Oracle® GoldenGate Adapters

Administrator's Guide for Java

11*g* Release 2 (11.2.1.0.0)

E28384-01

December 2012

Oracle GoldenGate Adapters Administrator’s Guide for Java 11*g* Release 2 (11.2.1.0.0)

E28384-01

Contents

CHAPTER 1

Introduction

This guide covers:

- Installing, configuring and running the Oracle GoldenGate for Java
- Using the prebuilt Java Message Service (JMS) and file handlers
- Developing custom filters, formatters or event handlers

Oracle GoldenGate

The core Oracle GoldenGate product:

- Captures transactional changes from a source database
- Sends and queues these changes as a set of database-independent files called the Oracle GoldenGate trail
- Optionally alters the source data using mapping parameters and functions
- Applies the transactions in the trail to a target system database

Oracle GoldenGate performs this capture and apply in near real-time across heterogeneous databases, platforms, and operating systems.

Adapter integration options

The Oracle GoldenGate adapters integrate with installations of the Oracle GoldenGate core product to do one of the following:

- Read JMS messages and deliver them as an Oracle GoldenGate trail
- Read an Oracle GoldenGate trail and deliver transactions to a JMS provider or other messaging system or custom application
- Read an Oracle GoldenGate trail and write transactions to a flat file that can be used by other applications

Capturing transactions to a trail

The Oracle GoldenGate message capture adapter can be used to read messages from a queue and communicate with an Oracle GoldenGate Extract process to generate a trail containing the processed data.

The message capture adapter is implemented as a Vendor Access Module (VAM) plug-in to a generic Extract process. A set of properties, rules and external files provide messaging connectivity information and define how messages are parsed and mapped to records in the target GoldenGate trail.

Currently this adapter supports capture from JMS text messages.

Applying transactions from a trail

The Oracle GoldenGate delivery adapters can be used to apply transactional changes to targets other than a relational database: for example, ETL tools (DataStage, Ab Initio, Informatica), JMS messaging, or custom APIs. There are a variety of options for integration with Oracle GoldenGate:

- *Flat file integration*: predominantly for ETL, proprietary or legacy applications, Oracle GoldenGate for Flat File can write micro batches to disk to be consumed by tools that expect batch file input. The data is formatted to the specifications of the target application such as delimiter separated values, length delimited values, or binary. Near real-time feeds to these systems are accomplished by decreasing the time window for batch file rollover to minutes or even seconds.
- *Messaging*: transactions or operations can be published as messages (e.g. in XML) to JMS. The JMS provider is configurable; examples include ActiveMQ, JBoss Messaging, TIBCO, WebLogic JMS, WebSphere MQ and others.
- *Java API*: custom event handlers can be written in Java to process the transaction, operation and metadata changes captured by Oracle GoldenGate on the source system. These custom Java handlers can apply these changes to a third-party Java API exposed by the target system.

Oracle GoldenGate VAM message capture

The Oracle GoldenGate messaging capture adapter connects to JMS messaging to parse messages and send them through a VAM interface to an Oracle GoldenGate Extract that builds an Oracle GoldenGate trail of message data. This allows JMS messages to be delivered to an Oracle GoldenGate system running for a target database.

Using Oracle GoldenGate JMS message capture requires two components:

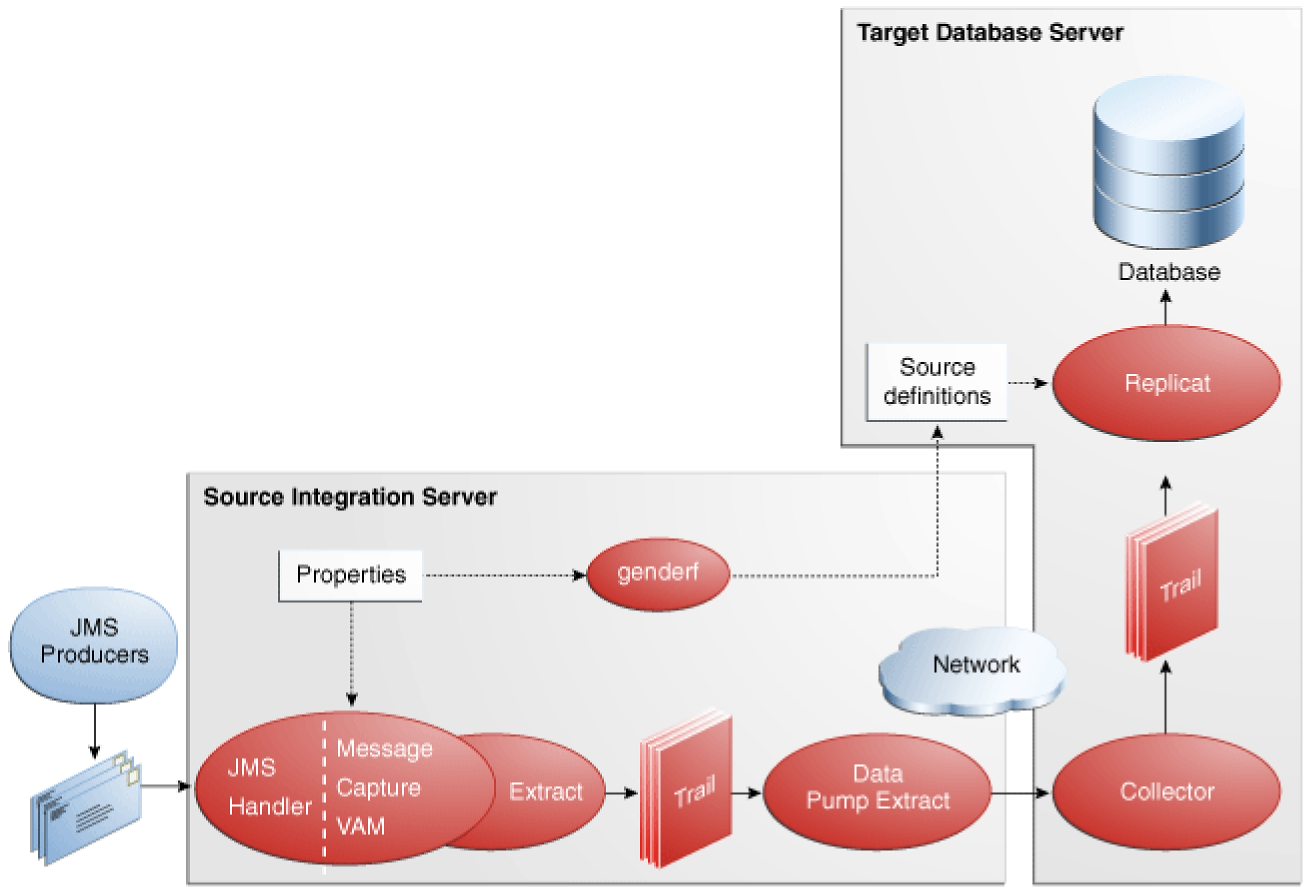
- The dynamically linked shared VAM library that is attached to the Oracle GoldenGate Extract process.
- A separate utility, Gendef, that uses the message capture properties file and parser-specific data definitions to create an Oracle GoldenGate source definitions file.

Message capture configuration options

The options for configuring the three parts of message capture are:

- Message connectivity: Values in the property file set connection properties such as the Java classpath for the JMS client, the JMS source destination name, JNDI connection properties, and security information.
- Parsing: Values in the property file set parsing rules for fixed width, comma delimited, or XML messages. This includes settings such as the delimiter to be used, values for the beginning and end of transactions and the date format.
- VAM interface: Parameters that identify the VAM .dll or .so library and a property file are set for the Oracle GoldenGate core Extract process.

Figure 1 Configuration for JMS message capture



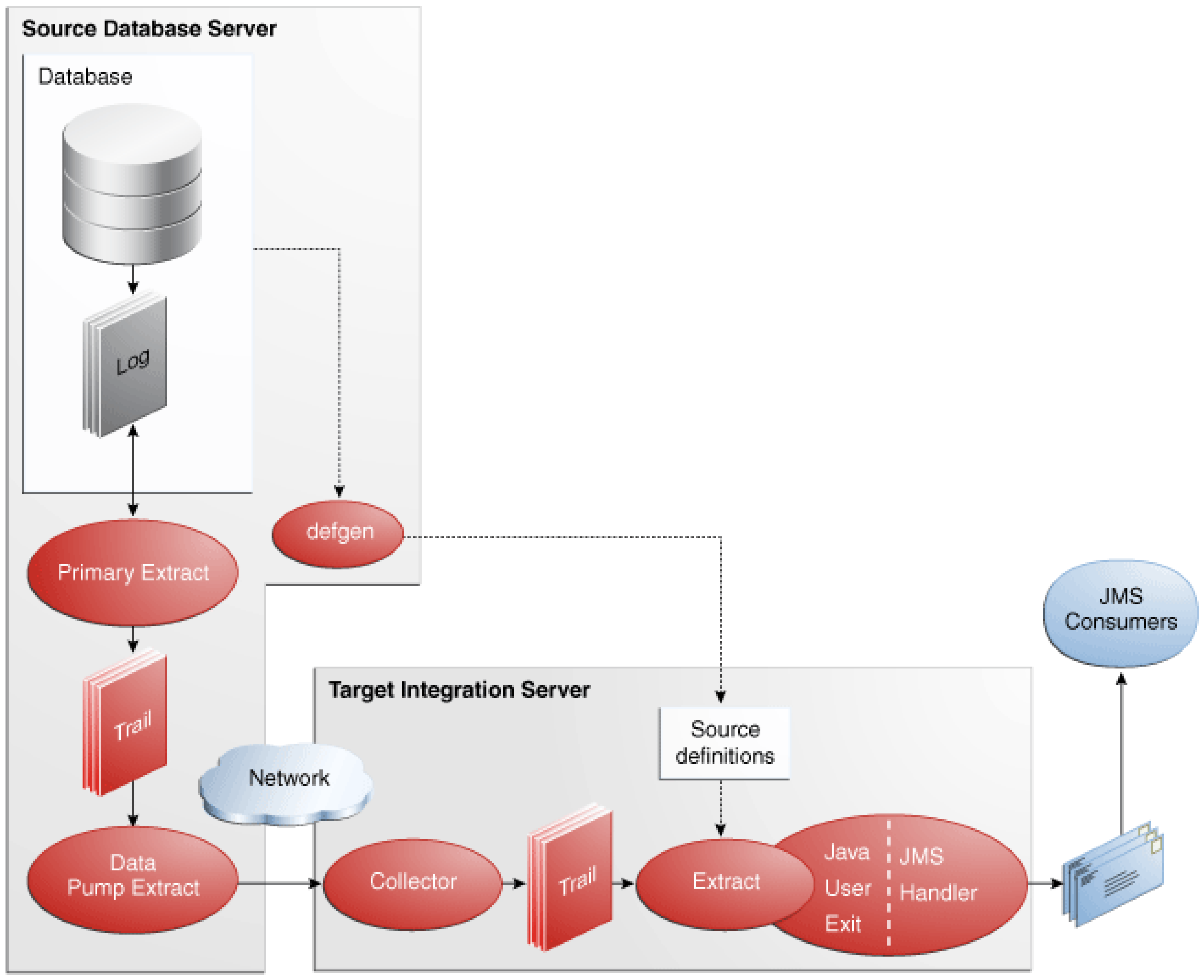
Oracle GoldenGate Java user exit

Through the Oracle GoldenGate Java API, transactional data captured by Oracle GoldenGate can be delivered to targets other than a relational database, such as JMS (Java Message Service), writing files to disk, or integrating with a custom application's Java API.

Oracle GoldenGate for Java provides the ability to execute code written in Java from the Oracle GoldenGate Extract process. Using Oracle GoldenGate for Java requires two components:

- A dynamically linked or shared library, implemented in C/C++, integrating as a **user exit** (UE) with the Oracle GoldenGate Extract process through a C API.
- A set of Java libraries (jars), which comprise the Oracle GoldenGate Java API. This Java framework communicates with the user exit through the Java Native Interface (JNI).

Figure 2 Configuration using the JMS Handler



Delivery configuration options

The dynamically linked library is configurable using a simple properties file. The Java framework is loaded by this user exit and is also initialized by a properties file. Application behavior can be customized by:

- Editing the property files; for example to:
    - Set host names, port numbers, output file names, JMS connection settings;
    - Add/remove targets (such as JMS or files) by listing any number of active handlers to which the transactions should be sent;
    - Turn on/off debug-level logging, etc.
    - Identify which message format should be used.

- Customizing the format of messages sent to JMS or files. Message formats can be custom tailored by:
  - Setting properties for the pre-existing formatters (for fixed-length or field-delimited message formats);
  - Customizing message templates, using the Velocity template macro language;
  - (Optional) Writing custom Java code.
- (Optional) Writing custom Java code to provide custom handling of transactions and operations, do filtering, or implementing custom message formats.

There are existing implementations (handlers) for sending messages via JMS and for writing out files to disk. There are several predefined message formats for sending the messages (e.g. XML or field-delimited); or custom formats can be implemented using templates. Each handler has documentation that describes its configuration properties; for example, a file name can be specified for a file writer, and a JMS queue name can be specified for the JMS handler. Some properties apply to more than one handler; for example, the same message format can be used for JMS and files.

Oracle GoldenGate documentation

For information on installing and configuring the core Oracle GoldenGate software for use with the Oracle GoldenGate Flat File or Java adapters, see the Oracle GoldenGate documentation:

- *Installation and Setup guides*: There is one such guide for each database that is supported by Oracle GoldenGate. It contains system requirements, pre-installation and post-installation procedures, installation instructions, and other system-specific information for installing the Oracle GoldenGate replication solution.
- *Oracle GoldenGate Windows and UNIX Administrator's Guide*: Explains how to plan for, configure, and implement the Oracle GoldenGate replication solution on the Windows and UNIX platforms.
- *Oracle GoldenGate Windows and UNIX Reference Guide*: Contains detailed information about Oracle GoldenGate parameters, commands, and functions for the Windows and UNIX platforms.
- *Oracle GoldenGate Windows and UNIX Troubleshooting and Tuning Guide:* Contains suggestions for improving the performance of the Oracle GoldenGate replication solution and provides solutions to common problems.

CHAPTER 2
Installing Oracle GoldenGate for Java

This chapter provides information on how to install a new instance of the Oracle GoldenGate Java Adapter and how to upgrade an existing one.

Preparing for installation

Prepare your Java environment by ensuring that you have the correct version of Java installed, and that the environmental variables have been set up and configured correctly.

Installing Java

Before installing and running Oracle GoldenGate for Java, you must install Java (JDK or JRE) version 1.6 or later. Either the Java Runtime Environment (JRE) or the full Java Development Kit (which includes the JRE) may be used.

Setting up Environmental Variables

To configure your Java environment for Oracle GoldenGate for Java:

- The `PATH` environmental variable should be configured to find your Java Runtime
- The shared (dynamically linked) Java virtual machine (JVM) library must also be found.

On Windows, these environmental variables should be set as system variables; on Linux/UNIX, they should be set globally or for the user running the Oracle GoldenGate processes. Examples of setting these environmental variables for Windows and UNIX/Linux are listed below.

NOTE There may be two versions of the JVM installed when installing Java; one in `JAVA_HOME/.../client`, and another in `JAVA_HOME/.../server`. For improved performance, use the server version, if it is available. On Windows, it may be that only the client JVM is there if only the JRE was installed (and not the JDK).

Java on Windows

After Java is installed, configure the `PATH` to find the JRE and JVM DLL (`jvm.dll`):

```
set JAVA_HOME=C:\Program Files\Java\jdk1.6.0
set PATH=%JAVA_HOME%\bin;%PATH%
set PATH=%JAVA_HOME%\jre\bin\server;%PATH%
```

In the example above, the directory `%JAVA_HOME%\jre\bin\server` should contain the file `jvm.dll`.

Verify the environment settings by opening a command prompt and checking the java version:

```
C:\> java -version
java version "1.6.0_30" Java(TM) SE Runtime Environment (build 1.6.0_30-b13)
```

Java on Linux/UNIX

Configure the environment to find the JRE in the `PATH`, and the JVM shared library, using the appropriate environmental variable for your system. For example, on Linux (and Solaris, etc.), set `LD_LIBRARY_PATH` to include the directory containing the JVM shared library as follows (for `sh/ksh/bash`):

```
export JAVA_HOME=/opt/jdk1.6
export PATH=${JAVA_HOME}/bin:${PATH}
export LD_LIBRARY_PATH=${JAVA_HOME}/jre/lib/i386/server:${LD_LIBRARY_PATH}
```

In the example above, the directory `$JAVA_HOME/jre/lib/i386/server` should contain the file `libjvm.so`. The actual directory containing the JVM library depends on the OS and if the 32-bit or 64-bit JVM is being used.

Verify the environment settings by opening a command prompt and checking the java version:

```
$ java -version
java version "1.6.0_30"
Java(TM) SE Runtime Environment (build 1.6.0_30-b02)
```

Installing the Oracle GoldenGate Java Adapter

Oracle GoldenGate adapters are available for Windows, Linux, and UNIX (32 and 64 bit). Visit http://edelivery.oracle.com to see if a build of Oracle GoldenGate for Java is available for your operating systemn and architecture.

Installation Overview

The Oracle GoldenGate Adapters installation zip file contains:

- Oracle GoldenGate Java Adapter
- Oracle GoldenGate Flat File Adapter. For information on this adapter see the *Oracle GoldenGate for Flat File* Administrator's Guide for Java.
- A version of Oracle GoldenGate designed to run the adapters. This version is sometimes labeled *generic* because it is not specific to any database, but it is platform dependent.

For JMS capture, the Java Adapter must run in the generic build of Oracle GoldenGate. However, the generic build is not required when using the adapter for delivery of trail data to a target; in this case the Oracle GoldenGate Flat File or Java Adapters can be used with any database version of Oracle GoldenGate. If you want to install to a non-generic instance of Oracle GoldenGate, unzip to a temporary location first and then copy the adapter files to your Oracle GoldenGate installation location.

Installation Steps

Perform the following steps to install the Oracle GoldenGate Adapters:

1. Create an installation directory that has no spaces in its name. Then extract the zip file into this new installation directory. For example:

   ```
   Shell> mkdir {installation_directory}
   Shell> cp path/to/{installation_zip} {installation_directory}
   Shell> cd {installation_directory}
   Shell> unzip {installation_zip}
   ```

   If you are on Linux or UNIX also:

   ```
   Shell> tar -xf {installation_tar}
   ```

   This will download the files into several of the subdirectories shown the table “Sample installation directory structure” on page 14.

2. Still on the installation directory, bring up GGSCI to create the remaining subdirectories in the installation location.

   ```
   Shell> ggsci
   GGSCI> CREATE SUBDIRS
   ```

3. Create a Manager parameter file:

   ```
   GGSCI> EDIT PARAM MGR
   ```

4. Specify a port for the Manager to listen on by using the editor to add a line to the Manager parameter file. For example:

   ```
   PORT 7801
   ```

5. Go to GGSCI, start the Manager, and check to see that it is running:

   ```
   GGSCI>START MGR
   GGSCI>INFO MGR
   ```

6. If you are on Windows and running Manager as a service, set the system variable `PATH` to include `jvm.dll`, then delete the Manager service and re-add it.

Directory Structure

The following table is a sample that includes the subdirectories and files that result from unzipping the installation file and creating the subdirectories. The following conventions have been used:

- Subdirectories are enclosed in square brackets []
- Levels are indicated by a pipe and hyphen |-
- The Internal notation indicates a read-only directory that should not be modified
- Text files (`*.txt`) are not included in the list
- Oracle GoldenGate utilities, such as Defgen, Logdump, and Keygen, are not included in the list

Table 1 Sample installation directory structure

Directory	Explanation
`[`*`gg_install_dir`*`]`	Oracle GoldenGate installation directory, such as `C:/ggs` on Windows or `/home/user/ggs` on UNIX.
`|-ggsci`	Command line interface used to start, stop, and manage processes.
`|-mgr`	Manager process.
`|-extract`	Extract process that will start the Java application or flat file writer.
`|-[AdapterExamples]`	Sample configuration files for Java user exit, Java API, flat file writer, and JMS capture adapters.
`|-[UserExitExamples]`	Sample C programming language user exit code examples.
`|-[dirprm]`	Subdirectory that holds all the parameter and property files created by the user, for example: ◆ `javaue.prm` ◆ `javaue.proprties` ◆ `jmsvam.prm` ◆ `jmsvam.properties` ◆ `ffwriter.prm`
`|-[dirdef]`	Subdirectory that holds source definitions files (*.def) defining the metadata of the trail: ◆ Created by the Defgen core utility for the user exit trail data. ◆ Created by the Gendef adapter utility for VAM message capture.
`|-[dirdat]`	Subdirectory that holds the trail files produced by the VAM Extract or read by the user exit Extract.
`|-[dirchk]`	Internal: Subdirectory that holds checkpoint files.
`|-[dirpcs]`	Internal: Subdirectory that holds process status files.
`|-[dirjar]`	Internal: Subdirectory that holds Oracle GoldenGate Monitor jar files.
`|-[ggjava]`	Internal: Installation directory for Java jars.
`|-ggjava.jar`	The main Java application jar that defines classpath and dependencies.
`|-[resources]`	Subdirectory that contains all `ggjava.jar` dependencies. Includes subdirectories for: ◆ `[class]` - properties and resources ◆ `[lib]` - application jars required by `ggjava.jar`
`|-ggjava_ue.dll`	The user exit shared library. This is `libggjava_ue.so` on UNIX.

Table 1 Sample installation directory structure

Directory	Explanation
`|-ggjava_vam.dll`	The VAM shared library. This is `libggjava_vam.so` on UNIX.
`|-gendef`	Utility to generate the adapter source definitions files containing metadata of the JMS message input. Note that this is different from the Oracle GoldenGate Defgen utility that creates source definitions containing the input metadata for the trail.
`|-flatfilewriter.dll`	The Windows `.dll` or the UNIX `.so` library for the Oracle GoldenGate Flat File Adapter.
`|-. . .`	Other subdirectories and files included in the installation or created later.

Upgrading the Oracle GoldenGate Java Adapter

There are two types of upgrades for the Oracle GoldenGate Java Adapters:

- An adapter that is receiving changes captured from a source database and written to an Oracle GoldenGate trail.
- An adapter that is receiving changes from a JMS source

The upgrade steps are different for each of these.

Source Database Capture

If the adapter is receiving trail data from a source database, use the following upgrade steps:

1. Create an installation directory that has no spaces in its name.
2. Extract the zip file into this new installation directory. This will download the files into several subdirectories.
3. Still on the installation directory, bring up GGSCI to create the remaining subdirectories in the installation location.

   ```
   Shell> ggsci
   GGSCI> CREATE SUBDIRS
   ```

4. Copy all of the `dirprm` files from your existing installation into the `dirprm` directory in the new installation location.

   NOTE All of your configuration files must be in the `dirprm` directory. If you have property files, velocity templates, or other configuration files in a location other than `dirprm` in your old installation, copy them to the `dirprm` directory in the new installation.

5. Copy all of the `dirdef` files from your existing installation into the `dirdef` directory in the new installation location.
6. If you have additional jar files or other custom files in your old installation, copy them to the new installation directory.

7. If the source database capture is writing trails in the new 11.2.1 format, run Defgen on the source database to create the source definitions files in the new format. Then install them to `dirdef`.

   If the source database capture is writing trails in a previous format, the existing source definitions files can be used for both:

   - Format Release 9.5, the trail format supported in Oracle GoldenGate Adapters prior to 11.2.1.
   - Format 10.1 and later trail formats, which are supported as of 11.2.1 release of the Oracle GoldenGate Adapters.

8. Configure the Extract pump processes in the new installation directory by bringing up GGSCI and adding the Extracts and naming the trails.

   ```
   GGSCI> ADD EXTRACT group_name, EXTTRAILSOURCE trail_name, . . .
   ```

9. Start the Extract processes and verify that they are running:

   ```
   GGSCI> START EXTRACT group_name
   GGSCI> INFO EXTRACT group_name
   GGSCI> VIEW REPORT group_name
   ```

10. Modify the source system to write to the new Oracle GoldenGate Adapter installation directory:

    - (Optional) Upgrade the source database Oracle GoldenGate capture following the upgrade procedure for your database platform.
    - Configure the source database capture to write to the new Oracle GoldenGate Adapter installation location `dirdat` directory.
    - When the old Oracle GoldenGate Adapter installation has processed all its data, switch over to the process that will send data to the new location.

JMS Capture

If your adapter is capturing changes from a JMS source, use the following steps to upgrade the installation.

1. Create an installation directory that has no spaces in its name.
2. Extract the zip file into this new installation directory. This will download the files into several subdirectories.
3. Still on the installation directory, bring up GGSCI to create the remaining subdirectories in the installation location.

   ```
   Shell> ggsci
   GGSCI> CREATE SUBDIRS
   ```

4. Copy all of the `dirprm` files from your existing installation into the `dirprm` directory in the new installation location.
5. Copy all of the `dirdef` files from your existing installation into the `dirdef` directory in the new installation location.
6. If you have additional jar files or other custom files in your old installation, copy them to the new installation directory.

7. Configure the Extract processes in the new installation directory to write to a new trail by bringing up GGSCI and adding the Extracts and naming the trails.

   ```
   GGSCI> ADD EXTRACT group_name, EXTTRAILSOURCE trail_name, . . .
   ```

8. Stop the old Extract from the previous version.

   ```
   GGSCI> STOP EXTRACT old_name
   ```

9. Start the new Extract processes and verify that they are running:

   ```
   GGSCI> START EXTRACT group_name
   GGSCI> INFO EXTRACT group_name
   GGSCI> VIEW REPORT group_name
   ```

10. When the old Oracle GoldenGate Adapter installation has processed all its data, configure the downstream processes to read from the new trails generated by the upgraded JMS capture process.

CHAPTER 3
VAM: Configuring Message Capture

This chapter explains how to configure the VAM Extract to capture JMS messages.

Configuring the VAM Extract

To run the Java message capture application you need the following:

- Oracle GoldenGate for Java adapter
- Extract process
- Extract parameter file configured for message capture
- Description of the incoming data format, such as a source definitions file.

Adding the Extract

To add the message capture VAM to the Oracle GoldenGate installation, add an Extract and the trail that it will create using GGSCI commands:

```
ADD EXTRACT jmsvam, VAM
ADD EXTTRAIL dirdat/id, EXTRACT jmsvam, MEGABYTES 100
```

The process name (`jmsvam`) can be replaced with any process name that is no more than 8 characters. The trail identifier (`id`) can be any two characters.

NOTE Commands to position the Extract, such as `BEGIN` or `EXTRBA`, are not supported for message capture. The Extract will always resume by reading messages from the end of the message queue.

Configuring the Extract parameters

The Extract parameter file contains the parameters needed to define and invoke the VAM. Sample Extract parameters for communicating with the VAM are shown in the table.

Parameter	Description
`EXTRACT jmsvam`	The name of the Extract process.

Parameter	Description

`VAM ggjava_vam.dll,`
`PARAMS dirprm/jmsvam.properties`
	Specifies the name of the VAM library and the location of the properties file. The VAM properties should be in the `dirprm` directory of the Oracle GoldenGate installation location.

`TRANLOGOPTIONS VAMCOMPATIBILITY 1`	Specifies the original (1) implementation of the VAM is to be used.
`TRANLOGOPTIONS GETMETADATAFROMVAM`	Specifies that metadata will be sent by the VAM.
`EXTTRAIL dirdat/id`	Specifies the identifier of the target trail Extract creates.
`TABLE OGG.*`	A list of tables to process. Wildcards may be used in the table name.

Configuring the message capture

Message capture is configured by the properties in the VAM properties file. This file is identified by the `PARAMS` option of the Extract `VAM` parameter and used to determine logging characteristics, parser mappings and JMS connection settings.

Connecting and retrieving the messages

To process JMS messages you must configure the connection to the JMS interface, retrieve and parse the messages in a transaction, write each messages to a trail, commit the transaction, and remove its messags from the queue.

Connecting to JMS

Connectivity to JMS is through a generic JMS interface. Properties can be set to configure the following characteristics of the connection:

- Java classpath for the JMS client
- Name of the JMS queue or topic source destination
- Java Naming and Directory Interface (JNDI) connection properties
    - Connection properties for Initial Context
    - Connection factory name
    - Destination name
- Security information
    - JNDI authentication credentials
    - JMS user name and password

The Extract process that is configured to work with the VAM (such as the `jmsvam` in the example) will connect to the message system. when it starts up.

NOTE The Extract may be included in the Manger's AUTORESTART list so it will automatically be restarted if there are connection problems during processing.

Currently the Oracle GoldenGate for Java message capture adapter supports only JMS text messages.

Retrieving messages

The connection processing performs the following steps when asked for the next message:

- Start a local JMS transaction if one is not already started.
- Read a message from the message queue.
- If the read fails because no message exists, return an end-of-file message.
- Otherwise return the contents of the message.

Completing the transaction

Once all of the messages that make up a transaction have been successfully retrieved, parsed, and written to the Oracle GoldenGate trail, the local JMS transaction is committed and the messages removed from the queue or topic. If there is an error the local transaction is rolled back leaving the messages in the JMS queue.

CHAPTER 4
VAM: Parsing the message

This chapter explains the types of parsers included with the Oracle GoldenGate Java Adapter and how each parser translates JMS text messages.

Parsing overview

The role of the parser is to translate JMS text message data and header properties into an appropriate set of transactions and operations to pass into the VAM interface. To do this, the parser always must find certain data:

- Transaction identifier
- Sequence identifier
- Timestamp
- Table name
- Operation type
- Column data specific to a particular table name and operation type

Other data will be used if the configuration requires it:

- Transaction indicator
- Transaction name
- Transaction owner

The parser can obtain this data from JMS header properties, system generated values, static values, or in some parser-specific way. This depends on the nature of the piece of information.

Parser types

The Oracle GoldenGate message capture adapter supports three types of parsers:

- Fixed – Messages contain data presented as fixed width fields in contiguous text.
- Delimited – Messages contain data delimited by field and end of record characters.
- XML – Messages contain XML data accessed through XPath expressions.

Source and target data definitions

There are several ways source data definitions can be defined using a combination of properties and external files. The Oracle GoldenGate Gendef utility generates a standard source definitions file based on these data definitions and parser properties. The options vary based on parser type:

- Fixed – COBOL copybook, source definitions or user defined
- Delimited – source definitions or user defined
- XML – source definitions or user defined

There are several properties that configure how the selected parser gets data and how the source definitions are converted to target definitions.

Required Data

The following information is required for the parsers to translate the messages:

Transaction identifier

The transaction identifier (`txid`) groups operations into transactions as they are written to the Oracle GoldenGate trail file. The Oracle GoldenGate message capture adapter supports only contiguous, non-interleaved transactions. The transaction identifier can be any unique value that increases for each transaction. A system generated value can generally be used.

Sequence identifier

The sequence identifier (`seqid`) identifies each operation internally. This can be used during recovery processing to identify operations that have already been written to the Oracle GoldenGate trail. The sequence identifier can be any unique value that increases for each operation. The length should be fixed.

The JMS Message ID can be used as a sequence identifier if the message identifier for that provider increases and is unique. However, there are cases (e.g. using clustering, failed transactions) where JMS does not guarantee message order or when the ID may be unique but not be increasing. The system generated Sequence ID can be used, but it can cause duplicate messages under some recovery situations. The recommended approach is to have the JMS client that adds messages to the queue set the Message ID, a header property, or some data element to an application-generated unique value that is increasing.

Timestamp

The timestamp (`timestamp`) is used as the commit timestamp of operations within the Oracle GoldenGate trail. It should be increasing but this is not required, and it does not have to be unique between transactions or operations. It can be any date format that can be parsed.

Table name

The table name is used to identify the logical table to which the column data belongs. The adapter requires a two part table name in the form `SCHEMA_NAME.TABLE_NAME`. This can either be defined separately (`schema and table`) or as a combination of schema and table (`schemaandtable`).

A single field may contain both schema and table name, they may be in separate fields, or the schema may be included in the software code so only the table name is required. How the schema and table names can be specified depends on the parser. In any case the two part logical table name is used to write records in the Oracle GoldenGate trail and to generate the source definitions file that describes the trail.

Operation type

The operation type (`optype`) is used to determine whether an operation is an insert, update or delete when written to the Oracle GoldenGate trail. The operation type value for any specific operation is matched against the values defined for each operation type.

The data written to the Oracle GoldenGate trail for each operation type depends on the Extract configuration:

- Inserts
  - The after values of all columns are written to the trail.
- Updates
  - Default – The after values of keys are written. The after values of columns that have changed are written if the before values are present and can be compared. If before values are not present then all columns are written.
  - `NOCOMPRESSUPDATES` – The after values of all columns are written to the trail.
  - `GETUPDATEBEFORES` – The before and after values of columns that have changed are written to the trail if the before values are present and can be compared. If before values are not present only after values are written.
  - If both `NOCOMPRESSUPDATES` and `GETUPDATEBEFORES` are included, the before and after values of all columns are written to the trail if before values are present
- Deletes
  - Default – The before values of all keys are written to the trail.
  - `NOCOMPRESSDELETES` – The before values of all columns are written to the trail.

Primary key update operations may also be generated if the before values of keys are present and do not match the after values.

Column data

All parsers retrieve column data from the message text and write it to the Oracle GoldenGate trail. In some cases the columns are read in index order as defined by the source definitions, in other cases they are accessed by name.

Depending on the configuration and original message text, both before and after or only after images of the column data may be available. For updates, the data for non-updated columns may or may not be available.

All column data is retrieved as text. It is converted internally into the correct data type for that column based on the source definitions. Any conversion problem will result in an error and the process will abend.

Optional data

The following data may be included, but is not required.

Transaction indicator

The relationship of transactions to messages can be:

- One transaction per message

This is determined automatically by the scope of the message.

- Multiple transactions per message

  This is determined by the transaction indicator (`txind`). If there is no transaction indicator, the XML parser can create transactions based on a matching transaction rule.
- Multiple messages per transaction

  The transaction indicator (`txind`) is required to specify whether the operation is the beginning, middle, end or the whole transaction. The transaction indicator value for any specific operation is matched against the values defined for each transaction indicator type. A transaction is started if the indicator value is beginning or whole, continued if it is middle, and ended if it is end or whole.

Transaction name

The transaction name (`txname`) is optional data that can be used to associate an arbitrary name to a transaction. This can be added to the trail as a token using a `GETENV` function.

Transaction owner

The transaction owner (txowner) is optional data that can be used to associate an arbitrary user name to a transaction. This can be added to the trail as a token using a `GETENV` function, or used to exclude certain transactions from processing using the `EXCLUDEUSER` Extract parameter.

Fixed width parsing

Fixed width parsing is based on a data definition that defines the position and the length of each field. This is in the format of a Cobol copybook. A set of properties define rules for mapping the copybook to logical records in the Oracle GoldenGate trail and in the source definitions file.

The incoming data should consist of a standard format header followed by a data segment. Both should contain fixed width fields. The data is parsed based on the PIC definition in the copybook. It is written to the trail translated as explained in "Header and record data type translation" on page 26.

Header

The header must be defined by a copybook 01 level record that includes the following:

- A commit timestamp or a change time for the record
- A code to indicate the type of operation: insert, update, or delete
- The copybook record name to use when parsing the data segment

Any fields in the header record that are not mapped to Oracle GoldenGate header fields are output as columns.

Specifying a header

The following example shows a copybook definition containing the required header values:

```
01 HEADER.
   20 Hdr-Timestamp          PIC X(23)
   20 Hdr-Source-DB-Function PIC X
   20 Hdr-Source-DB-Rec-ID    PIC X(8)
```

You would set the following properties for this example:

```
fixed.header=HEADER
fixed.timestamp=Hdr-Timestamp
fixed.optype=Hdr-Source-DB-Function
fixed.table=Hdr-Source-DB-Rec-Id
```

The logical name table output in this case will be the value of `Hdr-Source-DB-Rec-Id`.

Specifying compound table names

More than one field can be used for a table name. For example, you can define the logical schema name through a static property such as:

```
fixed.schema=MYSCHEMA
```

Then you can add a property that defines the data record as multiple fields from the copybook header definition.

```
01  HEADER.
    20  Hdr-Source-DB              PIC X(8).
    20  Hdr-Source-DB-Rec-Id       PIC X(8).
    20  Hdr-Source-DB-Rec-Version  PIC 9(4).
    20  Hdr-Source-DB-Function     PIC X.
    20  Hdr-Timestamp              PIC X(22).

fixed.header=HEADER
fixed.table=Hdr-Source-DB-Rec-Id,Hdr-Source-DB-Rec-Version
fixed.schema=MYSCHEMA
```

The fields will be concantenated to result in logical schema and table names of the form:

```
MYSCHEMA.Hdr-Source-DB-Rec-Id+Hdr-Source-DB-Rec-Version
```

Specifying timestamp formats

A timestamp is parsed using the default format `YYYY-MM-DD HH:MM:SS.FFF`, with `FFF` depending on the size of the field.

Specify different incoming formats by entering a comment before the datetime field as shown in the next example.

```
01  HEADER.
* DATEFORMAT YYYY-MM-DD-HH.MM.SS.FF
    20  Hdr-Timestamp      PIC X(23)
```

Specifying the function

Use properties to map the standard Oracle GoldenGate operation types to the `optype` values. The following example specifies that the operation type is in the `Hdr-Source-DB-Function` field and that the value for insert is `A`, update is `U` and delete is `D`.

```
fixed.optype=Hdr-Source-DB-Function
fixed.optype.insert=A
fixed.optype.update=U
fixed.optype.delete=D
```

Header and record data type translation

The data in the header and the record data are written to the trail based on the translated data type.

- A field definition preceded by a date format comment is translated to an Oracle GoldenGate datetime field of the specified size. If there is no date format comment, the field will be defined by its underlying datatype.
- A `PIC X` field is translated to the `CHAR` datatype of the indicated size.
- A `PIC 9` field is translated to a `NUMBER` datatype with the defined precision and scale. Numbers that are signed or unsigned and those with or without decimals are supported.

The following examples show the translation for various `PIC` definitions.

Input	Output
`PIC XX`	`CHAR(2)`
`PIC X(16)`	`CHAR(16)`
`PIC 9(4)`	`NUMBER(4)`

`* YYMMDD`
`PIC 9(6)`
	`DATE(10)`
	`YYYY-MM-DD`

`PIC 99.99`	`NUMBER(4,2)`
`PIC 9(5)V99`	`NUMBER(7,2)`

In the example an input `YYMMDD` date of 100522 is translated to 2010-05-22. The number 1234567 with the specified format `PIC 9(5)V99` is translated to a seven digit number with two decimal places, or 12345.67.

Key identification

A comment is used to identify key columns within the data record. The Gendef utility that generates the source definitions uses the comment to locate a key column.

In the following example `Account` has been marked as a key column for `TABLE1`.

```
01 TABLE1
* KEY
20  Account     PIC X(19)
20  PAN_Seq_Num PIC 9(3)
```

Delimited parsing

Delimited parsing is based a preexisting source definitions files and a set of properties. The properties specify the delimiters to use and other rules, such as whether there are column names and before values. The source definitions file determines the valid tables to be processed and the order and datatype of the columns in the tables.

The format of the delimited message is:

{*METACOLS*}^{n}[,{*COLNAMES*}]^m[,{*COLBEFOREVALS*}]^m,{*COLVALUES*}^{m}\n

Where: There can be *n* metadata columns each followed by a field delimiter such as the comma shown in the format statement.

There can be *m* column values. Each of these are preceded by a field delimiter such as a comma.

The column name and before value are optional.

Each record is terminated by an end of line delimiter, such as `\n`.

Metadata columns

The metadata columns correspond to the header and contain fields that have special meaning. Metadata columns should include the following information.

- **optype** contains values indicating if the record is an insert, update, or delete. The default values are `I`, `U`, and `D`.
- **timestamp** indicates type of value to use for the commit timestamp of the record. The format of the timestamp defaults to `YYYY-DD-MM HH:MM:SS.FFF`.
- **schemaandtable** is the full table name for the record in the format `SCHEMA.TABLE`.
- **schema** is the record's schema name.
- **table** is the record's table name.
- **txind** is a value that indicates whether the record is the beginning, middle, end or the only record in the transaction. The default values are 0, 1, 2, 3.
- **id** is the value used as the sequence number (RSN or CSN) of the record. The id of the first record (operation) in the transaction is used for the sequence number of the transaction.

Parsing properties

Properties can be set to describe delimiters, values, and date and time formats.

Properties to describe delimiters

The following properties determine the parsing rules for delimiting the record.

- **fielddelim** specifies one or more ASCII or hexadecimal characters as the value for the field delimiter
- **recorddelim** specifies one or more ASCII or hexadecimal characters as the value for the record delimiter
- **quote** specifies one or more ASCII or hexadecimal characters to use for quoted values
- **nullindicator** specifies one or more ASCII or hexadecimal characters to use for NULL values

You can define escape characters for the delimiters so they will be replaced if the characters are found in the text. For example if a backslash and apostrophe (\') are specified, then the input "They used Mike\'s truck" is translated to "They used Mike's truck". Or if two quotes ("") are specified, "They call him ""Big Al""" is translated to "They call him "Big Al"".

Data values may be present in the record without quotes, but the system only removes escape characters within quoted values. A non-quoted string that matches a null indicator is treated as null.

Properties to describe values

The following properties provide more information:

- **hasbefores** indicates before values are present for each record
- **hasnames** indicates column names are present for each record
- **afterfirst** indicates column after values come before column before values
- **isgrouped** indicates all column names, before values and after values are grouped together in three blocks, rather than alternately per column

Properties to describe date and time

The default format `YYYY-DD-MM HH:MM:SS.FFF` is used to parse dates. The user can use properties to override this on a global, table or column level. Examples of changing the format are shown below.

```
delim.dateformat.default=MM/DD/YYYY-HH:MM:SS
delim.dateformat.MY.TABLE=DD/MMM/YYYY
delim.dateformat.MY.TABLE.COL1=MMYYYY
```

Parsing steps

The steps in delimited parsing are:

1. The parser first reads and validates the metadata columns for each record.
2. This provides the table name, which can then be used to look up column definitions for that table in the source definitions file.
3. If a definition cannot be found for a table, the processing will stop.
4. Otherwise the columns are parsed and output to the trail in the order and format defined by the source definitions.

XML parsing

XML parsing is based on a preexisting source definitions file and a set of properties. The properties specify rules to determine XML elements and attributes that correspond to transactions, operations and columns. The source definitions file determines the valid tables to be processed and the ordering and data types of columns in those tables.

Styles of XML

The XML message is formatted in either dynamic or static XML. At runtime the contents of *dynamic XML* are data values that cannot be predetermined using a sample XML or

XSD document. The contents of *static XML* that determine tables and column element or attribute names can be predetermined using those sample documents.

The following two examples contain the same data.

An example of static XML

```
<NewMyTableEntries>
  <NewMyTableEntry>
    <CreateTime>2010-02-05:10:11:21</CreateTime>
    <KeyCol>keyval</KeyCol>
    <Col1>col1val</Col1>
  </NewMyTableEntry>
</NewMyTableEntries>
```

The `NewMyTableEntries` element marks the transaction boundaries. The `NewMyTableEntry` indicates an insert to `MY.TABLE`. The timestamp is present in an element text value, and the column names are indicated by element names.

You can define rules in the properties file to parse either of these two styles of XML through a set of XPath-like properties. The goal of the properties is to map the XML to a predefined source definitions file through XPath matches.

An example of dynamic XML

```
<transaction id="1234" ts="2010-02-05:10:11:21">
  <operation table="MY.TABLE" optype="I">
    <column name="keycol" index="0">
      <aftervalue><![CDATA[keyval]]></aftervalue>
    </column>
    <column name="col1" index="1">
      <aftervalue><![CDATA[col1val]]></aftervalue>
    </column>
  </operation>
</transaction>
```

Every operation to every table has the same basic message structure consisting of transaction, operation and column elements. The table name, operation type, timestamp, column names, column values, etc. are obtained from attribute or element text values.

XML parsing rules

Independent of the style of XML, the parsing process needs to determine:

- Transaction boundaries
- Operation entries and metadata including:
  - Table name
  - Operation type
  - Timestamp
- Column entries and metadata including:
  - Either the column name or index; if both are specified the system will check to see if the column with the specified data has the specified name.
  - Column before or after values, sometimes both.

This is done through a set of interrelated rules. For each type of XML message that is to be processed you name a rule that will be used to obtain the required data. For each of these named rules you add properties to:

- Specify the rule as a transaction, operation, or column rule type. Rules of any type are required to have a specified name and type.
- Specify the XPath expression to match to see if the rule is active for the document being processed. This is optional; if not defined the parser will match the node of the parent rule or the whole document if this is the first rule.
- List detailed rules (subrules) that are to be processed in the order listed. Which subrules are valid is determined by the rule type. Subrules are optional.

In the following example the top-level rule is defined as `genericrule`. It is a `transaction` type rule. Its subrules are defined in `oprule` and they are of the type `operation`.

```
xmlparser.rules=genericrule
xmlparser.rules.genericrule.type=tx
xmlparser.rules.genericrule.subrules=oprule
xmlparser.rules.oprule.type=op
```

XPath expressions

The XML parser supports a subset of XPath expressions necessary to match elements and extract data. An expression can be used to match a particular element or to extract data.

When doing data extraction most of the path is used to match. The tail of the expression is used for extraction.

Supported constructs:

`/e`	Use the absolute path from the root of the document to match `e`.
`./e or e`	Use the relative path from current node being processed to match `e`.
`../e`	Use a path based on the parent of the current node (can be repeated) to match `e`.
`//e`	Match `e` wherever it occurs in a document.
`*`	Match any element. Note: Partially wild-carded names are not supported.
`[n]`	Match the nth occurrence of an expression.
`[x=v]`	Match when x is equal to some value v where x can be: ◆ `@att` – some attribute value ◆ `text()` – some text value ◆ `name()` – the element name ◆ `position()` – the element position

Supported expressions

Match root element	`/My/Element`

Match sub element to current node	`./Sub/Element`
Match nth element	`/My/*[n]`
Match nth Some element	`/My/Some[n]`
Match any text value	`/My/*[text() ='value']`
Match the text in Some element	`/My/Some[text() = 'value']`
Match any attribute	`/My/*[@att = 'value']`
Match the attribute in Some element	`/My/Some[@att = 'value']`

Obtaining data values

In addition to matching paths, the XPath expressions can also be used to obtain data values, either absolutely or relative to the current node being processed. Data value expressions can contain any of the path elements above, but must end with one of the value accessors listed below.

`@att`	Some attribute value.
`text()`	The text content (value) of an element.
`content()`	The full content of an element, including any child XML nodes.
`name()`	The name of an element.
`position()`	The position of an element in its parent.

Some examples:

To extract the relative element text value:

```
/My/Element/text()
```

To extract the absolute attribute value:

```
/My/Element/@att
```

To extract element text value with a match:

```
/My/Some[@att = 'value']/Sub/text()
```

NOTE Path accessors, such as ancestor/descendent/self, are not supported.

Other value expressions

The values extracted by the XML parser are either column values or properties of the transaction or operation, such as table or timestamp. These values are either obtained from XML using XPath or through properties of the JMS message, system values, or hard coded values. The XML parser properties specify which of these options are valid for obtaining the values for that property.

The following example specifies that `timestamp` can be an XPath expression, a JMS property, or the system generated timestamp.

```
{txrule}.timestamp={xpath-expression}|${jms-property}|*ts
```

The next example specifies that `table` can be an XPath expression, a JMS property, or hard coded value.

```
{oprule}.table={xpath-expression}|${jms-property}|”value”
```

The last example specifies that name can be a XPath expression or hard coded value.

```
{colrule}.timestamp={xpath-expression}|”value”
```

Transaction rules

The rule that specifies the boundary for a transaction is at the highest level. Messages may contain a single transaction, multiple transactions, or a part of a transaction that spans messages. These are specified as follows:

- **single -** The transaction rule match is not defined.
- **multiple -** Each transaction rule match defines new transaction.
- **span** – No transaction rule is defined; instead a transaction indicator is specified in an operation rule.

For a transaction rule, the following properties of the rule may also be defined through XPath or other expressions:

- **timestamp** – The time at which the transaction occurred.
- **txid** – The identifier for the transaction.

Transaction rules can have multiple subrules, but each must be of type operation.

Examples

The following example specifies a transaction that is the whole message and includes a timestamp that comes from the JMS property.

```
singletxrule.timestamp=$JMSTimeStamp
```

The following example matches the root element transaction and obtains the timestamp from the `ts` attribute.

```
dyntxrule.match=/Transaction
dyntxrule.timestamp=@ts
```

Operation rules

An operation rule can either be a subrule of a transaction rule, or a highest level rule (if the transaction is a property of the operation).

In addition to the standard rule properties, an operation rule should also define the following through XPath or other expressions:

- **timestamp** – The timestamp of the operation. This is optional if the transaction rule is defined.
- **table** – The name of the table on which this is an operation. Use this with schema.
- **schema** – The name of schema for the table.
- **schemaandtable** – Both schema and table name together in the form `SCHEMA.TABLE.` This can be used in place of the individual table and schema properties.

- **optype** – Specifies whether this is an insert, update or delete operation based on optype values:
    - **optype.insertval** – The value indicating an insert. The default is `I`.
    - **optype.updateval** – The value indicating an update. The default is `U`.
    - **optype.deleteval** – The value indicating a delete. The default is `D`.
- **seqid** – The identifier for the operation. This will be the transaction identifier if `txid` has not already been defined at the transaction level.
- **txind** – Specifies whether this operation is the beginning of a transaction, in the middle or at the end; or if it is the whole operation. This property is optional and not valid if the operation rule is a subrule of a transaction rule.

Operation rules can have multiple subrules of type operation or column.

Examples

The following example dynamically obtains operation information from the `/Operation` element of a `/Transaction`.

```
dynoprule.match=./Operation
dynoprule.schemaandtable=@table
dynoprule.optype=@type
```

The following example statically matches `/NewMyTableEntry` element to an insert operation on the `MY.TABLE` table.

```
statoprule.match=./NewMyTableEntry
statoprule.schemaandtable="MY.TABLE"
statoprule.optype="I"
statoprule.timestamp=./CreateTime/text()
```

Column rules

A column rule must be a subrule of an operation rule. In addition to the standard rule properties, a column rule should also define the following through XPath or other expressions.

- **name** – The name of the column within the table definition.
- **index** – The index of the column within the table definition.

NOTE If only one of `name` and `index` is defined, the other will be determined.

- **before.value** – The before value of the column. This is required for deletes, but is optional for updates.
- **before.isnull** – Indicates whether the before value of the column is null.
- **before.ismissing** – Indicates whether the before value of the column is missing.
- **after.value** – The before value of the column. This is required for deletes, but is optional for updates.
- **after.isnull** – Indicates whether the before value of the column is null.
- **after.ismissing** – Indicates whether the before value of the column is missing.
- **value** – An expression to use for both `before.value` and `after.value` unless overridden by specific before or after values. Note that this does not support different before values for updates.

- **isnull** – An expression to use for both before.isnull and after.isnull unless overridden.
- **ismissing** – An expression to use for both before.ismissing and after.ismissing unless overridden.

Examples

The following example dynamically obtains column information from the `/Column` element of an `/Operation`**.**

```
dyncolrule.match=./Column
dyncolrule.name=@name
dyncolrule.before.value=./beforevalue/text()
dyncolrule.after.value=./aftervalue/text()
```

The following example statically matches the `/KeyCol` and `/Col1` elements to columns in `MY.TABLE`.

```
statkeycolrule.match=/KeyCol
statkeycolrule.name=”keycol”
statkeycolrule.value=./text()
statcol1rule.match=/Col1
statcol1rule.name=”col1”
statcol1rule.value=./text()
```

Overall rules example

The following example uses the XML samples shown earlier with appropriate rules to generate the same resulting operation on the `MY.TABLE` table.

Dynamic XML

```
<transaction id="1234"
    ts="2010-02-05:10:11:21">
  <operation table="MY.TABLE" optype="I">
    <column name="keycol" index="0">
      <aftervalue>
<![CDATA[keyval]]>
      </aftervalue>
    </column>
    <column name="col1" index="1">
      <aftervalue>
         <![CDATA[col1val]]>
      </aftervalue>
    </column>
  </operation>
</transaction>
```

```
dyntxrule.match=/Transaction
dyntxrule.timestamp=@ts
dyntxrule.subrules=dynoprule
dynoprule.match=./Operation
dynoprule.schemaandtable=@table
dynoprule.optype=@type
dynoprule.subrules=dyncolrule
dyncolrule.match=./Column
dyncolrule.name=@name
```

Static XML

```
NewMyTableEntries>
  <NewMyTableEntry>
    <CreateTime>
       2010-02-05:10:11:21
    </CreateTime>
    <KeyCol>keyval</KeyCol>
    <Col1>col1val</Col1>
  </NewMyTableEntry>
</NewMyTableEntries>
```

```
stattxrule.match=/NewMyTableEntries
stattxrule.subrules= statoprule
statoprule.match=./NewMyTableEntry
statoprule.schemaandtable=”MY.TABLE”
statoprule.optype=”I”
statoprule.timestamp=./CreateTime/text()
statoprule.subrules= statkeycolrule,
statcol1rule
statkeycolrule.match=/KeyCol
```

```
dyncolrule.before.value=./beforevalue/text()   statkeycolrule.name=”keycol”
dyncolrule.after.value=./aftervalue/text()     statkeycolrule.value=./text()
                                               statcol1rule.match=/Col1
                                               statcol1rule.name=”col1”
                                               statcol1rule.value=./text()
```

```
INSERT INTO MY.TABLE (KEYCOL, COL1)
VALUES (‘keyval’, ‘col1val’)
```

Source definitions generation utility

Oracle GoldenGate for Java includes a Gendef utility that generates an Oracle GoldenGate source definitions file from the properties defined in a properties file. It creates a normalized definition of tables based on the property settings and other parser-specific data definition values.

The syntax to run this utility is:

```
gendef –prop {property_file} [-out {output_file}]
```

This defaults to sending the source definitions to standard out, but it can be directed to a file using the –out parameter. For example:

```
gendef –prop dirprm/jmsvam.properties -out dirdef/msgdefs.def
```

The output source definitions file can then be used in a pump or delivery process to interpret the trail data created through the VAM.

CHAPTER 5
VAM: Message Capture Properties

This section explains the options available for configuration of the property file for the Oracle GoldenGate for Java VAM.

Place this property file in the `dirprm` directory of your Oracle GoldenGate installation location. The name of the VAM properties file is set with the Extract VAM parameter.

All properties in the property file are of the form: `fully.qualified.name=value`. The value may be integer, boolean, single string, or comma delimited strings.

Comments can be entered in the properties file with the # prefix at the beginning of the line. For example:

```
# This is a property comment
some.property=value
```

Properties themselves can also be commented out. However you cannot place a comment at the end of a line; either the whole line is a comment or it is a property.

Logging and connection properties

The following properties control the conenction to JMS and the log file names, error handling, and message output.

Logging properties

Logging is controlled by the following properties.

log.logname

Specifies the prefix to the log file name. This must be a valid ASCII string. The log file name has the current date appended to it, in `yyyymmdd` format, together with the `.log` extension.

The following example will create a log file of name `writer_20100803.log` on August 3, 2010. The log file will roll over each day, independent of the stopping and starting of the process.

```
# log file prefix
log.logname=writer
```

The following example will create a log file of name `msgv_20100803.log` on August 3, 2010.

```
# log file prefix
log.logname=msgv
```

log.level

Specifies the overall log level for all modules. The syntax is:

```
log.level=ERROR|WARN|INFO|DEBUG
```

The log levels are defined as follows:

`ERROR` – Only write messages if errors occur

`WARN` – Write error and warning messages

`INFO` – Write error, warning and informational messages

`DEBUG` – Write all messages, including debug ones.

The default logging level is `INFO`. The messages in this case will be produced on startup, shutdown and periodically during operation. If the level is switched to `DEBUG`, large volumes of messages may occur which could impact performance. For example, the following sets the global logging level to `INFO`:

```
# global logging level
log.level=INFO
```

log.tostdout

Controls whether or not log information is written to standard out. This setting is useful if the Extract process is running with a VAM started from the command line or on an operating system where `stdout` is piped into the report file. Generally Oracle GoldenGate processes run as background processes however.

The syntax is:

```
goldengate.log.tostdout=true|false
```

The default is `false`.

log.tofile

Controls whether or not log information is written to the specified log file.The syntax is:

```
log.tofile=true|false
```

The default is false. Log output is written to the specified log file when set to true.

log.modules, log.level.{module}

Specifies the log level of the individual source modules that comprise the user exit. This is typically used only for advanced debugging. It is possible to increase the logging level to `DEBUG` on a per module basis to help troubleshoot issues. The default levels should not be changed unless asked to do so by Oracle GoldenGate support.

JMS connection properties

The JMS connection properties set up the connection, such as how to start up the JVM for JMS integration.

jvm.boot options

Specifies the classpath and boot options that will be applied when the user exit starts up the JVM. The path needs colon (:) separators for UNIX/Linux and semicolons (;) for Windows.

The syntax is:

```
jvm.bootoptions={option}[, . . .]
```

The options are the same as those passed to Java executed from the command line. They may include classpath, system properties, and JVM memory options (such as max memory or initial memory) that are valid for the version of Java being used. Valid options may vary based on the JVM version and provider.

For example (all on a single line):

```
jvm.bootoptions= -Djava.class.path=ggjava/ggjava.jar
             -Dlog4j.configuration=my-log4j.properties
```

The `log4j.configuration` property could be a fully qualified URL to a log4j properties file; by default this file is searched for in the classpath. You may use your own log4j configuration, or one of the pre-configured log4j settings: `log4j.properties` (default level of logging), `debug_log4j.properties` (debug logging) or `trace_log4j.properties` (very verbose logging).

jms.report.output

Specifies where the JMS report is written. The syntax is:

```
jms.report.output=report|log|both
```

Where: `report` sends the JMS report to the Oracle GoldenGate report file. This is the default.

`log` will write to the Java log file (if one is configured)

`both` will send to both locations.

jms.report.time

Specifies the frequency of report generation based on time.

```
jms.report.time={time-specification}
```

The following examples write a report every 30 seconds, 45 minutes and eight hours.

```
jms.report.time=30sec
jms.report.time=45min
jms.report.time=8hr
```

jms.report.records

Specifies the frequency of report generation based on number of records.

```
jms.report.records={number}
```

The following example writes a report every 1000 records.

```
jms.report.records=1000
```

jms.id

Specifies that a unique identifier with the indicated format is passed back from the JMS integration to the message capture VAM. This may be used by the VAM as a unique sequence ID for records.

```
jms.id=ogg|time|wmq|activemq|{message-header}|{custom-java-class}
```

Where: `ogg` - returns the message header property `GG_ID` which is set by Oracle GoldenGate JMS delivery.

`time` - uses a system timestamp as a starting point for the message ID

`wmq` - reformats a WebSphere MQ Message ID for use with the VAM

`activemq` - reformats an ActiveMQ Message ID for use with the VAM

{*`message-header`*} - specifies the user customized JMS message header to be included, such as JMSMessageID, JMSCorrelationID, or JMSTimestamp.

{*`custom-java-class`*} - specifies a custom Java class that creates a string to be used as an ID.

For example:

```
jms.id=time
jms.id=JMSMessageID
```

The ID returned must be unique, incrementing, and fixed-width. If there are duplicate numbers, the duplicates are skipped. If the message ID changes length, the Extract process will abend.

jms.destination

Specifies the queue or topic name to be looked up via JNDI.

```
jms.destination={jndi-name}
```

For example:

```
jms.destination=sampleQ
```

jms.connectionFactory

Specifies the connection factory name to be looked up via JNDI.

```
jms.connectionFactory={jndi-name}
```

For example

```
jms.connectionFactory=ConnectionFactory
```

jms.user, jms.password

Sets the user name and password of the JMS connection, as specified by the JMS provider.

```
jms.user={user-name}
jms.password={password}
```

This is not used for JNDI security. To set JNDI authentication, see the JNDI `java.naming.security` properties.

For example:

```
jms.user=myuser
jms.password=mypasswd
```

JNDI properties

In addition to specific properties for the message capture VAM, the JMS integration also supports setting JNDI properties required for connection to an Initial Context to look up the connection factory and destination. The following properties must be set:

```
java.naming.provider.url={url}
java.naming.factory.initial={java-class-name}
```

If JNDI security is enabled, the following properties may be set:

```
java.naming.security.principal={user-name}
java.naming.security.credentials={password-or-other-authenticator}
```

For example:

```
java.naming.provider.url= t3://localhost:7001
java.naming.factory.initial=weblogic.jndi.WLInitialContextFactory
java.naming.security.principal=jndiuser
java.naming.security.credentials=jndipw
```

Parser properties

Properties specify the formats of the message and the translation rules for each type of parser: fixed, delimited, or XML. Set the `parser.type` property to specify which parser to use. The remaining properties are parser specific.

Setting the type of parser

The following property sets the parser type.

parser.type

Specifies the parser to use.

```
parser.type=fixed|delim|xml
```

Where: `fixed` invokes the fixed width parser

`delim` invokes the delimited parser

`xml` invokes the XML parser

For example:

```
parser.type=delim
```

Fixed parser properties

The following properties are required for the fixed parser.

fixed.schema

Specifies the type of file used as metadata for message capture. The two valid options are sourcedefs and copybook.

```
fixed.schematyype=sourcedefs|copybook
```

For example:

```
fixed.schematype=copybook
```

The value of this property determines the other properties that must be set in order to successfully parse the incoming data.

fixed.sourcedefs

If the `fixed.schematype=sourcedefs`, this property specifies the location of the source definitions file that is to be used.

```
fixed.sourcedefs={file-location}
```

For example:

```
fixed.sourcedefs=dirdef/hrdemo.def
```

fixed.copybook

If the `fixed.schematype=copybook`, this property specifies the location of the copybook file to be used by the message capture process.

```
fixed.copybook={file-location}
```

For example:

```
fixed.copybook=test_copy_book.cpy
```

fixed.header

Specifies the name of the sourcedefs entry or copybook record that contains header information used to determine the data block structure:

```
fixed.header={record-name}
```

For example:

```
fixed.header=HEADER
```

fixed.seqid

Specifies the name of the header field, JMS property, or system value that contains the `seqid` used to uniquely identify individual records. This value must be continually incrementing and the last character must be the least significant.

```
fixed.seqid={field-name}|${jms-property}|*seqid
```

Where: `field-name` indicates the name of a header field containing the seqid

`jms-property` uses the value of the specified JMS header property. A special value of this is `$jmsid` which uses the value returned by the mechanism chosen by the `jms.id` property `seqid` indicates a simple incrementing 64-bit integer generated by the system

For example:

```
fixed.seqid=$jmsid
```

fixed.timestamp

Specifies the name of the field, JMS property, or system value that contains the timestamp.

```
fixed.timestamp={field-name}|${jms-property}|*ts
```

For example:

```
fixed.timestamp=TIMESTAMP
fixed.timestamp=$JMSTimeStamp
fixed.timestamp=*ts
```

fixed.timestamp.format

Specifies the format of the timestamp field.

```
fixed.timestamp.format={format}
```

Where the format can include punctuation characters plus:

`YYYY` – four digit year

`YY` – two digit year

`M[M]` – one or two digit month

`D[D]` – one or two digit day

`HH` – hours in twenty four hour notation

`MI` – minutes

`SS` – seconds

`Fn` – n number of fractions

The default format is "`YYYY-MM-DD:HH:MI:SS.FFF`"

For example:

```
fixed.timestamp.format=YYYY-MM-DD-HH.MI.SS
```

fixed.txid

Specifies the name of the field, JMS property, or system value that contains the `txid` used to uniquely identify transactions. This value must increment for each transaction.

```
fixed.txid={field-name}|${jms-property}|*txid
```

For most cases using the system value of `*txid` is preferred.

For example:

```
fixed.txid=$JMSTxId
fixed.txid=*txid
```

fixed.txowner

Specifies the name of the field, JMS property, or static value that contains a user name associated with a transaction. This value may be used to exclude certain transactions from processing. This is an optional property.

```
fixed.txowner={field-name}|${jms-property}|”{value}”
```

For example:

```
fixed.txowner=$MessageOwner
fixed.txowner=”jsmith”
```

fixed.txname

Specifies the name of the field, JMS property, or static value that contains an arbitrary name to be associated with a transaction. This is an optional property.

```
fixed.txname={field-name}|${jms-property}|”{value}”
```

For example:

```
fixed.txname=”fixedtx”
```

fixed.optype

Specifies the name of the field, or JMS property that contains the operation type, which is validated against the `fixed.optype` values specified in the next sections.

```
fixed.header.optype={field-name}|${jms-property}
```

For example:

```
fixed.header.optype=FUNCTION
```

fixed.optype.insertval

This value identifies an insert operation. The default is `I`.

```
fixed.optype.insertval={value}|\x{hex-value}
```

For example:

```
fixed.optype.insertval=A
```

fixed.optype.updateval

This value identifies an update operation. The default is `U`.

```
fixed.optype.updateval={value}|\x{hex-value}
```

For example:

```
fixed.optype.updateval=M
```

fixed.optype.deleteval

This value identifies a delete operation.The default is `D`.

```
fixed.optype.deleteval={value}|\x{hex-value}
```

For example:

```
fixed.optype.deleteval=R
```

fixed.table

Specifies the name of the table. This enables the parser to find the data record definition needed to translate the non-header data portion.

```
fixed.table={field-name}|${jms-property}[, . . .]
```

More than one comma delimited field name may be used to determine the name of the table Each field name corresponds to a field in the header record defined by the `fixed.header` property or JMS property. The values of these fields are concatenated to identify the data record.

For example:

```
fixed.table=$JMSTableName
fixed.table=SOURCE_Db,SOURCE_Db_Rec_Version
```

fixed.schema

Specifies the static name of the schema when generating SCHEMA.TABLE table names.

```
fixed.schema=”{value}”
```

For example:

```
fixed.schema=”OGG”
```

fixed.txind

Specifies the name of the field or JMS property that contains a transaction indicator that is validated against the transaction indicator values. If this is not defined,j all operations within a single message will be seen to have occurred within a whole transaction. If defined, then it determines the beginning, middle and end of transactions. Transactions defined in this way can span messages. This is an optional property.

```
fixed.txind={field-name}|${jms-property}
```

For example:

```
fixed.txind=$TX_IND
```

fixed.txind.beginval

This value identifies an operation as the beginning of a transaction. The defaults is `B`.

```
fixed.txind.beginval={value}|\x{hex-value}
```

For example:

```
fixed.txind.beginval=0
```

fixed.txind.middleval

This value identifies an operation as the middle of a transaction. The default is `M`.

```
fixed.txind.middleval={value}|\x{hex-value}
```

For example:

```
fixed.txind.middleval=1
```

fixed.txind.endval

This value identifies an operation as the end of a transaction. The default is *E*.

```
fixed.txind.endval={value}|\x{hex-value}
```

For example:

```
fixed.txind.endval=2
```

fixed.txind.wholeval

This value identifies an operation as a whole transaction. The default is *W*.

```
fixed.txind.wholeval={value}|\x{hex-value}
```

For example:

```
fixed.txind.wholeval=3
```

Delimited Parser Properties

The following properties are required for the delimited parser except where otherwise noted.

delim.sourcedefs

Specifies the location of the source definitions file to use.

```
delim.sourcedefs={file-location}
```

For example:

```
delim.sourcedefs=dirdef/hrdemo.def
```

delim.header

Specifies the list of values that come before the data and assigns names to each.

```
delim.header={name},[. . .]
```

The names must be unique. They can be referenced in other `delim` properties or wherever header fields can be used.

For example:

```
delim.header=optype, tablename, ts
delim.timestamp=ts
```

delim.seqid

Specifies the name of the header field, JMS property, or system value that contains the `seqid` used to uniquely identify individual records. This value must increment and the last character must be the least significant.

```
delim.seqid={field-name}|${jms-property}|*seqid
```

Where: `field-name` indicates the name of a header field containing the seqid

`jms-property` uses the value of the specified JMS header property, a special value of this is $jmsid which uses the value returned by the mechanism chosen by the jms.id property

`seqid` indicates a simple continually incrementing 64-bit integer generated by the system

For example:

```
delim.seqid=$jmsid
```

delim.timestamp

Specifies the name of the JMS property, header field, or system value that contains the timestamp.

```
delim.timestamp={field-name}|${jms-property}|*ts
```

For example:

```
delim.timestamp=TIMESTAMP
delim.timestamp=$JMSTimeStamp
delim.timestamp=*ts
```

delim.timestamp.format

Specifies the format of the timestamp field.

```
delim.timestamp.format={format}
```

Where the format can include punctuation characters plus:

`YYYY` – four digit year

`YY` – two digit year

`M[M]` – one or two digit month

`D[D]` – one or two digit day

`HH` – hours in twenty four hour notation

`MI` – minutes

`SS` – seconds

`Fn` – n number of fractions

The default format is "`YYYY-MM-DD:HH:MI:SS.FFF`"

For example:

```
delim.timestamp.format=YYYY-MM-DD-HH.MI.SS
```

delim.txid

Specifies the name of the JMS property, header field, or system value that contains the `txid` used to uniquely identify transactions. This value must increment for each transaction.

```
delim.txid={field-name}|${jms-property}|*txid
```

For most cases using the system value of `*txid` is preferred.

For example:

```
delim.txid=$JMSTxId
delim.txid=*txid
```

delim.txowner

Specifies the name of the JMS property, header field, or static value that contains an arbitrary user name associated with a transaction. This value may be used to exclude certain transactions from processing. This is an optional property.

```
delim.txowner={field-name}|${jms-property}|”{value}”
```

For example:

```
delim.txowner=$MessageOwner
delim.txowner=”jsmith”
```

delim.txname

Specifies the name of the JMS property, header field, or static value that contains an arbitrary name to be associated with a transaction. This is an optional property.

```
delim.txname={field-name}|${jms-property}|”{value}”
```

For example:

```
delim.txname=”fixedtx”
```

delim.optype

Specifies the name of the JMS property or header field that contains the operation type. This is compared to the values for `delim.optype.insertval, delim.optype.updateval` and `delim.optype.deleteval` to determine the operation.

```
delim.optype={field-name}|${jms-property}
```

For example:

```
delim.optype=optype
```

delim.optype.insertval

This value identifies an insert operation. The default is I.

```
delim.optype.insertval={value}|\x{hex-value}
```

For example:

```
delim.optype.insertval=A
```

delim.optype.updateval

This value identifies an update operation. The default is U.

```
delim.optype.updateval={value}|\x{hex-value}
```

For example:

```
delim.optype.updateval=M
```

delim.optype.deleteval

This value identifies a delete operation. The default is `D`.

```
delim.optype.deleteval={value}|\x{hex-value}
```

For example:

```
delim.optype.deleteval=R
```

delim.schemaandtable

Specifies the name of the JMS property or header field that contains the schema and table name in the form `SCHEMA.TABLE`.

```
delim.schemaandtable={field-name}|${jms-property}
```

For example:

```
delim.schemaandtable=$FullTableName
```

delim.schema

Specifies the name of the JMS property, header field, or hard-coded value that contains the schema name.

```
delim.schema={field-name}|${jms-property}|”{value}”
```

For example:

```
delim.schema=”OGG”
```

delim.table

Specifies the name of the JMS property or header field that contains the table name.

```
delim.table={field-name}|${jms-property}
```

For example:

```
delim.table=TABLE_NAME
```

delim.txind

Specifies the name of the JMS property or header field that contains the transaction indicator to be validated against `beginval`, `middleval`, `endval` or `wholeval`. All operations within a single message will be seen as within one transaction if this property is not set. If it is set it determines the beginning, middle and end of transactions. Transactions defined in this way can span messages . This is an optional property.

```
delim.txind={field-name}|${jms-property}
```

For example:

```
delim.txind=txind
```

delim.txind.beginval

The value that identifies an operation as the beginning of a transaction. The default is `B`.

```
delim.txind.beginval={value}|\x{hex-value}
```

For example:

```
delim.txind.beginval=0
```

delim.txind.middleval

The value that identifies an operation as the middle of a transaction. The default is `M`.

```
delim.txind.middleval={value}|\x{hex-value}
```

For example:

```
delim.txind.middleval=1
```

delim.txind.endval

The value that identifies an operation as the end of a transaction. The default is `E`.

```
delim.txind.endval={value}|\x{hex-value}
```

For example:

```
delim.txind.endval=2
```

delim.txind.wholeval

The value that identifies an operation as a whole transaction. The default is `W`.

```
delim.txind.wholeval={value}|\x{hex-value}
```

For example:

```
delim.txind.wholeval=3
```

delim.fielddelim

Specifies the delimiter value used to separate fields (columns) in the data. This value is defined through characters or hexadecimal values:

```
delim.fielddelim={value}|\x{hex-value}
```

For example:

```
delim.fielddelim=,
delim.fielddelim=\xc7
```

delim.linedelim

Specifies the delimiter value used to separate lines (records) in the data. This value is defined using characters or hexadecimal values.

```
delim.linedelim={value}|\x{hex-value}
```

For example:

```
delim.linedelim=||
delim.linedelim=\x0a
```

delim.quote

Specifies the value used to identify quoted data. This value is defined using characters or hexadecimal values.

```
delim.quote={value}|\x{hex-value}
```

For example:

```
delim.quote=”
```

delim.nullindicator

Specifies the value used to identify NULL data. This value is defined using characters or hexadecimal values.

```
delim.nullindicator={value}|\x{hex-value}
```

For example:

```
delim.nullindicator=NULL
```

delim.fielddelim.escaped

Specifies the value that indicates a true field delimiter is present in data. This field delimiter is replaced with the `fielddelim.escaped` value.

```
delim.fielddelim.escaped={value}|\x{hex-value}
```

The following example specifies the comma as the field delimiter surrounded by the $ escape characters.

```
delim.fielddelim.escaped=$,$
```

delim.linedelim.escaped

Specifies the value that indicates a true line delimiter is present in data. This line delimiter is replaced with the `linedelim.escaped` value.

```
delim.linedelim.escaped={value}|\x{hex-value}
```

For example:

```
delim.linedelim.escaped=\x0affa0
```

delim.quote.escaped

Specifies the value that indicates a true quote is present in data. This quote value is replaced with the `quote.escaped` value.

```
delim.quote.escaped={value}|\x{hex-value}
```

For example:

```
delim.quote.escaped=””
```

delim.nullindicator.escaped

Specifies the value that indicates a true null indicator is present in data. This indicator is replaced with the `nullindicator.escaped` value.

```
delim.nullindicator.escaped={value}|\x{hex-value}
```

For example:

```
delim.nullindicator.escaped={NULL}
```

delim.hasbefores

Specifies whether before values are present in the data.

```
delim.hasbefores=true|false
```

The default is false. The parser expects to find before and after values of columns for all records if `delim.hasbefores` is set to true. The before values are used for updates and deletes, the after values for updates and inserts. The `afterfirst` property specifies whether the before images are before the after images or after them. If `delim.hasbefores` is false, then no before values are expected.

For example:

```
delim.hasbefores=true
```

delim.hasnames

Specifies whether column names are present in the data.

```
delim.hasnames=true|false
```

The default is false. If true, the parser expects to find column names for all records. The parser validates the column names against the expected column names. If false, no column names are expected.

For example:

```
delim.hasnames=true
```

delim.afterfirst

Specifies whether after values are positioned before or after the before values.

```
delim.afterfirst=true|false
```

The default is false. If true, the parser expects to find the after values before the before values. If false, the after values are before the before values.

For example:

```
delim.afterfirst=true
```

delim.isgrouped

Specifies whether the column names and before and after images should be expected grouped together for all columns or interleaved for each column.

```
delim.isgrouped=true|false
```

The default is false. If true, the parser expects find a group of column names (if `hasnames` is true), followed by a group of before values (if `hasbefores`), followed by a group of after values (the `afterfirst` setting will reverse the before and after value order). If false, the parser will expect to find a column name (if `hasnames`), before value (if `hasbefores`) and after value for each column.

For example:

```
delim.isgrouped=true
```

delim.dateformat

Specifies the date format for column data. The format used to parse the date is a subset of the formats used for `parser.timestamp.format`. This is specified at a global level, a table level or column level.

```
delim.dateformat={format}
delim.dateformat.{TABLE}={format}
delim.dateformat.{TABLE}.{COLUMN}={format}
```

Where: `format` is the format defined for `parser.timestamp.format`

`TABLE` is a fully qualified table name

`COLUMN` is a column of the specified table.

For example:

```
delim.dateformat=YYYY-MM-DD HH:MI:SS
delim.dateformat.MY.TABLE=DD/MM/YY-HH.MI.SS
delim.dateformat.MY.TABLE.EXP_DATE=YYMM
```

XML parser properties

The following properties are used by the XML parser.

xml.sourcedefs

Specifies the location of the source definitions file.

```
xml.sourcedefs={file-location}
```

For example:

```
xml.sourcedefs=dirdef/hrdemo.def
```

xml.rules

Specifies the list of XML rules for parsing a message and converting to transactions, operations and columns:

```
xml.rules={xml-rule-name}[, . . .]
```

The specified XML rules are processed in the order listed. All rules matching a particular XML document may result in the creation of transactions, operations and columns. The specified XML rules should be transaction or operation type rules.

For example:

```
xml.rules=dyntxrule, statoprule
```

{rulename}.type

Specifies the type of XML rule.

```
{rulename}.type=tx|op|col
```

Where: `tx` indicates a transaction rule

`op` indicates an operation rule

`col` indicates a column rule

For example:

```
dyntxrule.type=tx
statoprule.type=op
```

{rulename}.match

Specifies an XPath expression used to determine whether the rule is activated for a particular document or not.

```
{rulename}.match={xpath-expression}
```

If the XPath expression returns any nodes from the document, the rule matches and further processing occurs. If it does not return any nodes, the rule is ignored for that document.

The following example activates the `dyntxrule` if the document has a root element of `Transaction`

```
dyntxrule.match=/Transaction
```

Where `statoprule` is a subrule of `stattxtule`, the following example activates the `statoprule` if the parent rule's matching nodes have child elements of `NewMyTableEntry`.

```
statoprule.match=./NewMyTableEntry
```

{rulename}.subrules

Specifies a list of rule names to check for matches if the parent rule is activated by its match.

```
{rulename}.subrules={xml-rule-name}[, . . .]
```

The specified XML rules are processed in the order listed. All matching rules may result in the creation of transactions, operations and columns.

Valid subrules are determined by the parent type. Transaction rules can only have operation subrules. Operation rules can have operation or column subrules. Column rules cannot have subrules.

For example:

```
dyntxrule.subrules=dynoprule
statoprule.subrules=statkeycolrule, statcol1rule
```

{txrule}.timestamp

Controls the transaction timestamp by instructing the adapter to 1) use the transaction commit timestamp contained in a specified XPath expression or JMS property or 2) use the current system time. This is an optional property.

```
{txrule}.timestamp={xpath-expression}|${jms-property}|*ts
```

The timestamp for the transaction may be overridden at the operation level, or may only be present at the operation level. Any XPath expression must end with a value accessor such as `@att` or `text()`.

For example:

```
dyntxrule.timestamp=@ts
```

{txrule}.timestamp.format

Specifies the format of the timestamp field.

```
{txrule}.timestamp.format={format}
```

Where the format can include punctuation characters plus:

`YYYY` – four digit year

`YY` – two digit year

`M[M]` – one or two digit month

`D[D]` – one or two digit day

`HH` – hours in twenty four hour notation

`MI` – minutes

`SS` – seconds

`Fn` – n number of fractions

The default format is "`YYYY-MM-DD:HH:MI:SS.FFF`"

For example:

```
dyntxrule.timestamp.format=YYYY-MM-DD-HH.MI.SS
```

{txrule}.seqid

Specifies the `seqid` for a particular transaction. This can be used when there are multiple transactions per message. Determines the XPath expression, JMS property, or system value that contains the transactions `seqid`. Any XPath expression must end with a value accessor such as `@att` or `text()`.

```
{txrule}.seqid={xpath-expression}|${jms-property}|*seqid
```

For example:

```
dyntxrule.seqid=@seqid
```

{txrule}.txid

Specifies the XPath expression, JMS property, or system value that contains the `txid` used to unique identify transactions. This value must increment for each transaction.

```
{txrule}.txid={xpath-expression}|${jms-property}|*txid
```

For most cases using the system value of `*txid` is preferred.

For example:

```
dyntxrule.txid=$JMSTxId
dyntxrule.txid=*txid
```

{txrule}.txowner

Specifies the XPath expression, JMS property, or static value that contains an arbitrary user name associated with a transaction. This value may be used to exclude certain transactions from processing.

```
{txrule}.txowner={xpath-expression}|${jms-property}|"{value}"
```

For example:

```
dyntxrule.txowner=$MessageOwner
dyntxrule.txowner="jsmith"
```

{txrule}.txname

Specifies the XPath expression, JMS property, or static value that contains an arbitrary name to be associated with a transaction. This is an optional property.

```
{txrule}.txname={xpath-expression}|${jms-property}|"value"
```

For example:

```
dyntxrule.txname="fixedtx"
```

{oprule}.timestamp

Controls the operation timestamp by instructing the adapter to 1) use the transaction commit timestamp contained in a specified XPath expression or JMS property or 2) use the current system time. This is an optional property.

```
{oprule}.timestamp={xpath-expression}|${jms-property}|*ts
```

The timestamp for the operation will override a timestamp at the transaction level.

Any XPath expression must end with a value accessor such as `@att` or `text()`.

For example:

```
statoprule.timestamp=./CreateTime/text()
```

{oprule}.timestamp.format

Specifies the format of the timestamp field.

```
{oprule}.timestamp.format={format}
```

Where the format can include punctuation characters plus:

`YYYY` – four digit year

`YY` – two digit year

`M[M]` – one or two digit month

`D[D]` – one or two digit day

`HH` – hours in twenty four hour notation

`MI` – minutes

`SS` – seconds

`Fn` – n number of fractions

The default format is "`YYYY-MM-DD:HH:MI:SS.FFF`"

For example:

```
statoprule.timestamp.format=YYYY-MM-DD-HH.MI.SS
```

{oprule}.seqid

Specifies the `seqid` for a particular operation. Use the XPath expression, JMS property, or system value that contains the operation `seqid`. This overrides any `seqid` defined in parent transaction rules. Must be present if there is no parent transaction rule. This is an optional property.

Any XPath expression must end with a value accessor such as `@att` or `text()`.

```
{oprule}.seqid={xpath-expression}|${jms-property}|*seqid
```

For example:

```
dynoprule.seqid=@seqid
```

{oprule}.txid

Specifies the XPath expression, JMS property, or system value that contains the `txid` used to uniquely identify transactions. This overrides any `txid` defined in parent transaction rules and is required if there is no parent transaction rule. The value must be incremented for each transaction. This is an optional property.

```
{oprule}.txid={xpath-expression}|${jms-property}|*txid
```

For most cases using the system value of `*txid` is preferred.

For example:

```
dynoprule.txid=$JMSTxId
dynoprule.txid=*txid
```

{oprule}.txowner

Specifies the XPath expression, JMS property, or static value that contains an arbitrary user name associated with a transaction. This value may be used to exclude certain transactions from processing. This is an optional property.

```
{oprule}.txowner={xpath-expression}|${jms-property}|"{value}"
```

For example:

```
dynoprule.txowner=$MessageOwner
dynoprule.txowner="jsmith"
```

{oprule}.txname

Specifies the XPath expression, JMS property, or static value that contains an arbitrary name to be associated with a transaction. This is an optional property.

```
{oprule}.txname={xpath-expression}|${jms-property}|"{value}"
```

For example:

```
dynoprule.txname="fixedtx"
```

{oprule}.schemandtable

Specifies the XPath expression JMS property or hard-coded value that contains the schema and table name in the form `SCHEMA.TABLE`. Any XPath expression must end with a value accessor such as `@att` or `text()`. The value is verified to ensure the table exists in the source definitions.

```
{oprule}.schemaandtable={xpath-expression}|${jms-property}|"{value}"
```

For example:

```
statoprule.schemaandtable="MY.TABLE"
```

{oprule}.schema

Specifies the XPath expression, JMS property or hard-coded value that contains the schema name. Any XPath expression must end with a value accessor such as `@att` or `text()`.

```
{oprule}.schema={xpath-expression}|${jms-property}|"value"
```

For example:

```
statoprule.schema=@schema
```

{oprule}.table

Specifies the XPath expression, JMS property or hard-coded value that contains the table name. Any XPath expression must end with a value accessor such as `@att` or `text()`.

```
{oprule}.table={xpath-expression}|${jms-property}|"value"
```

For example:

```
statoprule.table=$TableName
```

{oprule}.optype

Specifies the XPath expression, JMS property or literal value that contains the optype to be validated against an optype `insertval`, etc. Any XPath expression must end with a value accessor such as `@att` or `text()`.

```
{oprule}.optype={xpath-expression}|${jms-property}|"value"
```

For example:

```
dynoprule.optype=@type
statoprule.optype="I"
```

{oprule}.optype.insertval

Specifies the value that identifies an insert operation. The default is `I`.

```
{oprule}.optype.insertval={value}|\x{hex-value}
```

For example:

```
dynoprule.optype.insertval=A
```

{oprule}.optype.updateval

Specifies the value that identifies an update operation. The default is `U`.

```
{oprule}.optype.updateval={value}|\x{hex-value}
```

For example:

```
dynoprule.optype.updateval=M
```

{oprule}.optype.deleteval

Specifies the value that identifies a delete operation. The default is `D`.

```
{oprule}.optype.deleteval={value}|\x{hex-value}
```

For example:

```
dynoprule.optype.deleteval=R
```

{oprule}.txind

Specifies the XPath expression or JMS property that contains the transaction indicator to be validated against `beginval` or other value that identifies the position within the transaction. All operations within a single message are regarded as occurring within a whole transaction if this property is not defined. Specifies the begin, middle and end of transactions. Any XPath expression must end with a value accessor such as `@att` or `text()`. Transactions defined in this way can span messages. This is an optional property.

```
{oprule}.txind={xpath-expression}|${jms-property}
```

For example:

```
dynoprule.txind=@txind
```

{oprule}.txind.beginval

Specifies the value that identifies an operation as the beginning of a transaction. The default is `B`.

```
{oprule}.txind.beginval={value}|\x{hex-value}
```

For example:

```
dynoprule.txind.beginval=0
```

{oprule}.txind.middleval

Specifies the value that identifies an operation as the middle of a transaction. The default is `M`.

```
{oprule}.txind.middleval={value}|\x{hex-value}
```

For example:

```
dynoprule.txind.middleval=1
```

{oprule}.txind.endval

Specifies the value that identifies an operation as the end of a transaction. The default is `E`.

```
{oprule}.txind.endval={value}|\x{hex-value}
```

For example:

```
dynoprule.txind.endval=2
```

{oprule}.txind.wholeval

Specifies the value that identifies an operation as a whole transaction. The default is `W`.

```
{oprule}.txind.wholeval={value}|\x{hex-value}
```

For example:

```
dynoprule.txind.wholeval=3
```

{colrule}.name

Specifies the XPath expression or hard-coded value that contains a column name. The column index must be specified if this is not and the column name will be resolved from that. If specified the column name will be verified against the source definitions file. Any XPath expression must end with a value accessor such as `@att` or `text()`.

```
{colrule}.name={xpath-expression}|”value”
```

For example:

```
dyncolrule.name=@name
statkeycolrule.name=”keycol”
```

{colrule}.index

Specifies the XPath expression or hard-coded value that contains a column index. If not specified then the column name must be specified and the column index will be resolved from that. If specified the column index will be verified against the source definitions file. Any XPath expression must end with a value accessor such as `@att` or `text()`.

```
{colrule}.index={xpath-expression}|”value”
```

For example:

```
dyncolrule.index=@index
statkeycolrule.index=1
```

{colrule}.value

Specifies the XPath expression or hard-coded value that contains a column value. Any XPath expression must end with a value accessor such as `@att` or `text()`. If the XPath expression fails to return any data because a node or attribute does not exist, the column value will be deemed as null. To differentiate between null and missing values (for updates) the `isnull` and `ismissing` properties should be set. The value returned is used for delete before values, and update/insert after values.

```
{colrule}.value={xpath-expression}|"value"
```

For example:

```
statkeycolrule.value=./text()
```

{colrule}.isnull

Specifies the XPath expression used to discover if a column value is null. The XPath expression must end with a value accessor such as `@att` or `text()`. If the XPath expression returns any value, the column value is null. This is an optional property.

```
{colrule}.isnull={xpath-expression}
```

For example:

```
dyncolrule.isnull=@isnull
```

{colrule}.ismissing

Specifies the XPath expression used to discover if a column value is missing. The XPath expression must end with a value accessor such as `@att` or `text()`. If the XPath expression returns any value, then the column value is missing. This is an optional property.

```
{colrule}.ismissing={xpath-expression}
```

For example:

```
dyncolrule.ismissing=./missing
```

{colrule}.before.value

Overrides `{colrule}.value` to specifically say how to obtain before values used for updates or deletes. This has the same format as `{colrule}.value`. This is an optional property.

For example:

```
dyncolrule.before.value=./beforevalue/text()
```

{colrule}.before.isnull

Overrides `{colrule}.isnull` to specifically say how to determine if a before value is null for updates or deletes. This has the same format as `{colrule}.isnull`. This is an optional property.

For example:

```
dyncolrule.before.isnull=./beforevalue/@isnull
```

{colrule}.before.ismissing

Overrides `{colrule}.ismissing` to specifically say how to determine if a before value is missing for updates or deletes. This has the same format as `{colrule}.ismissing`. This is an optional property.

For example:

```
dyncolrule.before.ismissing=./beforevalue/missing
```

{colrule}.after.value

Overrides {*colrule*}`.value` to specifically say how to obtain after values used for updates or deletes. This has the same format as {*colrule*}`.value`. This is an optional property.

For example:

```
dyncolrule.after.value=./aftervalue/text()
```

{colrule}.after.isnull

Overrides {*colrule*}`.isnull` to specifically say how to determine if an after value is null for updates or deletes. This has the same format as {*colrule*}`.isnull`. This is an optional property.

For example:

```
dyncolrule.after.isnull=./aftervalue/@isnull
```

{colrule}.after.ismissing

Overrides {*colrule*}`.ismissing` to specifically say how to determine if an after value is missing for updates or deletes. This has the same format as {*colrule*}`.ismissing`. This is an optional property.

For example:

```
dyncolrule.after.ismissing=./aftervalue/missing
```

CHAPTER 6
UE: Configuring for Message Delivery

To configure the adapter for delivering messages, you must set up the properties in the user exit properties file, configure an Extract as a data pump to run the user exit, and identify the built-in or custom event handlers you will use.

Configure the JRE in the user exit properties file

Modify the user exit properties file to point to the location of the Oracle GoldenGate for Java main jar (ggjava.jar) and set any additional JVM runtime boot options as required (these are passed directly to the JVM at startup):

```
javawriter.bootoptions=-Djava.class.path=ggjava/ggjava.jar
-Dlog4j.configuration=log4j.properties -Xmx512m
```

Note the following options in particular:

- java.class.path can include any custom jars in addition to the core application (ggjava.jar). The current directory (.) is included by default in the classpath. You can reference files relative to the Oracle GoldenGate install directory, to allow storing Java property files, Velocity templates and other classpath resources in the dirprm directory. It is also possible to append to the classpath in the Java application properties file.
- The log4j.configuration option specifies a log4j properties file, found in the classpath. There are pre-configured default log4j settings for basic logging (log4j.properties), debug logging (debug-log4j.properties), and detailed trace-level logging (trace-log4j.properties), found in the resources/classes directory.

Once the user exit properties file is correctly configured for your system, it usually remains unchanged. See “User exit properties” on page 70 for additional configuration options.

Configure a data pump to run the user exit

The user exit Extract is configured as a data pump. The data pump consumes a local trail (for example `dirdat/aa`) and sends the data to the user exit. The user exit is responsible for processing all the data.

An example of adding a data pump Extract:

```
ADD EXTRACT javaue, EXTTRAILSOURCE ./dirdat/aa
```

The process names and trail names used above can be replaced with any valid name.

Process names must be 8 characters or less, trail names must to be two characters. In the user exit Extract parameter file (javaue.prm) specify the location of the user exit library.

Table 2 User exit Extract parameters

Parameter	Explanation
`EXTRACT javaue`	All Extract parameter files start with the Extract name
`SOURCEDEFS ./dirdef/tcust.def`	The Extract process requires metadata describing the trail data. This can come from a database or a source definitions file. This metadata defines the column names and data types in the trail being read (./dirdat/aa).
`SETENV (GGS_USEREXIT_CONF = "dirprm/javaue.properties")`	(Optional) An absolute or relative path (relative to the Extract executable) to the properties file for the C user exit library. The default value is javawriter.properties in the same directory as Extract.
`SETENV (GGS_JAVAUSEREXIT_CONF = "dirprm/javaue.properties")`	(Optional) The Java properties.This example places the properties file in the dirpm directory.
`CUSEREXIT ggjava_ue.dll CUSEREXIT PASSTHRU INCLUDEUPDATEBEFORES`	The `CUSEREXIT` parameter includes the following: ◆ The location of the user exit library. For UNIX, the library would be suffixed `.so` ◆ `CUSEREXIT` - the callback function name that must be uppercase. ◆ `PASSTHRU` - avoids the need for a dummy target trail. ◆ `INCLUDEUPDATEBEFORES` - needed for transaction integrity.
`TABLE schema.*;`	The tables to pass to the User Exit; tables not included will be skipped. *No filtering* may be done in the user exit Extract; otherwise transaction markers will be missed. You can filter in the primary Extract, or use another, upstream data pump, or filter data directly in the Java application.

The two environment properties shown above are optional, but useful. For example, these allow you to place all your properties files in the dirprm directory instead of the default locations:

- `SETENV (GGS_USEREXIT_CONF = "dirprm/javaue.properties")`

  This changes the default configuration file used for the User Exit shared library. The value given is either an absolute path, or a path relative to Extract (or Replicat). The default file used is javawriter.properties, located in the same directory as Extract. The example above uses a relative path to put this property file in the dirprm directory.

- `SETENV (GGS_JAVAUSEREXIT_CONF = "dirprm/javaue.properties")`

  This changes the default properties file used for the Oracle GoldenGate for Java framework. The value found is a path to a file found in the classpath or in a normal file system path.

Configure the Java handlers

The Oracle GoldenGate Java API has a property file used to configure active event handlers. To test the configuration, you may use the built-in file handler. Here are some example properties, followed by explanations of the properties (comment lines start with #):

```
# the list of active handlers
gg.handlerlist=myhandler
# set properties on 'myhandler'
gg.handler.myhandler.type=file
gg.handler.myhandler.format=tx2xml.vm
gg.handler.myhandler.file=output.xml
```

This property file declares the following:

- Active event handlers. In the example a single event handler is active, called `myhandler`. Multiple handlers may be specified, separated by commas. For example: `gg.handlerlist=myhandler, yourhandler`
- Configuration of the handlers. In the example myhandler is declared to be a `file` type of handler: `gg.handler.myhandler.type=file`

  NOTE See the documentation for each type of handler (e.g. the JMS handler or the File writer handler) for the list of valid properties that may be set.

- The format of the output is defined by the Velocity template `tx2xml.vm`. You may specify your own custom template to define the message format; just specify the path to your template relative to the Java classpath (this is discussed later).

This property file is actually a complete example that will write captured transactions to the output file output.xml. Other handler types can be specified using the key words: **jms_text** (or **jms**), **jms_map**, **singlefile** (a file that does not roll), and others. Custom handlers can be implemented, in which case the type would be the fully qualified name of the Java class for the handler.

CHAPTER 7
UE: Running the User Exit

This section assumes that the primary Extract has already generated a trail to be consumed by the user exit Extract.

Starting the application

To run the user exit and execute the Java application, you only need an existing trail file and its corresponding source definitions file. For the examples that follow, a simple `TCUSTMER` and `TCUSTORD` trail is used (matching the demo SQL provided with the Oracle GoldenGate software download), along with a source definitions file defining the data types used in the trail.

NOTE The user exit does not require access to a database in order to run. But the Extract process does require metadata describing the trail data. Either the Extract must login to a database for metadata, or a source definitions file can be provided. In either case, the Extract cannot be in `PASSTHRU` mode when using a user exit.

To run the user exit, simply start the Extract process from GGSCI:

```
GGSCI> START EXTRACT javaue
GGSCI> INFO EXTRACT javaue
```

The `INFO` command will return information similar to the following:

```
EXTRACT JAVAUE Last Started 2011-08-25 18:41 Status RUNNING
Checkpoint Lag 00:00:00 (updated 00:00:00 ago)
Log Read Checkpoint File ./dirdat/bb000000
2011-09-24 12:52:58.000000 RBA 2702
```

If the Extract process is running and the file handler is being used (as in the example above), then you should see the output file `output.xml` in the Oracle GoldenGate installation directory (the same directory as the Extract executable).

If the process does not start or abends, see “Checking for Errors” on page 89:

Restarting the application at the beginning of a trail

There are two checkpoints for an Extract running the user exit: the user exit checkpoint and the Extract checkpoint. Before rerunning the Extract, you must reset both checkpoints:

1. Delete the user exit checkpoint file.

The sample properties file has `goldengate.userexit.chkptprefix=JAVAUE_` in the user exit properties file.

Windows: `cmd> del JAVAUE_javawriter.chkpt`

UNIX: `$ rm JAVAUE_javawriter.chkpt`

NOTE Do not modify checkpoints or delete the user exit checkpoint file on a production system.

2. Reset the Extract to the beginning of the trail data:

```
GGSCI> ALTER EXTRACT JAVAUE, EXTSEQNO 0, EXTRBA 0
```

3. Restart the Extract:

```
GGSCI> START JAVAUE
GGSCI> INFO JAVAUE

EXTRACT    JAVAUE    Last Started 2011-08-25 18:41   Status RUNNING
Checkpoint Lag       00:00:00 (updated 00:00:00 ago)
Log Read Checkpoint  File ./dirdat/ps000000
                     2011-09-24 12:52:58.000000  RBA 2702
```

It may take a few seconds for the Extract process status to report itself as running. Check the report file to see if it abended or is still in the process of starting:

```
GGSCI> VIEW REPORT JAVAUE
```

CHAPTER 8
UE: Configuring Event Handlers

Specifying event handlers

Processing transaction, operation and metadata events in Java works as follows:

- The Oracle GoldenGate Extract reads local trail data and passes the transactions, operations and database metadata to the user exit. Metadata can come from either a source definitions file or by querying the database.
- Events are fired by the Java framework, optionally filtered by custom Event Filters.
- Handlers (event listeners) process these events, and process the transactions, operations and metadata. Custom formatters may be applied for certain types of targets.

There are several existing handlers:

- A message handler to send to a JMS provider using either a MapMessage, or using a TextMessage with customizable formatters.
- A specialized message handler to send JMS messages to Oracle Advanced Queuing (AQ).
- A filewriter handler, for writing to a single file, or a rolling file.

NOTE The filewriter handler is particularly useful as development utility, since the filewriter can take the exact same formatter as the JMS TextMessage handler. Using the filewriter provides a simple way to test and tune the formatters for JMS without actually sending the messages to JMS.

Event handlers can be configured using the main Java property file or they may optionally read in their own properties directly from yet another property file (depending on the handler implementation). Handler properties are set using the following syntax:

```
gg.handler.{name}.someproperty=somevalue
```

This will cause the property *someproperty* to be set to the value *somevalue* for the handler instance identified in the property file by `{name}`. This `{name}` is used in the property file to define active handlers and set their properties; it is user-defined.

Implementation note (for Java developers): Following the above example: when the handler is instantiated, the method void setSomeProperty(String value) will be called on the handler instance, passing in the String value *somevalue*. A JavaBean PropertyEditor may also be defined for the handler, in which case the string can be automatically converted to the appropriate type for the setter method. For example, in the Java application properties file, we may have the following:

```
# the list of active handlers: only two are active
gg.handlerlist=one, two

# set properties on 'one'
gg.handler.one.type=file
gg.handler.one.format=com.mycompany.MyFormatter
gg.handler.one.file=output.xml

# properties for handler 'two'
gg.handler.two.type=jms_text
gg.handler.two.format=com.mycompany.MyFormatter
gg.handler.two.properties=jboss.properties
# set properties for handler 'foo'; this handler is ignored
gg.handler.foo.type=com.mycompany.MyHandler
gg.handler.foo.someproperty=somevalue
```

The type identifies the handler class; the other properties depend on the type of handler created. If a separate properties file is used to initialize the handler (such as the JMS handlers), the properties file is found in the classpath. For example, if properties file is at: `{`*`gg_install_dir`*`}/dirprm/foo.properties`, then specify in the properties file as follows: `gg.handler.{`*`name`*`}.properties=foo.properties`.

JMS handler

The main Java property file identifies active handlers. The JMS handler may optionally use a separate property file for JMS-specific configuration. This allows more than one JMS handler to be configured to run at the same time.

There are examples included for several JMS providers (JBoss, TIBCO, Solace, ActiveMQ, WebLogic). For a specific JMS provider, you can choose the appropriate properties files as a starting point for your environment. Each JMS provider has slightly different settings, and your environment will have unique settings as well.

The installation directory for the Java jars (`ggjava`) contains the core application jars (`ggjava.jar`) and its dependencies in `resources/lib/*.jar`. The resources directory contains all dependencies and configuration, and is in the classpath.

If the JMS client jars already exist somewhere on the system, they can be referenced directly and added to the classpath without copying them.

There are four types of JMS handlers which may be specified:

- **jms** – sends text messages to a topic or queue. The messages may be formatted using Velocity templates or by writing a formatter in Java. The same formatters can be used for a `jms_text message` as for writing to files. (`jms_text` is a synonym for `jms`.)
- **aq** – sends text messages to Oracle Advanced Queuing (AQ). The `aq` handler is a `jms` handler configured for delivery to AQ. The messages can be formatted using Velocity temlates or a custom formatter.
- **jms_map** – sends a JMS MapMessage to a topic or queue. The `JMSType` of the message is set to the name of the table. The body of the message consists of the following metadata, followed by column name and column value pairs:
  - `GG_ID` – position of the record, uniquely identifies this operation
  - `GG_OPTYPE` – type of SQL (insert/update/delete),

- `GG_TABLE` – table name on which the operation occurred
- `GG_TIMESTAMP` – timestamp of the operation

File handler

The file handler is often used to verify the message format when the actual target is JMS, and the message format is being developed using custom Java or Velocity templates. Here is a property file using a file handler:

```
# one file handler active, using velocity template formatting
gg.handlerlist=myfile
gg.handler.myfile.type=file
gg.handler.myfile.rollover.size=5M
gg.handler.myfile.format=sample2xml.vm
gg.handler.myfile.file=output.xml
```

This example uses a single handler (though, a JMS handler and the file handler could be used at the same time), writing to a file called `output.xml`, using a velocity template called `sample2xml.vm`. The template is found via the classpath.

Custom handlers

For information on coding a custom handler, see "Coding a custom handler in Java" on page 85.

Formatting the output

As previously described, the existing JMS and file output handlers can be configured through the properties file. Each handler has its own specific properties that can be set: for example, the output file can be set for the file handler, and the JMS destination can be set for the JMS handler. Both of these handlers may also specify a custom formatter. The same formatter may be used for both handlers. As an alternative to writing Java code for custom formatting, a Velocity template may be specified. For further information, see "Custom formatting" on page 82.

Reporting

Summary statistics about the throughput and amount of data processed are generated when the Extract process stops. Additionally, statistics can be written periodically either after a specified amount of time or after a specified number of records have been processed. If both time and number of records are specified, then the report is generated for whichever event happens first. These statistical summaries are written to the Oracle GoldenGate report file and the user exit log files.

CHAPTER 9

UE: Message Delivery Properties

This section explains the options available for configuration of the property files for:

- **User exit properties**
- **Java application properties**

Place the property file in the `dirprm` directory of your Oracle GoldenGate installation location. The combined user exit and Java application properties file is set through the environmental variable:

```
SETENV (GGS_USEREXIT_CONF = "dirprm/javaue.properties")
```

Optionally, the java application properties and native user exit library properties can be in separate property files. To do this, set `GGS_USEREXIT_CONF` to the user exit property file and `GGS_JAVAUSEREXIT_CONF` to the Java application properties file.

All properties in the property file are of the form: `fully.qualified.name=value`. The value may be integer, boolean, single string, or comma delimited strings.

Comments can be entered in to the properties file with the # prefix at the beginning of the line. For example:

```
# This is a property comment
some.property=value
```

Properties themselves can also be commented out. However you cannot place a comment at the end of a line; either the whole line is a comment or it is a property.

User exit properties

The following properties set the log files and the characteristics of the logging.

Logging properties

Logging is controlled by the following properties.

log.logname

Specifies the prefix to the log file name. This must be a valid ASCII string. The log file name has the current date appended to it, in `yyyymmdd` format, together with the `.log` extension.

The following example will create a log file of name `writer_20100803.log` on August 3, 2010. The log file will roll over each day, independent of the stopping and starting of the process.

```
# log file prefix
log.logname=writer
```

The following example will create a log file of name `msgv_20100803.log` on August 3, 2010.

```
# log file prefix
log.logname=msgv
```

log.level

Specifies the overall log level for all modules. The syntax is:

```
log.level=ERROR|WARN|INFO|DEBUG
```

The log levels are defined as follows:

`ERROR` – Only write messages if errors occur

`WARN` – Write error and warning messages

`INFO` – Write error, warning and informational messages

`DEBUG` – Write all messages, including debug ones.

The default logging level is `INFO`. The messages in this case will be produced on startup, shutdown and periodically during operation. If the level is switched to `DEBUG`, large volumes of messages may occur which could impact performance. For example, the following sets the global logging level to `INFO`:

```
# global logging level
log.level=INFO
```

log.tostdout

Controls whether or not log information is written to standard out. This setting is useful if the Extract process is running with a VAM started from the command line or on an operating system where `stdout` is piped into the report file. Oracle GoldenGate processes generally run in the background, however.

The syntax is:

```
goldengate.log.tostdout=true|false
```

The default is `false`.

log.tofile

Controls whether or not log information is written to the specified log file.The syntax is:

```
log.tofile=true|false
```

The default is `false`. Log output is written to the specified log file when set to true.

log.modules, log.level.{module}

Specifies the log level of the individual source modules that comprise the user exit. This is typically used only for advanced debugging. It is possible to increase the logging level to `DEBUG` on a per module basis to help troubleshoot issues. The default levels should not be changed unless asked to do so by Oracle support.

General properties

The following properties apply to all writer type user exits and are not specific to the user exit.

goldengate.userexit.writers

Specifies the name of the writer. This is always `javawriter` and should not be modified.

For example:

```
goldengate.userexit.writers=javawriter
```

All other properties in the file should be prefixed by the writer name, javawriter.

goldengate.userexit.chkptprefix

Specifies a string value for the prefix added to the checkpoint file name. For example:

```
goldengate.userexit.chkptprefix=javaue_
```

goldengate.userexit.nochkpt

Disables or enables the user exit checkpoint file. The default is `false`, the checkpoint file is enabled. Set this property to `true` if transactions are supported and enabled on the target.

For example, if JMS is the target and JMS local transactions are enabled (the default), set `goldengate.userexit.nocheckpt=true` to disable the user exit checkpoint file. If JMS transactions are disabled by setting `localTx=false` on the handler, the user exit checkpoint file should be enabled by setting `goldengate.userexit.nochkpt=false`.

```
goldengate.userexit.nochkpt=true|false
```

goldengate.userexit.usetargetcols

Specifies whether or not mapping to target columns is allowed. The default is `false`, no target mapping.

```
goldengate.userexit.usetargetcols=true|false
```

JVM boot options

The following options configure the Java Runtime Environment. In particular, this is where the maximum memory the JVM can use is specified; if you see Java out-of-memory errors, edit these settings.

javawriter.bootoptions

Specifies the classpath and boot options that will be applied when the user exit starts up the JVM. The path needs colon (:) separators for UNIX/Linux and semicolons (;) for Windows. This is where to specify various options for the JVM, such as heap size and classpath; for example:

-Xms: initial java heap size

-Xmx: maximum java heap size

-Djava.class.path: classpath specifying location of at least the main application jar, `ggjava.jar`. Other jars, such as JMS provider jars, may also be specified here as well; alternatively, these may be specified in the Java application properties file.

-verbose:jni: run in verbose mode (for JNI)

For example (all on a single line):

```
javawriter.bootoptions= -Djava.class.path=ggjava/ggjava.jar
-Dlog4j.configuration=my-log4j.properties -Xmx512m
```

The log4j.configuration property could be a fully qualified URL to a log4j properties file; by default this file is searched for in the classpath. You may use your own log4j configuration, or one of the preconfigured log4j settings: `log4j.properties` (default level of logging), `debug_log4j.properties` (debug logging) or `trace_log4j.properties` (very verbose logging).

Statistics and reporting

The use of the user exit causes Extract to assume that the records handled by the exit are ignored. This causes the standard Oracle GoldenGate reporting to be incomplete. Oracle GoldenGate for Java adds its own reporting to handle this issue.

Statistics can be reported every `t` seconds or every `n` records - or if both are specified, whichever criteria is met first.

There are two sets of statistics recorded: those maintained by the User Exit shared library (on the C side) and those obtained from the Java libraries. The reports received from the Java side are formatted and returned by the individual handlers.

The User Exit statistics include the total number of operations, transactions and corresponding rates.

javawriter.stats.display

Controls the output of statistics to the Oracle GoldenGate report file and to the user exit log files.

The following example outputs these statistics.

```
javawriter.stats.display=true
```

javawriter.stats.full

Controls the output of statistics from the Java side, in addition to the statistics from the C side.

Java side statistics are more detailed but also involve some additional overhead, so if statistics are reported often and a less detailed summary is adequate, it is recommended that `stats.full` property is set to `false`.

The following example will output Java statistics in addition to C.

```
javawriter.stats.full=true
```

javawriter.stats.{time, numrecs}

Specifies a time interval in seconds or a number of records, after which statistics will be reported. The default is to report statistics every hour or every 10000 records (which ever occurs first).

For example, to report ever 10 minutes or every 1000 records, specify:

```
javawriter.stats.time=600
javawriter.stats.numrecs=1000
```

The Java application statistics are handler-dependent:

- For the all handlers, there is at least the total elapsed time, processing time, number of operations, transactions;
- For the JMS handler, there is additionally the total number of bytes received and sent.
- The report can be customized using a template.

Java application properties

The following defines the properties which may be set in the Java application property file.

Properties for all handlers

The following properties apply to all handlers.

gg.handlerlist

The handler list is a comma-separated list of active handlers. These values are used in the rest of the property file to configure the individual handlers. For example:

```
gg.handlerlist=name1, name2
gg.handler.name1.propertyA=value1
gg.handler.name1.propertyB=value2
gg.handler.name1.propertyC=value3
gg.handler.name2.propertyA=value1
gg.handler.name2.propertyB=value2
gg.handler.name2.propertyC=value3
```

Using the `handlerlist` property, you may include completely configured handlers in the property file and just disable them by removing them from the handlerlist.

gg.handler.{name}.type

The type of handler is either a predefined value for built-in handlers, or a fully qualified Java class name. The syntax is:

```
gg.handler.{name}.type=jms|jms_map|aq|singlefile|rolling|
{com.foo.MyHandler}
```

Where: All but the last are pre-defined handlers:

jms – sends transactions, operations, and metadata as formatted messages to a JMS provider

aq – sends transactions, operations, and metadata as formatted messages to Oracle Advanced Queuing (AQ).

jms_map – sends JMS map messages

singlefile – writes to a single file on disk, but does not roll the file

rolling – writes transactions, operations, and metadata to a file on disk, rolling the file over after a certain size or after a certain amount of time

custom Java class – any class extending the Oracle GoldenGate for Java AbstractHandler class may handle transaction/operation/metadata events.

Properties for formatted output

The following properties apply to all handlers capable of producing formatted output; this includes:

- The `jms_text handler` (but not the `jms_map handler`)
- The `aq` handler
- The `singlefile` and `rolling` handlers, for writing formatted output to files

gg.handler.{name}.format

Specifies the format used to transform operations and transactions into messages sent to JMS or to a file. The format is specified uniquely for each handler. The value may be:

- **Velocity template**
- **Java class name** (fully qualified - the class specified must be a type of formatter)
- **csv** for delimited values (such as comma-separated values; the delimiter can be customized)
- **fixed** for fixed-length fields
- **Built-in formatter**, such as:
  - `xml` – demo XML format (this format may change in future releases)
  - `xml2` – internal XML format (this format may change in future releases)

For example, to specify a custom Java class:

```
gg.handlerlist=abc
gg.handler.abc.format=com.mycompany.MyFormat
```

Or, for a Velocity template:

```
gg.handlerlist=xyz
gg.handler.xyz.format=path/to/sample.vm
```

If using templates, the file is found relative to some directory or jar that is in the classpath. By default, the Oracle GoldenGate install directory is in the classpath, so the above template could be placed in the `dirprm` directory of the Oracle GoldenGate installation location.

The default format is to use the built-in XML formatter.

gg.handler.{name}.includeTables

Specifies a list of tables to include by this handler. If the schema (or owner) of the table is specified, then only that schema matches the table name; otherwise, the table name matches any schema. A list of tables may be specified, commaseparated.

For example, to have the handler only process tables foo.customer and bar.orders:

```
gg.handler.myhandler.includeTables=foo.customer, bar.orders
```

NOTE In order to selectively process operations on a table by table basis, the handler must be processing in operation mode. If the handler is processing in transaction mode, then when a single transaction contains several operations spanning several tables, if any table matches the include list of tables, the transaction will be included.

gg.handler.{name}.excludeTables

Specifies a list of tables to exclude by this handler. If the schema (or owner) of the table is specified, then only that schema matches the table name; otherwise, the table name matches any schema. A list of tables may be specified, comma-separated. For example, to have the handler process all operations on all tables *except* table `date_modified` in all schemas:

```
gg.handler.myhandler.excludeTables=date_modified
```

gg.handler.{name}.mode, gg.handler .{name}.format.mode

Specifies whether to output one operation per message (op) or one transaction per message (`tx`). The default is op. Use `format.mode` when you have a custom formatter.

Properties for CSV and fixed-format output

If the handler is set to use either CSV or fixed-format output, the following properties may also be set. Many of the same properties apply for both formats; there is however no unique prefix to the property settings. If there is more than one handler requiring unique settings, these properties can be set in a separate properties file. For example, if there are two JMS handlers, each using CSV or fixed-format:

```
gg.handler.my_jms_handler1.type=jms_text
gg.handler.my_jms_handler1.format=csv
gg.handler.my_jms_handler1.properties=my-csv.properties
.
.
.
gg.handler.my_jms_handler2.type=jms_text
gg.handler.my_jms_handler2.format=fixed
gg.handler.my_jms_handler2.properties=my-fixed.properties
.
.
.
```

delim

Specifies the delimiter to use between fields (set to no value in order to have no delimiter used). For example:

```
delim=,
```

quote

Specifies the quote character to be used if column values are quoted. For example:

```
quote='
```

metacols

Specifies the metadata column values to appear at the beginning of the record, before any column data. Specify any of the following, in the order they should appear:

- **position** – unique position indicator of records in a trail
- **opcode** – `I`, `U`, or `D` for insert, update, or delete records (see: `insertChar`, `updateChar`, `deleteChar`)
- **txind** – transaction indicator – such as `0`=begin, `1`=middle, `2`=end, `3`=whole tx (see `beginTxChar`, `middleTxChar`, `endTxChar`, `wholeTxChar`)
- **opcount** – position of a record in a transaction, starting from 0
- **schema** – schema/owner of the table for the record
- **tableonly** – just table (no schema/owner)
- **table** – full name of table, schema.table
- **timestamp** – commit timestamp of record

For example:

```
metacols=opcode, table, txind, position
```

missingColumnChar, presentColumnChar, nullColumnChar

Specifies a special column prefix for columns values that are:

- **present** – column value exists in the trail and is non-NULL
- **missing** – column value not in trail; it is unknown if it has a value or is NULL. It was not captured from the source database transaction log.
- **null** – column value is set to NULL

The character used to represent these special states can be customized. By default, they are set to an empty string and do not show. For example:

```
missingColumnChar=M
presentColumnChar=P
nullColumnChar=N
```

beginTxChar, middleTxChar, endTxChar, wholeTxChar

Specifies the header metadata characters (see `metacols`) used to identify a record as the begin, middle, or end of a transaction. If one operation consists of a complete Tx, then it's a "whole" transaction. For example:

```
beginTxChar=B
middleTxChar=M
endTxChar=E
wholeTxChar=W
```

insertChar, updateChar, deleteChar

Specifies the characters to identify insert, update, and delete. By default, these are `I`, `U`, and `D`. For example, to use `INS`, `UPD`, and `DEL` instead of `I`, `U` and `D` for insert, update, and delete operations:

```
insertChar=INS
updateChar=UPD
deleteChar=DEL
```

endOfLine

Specifies the end-of-line character as:

- Native platform: `EOL`
- Neutral (UNIX-style \n): `CR`
- Windows (\r\n): `CRLF`

For example:

```
endOfLine=CR
```

justify

Specifies the left or right justification of fixed fields. For example:

```
justify=left
```

includeBefores

Controls whether before images should be included in the output. There must be before images in the trail. For example:

```
includeBefores=false
```

File writer properties

The following properties only apply to handlers that write their output to files: the file handler and the singlefile handler.

gg.handler.{name}.file

Specifies the name of the output file for the given handler. If the handler is a rolling file, this name is used to derive the rolled file names. The default file name is `output.xml`.

gg.handler.{name}.append

Controls whether the file should be appended to (`true`) or overwritten upon restart (`false`).

gg.handler.{name}.rolloverSize

If using the file handler, this specifies the size of the file before a rollover should be attempted. The file size will be at least this size, but will most likely be larger. Operations and transactions are not broken across files. The size is specified in bytes, but a suffix may be given to identify MB or KB. For example:

```
gg.handler.myfile.rolloverSize=5M
```

The default rollover size is `10 MB`.

JMS handler properties

The following properties apply to the JMS handlers. Some of these values may be defined in the Java application properties file using the name of the handler. Other properties may be placed into a separate JMS properties file, which is useful if using more than one JMS handler at a time. For example:

```
gg.handler.myjms.type=jms_text
gg.handler.myjms.format=xml
gg.handler.myjms.properties=weblogic.properties
```

Just as with Velocity templates and formatting property files, this additional JMS properties file is found in the classpath. The above properties file `weblogic.properties` would be found in {*`gg_install_dir`*}`/dirprm/weblogic.properties`, since the `dirprm` directory is included by default in the classpath.

Settings that can be made in the Java application properties file will override the corresponding value set in the supplemental JMS properties file (`weblogic.properties` in the example above). In the following example, the destination property is specified in the Java application properties file. This allows the same default connection information for the two handlers `myjms1` and `myjms2`, but customizes the target destination queue.

```
gg.handler.myjms1.type=jms_text
gg.handler.myjms1.destination=queue.sampleA
gg.handler.myjms1.format=sample.vm
gg.handler.myjms1.properties=tibco-default.properties
gg.handler.myjms2.type=jms_map
gg.handler.myjms2.destination=queue.sampleB
gg.handler.myjms2.properties=tibco-default.properties
```

To set a property, specify the handler name as a prefix; for example:

```
gg.handlerlist=sample,sample2
gg.handler.sample.type=jms_text
gg.handler.sample.format=my_template.vm
gg.handler.sample.destination=gg.myqueue
gg.handler.sample.queueortopic=queue
gg.handler.sample.connectionUrl=tcp://host:61616?jms.useAsyncSend=true
gg.handler.sample.useJndi=false
gg.handler.sample.connectionFactory=ConnectionFactory
gg.handler.sample.connectionFactoryClass=\
   org.apache.activemq.ActiveMQConnectionFactory
gg.handler.sample.connection.Url=
tcp://localhost:61616?jms.useAsyncSend=true
gg.handler.sample.timeToLive=50000
```

Standard JMS settings

The following outlines the JMS properties which may be set, and the accepted values. These apply for both JMS handler types: `jms_text` (TextMessage) and `jms_map` (MapMessage).

gg.handler.{name}.destination

The queue or topic to which the message is sent. This must be correctly configured on the JMS server. Typical values may be: `queue/A`, `queue.Test`, `example.MyTopic`, etc.

gg.handler.{name}.user

User name required to send messages to the JMS server (optional)

gg.handler.{name}.password

Password required to send messages to the JMS server (optional)

gg.handler.{name}.queueOrTopic

Whether the handler is sending to a queue (a single receiver) or a topic (publish / subscribe). This must be correctly configured in the JMS provider. The syntax is:

```
gg.handler.{name}.queueOrTopic=queue|topic
```

Where: **queue** – a message is removed from the queue once it has been read.

topic – messages are published and may be delivered to multiple subscribers.

gg.handler.{name}.persistent

If the delivery mode is set to persistent or not. If the messages are to be persistent, the JMS provider must be configured to log the message to stable storage as part of the client's send operation. The syntax is:

```
gg.handler.{name}.persistent=true|false
```

gg.handler.{name}.priority

JMS defines a 10 level priority value, with 0 as the lowest and 9 as the highest. Clients should consider 04 as gradients of normal priority and 59 as gradients of expedited priority. Priority is set to 4, by default.

gg.handler.{name}.timeToLive

The default length of time in milliseconds from its dispatch time that a produced message should be retained by the message system. Time to live is set to zero by default (zero is unlimited).

gg.handler.{name}.connectionFactory

Name of the connection factory to lookup via JNDI

gg.handler.{name}.useJndi

If `usejndi` is `false`, then JNDI is not used to configure the JMS client. Instead, factories and connections are explicitly constructed. The syntax is:

```
gg.handler.{name}.useJndi=true|false
```

gg.handler.{name}.connectionUrl

Connection Url used only when usejndi=false, to explicitly create the connection.

gg.handler.{name}.connection.FactoryClass

The ConnectionFactoryClass that is only used if `usejndi=false`. When not relying on JNDI to access a factory, the value of this property is the Java classname to instantiate, constructing a factory object explicitly.

gg.handler.{name}.localTX

If set to `false`, then local transactions are not used.

gg.handlerlist.nop

In addition to the other JMS properties, there is a debug “nop” property that can be globally set to disable the sending of the JMS messages altogether. This is only used for testing purposes. The events are still generated and handled and the message is constructed. This can be used to test the performance of the message generation. It can be set to `true` or `false` (the default is `false`). For example:

```
gg.handlerlist.nop=true
```

JNDI properties

These JNDI properties are required for connection to an Initial Context to look up the connection factory and destination

```
java.naming.provider.url={url}
java.naming.factory.initial={java-class-name}
```

If JNDI security is enabled, the following properties may be set:

```
java.naming.security.principal={user-name}
java.naming.security.credentials={password-or-other-authenticator}
```

For example:

```
java.naming.provider.url= t3://localhost:7001
java.naming.factory.initial=weblogic.jndi.WLInitialContextFactory
java.naming.security.principal=jndiuser
java.naming.security.credentials=jndipw
```

General properties

The following are general properties that are used for the user exit Java framework.

gg.classpath

Specifies additional directories or jars to add to classpath.

gg.report.format

Specifies the template to use for customizing the report format.

CHAPTER 10

UE: Developing Custom Filters, Formatters and Handlers

You can write Java code to implement an event filter, a custom formatter for a built-in handler, or a custom event handler. You can also specify custom formatting through a Velocity template.

Filtering events

By default, all transactions, operations and metadata events are passed to the `DataSourceListener` event handlers. An event filter can be implemented to filter the events sent to the handlers. The filter could select certain operations on certain tables containing certain column values, for example

Filters are additive: if more than one filter is set for a handler, then all filters must return true in order for the event to be passed to the handler.

You can configure filters using the Java application properties file:

```
# handler “foo” only receives certain events
gg.handler.one.type=jms
gg.handler.one.format=mytemplate.vm
gg.handler.one.filter=com.mycompany.MyFilter
```

To activate the filter, you write the filter and set it on the handler; no additional logic needs to be added to specific handlers.

Custom formatting

You can customize the output format of a built-in handler by:

- Writing a custom formatter in Java or
- Using a Velocity template

Coding a custom formatter in Java

The earlier examples show a JMS handler and a file output handler using the same formatter (`com.mycompany.MyFormatter`). The following is an example of how this formatter may be implemented:

```
package com.mycompany.MyFormatter;

import com.goldengate.atg.datasource.DsOperation;
import com.goldengate.atg.datasource.DsTransaction;
import com.goldengate.atg.datasource.format.DsFormatterAdapter;
import com.goldengate.atg.datasource.meta.ColumnMetaData;
import com.goldengate.atg.datasource.meta.DsMetaData;
import com.goldengate.atg.datasource.meta.TableMetaData;
import java.io.PrintWriter;

public class MyFormatter extends DsFormatterAdapter {
   public MyFormatter() { }

   @Override
   public void formatTx(DsTransaction tx,
            DsMetaData meta,
            PrintWriter out)
   {
      out.print("Transaction: " );
      out.print("numOps=\'" + tx.getSize() + "\' " );
      out.println("ts=\'" + tx.getStartTxTimeAsString() + "\'");

      for(DsOperation op: tx.getOperations()) {
         TableName currTable = op.getTableName();
         TableMetaData tMeta = dbMeta.getTableMetaData(currTable);
         String opType = op.getOperationType().toString();
         String table = tMeta.getTableName().getFullName();
         out.println(opType + " on table \"" + table + "\":" );
         int colNum = 0;
         for(DsColumn col: op.getColumns())
         {
            ColumnMetaData cMeta = tMeta.getColumnMetaData( colNum++ );
            out.println(
            cMeta.getColumnName() + " = " + col.getAfterValue() );
         }
   }

   @Override
   public void formatOp(DsTransaction tx,
            DsOperation op,
            TableMetaData tMeta,
            PrintWriter out)
   {
      // not used...
   }
}
```

The formatter defines methods for either formatting complete transactions (after they are committed) or individual operations (as they are received, before the commit). If the formatter is in operation mode, then `formatOp`(...) is called; otherwise, `formatTx`(...) is called at transaction commit.

To compile and use this custom formatter, include the Oracle GoldenGate for Java jars in the classpath and place the compiled .class files in `{gg_install_dir}/dirprm`:

```
javac -d {gg_install_dir}/dirprm
-classpath ggjava/ggjava.jar MyFormatter.java
```

The resulting class files are located in `resources/classes` (in correct package structure):

```
{gg_install_dir}/dirprm/com/mycompany/MyFormatter.class
```

Alternatively, the custom classes can be put into a jar; in this case, either include the jar file in the JVM classpath via the user exit properties (using `java.class.path` in the `javawriter.bootoptions` property), or by setting the Java application properties file to include your custom jar:

```
# set properties on 'one'
gg.handler.one.type=file
gg.handler.one.format=com.mycompany.MyFormatter
gg.handler.one.file=output.xml
gg.classpath=/path/to/my.jar,/path/to/directory/of/jars/*
```

Using a Velocity template

As an alternative to writing Java code for custom formatting, Velocity templates can be a good alternative to quickly prototype formatters. For example, the following template could be specified as the format of a JMS or file handler:

```
Transaction: numOps='$tx.size' ts='$tx.timestamp'
#for each( $op in $tx )
operation: $op.sqlType, on table "$op.tableName":
#for each( $col in $op )
$op.tableName, $col.meta.columnName = $col.value
#end
#end
```

If the template were named sample.vm, it could be placed in the classpath, for example:

```
{gg_install_dir}/dirprm/sample.vm
```

NOTE If using Velocity templates, the file name must end with the suffix .vm; otherwise the formatter is presumed to be a Java class.

Update the Java application properties file to use the template:

```
# set properties on 'one'
gg.handler.one.type=file
gg.handler.one.format=sample.vm
gg.handler.one.file=output.xml
```

When modifying templates, there is no need to recompile any Java source; simply save the template and re-run the Java application. When the application is run, the following output would be generated (assuming a table named `SCHEMA.SOMETABLE`, with columns `TESTCOLA` and `TESTCOLB`):

```
Transaction: numOps='3' ts='2008-12-31 12:34:56.000'
operation: UPDATE, on table "SCHEMA.SOMETABLE":
SCHEMA.SOMETABLE, TESTCOLA = value 123
SCHEMA.SOMETABLE, TESTCOLB = value abc
operation: UPDATE, on table "SCHEMA.SOMETABLE":
SCHEMA.SOMETABLE, TESTCOLA = value 456
SCHEMA.SOMETABLE, TESTCOLB = value def
operation: UPDATE, on table "SCHEMA.SOMETABLE":
SCHEMA.SOMETABLE, TESTCOLA = value 789
SCHEMA.SOMETABLE, TESTCOLB = value ghi
```

Coding a custom handler in Java

A custom handler can be implemented by extending `AbstractHandler`:

```
import com.goldengate.atg.datasource.*;
import static com.goldengate.atg.datasource.GGDataSource.Status;

public class SampleHandler extends AbstractHandler {

   @Override
   public void init(DsConfiguration conf, DsMetaData metaData) {
      super.init(conf, metaData);
      // ... do additional config...
   }

   @Override
   public Status operationAdded(DsEvent e, DsTransaction tx, DsOperation
   op) { ... }

   @Override
   public Status transactionCommit(DsEvent e, DsTransaction tx) { ... }

   @Override
   public Status metaDataChanged(DsEvent e, DsMetaData meta) { .... }

   @Override
   public void destroy() { /* ... do cleanup ... */ }

   @Override
   public String reportStatus() { return "status report..."; }
}
```

When a transaction is processed from the Extract, the order of calls into the handler is as follows:

1. Initialization:
   - First, the handler is constructed.
   - Next, all the "setters" are called on the instance with values from the property file.
   - Finally, the handler is initialized; the `init(...)` method is called before any transactions are received. It is important that the `init(...)` method call `super.init(...)` to properly initialize the base class.

2. Metadata is received. If the user exit is processing an operation on a table not yet seen during this run, a metadata event is fired, and the `metadataChanged(...)` method is called. Typically, there is no need to implement this method. The `DsMetaData` is automatically updated with new data source metadata as it is received.
3. A transaction is started. A transaction event is fired, causing the `transactionBegin(...)` method on the handler to be invoked (not shown). This is typically not used, since the transaction has zero operations at this point.
4. Operations are added to the transaction, one after another. This causes the `operationAdded(...)` method to be called on the handler for each operation added. The containing transaction is also passed into the method, along with the data source metadata (containing all table metadata seen thus far). Note that the transaction has not yet been committed, and could be aborted before the commit is received.

   Each operation contains the column values from the transaction (possibly just the changed values, if Extract is processing with compressed updates.) The column values may contain both before and after values.
5. The transaction is committed. This causes the `transactionCommit(...)` method to be called.
6. Periodically, `reportStatus` may be called; it is also called at process shutdown. Typically, this displays the statistics from processing (number of operations/transactions processed, etc).

Below is a complete example of a simple printer handler, which just prints out very basic event information for transactions, operations and metadata. Note that the handler also has a property `myoutput` for setting the output file name; this can be set in the Java application properties file as follows:

```
gg.handlerlist=sample
# set properties on 'sample'
gg.handler.sample.type=sample.SampleHandler
gg.handler.sample.myoutput=out.txt
```

To use the custom handler,

1. Compile the class
2. Include the class in the application classpath,
3. Add the handler to the list of active handlers in the Java application properties file.

To compile the handler, include the Oracle GoldenGate for Java jars in the classpath and place the compiled .class files in `{gg_install_dir}/javaue/resources/classes`:

```
javac -d {gg_install_dir}/dirprm
-classpath ggjava/ggjava.jar SampleHandler.java
```

The resulting class files would be located in `resources/classes`, in correct package structure, such as:

```
{gg_install_dir}/dirprm/sample/SampleHandler.class
```

NOTE For any Java application development beyond "hello world" examples, either Ant or Maven would be used to compile, test and package the application. The examples showing javac are for illustration purposes only.

Alternatively, custom classes can be put into a jar and included in the classpath. Either include the custom jar file(s) in the JVM classpath via the user exit properties (using `java.class.path` in the `javawriter.bootoptions` property), or by setting the Java application properties file to include your custom jar:

```
# set properties on 'one'
gg.handler.one.type=sample.SampleHandler
gg.handler.one.myoutput=out.txt
gg.classpath=/path/to/my.jar,/path/to/directory/of/jars/*
```

The classpath property can be set on any handler to include additional individual jars, a directory (which would contain resources or unjarred class files) or a whole directory of jars. To include a whole directory of jars, use the Java 6 style syntax:

```
c:/path/to/directory/* (or on Unix: /path/to/directory/* )
```

Only the wildcard * can be specified; a file pattern cannot be used. This automatically matches all files in the directory ending with the `.jar` suffix. To include multiple jars or multiple directories, you can use the system-specific path separator (on Unix, the colon and on Windows the semicolon) or you can use platform-independent commas, as shown above.

If the handler requires many properties to be set, just include the property in the parameter file, and your handler's corresponding "setter" will be called. For example:

```
gg.handler.one.type=com.mycompany.MyHandler
gg.handler.one.myOutput=out.txt
gg.handler.one.myCustomProperty=12345
```

The above example would invoke the following methods in the custom handler:

```
public void setMyOutput(String s) {
    // use the string...
} public void setMyCustomProperty(int j) {
    // use the int...
}
```

Any standard Java type may be used, such as int, long, String, boolean, etc. For custom types, you may create a custom property editor to convert the String to your custom type.

Additional resources

There is Javadoc available for the Java API. The Javadoc has been intentionally reduced to a set of core packages, classes and interfaces in order to only distribute the relevant interfaces and classes useful for customization and extension.

In each package, some classes have been intentionally omitted for clarity. The important classes are:

- `com.goldengate.atg.datasource.DsTransaction`: represents a database transaction. A transaction contains zero or more operations.
- `com.goldengate.atg.datasource.DsOperation`: represents a database operation (insert, update, delete). An operation contains zero or more column values representing the data-change event. Columns indexes are offset by zero in the Java API.

- `com.goldengate.atg.datasource.DsColumn`: represents a column value. A column value is a composite of a before and an after value. A column value may be 'present' (having a value or be null) or 'missing' (is not included in the source trail).
  - `com.goldengate.atg.datasource.DsColumnComposite` is the composite
  - `com.goldengate.atg.datasource.DsColumnBeforeValue` is the column value before the operation (this is optional, and may not be included in the operation)
  - `com.goldengate.atg.datasource.DsColumnAfterValue` is the value after the operation
- `com.goldengate.atg.datasource.meta.DsMetaData`: represents all database metadata seen; initially, the object is empty. DsMetaData contains a hash map of zero or more instances of TableMetaData, using the TableName as a key.
- `com.goldengate.atg.datasource.meta.TableMetaData`: represents all metadata for a single table; contains zero or more `ColumnMetaData`.
- `com.goldengate.atg.datasource.meta.ColumnMetaData`: contains column names and data types, as defined in the database and/or in the Oracle GoldenGate source definitions file.

See the Javadoc for additional details.

CHAPTER 11
Troubleshooting

Perform the error checks listed in this section. If you do not succeed in identifying the problem, contact Oracle Support.

Checking for Errors

There are two types of errors that can occur in the operation of Oracle GoldenGate for Java:

- The Extract process running the user exit or VAM does not start or abends
- The process runs successfully, but the data is incorrect or nonexistent

If the Extract process does not start or abends, check the error messages in order from the beginning of processing through to the end:

1. Check the Oracle GoldenGate event log for errors, and view the Extract report file:

   ```
   GGSCI> VIEW GGSEVT
   GGSCI> VIEW REPORT {extract name}
   ```

2. Check the applicable log file.

   For the user exit:

   - Look at the last messages reported in the log file for the user exit library. The file name is the log file prefix (`log.logname`) set in the property file and the current date.

     ```
     shell> more {log.logname}_{yyyymmdd}.log
     ```

   Note: This is only the log file for the shared library, not the Java application.

3. If the user exit or VAM was able to launch the Java runtime, then a log4j log file will exist.

   The name of the log file is defined in your log4j.properties file. By default, the log file name is `ggjava-{`*`version`*`}-log4j.log`, where *`version`* is the version number of the jar file being used. For example:

   ```
   shell> more ggjava-*log4j.log
   ```

   To set a more detailed level of logging for the Java application, either:

   - Edit the current log4j properties file to log at a more verbose level or

- ❍ Re-use one of the existing log4j configurations by editing properties file:

  ```
  {javawriter or jvm}.bootoptions=-Djava.class.path=ggjava/ggjava.jar
  -Dlog4j.configuration=debug-log4j.properties –Xmx512m
  ```

These pre-configured log4j property files are found in the classpath, and are installed in:

```
./ggjava/resources/classes/*log4j.properties
```

4. If one of these log files does not reveal the source of the problem, run the Extract process directly from the shell (outside of GGSCI) so that `stderr` and `stdout` can more easily be monitored and environmental variables can be verified. For example:

   ```
   shell> EXTRACT PARAMFILE dirprm/javaue.prm
   ```

If the process runs successfully, but the data is incorrect or nonexistent, check for errors in any custom filter, formatter or handler you have written for the user exit.

To restart the user exit Extract from the beginning of a trail, see page 65.

For further information on troubleshooting the core Oracle GoldenGate software, see the *Oracle GoldenGate Troubleshooting and Performance Tuning Guide*.

Recovery after an abend

The Extract parameter `RECOVERYOPTIONS` defaults to `APPENDMODE` for release 10 and later trails. In append mode, Extract writes a recovery marker to the trail when it abends . When the Extract restarts and encounters the recovery marker, it requests a rollback of the incomplete transaction if local transactions are enabled. If local transactions are not enabled, a warning message is issued. Local transactions are enabled unless the property `gg.handler.{name}.localTX` is explicitly set to `false`.

Reporting issues

If you have a support account for Oracle GoldenGate, submit a support ticket. Please include:

- Operating system and Java versions

  The version of the Java Runtime Environment can be displayed by:

  ```
  $ java -version
  ```

- Configuration files:
  - ❍ Parameter file for the Extract running the user exit
  - ❍ All properties files used, including any JMS or JNDI properties files
  - ❍ Velocity templates for the user exit

- Log files:

  In the Oracle GoldenGate install directory, all `.log` files: the Java log4j log files and the user exit or VAM log file.

APPENDIX 1

Adapter Examples

Examples are included with the Oracle GoldenGate Adapter installation. The following examples are located in the designated subdirectories of the installation location:

FlatFileWriter

- Using the Oracle GoldenGate Flat File Adapter to convert Oracle GoldenGate trail data to text files.

MessageDelivery

- Using the Oracle GoldenGate Java Adapter to send JMS messages with a custom message format.
- Using the Oracle GoldenGate Java Adapter to send JMS messages with custom message header properties.

MessageCapture

- Using the Oracle GoldenGate Java Adapter to process JMS messages, creating an Oracle GoldenGate trail.

JavaUserExitAPI

- Using the Oracle GoldenGate Java Adapter API to write a custom event handler.

Index