAP handlers are responsible for adding business object data into the SAP application database (Create, Update, Delete) or for using the business object data as the keys to retrieving data from the SAP application database (Retrieve).

The adapter provides generic ABAP handlers. For example, function module `Y_XR_RFC_DYNAMIC_TRANSACTION` supports flat business objects for Create, Update, Delete, and Retrieve operations.

The WebSphere business integration system provides a meta-data repository and a generic ABAP handler to support flat business objects. The adapter also provides an ABAP handler (`Y_XR_IDOC_HANDLER`) to support hierarchical business objects; however, you must develop an additional business-object-specific ABAP handler for each hierarchical business object that you need to support.

The WebSphere business integration system provides tools that facilitate the development process. For more information on developing business objects and ABAP handlers, see Chapter 22, "Developing business objects for the ABAP Extension Module," on page 229 and Chapter 5, "Generating business object definitions using SAPODA," on page 47.

## Event notification

Event notification refers to the collection of processes that notify the connector of SAP application object events. Notification includes, but is not limited to the type of the event (object and verb) and the data key required for the external system to retrieve the associated data.

Figure 67 illustrates the event notification process, which uses the `pollForEvents()` method.

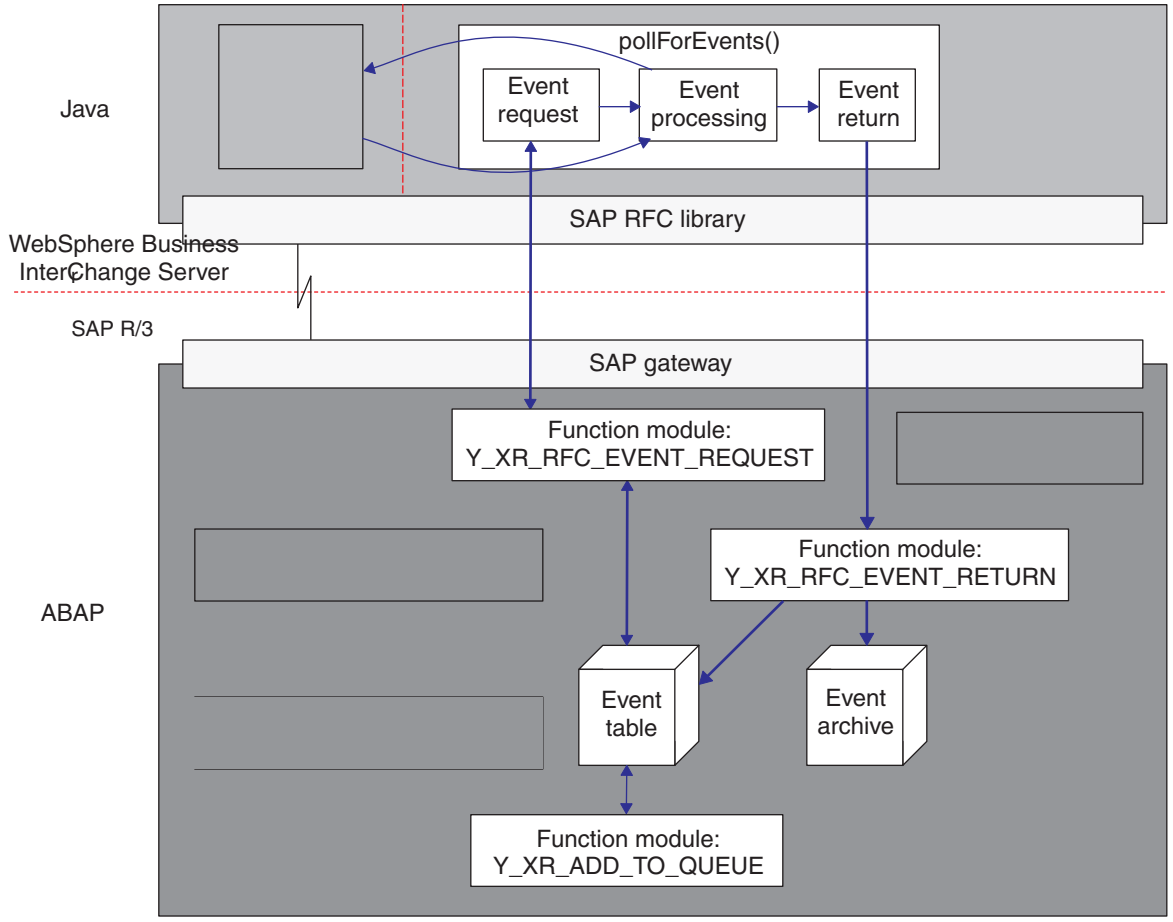



*Figure 67. Event notification process*

Event notification for the connector consists of two functions:

- "Event polling"
- "Event triggering" on page 207

## Event polling

Event polling consists of three functions that are carried out by the `pollForEvents()` method:

- "Event Request"
- "Event Processing" on page 206
- "Event Return" on page 206

**Note:** The roles of these functions are distributed in the Java and ABAP components. However, the Java component always initiates event polling.

**Event Request:** Event request is the process of polling and retrieving events from the event table in the SAP application. The event request mechanism of the Java component has a counterpart function module in the SAP application, `Y_XR_RFC_EVENT_REQUEST`. This function retrieves events from the connector's ABAP event table, `YXR_EVENTS`.

Every triggered event enters the event table with an initial status of prequeued (status marked as P in the event table) and a default event priority of zero. Before an event can be processed, its status must be changed to queued (Q in the event table). The priority of an event must be zero before the connector retrieves the full object that it represents. For more information on event priority, see "Event Priority" on page 209.

The status of an event changes from prequeued to queued if there are no database locks for the combination of the user who created the event and the event's key. If locks exist, the status of the event is set to locked (L in the event table) and the event is requeued. An ABAP constant, `C_MAXIMUM_REQUEUE`, defines of the number of times that an event can be requeued. If the maximum number (defaulted to 100) is attained, then the event is archived to the event archive table.

**Note:** Every event with a prequeued or locked status is updated with every poll. You can run into performance issues when events are triggered in batches. You can configure the polling frequency using the `PollFrequency` configuration property. For more information, see Appendix D, "Standard configuration properties for connectors," on page 287.

After preprocessing all prequeued events, the ABAP function module `Y_XR_RFC_EVENT_REQUEST` selects the events to return to the event request method in the Java component of the connector module (only events with a status of queued can be selected). The connector-specific configuration property `PollQuantity` (defaulted to 20) determines the maximum number of events returned for a single poll. For more information, see Chapter 4, "Running the connector," on page 43.

The event request mechanism performs the event selection process in two steps:

1. Selects events dedicated to the connector and the integration broker.

   Events are dedicated to a specific integration broker in the event distribution table. The name of the integration broker specified in this table must match the name specified in the shortcut that starts the connector. For example, the standard shortcut for an SAP connector running on Windows has the format:

   `...\start_SAP.bat` *`SAPconnectorName integrationBrokerName -cConfigFileName`*

   When WMQI is the integration broker, the WebSphere business integration system identifies the integration broker specified in the event distribution table by getting values from the connector's startup command:

   - The value of the `integrationBrokerName` parameter links the broker instance in the startup command to the broker specified in the event distribution table.

     **Note:** The product's installation program uses the integration broker name specified at installation as the value of the `integrationBrokerName` parameter in the startup command.

   - The value of the `ConfigFileName` parameter identifies the Queue Manager and queues configured for the specific WMQI instance.

2. If fewer than the maximum number of events have been selected, pulls the balance from the events that are not configured for event distribution.

   For example, if the connector-specific configuration property `PollQuantity` is kept at 20 and there are 8 events dedicated to the specific connector and the integration broker, the mechanism selects 12 additional events that are not configured for event distribution.

   When WMQI is the integration broker and only one Queue Manager has been configured, the names of the queues must be unique for each instance of the

integration broker. When WMQI is the integration broker and a cluster has been configured, the names of the queues must be unique for each integration broker within the cluster.

If desired, you can incorporate the name of the broker (as specified in the `integrationBrokerName` parameter of the startup command) or the name of the connector into the names of the queues. For example, if two brokers are named `WMQI1` and `WMQI2`, their respective ADMINOUTQUEUEs might be named `ADMINOUTQUEUE_MQI1` and `ADMINOUTQUEUE_MQI2`, respectively.

**Important:** If you set up multiple connectors to poll, you must configure every event to be processed by only one connector. Otherwise the connector may send duplicate events, or may archive events instead of retrieving them.

**Event Processing:** The event request function produces an array of events to be processed from the `YXR_EVENTS` event table. It passes these events to the event processing function, which handles them one at a time in the following manner:

1. Evaluates if the event is in the connector subscription list using the `object.verb` value.
   - If an event is not in the subscription list, sets the status of the event to `not subscribed`.
   - If an event is in the subscription list, creates a `parentObjectOnly.Retrieve` business object, and sets the value of the first key attribute with the event key value. Composite keys are treated as singletons and must be interpreted by the ABAP business object processing function modules
2. Invokes `doVerbFor()` and passes the business object data to it. Once the business object is passed, event processing waits for business object data to return.
3. Updates the status of the event array based on the `doVerbFor()` processing.
4. Delivers the business object data to the integration broker if the business object data is successfully retrieved.

**Event Return:** After each event is processed by event request, it is returned to the SAP application using function module `Y_XR_RFC_EVENT_RETURN`. This function module makes a copy of the processed event, adds it to the event archive table (`YXR_ARCHIV`), and then deletes the original entry from the event table.

**Note:** Events with their new status are all updated after each event is processed.

Archived events include successfully processed events, events that were processed but terminated in an error, and unsubscribed events. Each event has a status that can indicate one of the following conditions:

- The business object was successfully sent to the integration broker.
- The event produced an unknown Java return code from the connector.
- The event failed in attempting to retrieve data from the SAP application.
- The event timed out because the business object was locked.
- No collaboration subscribes to the event—relevant only when InterChange Server (ICS) is the integration broker.

Use the IBM CROSSWORLDS Connector Tool in the SAP application to administer the event archive table. Connector Tool enables an administrator to display and truncate the archive table and to resubmit events for processing. For more

information about maintaining the archive table and setting up log truncation, see Chapter 25, "Managing the ABAP Extension Module," on page 259.

## Event triggering

The connector is event-driven. In order to get events out of the SAP application, you need to implement an event triggering mechanism for each IBM WebSphere-supported business object. Event triggering for the connector comprises three functions:

- "Event Detection"
- "Event Trigger" on page 207
- "Event persistence" on page 209

**Event Detection:** Event detection is the process of identifying that an event was generated in the SAP application. Typically, connectors use database triggers to detect an event. However, because the SAP application is tightly integrated with the SAP database, SAP allows very limited access for direct modifications to its database. Therefore, the event detection mechanisms are implemented in the application transaction layer above the database.

The IBM WebSphere Business Integration Adapter for mySAP.com commonly uses three mechanisms to detect an event in the SAP application:

- Code enhancements
- Batch programs
- Business Workflow

**Note:** Each event detection mechanism has advantages and disadvantages that need to be considered when designing and developing a business object trigger. For more information on implementing an event detection mechanism, see Chapter 23, "Developing event detection for the ABAP Extension Module," on page 247.

**Note:** These are only a few examples of event detection mechanisms. There are many different ways to detect events.

**Event Trigger:** Regardless of the detection mechanism used, all events are triggered using the event trigger `Y_XR_ADD_TO_QUEUE`. Once an event is identified by one of the event detection mechanisms, it is passed to the event trigger. The IBM WebSphere Business Integration Adapter for mySAP.com includes an event trigger (`Y_XR_ADD_TO_QUEUE`) that commits events to the event table (`YXR_EVENTS`). Specifically, it adds a row of data for the object name, verb, and key that represents the event.

All events are added to the current events table using `Y_XR_ADD_TO_QUEUE`. In addition to adding a row of data to `YXR_EVENTS`, `Y_XR_ADD_TO_QUEUE` can be set up for:

- Event filtering
- Event distribution
- Event priority

Event filtering, event distribution, and event priority are executed as part of the event trigger and by no other program. They result in either the event's restriction (filtering), or modification (event distribution and event prioritization).

**Event filtering** The event trigger can be used to filter out events

that you do not want added to the event table. The adapter provides an ABAP include program (YXRRESTR) that enables you to restrict specific events for this purpose.

**Event distribution**

Load balancing can be used to distribute event processing across multiple connectors allowing you to process multiple events at the same time. The event trigger provides this capability through the event distribution table (YXR_EVTDIS). You can dedicate business objects to be retrieved by a specific connector. Also, event distribution can take a single event and replicate it one or more times for each subscribed combination of connector and the integration broker.

Figure 68 illustrates the event triggering functionality inside the SAP application. The events E1, E2, and E3 are received by the event trigger Y_XR_ADD_TO_QUEUE. E1 represents a Customer event and E3 represents an Order event. Event distribution is set up so that all Customer objects are handled by SAPconnector1 and all Order objects are handled by SAPconnector2. In this environment, both connectors use the same integration broker. Because E1 is a Customer object, it is polled by SAPconnector1 and because E3 is an Order object, it is polled by SAPconnector2. E2 is an Inventory object that is filtered out by code in the restriction program YXRRESTR that restricts inventory objects from Plant 100.

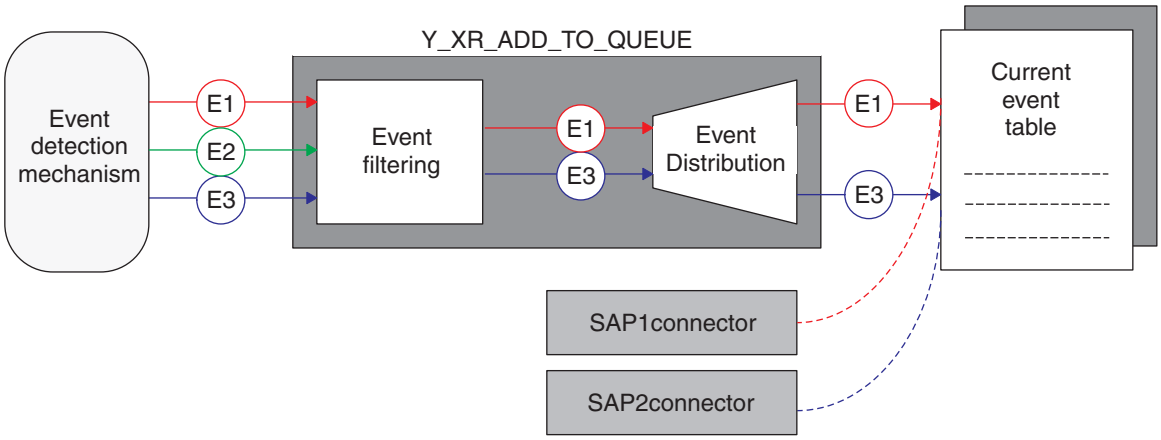



*Figure 68. Event triggering with function module Y_XR_ADD_TO_QUEUE*

**Attention:** If you are using multiple connectors to poll, you must dedicate every subscribed event to a specific connector. Failure to do so may result in duplicate events delivered. You must guarantee that there is no dependency between objects dedicated to different connectors, because this may result in events being delivered out of sequence.

For example, assume you have a single integration broker named CROSSWORLDS1 that subscribes to two different business objects, BO_A and BO_B. The BO_A business object is small and can be retrieved quickly whereas BO_B is large and takes much longer to retrieve. With two connectors polling, SAPconnector1 and SAPconnector2, you can set up the event distribution table so that SAPconnector1 retrieves BO_A and SAPconnector2 retrieves BO_B. SAPconnector1 can continuously poll small objects of type A, while SAPconnector2 focuses on the larger type B objects.

**Note:** For information on how the WebSphere business integration system identifies each unique instance of a WMQI integration broker, see "Event Request" on page 204.

**Important:** If the event distribution table is not configured for a specific object, then each event triggered for that object is available for any combination of connector and integration broker.

**Event priority** You can set the event priority for each combination of business object, connector, and integration broker by delaying the retrieval of events. An event's priority indicates the number of polls that are needed before the event is picked up for delivery. For example, if you set the priority of an event to 10, then the connector polls the event table ten times before the event is retrieved. Each time the connector polls, the priority value is reduced by one until it reaches zero.

By default, all events are given a priority of zero. An object's priority is configured in the same ABAP table as event distribution.

**Event persistence:** Once the event trigger inserts an event into the event table, the event is committed to the database with its event distribution and event priority values set. At this time, only polling can modify the event. When the event polling processes is completed, meaning the event was retrieved from the SAP application and processed by the Java component of the connector, a copy o f the processed event is added to the event archive table (`YXR_ARCHIV`). The original event is then deleted from the event table.

**Note:** You can resubmit an event from the archive table. Keep in mind that the event is simply moved to the event table and is not triggered again. Specifically, it does not pass back through event filtering, event distribution, and event priority.

# Chapter 20. Installing and customizing the ABAP Extension Module



This chapter describes the installation and customization of the ABAP Extension Module only and assumes that you have already installed and configured the IBM WebSphere Business Integration Adapter for mySAP.com. For more information on installing and configuring the connector, see Chapter 4, "Running the connector," on page 43. Customizing the connector is optional, but recommended.

All of the components of the connector can be found in the `\connectors\SAP` directory for Windows and the `/lib` directory for UNIX. The transports are installed on an SAP R/3 application or database server as described below in "Connector transport file installation" on page 211.

**Note:** In this document backslashes (\) are used as the convention for directory paths. For UNIX installations, substitute backslashes with slashes (/). All file pathnames are relative to the directory where the product is installed on your system.

## Connector transport file installation

The connector's transport files contain a variety of objects such as table structures, functions, and data. These development objects need to be imported into your SAP installation to provide specific functionality required by the ABAP Extension Module.

### Transport files

Each transport file is included in a `.zip` file. For example, the transport file for the SAP R/3 version 3.x Primary transport is located in the `Primary.zip` file. These files can be found in `\connectors\SAP\dependencies\transports_31`.

Modifications required by IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x) are handled by a set of three required transport files along with one transport file for each business object. To ensure that all necessary tables are created before the data for those tables is added, the transport files must be imported in the following order:

1. `Primary`
2. `Infrastructure_1`
3. `Infrastructure_2`

Once the required transport files have been successfully loaded, the business object-specific transports can be loaded in any order. See the transport note included in each transport `.zip` file for detailed information about the transport file.

**Primary** This transport file contains the development objects, which should only be loaded once into the recipient system. It contains the number range

objects, the development class for YXR1 as well as the restriction include, which can be used to make customer-specific changes to the triggering logic. Caution should be used when applying this transport file to a system that already has the connector running on it, because the contents of the transport file will overwrite all objects in the existing environment.

**Infrastructure_1**

This transport file contains the programs and data dictionary objects associated with the connector that are not business object specific.

All of the objects begin with YXR with the following exceptions:

- The message class used in the connector's development environment is YX.
- There are two set/get memory parameters YXD and YXV, because set/get parameters are limited to three characters.
- The programs behind the two product area menus are MENUYXR0 and MENUYXR1, because SAP automatically prefixes the string MENU before all area menu programs. The area menus themselves are within our name range.

  **CAUTION:**
  **Any changes that are made to objects in this transport file need to be well documented outside of SAP. Changes will be overwritten by the next IBM WebSphere adapter infrastructure transport and will need to be re-applied manually.**

**Infrastructure_2**

This transport contains SAP customizing data necessary for the connector log and for the transaction to maintain the connector's tables. All of the keys begin with YXR. The customizing table entries in the connector's tables do not begin with YXR.

## Installing connector transport files

The connector transport files make all necessary modifications to SAP by importing programs and other development objects included with the IBM WebSphere Business Integration Adapter for mySAP.com. They do not alter any SAP programs or modify user exits.

In the following instructions, SID refers to your SAP system ID and *TransportFileName* refers to the name of the transport file. However, the characters that make up the transport file name appear in a different order in the installation directory from the way the name is passed as a parameter to the various tp commands. In the \usr\sap\trans\cofiles directory, the format of a transport file name is K9*xxxxx*.*SID*, but when the file name is passed as a parameter it has the format *SID*K9*xxxxx*. For example, the file name K912345.D30 would be passed as a parameter as D30K912345 if your *SID* is D30.

To install the transports:

1. Log in as the SAP administrator, SIDadm.
2. Copy the transports to the SAP database server.The transports consist of two kinds of files and should be copied as described below:
   a. Copy files that have names beginning in K to the \usr\sap\trans\cofiles directory.
   b. Copy the other files to the \usr\sap\trans data directory.

      Check the connection to the database and determine the path of the tpparam file by running the tp connect command:

      tp connect *SID*

      If this command fails, try adding the path of the tpparam file as a second parameter:

      tp connect *SID* pf = *path_of_tpparam*

      For example, if the SID is P11 and the path of the tpparam file is \usr\sap\trans\bin\tpparam, the command would be:

      tp connect P11 pf = \usr\sap\trans\bin\tpparam

      If tp connect succeeds when you specify the path of the tpparam file and fails when you do not, you should specify the optional tpparam path in the commands described below in step 3.
3. The transports can be imported in one of the following two ways:
   - In \usr\sap\trans\bin, execute the following commands for each transport, in the order specified:

     tp addtobuffer *TransportFileName SID* pf = *path_of_tpparam*

     tp import *TransportFileName SID* u023689 CLIENT=*CLIENT#* pf = *path_of_tpparam*
   - In the Transport Management System (transaction STMS):
     a. Click the Import overview icon (F5).
     b. Double-click the appropriate queue to be updated.
     c. In the menu bar, click Extras, then Other requests, and then click Add.
     d. Populate the transport request field, and click the check mark to enter it.
     e. When the Add Transport Request confirmation window appears, click Yes to attach the import to the queue.
     f. Place the cursor on the transport that was just added.
     g. In the menu bar, click Request, and then click Import.
     h. Populate the Target client field, and click the check mark to import it.

   **Important:** Install the transports in order.
4. When the transports are installed, change the development class to follow the migration path of your development classes. In SAP R/3 versions 3.x the development class is YXR1.

   Using the IBM CrossWorlds Connector Tools window (transaction YXR1):
   a. From the Customizing menu, click Connector, and click Reassign Transp Lyr.
   b. Select the appropriate Transport layer entry, and then click the Save button.

For additional configuration requirements of particular application-specific business objects, see the reference page for that business object.

**CAUTION:**
**Any changes you make to development objects which were in the connector transports, should be well documented outside of SAP. Changes could be overwritten by the next release of the adapter's transport files and would need to be re-applied manually.**

## Verifying the connector transport file installation

To verify that the connector transport files were physically moved into the SAP application, examine the transport logs in one of the following two ways:

- To verify that the connector transport files were physically moved into the SAP application, examine the transport logs in one of the following ways:

  Using the Transport Organizer (transaction SE01):

  1. Populate the number field with the name of the transport file.
  2. Click Display to see the log.

  Using the Transport Management System graphic interface (transaction STMS):

  1. Click the Import overview icon (F5).
  2. Double-click the appropriate queue.
  3. Right-click the transport number, and then select Logs.
  4. Examine the log to see if the installation was successful.
- To verify that SAP generated the objects successfully:
  1. Go to transaction SE38
  2. Enter `YXR_CNST` as the program.
  3. Select Source Code, and then click Display.
  4. From the Program menu, click Generate.
  5. Click Select All, and then click Continue (F2).

     This generates all of the adapter's programs that include these programs.

  If you get the response `Programs successfully generated`, you can assume that the transport was successful.

## Enabling the SAP application for the connector

After installing the connector and configuring the standard and connector-specific configuration properties, you have the option of modifying the event handling and logging capabilities for the connector from within the SAP application.

### Setting up event distribution

Load balancing distributes event and business object request processing across multiple connectors. The IBM WebSphere Business Integration Adapter for mySAP.com can handle only one transaction at a time. Therefore, if you set up multiple connectors to handle specific business objects, then multiple events and business objects can be processed at the same time. For more information on setting up multiple connectors, see "Installing multiple connectors" on page 18.

To set up event distribution for multiple connectors:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Customizing menu, click Connector, and then click Event Distribution.

3. Click the New Entries button (F5), and in the New Entries window, enter the business object name, connector name, and InterChange Server name.
4. Enter a number in the counter field for each business object. The combination of the business object and counter provides a unique key for the event distribution table. The counter can be any number up to six digits in length.

**Note:** In a test environment, you may have multiple users testing the same business object that is subscribed to by multiple connectors. If each user wants only a certain event for that business object, then you can specify a user name to differentiate between which event is passed to which combination of connector and integration broker. In the User (Event Trigger) field, enter the appropriate user name for the business objects.

## Setting up event filtering

The configuration table in the SAP application cannot accommodate all modifications, so the IBM WebSphere Business Integration Adapter for mySAP.com provides an ABAP include program that can be modified to filter events. This program, `YXRRESTR` is called from within the event trigger `Y_XR_ADD_TO_QUEUE` to enable additional filtering of events.

**Note:** You must have developer privileges to make changes because the code needs to be recompiled.

To view or modify the include program `YXRRESTR`:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Customizing menu, click Event Triggering, and click Modify Restrictions (transaction YXRS).

A number of possibilities for event filtering can be configured using this program.

## Setting up event priority

You can set the priority of an event to be processed based on its importance. By setting the priority of each combination of business object, connector, and integration broker, you can delay a connector's retrieval of an event. For example, if you set the priority of an event to 10, the connector polls the event table ten times before retrieving the event. So, if the connector polls the event table every 5 seconds, the connector picks up the event after 50 seconds. Each time the connector polls, the priority value is reduced by one until the event is retrieved and processed.

To set the priority of an event:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Customizing menu, click Connector, and click Event Distribution.
3. Populate the Priority column, with a value between 1 and 99 for the appropriate business object.

## Increasing log tablespace size

The log tables for the IBM WebSphere Business Integration Adapter for mySAP.com are located, by default, in the tablespace named `PSAPUSER1D`,and the indexes are located in tablespace `PSAPUSER1I`. `PSAPUSER1D` and `PSAPUSER1I` are SAP application tablespaces reserved for customer use, but are typically small. Because

of the default size, these tablespaces can fill up quickly, depending on the level of activity and the logging level of the adapter's installation.

To view the current size of these tablespaces, go to transaction DB02, and then click the Current Sizes button. The volume of events captured by IBM WebSphere business integration system determines the size needed for these tablespaces.

If the default sizes are too small, ask the SAP database administrator for the installation to modify them.

## Verifying number ranges for transport objects

There are three objects for the adapter that must have an adequate number range within the SAP application. When the transports are installed, the following objects and their default number ranges are set:

- YXR_EVENT
- YXR_IDOC
- YXR_LOG
- YXR_OBJARC

You should have to verify only that the associated number ranges are set correctly. To view the number ranges:

1. Go to transaction SNRO.
2. Populate the Object field with the object name (for example, `YXR_EVENT`).
3. Click Number Ranges, and then click Intervals.

**Note:** If you reinstall the `Primary` connector transport in an installation where events have already been generated, new events may be created using existing event IDs. To prevent this problem, turn off logging (transaction YXRM), and then truncate the log completely before re-importing the connector transport file. Once the connector transport file has been successfully loaded, turn logging back on. For more information on truncating the event log, see "Setting up truncation of the event log" on page 260.

# Chapter 21. Business object processing in the ABAP Extension Module



This chapter discusses business object processing for the ABAP Extension Module. It provides a detailed description of how the connector processes business objects. The chapter is set up to show the progression of a business object through the Java and ABAP components of the connector.

**Note:** All references to ABAP components of the connector use the SAP R/3 version 3.x naming convention.

Business object processing for the Extension Module of the IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x) is the same for all business objects regardless of the specific native SAP API that is used. For example, if you develop a business object based on a Call Transaction or an IDoc, the business object data is processed the same way. The processing is the same whether a business object is sent into the SAP application as a retrieve performed as part of event notification or as a business object request. The business object's verb also does not change the processing.

Figure 69 illustrates the conversion and processing of an application-specific business object to a flat structure and then back to an application-specific business object. Note that the business object data that is passed out of the SAP application must have the same structure as the data passed in, but the data might not have the same values.

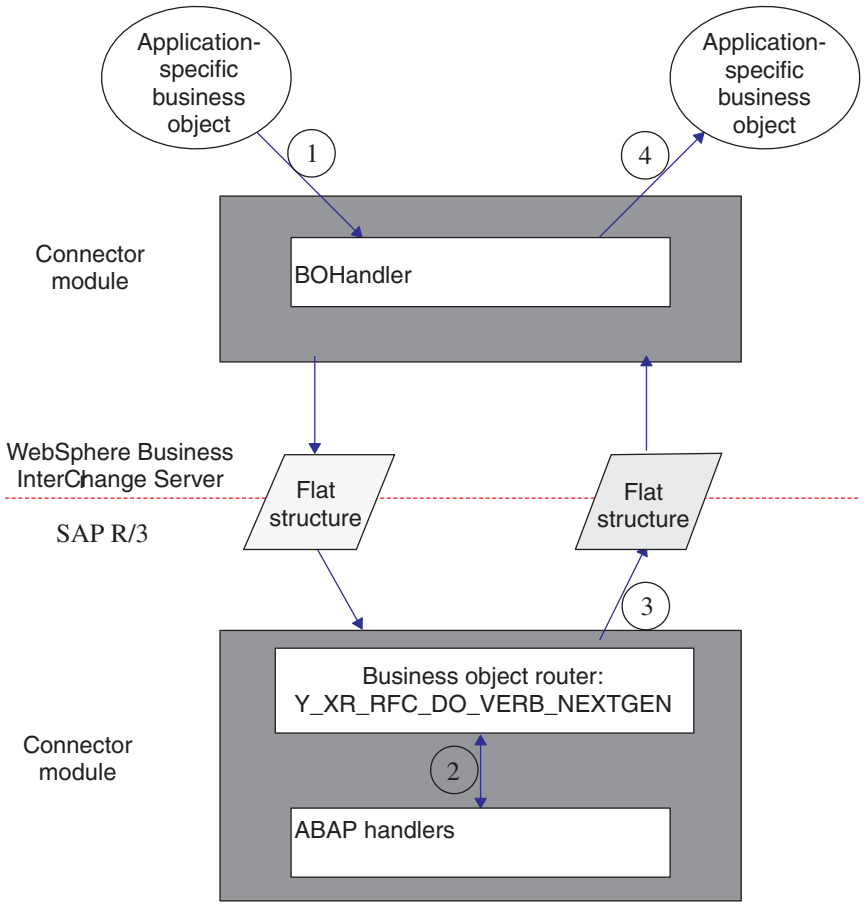



*Figure 69. Business object processing*

Business object processing consists of four steps. The four steps listed below correspond to the numbers in Figure 69.

1. The connector converts an application-specific business object into a flat structure containing business object data and passes the data to the SAP application.
2. The connector's function module `Y_XR_RFC_DO_VERB_NEXTGEN` dynamically routes the business object data to an ABAP handler.
3. The ABAP handler processes the business object data, generates business object response data, and returns new business object data to the connector back through `Y_XR_RFC_DO_VERB_NEXTGEN`.
4. The connector receives the new business object data, and uses it and the business object definition of the application-specific business object to create a new business object to pass to the integration broker.

## Business object conversion to a flat structure

As a first step in business object processing, the connector converts a business object into a flat structure that can be processed in the SAP application. The format of the flat structure is the same for all types of business objects (such as Call Transaction-based or IDoc-based business objects). The flat structure is reformatted data from an application-specific business object. The only difference between the two forms of data is that the flat structure does not maintain parent and child business object relationships. Therefore, the connector relies on a set of rules to create a flat structure.

When converting a business object into a flat structure, the connector creates a structure in memory and then populates it with data from the business object. In doing so, it passes the following data into the SAP application from the business object:

- Business object name
- Business object application-specific information
- Business object verb
- Business object verb application-specific information
- Attribute name
- Attribute property `IsKey`
- Attribute property `AppText`
- Attribute value

Table 39 shows the generic flat structure of a business object. The connector uses this flat structure when adding the business object data from a WebSphere business object.

*Table 39. Generic Flat Structure Representation of a WebSphere Business Object for SAP*

| Field Name | Data Type | Length | Description |
|---|---|---|---|
| ATTR_NAME | CHAR | 32 | Attribute Name (example, CustomerId) |
| BLANK1 | CHAR | 1 | Delimiter |
| ATTR_VALUE | CHAR | 200 | Attribute Value (example, 00000103) |
| BLANK2 | CHAR | 1 | Delimiter |
| ISKEY | CHAR | 1 | 1= true, 0 = false; attributes only |
| BLANK3 | CHAR | 1 | Delimiter |
| ISNEW | CHAR | 1 | 1 = BO; 0 = verb or attribute |
| BLANK4 | CHAR | 1 | Delimiter |
| PEERS | CHAR | 6 | Indicates number of peers of an array of business objects |
| BLANK5 | CHAR | 1 | Delimiter |
| OBJ_NUMBER | CHAR | 6 | Not used |
| BLANK6 | CHAR | 1 | Delimiter |
| APPTEXT | CHAR | 120 | Application-specific information of object, verb or attribute |
| BLANK7 | CHAR | 1 | Delimiter |

**Note:** The BLANKn field names always contain a single character (CHAR) space and should never be populated.

In order for the data conversion to work properly, the business object data in the flat structure must strictly adhere to a set of rules. These rules are defined in this initial data conversion step:

- Each business object attribute is placed sequentially into a flat structure, where one row corresponds to one attribute.
- Hierarchical business objects are converted as depth and then breadth.

When the connector populates the flat structure with business object data, the connector loops through each business object twice, beginning with the top-level business object.

1. In the first pass, it sets all simple attributes. Each attribute equals one row in the flat structure.

2. In the second pass, it recursively executes the same processing in step 1 for each child business object.

Attributes that represent child business objects are not included in their parents. Instead, each child that contains data is created as a complete business object. The result is a single list of attributes ordered by depth, then breadth.

Figure 70 illustrates the data conversion of a WebSphere business object for SAP into a flat data structure. The conversion of data always follows the rule of depth first and then breadth. In the example, the top-level parent business object, `SAP_Order`, has two children, `SAP_LineItem (1)` and `SAP_LineItem (2)`, which are considered peers. `SAP_LineItem (1)` has one child business object, `SAP_ScheduleLines`.

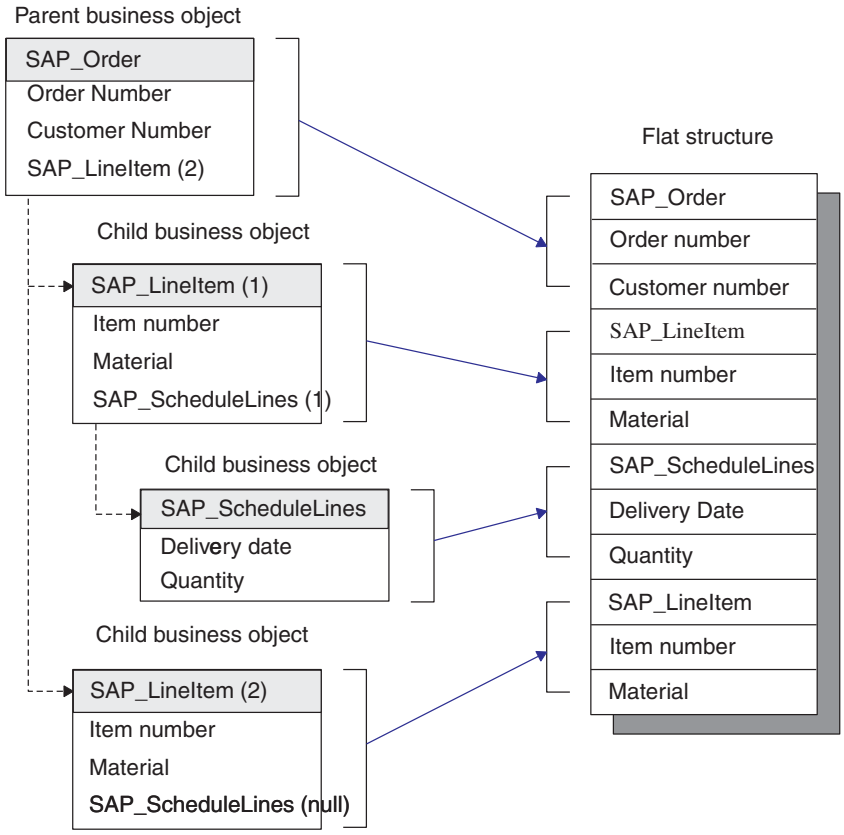



*Figure 70. Conversion from a business object to a flat structure*

It is important to understand the ordering of the business objects and their attributes when designing a business object definition. The following tables illustrate the result of the conversion of an WebSphere business object to a flat structure. Table 40 represents a flat structure for a flat business object, SAP_Material, whose key value is ItemID. In this example, there is no application-specific information for the business object or any of the attributes. Table 41 represents a flat structure of a hierarchical business object based on an IDoc Sales Order.

*Table 40. Flat business object SAP_Material*

| ATTR_NAME | ATTR_VALUE | ISKEY | ISNEW | PEERS | OBJ_ NUMBER | APPTEXT |
|---|---|---|---|---|---|---|
| BoName | SAP_Material | 0 | 1 | 1 | (blank) | (blank) |
| BoVerb | Retrieve | 0 | 0 | 1 | (blank) | :Y_XR_ DYNAMIC_RETRIEVE |
| ItemID | 000000000000001179 | 1 | 0 | 1 | (blank) | (blank) |
| ShortDesc | CxIgnore | 0 | 0 | 1 | (blank) | (blank) |
| ObjectEventID | SAP_124 | 0 | 0 | 1 | (blank) | (blank) |

In this example, there is no application-specific information for the business object or any of the attributes.

*Table 41. Hierarchical business object based on an IDoc sales order*

| ATTR_NAME | ATTR_VALUE | ISKEY | ISNEW | PEERS | OBJ_ NUMBER | APPTEXT |
|---|---|---|---|---|---|---|
| BoName | SAP_Order | 0 | 1 | 1 | (blank) | YXRV4B01 |
| BoVerb | Create | 0 | 0 | 1 | (blank) | [archive:methods] |
| Currency | USD | 0 | 0 | 1 | (blank) | E1EDK01:CURCY |
| OrderId | CxIgnore | 1 | 0 | 1 | (blank) | E1EDK01:BELNR |
| ObjectEventId | SAP_124 | 0 | 0 | 1 | (blank) | E1EDK01: ObjectEventId |
| BoName | SAP_LineItem | 0 | 1 | 2 | (blank) | Z1XRV40 |
| BoVerb | Create | 0 | 0 | 2 | (blank) | (blank) |
| Createdby | User1 | 1 | | 2 | (blank) | Z1XRV40:ERNAM |
| ObjectEventId | SAP_125 | 0 | 0 | 2 | (blank) | Z1XRV40: ObjectEventId |
| BoName | SAP_ ScheduleLines | 0 | 1 | 1 | (blank) | E1EDK14 |
| BoVerb | Create | 0 | 0 | 1 | (blank) | (blank) |
| Qualifier | 001 | 1 | 0 | 1 | (blank) | Z1XRV40:QUALF |
| OrganizationId | 1000 | 0 | 0 | 1 | (blank) | E1EDK14:ORGID |
| ObjectEventId | SAP_126 | 0 | 0 | 1 | (blank) | E1EDK14: ObjectEventId |
| BoName | SAP_LineItem | 0 | 1 | 2 | (blank) | Z1XRV40 |
| BoVerb | Create | 0 | 0 | 2 | (blank) | (blank) |
| Createdby | User1 | 1 | 0 | 2 | (blank) | Z1XRV40:ERNAM |
| ObjectEventId | SAP_127 | 0 | 0 | 2 | (blank) | Z1XRV40: ObjectEventId |

The first two rows, `BoName` and `BoVerb`, are added by the connector for each business object. `BoName` and `BoVerb` are keywords that cannot be used as business object attributes.

## Business object data routing to ABAP handlers

Once the business object data is converted into a flat structure, the business object data is passed into SAP memory by calling the adapter's ABAP function module `Y_XR_RFC_DO_VERB_NEXTGEN`. `Y_XR_RFC_DO_VERB_NEXTGEN` does not manipulate the business object data; it simply routes it to the appropriate ABAP handler for further processing. After `Y_XR_RFC_DO_VERB_NEXTGEN` passes the business object data to an ABAP handler, it waits for business object data to be returned.

**Note:** Remember that every business object retrieve and request is processed through Y_XR_RFC_DO_VERB_NEXTGEN.

Y_XR_RFC_DO_VERB_NEXTGEN uses a business object's verb application-specific information to determine which ABAP handler processes the business object data. At runtime, Y_XR_RFC_DO_VERB_NEXTGEN reads the verb application-specific information and passes the business object data to the specified ABAP handler.

Every ABAP handler must reserve the use of verb application-specific information for the connector. The format for the verb application-specific information is:

:*function1*:*function2*:*function3*

where Y_XR_RFC_DO_VERB_NEXTGEN executes function1, passing function2 and function3 as parameters. For example, Customer Update and Material Retrieve execute only function1:

For Create, Update or Delete verbs, specify :Y_XR_RFC_DYNAMIC_TRANSACTION

For the Retrieve verb, specify :Y_XR_RFC_DYNAMIC_RETRIEVE

One of the ABAP handlers provided by the adapter is function module Y_XR_IDOC_HANDLER. This ABAP handler reformats the data of the flat structure into an instance of an IDoc definition and passes that reformatted data to another ABAP handler written to handle that specific type of IDoc. The following examples illustrate the use of the IDoc handler API:

Sales Order Update = :Y_XR_IDOC_HANDLER:Y_XR_ORDER_C2

Sales Order Retrieve = :Y_XR_IDOC_HANDLER:Y_XR_ORDER_C4

In the examples, Y_XR_IDOC_HANDLER is executed and passes the second function module name as well as the business object data. Y_XR_IDOC_HANDLER executes the call to the second ABAP handler to pass the business object data in an IDoc format to the Y_XR_ORDER function module written specifically to handle Order objects. For steps on setting up verb support for the IDoc handler, see "Developing business objects using IDocs" on page 240.

**Note:** Y_XR_RFC_DO_VERB_NEXTGEN uses the value of function1 only. function2 and function3 may be used by the ABAP handler.

To dynamically call an ABAP handler, Y_XR_RFC_DO_VERB_NEXTGEN requires the interface of every ABAP handler to be exactly the same. This enables Y_XR_RFC_DO_VERB_NEXTGEN to send and receive business object data, as well as a return code and a return text message to any ABAP handler. For more information on the functional module interface, see "IBM WebSphere function module interface" on page 231.

## How ABAP handlers process business object data

The function of an ABAP handler is to get business object data into or out of the SAP application database. When processing business object data, ABAP handlers:

1. Interpret business object data.
2. Integrate data with SAP native APIs.
3. Reformat all data returned from native APIs.

## Business object data and ABAP handlers

Every ABAP handler receives business object data in the same format (flat structure). However, each ABAP handler has specific requirements for business objects that are determined by the complexity of the WebSphere business object definition, the native API that SAP provides, and the level of functionality that the ABAP handler provides. For these reasons, ABAP handlers may interpret business object data by parsing it into a structure specific to the business object. This enables the ABAP handler to more easily manipulate the data.

**Note:** Parsing the data is not required. However, it simplifies the ABAP handler's processing of a business object.

The adapter provides several ABAP handlers, such as an IDoc handler. The IDoc handler leverages SAP's IDoc technology by providing an ABAP handler to interpret business object data by reformatting it into an IDoc-based structure for the ABAP handler to use.

## Business object data and SAP native APIs

Once the ABAP handler interprets the business object data, the ABAP handler must integrate it with the SAP application database. It must manipulate the business object data to use SAP native APIs such as Call Transaction, BAPI, or ABAP SQL to get data into or out of the application database.

### Create, update, and delete processing

The intent of a Create, Update, or Delete operation is to modify the SAP application database. While the SAP application database schema for a given business object defines the structure of the data, the transactions provided by SAP that modify that data have a much broader scope of influence. As a result, directly modifying the application database tables of an SAP application can have disastrous results to the applications's data integrity.

Instead of directly modifying the database tables, SAP provides a flexible ABAP API (Call Transaction) for Create, Update, and Delete operations. Call Transaction is SAP-provided functionality for entering data into an SAP application. It guarantees that the data adheres to SAP's data model by using the same screens an online user would use in a transaction. This process is commonly referred to as screen scraping.

### Retrieve Processing

If the verb is Retrieve, then the connector uses ABAP SQL statements to retrieve data from the SAP application database. The business object data provides the keys for the `where` clause when pulling data. The difficulty in this methodology of retrieving data is that the retrieved data must be represented in a format that represents the business object structure. This is done in the ABAP handler ABAP code.

## Reformatting returned business object data

Regardless of the verb of the business object, the connector waits for two types of confirmations:

- Return code
- Returned business object data (for success only, return code = 0)

If the ABAP handler returns a non-zero code, then no business object is returned to the connector. If ABAP handler processing is successful, then the connector expects

new business object data that reflects the operation performed. For example, after a successful Create, the returned business object is an exact copy of the business object initially sent in, except that the keys are updated. Similarly, a successful Retrieve results in a fully formed instance of the business object. However, Create, Update, and Delete operations have different requirements for returned business objects than do Retrieve operations.

When InterChange Server (ICS) is the integration broker, the difference in requirements comes from how the WebSphere business integration system handles business objects, specifically dynamic cross-referencing of object IDs during mapping. When the connector returns a business object to InterChange Server after a Create or Update operation, the mapping infrastructure attempts to update the cross-reference tables with the newly acquired object ID. This is accomplished by looking up the value of the business object's `ObjectEventId` attribute that was set when the business object was originally sent to the connector.

To the ABAP handlers, this is significant because the ABAP handlers are responsible for "stitching" the object IDs into the business object that is returned to the connector. Typically this is not an issue for Retrieve operations because there is no corresponding dynamic cross-referencing. Retrieve operations generate an entirely new business object that is returned to the connector. This business object does not have any direct relationship to the structure of the original business object.

The business object data returned by the ABAP handler must be in the same flat structure format as when it was initially passed in to function module `Y_XR_RFC_DO_VERB_NEXTGEN`. The ABAP handler needs to send out only simple type attributes with the following information for each:

- Value
- Peer relationship
- Application-specific information

The attribute name is not required at this point, because the connector uses only the application-specific information to create a business object from this data. Identifiers for the beginning and ending of business objects or object type attributes are not used and should not be added. For example, the `BoName` and `BoVerb` rows are not used in the business object returned from the ABAP handler. They are initially passed into the ABAP handler only to facilitate processing.

The ABAP handler must adhere to the following set of rules when populating a flat structure with business object response data representing an WebSphere business object:

- Send only simple attributes, not object types.
- All attributes must exist in the WebSphere business object definition.
- All attributes must be sent in the order they are listed in the WebSphere business object definition.
- No attribute of a child business object can be sent unless at least one attribute is sent for its parent business object.
- Contained business objects must communicate the number of peers they have.
- Attribute name (field ATTR_NAME) is not required.

Figure 71 illustrates a flat business object (no object type attributes).

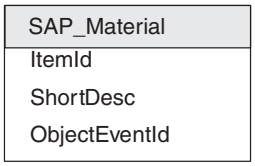



*Figure 71. Flat business object SAP_Material*

Table 42 represents the structure of a flat business object, SAP_Material, whose key value is ItemID. Notice that field ATTR_NAME is not required, APPTEXT is unique for each attribute, and because this business object is flat, the PEERS field can be left blank.

*Table 42. Flat business object SAP_Material*

| ATTR_NAME | ATTR_VALUE | ISKEY | ISNEW | PEERS | OBJ_ NUMBER | APPTEXT |
|---|---|---|---|---|---|---|
| (blank) | 000000000000001179 | (blank) | (blank) | (blank) | (blank) | ItemId |
| (blank) | Toaster 6000 | (blank) | (blank) | (blank) | (blank) | ShortDesc |
| (blank) | SAP_124 | (blank) | (blank) | (blank) | (blank) | ObjectEventId |

Figure 72 illustrates a hierarchical business object (containing object types).

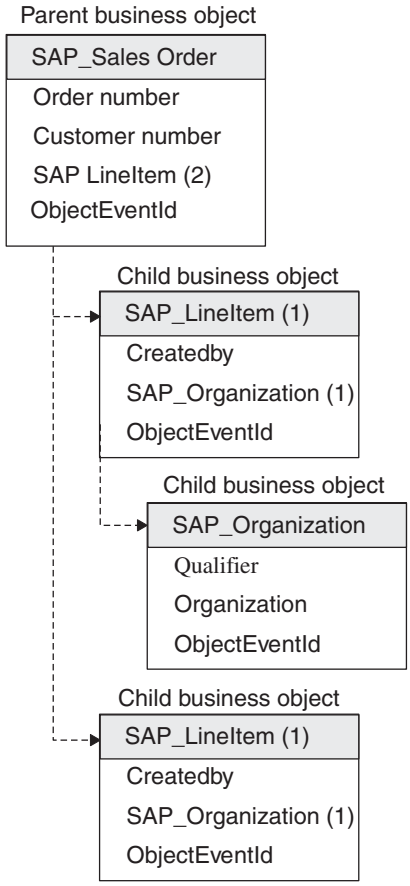



*Figure 72. Hierarchical business object SAP sales order (IDoc)*

Table 43 shows a representation of a flat structure of a hierarchical business object based on an IDoc Sales Order. Notice that field ATTR_NAME is not required, APPTEXT

is unique for each attribute, and because this business object is hierarchical, the PEERS field lists the appropriate relationship.

*Table 43. Hierarchical business object based on an IDoc sales order*

| ATTR_NAME | ATTR_VALUE | ISKEY | ISNEW | PEERS | OBJ_ NUMBER | APPTEXT |
|---|---|---|---|---|---|---|
| (blank) | USD | 0 | 0 | 1 | (blank) | E1EDK01:CURCY |
| (blank) | 0000000101 | 0 | 0 | 1 | (blank) | E1EDK01:BELNR |
| (blank) | SAP_124 | 0 | 0 | 1 | (blank) | E1EDK01: ObjectEventId |
| (blank) | User1 | 0 | 0 | 2 | (blank) | Z1XRV40:ERNAM |
| (blank) | SAP_125 | 0 | 0 | 2 | (blank) | Z1XRV40: ObjectEventId |
| (blank) | 001 | 0 | 0 | 1 | (blank) | Z1XRV40:QUALF |
| (blank) | 1000 | 0 | 0 | 1 | (blank) | E1EDK14:ORGID |
| (blank) | SAP_126 | 0 | 0 | 1 | (blank) | E1EDK14: ObjectEventId |
| (blank) | User1 | 0 | 0 | 2 | (blank) | Z1XRV40:ERNAM |
| (blank) | SAP_127 | 0 | 0 | 2 | (blank) | Z1XRV40: ObjectEventId |

## Flat structure conversion to a business object

Once the flat structure has been repopulated with new business object data, Y_XR_RFC_DO_VERB_NEXTGEN returns the business object data to the calling connector. Remember that the connector is single-threaded; therefore, it passes only one business object at a time. The connector must now convert the business object data from the flat structure into a business object. When processing data in a flat structure into a business object, the connector must:

1. Initialize the original business object.
2. Transfer the business object data from the flat structure to the business object.
3. Deliver the business object to the connector infrastructure.

### Business object initialization

The connector initializes the original business object that it received from the integration broker before it populates it. When initializing the business object, the connector sets every attribute in the top-level business object to null. For object type attributes, this action recursively deletes every contained business object, leaving only the top-level business object.

### How the connector rebuilds a business object

After the connector initializes the original business object, what remains is the top-level business object containing the business object name and business object verb, but no attribute value data. The attribute value data must be transferred from the flat structure from the ABAP handler. The logic for transferring the returned data is simple, but the data must be transferred in the exact order that the connector expects it.

The connector matches the application-specific information in the returned data to an attribute's application-specific information in the business object definition. The connector attempts to set every attribute that is in the returned business object data. If any attribute cannot be set, the connector returns FAIL to the connector infrastructure.

In order for the returned data transfer to execute successfully, the connector expects the following to be true of the returned data:

- It contains only simple attributes, where one row equals one attribute.
- Attributes must exist in the WebSphere business object definition.
- Attributes must be ordered as they are in the WebSphere business object definition (depth and then breadth).
- An attribute's application-specific information links its object's application-specific information with another value that uniquely identifies the attribute within the business object's definition.
- Child attributes must occur after their parent object's attributes (never before their parents and never after their grandparents).
- An attribute must communicate its business object's number of peers.

When the connector rebuilds the application-specific business object, the connector loops through the business object twice, beginning with the top-level business object.

1. In the first pass, it sets all simple attributes.
2. In the second pass, it checks if the flat attribute exists in a child object. If it exists the connector recursively executes the same processing for the child object.

**Attention:** If the conversion of a flat structure to a business object fails, the connector reports a failure to the integration broker. However, the data is already posted in the SAP application and, therefore, cannot be rolled back at this stage. While the rules are simple, implementing a complex, hierarchical business object with many attributes can be difficult to manage.

Once the business object is successfully rebuilt with new business object data, the connector returns it to the integration broker.

# Chapter 22. Developing business objects for the ABAP Extension Module

This chapter discusses business object development for the ABAP Extension Module. It provides background information as well as steps for developing business objects and ABAP handlers. The contents of this chapter should be used as guidelines for business object development. You should be familiar with how the connector processes business objects.

**Note:** All references to ABAP components of the connector use the SAP R/3 version 3.x naming convention.

This chapter contains the following sections:



## Background information

Business object development for the ABAP Extension Module consists of creating an application-specific business object definition and an associated ABAP handler for each verb that you want to support.

To develop an application-specific business object, you must create a business object definition that supports your business needs. The IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x) includes tools that facilitate the process of developing business object definitions in the SAP application. Although you can use Business Object Designer or a text editor to create business object definitions for the ABAP Extension Module, we recommend that you initially use the adapter's business object development tools. These tools use the SAP application's native definitions as a template.

For each application-specific business object definition that you develop, you must support it by using an adapter-provided ABAP handler or by developing a custom ABAP handler. The ABAP handler is the mechanism that gets data into and out of the SAP application database.

**Note:** The application-specific business object and the ABAP handler rely on each other's consistency to pass data into and out of the SAP application; therefore, if you change the business object definition, then you must change the ABAP handler to support it.

The adapter's ABAP handler is implemented as an ABAP function module. ABAP handlers are one or more function modules that work together to fulfill a business object retrieve or request from the business object router `Y_XR_RFC_DO_VERB_NEXTGEN`. ABAP handlers are responsible for passing business object data into and out of the SAP application.

**Note:** SAP supports many verbs other than those (Create, Retrieve, Update, and Delete) supported by the WebSphere business integration system. You can develop an ABAP handler to support any verb.

To develop an ABAP handler, you must understand how the connector gets data into and out of the SAP application and what form that data takes during this process. For a high level description of business object processing, see Chapter 19, "Overview of the ABAP Extension Module," on page 199. For a detailed description of business object processing, see Chapter 21, "Business object processing in the ABAP Extension Module," on page 217.

**Note:** When you develop business objects, you must make sure that the objects are added to the connector's YXROBJ table in the SAP R/3 application. If they are not, you will not be able to access the business objects for customization (for example, setting up the object for event distribution).

## SAP native APIs

Adapter-provided ABAP handlers use SAP native APIs, which enable ABAP handlers to pass data into and out of the SAP application. The WebSphere business integration system has implemented the following native APIs:

- "ABAP SQL"
- "Call transaction"
- "Batch data communication (BDC)" on page 231

### ABAP SQL

ABAP SQL is SAP's proprietary version of SQL. It is database and platform independent, so that whatever SQL code you write, you can run it on any database and platform combination that SAP supports. ABAP SQL is similar in syntax to other versions of SQL and supports all of the basic database table commands such as update, insert, modify, select and delete. For a complete description of ABAP SQL, its use, syntax and functionality, see your SAP documentation.

Using ABAP SQL, an ABAP handler can modify SAP database tables with business object data for create, update and delete operations and similarly can use the business object data in the "`where`" clause of an ABAP select statement as the keys.

**Note:** The WebSphere business integration system never uses ABAP SQL to modify SAP tables, because this may corrupt the integrity of the database. The connector uses ABAP SQL only to retrieve data and to modify adapter-delivered database tables.

### Call transaction

Call transaction is SAP-provided functionality for entering data into an SAP system. Call Transaction guarantees that the data adheres to SAP's data model by using the same screens an online user sees in a transaction. This process is commonly referred to as screen scraping. To use Call Transaction, specify the following types of instructions:

- Initiation—transaction to call
- Navigation—sequence of screens to process
- Mapping—input data that should go into each field on a screen

Initiation is passed as a single value parameter in the Call Transaction call. Navigation and Mapping instructions are passed in together in a table with a

specific format; this format is usable for invoking Call Transaction for any SAP transaction. In this format, these instructions are referred to as the BDC data, BDC table, or BDC session.

### Batch data communication (BDC)

Batch data communication (BDC) is an instruction set that SAP can follow to execute a transaction without user intervention. The instructions dictate the sequence in which a transaction's screens are processed and which fields should be populated with data on which screens. All of the elements of an SAP transaction that are exposed to an online user have identifications that can be used in a BDC. The elements are as follows:

- Screens—identified by a program name and screen number.
- Input fields—typically identified by the database table and field name to which it refers.
- Commands in the transaction—commands such as save, new items, details, and exit (identified by a one- to eight-character code)

To get a screen's BDC identity, place the cursor in any field on the screen. Press F1 for help and then F9 for technical information. The program name and screen number are listed under Screen Data.

To get an input field's BDC identity, place the cursor in each field on the screen in which you want to input data. Press F1 for help and then F9 for technical information. If there is a box named Field Description for Batch Input, then use the information in the Screen Field field. If this box does not exist, from the Field Data box, concatenate the Table Name and Field Name together with a hyphen.

To get a command's BDC identity, highlight the command in the menu and press F1 for help. Use the value in the Function field.

## IBM WebSphere function module interface

Every ABAP handler must implement the same function module interface. The function module interface guarantees that the business object router Y_XR_RFC_DO_VERB_NEXTGEN can pass business object data to and from ABAP handlers. The interface is:

```
*"*"Local interface:
*"  IMPORTING
*"      VALUE(PROC_FUNC_1) LIKE  RS38L-NAME OPTIONAL
*"      VALUE(PROC_FUNC_2) LIKE  RS38L-NAME OPTIONAL
*"      VALUE(OBJECT_NAME) LIKE  YXR_LOG_H-OBJ_NAME OPTIONAL
*"      VALUE(OBJECT_VERB) LIKE  YXR_CHANGE-OBJ_VERB OPTIONAL
*"      VALUE(ARCHIVE) OPTIONAL
*"      VALUE(TEXT) LIKE  T100-TEXT OPTIONAL
*"  EXPORTING
*"      VALUE(RETURN_TEXT) LIKE  YXR_EVENT-OBJ_KEY
*"      VALUE(RFCRC) LIKE  YXR_RFCRC-YXR_RFCRC
*"  TABLES
*"      RFC_STRUCTURE STRUCTURE  YXR_RFC_S
*"  EXCEPTIONS
*"      NOT_FOUND
*"      ERROR_PROCESSING
```

In the importing section of the interface, you can communicate values such as the ABAP handler name, business object name, and business object.

The exporting section of the interface is used to communicate the results of the ABAP handler processing. The return code RFCRC parameter is a single field used to determine the code a connector returns. The possible values are:

RC = 0 (success, VALCHANGE)

RC = 1 (failure, FAIL)

The RETURN_TEXT parameter is a 120-character free text field that is written to by the connector or logged as an error message in the return status descriptor. If the ABAP handler does not provide a value for this parameter, then Y_XR_RFC_DO_VERB_NEXTGEN supplies default text depending on the return code.

**Note:** The exceptions section of the interface defines two exceptions. It is recommended that you use the exporting parameters instead.

## IBM WebSphere ABAP handler APIs

The adapter includes several APIs that facilitate the development of ABAP handlers that support WebSphere business objects for SAP. These APIs were developed as "generic" ABAP handlers, because they only require metadata to support additional business objects of any type. The adapter includes the following ABAP handler APIs:

- Dynamic Retrieve—Y_XR_DYNAMIC_RETRIEVE
- Dynamic Transaction—Y_XR_DYNAMIC_TRANSACTION
- IDoc Handler—Y_XR_IDOC_HANDLER

The adapter includes a set of tools that support these APIs. The tools can be found in IBM WebSphere InterChange Server Connector Tool (transaction YXR1). The following sections discuss the adapter-provided APIs and gives you steps on how to use the IBM WebSphere InterChange Server Connector Tool (transaction YXR1) to develop business objects for them.

# Developing business objects using dynamic retrieve

The Dynamic Retrieve function module is a mapping tool and dynamic SQL statement generator. This function module uses the metadata stored in the YXR_DISPLY table to generate SQL select statements at runtime. Dynamic Retrieve takes the resulting fields of these SQL statements and fills the attributes of the WebSphere business object. When the Dynamic Retrieve function module is called, the following steps are performed:

1. All entries are retrieved from YXR_DISPLY, where,

   object name = *objectName*
2. For each new table specified in YXR_DISPLY, a SQL where clause is generated based on the fields marked as key. The corresponding Field Name in business object attributes is used to populate the value in the where clause. If a default value is specified in YXR_DISPLY, this default is used.
3. The SQL select statement is executed. The resulting fields are copied into the corresponding Field Name in business object attributes.

**Note:** Before you can generate a business object definition, you must create a WebSphere business object using the IBM WebSphere InterChange Server Connector Tools Window (YXR1).

## Tips

- Entries in YXR_DISPLY must be grouped by table name. All relevant key values must appear first.
- If data from a specific table is optional, all non-key fields for that table must be marked as optional.
- The default operand for the where clause is equals. Other operands can be specified in the Rel column. Use the F4 drop-down list for possible operands.
- System fields such as system language (LANGU), current date (DATUM) or current time (UZEIT), can be specified in the System column. Press the F4 key for more options. This applies only to key fields.
- If you want to do an existence check, specify at least one non-key field even if you are only interested in the success or failure of the select statement.
- Data read from one table can be used in the where clause of a later table.

Table 44 shows table entries for the Dynamic Retrieve table.

*Table 44. Table Entries for Dynamic Retrieve*

| Field Name | Description | When Used | Technical Name |
|---|---|---|---|
| Object Name | WebSphere business object name | Always | OBJ_NAME |
| Counter | Counter | Always | POSNR |
| Table | Table to read | Always | TABNAME |
| Field Name | Field name in table | Always | NAME_FELD |
| Key | Specifies a key field of a table | First field of each table. Used to build the where clause of the select statement. | KEYFLAG |
| Optional | Free text description of screen, field or command | Used for non-key fields. If all non-key fields are marked as optional and if the select statement fails, the results will be a warning, not an error. | OPTIONAL |
| Rel | Operand (relation) | Used to determine relationships in where clause. By default, the operands in the where clause are 'equal' but can be changed by entering a value in this field. | YXR_OPERND |
| Field Name in business object | Attribute in the WebSphere business object to supply the input value | • Key fields: to build the where clause.<br>• Non-key fields: to return database fields to attributes in the business object | SOURCEFLD |
| Default Value | A static default value to use if no entry is provided in the WebSphere business object | Key fields | DEFLT_VAL |
| SY Field | A dynamic system field to be used as a default value (for example: DATUM) | Key fields | SYFIELD |

*Table 44. Table Entries for Dynamic Retrieve (continued)*

| Field Name | Description | When Used | Technical Name |
|---|---|---|---|
| Length | Character length from the 0 or offset position of the attribute value that should be used when building the where clause. | Key fields. Only relevant when using an attribute that contains a composite value. | LENGTH |
| Offset | Character offset from the 0 position of the attribute value that should be used when building the where clause. | Key fields. Only relevant when using an attribute that contains a composite value. | YXR_OFFSET |

To access adapter's table-driven connector table for Display:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Customizing menu, click Dynamic Read, and then click Modify Retrieve.

Figure 73 shows the Dynamic Retrieve table with a nested SQL select statement. Results from a previous select statement are used to build the key on subsequent select statements.

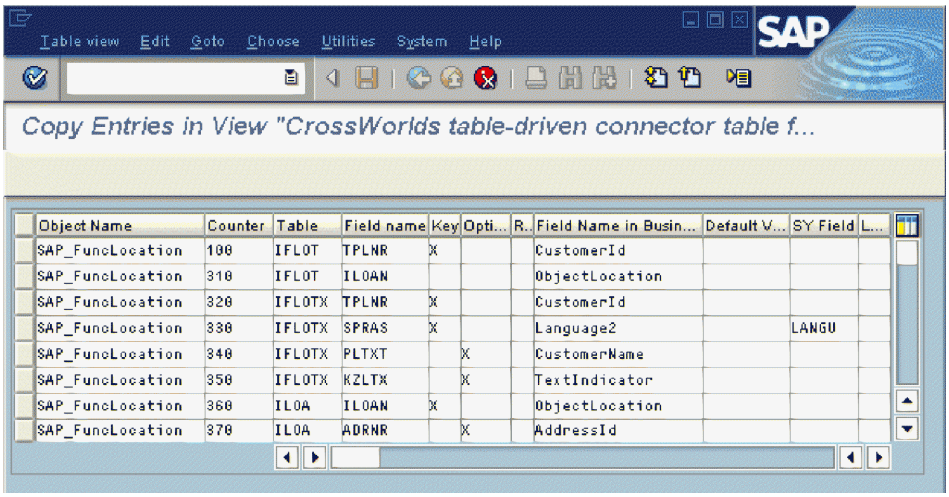



*Figure 73. Dynamic retrieve with a nested SQL select statement*

Using the Counter column as a line number for discussion, you can step through the SAP_FuncLocation example of a functional location object in the Dynamic Retrieve table.

**100** Table IFLOT has only one key field. The value in the CustomerId attributes in the `where` clause. If the value in **CustomerId** is `4711`, then the `where` clause is:

```
where TPLNR = '4711'
```

**310** This is the first non-key field. At this point, the actual select statement is executed. The select statement is:

```
Select * from IFLOT where TPLNR = '4711'
```

The resulting value of ILOAN is then copied into the ObjectLocation attribute, which is '5678' for this example.

**320** Since this is a new table and a key field, the `where` clause is built again. Once again the `where` clause is:

```
where TPLNR = '4711'
```

**330** Another key for table `TFLOTX`. The `where` clause is extended with:

```
and SPRAS = 'E'
```

If the value of Language2 is `CxIgnore`, then the `E` is taken from the Default Value field.

**340** This is the first non-key field for table `IFLOTX`. The select statement is executed. The statement is:

```
Select * from IFLOTX where TPLNR = '4711' and SPRAS = 'E'
```

The resulting value of `PLTXT` is copied into the CustomerName attribute. If the select statement fails, a warning is issued, because all the non-key fields for table `IFLOTX` are marked as optional.

**350** The value of `KZLTX` from the previous select statement is copied into the TextIndicator attribute.

**360** Since this is a new table and key field, the `where` clause is built again. The value of the `where` clause is taken from the attribute ObjectLocation, which was filled by an earlier select statement. If `'5678'` is the value in the attribute ObjectLocation, the `where` clause is:

```
where ILOAN = '5678'
```

**370** This is the first non-key field. The select statement is executed. The statement is:

```
Select * from ILOA where ILOAN = '5678'
```

The resulting value of `ADRNR` will be copied into the AddressId attribute.

This completes the building of the SAP_FuncLocation function module for Dynamic Retrieve support.

## Developing business objects using dynamic transaction

The Dynamic Transaction function module is a mapping tool and dynamic code generator. It uses SAP's Call Transaction API to get data into an SAP application. Also, it stores static definitions of Batch Data Communication (BDC) sessions by object/verb combinations. Before the BDC data is passed to a Call Transaction, the business object attribute values are mapped into the BDC session. At the completion of the call transaction, the resulting key value is set in the appropriate value of the business object, and all messages from the call transaction are logged.

**Note:** If the Call Transaction fails, the connector does not store a BDC session in SAP for reprocessing. Obsolete versions of the connector agent did store a BDC session; however, using the stored session led to inconsistencies in cross-referencing and request processing.

The Dynamic Transaction function module builds a BDC session to do a call transaction by combining the BDC defined in the Dynamic Transaction table, `YXR_CHANGE`, and the values from the incoming business object. When the Dynamic Transaction function module is called, the following steps are performed:

1. All entries are retrieved from YXR_CHANGE, where:
   object name = *objectName* and verb = *objectVerb*
2. Field input values are mapped from the business object into the BDC session based on the attribute name.
3. BDC sessions are processed using Call Transaction.
4. Key values are captured, Call Transaction messages are logged, and the key is set in the business object.

**Note:** Before you can generate a business object definition, you must create a WebSphere business object using the IBM WebSphere InterChange Server Connector Tools Window (YXR1).

## Tips

- Data entered on an initial screen may default for all line items and reduce required line item input.
- Line item overview screens may provide enough input rather than drilling down to a details screen which may require additional input.
- Confirmation messages usually do not need to be answered in BDC; for example, Are you sure you want to save?
- The counter renumbers in increments of 10, for each object and verb combination, every time you enter and exit the table maintenance in change mode.
- During execution, the Call Transaction uses the user's settings for date formatting. Be sure the connector user is set up to use a variation of YYYY-MM-DD date format. This is the standard date format used by the WebSphere business integration system. Similarly, change your own user settings if you want to reprocess the business objects by stepping through the transaction.

## Composing a BDC session for a business object

Composing a BDC session requires an understanding of an SAP transaction's design. An SAP transaction allows the same data to be input in various sequences and on different screens. Typically each sequence or flow exposes additional functionality. As a result, certain data validation and input field requirements occur on some screens, but not on others. The challenge is to find the sequence that does what you need with the least amount of effort. A simple BDC session is more stable than a complex BDC session.

An SAP transaction may behave differently when accessed using the Call Transaction method in a background process instead of executing online. For example, different or additional screens may appear or input fields may reside on different screens than your online investigation revealed. The discrepancy occurs because the transaction's controlling code may dictate different behavior when executed in the background instead of executing online. As a result, your online test may work when reprocessing a failed object event as you step through the transaction, however, the connector consistently fails when processing the same object. If this occurs, modify the BDC so that it processes in the background. If you modify the BDC, you may encounter cases where the BDC processes in the background, but now fails when processed online.

The BDC you define in the Dynamic Transaction table is static. It cannot react during the transaction if certain input data causes other screens to pop-up or other fields become mandatory during runtime. Proper investigation of a transaction's

configuration is important to be able to predict consistent behavior. Experiment several times with the transaction; repeated behavior can become your guideline.

Once you have determined the screen flow, follow the steps below and document the information you gather in a spreadsheet.

1. Go to the transaction that supports your object and identify the transaction code.
2. Identify the BDC elements for the screen and input fields you require.
3. Identify the menu command you need to continue processing to the next screen.
4. Repeat steps 2 and 3 for each screen required.
5. Conclude by noting the command to save the transaction.

Table 45 describes the column names for Dynamic Transaction table YXR_CHANGE.

*Table 45. YXR_CHANGE Table Entries for Dynamic Retrieve*

| Field Name | Description | When Used | Technical Name |
|---|---|---|---|
| Object Name | WebSphere business object name | Always | OBJ_NAME |
| Verb | Verb (Create, Update, Delete, or Retrieve) | Always | OBJ_VERB |
| Counter | Counter | Always | POSNR |
| Program | Program associated with a screen | BDC screen identification | PROG_NAME |
| ScNo | Screen number associated with a screen | BDC screen identification | DYNPRO |
| Start | Specifies a new screen | BDC screen identification | DYNBEGIN |
| BDC field name | BDC input field name | BDC input fields | FNAM |
| Default Value | A static default value to use if no entry is provided in the WebSphere business object, or if using BDC_OKCODE, because it is the command value | A value might not always be passed in and it is mandatory for the transaction | DEFLT_VAL |
| SY Field | A dynamic system field to be used as a default value (for example: DATUM) | A value is not passed in or should be determined by SAP system fields | SYFIELD |
| Return | A numeric, 1-4, that identifies which system message field returns the key value at transaction completion (sy-msgv#) | A business object key attribute that should receive the key value | RETURNFLD |
| Field Name in business object | Attribute in the WebSphere business object to supply the input value | BDC input fields | SOURCEFLD |
| Length | Character length from the zero position of the attribute value that should be used for input | Only relevant when using an attribute that contains a composite value | LENGTH |

To define or modify a business object's metadata (transferring information to YXR_CHANGE):

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Customizing menu, click Call Transaction, and click Modify Create, Update.

Defining the metadata for the business object is simple. For each screen, the first entry identifies the screen, the following entries identify the input fields, and the last entry must be a command. This grouping repeats for each screen.

Figure 74 shows the Dynamic Transaction table for an SAP CustomerMaster business object to create a customer (transaction XD01).

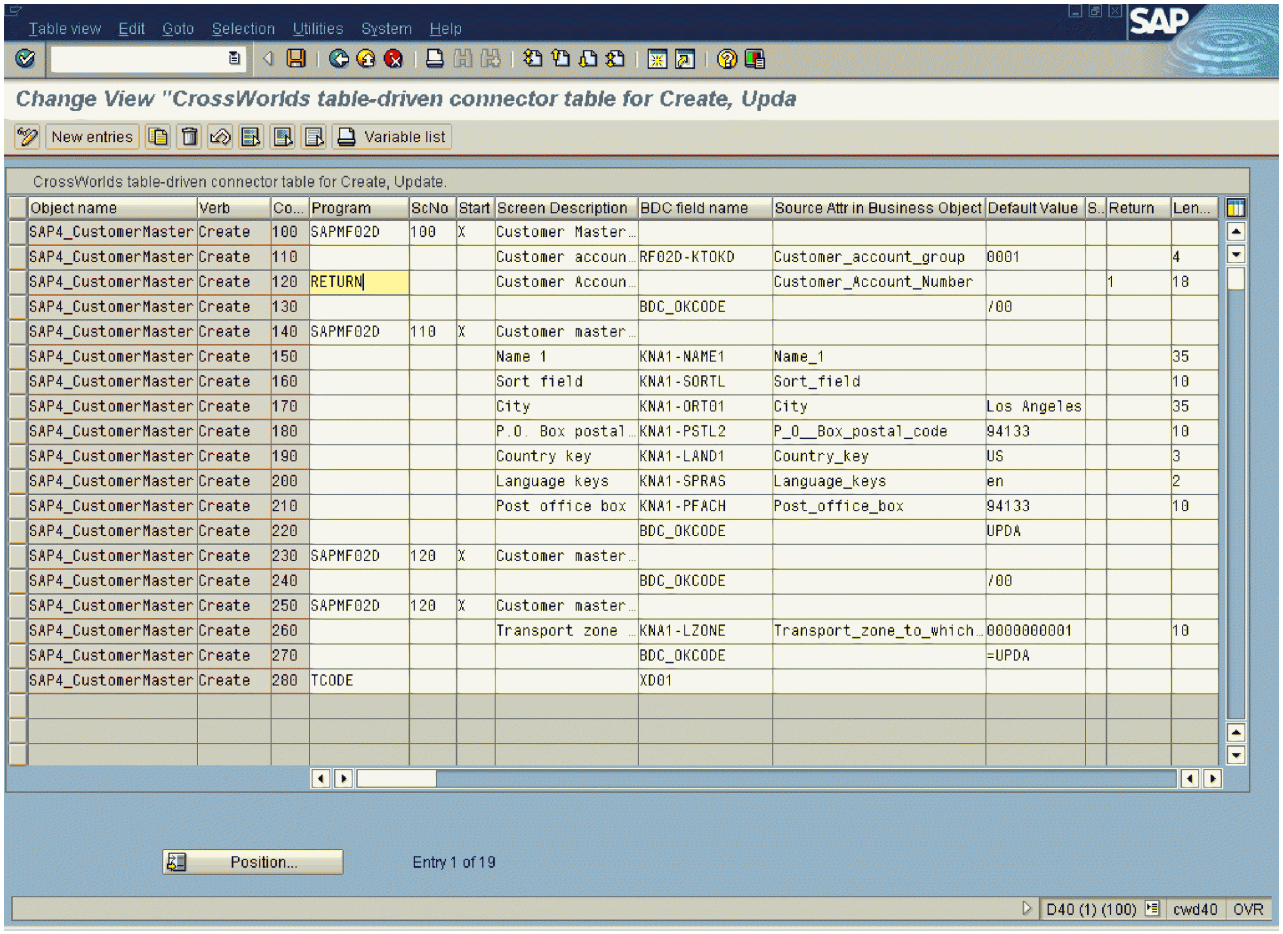



*Figure 74. Dynamic transaction for SAP CustomerMaster business object*

Using the Counter column as a line number for discussion, step through the SAP CustomerMaster example.

**100** Begin with screen number 100 of program `SAPMF02D`. This is a new screen, the first, so it is flagged in the Start column.

**110** On screen 110, use the value from the Customer_account_group attribute in the business object, and add it to the BDC field name column (the value is `RF02D-KT0KD`). Specify the default value as `0001`. If the Customer_account_group attribute contains `CxIgnore`, then the BDC field name column receives the default value `0001`

**120** The Customer_Account_Number attribute is the key value, so it is

not set during the Call Transaction. SAP assigns the key value internally and makes it available only after the transaction is successfully posted. For this reason, leave the BDC field name column blank, but include an entry in the table because the Customer_Account_Number attribute must be set with this key value when it is returned at the conclusion of the Call Transaction. Also enter the word `RETURN` in the Program column for CustomerNumber.

Depending on the transaction, SAP returns the key value in one of four possible fields: `SY-MSGV1`, `SY-MSGV2`, `SY-MSGV3` or `SY-MSGV4`. To specify that you want the return value set in a particular attribute, enter a number, 1-4, in the Return column. This number corresponds to the `SY-MSGV#` field containing the key value. For example, Figure 74 illustrates a 1 in the Return column, which indicates that `SY-MSGV1` contains the Customer Number.

**130** You are finished entering the necessary values for the first screen, so enter a command, `/00`, in the Default Value column to simulate pressing the Enter key. This takes you to the next transaction screen. Commands are entered in the screen input field, `BDC_OKCODE`, which is where you enter in a transaction code.

**140** At this point, you are at the next transaction screen. Enter the address information. Since it is a new screen, flag it in the Start column. In this example, the second screen is associated with the same program as the initial screen, and only the screen number changed from 100 to 110. This is not always the case.

**150 -210** use the values from the Name_1, Sort_field, City, P_0_Box_postal_code, Country_key, Language_keys, and Post_office_box attributes in the business object, and add corresponding values to the BDC field name column.

**220** Similar to line 130, processing for this screen is complete. However, rather than simply simulating the Enter key, enter the command value `UPDA` to save the transaction. This takes you to the next transaction screen.

**230** At this point, you are at the third transaction screen, so flag it in the Start column. Because your business object does not require data from this screen, you will complete processing for this screen in the next line.

**240** Similar to line 130, processing for this screen is complete. Enter the command value `/00` to simulate pressing the Enter key. This takes you to the final transaction screen.

**250** At this point, you are at the final transaction screen. Flag it in the Start column.

**260** Similar to lines 150-210. Use the value from the business object attribute, Transport_zone_to_which_or_from_which_the_goods _are_delivered, and add its corresponding value (`KNA1-LZONE`) to the BDC field name column.

**270** Similar to line 220, processing for this screen is complete and the transaction is complete, so enter the command value to save, `UPDA`. This is the last action the Call Transaction API receives.

**280** The final entry for any business object is always the specification of

the transaction code. The keyword TCODE goes in the Program column and the transaction code goes in the BDC field name column.

This completes the definition of the BDC Session for the SAP4_CustomerMaster business object.

If a Call Transaction returns an error message when it fails, you could have one of the common errors described below.

- The SAP application has called a screen that the BDC did not expect, so the SAP application returns the message, `No input available for program XX and screen YY`. If this occurs, add the appropriate entries to the Dynamic Transaction table to handle the input screen for program XX and screen YY.
- The SAP application is instructed by the BDC to set a field that does not exist. Most likely, the SAP application executed its own instruction that you did not explicitly set. As a result, you are on a different screen than you intended. If this occurs, repeat the instruction and add only the piece that sends you to the appropriate screen.

## Developing business objects using IDocs

WebSphere business objects for the ABAP Extension Module can be defined in SAP as an IDoc. IDocs are part of SAP's EDI solution known as ALE (Application Link Enabling). Their definitions are stored in SAP's BOR (Business Object Repository) and can be accessed globally within an SAP system. The IBM WebSphere Business Integration Adapter for mySAP.com leverages the definition part of ALE to interpret and parse WebSphere business objects in the SAP application in preparation for use with an SAP native API. The adapter provides an IDoc handler that supports business objects developed using IDocs.

IDoc handler is made up of two function modules. Other ABAP handlers such as Dynamic Retrieve and Dynamic Transaction are only a single function module.

`Y_XR_DO_VERB_NEXTGEN` passes business object data to IDoc handler, `Y_XR_IDOC_HANDLER`. Based on the application-specific information, `Y_XR_IDOC_HANDLER` reformats the business object data into the structure of the IDoc specified by the application-specific information. After reformatting, the business object data is passed to an object-specific IDoc handler (based on the object/verb combination of the business object) that handles the integration with an SAP native API. Once the object-specific IDoc handler finishes processing the business object data, it returns the business object data in IDoc format to `Y_XR_IDOC_HANDLER`. The business object data is now converted back to its original format and returned to `Y_XR_DO_VERB_NEXTGEN`.

Figure 75 illustrates the basic architecture of an IDoc handler.

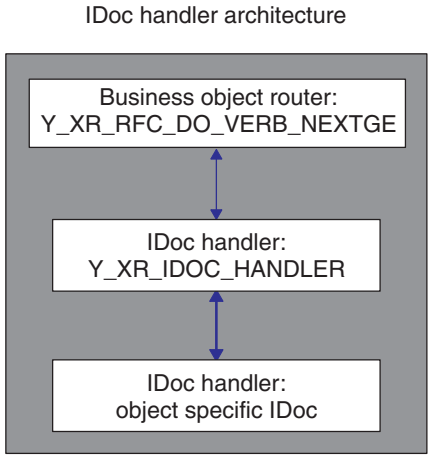



*Figure 75. IDoc handler architecture*

To use the adapter-provided IDoc handler, you must have an IDoc defined in the SAP application. Either SAP-delivered or customer-built IDocs can be used. Because an IDoc definition must mirror the definition of the WebSphere business object for SAP, the adapter provides a tool in IBM WebSphere InterChange Server Connector Tool (transaction YXR1) that you can use to generate the WebSphere business object definition based on the IDoc.

Before you can generate a business object definition, you must have already created a WebSphere business object in the SAP application. To create a business object definition based on an IDoc:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Customizing menu, click Maintain Objects.
3. Create the new object name.

For more information on how the application-specific information is used for the verb functions, see "Business object data routing to ABAP handlers" on page 221.

After defining the IDoc, create a function module for each verb the business object must support. Each function should have the following interface to ensure that `Y_XR_IDOC_HANDLER` can call it:

```
*"       IMPORTING
*"          VALUE(OBJECT_KEY_IN) LIKE  YXR_EVENT-OBJ_KEY OPTIONAL
*"          VALUE(INPUT_METHOD) LIKE  BDWFAP_PAR-INPUTMETHD
*"                              OPTIONAL
*"              VALUE(LOG_NUMBER) LIKE  YXR_LOG_H-LOG_NR OPTIONAL
*"       EXPORTING
*"              VALUE(OBJECT_KEY_OUT) LIKE  YXR_EVENT-OBJ_KEY
*"              VALUE(RETURN_CODE) LIKE  YXR_RFCRC-YXR_RFCRC
*"              VALUE(RETURN_TEXT) LIKE  YXR_EVENT-OBJ_KEY
*"       TABLES
*"               IDOC_DATA STRUCTURE  EDIDD
```

## IDoc handlers and create, update, and delete verbs

IDoc handlers that support Create, Update and Delete operations receive business object data formatted as an IDoc. The role of these operations is to integrate the business object data with SAP's Call Transaction API and generate an object key. Only the object key is passed back to `Y_XR_IDOC_HANDLER`, not the business object data. `Y_XR_IDOC_HANDLER` stores the business object data in memory and inserts the

object key into the first attribute marked isKey in the parent business object. Then, Y_XR_IDOC_HANDLER passes the business object data back to the connector.

**Note:** When InterChange Server (ICS) is the integration broker, it is critical to maintain the business object data because the mapping infrastructure requires the preservation of the ObjectEventId for dynamic cross-referencing.

The sample code below represents the following flow:

1. Initializes global data.
2. Deconstructs the IDoc into working tables.
   - Initializes the target structure with '/' (CxIgnore) because not all objects are sent into the SAP application. Uses the form in YXRIFRM0.
   - Uses the forms in YXRIFRM0 to transfer data from the IDoc into internal tables for consistent behavior across objects.
3. Builds the BDC. Uses the forms in YXRIFRM0 to transfer data from the internal tables into the BDC table for consistent behavior across objects.
4. Creates a Call Transaction.
5. Captures the object key.

The following sample code supports SAP Sales Quote Create:

```
*- Initialize working variables and internal tables
  PERFORM INITIALIZE_IN.

*- I01(MF): Begin IDoc interpretation
  PERFORM LOG_UPDATE(SAPLYXR1) USING C_INFORMATION_LOG TEXT-I01
                                     SPACE SPACE SPACE.

*- Interpret IDoc data structure
  IF NOT IDOC_DATA[] IS INITIAL.

*- Move IDoc to internal tables
    PERFORM INTERPRET_IDOC.

*- Check some of the input fields
    PERFORM CHECK_INPUT.

*- If key values were missing, exit function
    IF RETURN_CODE NE 0.
      EXIT.
    ENDIF.

*- E01(MF): No Idoc data lines sent for processing.
  ELSE.

    RETURN_CODE = 2.
    RETURN_TEXT = TEXT-E01.
    EXIT.

  ENDIF.

*- Build the BDC session for transaction VA21.
  PERFORM BUILD_BDC_VA21.

*- Call Transaction
  PERFORM LOG_UPDATE(SAPLYXR1) USING C_INFORMATION_LOG TEXT-I02
                                     'VA21' C_BLANK C_BLANK.

  CALL TRANSACTION 'VA21' USING BDCDATA
                           MODE INPUT_METHOD
                         UPDATE 'S'
```

```
                        MESSAGES INTO BDC_MESSAGES.

*- Capture return code and object key from transaction
  PERFORM PREPARE_RETURNED_MESSAGE.

ENDFUNCTION.
```

The Create logic has two main functions:

- Translates the IDoc Data into manageable data structures
- Executes a Call Transaction

### Translating IDOC structure

The first part of the Create logic is the task of translating data in the IDoc structure into working data structures. To do this, you need to create code similar to the following:

```
loop at idoc_data.

    case idoc_data-segnam.
      when 'ZSQVBAK'.                  " Header Data
        move idoc_data-sdata to zsqvbak.

      when 'ZSQVBUK'.                  " Status Segment
        move idoc_data-sdata to zsqvbuk.

      when 'ZSQVBP0'.                  " Partner Header Level
        move idoc_data-sdata to zsqvbp0.

      when 'ZSQVBAP'.                  " Item Detail
        move idoc_data-sdata to zsqvbap.

      when 'ZSQVBA2'.                  " Item Detail Part 2
        move idoc_data-sdata to zsqvba2.

      when 'ZSQVBUP'.                  " Item Status
        move idoc_data-sdata to zsqvbup.

      when 'ZSQVBKD'.                  " Commerical data
        move idoc_data-sdata to zsqvbkd.

      when 'ZSQKONV'.                  " Condition
        move idoc_data-sdata to zsqkonv.

      when 'ZSQVBPA'.                  " Partner Item Level
        move idoc_data-sdata to zsqvbpa.

    endcase.

  endloop.
```

## IDoc handlers and the retrieve verb

Object-specific IDoc handlers that support the Retrieve verb do not receive business object data from the initial IDoc handler. `Y_XR_IDOC_HANDLER` passes the value of the first attribute marked `isKey` in the business object data using the parameter `OBJECT_KEY_IN`. It is the IDoc handlers responsibility to use this key to retrieve all information relevant to this instance of the object using ABAP SQL and format that data in the appropriate IDoc structure.

The following code supports the Sales Quote example. The Sales Quote object must retrieve data from tables `VBAK`, `VBUK`, `VBPO`, `VBAP`, `VBUP`, `VBKD`, `KNOV`, and `VBPA`. The tables follow the hierarchy and cardinality of IDoc type `ZSLSQUOT`. The code does the following:

1. Initializes global data.
2. Returns business object data from the SAP application database.
3. Builds an IDoc from the returned data and returns that data to Y_XR_IDOC_HANDLER.

The code for IDoc type ZSLSQUOT is:

```
*- Clear the interface structures.
  clear: g_text, object_key_out, return_code, return_text, idoc_data.
  refresh: idoc_data.

*  If no key value is specified, log it as an error and exit.
  if object_key_in is initial or
     object_key_in = c_cxignore_const.
    perform log_update(saplyxr1) using c_error_log text-e02
                                       space space space.
    return_code = 1.
    return_text = text-e02.
    exit.
  endif.

  perform initialize_global_structures.

  perform fill_internal_tables.
  if not return_code is initial.
    exit.
  endif.

* Build Idoc segments from internal tables
  perform fill_idoc_inttab.

  return_code = 0.
  return_text = text-s01.

  perform log_update(saplyxr1) using c_information_log text-s01
                                     space space space.
endfunction.
```

The two most important parameters are OBJECT_KEY_IN for the inbound key and IDOC_DATA for the outbound data. Note that OBJECT_KEY_IN may even be a multiple key depending on the conventions you have defined.

The VBAK table drives the selection criteria for the child tables, so each table is loaded into working tables. Using the VBAK table, you can retrieve the child tables with additional keys. So, for the Sales Quote example, the code is as follows:

```
form fill_internal_tables.

  * Get information from VBAK, VBUK, VBAP, VBKD, KONV, VBPA

  select single * from vbak
         where vbeln = object_key_in.

  if sy-subrc <> 0.
    perform log_update(saplyxr1) using c_error_log text-e01
                                 object_key_out c_blank c_blank.
    return_code = '1'.
    g_text = text-e01.
    replace '&' with order_number into g_text.
    return_text = g_text.

    exit.
  endif.

  select single * from vbuk
```

```
        where vbeln = vbak-vbeln.

  select * from vbap into table t_vbap
        where vbeln = vbak-vbeln.

  * Continue for other tables
```

The following code is used to copy the requested data from the application database into internal tables and working variables. Then it creates segments that directly correspond to the WebSphere business object definition and puts it into the SAP segment structure.

In some cases for close matches on fields between the IDoc type and the working structure, you can do an ABAP move-corresponding command. In other cases, it is more preferable to do manual moves from the working table to the IDoc type table because of the relatively few fields to move in comparison to the overall number of fields in the structure. Simply, it is used to transfer data from the working data structures into the IDoc structures and then in the flat data field.

The code is:

```
form fill_idoc_inttab.

perform fill_zsqvbak." Fill the Sales Quote Header
perform fill_zsqvbuk." Fill the Sales Quote Status
perform fill_zsqvbap." Fill Sales Quote Lines

endform." FILL_IDOC_INTTAB

*-- fill the Sales Quote Header
form fill_zsqvbak.

  clear idoc_data.
  clear zsqvbak.
  idoc_data-segnam = 'ZSQVBAK'.

  move-corresponding vbak to zsqvbak.
  move zsqvbak to idoc_data-sdata.
  append idoc_data.

endform." FILL_ZSQVBAK

*-- fill the Sales Quote Header Status
form fill_zsqvbuk.

  clear idoc_data.
  clear zsqvbuk.
  idoc_data-segnam = 'ZSQVBUK'.

  move-corresponding vbuk to zsqvbuk.
  move zsqvbuk to idoc_data-sdata.
  append idoc_data.

endform." FILL_ZSQVBAK

*-- fill the Sales Quote Line and the Line Child segments
form fill_zsqvbap.

  loop at t_vbap.
    clear idoc_data.
    clear zsqvbap.
    idoc_data-segnam = 'ZSQVBAP'.

    move-corresponding t_vbap to zsqvbap.
    move zsqvbap to idoc_data-sdata.
```

```
    append idoc_data.

    perform fill_zsqvba2.
    perform fill_zsqvbup.
    perform fill_zsqvbkd.
    perform fill_zsqkonv.
    perform fill_zsqvbpa.


  endloop.

endform.

*-- fill second part of vbap
form fill_zsqvba2.
" etc.
```

## Calling the ABAP Extension Module and ABAP handler

The connector uses the value of the verb application-specific information in a business object to call the appropriate ABAP handler in the ABAP Extension Module. To call the appropriate ABAP handler in the ABAP Extension Module, you must specify the classname for the ABAP Extension Module and the ABAP handler function module use by the business object. For example, the verb application-specific information for the Dynamic Retrieve ABAP handler is:

```
AppSpecificInfo = sap.sapextensionmodule.VSapBOHandler,:Y_XR_DYNAMIC_RETRIEVE
```

**Note:** You must uses a comma delimiter between the connector module (classname) and ABAP handler.

For more information on business object processing for the ABAP Extension Module, see “Business object processing” on page 201.

# Chapter 23. Developing event detection for the ABAP Extension Module

Event detection is part of the event triggering process in the ABAP component of the ABAP Extension Module. Every event detection mechanism must call an event trigger, which takes the detected event and adds it to an event table. For more information on triggering events, see "Event triggering" on page 207.

**Note:** All references to ABAP components of the connector use the SAP R/3 version 3.x naming convention.

This chapter covers the following subjects



## Designing an event detection mechanism

You can use many different mechanisms to detect events in the SAP application. An event detection mechanism should have the ability to make a function module call. The three event detection mechanisms that the IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x) has implemented are:

- Code Enhancement—implemented for a business process (normally a single SAP transaction) by inserting event detection code at an appropriate point within the SAP transaction
- Batch Program—involves developing an ABAP program containing the criteria for detecting an event
- Business Workflow—uses SAP's own object-oriented event detection capabilities

It is important that you determine the appropriate event detection mechanism to implement for each business object that you develop, because some may not be available for a particular business process. Technical and functional knowledge of a particular business process is necessary for each transaction for which you want to implement event detection.

Review the following implementation considerations when determining which event detection mechanism to implement for your business process.

| | |
|---|---|
| **Availability** | Which event detection mechanisms are available for this business process? This should be one of the first questions that you consider. Code Enhancement and Batch Program have high availability, whereas Business Workflow does not. |
| **Real-time integration** | Do events need to be detected synchronously? Do you need to detect a large number of events at one time? All mechanisms except Batch Program are suitable for real-time integration. |
| **Reliability** | Are all data changes for this business process detected when generating an event? Code Enhancement and Batch Program, provide the best control of capturing all events of an object. Business Workflow provides limited reliability. For |

| | |
|---|---|
| | example, Business Workflow does not detect an address change during a Vendor transaction update. |
| **Flexibility** | Do certain criteria need to be evaluated before an event is triggered? Does an event need to be detected at a certain point in the transaction? Code Enhancement is the most flexible, because you can insert code at a specific point before event data is committed. Batch Program is moderately flexible, while Business Workflow has very little flexibility in its implementation. |
| **Upgrade dependency** | Does an upgrade to the SAP application change the way an event is detected for this business process? Typically, this is not known, but Business Workflow is affected by application changes the most because it is under SAP's control. |
| **Difficulty** | Is time or level of difficulty an issue? Each mechanism has its own level of implementation difficulty. In general, Batch Program is the easiest. Code Enhancement and Business Workflow are moderately more difficult. |

At this point, you should have an idea of the event detection mechanisms that you need to consider. Use Table 46 as a general guideline in determining which mechanism can be used for each business process you need to support.

*Table 46. Event Detection Mechanism Decision Table*

| | Code Enhancement | Batch Program | Business Workflow |
|---|---|---|---|
| **Availability** | High | High | Low |
| **Real-time integration** | Yes | No | Yes |
| **Reliability** | High | High | Low |
| **Flexibility** | High | Medium | Low |
| **Upgrade dependency** | Low | Low | Medium |
| **Difficulty** | Medium | Low | Medium |

A final consideration to note is the development methodology of your site. Perhaps event detection using only Business Workflow is the preferred method and Code Enhancement cannot be used at all.

Using Code Enhancement is the recommended approach for event detection because it is reliable, highly flexible, synchronous, and has high availability. In contrast, the Business Workflow mechanism is not generally available for all business processes. Batch Program is typically used when real-time integration is not desired.

Each event detection mechanism has advantages and disadvantages for detecting an event in a business process. The following sections give more detail about each of the event detection mechanisms, including the main advantages and disadvantages of each.

## Code enhancement

Code Enhancement is implemented at specific points in the code of an SAP transaction. By making use of user exits, you can insert event detection code at the most logical point in a transaction. The event detection code allows for evaluation of criteria to determine whether an event is generated.

The general strategy of this mechanism is to insert your event detection code when the data for a transaction is about to be committed to the database.

### Advantages

- Has access to SAP transactional information for the event detection process
- Allows the insertion of event detection code at an appropriate point of a transaction
- Provides synchronous event detection
- Limits the reliance on SAP functionality, so maintenance and enhancements are easier

### Disadvantages

- User exits may not always be in the appropriate location in the transaction.
- SAP modification features may be necessary.

## Batch program

Batch program is useful when a large number of events of the same type (such as customer orders) need to be triggered or a business process requires a large amount of processing time. This mechanism does not require any modifications to SAP delivered code; however, you need to use (write) an ABAP program that evaluates criteria for detecting events.

### Advantages

- Can be implemented for most business processes
- Accurately detects events
- Is easy to implement
- Can be scheduled to run at a specific time if runtime resources are an issue

### Disadvantages

- It does not provide synchronous event detection.
- SAP transactional information is not available.
- State (create, update, or delete) or status changes cannot be detected or may not be easily detected.
- If a background job is created to automate a batch program, an additional task needs to be maintained and monitored.

## Business workflow

Business workflow is a cross-application tool within the SAP application that enables you to integrate business tasks between applications. This tool supplements the existing business functions of the SAP application. The standard functions of SAP can be adapted using Business Workflow to meet the specific requirements of the desired business function. Business Workflow uses the Business Object Repository (BOR), which stores the definitions for each SAP object in the application.

### Advantages

- Provides synchronous event detection
- Makes use of SAP's object-oriented business object capability to link the detection of events to ABAP function modules
- Is easy to implement

### Disadvantages

- An SAP object does not exist in the SAP BOR for every business process.
- The SAP event (such as created or deleted) may not exist for the SAP object.
- It may not detect all changes in a business process.
- It does not always provide the flexibility for detecting events at the proper time.
- It depends on SAP-provided functionality, which may change between versions of SAP.

## Implementing an event detection mechanism

Once you determine the business process to support (for example, sales quotes or sales orders), and determine the preferred event detection mechanism, implement the mechanism for your business process.

**Note:** When implementing an event detection mechanism, it is a good idea to support all of the functionality for a business process in one mechanism. This limits the impact in the SAP application and makes event detection easier to manage.

The following sections describe the implementation process for the four event detection mechanisms implemented by the IBM WebSphere Business Integration Adapter for mySAP.com. Whenever applicable, an example is provided along with sample code.

### Code enhancement

Code enhancement requires encapsulating a portion of ABAP code in a custom function module. The event detection code is written as a function module to ensure that the processing remains separate from the transaction. Any tables or variables used from the transaction need to be passed to the function module by value and not by reference.

To minimize the effects of locking a business object when retrieving an event, the function module typically executes in an update-task mode. To avoid inconsistencies, do not use update task if the function module is already being called within a process that is in an update -task mode.

To minimize the impact in the transaction, place the function module within another include program. Using an include program allows you to make changes to custom code rather than to SAP code.

The event detection code contains logic that identifies the object for the event. For example, the sales order transaction handles many types of orders, but only one order type is required. This logic is in the event detection code. The general strategy for placing this event detection code is to insert it just before the data is committed to the database. The function module containing the event detection code is typically created as a part of the function group for the business object.

To implement Code Enhancement for event detection:

- Determine which verbs to support: Create, Update, or Delete. This helps define which transactions to investigate.
- Determine the business object key for the transaction. This key must be unique to allow the connector to retrieve the business object from the database. A composite key may be required.
- Check that an SAP-provided user exit in the transaction has all of the information needed to detect an event. For example, a user exit may not be able to implement a Delete verb because the business object is removed from the database prior to that point.
- If a user exit cannot be used, determine the appropriate location for the event detection code, and then add the event detection code using an SAP modification. Select a location that has access to the business object key and other variables used to make the decision.

  Research a business process by looking for a "commit work statement" in the code executed by the transaction for the business process. You can use the ABAP debugger to investigate the value of different attributes at that point.
- Determine the criteria for detecting an event.
- Create the function module containing the event detection code.
- Create the include program and then add it to the transaction's code. Test all of the scenarios designed to detect an event.

The following steps describe the process of creating an example SAP sales quote using the Code Enhancement event detection mechanism. The code that follows it is a result of this process.

1. Upon investigation of the SAP sales quote transaction, transaction `VA21` is found to support the desired sales quote creation business process.
2. The sales quote number is determined to be the unique key. The Sales quote number is stored in table/field `VBAK-VBELN`.
3. Transaction `VA21` has a user exit in the transaction flow as part of the document save process (`Form Userexit_save_document`). At this point in the transaction, the quote number is available when the user exit is executed.
4. The user exit belongs to other business processes, so additional coding is needed to differentiate a sales quote from other categories of documents. `VBAK-VBTYP` is available to determine the document category. A sales quote is saved in the SAP database with a document category of `B`.
5. An include statement is added to the user exit that points to the include program.
6. At this time, the include program and a function module need to be created.

The new function module contains the following code:

```
If VBAK-VBTYP = 'B'.
     C_OBJ_ORDER = 'SAP_SalesQuote'.
        TMP_OBJKEY = XVBAK-VBELN.
 TMP_EVENT = 'Create'.
 TMP_OBJTYPE = Space.

     CALL FUNCTION 'Y_XR_ADD_TO_QUEUE'
             EXPORTING
OBJTYPE = TMP_OBJTYPE
OBJNAME = C_OBJ_ORDER
OBJKEY = TMP_OBJKEY
EVENT = TMP_EVENT
GENERIC_RECTYPE = ''
IMPORTING
RECTYPE = TMP_RECTYPE
```

```
                TABLES
                     EVENT_CONTAINER = TMP_EVENT_CONTAINER
                EXCEPTIONS
                     OTHERS          = 1.

Endif.
```

## Batch program

To implement batch program as an event detection mechanism, you must write an ABAP program that evaluates database information. If the criteria in the ABAP program is fulfilled when the program executes, then an event is triggered.

To implement Batch Program for event detection:

- Determine which verb to support: Create, Update, or Delete.
- Determine the business object key for the transaction. The business object key must be unique so that the business object can be retrieved from the database. A composite key may be required. For example, implementing a batch program for inventory levels of materials at different plants requires the key `Material_key + Plant_key`.
- Determine the criteria for detecting an event. You should have knowledge of the database tables associated with a business object.
- Create an ABAP program containing the criteria for generating an event.
- Determine if a background job is required to automate the batch program. A background job is useful if there is an impact on system resources, which makes it necessary to run the batch program during off-peak hours.

The following steps describe the process of creating a batch program that detects events for all sales quotes created on today's date. The code that follows it is a result of this process.

1. Create is determined to be the supported verb.
2. The quote number is determined to be the unique key used to retrieve the events.
3. The creation date (VBAK-ERDAT) and the document category (VBAK-VBTYP) need to be checked.

The following sample code supports the SAP Sales Quote as a batch program:

```
REPORT ZSALESORDERBATCH.

tables: vbak.

parameter: d_date like sy-datum default sy-datum.

data: tmp_key like YXR_EVENT-OBJ_KEY,
      tmp_event_container like swcont occurs 0.

" retrieve all sales quotes for today's date
" sales quotes have vbtyp = B
select * from vbak where erdat = d_date
                     and vbtyp = 'B'.

tmp_key = vbak-vbeln.
TMP_OBJTYPE = space.

  CALL FUNCTION 'Y_XR_ADD_TO_QUEUE'
       EXPORTING
OBJTYPE = TMP_OBJTYPE
OBJNAME = 'SAP_SalesQuote'
OBJKEY = tmp_key
```

```
EVENT = 'Create'
GENERIC_RECTYPE = ''
IMPORTING
RECTYPE = r_rectype
TABLES
            EVENT_CONTAINER = tmp_event_container.

  write: / vbak-vbeln.
endselect.
```

## Business workflow

Business workflow is a set or sequence of logically related business operations. The processing logic within a workflow detects events. The Business Workflow event detection mechanism relies on the SAP Business Object Repository (BOR), which contains the directory of objects along with their related attributes, methods, and events.

To implement business workflow for event detection:

- Determine which business object represents the functionality that you need. Check if the events trigger, start, or end a workflow. You can use the Business Object Builder (transaction SWO1) to search for the appropriate business object.
- Create a subtype of this business object. A subtype inherits the properties of the supertype and can be customized for use.
- Activate the events (such as CREATED, CHANGED, and DELETED) for the business object by customizing the subtype.

The following example of SAP sales quote can be used to implement an event trigger using business workflow:

1. Search the BOR for the appropriate sales quote business object. A search can be done using the short description field and the string '*quot*'. BUS2031 (Customer Quotes) is one of the business objects returned.
2. Upon further investigation of BUS2031, it is determined that the key field is CustomerQuotation.SalesDocument (VBAK-VBELN).
3. A subtype for BUS2031 is created using the following entries:

   Object type—ZMYQUOTE

   Event—SAP_SalesQuote

   Name—SAP Sales Quote

   Description—Example of an SAP Sales Quote Subtype

   Program—ZMYSALESQUOTE

   Application—V
4. The event detection mechanism is activated by adding an entry to the Event Linkage table (transaction SWE3). The create event is activated using the following entries:

   Object type—ZMYQUOTE

   Event—SAP_SalesQuote

   Receiver FM—Y_XR_ADD_TO_QUEUE_DUMMY

   Receiver type FM—Y_XR_ADD_TO_QUEUE_WF

**Note:** The Receiver and Receiver type function modules (FM) both point to Y_XR_ADD_TO_QUEUE. The DUMMY function module is used only because sometimes the SAP application requires that both fields be populated. The WF function module translates the SAP standard interface to the one used by Y_XR_ADD_TO_QUEUE.

The business workflow event detection mechanism is created and active. It is set up to detect all SAP Customer Quotes that are created.

# Chapter 24. Testing a business object for the ABAP Extension Module

Once you have developed an application-specific business object and a supporting ABAP handler, you must unit test to make sure they support the desired functionality. The IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x). provides unit test tools to facilitate this testing. These tools operate independently from your IBM WebSphere business integration system, which means that you do not need to have this system running to test your business object.

**Note:** These tools do not replace full end-to-end testing through the IBM WebSphere business integration system. They are meant only to be used for unit testing of individual business objects and ABAP handlers.

This chapter covers the following subjects:



## Preparing to test

All business object processing originates from the Java component of the connector. This is for all objects and all possible verbs. To unit test, the adapter includes an ABAP program that simulates the connector's action of sending in a business object request.

Specifically, the program simulates the `doVerbFor()` processing in the Java component of the connector by calling the ABAP function module `Y_XR_RFC_DO_VERB_NEXTGEN`. Like `doVerbFor()`, the test program requires a business object as an input to pass to the ABAP function module n. The ABAP test program uses a text file as its input.

All input test files have the same ASCII text format. From this file format, the test program restructures the data to resemble the business object passed to `Y_XR_RFC_DO_VERB_NEXTGEN`. The following rules apply to business object input files:

- Business object must have only one parent business object in a file.
- Child business objects are ordered first in depth, then in breadth
- Attributes and objects must be ordered in the exact sequence as they occur in the business object repository definition.
- For each attribute, the information described in Table 47 must be provided in the described format and in the sequence shown (leading spaces after the "=" are ignored):

*Table 47. Attribute Properties and Values*

| Attribute Property | Description or Possible Values |
|---|---|
| `Name` | name of the attribute |
| `Value` | value of the attribute or `CxIgnore = 'CxIgnore'` or `CxBlank = ' '` |

*Table 47. Attribute Properties and Values (continued)*

| Attribute Property | Description or Possible Values |
|---|---|
| IsKey | value that specifies whether the attribute is a key:0 = no 1 = yes |
| Peers | NumberOfPeers value expressed an integer that represents the total number of child business objects at the same level For example, if an Item business object contains two line items, each line item would have the value '2'. |
| AppInfo | application-specific information that is specific to each business object |

The test program provides a Quick Retrieve function to help generate a test input file. For more information, see "Testing an ABAP handler" on page 257.

## Unit test issues

The unit tools test all SAP development work that handles business object processing for the connector. Also, the unit test tools enable you to test the interaction of your work with the ABAP components of the connector. The test tools allow you to test your development work as an online user (real-time) only.

**Note:** It is important to understand the differences between testing the connector as an online user and testing the connector as if operating as a background user.

The differences between testing the connector as an online user or as a background user are described as follows:

- Memory—When testing a business object, the connector must log into the SAP application.

  The connector runs as a background user, so it processes in a single memory space that is never implicitly refreshed until the connector is stopped and then restarted (therefore it is critical in business object development to clear memory after processing is complete). Since you are an online user, memory is typically refreshed after each transaction you execute.

  For more information, see Chapter 22, "Developing business objects for the ABAP Extension Module," on page 229. Any problems that may occur because of this (for example, return codes never being initialized) are not detected using the test tool; only testing with the connector will reveal these issues.
- Screen flow behavior—Screen flow behavior is relevant only when using the Call Transaction API. The precise screen and sequence of screens that a user interacts with is usually determined at runtime by the transaction's code. For example, if a user chooses to extend a material master record to include a sales view by checking the Sales view check box, SAP queries the user for the specific Sales Organization information by presenting an additional input field. In this way, the transaction source code at runtime determines the specific screen and its requirements based on the data input by the user. While the test tool does handle this type of test scenario, there is a related scenario that the test tool cannot handle.

  SAP's transaction code may present different screens to online users versus background users (usually for usability versus performance). The test tool only

operates as an online user. The connector only operates as a background user. Despite this difference, unit testing should get through most of the testing situations.

## Testing an ABAP handler

To test, you must first generate a business object input file. At this point, you may need to modify it to contain attribute values and appropriate application-specific information. The last step is to execute the test program, pointing to your test file as an input.

### Creating a test file

To create a test file:

1. Go to WebSphere InterChange Server Connector Tools (transaction YXR1).
2. Select Test Program.
3. Perform a Quick Retrieve for the required business object:
   - Enter the name of an output file.
   - Select either an IDoc Retrieve or a Dynamic Retrieve.
   - Enter the business object's name and object key.
   - If you selected an IDoc Retrieve, enter the IDoc Type, enter `Y_XR_IDOC_HANDLER` in the Method 1 field, and enter the name of your Retrieve function module in the Method 2 field.
   - If you selected a Dynamic Retrieve, enter `Y_XR_DYNAMIC_RETRIEVE` in the Method 1 field.
4. Click execute to save the test business object in the output file you specified.
5. Edit the test file in any text editor. You must:
   - Modify the verb application specific information to point to your ABAP handler See "Business object data routing to ABAP handlers" on page 221 for the syntax. For example,`:function1:function2`.
   - Verify that the appropriate attribute on the parent is marked `isKey`.
   - Add input values for the attributes, as required.

### Using the test file

To use the test file:

1. Go to WebSphere InterChange Server Connector Tools (transaction YXR1).
2. Select Test Program.
3. Enter the location and file name of your input file in the input file field.
4. (Optional) Enter a file name and location for the output data (can be the same as the input, but it will overwrite the input).
5. Click the execute button.

When finished, the program will display the last message that was raised during processing. In addition, the processed data is displayed on the screen for verification. This is the same information that would be generated in the output file of step 4.

Also, you can look in the IBM WebSphere InterChange Server ABAP Log for additional details.

# Chapter 25. Managing the ABAP Extension Module

The IBM CrossWorlds Connector Tool (transaction YXR1) enables you to maintain the IBM WebSphere Business Integration Adapter for mySAP.com (SAP R/3 Version 3.x) event processing. You can also use this tool to maintain the connection to the SAP application. You can view the connector log file and the SAP Gateway Service connections. Also, you can reprocess archived objects from the connector log, view events waiting to be processed, and resubmit and delete events from the archive table.

This chapter covers the following subjects:



## Managing the connector log file

The connector log in the SAP application displays in reverse chronological order all events and errors that relate to the connector, such as Create or Update operations or events that arrive in the event queue. The log file lists the date, time, and event for each log entry. The log file is a good source to start troubleshooting problems.

### Setting log options

You can set the global and user settings to the level of detail you want logged in the connector log file, as well as the number of entries and type of data you want displayed. To set the connector logging levels:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1)
2. From the Customizing menu, click Log, and then click Logging Options.
3. Under Logging Level, select from the levels 0 - 3. The four levels of logging are as follows:
   - 0 — Off
   - 1 — Log only warnings and errors
   - 2 — Log every event with minimal information
   - 3 — Log each event in detail, including every attribute of every business object

   **Note:** Logging level 0 is not recommended. Logging level 1 is recommended for a production system. Logging level 3 is recommended for a development or debugging system.

### Displaying the log

To view recently processed objects and details associated with them, display the connector log. To display the connector log in the SAP application:

1. Go to IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).

2. Click the Display Log button, or from the Tools menu, click Display Log (F8).
   - Green—indicates a successful event
   - Yellow—indicates a warning message
   - Red—indicates an error
   - White—indicates an archived object
   - Magenta—provides information on the beginning and end of the event.
3. Click on any arrow to link to SAP's display transaction for that business object.

You can change the amount of detail that is displayed about each event. To change the display level, click the More Details or Fewer Details button depending on the level of detail desired.

### Filtering log details

You can change the amount of detail that is displayed about each event. If the amount of data displayed is more than you currently need, narrow the information displayed. For example, you can view business objects by user, name, date, or event number.

1. Click the Filter Data button.
2. Populate the appropriate fields to filter the log file.
3. Click Filter.

In the Logging Options screen, you can set user settings for the number of log entries to display at one time and the default logging display level.

## Setting up truncation of the event log

SAP keeps an event log of the connector's activity. This log can, over time, take up a lot of disk space. To save disk space, you can set this log to automatically truncate. When you set automatic truncation, by default SAP prints the truncated entries to the default printer of the user who sets up the job. Therefore, you may also want to control the print options.

To set truncation options:

1. Go to IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. Click the Display Log button, or from the Tools menu, click Display Log (F8).
3. Click the Log Options button or from the Goto menu, click Log Options (F7).
4. Under Global Settings (for all users), enter the number of log entries you want kept in the log after each truncation. For example, if you specify 1000, then on each log truncation, all entries in the log except for the newest 1000 will be truncated.
5. To truncate the log immediately, click the Truncate Log button.

**Important:** Set up automatic truncation of the event log by scheduling report YXRLOGT. It is recommended that you run this report on a regular basis.

To schedule the YXRLOGT report:

1. From the System menu, click Services, click Jobs, and then click Define Job (transaction SM36).
2. Name the job, and specify the class (priority). The target host needs to be filled in only if you have multiple application servers accessing a single database server.

3. Specify the start date and frequency of the job by clicking the Start Date button.
4. Specify the frequency with which you would like to run the job. Select the Periodic job check box, click the Period values button, and then select the appropriate button by clicking the Period Values button.
5. Click the save button twice to get back to the first screen. Define which program is to be run by clicking the Steps button. Schedule ABAP program YXRLOGT. No Variant is needed.
6. By default, SAP will print the truncated entries in the log to the default printer of the user who sets up the job. If logging is turned high and many events are processed, this printout could be very long (several hundred pages). You can control where the entries will be printed (or whether they are printed at all) by clicking on the Print specifications button.
7. To deactivate the automatic printing of the truncated log, uncheck the Print immed. check box. This way the printout will be spooled and kept for a default of 8 days, where it could be referenced if necessary, without wasting paper. Now click the Save button twice.
8. Click the green back arrow.
9. Click the save button, and then click the green back arrow. Your job is now scheduled.

To view your truncation job:

1. From the System menu, click Services, click Jobs, and then click Job Overview (transaction SM37).
2. Type the job name, and then press Enter. If the job is in Released state, it is fine.

**Note:** You can access the connector log file by clicking the Connector Log button.

## Monitoring the SAP gateway service connections

You can monitor the SAP Gateway Service connections between the connector and the SAP application. Each entry displays information such as connector host name, user name, and connection status.

To monitor the SAP Gateway Service connections:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Tools menu, click Monitor Gateway.
3. Click on a Server Name to view more details.

## Shutting down the connector

It is recommended that you shut down your connector using:

- IBM WebSphere InterChange Server System Manager (when InterChange Server is the integration broker)
- The `mqsiremotestopadapter` command (when a message broker is the integration broker).

**Important:** Do not use the Gateway monitor window. If you use the Gateway monitor window, your connector may not shut down properly.

## Maintaining the event queue

You can check the outgoing current event queue for events that have not been processed by the connector.

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Tools menu, click Outgoing Queue, and then click Display Queue.
3. Click Execute or press the F8 key to display the event queue.

To limit the number of event entries that are displayed, populate the applicable fields in the Current Event Selection section. For example, to limit the displayed entries for a particular business object, enter a business object name in the Object Name field. If you do not know the exact syntax for the business object name, click the Object Name field, click the arrow button (F4), and then select the appropriate business object name.

To see more information about an event, double-click an event field. Under normal conditions, events are picked up every few seconds. If an event is displayed, it has not been processed by the connector. This may indicate that the connector is not running.

The following is a list of the possible event status values for the event queue:

| | |
|---|---|
| P — Prequeued | When an event is triggered, the status is initially set to prequeue (P), because it has not yet been determined whether the business object is locked. |
| L — Locked | When a user creates or updates a business object in SAP, a lock is placed against that business object. Once the business object has been committed to the database, SAP removes the lock. If an event is triggered while a business object is locked, the event remains in the event queue with status locked (L) until the lock has been removed. |
| R — Retrieved | When the connector retrieves an event, the status changes to retrieved (R). This is a temporary status. Once event processing finishes, the connector updates the status and moves the event to the archive table. If the status remains retrieved for an extended period of time, it indicates that the connection between the connector and SAP R/3 may have been lost during processing of that event. |
| Q — Queued | When the business object is no longer locked, the status changes to queued (Q), and the event is ready to be picked up by the connector. The event remains in this status until a confirmation of a retrieval is received. |

## Maintaining the archive table

Using the IBM WebSphere InterChange Server Connector Tool (transaction YXR1), you can display the archive table and determine the status of archived events. In the table, you can identify events that need to be resubmitted for polling when an integration broker subscribes to them.

To display the archive table:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Tools menu, click Outgoing Queue, and then click Display Archive.
3. Click Execute or press the F8 key to display the archive queue.

To limit the number of archive entries that are displayed, populate the applicable fields in the Archived Event Selection section. For example, to limit the displayed entries for a particular business object, enter a business object name in the Object Name field. If you do not know the exact syntax for the business object, click the Object Name field, click the arrow button, and then select the appropriate business object name.

To see more information about an event, double-click an event field.

The following is a list of the possible event status values for the archive table:

| | |
|---|---|
| 0 — Success | The connector successfully processed the event and sent the business object to the integration broker. |
| 1 — Error in SAP | The connector encountered an error while retrieving the business object within SAP for this event. |
| 2— Not Subscribed | No integration broker was subscribed to the combination of the business object and verb for this event. |
| 3— Error in Java | The connector encountered an error during one of the following:<br>• Receiving the business object from SAP<br>• Converting the SAP business object to a WebSphere business object for SAP<br>• Inserting the business object into the message queue |
| 4 — Max requeued | The event was requeued more than the maximum times specified by the requeued constant, `c_maximum_requeue` (usually 100). An event is requeued if its business object is locked. |
| 5 — Multiple Event | Some business objects have single events in the event table that cause multiple events to be created at the time of retrieval. The original single event does not create a business object and is therefore archived using this event status. |
| 6— Event Deleted | A user manually deleted the event from the event table. |

## Resubmitting events from the archive table

You can resubmit events from the archive table to the event queue for reprocessing. Depending on how you want to handle the events in the archive table, you have the option of resubmitting a single event or multiple events. Keep in mind that resubmitting events only moves the events from the archive table to the event table and therefore the events do not pass through event distribution, event restriction, or event priority. Follow these steps from the Archived Events window:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).
2. From the Tools menu, click Outgoing Queue, and then click Resubmit Events.
3. Choose the event or events to be resubmitted.
4. Click the Execute button, or from the Program menu, click Execute (F8).

   A status message displays. You can display the connector log to view the event and its new status.

## Deleting events from the archive table

You can delete archive events manually or schedule them to be deleted automatically.

To delete Archive Events manually:

1. Go to the IBM WebSphere InterChange Server Connector Tools window (transaction YXR1).

2. From the Tools menu, click Outgoing Queue, and click Truncate Archive.
3. Populate the applicable fields.
4. Click the Execute button (F8).

# Part 7. Appendixes

# Appendix A. Quick Steps

This appendix supplements information contained in the *Adapter for mySAP.com User Guide*. It is not intended to replace the information in the user guide.

**Note:** The quick steps presented here are intended for the adapter running in the standalone mode with one of the WebSohere message brokers or WebSphere Application Server as the integration broker.

Before you begin these steps, you must:

- Install a WebSphere message broker or WebSphere Application Server as your broker.
- Install the SAP JCo API. The SAP JCo is available for download from SAP's website at `http://service.sap.com/connectors`. You must have an SAPNet account to access the SAP JCo (if you do not already have one, contact your local SAP Basis administrator). Add these files to the *ProductDir*`\ODA\SAP` and *ProductDir*`\connectors\SAP` directories, where *ProductDir* represents the directory where the connector is installed.
- Install the JDK.
- Install WebSphere Business Integration Adapter runtime environment (adapter framework).
- Configure standard MQ queues.

As you follow these quick steps, you can create your own business objects or use the sample business objects provided. The samples are available in the *ProductDir*`\connectors\SAP\samples` directory, where *ProductDir* represents the directory where the connector is installed.

## Common configuration properties

The following tables list configuration properties that must be maintained for the WMQI broker. Create the SAP configuration file using `CN_SAP.txt`. This file is located in `%CROSSWORLDS%\repository\SAP`. Open the file using Connector Configurator.

*Table 48. Standard configuration properties*

| Property name | Default Value | Value Needed |
|---|---|---|
| ApplicationName | none | SAPConnector |
| BrokerType | ICS | WMQI |
| AdminInQueue | /ADMININQUEUE | ADMININQUEUE |
| AdminOutQueue | /ADMINOUTQUEUE | ADMINOUTQUEUE |
| DeliveryQueue | /DELIVERYQUEUE | DELIVERYQUEUE |
| FaultQueue | /FAULTQUEUE | FAULTQUEUE |
| RequestQueue | /REQUESTQUEUE | REQUESTQUEUE |
| ResponseQueue | /RESPONSEQUEUE | RESPONSEQUEUE |
| SynchronousRequestQueue | /SYNCHRONOUSREQUESTQUEUE | SYNCHRONOUSREQUESTQUEUE |
| SynchronousResponseQueue | /SYNCHRONOUSRESPONSEQUEUE | SYNCHRONOUSRESPONSEQUEUE |

*Table 48. Standard configuration properties (continued)*

| Property name | Default Value | Value Needed |
|---|---|---|
| MessageFileName | SAPConnector.txt | SAPCONNECTOR.TXT |
| RepositoryDirectory | C:\crossworlds\repository | *<location of business object specifications>* |
| Jms.MessageBrokerName | crossworlds.queue.manager | *<Queue Manager name>* |
| AgentTraceLevel | 0 | 5 |

*Table 49. Connector-specific properties*

| Property Name | Default Value | Value Needed |
|---|---|---|
| ApplicationPassword | SOFTWARE | *<password for SAP application>* |
| ApplicationUserName | CROSSWORLDS | *<username for SAP application>* |
| Client | none | *<Client number>* |
| Hostname | none | *<SAP application server name>* |

# Quick steps for the BAPI Module

Before configuring the BAPI Module, configure the following connector-specific property:

| Property Name | Default Value | Value Needed |
|---|---|---|
| Modules | none | BAPI |

## Generating a business object in the BAPI Module

To generate a business object for the BAPI Module:

1. Start the SAP ODA.
2. Start the business object designer.
3. In the business object designer, choose File > New. The wizard starts.

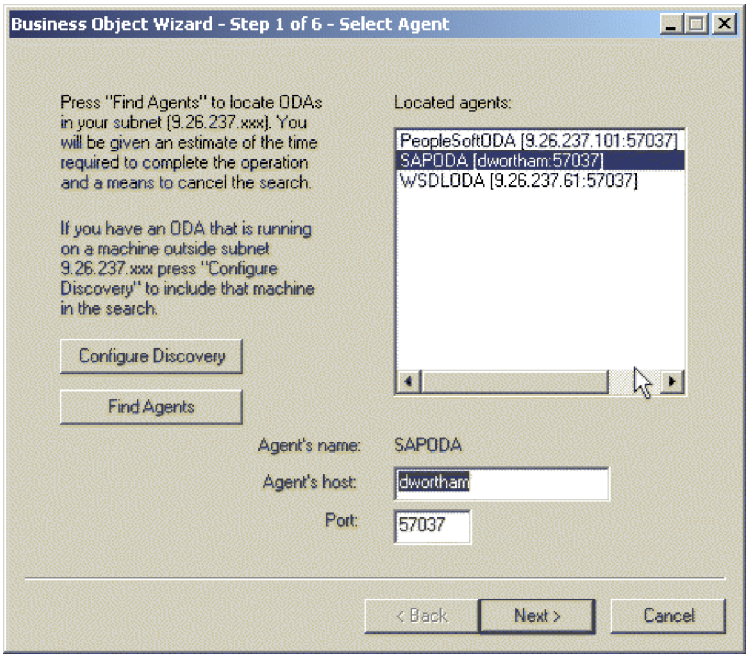



*Figure 76. Business Object Wizard—Select Agent*

4. Select Configure Discovery:
   a. Enter the host address for the machine where Discovery is running.
   b. Choose Add Host.
   c. Choose OK.
5. Choose Find Agents.
   a. Highlight Agent. Choose Next.
   b. Populate the values for UserName, Password, Client, SystemNumber, ASHostName, and FileDestination. Save the profile.
6. In Step 3 of the wizard, expand the RFC node.
   a. Right-click Search By Name.
   b. Type `bapi_customer_getdetail`.
   c. Highlight `bapi_customer_getdetail`.
   d. Choose Next.

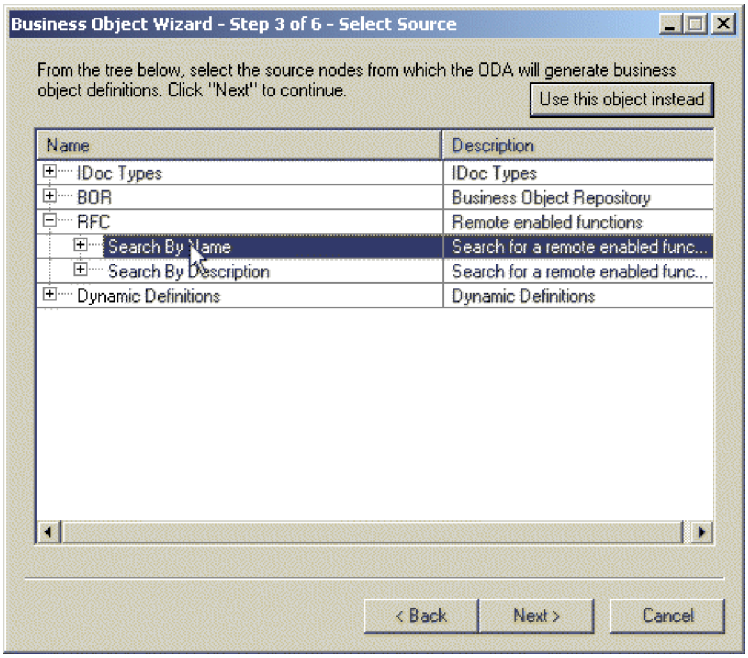



*Figure 77. Business Object Wizard—Select Source*

7. Choose Next.
8. Set Verb to **Retrieve**, and Server Support to **No**. Choose OK.
9. In Agent SAPODA Notification, choose No.
10. Open the business object in a separate window. Save the generated business object specification to the location you specified in the Repository Directory standard property value.

## Configuring the BAPI Module

After you have generated a business object, add the parent object name to the Supported Business Object section of the configuration file to continue configuring the BAPI Module.

## Preparing the BAPI Module for testing

To set up the BAPI Module for testing, use Port Connector:

1. Copy the SAP configuration file. Rename the copied file `portconnector.cfg`.
2. Open portconnector.cfg in Connector Configurator.
3. Change the following properties in the Standard tab:
   - `ApplicationName` to `PortConnector`
   - `DELIVERYQUEUE` to `REQUESTQUEUE`
   - `REQUESTQUEUE` to `RESPONSEQUEUE`
4. Save changes. Close `portconnector.cfg`.
5. Open `sapconnector.cfg`.
6. Save the change. Start mySAP.com.

## Testing the BAPI Module

To test the BAPI Module:

1. Open Test Connector.

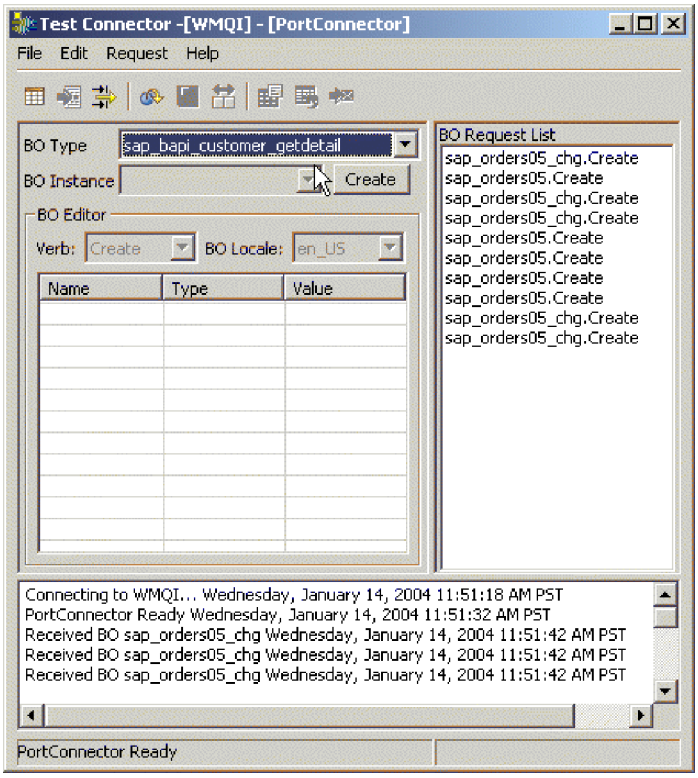



*Figure 78. Test Connector*

2. Choose File > Create/Select Profile.
3. Choose File > New Profile.

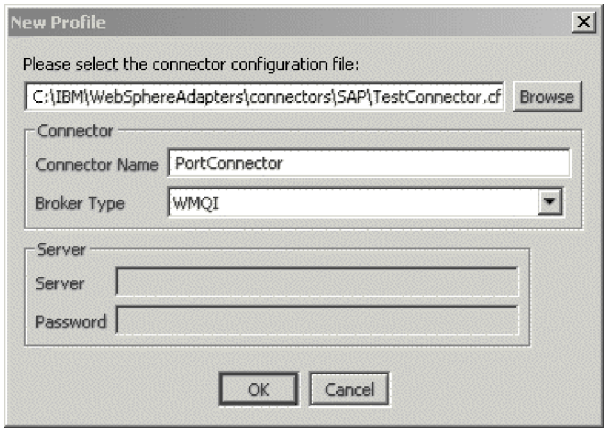



*Figure 79. Test Connector—New Profile*

4. Select Browse.
   a. Locate `portconnector.cfg`. Choose Open.
   b. For Connector Name, enter `PortConnector`.
   c. For Broker Type, enter `WMQI`.
   d. Choose OK.
5. Highlight `PortConnector`. Choose OK.
6. Choose File > Connect.

7. Create a Business Object Instance:
   a. For BO Type select `SAP_BAPI_customer_getdetail`.
   b. Choose Create.
   c. Enter New Object. Choose OK.
8. Change the Verb to Retrieve. Populate `Customer_to_be_required` with an existing customer.
9. Choose Request > Send.
10. Check the log file for a success message.

## Quick steps for the RFC Server Module

Before configuring the RFC Module, configure the following connector-specific properties:

| Property Name | Default Value | Value Needed |
|---|---|---|
| `Modules` | none | `Rfcserver` |
| `RfcProgramId` | `CWLDSERVER` | *<ProgramId registered in SAP transaction sm59>* |

### Generating a business object in the RFC Server Module

To generate a business object for the RFC Module:

1. Start the SAP ODA.
2. Start the business object designer.
3. In the business object designer, choose File > New. The wizard starts.
4. Select Configure Discovery:
   a. Enter the host address for the machine where Discovery is running.
   b. Choose Add Host.
   c. Choose OK.
5. In Step 3 of the wizard, expand the RFC node.
   a. Right-click Search By Name.
   b. Type `bapi_customer_getdetail`.
   c. Highlight `bapi_customer_getdetail`.
   d. Choose Next.
6. Choose Next.
7. Set the Verb to Retrieve and Server Support to No. Choose OK.
8. In Agent SAPODA Notification, choose No.
9. Open the business object in a separate window. Choose General > Set Collab = ″RFCCollab″.
10. Save the generated business object specification to the location you specified in the Repository Directory standard property value.

### Configuring the RFC Server Module

After you have generated a business object, continue configuring the RFC Server Module:

1. Add the parent object name to the Supported Business Object section of the configuration file.

2. Copy the generated BOHandler .class file from the definition specified in the ODA configuration properties to %CROSSWORLD%\connectors\SAP\rfc\client.

## Creating a profile for the SAP server

To create a profile for the SAP server:

1. Open SAP Logon.
2. Choose New.
3. Populate the following fields, then choose OK:

| Description | Hostname of server |
|---|---|
| Application server | Hostname of server |
| System Number | 00 |
| Description | Hostname is standard. Enter a description of your choice. |

4. Double-click to open the profile you just created.
5. Enter your username and password. Choose Transaction > Type /nse37. Function Builder opens.
6. For Function Module, input bapi_customer_getdetail. Choose Function Module >Test > Single Test.
7. For the RFC target system, use the value for Rfcprogramid you set in the connector-specific properties. Also populate the following fields:

| Field | Example |
|---|---|
| Customer Number | 0000000001 |
| PI_SALESORG | 0001 |
| PI_DISTR_CHAN | 01 |
| PI_DIVISION | 01 |

## Testing the RFC server Module

To set up the BAPI Module for testing, use Port Connector:

1. Copy the SAP configuration file. Rename the copied file portconnector.cfg.
2. Open portconnector.cfg in Connector Configurator.
3. Change the following properties in the Standard tab:
   - ApplicationName to PortConnector
   - REQUESTQUEUE to SYNCHRONOUSREQUESTQUEUE.

   Save the changes and close the window.
4. Open sapconnector.cfg.
5. Change REQUESTQUEUE to SYNCHRONOUSREQUESTQUEUE. Save the change.
6. Start the connector. Choose Function Module > Execute.
7. In Test Connector, find the object in BO Request List. Highlight the object, and choose Request > Reply > Success.
8. Check the log for a success message.

## Quick steps for the ALE Module

Before you configure the ALE Module, create the following persistent WebSphere MQ queues:

- SAPtid_Queue
- SAPtid_QueueManager
- SAPALE_Event_Queue
- SAPALE_Wip_Queue
- SAPALE_Archive_Queue
- SAPALE_UnSubscribed_Queue
- SAPALE_Error_Queue

Refer to the MQ Series documentation for information on creating MQ Queues.

Next, configure the following connector-specific properties:

| Property Name | Default Value | Value Needed |
|---|---|---|
| Modules | none | Ale |
| AleEventDir | none | %CROSSWORLDS%\connectors\SAP\ale |
| SAPtid_QueueManager | none | *<Queue Manager name>* |
| SAPtid_Queue | none | *<Queue name>* |
| SAPALE_Event_Queue | none | *<Event Queue name>* |
| SAPALE_Wip_Queue | none | *<WIP Queue name>* |
| SAPALE_Archive_Queue | none | *<Archive Queue name>* |
| SAPALE_UnSubscribed_Queue | none | *<UnSubscribed Queue name>* |
| SAPALE_Error_Queue | none | *<Error Queue name>* |
| RfcProgramId | none | *<Program ID name defined in SAP Transaction sm59>* |
| NumberOfListeners | 1 | 1 (for single-threaded) |

For remote WebSphere Queues, also configure the following properties:

| Property Name | Default Value | Value Needed |
|---|---|---|
| SAPtid_QueueManagerLogin | none | *<Queue Manager login>* |
| SAPtid_QueueManagerPassword | none | *<Queue Manager password>* |
| SAPtid_QueueManagerHost | none | *<Queue Manager host>* |
| SAPtid_MQPort | none | *<MQ port>* |
| SAPtid_MQChannel | none | *<MQ channel>* |

## Generating a business object in the ALE Module

To generate a business object in the ALE Module:

1. Start the SAP ODA.
2. Start the business object designer.
3. In the business object designer, choose File > New. The wizard starts.
4. Select Configure Discovery:
   a. Enter the host address for the machine where Discovery is running.

b. Choose Add Host.
c. Choose OK.

5. In Step 3 of the wizard, expand IDoc Types.
   a. Expand Generate From System.
   b. Expand Basic IDoc Types.
   c. Right-click Select by Name...
   d. Select Search for Items...
   e. Type `orders03`. Choose OK.
6. Highlight `ORDERS03`. Choose Next.
7. Choose Next.
8. Choose OK. The business object generates.
9. Select ″Save a copy of business object definitions to a separate file″ and select ″Open new business object definition to a separate window″. Choose Finish.

## Editing the business object

To edit the business object:

1. Choose the General tab.
2. Change Create Application-specific information message type to `MsgType = ORDERS`.
3. Open `%CROSSWORLDS\repository\SAP\BO_SAPIDocControl.txt` and save it to the Repository directory.
4. Add the parent object name to the Supported Business Objects section of the configuration file.
5. Register the RFC Server Module with the SAP Gateway, using SAP transaction SM59.
6. Ensure the following:
   - That the logical systems are defined and assigned for the SAP system and external system (SALE).
   - That the distribution model has been maintained and that the required message types have been added to the model (transaction code BD64).
   - That there are partner profiles for the logical systems or distribution model (transaction code WE20).
   - That there are ports defined for the logical systems or distribution model (transaction code WE21).

## Preparing the ALE Module for testing

To set up the ALE Module for testing, use Port Connector:

1. Copy the SAP configuration file. Rename the copied file `portconnector.cfg`.
2. Open portconnector.cfg in Connector Configurator.
3. Change the following properties in the Standard tab:
   - `ApplicationName` to `PortConnector`
   - `DELIVERYQUEUE` to `REQUESTQUEUE`
   - `REQUESTQUEUE` to `RESPONSEQUEUE`
4. Save changes. Close `portconnector.cfg`.
5. Open `sapconnector.cfg`.
6. Save the change. Start mySAP.com.

## Testing request processing for the ALE Module

To test the ALE Module:

1. Open Test Connector.
2. Choose File > Create/Select Profile.
3. Choose File > New Profile.
4. Select Browse.
   a. Choose Open.
   b. For Connector Name, enter `PortConnector`.
   c. For Broker Type, enter `WMQI`.
   d. Choose OK.
5. Highlight `PortConnector`. Choose OK.
6. Choose File > Connect.
7. Create a business object instance:
   a. For BO Type, select `sap_order03`.
   b. Choose Create.
   c. In Enter Name, type new object. Choose OK.
8. Change the verb to Create.
9. Right-click Control Record. Choose Add Instance.
10. Expand Control Record. Populate these fields:
    - `IDoc_number`
    - `Sender_port`
    - `Partner_number_of_sender`
    - `Receiver_port`
    - `Partner_number_of_recipient`
    - `Client`
    - `SAP_Release`
11. Start the connector.
12. In Test Connector, choose Request > Send. Check the log for a success message.

## Testing event processing in the ALE Module

To test event processing in the ALE Module:

1. Go to transaction we19, Test Tool for IDoc processing.
2. Populate the field with an existing IDoc. Choose IDoc > Create.
3. Choose StandardOutboundProcessing to send an IDoc to the test connector.
4. In the pop-up window, choose the check mark.
5. To verify that the IDoc was sent from SAP, check the mySAP.com connector log file for a success message. If the event exists in transaction sm58, then it was not sent correctly.
6. View the message that was sent to the `SAPALE_Archive_Queue` to verify that the ProcessingStatus was successful. If you do not see a success message, check the `SAPALE_Error_Queue` to see if a failure occurred.

# Quick steps for the HDR Module

Before configuring the HDR Module, configure the following connector-specific property:

| Property Name | Default Value | Value Needed |
|---|---|---|
| Modules | none | BAPI |

## Generating a business object in the HDR Module

To generate a business object in the HDR Module:

1. Start the SAP ODA.
2. Start the business object designer.
3. In the business object designer, choose File > New. The wizard starts.
4. Select Configure Discovery:
   a. Enter the host address for the machine where Discovery is running.
   b. Choose Add Host.
   c. Choose OK.
5. In Step 3 of the wizard, expand the Dynamic Definitions.
   a. Expand HDR.
   b. Right-click Search by Name.... Choose Search for Items.
   c. Type kna1. Choose OK.
   d. Highlight kna1. Choose Next.
   e. Choose Next.
   f. Choose OK.
6. In Notification, choose No.
7. Select ″Open new business object definition to a separate window″. Choose Finish.
8. Save the new business object to the Repository directory.

## Preparing the HDR Module for testing

To set up the HDR Module for testing, use Port Connector:

1. Copy the SAP configuration file. Rename the copied file portconnector.cfg.
2. Open portconnector.cfg in Connector Configurator.
3. Change the following properties in the Standard tab:
   - ApplicationName to PortConnector
   - DELIVERYQUEUE to REQUESTQUEUE
   - REQUESTQUEUE to RESPONSEQUEUE
4. Save changes.
5. Open sapconnector.cfg.
6. Change REQUESTQUEUE to SYNCHRONOUSREQUESTQUEUE.
7. Save the change.

## Testing the HDR Module

To test the HDR Module:

1. Open Test Connector.
2. In Business Object Type, select SAP_kna1. Choose Create.

3. In Enter Name, type `new object`. Choose OK.
4. Change the verb to Retrieve.
5. Populate `customer_number_KUNNR` with an existing SAP customer number. The number must be 10 digits long, for example: 0000000001.
6. Choose Request > Send.
7. Check the log file for a success message.

# Appendix B. Common event infrastructure

WebSphere Business Integration Server Foundation includes the Common Event Infrastructure Server Application, which is required for Common Event Infrastructure to operate. The WebSphere Application Server Foundation can be installed on any system (it does not have to be the same machine on which the adapter is installed.)

The WebSphere Application Server Application Client includes the libraries required for interaction between the adapter and the Common Event Infrastructure Server Application. You must install WebSphere Application Server Application Client on the same system on which you install the adapter. The adapter connects to the WebSphere Application Server (within the WebSphere Business Integration Server Foundation) by means of a configurable URL.

Common Event Infrastructure support is available using any integration broker supported with this release.

## Required software

In addition to the software prerequisites required for the adapter, you must have the following installed for Common Event Infrastructure to operate:

- WebSphere Business Integration Server Foundation 5.1.1
- WebSphere Application Server Application Client 5.0.2, 5.1, or 5.1.1.

  (WebSphere Application Server Application Client 5.1.1 is provided with WebSphere Business Integration Server Foundation 5.1.1. )

**Note:** Common Event Infrastructure is not supported on any HP-UX or Linux platform.

## Enabling Common Event Infrastructure

Common Event Infrastructure functionality is enabled with the standard properties `CommonEventInfrastructure` and `CommonEventInfrastructureContextURL`, configured with Connector Configurator. By default, Common Event Infrastructure is not enabled. The `CommonEventInfrastructureContextURL` property enables you to configure the URL of the Common Event Infrastructure server.(Refer to the "Standard Properties" appendix of this document for more information.)

## Obtaining Common Event Infrastructure adapter events

If Common Event Infrastructure is enabled, the adapter generates Common Event Infrastructure events that map to the following adapter events:

- Starting the adapter
- Stopping the adapter
- An application response to a timeout from the adapter agent
- Any `doVerbFor` call issued from the adapter agent
- A `gotApplEvent` call from the adapter agent

For another application (the "consumer application") to receive the Common Event Infrastructure events generated by the adapter, the application must use the

Common Event Infrastructure event catalog to determine the definitions of appropriate events and their properties. The events must be defined in the event catalog for the consumer application to be able to consume the sending application's events.

The "Common Event Infrastructure event catalog definitions" appendix of this document contains XML format metadata showing, for WebSphere Business Information adapters, the event descriptors and properties the consumer application should search for.

## For more information

For more information about Common Event Infrastructure, refer to the Common Event Infrastructure information in the WebSphere Business Integration Server Foundation documentation, available at the following URL:

http://publib.boulder.ibm.com/infocenter/ws51help

For sample XML metadata showing the adapter-generated event descriptors and properties a consumer application should search for, refer to"Common Event Infrastructure event catalog definitions."

## Common Event Infrastructure event catalog definitions

The Common Event Infrastructure event catalog contains event definitions that can be queried by other applications. The following are event definition samples, using XML metadata, for typical adapter events. If you are writing another application, your application can use event catalog interfaces to query against the event definition. For more information about event definitions and how to query them, refer to the Common Event Infrastructure documentation that is available from the online IBM WebSphere Server Foundation Information Center.

For WebSphere Business Integration adapters, the extended data elements that need to be defined in the event catalog are the keys of the business object. Each business object key requires an event definition. So for any given adapter, various events such as start adapter, stop adapter, timeout adapter, and any `doVerbFor` event (create, update, or delete, for example) must have a corresponding event definition in the event catalog.

The following sections contain examples of the XML metadata for start adapter, stop adapter, and event request or delivery.

## XML format for "start adapter" metadata

```
<eventDefinition name="startADAPTER"
      parent="event">
    <property name ="creationTime" //Comment: example value would be
 "2004-05-13T17:00:16.319Z"
         required="true" />
    <property name="globalInstanceId" //Comment: Automatically generated
 by Common Event Infrastructure
         required="true"/>
    <property name="sequenceNumber"    //Comment: Source defined number
for messages to be sent/sorted logically
         required="false"/>
    <property name="version"    //Comment: Version of the event
         required="false"
         defaultValue="1.0.1"/>
```

```
    <property name="sourceComponentId"
         path="sourceComponentId"
         required="true"/>
    <property name="application"   //Comment: The name#version of the
source application generating the event. Example is "SampleConnector#3.0.0"
         path="sourceComponentId/application"         required="false"/>
    <property name="component"   //Comment: This will be the name#version
 of the source component.
         path="sourceComponentId/component"
         required="true"
         defaultValue="ConnectorFrameWorkVersion#4.2.2"/>
    <property name="componentIdType"    //Comment: specifies the format
and meaning of the component
          path="sourceComponentId/componentIdType"
          required="true"
          defaultValue="Application"/>
    <property name="executionEnvironment"
 //Comment: Identifies the environment the application is running
 in...example is "Windows 2000#5.0"
          path="sourceComponentId/executionEnvironment"
          required="false" />
     <property name="location"    //Comment: The value of this is the
 server name...example is "WQMI"
          path="sourceComponentId/location"
          required="true"/>
    <property name="locationType"   //Comment specifies the format and
     meaning of the location
          path="sourceComponentId/locationType"
          required="true"
          defaultValue="Hostname"/>
     <property name="subComponent"     //Comment:further distinction
of the logical component
          path="sourceComponentId/subComponent"
          required="true"
          defaultValue="AppSide_Connector.AgentBusinessObjectManager"/>
     <property name="componentType"      //Comment: well-defined name
used to characterize all instances of this component
          path="sourceComponentId/componentType"
          required="true"
          defaultValue="ADAPTER"/>
     <property name="situation"   //Comment: Defines the type of
 situation that caused the event to be reported
          path="situation"
          required="true"/>
     <property name="categoryName="    //Comment: Specifies the type
of situation for the event
         path="situation/categoryName"
         required="true"
         defaultValue="StartSituation"/>
    <property name="situationType"    //Comment: Specifies the type
of situation and disposition of the event
         path="situation/situationType"
         required="true"
    <property name="reasoningScope" //Comment: Specifies the scope
 of the impact of the event
         path="situation/situationType/reasoningScope"
         required="true"
         permittedValue="INTERNAL"
         permittedValue="EXTERNAL"/>
    <property name="successDisposition" //Comment: Specifies the
 success of event
         path="situation/situationType/successDisposition"
         required="true"
         permittedValue="SUCCESSFUL"
         permittedValue="UNSUCCESSFUL" />
    <property name="situationQualifier"  //Comment: Specifies the
 situation qualifiers for this event
```

```
        path="situation/situationType/situationQualifier"
        required="true"
        permittedValue="START_INITIATED"
        permittedValue="RESTART_INITIATED"
        permittedValue="START_COMPLETED" />
</eventDefinition>
```

## XML format for ″stop adapter″ metadata

The metadata for “stop adapter” is the same as that for “start adapter” with the following exceptions:

- The default value for the `categoryName` property is `StopSituation`:

```
<property name="categoryName="
 //Comment: Specifies the type
 of situation for the event
             path="situation/categoryName"
             required="true"
             defaultValue="StopSituation"/>
```

- The permitted values for the `situationQualifier` property differ and are as follows for “stop adapter”:

```
<property name="situationQualifier"
 //Comment: Specifies the situation qualifiers for this event
          path="situation/situationType/situationQualifier"
          required="true"
          permittedValue="STOP_INITIATED"
          permittedValue="ABORT_INITIATED"
          permittedValue="PAUSE_INITIATED"
          permittedValue="STOP_COMPLETED"
 />
```

## XML format for “timeout adapter” metadata

The metadata for “timeout adapter” is the same as that for “start adapter” and “stop adapter” with the following exceptions:

- The default value for the `categoryName` property is `ConnectSituation`:

```
<property name="categoryName="
 //Comment: Specifies the type
 of situation for the event
             path="situation/categoryName"
             required="true"
             defaultValue="ConnectSituation"/>
```

- The permitted values for the `situationQualifier` property differ and are as follows for “timeout adapter”:

```
<property name="situationQualifier"  //Comment: Specifies
 the situation qualifiers for this event
          path="situation/situationType/situationQualifier"
          required="true"
          permittedValue="IN_USE"
          permittedValue="FREED"
          permittedValue="CLOSED"
          permittedValue="AVAILABLE"
 />
```

## XML format for ″request″ or ″delivery″ metadata

At the end of this XML format are the extended data elements. The extended data elements for adapter request and delivery events represent data from the business object being processed. This data includes the name of the business object, the key (foreign or local) for the business object, and business objects that are children of parent business objects. The children business objects are then broken down into the same data as the parent (name, key, and any children business objects). This data is represented in an extended data element of the event definition. This data will change depending on which business object, which keys, and which child business objects are being processed. The extended data in this event definition is just an example and represents a business object named `Employee` with a key `EmployeeId` and a child business object `EmployeeAddress` with a key `EmployeeId`. This pattern could continue for as much data as exists for the particular business object.

```
<eventDefinition name="createEmployee"     //Comment: This
 extension name is always the business object verb followed by the business
 object name
          parent="event">
    <property name ="creationTime"  //Comment: example value would be
"2004-05-13T17:00:16.319Z"
         required="true" />
    <property name="globalInstanceId" //Comment: Automatically generated
 by Common Event Infrastructure
         required="true"/>
    <property name="localInstanceId"    //Comment: Value is business
 object verb+business object name+#+app name+ business object identifier
         required="false"/>
    <property name="sequenceNumber"    //Comment: Source defined number
for messages to be sent/sorted logically
         required="false"/>
    <property name="version"  //Comment: Version of the event...value is
 set to 1.0.1
         required="false"
         defaultValue="1.0.1"/>
    <property name="sourceComponentId"
         path="sourceComponentId"
         required="true"/>
    <property name="application"    //Comment: The name#version of the
 source application generating the event...example is
 "SampleConnector#3.0.0"
         path="sourceComponentId/application"
         required="false"/>
    <property name="component"   //Comment: This will be the name#version
of the source component.
         path="sourceComponentId/component"
         required="true"
         defaultValue="ConnectorFrameWorkVersion#4.2.2"/>
    <property name="componentIdType"     //Comment: specifies the format
 and meaning of the component
         path="sourceComponentId/componentIdType"
         required="true"
         defaultValue="Application"/>
    <property name="executionEnvironment" //Comment: Identifies the
 environment#version the app is running in...example is "Windows 2000#5.0"
         path="sourceComponentId/executionEnvironment"
         required="false" />
    <property name="instanceId" //Comment: Value is business object
  verb+business object name+#+app name+ business object identifier
          path="sourceComponentId/instanceId"
          required="false"
    <property name="location"   //Comment: The value of this is the
server name...example is "WQMI"
          path="sourceComponentId/location"
```

```
          required="true"/>
     <property name="locationType" //Comment specifies the format and
 meaning of the location
          path="sourceComponentId/locationType"
          required="true"
          defaultValue="Hostname"/>
     <property name="subComponent"  //Comment:further distinction of the
 logical component-in this case the value is the name of the business
 object
          path="sourceComponentId/subComponent"
          required="true"/>
     <property name="componentType"      //Comment: well-defined name used
 to characterize all instances of this component
          path="sourceComponentId/componentType"
          required="true"
          defaultValue="ADAPTER"/>
     <property name="situation" //Comment: Defines the type of
situation that caused the event to be reported
          path="situation"
          required="true"/>
    <property name="categoryName"    //Comment: Specifies the type
 of situation for the event
         path="situation/categoryName"
         required="true"
         permittedValue="CreateSituation"
         permittedValue="DestroySituation"
         permittedValue="OtherSituation" />
    <property name="situationType"    //Comment: Specifies the type
of situation and disposition of the event
         path="situation/situationType"
         required="true"
    <property name="reasoningScope" //Comment: Specifies the scope
of the impact of the event
         path="situation/situationType/reasoningScope"
         required="true"
         permittedValue="INTERNAL"
         permittedValue="EXTERNAL"/>
    <property name="successDisposition" //Comment: Specifies the
 success of event
         path="situation/situationType/successDisposition"
         required="true"
         permittedValue="SUCCESSFUL"
         permittedValue="UNSUCCESSFUL" />
    <extendedDataElements name="Employee" //Comment: name of business
 object itself
             type="noValue"
             <children name="EmployeeId"
                  type="string"/>  //Comment: type is one of the
 permitted values within Common Event Infrastructure documentation
             <children name="EmployeeAddress"
                  type="noValue"/>
                    <children name="EmployeeId"
                        type="string"/>
                     -
                     -
                     -
    </extendedDataElements
</eventDefinition>
```

# Appendix C. Application response measurement

This adapter is compatible with the Application Response Measurement application programming interface (API), an API that allows applications to be managed for availability, service level agreements, and capacity planning. An ARM-instrumented application can participate in IBM Tivoli Monitoring for Transaction Performance, allowing collection and review of data concerning transaction metrics.

## Application Response Measurement instrumentation support

This adapter is compatible with the Application Response Measurement application programming interface (API), an API that allows applications to be managed for availability, service level agreements, and capacity planning. An ARM-instrumented application can participate in IBM Tivoli Monitoring for Transaction Performance, allowing collection and review of data concerning transaction metrics.

### Required software

In addition to the software prerequisites required for the adapter, you must have the following installed for ARM to operate:

- WebSphere Application Server 5.0.1 (contains the IBM Tivoli Monitoring for Transaction Performance server). This does not have to be installed on the same system as the adapter.
- IBM Tivoli Monitoring for Transaction Performance v. 5.2 Fixpack 1. This must be installed on the same system on which the adapter is installed and configured to point to the system on which the IBM Tivoli Monitoring for Transaction Performance server resides.

Application Response Measurement support is available using any integration broker supported with this release.

**Note:** Application Response Measurement instrumentation is supported on all operating systems supported with this IBM WebSphere Business Integration Adapters release *except* HP-UX (any version) and Red Hat Linux 3.0.

### Enabling Application Response Measurement

ARM instrumentation is enabled via by setting the standard property `TivoliMonitorTransactionPerformance` in Connector Configurator to "True." By default ARM support is not enabled. (Refer to the ″Standard Properties″ appendix of this document for more information.)

### Transaction monitoring

When ARM is enabled, the transactions that are monitored are service events and event deliveries. The transaction is measured from the start of a service request or event delivery to the end of the service request or event delivery. The name of the transaction displayed on the Tivoli Monitoring for Transaction Performance console will start with either `SERVICE REQUEST` or `EVENT DELIVERY`. The next part of the name will be the business object verb (such as `CREATE`, `RETRIEVE`, `UPDATE` or `DELETE`). The final part of the name will be the business object name such as "`EMPLOYEE`."

For example, the name of a transaction for an event delivery for creation of an employee might be `EVENT DELIVERY CREATE EMPLOYEE`. Another might be `SERVICE REQUEST UPDATE ORDER`.

The following metrics are collected by default for each type of service request or event delivery:

- Minimum transaction time
- Maximum transaction time
- Average transaction time
- Total transaction runs

You (or the system administrator of the WebSphere Application Server) can select which of these metrics to display, for which adapter events, by configuring Discovery Policies and Listener Policies for particular transactions from within the Tivoli Monitoring for Transaction Performance console. (Refer to "For more information.")

## For more information

Refer to the IBM Tivoli Monitoring for Transaction Performance documentation for more information. In particular, refer to the *IBM Tivoli Monitoring for Transaction Performance User's Guide* for information about monitoring and managing the metrics generated by the adapter.

# Appendix D. Standard configuration properties for connectors

This appendix describes the standard configuration properties for the connector component of WebSphere Business Integration adapters. The information covers connectors running with the following integration brokers:

- WebSphere InterChange Server (ICS)
- WebSphere MQ Integrator, WebSphere MQ Integrator Broker, and WebSphere Business Integration Message Broker, collectively referred to as the WebSphere Message Brokers (and shown as WMQI in the Connector Configurator).
- Information Integrator (II)
- WebSphere Application Server (WAS)

If your adapter supports DB2 Information Integrator, use the WMQI options and the DB2 II standard properties (see the Notes column in Table 50 on page 289.)

The properties you set for the adapter depend on which integration broker you use. You choose the integration broker using Connector Configurator. After you choose the broker, Connector Configurator lists the standard properties you must configure for the adapter.

For information about properties specific to this connector, see the relevant section in this guide.

## New properties

These standard properties have been added in this release:

- AdapterHelpName
- BiDi.Application
- BiDi.Broker
- BiDi.Metadata
- BiDi.Transformation
- CommonEventInfrastructure
- CommonEventInfrastructureContextURL
- ControllerEventSequencing
- jms.ListenerConcurrency
- jms.TransportOptimized
- ResultsSetEnabled
- ResultsSetSize
- TivoliTransactionMonitorPerformance

## Standard connector properties overview

Connectors have two types of configuration properties:

- Standard configuration properties, which are used by the framework
- Application, or connector-specific, configuration properties, which are used by the agent

These properties determine the adapter framework and the agent run-time behavior.

This section describes how to start Connector Configurator and describes characteristics common to all properties. For information on configuration properties specific to a connector, see its adapter user guide.

## Starting Connector Configurator

You configure connector properties from Connector Configurator, which you access from System Manager. For more information on using Connector Configurator, refer to the sections on Connector Configurator in this guide.

Connector Configurator and System Manager run only on the Windows system. If you are running the connector on a UNIX system, you must have a Windows machine with these tools installed.

To set connector properties for a connector that runs on UNIX, you must start up System Manager on the Windows machine, connect to the UNIX integration broker, and bring up Connector Configurator for the connector.

## Configuration property values overview

The connector uses the following order to determine a property's value:

1. Default
2. Repository (valid only if WebSphere InterChange Server (ICS) is the integration broker)
3. Local configuration file
4. Command line

The default length of a property field is 255 characters. There is no limit on the length of a STRING property type. The length of an INTEGER type is determined by the server on which the adapter is running.

A connector obtains its configuration values at startup. If you change the value of one or more connector properties during a run-time session, the property's update method determines how the change takes effect.

The update characteristics of a property, that is, how and when a change to the connector properties takes effect, depend on the nature of the property.

There are four update methods for standard connector properties:

- **Dynamic**
  The new value takes effect immediately after the change is saved in System Manager. However, if the connector is in stand-alone mode (independently of System Manager), for example, if it is running with one of the WebSphere message brokers, you can change properties only through the configuration file. In this case, a dynamic update is not possible.
- **Agent restart (ICS only)**
  The new value takes effect only after you stop and restart the connector agent.
- **Component restart**
  The new value takes effect only after the connector is stopped and then restarted in System Manager. You do not need to stop and restart the agent or the server process.

- **System restart**
  The new value takes effect only after you stop and restart the connector agent and the server.

To determine how a specific property is updated, refer to the **Update Method** column in the Connector Configurator window, or see the Update Method column in Table 50 on page 289.

There are three locations in which a standard property can reside. Some properties can reside in more than one location.

- **ReposController**
  The property resides in the connector controller and is effective only there. If you change the value on the agent side, it does not affect the controller.
- **ReposAgent**
  The property resides in the agent and is effective only there. A local configuration can override this value, depending on the property.
- **LocalConfig**
  The property resides in the configuration file for the connector and can act only through the configuration file. The controller cannot change the value of the property, and is not aware of changes made to the configuration file unless the system is redeployed to update the controller explicitly.

## Standard properties quick-reference

Table 50 provides a quick-reference to the standard connector configuration properties. Not all connectors require all of these properties, and property settings may differ from integration broker to integration broker.

See the section following the table for a description of each property.

**Note:** In the Notes column in Table 50, the phrase "RepositoryDirectory is set to <REMOTE>" indicates that the broker is InterChange Server. When the broker is WMQI or WAS, the repository directory is set to <*ProductDir*>\repository

*Table 50. Summary of standard configuration properties*

| Property name | Possible values | Default value | Update method | Notes |
|---|---|---|---|---|
| AdapterHelpName | One of the valid subdirectories in <*ProductDir*>\bin\Data \App\Help\ that contains a valid <*RegionalSetting*> directory | Template name, if valid, or blank field | Component restart | Supported regional settings. Include `chs_chn`, `cht_twn`, `deu_deu`, `esn_esp`, `fra_fra`, `ita_ita`, `jpn_jpn`, `kor_kor`, `ptb_bra`, and `enu_usa` (default). |
| AdminInQueue | Valid JMS queue name | <*CONNECTORNAME*> /ADMININQUEUE | Component restart | This property is valid only when the value of DeliveryTransport is JMS |
| AdminOutQueue | Valid JMS queue name | <*CONNECTORNAME*> /ADMINOUTQUEUE | Component restart | This property is valid only when the value of DeliveryTransport is JMS |

*Table 50. Summary of standard configuration properties (continued)*

| Property name | Possible values | Default value | Update method | Notes |
|---|---|---|---|---|
| AgentConnections | 1 through 4 | 1 | Component restart | This property is valid only when the value of DeliveryTransport is MQ or IDL, the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| AgentTraceLevel | 0 through 5 | 0 | Dynamic if broker is ICS; otherwise Component restart | |
| ApplicationName | Application name | The value specified for the connector application name | Component restart | |
| BiDi.Application | Any valid combination of these bidirectional attributes:<br><br>1st letter: I,V<br>2nd letter: L,R<br>3rd letter: Y, N<br>4th letter: S, N<br>5th letter: H, C, N | ILYNN (five letters) | Component restart | This property is valid only if the value of BiDi.Transforma tion is true |
| BiDi.Broker | Any valid combination of these bidirectional attributes:<br><br>1st letter: I,V<br>2nd letter: L,R<br>3rd letter: Y, N<br>4th letter: S, N<br>5th letter: H, C, N | ILYNN (five letters) | Component restart | This property is valid only if the value of BiDi.Transformation is true. If the value of BrokerType is ICS, the property is read-only. |
| BiDi.Metadata | Any valid combination of these bidirectional attributes:<br><br>1st letter: I,V<br>2nd letter: L,R<br>3rd letter: Y, N<br>4th letter: S, N<br>5th letter: H, C, N | ILYNN (five letters) | Component restart | This property is valid only if the value of BiDi.Transformation is true. |
| BiDi.Transformation | true or false | false | Component restart | This property is valid only if the value of BrokerType is not WAS<br>. |
| BrokerType | ICS, WMQI, WAS | ICS | Component restart | |
| CharacterEncoding | Any supported code. The list shows this subset: ascii7, ascii8, SJIS, Cp949, GBK, Big5, Cp297, Cp273, Cp280, Cp284, Cp037, Cp437<br>. | ascii7 | Component restart | This property is valid only for C++ connectors. |

*Table 50. Summary of standard configuration properties (continued)*

| Property name | Possible values | Default value | Update method | Notes |
|---|---|---|---|---|
| CommonEventInfrastructure | true or false | false | Component restart | |
| CommonEventInfrastructureURL | A URL string, for example, corbaloc:iiop:host:2809. | No default value. | Component restart | This property is valid only if the value of CommonEvent Infrastructure is true. |
| ConcurrentEventTriggeredFlows | 1 through 32,767 | 1 | Component restart | This property is valid only if the value of RepositoryDirectory is set to <REMOTE> and the value of BrokerType is ICS. |
| ContainerManagedEvents | Blank or JMS | Blank | Component restart | This property is valid only when the value of Delivery Transport is JMS. |
| ControllerEventSequencing | true or false | true | Dynamic | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| ControllerStoreAndForwardMode | true or false | true | Dynamic | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| ControllerTraceLevel | 0 through 5 | 0 | Dynamic | This property is valid only if the value of RepositoryDirectory is set to <REMOTE> and the value of BrokerType is ICS. |
| DeliveryQueue | Any valid JMS queue name | *<CONNECTORNAME>* /DELIVERYQUEUE | Component restart | This property is valid only when the value of Delivery Transport is JMS. |
| DeliveryTransport | MQ, IDL, or JMS | IDL when the value of RepositoryDirectory is <REMOTE>, otherwise JMS | Component restart | If the value of RepositoryDirectory is not <REMOTE>, the only valid value for this property is JMS. |
| DuplicateEventElimination | true or false | false | Component restart | This property is valid only if the value of DeliveryTransport is JMS. |
| EnableOidForFlowMonitoring | true or false | false | Component restart | This property is valid only if the value of BrokerType is ICS. |
| FaultQueue | Any valid queue name. | *<CONNECTORNAME>* /FAULTQUEUE | Component restart | This property is valid only if the value of DeliveryTransport is JMS. |
| jms.FactoryClassName | CxCommon.Messaging.jms.IBMMQSeriesFactory, CxCommon.Messaging.jms.SonicMQFactory, or any Java class name | CxCommon.Messaging.jms.IBMMQSeriesFactory | Component restart | This property is valid only if the value of DeliveryTransport is JMS. |

*Table 50. Summary of standard configuration properties (continued)*

| Property name | Possible values | Default value | Update method | Notes |
|---|---|---|---|---|
| jms.ListenerConcurrency | 1 through 32767 | 1 | Component restart | This property is valid only if the value of jms.TransportOptimized is true. |
| jms.MessageBrokerName | If the value of jms.FactoryClassName is IBM, use crossworlds.queue.manager. | crossworlds.queue.manager | Component restart | This property is valid only if the value of DeliveryTransport is JMS . |
| jms.NumConcurrent Requests | Positive integer | 10 | Component restart | This property is valid only if the value of DeliveryTransport is JMS . |
| jms.Password | Any valid password | | Component restart | This property is valid only if the value of DeliveryTransport is JMS . |
| jms.TransportOptimized | true or false | false | Component restart | This property is valid only if the value of DeliveryTransport is JMS and the value of BrokerType is ICS. |
| jms.UserName | Any valid name | | Component restart | This property is valid only if the value of Delivery Transport is JMS. |
| JvmMaxHeapSize | Heap size in megabytes | 128m | Component restart | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| JvmMaxNativeStackSize | Size of stack in kilobytes | 128k | Component restart | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| JvmMinHeapSize | Heap size in megabytes | 1m | Component restart | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| ListenerConcurrency | 1 through 100 | 1 | Component restart | This property is valid only if the value of DeliveryTransport is MQ. |
| Locale | This is a subset of the supported locales: en_US, ja_JP, ko_KR, zh_CN, zh_TW, fr_FR, de_DE, it_IT, es_ES, pt_BR | en_US | Component restart | |

*Table 50. Summary of standard configuration properties (continued)*

| Property name | Possible values | Default value | Update method | Notes |
|---|---|---|---|---|
| LogAtInterchangeEnd | `true` or `false` | `false` | Component restart | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| MaxEventCapacity | 1 through `2147483647` | `2147483647` | Dynamic | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| MessageFileName | Valid file name | `InterchangeSystem.txt` | Component restart | |
| MonitorQueue | Any valid queue name | *<CONNECTORNAME>* `/MONITORQUEUE` | Component restart | This property is valid only if the value of DuplicateEventElimination is `true` and ContainerManagedEvents has no value. |
| OADAutoRestartAgent | `true` or `false` | `false` | Dynamic | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| OADMaxNumRetry | A positive integer | `1000` | Dynamic | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| OADRetryTimeInterval | A positive integer in minutes | `10` | Dynamic | This property is valid only if the value of Repository Directory is set to <REMOTE> and the value of BrokerType is ICS. |
| PollEndTime | HH = 0 through 23<br>MM = 0 through 59 | `HH:MM` | Component restart | |
| PollFrequency | A positive integer (in milliseconds) | `10000` | Dynamic if broker is ICS; otherwise Component restart | |
| PollQuantity | 1 through `500` | `1` | Agent restart | This property is valid only if the value of ContainerManagedEvents is `JMS`. |
| PollStartTime | HH = 0 through 23<br>MM = 0 through 59 | `HH:MM` | Component restart | |
| RepositoryDirectory | <REMOTE> if the broker is ICS; otherwise any valid local directory. | For ICS, the value is set to <REMOTE><br><br>For WMQI and WAS, the value is *<ProductDir* `\repository` | Agent restart | |

*Table 50. Summary of standard configuration properties (continued)*

| Property name | Possible values | Default value | Update method | Notes |
|---|---|---|---|---|
| RequestQueue | Valid JMS queue name | <*CONNECTORNAME*> /REQUESTQUEUE | Component restart | This property is valid only if the value of DeliveryTransport is JMS |
| ResponseQueue | Valid JMS queue name | <*CONNECTORNAME*> /RESPONSEQUEUE | Component restart | This property is valid only if the value of DeliveryTransport is JMS. |
| RestartRetryCount | 0 through 99 | 3 | Dynamic if ICS; otherwise Component restart | |
| RestartRetryInterval | A value in minutes from 1 through 2147483647 | 1 | Dynamic if ICS; otherwise Component restart | |
| ResultsSetEnabled | true or false | false | Component restart | Used only by connectors that support DB2II.<br><br>This property is valid only if the value of DeliveryTransport is JMS, and the value of BrokerType is WMQI. |
| ResultsSetSize | Positive integer | 0 (means the results set size is unlimited) | Component restart | Used only by connectors that support DB2II.<br><br>This property is valid only if the value of ResultsSetEnabled is true. |
| RHF2MessageDomain | mrm or xml | mrm | Component restart | This property is valid only if the value of DeliveryTransport is JMS and the value of WireFormat is CwXML. |
| SourceQueue | Any valid WebSphere MQ queue name | <*CONNECTORNAME*> /SOURCEQUEUE | Agent restart | This property is valid only if the value of ContainerManagedEvents is JMS. |
| SynchronousRequest Queue | Any valid queue name. | <*CONNECTORNAME*> /SYNCHRONOUSREQUEST QUEUE | Component restart | This property is valid only if the value of DeliveryTransport is JMS. |
| SynchronousRequest Timeout | 0 to any number (milliseconds) | 0 | Component restart | This property is valid only if the value of DeliveryTransport is JMS. |
| SynchronousResponse Queue | Any valid queue name | <*CONNECTORNAME*> /SYNCHRONOUSRESPONSE QUEUE | Component restart | This property is valid only if the value of DeliveryTransport is JMS. |
| TivoliMonitorTransaction Performance | true or false | false | Component restart | |

*Table 50. Summary of standard configuration properties (continued)*

| Property name | Possible values | Default value | Update method | Notes |
|---|---|---|---|---|
| WireFormat | CwXML or CwBO | CwXML | Agent restart | The value of this property must be CwXML if the value of RepositoryDirectory is not set to <REMOTE>. The value must be CwBO if the value of RepositoryDirectory is set to <REMOTE>. |
| WsifSynchronousRequest Timeout | 0 to any number (milliseconds) | 0 | Component restart | This property is valid only if the value of BrokerType is WAS. |
| XMLNameSpaceFormat | short or long | short | Agent restart | This property is valid only if the value of BrokerType is WMQI or WAS |

# Standard properties

This section describes the standard connector configuration properties.

## AdapterHelpName

The AdapterHelpName property is the name of a directory in which connector-specific extended help files are located. The directory must be located in <*ProductDir*>\bin\Data\App\Help and must contain at least the language directory enu_usa. It may contain other directories according to locale.

The default value is the template name if it is valid, or it is blank.

## AdminInQueue

The AdminInQueue property specifies the queue that is used by the integration broker to send administrative messages to the connector.

The default value is <*CONNECTORNAME*>/ADMININQUEUE

## AdminOutQueue

The AdminOutQueue property specifies the queue that is used by the connector to send administrative messages to the integration broker.

The default value is <*CONNECTORNAME*>/ADMINOUTQUEUE

## AgentConnections

The AgentConnections property controls the number of ORB (Object Request Broker) connections opened when the ORB initializes.

It is valid only if the value of the RepositoryDirectory is set to <REMOTE> and the value of the DeliveryTransport property is MQ or IDL.

The default value of this property is 1.

## AgentTraceLevel

The AgentTraceLevel property sets the level of trace messages for the application-specific component. The connector delivers all trace messages applicable at the tracing level set and lower.

The default value is `0`.

## ApplicationName

The ApplicationName property uniquely identifies the name of the connector application. This name is used by the system administrator to monitor the integration environment. This property must have a value before you can run the connector.

The default is the name of the connector.

## BiDi.Application

The BiDi.Application property specifies the bidirectional format for data coming from an external application into the adapter in the form of any business object supported by this adapter. The property defines the bidirectional attributes of the application data. These attributes are:

- Type of text: implicit or visual (`I` or `V`)
- Text direction: left-to-right or right-to-left (`L` or `R`)
- Symmetric swapping: on or off (`Y` or `N`)
- Shaping (Arabic): on or off (`S` or `N`)
- Numerical shaping (Arabic): Hindi, contextual, or nominal (`H`, `C`, or `N`)

This property is valid only if the BiDi.Transformation property value is set to true.

The default value is `ILYNN` (implicit, left-to-right, on, off, nominal).

## BiDi.Broker

The BiDi.Broker property specifies the bidirectional format for data sent from the adapter to the integration broker in the form of any supported business object. It defines the bidirectional attributes of the data, which are as listed under `BiDi.Application` above.

This property is valid only if the BiDi.Transformation property value is set to true. If the BrokerType property is ICS, the property value is read-only.

The default value is `ILYNN` (implicit, left-to-right, on, off, nominal).

## BiDi.Metadata

The BiDi.Metadata property defines the bidirectional format or attributes for the metadata, which is used by the connector to establish and maintain a link to the external application. The attribute settings are specific to each adapter using the bidirectional capabilities. If your adapter supports bidirectional processing, refer to section on adapter-specific properties for more information.

This property is valid only if the BiDi.Transformation property value is set to true.

The default value is `ILYNN` (implicit, left-to-right, on, off, nominal).

## BiDi.Transformation

The BiDi.Transformation property defines whether the system performs a bidirectional transformation at run time.

If the property value is set to `true`, the BiDi.Application, BiDi.Broker, and BiDi.Metadata properties are available. If the property value is set to `false`, they are hidden.

The default value is `false`.

## BrokerType

The BrokerType property identifies the integration broker type that you are using. The possible values are `ICS`, `WMQI (for WMQI, WMQIB or WBIMB)`, or `WAS`.

## CharacterEncoding

The CharacterEncoding property specifies the character code set used to map from a character (such as a letter of the alphabet, a numeric representation, or a punctuation mark) to a numeric value.

**Note:** Java-based connectors do not use this property. C++ connectors use the value `ascii7` for this property.

By default, only a subset of supported character encodings is displayed. To add other supported values to the list, you must manually modify the \Data\Std\stdConnProps.xml file in the product directory (<*ProductDir*>). For more information, see the Connector Configurator appendix in this guide.

## CommonEventInfrastructure

The Common Event Infrastructure (CEI) is a simple event management function handling generated events. The CommonEventInfrastructure property specifies whether the CEI should be invoked at run time.

The default value is `false`.

## CommonEventInfrastructureContextURL

The CommonEventInfrastructureContextURL is used to gain access to the WAS server that executes the Common Event Infrastructure (CEI) server application. This property specifies the URL to be used.

This property is valid only if the value of CommonEventInfrastructure is set to `true.`

The default value is a blank field.

## ConcurrentEventTriggeredFlows

The ConcurrentEventTriggeredFlows property determines how many business objects can be concurrently processed by the connector for event delivery. You set the value of this attribute to the number of business objects that are mapped and delivered concurrently. For example, if you set the value of this property to 5, five business objects are processed concurrently.

Setting this property to a value greater than 1 allows a connector for a source application to map multiple event business objects at the same time and deliver

them to multiple collaboration instances simultaneously. This speeds delivery of business objects to the integration broker, particularly if the business objects use complex maps. Increasing the arrival rate of business objects to collaborations can improve overall performance in the system.

To implement concurrent processing for an entire flow (from a source application to a destination application), the following properties must configured:

- The collaboration must be configured to use multiple threads by setting its `Maximum number of concurrent events` property high enough to use multiple threads.
- The destination application's application-specific component must be configured to process requests concurrently. That is, it must be multithreaded, or it must be able to use connector agent parallelism and be configured for multiple processes. The Parallel Process Degree configuration property must be set to a value larger than 1.

The ConcurrentEventTriggeredFlows property has no effect on connector polling, which is single-threaded and is performed serially.

This property is valid only if the value of the RepositoryDirectory property is set to <REMOTE>.

The default value is 1.

## ContainerManagedEvents

The ContainerManagedEvents property allows a JMS-enabled connector with a JMS event store to provide guaranteed event delivery, in which an event is removed from the source queue and placed on the destination queue as one JMS transaction.

When this property is set to `JMS`, the following properties must also be set to enable guaranteed event delivery:

- PollQuantity = `1` to `500`
- SourceQueue = `/SOURCEQUEUE`

You must also configure a data handler with the MimeType and DHClass (data handler class) properties. You can also add DataHandlerConfigMOName (the meta-object name, which is optional). To set those values, use the **Data Handler** tab in Connector Configurator.

Although these properties are adapter-specific, here are some example values:

- MimeType = `text\xml`
- DHClass = `com.crossworlds.DataHandlers.text.xml`
- DataHandlerConfigMOName = `MO_DataHandler_Default`

The fields for these values in the **Data Handler** tab are displayed only if you have set the ContainerManagedEvents property to the value `JMS`.

**Note:** When ContainerManagedEvents is set to `JMS`, the connector does not call its pollForEvents() method, thereby disabling that method's functionality.

The ContainerManagedEvents property is valid only if the value of the DeliveryTransport property is set to `JMS`.

There is no default value.

## ControllerEventSequencing

The ControllerEventSequencing property enables event sequencing in the connector controller.

This property is valid only if the value of the RepositoryDirectory property is set to set to <REMOTE> (`BrokerType` is `ICS`).

The default value is `true`.

## ControllerStoreAndForwardMode

The ControllerStoreAndForwardMode property sets the behavior of the connector controller after it detects that the destination application-specific component is unavailable.

If this property is set to `true` and the destination application-specific component is unavailable when an event reaches ICS, the connector controller blocks the request to the application-specific component. When the application-specific component becomes operational, the controller forwards the request to it.

However, if the destination application's application-specific component becomes unavailable after the connector controller forwards a service call request to it, the connector controller fails the request.

If this property is set to `false`, the connector controller begins failing all service call requests as soon as it detects that the destination application-specific component is unavailable.

This property is valid only if the value of the RepositoryDirectory property is set to <REMOTE> (the value of the BrokerType property is ICS).

The default value is `true`.

## ControllerTraceLevel

The ControllerTraceLevel property sets the level of trace messages for the connector controller.

This property is valid only if the value of the RepositoryDirectory property is set to set to <REMOTE>.

The default value is `0`.

## DeliveryQueue

The DeliveryQueue property defines the queue that is used by the connector to send business objects to the integration broker.

This property is valid only if the value of the DeliveryTransport property is set to `JMS`.

The default value is *<CONNECTORNAME>*`/DELIVERYQUEUE`.

## DeliveryTransport

The DeliveryTransport property specifies the transport mechanism for the delivery of events. Possible values are MQ for WebSphere MQ, IDL for CORBA IIOP, or JMS for Java Messaging Service.

- If the value of the RepositoryDirectory property is set to <REMOTE>, the value of the DeliveryTransport property can be MQ, IDL, or JMS, and the default is IDL.
- If the value of the RepositoryDirectory property is a local directory, the value can be only JMS.

The connector sends service-call requests and administrative messages over CORBA IIOP if the value of the RepositoryDirectory property is MQ or IDL.

The default value is JMS.

### WebSphere MQ and IDL

Use WebSphere MQ rather than IDL for event delivery transport, unless you must have only one product. WebSphere MQ offers the following advantages over IDL:

- Asynchronous communication:
  WebSphere MQ allows the application-specific component to poll and persistently store events even when the server is not available.
- Server side performance:
  WebSphere MQ provides faster performance on the server side. In optimized mode, WebSphere MQ stores only the pointer to an event in the repository database, while the actual event remains in the WebSphere MQ queue. This prevents writing potentially large events to the repository database.
- Agent side performance:
  WebSphere MQ provides faster performance on the application-specific component side. Using WebSphere MQ, the connector polling thread picks up an event, places it in the connector queue, then picks up the next event. This is faster than IDL, which requires the connector polling thread to pick up an event, go across the network into the server process, store the event persistently in the repository database, then pick up the next event.

### JMS

The JMS transport mechanism enables communication between the connector and client connector framework using Java Messaging Service (JMS).

If you select JMS as the delivery transport, additional JMS properties such as jms.MessageBrokerName, jms.FactoryClassName, jms.Password, and jms.UserName are listed in Connector Configurator. The properties jms.MessageBrokerName and jms.FactoryClassName are required for this transport.

There may be a memory limitation if you use the JMS transport mechanism for a connector in the following environment:

- AIX 5.0
- WebSphere MQ 5.3.0.1
- ICS is the integration broker

In this environment, you may experience difficulty starting both the connector controller (on the server side) and the connector (on the client side) due to memory use within the WebSphere MQ client. If your installation uses less than 768MB of process heap size, set the following variable and property:

- Set the LDR_CNTRL environment variable in the CWSharedEnv.sh script.

This script is located in the \bin directory below the product directory (<*ProductDir*>). Using a text editor, add the following line as the first line in the CWSharedEnv.sh script:

```
export LDR_CNTRL=MAXDATA=0x30000000
```

This line restricts heap memory usage to a maximum of 768 MB (3 segments * 256 MB). If the process memory grows larger than this limit, page swapping can occur, which can adversely affect the performance of your system.

- Set the value of the IPCCBaseAddress property to 11 or 12. For more information on this property, see the *System Installation Guide for UNIX*.

## DuplicateEventElimination

When the value of this property is `true`, a JMS-enabled connector can ensure that duplicate events are not delivered to the delivery queue. To use this feature, during connector development, the connector must have a unique event identifier set as the business object ObjectEventId attribute in the application-specific code.

**Note:** When the value of this property is `true`, the MonitorQueue property must be enabled to provide guaranteed event delivery.

The default value is `false`.

## EnableOidForFlowMonitoring

When the value of this property is `true`, the adapter runtime will mark the incoming ObjectEventID as a foreign key for flow monitoring.

This property is only valid if the BrokerType property is set to ICS.

The default value is `false`.

## FaultQueue

If the connector experiences an error while processing a message, it moves the message (and a status indicator and description of the problem) to the queue specified in the FaultQueue property.

The default value is <*CONNECTORNAME*>`/FAULTQUEUE`.

## jms.FactoryClassName

The jms.FactoryClassName property specifies the class name to instantiate for a JMS provider. This property must be set if the value of the DeliveryTransport property is `JMS`.

The default is `CxCommon.Messaging.jms.IBMMQSeriesFactory`.

## jms.ListenerConcurrency

The jms.ListenerConcurrency property specifies the number of concurrent listeners for the JMS controller. It specifies the number of threads that fetch and process messages concurrently within a controller.

This property is valid only if the value of the jms.OptimizedTransport property is `true`.

The default value is 1.

## jms.MessageBrokerName

The jms.MessageBrokerName specifies the broker name to use for the JMS provider. You must set this connector property if you specify JMS as the delivery transport mechanism (in the DeliveryTransport property).

When you connect to a remote message broker, this property requires the following values:
*QueueMgrName*:*Channel*:*HostName*:*PortNumber*
where:
*QueueMgrName* is the name of the queue manager.
*Channel* is the channel used by the client.
*HostName* is the name of the machine where the queue manager is to reside.
*PortNumber*is the port number used by the queue manager for listening

For example:
```
jms.MessageBrokerName = WBIMB.Queue.Manager:CHANNEL1:RemoteMachine:1456
```

The default value is `crossworlds.queue.manager`. Use the default when connecting to a local message broker.

## jms.NumConcurrentRequests

The jms.NumConcurrentRequests property specifies the maximum number of concurrent service call requests that can be sent to a connector at the same time. Once that maximum is reached, new service calls are blocked and must wait for another request to complete before proceeding.

The default value is `10`.

## jms.Password

The jms.Password property specifies the password for the JMS provider. A value for this property is optional.

There is no default value.

## jms.TransportOptimized

The jms.TransportOptimized property determines if the WIP (work in progress) is optimized. You must have a WebSphere MQ provider to optimize the WIP. For optimized WIP to operate, the messaging provider must be able to:

1. Read a message without taking it off the queue
2. Delete a message with a specific ID without transferring the entire message to the receiver's memory space
3. Read a message by using a specific ID (needed for recovery purposes)
4. Track the point at which events that have not been read appear.

The JMS APIs cannot be used for optimized WIP because they do not meet conditions 2 and 4 above, but the MQ Java APIs meet all four conditions, and hence are required for optimized WIP.

This property is valid only if the value of DeliveryTransport is `JMS` and the value of BrokerType is `ICS`.

The default value is `false`.

## jms.UserName

the jms.UserName property specifies the user name for the JMS provider. A value for this property is optional.

There is no default value.

## JvmMaxHeapSize

The JvmMaxHeapSize property specifies the maximum heap size for the agent (in megabytes).

This property is valid only if the value for the RepositoryDirectory property is set to <REMOTE>.

The default value is 128m.

## JvmMaxNativeStackSize

The JvmMaxNativeStackSize property specifies the maximum native stack size for the agent (in kilobytes).

This property is valid only if the value for the RepositoryDirectory property is set to <REMOTE>.

The default value is 128k.

## JvmMinHeapSize

The JvmMinHeapSize property specifies the minimum heap size for the agent (in megabytes).

This property is valid only if the value for the RepositoryDirectory property is set to <REMOTE>.

The default value is 1m.

## ListenerConcurrency

The ListenerConcurrency property supports multithreading in WebSphere MQ Listener when ICS is the integration broker. It enables batch writing of multiple events to the database, thereby improving system performance.

This property valid only with connectors that use MQ transport. The value of the DeliveryTransport property must be `MQ`.

The default value is 1.

## Locale

The Locale property specifies the language code, country or territory, and, optionally, the associated character code set. The value of this property determines cultural conventions such as collation and sort order of data, date and time formats, and the symbols used in monetary specifications.

A locale name has the following format:

*ll_TT.codeset*

where:
*ll* is a two-character language code (in lowercase letters)
*TT* is a two-letter country or territory code (in uppercase letters)
*codeset* is the name of the associated character code set (may be optional).

By default, only a subset of supported locales are listed. To add other supported values to the list, you modify the \Data\Std\stdConnProps.xml file in the <*ProductDir*>\bin directory. For more information, refer to the Connector Configurator appendix in this guide.

If the connector has not been internationalized, the only valid value for this property is `en_US`. To determine whether a specific connector has been globalized, refer to the user guide for that adapter.

The default value is `en_US`.

## LogAtInterchangeEnd

The LogAtInterchangeEnd property specifies whether to log errors to the log destination of the integration broker.

Logging to the log destination also turns on e-mail notification, which generates e-mail messages for the recipient specified as the value of MESSAGE_RECIPIENT in the InterchangeSystem.cfg file when errors or fatal errors occur. For example, when a connector loses its connection to the application, if the value of LogAtInterChangeEnd is `true`, an e-mail message is sent to the specified message recipient.

This property is valid only if the value of the RespositoryDirectory property is set to <REMOTE> (the value of BrokerType is ICS).

The default value is `false`.

## MaxEventCapacity

The MaxEventCapacity property specifies maximum number of events in the controller buffer. This property is used by the flow control feature.

This property is valid only if the value of the RespositoryDirectory property is set to <REMOTE> (the value of BrokerType is ICS).

The value can be a positive integer between 1 and 2147483647.

The default value is 2147483647.

## MessageFileName

The MessageFileName property specifies the name of the connector message file. The standard location for the message file is \connectors\messages in the product directory. Specify the message file name in an absolute path if the message file is not located in the standard location.

If a connector message file does not exist, the connector uses `InterchangeSystem.txt` as the message file. This file is located in the product directory.

**Note:** To determine whether a connector has its own message file, see the individual adapter user guide.

The default value is `InterchangeSystem.txt`.

## MonitorQueue

The MonitorQueue property specifies the logical queue that the connector uses to monitor duplicate events.

It is valid only if the value of the DeliveryTransport property is `JMS` and the value of the DuplicateEventElimination is `true`.

The default value is *<CONNECTORNAME>*`/MONITORQUEUE`

## OADAutoRestartAgent

the OADAutoRestartAgent property specifies whether the connector uses the automatic and remote restart feature. This feature uses the WebSphere MQ-triggered Object Activation Daemon (OAD) to restart the connector after an abnormal shutdown, or to start a remote connector from System Monitor.

This property must be set to `true` to enable the automatic and remote restart feature. For information on how to configure the WebSphere MQ-triggered OAD feature. see the *Installation Guide for Windows* or *for UNIX*.

This property is valid only if the value of the RespositoryDirectory property is set to <REMOTE> (the value of BrokerType is ICS).

The default value is `false`.

## OADMaxNumRetry

The OADMaxNumRetry property specifies the maximum number of times that the WebSphere MQ-triggered Object Activation Daemon (OAD) automatically attempts to restart the connector after an abnormal shutdown. The OADAutoRestartAgent property must be set to `true` for this property to take effect.

This property is valid only if the value of the RespositoryDirectory property is set to <REMOTE> (the value of BrokerType is ICS).

The default value is `1000`.

## OADRetryTimeInterval

The OADRetryTimeInterval property specifies the number of minutes in the retry-time interval for the WebSphere MQ-triggered Object Activation Daemon (OAD). If the connector agent does not restart within this retry-time interval, the connector controller asks the OAD to restart the connector agent again. The OAD repeats this retry process as many times as specified by the OADMaxNumRetry property. The OADAutoRestartAgent property must be set to `true` for this property to take effect.

This property is valid only if the value of the RespositoryDirectory property is set to <REMOTE> (the value of BrokerType is ICS).

The default value is `10`.

## PollEndTime

The PollEndTime property specifies the time to stop polling the event queue. The format is *HH:MM*, where *HH* is 0 through 23 hours, and *MM* represents 0 through 59 minutes.

You must provide a valid value for this property. The default value is `HH:MM` without a value, and it must be changed.

If the adapter runtime detects:

- PollStartTime set and PollEndTime not set, or
- PollEndTime set and PollStartTime not set

it will poll using the value configured for the PollFrequency property.

## PollFrequency

The PollFrequency property specifies the amount of time (in milliseconds) between the end of one polling action and the start of the next polling action. This is not the interval between polling actions. Rather, the logic is as follows:

- Poll to obtain the number of objects specified by the value of the PollQuantity property.
- Process these objects. For some connectors, this may be partly done on separate threads, which execute asynchronously to the next polling action.
- Delay for the interval specified by the PollFrequency property.
- Repeat the cycle.

The following values are valid for this property:

- The number of milliseconds between polling actions (a positive integer).
- The word `no`, which causes the connector not to poll. Enter the word in lowercase.
- The word `key`, which causes the connector to poll only when you type the letter `p` in the connector Command Prompt window. Enter the word in lowercase.

The default is `10000`.

**Important:** Some connectors have restrictions on the use of this property. Where they exist, these restrictions are documented in the chapter on installing and configuring the adapter.

## PollQuantity

The PollQuantity property designates the number of items from the application that the connector polls for. If the adapter has a connector-specific property for setting the poll quantity, the value set in the connector-specific property overrides the standard property value.

This property is valid only if the value of the `DeliveryTransport` property is `JMS`, and the `ContainerManagedEvents` property has a value.

An e-mail message is also considered an event. The connector actions are as follows when it is polled for e-mail.

- When it is polled once, the connector detects the body of the message, which it reads as an attachment. Since no data handler was specified for this mime type, it will then ignore the message.

- The connector processes the first BO attachment. The data handler is available for this MIME type, so it sends the business object to Visual Test Connector.
- When it is polled for the second time, the connector processes the second BO attachment. The data handler is available for this MIME type, so it sends the business object to Visual Test Connector.
- Once it is accepted, the third BO attachment should be transmitted.

## PollStartTime

The PollStartTime property specifies the time to start polling the event queue. The format is *HH:MM*, where *HH* is 0 through 23 hours, and *MM* represents 0 through 59 minutes.

You must provide a valid value for this property. The default value is `HH:MM` without a value, and it must be changed.

If the adapter runtime detects:

- PollStartTime set and PollEndTime not set, or
- PollEndTime set and PollStartTime not set

it will poll using the value configured for the PollFrequency property.

## RepositoryDirectory

The RepositoryDirectory property is the location of the repository from which the connector reads the XML schema documents that store the metadata for business object definitions.

If the integration broker is ICS, this value must be set to set to <REMOTE> because the connector obtains this information from the InterChange Server repository.

When the integration broker is a WebSphere message broker or WAS, this value is set to <*ProductDir*>\repository by default. However, it may be set to any valid directory name.

## RequestQueue

The RequestQueue property specifies the queue that is used by the integration broker to send business objects to the connector.

This property is valid only if the value of the DeliveryTransport property is `JMS`.

The default value is `<CONNECTORNAME>/REQUESTQUEUE`.

## ResponseQueue

The ResponseQueue property specifies the JMS response queue, which delivers a response message from the connector framework to the integration broker. When the integration broker is ICS, the server sends the request and waits for a response message in the JMS response queue.

This property is valid only if the value of the DeliveryTransport property is `JMS`.

The default value is `<CONNECTORNAME>/RESPONSEQUEUE`.

## RestartRetryCount

The RestartRetryCount property specifies the number of times the connector attempts to restart itself. When this property is used for a connector that is connected in parallel, it specifies the number of times the master connector application-specific component attempts to restart the client connector application-specific component.

The default value is 3.

## RestartRetryInterval

The RestartRetryInterval property specifies the interval in minutes at which the connector attempts to restart itself. When this property is used for a connector that is linked in parallel, it specifies the interval at which the master connector application-specific component attempts to restart the client connector application-specific component.

Possible values for the property range from 1 through 2147483647.

The default value is 1.

## ResultsSetEnabled

The ResultsSetEnabled property enables or disables results set support when Information Integrator is active. This property can be used only if the adapter supports DB2 Information Integrator.

This property is valid only if the value of the DeliveryTransport property is JMS, and the value of BrokerType is WMQI.

The default value is false.

## ResultsSetSize

The ResultsSetSize property defines the maximum number of business objects that can be returned to Information Integrator. This property can be used only if the adapter supports DB2 Information Integrator.

This property is valid only if the value of the ResultsSetEnabled property is true.

The default value is 0. This means that the size of the results set is unlimited.

## RHF2MessageDomain

The RHF2MessageDomain property allows you to configure the value of the field domain name in the JMS header. When data is sent to a WebSphere message broker over JMS transport, the adapter framework writes JMS header information, with a domain name and a fixed value of mrm. A configurable domain name lets you track how the WebSphere message broker processes the message data.

This is an example header:

```
<mcd><Msd>mrm</Msd><Set>3</Set><Type>
Retek_POPhyDesc</Type><Fmt>CwXML</Fmt></mcd>
```

This property is valid only if the value of BrokerType is WMQI or WAS. Also, it is valid only if the value of the DeliveryTransport property is JMS, and the value of the WireFormat property is CwXML.

Possible values are mrm and xml. The default value is mrm.

## SourceQueue

The SourceQueue property designates the JMS source queue for the connector framework in support of guaranteed event delivery for JMS-enabled connectors that use a JMS event store. For further information, see "ContainerManagedEvents" on page 298.

This property is valid only if the value of DeliveryTransport is JMS, and a value for ContainerManagedEvents is specified.

The default value is <*CONNECTORNAME*>/SOURCEQUEUE.

## SynchronousRequestQueue

The SynchronousRequestQueue property delivers request messages that require a synchronous response from the connector framework to the broker. This queue is necessary only if the connector uses synchronous execution. With synchronous execution, the connector framework sends a message to the synchronous request queue and waits for a response from the broker on the synchronous response queue. The response message sent to the connector has a correlation ID that matches the ID of the original message.

This property is valid only if the value of DeliveryTransport is JMS.

The default value is <*CONNECTORNAME*>/SYNCHRONOUSREQUESTQUEUE

## SynchronousRequestTimeout

The SynchronousRequestTimeout property specifies the time in milliseconds that the connector waits for a response to a synchronous request. If the response is not received within the specified time, the connector moves the original synchronous request message (and error message) to the fault queue.

This property is valid only if the value of DeliveryTransport is JMS.

The default value is 0.

## SynchronousResponseQueue

The SynchronousResponseQueue property delivers response messages in reply to a synchronous request from the broker to the connector framework. This queue is necessary only if the connector uses synchronous execution.

This property is valid only if the value of DeliveryTransport is JMS.

The default is <*CONNECTORNAME*>/SYNCHRONOUSRESPONSEQUEUE

## TivoliMonitorTransactionPerformance

The TivoliMonitorTransactionPerformance property specifies whether IBM Tivoli Monitoring for Transaction Performance (ITMTP) is invoked at run time.

The default value is false.

## WireFormat

The WireFormat property specifies the message format on the transport:

- If the value of the RepositoryDirectory property is a local directory, the value is `CwXML`.
- If the value of the RepositoryDirectory property is a remote directory, the value is `CwBO`.

## WsifSynchronousRequestTimeout

The WsifSynchronousRequestTimeout property specifies the time in milliseconds that the connector waits for a response to a synchronous request. If the response is not received within the specified time, the connector moves the original synchronous request message (and an error message) to the fault queue.

This property is valid only if the value of BrokerType is `WAS`.

The default value is 0.

## XMLNameSpaceFormat

The XMLNameSpaceFormat property specifies short or long namespaces in the XML format of business object definitions.

This property is valid only if the value of BrokerType is set to WMQI or WAS.

The default value is `short`.

# Appendix E. Connector-specific configuration properties

Connectors have two kinds of configuration properties: Connector-specific configuration properties, and standard configuration properties. This appendix describes the properties that are specific to the connector for mySAP.com (SAP R/3 Version 3.x. For information about using Connector Configurator, see Chapter 3, "Configuring the connector," on page 25.

Standard configuration properties provide information that all connectors use. See Appendix D, "Standard configuration properties for connectors," on page 287 for documentation of these properties. Note that several of the standard configuration properties have unique issues for the connector for SAP, as described in Table 51.

*Table 51. Property information specific to this connector*

| Property | Note |
|---|---|
| `CharacterEncoding` | The connector does not use this property. |
| `Locale` | Because this connector has been internationalized, you can change the value of this property. See release notes for the adapter to determine currently supported locales. |
| `PollFrequency` | If using the RFC Server Module or the ALE Module for event processing, do not set this property's value to `key` or to `no`. Setting the value to `key` or `no` prevents the connector from instantiating these modules at startup. |

You must provide a value for the `ApplicationName` configuration property before running the connector.

## Connector-specific configuration properties

Connector-specific configuration properties provide information needed by the connector at runtime. Connector-specific properties also provide a way of changing static information or logic within the connector framework and the connector's application-specific component without having to recode and rebuild the connector.

Table 52 is a quick reference for the connector-specific configuration properties. The modules column contains a list of the connector modules that use the associated property.

*Table 52. Quick reference for connector-specific configuration properties*

| Name | Possible values | Default value | Modules |
|---|---|---|---|
| ABAPDebug | `true` or `false` | `false` | ABAP Extension<br>BAPI<br>HDR |
| AleEventDir | *path* | | ALE |
| AleUpdateStatus | `true` or `false` | `false` | ALE |
| AleSelectiveUpdate | *IDocType:MessageType* | | ALE |
| AleStatusMsgCode | *MessageCode* | | ALE |
| AleSuccessCode | `52` or `53` | `52` | ALE |
| AleFailureCode | `68` or `58` | `68` | ALE |

*Table 52. Quick reference for connector-specific configuration properties (continued)*

| Name | Possible values | Default value | Modules |
|---|---|---|---|
| AleSuccessText | *SuccessText* | | ALE |
| AleFailureText | *FailureText* | | ALE |
| ApplicationPassword | | SOFTWARE | All |
| ApplicationUserName | | CROSSWORLDS | All |
| ArchiveDays | | | ALE |
| Client | | | All |
| Group | *any valid name of the logon group that represents a group of application servers* | | All |
| gwService | *Gateway server identifier* | sapgw00 | RFC Server ALE |
| Hostname | IP-address or *server-name* | | All |
| Language | | E | All |
| MaxNumberOfConnections | | 2 | ABAP Extension, ALE (request processing only), BAPI HDR |
| Modules | *ModuleName* | | All |
| Namespace | true or false | true | ABAP Extension |
| NumberOfListeners | *any positive integer* | 1 | RFC Server,<br>ALE |
| PollQuantity | *any positive integer* | 20 | ABAP Extension,<br>ALE |
| RefreshLogonCycle | true | true | All |
| RfcProgramId | *program ID* | CWLDSERVER | RFC Server, ALE |
| RfcTraceOn | true or false | false | All |
| SAPALE_Archive_Queue | *any valid MQ Series queue name* | | ALE |
| SAPALE_Event_Queue | *any valid MQ Series queue name* | | ALE |
| SAPALE_Wip_Queue | *any valid MQ Series queue name* | | ALE |
| SAPALE_Error_Queue | | | |
| SAPALE_Unsubscribed_Queue | | | |
| SAPSystemID | *logical name of the SAP R/3 System* | | All |
| SAPtid_MQChannel | *any valid MQ channel* | | ALE |
| SAPtid_MQPort | *any valid MQ port* | | ALE |
| SAPtid_Queue | *any valid MQ queue name* | | ALE (request processing only) |
| SAPtid_QueueManager | *any valid MQ queue manager name* | | ALE |

*Table 52. Quick reference for connector-specific configuration properties (continued)*

| Name | Possible values | Default value | Modules |
|---|---|---|---|
| SAPtid_QueueManagerHost | *any valid MQ queue manager host name* | | ALE |
| SAPtid_QueueManagerLogin | *any valid MQ queue manager login name* | | ALE |
| SAPtid_QueueManagerPassword | *any valid MQ queue manager password* | | ALE |
| Sysnr | *system-number* | 00 | All |
| DateTimeFormat | *nothing or legacy* | | All |
| TransIdCollabName | | | **No longer supported** |
| UpdateIDocStatus | true or false | True | ALE |
| IDocSuccessCode | 12 | | ALE |
| IDocFailureCode | 11 | | ALE |
| IDocSuccessText | Dispatched Okay | | ALE |
| IDocFailureText | Dispatch failed | | ALE |
| UseDefaults | true or false | false | ABAP Extension<br>ALE<br>BAPI |

## ABAPDebug

Specifies whether the connector invokes the ABAP Debugger for the appropriate function module when the connector begins processing a business object. When this property is set to true, the connector opens the ABAP Debugger for the following connector modules:

- ABAP Extension—when processing events out of SAP and service call requests into SAP
- BAPI—only when processing service call requests into SAP
- Hierarchical Dynamic Retrieve—when processing service call requests into SAP

The connector invokes the ABAP Debugger only if you have:

- Changed the default value of the **"ApplicationUserName" on page 315** configuration property from CROSSWORLDS to a Dialog user with proper user authorizations.
- Set the ABAPDebug property to true.

**Note:** You can add breakpoints only after the debugger opens.

**Important:** This property should always be set to false in a production environment.

The default value is false.

## AleEventDir

Specifies the location of the root directory (\ale) for the event directory used by the ALE Module to log and recover events. When the connector starts for the first time, if it does not find the root directory in the directory from which the connector is started, it creates it and the event subdirectory:

- If the path is specified in this property, it uses that path to create the directory.

- If no path is specified, it creates the root directory in the directory from which the connector is started.

For example, if your connector is located in `\connectors\SapConnector1` (within the product directory), the connector creates the following directory:

```
\connectors\SapConnector1\ale
```

**UNIX**

If you are not in the connector's directory when you start the connector for the first time, the connector creates the root directory in the directory from which you start the connector regardless of the value of this property.

For more information, see Chapter 10, "Overview of the ALE Module," on page 121.

The default value is:

**UNIX**

$<ProductNameDir>/connectors/SAP/ale

**Windows**

%ProductNameDir%\connectors\SAP\ale

## AleUpdateStatus

Specifies whether an audit trail is required for all message types. This property must be set to `true` to cause the connector to update a standard SAP status code after the ALE Module has retrieved an IDoc object for event processing.

For more information, see Chapter 10, "Overview of the ALE Module," on page 121.

The default value is `false`.

## AleSelectiveUpdate

Specifies which IDocType and MessageType combinations are to be updated when the connector is configured to update a standard SAP status code. You can define values for this property only if `AleUpdateStatus` has been set to `true`.

The syntax for this property is:

*IDocType:MessageType*`[,`*IDocType:MessageType* `[,...]]`

where a colon (`:`) delimiter separates each IDocType and MessageType, and a comma (`,`) delimiter separates entries in a set. The example below illustrates two sets. In the example, `MATMAS03` and `DEBMAS03` are the IDocs, and `MATMAS` and `DEBMAS` are the message types:

```
MATMAS03:MATMAS,DEBMAS03:DEBMAS
```

For more information, see Chapter 10, "Overview of the ALE Module," on page 121.

## AleStatusMsgCode

If required, specifies the message code to use when the connector posts the ALEAUD Message IDoc (ALEAUD01). Configure this message code in the receiving Partner Profile. You can set a value for this property only if AleUpdateStatus has been set to true.

For more information, see "Configuring SAP to update IDoc status" on page 129.

## AleSuccessCode

Specifies the success status code for Application Document Posted. You must specify a value for this property (52 or 53) to cause the connector to update the SAP success status code after the ALE Module has retrieved an IDoc object for event processing. SAP converts this value to status 41 (Application Document Created in Receiving System).

For more information, see Chapter 10, "Overview of the ALE Module," on page 121.

## AleFailureCode

Specifies the status code for dispatch failure. You must specify a value for this property (68 or 58) to cause the connector to update the SAP failure status code after the ALE Module has retrieved an IDoc object for event processing. SAP converts this value to 40.

For more information, see Chapter 10, "Overview of the ALE Module," on page 121.

## AleSuccessText

Specifies the descriptive text for successful Application Document Posted. Specifying a value for this property is optional, even when you set AleUpdateStatus to true.

For more information, see Chapter 10, "Overview of the ALE Module," on page 121.

## AleFailureText

Specifies the descriptive text for dispatch failure. Specifying a value for this property is optional, even when you set AleUpdateStatus to true.

For more information, see Chapter 10, "Overview of the ALE Module," on page 121.

## ApplicationPassword

Password for the connector's user account on the SAP application. The default is SOFTWARE.

## ApplicationUserName

Name of the connector's user account on the SAP application. The default is CROSSWORLDS.

## ArchiveDays

The ArchiveDays connector configuration property determines the number of days after which TID Management files should be deleted from the request directory. The default value maintained internally is seven days. You can also specify partial day values, for example `1.234`.

## Client

Client number under which the connector logs in, often `100`.

## Group

When configuring the connector for load balancing, specifies the name of the logon group that represents a group of application servers. For more information, see "Taking advantage of load balancing" on page 44.

## gwService

Gateway server identifier; often `sapgw00`. The `00` is the system number of the server running the SAP Gateway (usually an application server) and may not be `00` if you have more than one. The default is `sapgw00`.

## Hostname

When configuring the connector for load balancing, specifies the name of the message server. When configuring the connector to run without load balancing, specifies the IP address or the name of the application server that the connector logs in to. In both cases, the connector assumes that the name of the gateway host is the same as the value specified for this property.

## Language

Language in which the connector logs in. The default is `E`, for English.

## MaxNumberOfConnections

The maximum number of concurrent interactions possible between the connector and the SAP application. These interactions include polling for events and handling service call requests. Only the ABAP Extension, BAPI, and ALE Modules use this property. The ALE Module uses this property only for service call requests.

Because each interaction uses a dialog process on the SAP application server, the number of connections cannot exceed the number of dialog processes available. For more information, see "Processing multiple concurrent interactions" on page 11.

If no value is specified for this property, the connector uses the default value of 2.

## Modules

Identifies the module used by the connector to carry out the `init()`, `pollForEvents()`, and `Terminate()` requests. Specifically, it specifies the connector module used by the Vision Connector framework. Specify multiple connector modules by separating each value with a comma. Do not add spaces.

The supported connector modules and the syntax to specify them is as follows:

ABAP Extension Module—`Extension`

ALE Module—`ALE`

BAPI Module—`Bapi`

RFC Server Module—`RfcServer`

Hierarchical Dynamic Retrieve Module—`Bapi`

**Note:** When you run the Hierarchical Dynamic Retrieve Module, add the value of `Bapi` to this property so as to establish at least one connector thread during processing, thus allowing the initialization and termination of the connector. The Hierarchical Dynamic Retrieve Module performs service call requests, so the business object handler is invoked through the meta-data in the business object being sent. However, by adding the value `Bapi` to the `Modules` property, you establish a connector thread, and thus if any issues arise during Hierchical Dynamic Retrieve Module processing, you can easily shut down the connector by calling the `terminate()` method on the running connector thread.

## Namespace

Specifies whether or not the connector uses the ABAP components defined in the connector's namespace `/CWLD/`. The value must be set to `true` in order for the connector to use the ABAP components defined in the namespace. The default is `true`.

## NumberOfListeners

Specifies the number of listener threads that are created when the connector is initialized. A listener thread can handle one request at a time. Each listener thread handles a single event at a time; therefore, if you have multiple listener threads, the connector can handle multiple events concurrently. The default is 1.

It is recommended that you have no more listener threads than the available work processes in SAP.

## PollQuantity

Defines the maximum number of events picked up for a single poll. The default is `20`.

## RefreshLogonCycle

Specifies whether all resources are to be freed for an SAP client connection. The default is `false`.

## RfcProgramId

Identification that the connector registers in the SAP Gateway so that the listener threads can process events from RFC-enabled functions. This value must match the Program ID registered in the SAP application (transaction SM59). The default is `CWLDSERVER`.

For more information on configuring the Program ID in the SAP application, see "Registering the RFC Server Module with the SAP Gateway" on page 177.

## RfcTraceOn

Specifies whether or not to generate a text file detailing the RFC activity for each listener thread. You can specify a value of `true` or `false`. A value of `true` activates

tracing, which generates a text file. It is recommended that you use these text files in a development environment only, because the files can grow rapidly. The default is `false`.

## SAPALE_Archive_Queue

Specifies the MQ Series queue that archives TIDs and IDoc data after the ALE Module has finished processing events. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## SAPALE_Event_Queue

Specifies the MQ Series queue that stores TIDs and IDoc data during the ALE Module’s processing of events. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## SAPALE_Wip_Queue

Specifies the MQ Series work-in-progress (wip) queue that holds TIDs and IDoc data while the ALE Module builds the MQ message for the event queue. After the connector receives all data for an event, it moves the data in this queue to the `SAPALE_Event_Queue`. For more information, seeChapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## SAPALE_Error_Queue

Defines a queue to handle MQ messages that fail between the WIP Queue and the Event Queue. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

## SAPALE_Unsubscribed_Queue

Defines a queue to collect unsubscribed IDoc objects. Unsubscribed IDoc objects previously were placed in the Archive queue. These messages can be resubmitted using the event management utility. The connector now checks for subscriptions when processing the data from SAP to the connector, resulting in transactions remaining in SAP until the collaboration is started. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

## SAPSystemID

When configuring the connector for load balancing, specifies the logical name of the SAP R/3 System, which is also known as `R3name`. For more information, see “Taking advantage of load balancing” on page 44.

## SAPtid_MQChannel

Specifies the Client channel for the MQ Series queue manager. For more information, seeChapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## SAPtid_MQPort

Specifies the port used to communicate with the MQ Series queue manager that handles the queues for the ALE Module. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## SAPtid_Queue

Specifies the MQ Series queue on which messages containing the TID and TID status reside. This property is used by the ALE Module only when processing requests. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## SAPtid_QueueManager

Name of the MQ Series queue manager for the queues that store TIDs and IDoc data. This property is used by the ALE Module to process events and requests. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## SAPtid_QueueManagerHost

Name of the host where the MQ Series queue manager resides. This property is used by the ALE Module to process events and requests. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## SAPtid_QueueManagerLogin

User name to log into the MQ Series queue manager. This property is used by the ALE Module to process events and requests. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## SAPtid_QueueManagerPassword

Password for the user who logs into the MQ Series queue manager. This property is used by the ALE Module to process events and requests. For more information, see Chapter 10, “Overview of the ALE Module,” on page 121.

There is no default value.

## Sysnr

System number of the application server. The value is a two-digit number, often `00`. The default is `00`.

## DateTimeFormat

Preserves the delimiters provided with `DATE` and `TIME` field values. If set to `Legacy`, the connector will preserve the delimiters for `DATE` and `TIME` fields. Otherwise, the delimiters will be removed and the value’s length will conform to the attribute defined length.

## TransIdCollabName

**Important:** The connector no longer supports this property.

## TransIdCollabName

**Important:** The connector no longer supports this property.

## UpdateIDocStatus

States whether or not an audit trail is required for all message types.

## IDocSuccessCode

The standard IDoc status code for dispatched okay.

## IDocFailureCode

The standard IDoc status code for dispatched failure.

## IDocSuccessText

The IDoc status message text associated with the IDocSuccessCode for dispatched okay.

## IDocFailureText

The IDoc status message text associated with the IDocFailureCode for dispatched failure.

## UseDefaults

On a Create or Update operation, if UseDefaults is set to `true`, the Adapter Framework for the integration broker, checks whether a valid value or a default value is provided for each business object attribute marked as required. If a value is provided, the Create or Update operation succeeds. If the parameter is set to `false`, the connector checks only for a valid value and causes the Create or Update operation to fail if it is not provided. The default is `false`.

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