SYBASE®

Administration Guide

Replication Agent™

15.1

[Linux, Microsoft Windows, and UNIX]

DOCUMENT ID: DC38261-01-1510-01

LAST REVISED: February 2008

Contents

About This Book

Replication Agent™ 15.1 extends the capabilities of Replication Server® to support the following non-Sybase primary data servers in a Sybase replication system:

- IBM DB2 Universal Database (UDB) on UNIX and Microsoft Windows platforms
- Microsoft SQL Server
- Oracle Database Server

Audience

This book is for anyone who needs to manage or administer a Sybase replication system with non-Sybase primary databases, or administer the non-Sybase primary databases in a Sybase replication system. This may include:

- Database Administrators
- Network Administrators
- System Administrators

How to use this book

Use the Replication Agent *Administration Guide* to find an overview of the Replication Agent, detailed information about configuring and administering Replication Agent instances, and other components in a Sybase replication system.

This book is organized as follows:

Chapter 1, "Introduction to Replication Agent," provides an introduction to replication system concepts and an overview of the Replication Agent. This chapter describes Replication Agent components and explains how they work.

Chapter 2, "Setting Up and Configuring Replication Agent," describes how to set up and configure Replication Agent. The procedures described in this chapter must be performed *after* you install the software and *before* you begin replication.

Chapter 3, "Administering Replication Agent," describes administrative operations, including managing Replication Agent instances and using Replication Agent commands to perform a variety of routine tasks.

Chapter 4, “Troubleshooting Replication Agent,” describes basic Replication Agent troubleshooting and system recovery procedures.

Appendix A, “Materializing Subscriptions to Primary Data,” describes the materialization process and provides a detailed procedure for materializing subscriptions to primary tables.

Related documents

Replication Agent Refer to the following documents to learn more about the Replication Agent:

- Replication Agent *Reference Manual* – for information about all Replication Agent commands and configuration parameters, including syntax, examples, and detailed command usage notes.
- Replication Agent *Primary Database Guide* – for detailed, database-specific information about each non-Sybase database that is supported by the Replication Agent.
- Replication Agent *Installation Guide* – for information about installing the Replication Agent software.
- The Replication Agent *Release Bulletin* – for last-minute information that was too late to be included in the books.

Note A more recent version of the Replication Agent *Release Bulletin* may be available on the World Wide Web. To check for critical product or document information that was added after the release of the product CD, use the Sybase Technical Library Web site.

Replication Server Refer to the following documents for more information about transaction replication systems and the Replication Server software:

- Replication Server *Design Guide* – for an introduction to basic transaction replication concepts and Sybase replication technology.
- Replication Server *Heterogeneous Replication Guide* – for detailed information about configuring Replication Server and implementing a Sybase replication system with non-Sybase databases.

Primary data server Make sure that you have appropriate documentation for the non-Sybase primary data server that you use with the Sybase replication system.

Java environment The Replication Agent requires a Java Runtime Environment (JRE) on the Replication Agent host machine.

- The Replication Agent *Release Bulletin* contains the most up-to-date information about Java and JRE requirements.

- Java documentation available from your operating system vendor describes how to set up and manage the Java environment on your platform.

Other sources of information

Use the Sybase Getting Started CD, the SyBooks CD, and the Sybase Product Manuals Web site to learn more about your product:

- The Getting Started CD contains *Release Bulletins* and installation guides in PDF format, and may also contain other documents or updated information not included on the SyBooks CD. It is included with your software. To read or print documents on the Getting Started CD, you need Adobe Acrobat Reader, which you can download at no charge from the Adobe Web site using a link provided on the CD.
- The SyBooks CD contains product manuals and is included with your software. The Eclipse-based SyBooks browser allows you to access the manuals in an easy-to-use, HTML-based format.

  Some documentation may be provided in PDF format, which you can access through the PDF directory on the SyBooks CD. To read or print the PDF files, you need Adobe Acrobat Reader.

  Refer to the *SyBooks Installation Guide* on the Getting Started CD, or the *README.txt* file on the SyBooks CD for instructions on installing and starting SyBooks.
- The Sybase Product Manuals Web site is an online version of the SyBooks CD that you can access using a standard Web browser. In addition to product manuals, you can find links to EBFs/Maintenance, Technical Documents, Case Management, Solved Cases, newsgroups, and the Sybase Developer Network.

  To access the Sybase Product Manuals Web site, go to Product Manuals at http://www.sybase.com/support/manuals/.

Sybase certifications on the Web

Technical documentation at the Sybase Web site is updated frequently.

❖ **Finding the latest information on product certifications**

1. Point your Web browser to Technical Documents at http://www.sybase.com/support/techdocs/.
2. Click Certification Report.
3. In the Certification Report filter select a product, platform, and timeframe and then click Go.
4. Click a Certification Report title to display the report.

❖ **Finding the latest information on component certifications**

1. Point your Web browser to Availability and Certification Reports at http://certification.sybase.com/.
2. Either select the product family and product under Search by Base Product; or select the platform and product under Search by Platform.
3. Select Search to display the availability and certification report for the selection.

❖ **Creating a personalized view of the Sybase Web site (including support pages)**

Set up a MySybase profile. MySybase is a free service that allows you to create a personalized view of Sybase Web pages.

1. Point your Web browser to Technical Documents at http://www.sybase.com/support/techdocs/.
2. Click MySybase and create a MySybase profile.

Sybase EBFs and software maintenance

❖ **Finding the latest information on EBFs and software maintenance**

1. Point your Web browser to the Sybase Support Page at http://www.sybase.com/support.
2. Select EBFs/Maintenance. If prompted, enter your MySybase user name and password.
3. Select a product.
4. Specify a time frame and click Go. A list of EBF/Maintenance releases is displayed.

   Padlock icons indicate that you do not have download authorization for certain EBF/Maintenance releases because you are not registered as a Technical Support Contact. If you have not registered, but have valid information provided by your Sybase representative or through your support contract, click Edit Roles to add the “Technical Support Contact” role to your MySybase profile.
5. Click the Info icon to display the EBF/Maintenance report, or click the product description to download the software.

Style conventions

The following style conventions are used in this book:

- In a sample screen display, commands that you should enter exactly as shown appear like this:

  ```
  pdb_init
  ```

- In the regular text of this document, variables or user-supplied words appear like this:

  Specify the *value* option to change the setting of the configuration parameter.

- In a sample screen display, variables or words that you should replace with the appropriate value for your site appear like this:

  ```
  resume connection to pds.pdb
  ```

  Here, *pds* and *pdb* are the variables you should replace.

- In the regular text of this document, names of programs, utilities, procedures, and commands appear like this:

  Use the pdb_init command to initialize the primary database.

- In the regular text of this document, names of database objects (tables, columns, stored procedures, and so on) appear like this:

  Check the price column in the widgets table.

- In the regular text of this document, names of datatypes appear like this:

  Use the date or datetime datatype.

- In the regular text of this document, names of files and directories appear like this:

  Log files are located in the *$SYBASE/RAX-15_1/inst_name/log* directory.

Syntax conventions

The following syntax conventions are used in this book:

Table 1: Syntax conventions

Key	Definition
{ }	Curly braces indicate that you must choose at least one of the enclosed options. Do not type the braces when you enter the command.
[ ]	Brackets mean that choosing one or more of the enclosed options is optional. Do not type the brackets when you enter the command.
( )	Parentheses are to be typed as part of the command.
|	The vertical bar means you can select only one of the options shown.
,	The comma means you can choose as many of the options shown as you like, separating your choices with commas that you type as part of the command.

In reference sections of this document, statements that show the syntax of commands appear like this:

ra_config [*param*[, *value*]]

The words *param* and *value* in the syntax are variables or user-supplied words.

Character case conventions

The following character case conventions are used in this book:

- All command syntax and command examples are shown in lowercase. However, Replication Agent command names are *not* case sensitive. For example, RA_CONFIG, Ra_Config, and ra_config are equivalent.
- Names of configuration parameters are case sensitive. For example, Scan_Sleep_Max is not the same as scan_sleep_max, and the former would be interpreted as an invalid parameter name.
- Database object names are *not* case sensitive in Replication Agent commands. However, if you need to use a mixed-case object name in a Replication Agent command (to match a mixed-case object name in the primary database), you must delimit the object name with quote characters. For example:

```
pdb_get_tables "TableName"
```

Accessibility features

This document is available in an HTML version that is specialized for accessibility. You can navigate the HTML with an adaptive technology such as a screen reader, or view it with a screen enlarger.

Replication Agent 15.1 and the HTML documentation have been tested for compliance with U.S. government Section 508 Accessibility requirements. Documents that comply with Section 508 generally also meet non-U.S. accessibility guidelines, such as the World Wide Web Consortium (W3C) guidelines for Web sites.

Note You might need to configure your accessibility tool for optimal use. Some screen readers pronounce text based on its case; for example, they pronounce ALL UPPERCASE TEXT as initials, and MixedCase Text as words. You might find it helpful to configure your tool to announce syntax conventions. Consult the documentation for your tool.

For information about how Sybase supports accessibility, see Sybase Accessibility at http://www.sybase.com/accessibility. The Sybase Accessibility site includes links to information on Section 508 and W3C standards.

For a Section 508 compliance statement for Replication Agent 15.1, see Sybase Accessibility at http://www.sybase.com/detail_list?id=52484.

If you need help

Each Sybase installation that has purchased a support contract has one or more designated people who are authorized to contact Sybase Technical Support. If you cannot resolve a problem using the manuals or online help, please have the designated person contact Sybase Technical Support or the Sybase subsidiary in your area.

CHAPTER 1 Introduction to Replication Agent

Replication Agent extends the capabilities of Replication Server® by allowing non-Sybase (heterogeneous) data servers to act as primary data servers in a replication system based on Sybase replication technology.

This chapter provides an introduction to and overview of the Replication Agent.

Basic replication system concepts

Transaction replication can be used to maintain data in separate databases called **replicate databases**. Replicate databases contain accurate, current copies or subsets of data from a **primary database**.

When a table in the primary database is marked for replication, transactions that change the data in that table are captured for replication. The primary database processes the transaction, and a copy of the transaction (including all its operations) is stored in the **transaction log**.

In the case of a stored procedure marked for replication, when the stored procedure is invoked in the primary database, all parameter values provided with the procedure invocation are captured and recorded in the transaction log. When a marked stored procedure generates a transaction that affects data in marked tables in the primary database, the transaction generated by the stored procedure is ignored, so only the procedure invocation is replicated.

Transaction replication

The events captured for replication through a Sybase replication system are referred to as *transactions*, even if they do not correspond directly to an actual transaction in the primary database. For example, if a transaction affects both marked tables and unmarked tables, only the operations that affect the marked tables are captured for replication. Operations on unmarked tables are ignored.

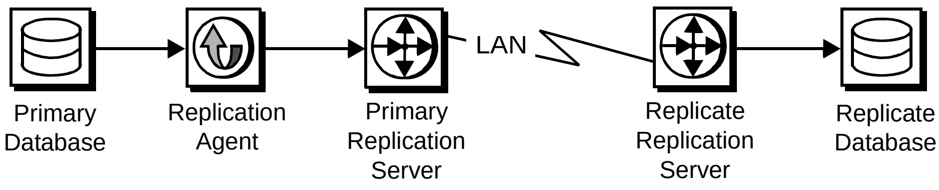
All data-change operations captured for replication exist within a *transaction context*, that is, only committed transaction operations are replicated; transactions that are rolled back are not replicated.

Even if the data-change events replicated through a Sybase replication system are really *operations*, those operations are grouped in an atomic collection, and they represent the results of a committed transaction in the primary database.

Replication system components

Figure 1-1 illustrates the basic components in a typical Sybase replication system.

Figure 1-1: Typical Sybase replication system



The following sections describe the primary-side components of a typical Sybase replication system:

- Primary databases
- Replication Agents
- Replication Servers

Primary databases

A primary database is the source of transactions that modify data in the replicate databases. Transactions are replicated by table or by procedure.

Tables marked for replication in a primary database are called primary tables. A primary table must be marked for replication so that the Replication Agent can identify and replicate the transactions that affect the data in that table.

Large-object (LOB) columns within a primary table must have replication enabled separately from the primary table. You can selectively replicate LOB columns within a primary table.

To replicate invocations of a stored procedure, the procedure must be marked for replication so that the Replication Agent can identify and replicate invocations of that procedure in the primary database.

Replication Agents

A **Replication Agent** is the Sybase replication system component that captures the replicated transactions in a primary database and sends those transactions to a Replication Server for distribution to replicate databases.

Replication Agent reads a transaction log in the primary database and generates Log Transfer Language (LTL) output. LTL is the language that Replication Server uses to process and distribute replicated transactions throughout a replication system.

Replication Agent can be configured to use information stored in the Replication Server System Database (RSSD) of the primary Replication Server to provide more sophisticated replication features and generate more efficient LTL.

Replication Agent retrieves the information it needs for transaction replication from the native transaction log maintained by the primary data server.

Replication Agent uses the log-based solution for primary databases in following primary databases:

- IBM DB2 Universal Database
- Microsoft SQL Server
- Oracle

Note Procedure and DDL replication is not available for IBM DB2 Universal Database.

Replication Servers

The Replication Server that receives replicated transactions from a primary database (that is, directly from a Replication Agent) is called the **primary Replication Server**. The Replication Server that sends replicated transactions to a replicate database is called the **replicate Replication Server**.

Note In a simple replication system, a single Replication Server can act as both the primary Replication Server and the replicate Replication Server.

After it receives LTL from a Replication Agent, the primary Replication Server sends the replicated transaction to a replicate database, either directly or through a replicate Replication Server. The replicate Replication Server converts the replicated transaction from the LTL it receives to the native language of the replicate database, and then it sends the replicated transaction to the replicate data server for processing. When the replicated transaction is processed successfully by the replicate database, the replicate database is synchronized with the primary database.

Each Replication Server holds transaction operations in a stable queue and delivers them as soon as possible to other Replication Servers or replicate databases. By doing this, Replication Server guarantees that every transaction successfully received from a Replication Agent is guaranteed to be delivered to appropriately subscribing replicate databases.

Each Replication Server uses a database called the Replication Server System Database (RSSD) to store replication system data and metadata. Replication Agent can use some of the information stored in the RSSD to provide advanced replication features.

Understanding Replication Agent

Replication Agent supports transaction replication from a primary database through Replication Server. This section describes Replication Agent functionality in detail.

Note See the Replication Agent 15.1 *Release Bulletin* for information on the specific versions of the IBM DB2 Universal Database, Microsoft SQL Server, and Oracle that Replication Agent supports.

Replication Agent runs as a standalone application, independent of the primary data server, the primary Replication Server, and any other replication system components.

Replication Agents can reside on the same host machine as the primary database or any other replication system component; or, they can reside on a machine separate from any other replication system components that has network access to the primary database. Replication Agents must execute on a machine that has access to the transaction logs for the primary database. For Replication Agent for UDB, this is accomplished using the DB2 Client.

Replication Agent is compatible with Replication Manager (RM). Replication Agent instances can be configured, managed, and monitored by RM. In addition, you can completely configure, manage, and monitor a Replication Agent instance using any Open Client™ application that is capable of communicating with the Sybase Tabular Data Stream™ (TDS) protocol (such as isql).

Replication Agent instances

An instance of the Replication Agent must be created for each primary database from which you want to replicate transactions. Each Replication Agent instance is an independent application with its own configuration and log files, administration port, and connections to the primary database and the primary Replication Server.

Replication Agent instances created for a specific primary database type are referred to in this book as follows:

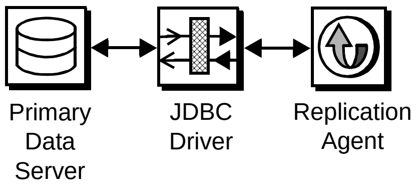
- IBM DB2 Universal Database – Replication Agent for UDB
- Microsoft SQL Server – Replication Agent for Microsoft SQL Server
- Oracle Database Server – Replication Agent for Oracle

Replication Agent communications

Replication Agent uses the Java Database Connectivity (JDBC) protocol for all communications. However, some supported databases require the Open Database Connectivity (ODBC) protocol. When connecting to a primary database, Replication Agent connects to either the JDBC driver or the JDBC/ODBC bridge provided by the database vendor.

Figure 1-2 illustrates the communication between Replication Agent and a primary database using a JDBC driver.

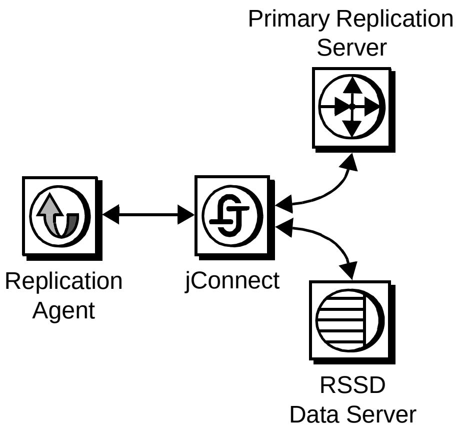
Figure 1-2: Replication Agent primary database communication



Replication Agent uses the Sybase JDBC driver (jConnect™ for JDBC™) to communicate with all Open Client™ and Open Server™ applications, such as Adaptive Server® Enterprise and Replication Server. Each Replication Agent instance uses a single instance of jConnect for JDBC.

Figure 1-3 illustrates the communication between Replication Agent and the primary Replication Server and its RSSD.

Figure 1-3: Replication Agent communication with Replication Server



While replicating transactions, the Replication Agent maintains connections with both the primary database and the primary Replication Server, and it may occasionally connect to the RSSD of the primary Replication Server to retrieve replication definition data.

Replication Agent components

Replication Agent consists of a set of components that work together to perform all the operations required to propagate transactions from a primary database for replication.

Following are the main Replication Agent components:

- Log Reader – reads the transaction log in the primary database to retrieve transactions for replication.
- Log Transfer Interface (LTI) – generates Log Transfer Language (LTL) and sends it to the primary Replication Server.
- Log Administrator – administers the Replication Agent transaction log and manages transaction log objects.
- Log Transfer Manager (LTM) – manages all the other components and coordinates their operations and interactions.

The process is as follows:

1. The Log Reader component retrieves transaction data from the transaction log in the primary database.
2. The Log Reader generates change set data and passes the change sets to the LTI.
3. The LTI component processes the change set data from the Log Reader and generates the LTL to send to the primary Replication Server.

   The LTI component also receives messages from the primary Replication Server.

Although the LTM component is not involved in the flow of data from the primary database to the primary Replication Server, it coordinates the activities of the other Replication Agent components and processes any errors generated by those components.

Administration port

Replication Agent provides an administrative user interface through its *administration port*.

The administration port allows an Open Client application to log in to a Replication Agent instance as if the Replication Agent were an Open Server application. After it is logged in, the administrative client can issue commands to control, administer, and monitor the Replication Agent instance.

The administration port communicates with the client through the Sybase JDBC driver (jConnect™ for JDBC™).

The administration port passes commands from the administrative client to the Replication Agent components. The administration port also processes the messages from Replication Agent components, and passes those messages out to the client.

Java requirement

Replication Agent 15.1 includes a Java Runtime Environment (JRE), so the computer that acts as the Replication Agent host machine must meet JRE requirements.

For more information on installing and setting up a JRE, see:

- Replication Agent 15.1 *Installation Guide*
- Replication Agent 15.1 *Release Bulletin*

CHAPTER 2

Setting Up and Configuring Replication Agent

This chapter describes how to set up Replication Agent after the software is installed, verify that your replication system is ready to replicate transactions, and start replication.

Note The procedures in this chapter assume you have already installed the Replication Agent software and Replication Server software, as described in the Replication Agent *Installation Guide* and the Replication Server installation and configuration guides for your platform.

Create the Replication Agent instance

After you install the Replication Agent software, you must create one instance of the Replication Agent for each primary database that you want to replicate transactions from.

Each Replication Agent instance is an independent process, with its own instance directories to contain its configuration file, system log files, and script files. In addition, each Replication Agent instance creates some tables and stored procedures in the primary database. Replication Agents for Oracle and Microsoft SQL Server also create objects in the Replication Agent System Database (RASD). Each Replication Agent instance manages its own connections to the primary data server, primary Replication Server, and RSSD.

When you create a Replication Agent instance, you must specify:

- A unique instance (server) name
- A unique client socket port number for its administration port
- The type of primary database the instance supports

You can create and run more than one Replication Agent instance on a single host machine, but each instance must have a unique name and a unique port number.

For more information, see “Creating a Replication Agent instance” on page 16.

Replication Agent instance directories

Replication Agent instance directories are created under the Replication Agent base directory when you create a Replication Agent instance. The Replication Agent base directory (*RAX-15_1*) and the installation directory (*sybase*) are created when you install the Replication Agent software.

Note A single installation (on a single host machine) can support multiple Replication Agent instances. Each instance directory resides under the Replication Agent base directory created when you install the software.

Using Replication Agent utilities

Two utilities are provided with the Replication Agent:

- ra – starts a Replication Agent instance, or returns the Replication Agent software version number.

- ra_admin – allows you to create, copy, verify, and delete Replication Agent instances, or to list all verifiable, installed Replication Agent instances on a machine.

Replication Agent utilities are supplied as batch files for Windows platforms and as shell scripts for UNIX platforms. The utility files reside in the *bin* subdirectory, under the Replication Agent base directory.

Note On Windows platforms, when you execute a *run* script, you can omit the extension ra -i my_ra. However, on UNIX, you must always include the extension ra.sh -i my_ra.

You can use the -help option with either the ra_admin or ra command line utility to obtain information about that utility.

For more information, see "Using the command line interface" on page 12.

Preparing to use the utilities

Before you can invoke a Replication Agent utility, you must:

- Log in to the operating system on the Replication Agent host machine with a user login that has execute permission in the Replication Agent installation directory and all subdirectories (for example, the "sybase" user)
- Use the SYBASE environment script to set the Sybase environment variables

The SYBASE environment script is supplied as a batch file for Microsoft Windows platforms (*SYBASE.bat*) and as a shell script for UNIX platforms (*SYBASE.sh* or *SYBASE.csh*).

❖ To set the SYBASE environment

1. Log in to the operating system on the Replication Agent host machine with a user login that has the appropriate permissions.
2. Open an operating system command window.
3. At the operating system prompt, navigate to the Replication Agent installation directory:
   - On Microsoft Windows:

     ```
     cd c:\sybase
     ```

Here, *c:\sybase* is the path to the Replication Agent installation directory.

- On UNIX:

  ```
  cd /opt/sybase
  ```

  Here, */opt/sybase* is the path to the Replication Agent installation directory.

4 In the Replication Agent installation directory, invoke the *SYBASE* environment script:

- On Microsoft Windows:

  ```
  SYBASE
  ```

- On UNIX, for Bourne and Korn shells:

  ```
  . SYBASE.sh
  ```

- On UNIX, for C-shell:

  ```
  source SYBASE.csh
  ```

Note On UNIX platforms, you can insert the source command line in the *.login* file for the Replication Agent administrator (or “sybase” user), so that the SYBASE environment is set automatically when you log in to the Replication Agent host machine.

Using the command line interface

This section describes how to administer a Replication Agent instance using the command line interface.

Using the ra utility

The Replication Agent ra utility provides the following functions:

- Starts a specified Replication Agent instance
- Returns the Replication Agent software version string

See “Using the ra_admin utility” on page 14 for information about creating a Replication Agent instance.

To run the ra utility, invoke it as a command at the operating system prompt.

Syntax

ra [-help | -i *inst_name* [-*state*] | -v]

Parameters

-help

The option that returns command usage information.

Note You can also invoke ra with no option specified to return command usage information.

-i *inst_name*

The option that specifies a Replication Agent instance to start. Here, *inst_name* is the name of an existing Replication Agent instance.

-*state*

The keyword that specifies a start-up state for the Replication Agent instance.

Valid -*state* values are:

- -admin – starts the Replication Agent instance in *Admin* state. (This is the default start-up state.)
- -replicate – starts the Replication Agent instance in *Replicating* state.

-v

The option that returns the Replication Agent software version number.

Example

To start a Replication Agent instance named “my_ra” in *Replicating* state, enter the following command at the operating system prompt:

```
ra -i my_ra -replicate
```

See “Starting the Replication Agent” on page 35 for more information about starting a Replication Agent instance.

Start-up errors

If the Replication Agent instance encounters start-up errors:

- On Microsoft Windows platforms, start-up errors are displayed in the operating system command window.
- On UNIX platforms, start-up errors are displayed in the operating system command window and recorded in the Replication Agent system log.

See Chapter 4, “Troubleshooting Replication Agent” for more information.

Using the ra_admin utility

The Replication Agent ra_admin utility provides the following functions:

- Creates, copies, deletes, and verifies Replication Agent instances.
- Lists all valid Replication Agent instances on the Replication Agent host machine.
- Returns the path of the Replication Agent installation directory.
- Creates an output file in the *$SYBASE/RAX-15_1/admin_logs* directory. The format of the file name is *adminmmddyyyy_hhmmss.log*. Here, *mmddyyy* and *hhmmss* are the current date and time.

To run the ra_admin utility, invoke it as a command at the operating system prompt.

Syntax

```
ra_admin [option [create options]] [inst_name]
```

Note You can also invoke ra_admin with no option specified to return command usage information.

Parameters

-b

The option that returns the complete path of the Replication Agent installation directory.

-c *inst_name*

The option that creates a new Replication Agent instance using the specified name (*inst_name*).

The *inst_name* string must be a valid server name, and unique on the host machine.

When you use the -c option, one of the following options are required:

- -p and -t, or
- -p and -f.

When you use the -f option to copy an existing Replication Agent configuration, you need not specify the -t option. The primary database type specified for the existing Replication Agent instance is copied to the configuration of the new Replication Agent instance when you specify the -f option.

-h

The option that returns command usage information.

-p *port_num*

The option that specifies a client socket port number for the administration port of the Replication Agent instance.

The *port_num* must be a valid port number and unique on the Replication Agent host machine. For Oracle and Microsoft SQL Server, Replication Agent also requires that a second port, *port_num+1*, must be available for the RASD.

-t *database*

The option that identifies the type of data server that the primary database resides in.

The *database* string must be one of the following:

- ibmudb – IBM DB2 Universal Database
- mssql – Microsoft SQL Server
- oracle – Oracle database server

Note The *database* value is not case sensitive.

When the -c option is used, you also have the option to specify the configuration of the new Replication Agent instance to be based on the configuration file for an existing Replication Agent instance. To do this, use the -f option.

-f *old_inst*

The option that copies the configuration of an existing Replication Agent instance for a new Replication Agent instance.

The *old_inst* string is the name of the existing Replication Agent instance whose configuration you want to copy for the new Replication Agent instance.

When you use the -f option to copy an existing Replication Agent configuration, you need not specify the -t option; the primary database type specified for the existing Replication Agent instance is copied to the configuration of the new Replication Agent instance when you specify the -f option.

Note When you use the -f option, some configuration parameters are set to default values. See “Copying a Replication Agent configuration” on page 26 for more information.

-d *inst_name*

The option that deletes a specified Replication Agent instance.

The *inst_name* string must be the name of an existing Replication Agent instance.

When you invoke ra_admin with the -d option, the utility deletes all of the subdirectories associated with the specified instance from the Replication Agent installation directory.

Note On Windows platforms, if any application is accessing a file or directory associated with a Replication Agent instance when you delete the instance, the open file or directory is *not* deleted. An error message informs you of the file or directory not deleted.

To finish deleting a Replication Agent instance after a file or directory access conflict on a Microsoft Windows platform, you must:

- Verify that the file or directory is not open in any application
- Manually delete the file or directory

-l (lowercase *L*)

The option that lists all verifiable Replication Agent instances.

-v *inst_name*

The option that verifies the complete directory structure for a specified Replication Agent instance.The *inst_name* string must be the name of an existing Replication Agent instance.

-vr *res_file*

Validates the specified resource file (*res_file*), without creating a Replication Agent instance or making any change in the environment.

-r *res_file*

Creates a Replication Agent instance, based on the contents of the specified resource file (*res_file*).

Creating a Replication Agent instance

To create a Replication Agent instance at any time after the Replication Agent software is installed, invoke ra_admin with the -c option or use the Administrator GUI utility. See “Using the Administrator GUI utility” on page 32.

The complete syntax is:

ra_admin -c *new_inst* -p *port_num* {-t *database*|-f *old_inst*}

where:

- *new_inst* is the name of the new Replication Agent instance you are creating.
- *port_num* is the client socket port number for the administration port of the new Replication Agent instance. For Oracle and Microsoft SQL Server, be sure that a second port, *port_num+1*, is available for the RASD.
- *database* is the type of data server that contains the primary database.
- *old_inst* is the name of an existing Replication Agent instance whose configuration you want to duplicate for the new Replication Agent instance.

For information about creating a Replication Agent instance based on the configuration of an existing instance, see "Copying a Replication Agent configuration" on page 26.

Creating a Replication Agent instance using resource files

The ra_admin utility provides two command-line parameters that support creating a Replication Agent instance using a resource file, and validating resource files.

Syntax

```
ra_admin {-vr res_file | -r res_file}
```

Parameters

-vr *res_file*

Validates the specified resource file (*res_file*), without creating a Replication Agent instance or making any change in the environment.

-r *res_file*

Creates a Replication Agent instance, based on the contents of the specified resource file (*res_file*).

A *resource* file is an ASCII text file that contains configuration information for the Replication Agent instance to be created by the ra_admin utility.

The ra_admin parameters in the resource file allow you to specify the following options, in addition to creating a Replication Agent instance:

- Create the instance user login in the primary data server, and grant all required permissions.
- Start the new instance after it is created.

- Initialize the new instance after it starts.

Note When you *validate* a resource file with ra_admin -vr, no other action is taken, and no Replication Agent instance is created.

The following sections describe how to use a Replication Agent resource file:

- Creating a new resource file
- Editing a resource file
- Validating a resource file
- Creating an instance with a resource file

Creating a new resource file

Resource file templates, *mssql.rs* (for Microsoft SQL Server), *oracle.rs* (for Oracle), and *ibmudb.rs* (for IBM DB2 Universal Database) are provided in the *init* subdirectory of the Replication Agent installation directory. For example:

```
C:\sybase\RAX-15_1\init\mssql.rs
```

or

```
C:\sybase\RAX-15_1\init\oracle.rs
```

or

```
C:\sybase\RAX-15_1\init\ibmudb.rs
```

The resource file template contains comments that describe each configuration parameter and its value.

Note Sybase recommends that you validate each resource file *before* you create a Replication Agent instance using that resource file.

❖ To create a resource file

1. Copy the resource file template to another file that you edit to create the new resource file. For example:

   ```
   cp oracle.rs pubs2.rs
   ```

   Here, *pubs2.rs* is the name of the new resource file you want to create.

   If you have an existing resource file, you can copy that file to create a new resource file, instead of copying the template.

2 Use your preferred text editor to edit the resource file copy that you created.

After you create a new resource file, you should validate it. For more information, see “Validating a resource file” on page 20.

Editing a resource file

The ra_admin resource file is an ASCII text file that you can edit using any standard text editor.

Resource file contents must conform to the following:

- Configuration parameters for both the Replication Agent and the ra_admin utility must use the following format:

  ```
  param=value
  ```

  where:

  - *param* is the name of the configuration parameter.
  - *value* is the value of the configuration parameter.

  Note Spaces are not allowed before or after the = symbol, or within the *value* string.

- Each ***param*=*value*** statement must occur on a separate line.
- If a default value exists for a configuration parameter, you can specify the default value with the string `USE_DEFAULT`:

  ```
  param=USE_DEFAULT
  ```

  Here, *param* is the name of the configuration parameter.

- The following ra_admin configuration parameters require a value of yes or no:

  - create_pds_username
  - start_instance
  - initialize_instance

The yes value is case-sensitive. Any string other than `[y|Y] [e|E] [s|S]` is interpreted as no.

Note Blank lines and lines that begin with the # symbol are ignored in the resource file.

Validating a resource file

When you invoke the ra_admin utility with the -vr option, the utility validates the specified resource file and returns information about the validation process.

The ra_admin utility validates resource files by:

- Verifying uniqueness of the Replication Agent administration port number and instance name
- Verifying access to the primary data server, Replication Server®, and RSSD
- Verifying the host name, port number, database name, user login, and password on each server
- Verifying the Replication Server database connection for the primary database
- Verifying that the pds_username user has all the required permissions at the primary database

If any validation fails, the ra_admin utility returns an error message and information about the failure.

You can repeat the validation process as many times as necessary. No entities are changed or created as a result of this process.

Note Sybase recommends that you validate a new resource file *before* you create a Replication Agent instance using the new resource file.

❖ To validate a resource file

1 Invoke the ra_admin utility, specifying the -vr option and the name of the resource file:

```
ra_admin -vr res_file
```

Here, *res_file* is the name of the resource file you want to validate.

For example, if the resource file is named *pubs2.rs*, enter the following at the command prompt:

```
ra_admin -vr pubs2.rs
```

Validation results are returned as either:

- `Response-file processing completed.`

  or

- `Response-file processing completed with errors.`

If the validation is successful, you can skip step 2, and use the resource file to create a Replication Agent instance. For more information, see "Creating an instance with a resource file" on page 21.

If the validation encounters errors, continue to step 2.

2 Use the following procedure to correct validation errors:

   a Review the error messages to determine the cause of the failure.

   b Edit the resource file to correct the appropriate values.

   c Invoke ra_admin -vr again, specifying the name of the resource file.

   Repeat this step until the resource file is successfully validated.

Creating an instance with a resource file

When you invoke the ra_admin utility with the -r option, the utility first validates the specified resource file, as described in "Validating a resource file" on page 20, except:

- If the Replication Agent for Microsoft SQL Server or Replication Agent for Oracle primary database user login does not exist in the primary data server, the utility creates it, if specified in the resource file (`create_pds_username=yes`). If the user login does exist in the primary data server but does not have all the required privileges, set create to yes, to have the utility grant all required permissions.

  If the Replication Agent for Microsoft SQL Server or Replication Agent for Oracle primary database user login does exist in the primary data server, has all the required privileges, and the resource file specifies that it should be created, the utility returns an error message and does not create the instance. (This error would be caught in the validation process described in "Validating a resource file" on page 20.)

- If the resource file specifies that the new Replication Agent instance should be initialized (`initialize_instance=yes`), then:
  - The Replication Agent primary database user login must either exist in the primary data server, or be created by the ra_admin utility (`create_pds_username=yes`).
  - The resource file must specify that the Replication Agent instance should be started (`start_instance=yes`).

  Otherwise, the utility returns an error message and does not create the instance.

After validating the resource file successfully, the ra_admin utility does the following:

- Creates and configures a Replication Agent instance, based on the contents of the specified resource file.
- Creates or grants all required privileges for the instance user, if specified in the resource file.
- Starts the new Replication Agent instance, if specified in the resource file.
- Initializes the new Replication Agent instance, if specified in the resource file.

The utility also returns information about the instance created and the result.

If instance creation fails, the ra_admin utility returns an error message and information about the failure.

Note Sybase recommends that you validate a new resource file *before* you create a Replication Agent instance using the new resource file. For more information, see "Validating a resource file" on page 20.

❖ To create a Replication Agent instance

- Invoke the ra_admin utility, specifying the -r option and the name of the resource file:

  ```
  ra_admin -r res_file
  ```

  Here, *res_file* is the name of the resource file.

  For example, if the resource file is named *pubs2.rs*, enter the following at the command prompt:

  ```
  ra_admin -r pubs2.rs
  ```

Results are returned as either:

- `Response-file processing completed.`

  or

- `Response-file processing completed with errors.`

If the instance creation is successful, you can begin using the new Replication Agent instance.

If the instance creation fails, you may have to:

- Delete all files and subdirectories in the instance directory, and delete the instance directory from the Replication Agent installation directory.
- Edit the resource file to correct the appropriate values.

Note If the instance creation fails, use the following recovery procedure *before* you attempt to create the instance again.

❖ **To recover from instance creation errors**

1 If the resource file does *not* specify that the instance user login be created in the primary data server, skip this step and continue with step 2.

If the resource file specifies that the instance user login be created in the primary data server (that is, `create_pds_username=yes`), then:

a Check the primary database to determine if the instance user was added.

b Check that the pds_sa_username has sufficient privileges to create the instance login at the primary database.

c Edit the resource file to specify that the instance user login should not be created in the primary data server (`create_pds_username=no`).

Note If the Replication Agent primary database user login is successfully created before the instance creation fails, you must either:

- Edit the resource file to set the value of the create_pds_username parameter to no, or
- Log in to the primary data server and drop the instance login.

---

2 Check the Replication Agent base directory on the Replication Agent host to determine if a new instance directory was created. The Replication Agent base directory is:

```
%SYBASE%\RAX-15_1
```

Here, *%SYBASE%* is the Replication Agent installation directory.

If you do *not* find a new instance directory in the Replication Agent base directory, skip step 3 and continue with step 4.

If you find a new instance directory in the Replication Agent base directory, continue with step 3.

3 To delete the new instance directory, you have two options:

- Use the ra_admin utility to delete the instance:

  ```
  ra_admin -d inst_name
  ```

  Here, *inst_name* is the name of the instance you want to delete, or

- Use operating system commands to delete all of the files and subdirectories in the new instance directory, and then delete the new instance directory.

4 Review the error messages to find the cause of the instance creation failure, and if necessary, edit the resource file to correct the appropriate values.

After editing the resource file, use ra_admin to validate the resource file:

```
ra_admin -vr res_file
```

Here, *res_file* is the name of the resource file.

See "Validating a resource file" on page 20 for more information.

After you complete the recovery procedure, you can retry creating the Replication Agent instance.

Creating a Replication Agent instance using the command line

Use the following procedure to create a Replication Agent instance using the command line.

Note You must set the SYBASE environment before you invoke the Replication Agent ra_admin utility. See "Preparing to use the utilities" on page 11 for more information.

❖ To create a Replication Agent instance using the command line

1. Open an operating system command window on the Replication Agent host machine.
2. At the operating system prompt, navigate to the Replication Agent *bin* directory:
   - On Windows platforms:
     ```
     cd %SYBASE%\RAX-15_1\bin
     ```
     Here, *%SYBASE%* is the path to the Replication Agent installation directory.
   - On UNIX platforms:
     ```
     cd $SYBASE/RAX-15_1/bin
     ```
     Here, *$SYBASE* is the path to the Replication Agent installation directory.
3. In the Replication Agent *bin* directory, invoke the ra_admin utility to create a new Replication Agent instance:
   ```
   ra_admin -c new_inst -p port_num -t database
   ```
   where:
   - *new_inst* is the name of the Replication Agent instance.
   - *port_num* is the client socket port number for the administration port of the new instance. For Oracle and Microsoft SQL Server, be sure that a second port, *port_num+1*, is available for the RASD.
   - *database* identifies the type of data server that the primary database resides in:
     - ibmudb – IBM DB2 Universal Database
     - mssql – Microsoft SQL Server (valid only on Microsoft Windows platforms)
     - oracle – Oracle database server

   After you invoke ra_admin, the operating system prompt returns when the new Replication Agent instance is created.
4. Verify that the Replication Agent instance was created properly using one of the following methods:
   - Invoke ra_admin with the -v option, and specify the name of the new Replication Agent instance:

```
ra_admin -v new_inst
```

Here, *new_inst* is the name of the new Replication Agent instance.

When you verify a Replication Agent instance with the -v option, the utility verifies the instance by checking for an instance directory with the specified instance name under the Replication Agent base directory, and checking all of the subdirectories under the Replication Agent instance directory.

- Invoke ra_admin with the -l option:

  ```
  ra_admin -l
  ```

  The -l option lists all verifiable Replication Agent instances, which should include the new one you just created.

- As an alternative to using the ra_admin utility, you can use operating system commands to verify that the Replication Agent instance directories were created correctly.

After you create a Replication Agent instance, you can use the ra utility to start the instance so that you can administer and configure it. See "Starting the Replication Agent" on page 35 for more information.

Note Sybase recommends that you create a user login name and password to replace the default "sa" login and secure access to the administration port, immediately after you create a Replication Agent instance. For more information, see "Creating the Replication Agent administrator login" on page 45.

Copying a Replication Agent configuration

When you create a new Replication Agent instance, you can copy the configuration of an existing instance by invoking ra_admin with the -c option and -f option.

The complete syntax is:

ra_admin -c *new_inst* -p *port_num* -f *old_inst*

where:

- *new_inst* is the name of the new Replication Agent instance you are creating.

- *port_num* is the client socket port number for the administration port of the new Replication Agent instance. For Oracle and Microsoft SQL Server, be sure that a second port, *port_num+1*, is available for the RASD.
- *old_inst* is the name of an existing Replication Agent instance whose configuration you want to duplicate for the new Replication Agent instance.

For information about creating a Replication Agent instance with the default configuration, see "Creating a Replication Agent instance" on page 16.

Use the following procedure to create a new Replication Agent instance, based on the configuration of an existing instance.

Note You must set the SYBASE environment before you invoke the Replication Agent ra_admin utility. See "Preparing to use the utilities" on page 11 for more information.

❖ **To copy an existing Replication Agent instance configuration to a new instance**

1. Open an operating system command window on the Replication Agent host machine.
2. At the operating system prompt, navigate to the Replication Agent *bin* directory.
   - On Windows platforms:

     ```
     cd %SYBASE%\RAX-15_1\bin
     ```

     Here, *%SYBASE%* is the path to the Replication Agent installation directory.
   - On UNIX platforms:

     ```
     cd $SYBASE/RAX-15_1/bin
     ```

     Here, *$SYBASE* is the path to the Replication Agent installation directory.
3. In the Replication Agent *bin* directory, invoke the ra_admin utility to create a new Replication Agent instance whose configuration is based on the configuration of an existing instance:

   ```
   ra_admin -c new_inst -p port_num -f old_inst
   ```

   where:

   - *new_inst* is the name of the new Replication Agent instance.

- *port_num* is the client socket port number for the administration port of the new instance.
- *old_inst* is the name of an existing Replication Agent instance whose configuration you want to copy for the new instance.

After you invoke ra_admin, the operating system prompt returns when the new Replication Agent instance is created.

4 Verify that the Replication Agent instance was created properly using one of the following methods:

- Invoke ra_admin with the -v option, and specify the name of the new Replication Agent instance:

  ```
  ra_admin -v new_inst
  ```

  Here, *new_inst* is the name of the new Replication Agent instance.

  When you verify a Replication Agent instance with the -v option, the utility verifies the instance by checking for an instance directory with the specified instance name under the Replication Agent base directory, and then checking all of the subdirectories under the Replication Agent instance directory.

- Invoke ra_admin with the -l (lowercase L) option:

  ```
  ra_admin -l
  ```

  The -l option lists all verifiable Replication Agent instances, which should include the new one you just created.

- As an alternative to using the ra_admin utility, you can use operating system commands to verify that the Replication Agent instance directories were created correctly.

Note When you create a new Replication Agent instance and copy the configuration of an existing instance, some configuration parameters are set to default values, and they are not copied from the existing configuration.

The values of the following configuration parameters are not copied from an existing configuration:

admin_port
log_directory
pds_database_name
pds_datasource_name
pds_host_name

pds_password
pds_port_number
pds_retry_count
pds_retry_timeout
pds_server_name
pds_username
rs_source_db
rs_source_ds

Note The following parameters are valid only for Replication Agent for Oracle and Replication Agent for Microsoft SQL Server.

---

rasd_backup_dir
rasd_database
rasd_trace_log_dir
rasd_tran_log
asa_port

See the Replication Agent *Reference Manual* for more information about Replication Agent configuration parameters.

After you create a Replication Agent instance, you can use the ra utility to start the instance so that you administer and configure it.

Note Sybase recommends that you create a user login name and password to replace the default `sa` login and secure access to the administration port, immediately after you create a Replication Agent instance. For more information, see “Creating the Replication Agent administrator login” on page 45.

Deleting a Replication Agent instance

You can delete a Replication Agent instance at any time by invoking ra_admin with the -d option.

Before you delete a Replication Agent instance, you should:

- Shut down the Replication Agent instance, if it is running. For more information, see “Shutting down the Replication Agent instance” on page 71.

- If the Replication Agent software is installed on a Microsoft Windows platform, verify that none of the files in the instance subdirectories are open, and that no application or window is accessing the instance subdirectories.

Note You must set the SYBASE environment before you invoke the Replication Agent ra_admin utility. See "Preparing to use the utilities" on page 11 for more information.

❖ **To delete a Replication Agent instance**

1. Open an operating system command window on the Replication Agent host machine.
2. At the operating system prompt, navigate to the Replication Agent *bin* directory.
   - On Windows platforms:
     ```
     cd %SYBASE%\RAX-15_1\bin
     ```
     Here, *%SYBASE%* is the path to the Replication Agent installation directory.
   - On UNIX platforms:
     ```
     cd $SYBASE/RAX-15_1/bin
     ```
     Here, *$SYBASE* is the path to the Replication Agent installation directory.
3. In the Replication Agent *bin* directory, invoke the ra_admin utility with the -d option to delete a Replication Agent instance:
   ```
   ra_admin -d inst_name
   ```
   Here, *inst_name* is the name of the Replication Agent instance you want to delete.

   After you invoke ra_admin with the -d option, the following message appears:
   ```
   Are you sure you want to delete the Replication Agent
   instance inst_name? [y/n]
   ```
4. Enter y to delete the Replication Agent instance.

   After the instance is deleted, the operating system prompt returns.

If the instance is running when you invoke ra_admin with the -d option, the utility returns an error message:

```
Cannot delete Replication Agent instance 'inst_name'
because it is currently running.
```

To shut down a Replication Agent instance, log in to its administrative port, and use the shutdown command. For more information, see “Shutting down the Replication Agent instance” on page 71.

5 Verify that the Replication Agent instance was deleted properly using one of the following methods:

- Invoke the ra_admin utility with the -v option, and specify the name of the deleted Replication Agent instance:

  ```
  ra_admin -v inst_name
  ```

  Here, *inst_name* is the name of the deleted Replication Agent instance.

  When you verify a Replication Agent instance with the -v option, the utility looks for an instance directory with the specified instance name under the Replication Agent base directory, and looks for the correct subdirectories under the Replication Agent instance directory.

- Invoke the ra_admin utility with the -l option:

  ```
  ra_admin -l
  ```

  The -l option lists all verifiable Replication Agent instances, which should *not* include the one you just deleted.

- As an alternative to using the ra_admin utility, you can use operating system commands to verify that the Replication Agent instance directories were deleted correctly.

Note On Microsoft Windows platforms, if any application is accessing a file or directory associated with a Replication Agent instance when you delete the instance, the open file or directory is *not* deleted. An error message informs you of the file or directory not deleted.

To finish deleting a Replication Agent instance after a file or directory access conflict occurs on a Microsoft Windows platform, you must:

- Verify that the file or directory is not open in any application

- Manually delete the file or directory

Note If you delete a Replication Agent instance, Replication Agent does not unmark any primary database objects marked for replication, nor does it delete its transaction log objects. Before you shut down and delete a Replication Agent instance, you must unmark primary database objects and deinitialize the Replication Agent so that it removes the objects it created in the primary database.

Using the Administrator GUI utility

This section describes how to administer Replication Agent instances using Administrator, the Replication Agent GUI utility.

Starting the Administrator GUI

To start the Administrator GUI, do one of the following:

- Enter the following command at the operating system prompt:

  ```
  administrator
  ```

  Note You must set the SYBASE environment before you invoke the Replication Agent administrator utility. For more information see “Preparing to use the utilities” on page 11.

- On Windows, double-click the file name *administrator.bat* in File Manager or Explorer.

  This file is located in the *RAX-15_1\bin* subdirectory, in your installation directory.

When you start Administrator, the Replication Agent Administrator GUI window opens.

When you use the Administrator GUI, it creates an output file in the *$SYBASE/RAX-15_1/admin_logs* directory. The format of the file name is *adminmmddyyyy_hhmmss.log*. Here, *mmddyyy* and *hhmmss* are the current date and time.

The Administrator GUI window provides the following information for each Replication Agent instance:

- *Name* – name of the instance
- *Type* – instance type
- *Port* – port number assigned to the instance
- *Running* – status of the instance (running or not)

Use the procedures in the following sections to administer Replication Agent instances with the Administrator GUI.

Creating an instance

Note You must set the SYBASE environment before you invoke the Replication Agent administrator utility. For more information, see “Preparing to use the utilities” on page 11.

❖ To create a Replication Agent instance using Administrator

1 Select an instance type from the drop-down list:

   - `oracle` – Oracle
   - `ibmudb` – IBM DB2 Universal Database
   - `mssql` – Microsoft SQL Server

2 Enter an instance name.

   The instance name must be unique; otherwise, Administrator returns an error.

   The default instance name is repagent.

3 Enter a client socket port number that is not assigned to any other application on the machine for the administration port of the new Replication Agent instance. For Oracle and Microsoft SQL Server, be sure that a second port, *port_num+1*, is available for the RASD.

   The default client socket port number is 10000.

4 Click Create.

   The instance name you specified appears in the List of Instances.
   The status under Running is no.

5 Click Done to exit the Administrator GUI window.

Copying an instance

Note You must set the SYBASE environment before you invoke the Replication Agent administrator utility. For more information, see "Preparing to use the utilities" on page 11.

❖ **To copy a Replication Agent instance using Administrator**

1. Select the Replication Agent instance you want to copy.
2. Enter an instance name.

   This name must be unique; otherwise, Administrator returns an error.
3. Enter a client socket port number that is not assigned to any other application on the machine for the administration port of the new Replication Agent instance.

   Administrator returns an error if you enter a port number that is used by another application.
4. Click Copy.

   The new instance appears in the List of Instances.

   Note Primary database server parameters and port numbers are not duplicated when you copy a Replication Agent instance.

Deleting an instance

Note You must set the SYBASE environment before you invoke the Replication Agent administrator utility. For more information, see "Preparing to use the utilities" on page 11.

❖ **To delete a Replication Agent instance using Administrator**

1. Select the Replication Agent instance or instances you want to delete in the list of instances.
2. Click Delete.

   Administrator provides a dialog box asking you to confirm that you want to delete the instance you selected. Click Yes to delete the instance.

Administrator deletes the instance from the instance list. However, if the instance you selected is running, Administrator returns an error.

To delete an instance that is running, you must first shut the instance down by logging in to its administrative port and using the shutdown command. Then, delete the instance. For more information, see "Shutting down the Replication Agent instance" on page 71.

Note You must unmark primary database objects and delete the transaction log *before* you shut down and delete a Replication Agent instance.

Starting the Replication Agent

To start a Replication Agent instance, you must log in to the Replication Agent host machine with a user name that has execute permission in the Replication Agent installation directory and all subdirectories (for example, the "sybase" user).

Note On Windows Vista, you must run the command window as an Administrator. To do so, click Start, navigate the All Programs menu to Accessories, right-click on Command Prompt, and then select Run As Administrator.

Following are two ways you can start a Replication Agent instance:

- Invoke the ra utility and specify the instance that you want to start.
- Invoke the administrator GUI utility and specify the instance that you want to start.
- Invoke the *RUN* script for the instance that you want to start.

The ra utility, the administrator GUI utility, and the *RUN* script are batch files on Microsoft Windows and shell scripts on UNIX.

Start-up requirements

Before you can start a Replication Agent instance and connect to the primary data server, you must set all required variables.

- Add the location of the JDBC driver for the primary database to the CLASSPATH environment variable.

  See the Replication Agent *Primary Database Guide* for more information about installing and setting up the JDBC driver for the primary database and setting up Replication Agent connectivity.

- If the character set on your Replication Agent is different from the one on your primary database, you need to set the RA_JAVA_DFLT_CHARSET environment variable, so it is the same as that of the primary database. For more information, see the following section.

See the Replication Agent *Primary Database Guide* for more information about connectivity requirements specific to your primary database.

Setting character sets

In a heterogeneous replication system, in which the primary and replicate data servers are different types, the data servers might not support the same character sets. In that case, replication system components must perform at least one character set conversion (from the primary data server character set to the replicate data server character set).

Even in a homogeneous replication system, in which both primary and replicate data servers are the same type, character set conversions might be required if replication system components reside on more than one type of platform.

Character set problems can produce data inconsistencies between the primary database and the replicate database. To avoid character set problems, you must either:

- Use the same character set on all servers and platforms in the replication system, or
- Use compatible character sets on all servers and platforms in the replication system, and configure replication system components to perform the appropriate character set conversions.

Using character set conversions slows performance.

Note Sybase recommends that you use the same character set on *all* servers and platforms in a Replication Agent system.

Configuring your environment character set

By default, the Java Virtual Machine (JVM) under which a Replication Agent instance is running finds your system default character set. The type of character data that Replication Agent can handle is determined by the character set, also known as the encoding. Unless you want to override the default character set that the JVM finds on your system, you do *not* need to explicitly set the character set-related environment variable.

To support overriding the default character set, all of the executable scripts (or batch files) in the Replication Agent */bin* directory, refer to an environment variable named RA_JAVA_DFLT_CHARSET. You can set this environment variable to use the character set you want. The character set you specify must be the character set configured on the primary database. For a list of valid Java character sets, see Supported Encodings on the Internationalization page under Documentation for the J2SE 5.0 JDK at http://java.sun.com/javase/technologies/core/basic/intl/.

All Replication Agent instance *RUN* scripts also reference the RA_JAVA_DFLT_CHARSET environment variable.

Note If you are using Replication Server to replicate a number of different character sets, you must configure it for UTF8.

You can override the system default character set by doing one of the following:

- Set the value of a system variable named RA_JAVA_DFLT_CHARSET in your environment and use the ra utility to start the Replication Agent instance, or
- Set the value of the RA_JAVA_DFLT_CHARSET variable in the Replication Agent instance *RUN* script and use the *RUN* script to start the Replication Agent instance.

If you start a Replication Agent instance by invoking the ra utility, you can override the value of the RA_JAVA_DFLT_CHARSET system variable in your environment to specify the character set.

If you start a Replication Agent instance by invoking the instance *RUN* script (or batch file), you can edit the instance *RUN* script to specify the default value of RA_JAVA_DFLT_CHARSET and specify the character set you want to use.

❖ To override the system default character set for all Replication Agent instances

1 Enter a character set value in the *ra* script:

- For Windows, edit the *%SYBASE%\RAX-15_1\bin\ra.bat* file.
- For UNIX, edit the *$SYBASE/RAX-15_1/bin/ra.sh* file:

  ```
  RA_JAVA_DFLT_CHARSET=charset
  ```

  Here, *charset* is the Java-supported encoding.

  For example, `ISO8859_1` or `Cp1252` for ISO-1 (also known as Latin-1), and `ISO8859_8` or `Cp1255` for Hebrew.

  Note In UNIX, spaces are *not* allowed on either side of the equals sign. For a list of valid Java character sets, see Character Encodings on the Internationalization page at http://java.sun.com/javase/technologies/core/basic/intl/.

  ---

2 Uncomment the following lines of code:

- For Windows:

  ```
  set RA_JAVA_DFLT_CHARSET=charset
  ```

- For UNIX:

  ```
  RA_JAVA_DFLT_CHARSET=charset
  export RA_JAVA_DFLT_CHARSET
  ```

❖ To override the system default character set for a specific Replication Agent instance

- Enter a character set value in the *RUN* script:
  - For Windows, edit the *%SYBASE%\RAX-15_1\<instance>\RUN_<instance>.bat* script:
  - For UNIX, edit the *$SYBASE/RAX-15_1/<instance>/RUN_<instance>.sh* batch file:

  Here, *charset* is the Java-supported encoding.

For example, `ISO8859_1` or `Cp1252` for ISO-1 (also known as Latin-1), and `ISO8859_8` or `Cp1255` for Hebrew is supported.

Note In UNIX, spaces are *not* allowed on either side of the equals sign. For a list of valid Java character sets, see Character Encodings on the Internationalization page at http://java.sun.com/javase/technologies/core/basic/intl/.

Starting an instance with the ra utility

When you start the Replication Agent with the ra utility, you can specify the instance start-up state. If you do *not* specify a start-up state when you invoke the ra utility, the Replication Agent instance starts in its default *Admin* state.

Note Set the SYBASE environment before you invoke the Replication Agent ra utility. See “Preparing to use the utilities” on page 11 for more information.

❖ To start Replication Agent using the *ra* utility

1 Open an operating system command window on the Replication Agent host machine.

2 At the operating system prompt, navigate to the Replication Agent *bin* directory.

- On Windows platforms, enter1

  ```
  cd %SYBASE%\RAX-15_1\bin
  ```

  Here, *%SYBASE%* is the path to the Replication Agent installation directory.

- On UNIX platforms, enter:

  ```
  cd $SYBASE/RAX-15_1/bin
  ```

  Here, *$SYBASE* is the path to the Replication Agent installation directory.

3 In the Replication Agent *bin* directory, invoke the ra utility to start the Replication Agent instance:

```
ra -iinst_name
```

or

```
ra -iinst_name -state
```

where:

- *inst_name* is the server name of the Replication Agent instance.
- *state* is the optional keyword for the start-up state:
    - admin – starts the Replication Agent instance in *Admin* state.
    - replicate – starts the Replication Agent instance in *Replicating* state.

Note If you do not specify the state option, Replication Agent starts up in *Admin* state.

For example, to start the Replication Agent instance named "my_ra" in *Replicating* state:

```
ra -i my_ra -replicate
```

After you start the Replication Agent instance, you must open another operating system command window to log in to its administration port.

See "Using the ra utility" on page 12 for more information.

Starting an instance with the Administrator GUI

Note You must set the SYBASE environment before you invoke the Replication Agent administrator utility. See "Preparing to use the utilities" on page 11 for more information.

❖ To start a Replication Agent instance using Administrator

The administrator utility must be running before you use it to start a Replication Agent instance. See "Starting the Administrator GUI" on page 32 for details.

1 Select the Replication Agent instance or instances you want to start in the list of instances. Click Start.

Administrator provides a dialog box asking you to confirm that the appropriate JDBC driver is specified in the CLASSPATH environment variable. Click Yes to continue.

Note If the appropriate JDBC driver is not listed in the CLASSPATH environment variable, you can start the Replication Agent instance, but it is not able to establish a connection to the primary database server.

---

2 Click Start.

The Replication Agent window indicates that the instance you selected is running:

Note You may need to click Refresh to see if the Replication Agent instance is running.

- On Windows, a console window opens for each Replication Agent instance you selected to start.
- On UNIX, each Replication Agent instance you selected is started in the background.

For all platforms, the Replication Agent is started in *Admin* state using the *ra_auto* script, which is located in the *RAX-15_1/bin* directory. During start-up, standard error output is redirected to the *error.log* file, which is located in the Replication Agent instance *log* directory. After start-up, standard error and standard output directed to the *<instance>.log* file in the *<instance>/log* directory.

Note If you try to start a Replication Agent instance with the same administration port number as an instance that is already running, Replication Agent aborts the process and logs an error message in the system log.

If the instance you try to start does not run, check the *instance* log to see if an error occurred. For more information, see “Examine the Replication Agent logs” on page 134.

3 Click Done to exit the Administrator GUI window.

Starting an instance with the RUN script

The *RUN* script is named *RUN_inst_name*. Here, *inst_name* is the name of the Replication Agent instance. It is created automatically when the Replication Agent instance is created.

The *RUN* script invokes the ra utility with the appropriate parameter values to start the Replication Agent instance. You can edit the *RUN* script to specify the start-up state.

Note You do not need to set the SYBASE environment variable before you invoke the *RUN* script, because the *RUN* script sets the SYBASE environment variable before it starts the Replication Agent instance.

❖ To start Replication Agent with the *RUN* script

1. Open an operating system command window on the Replication Agent host machine.
2. At the operating system prompt, navigate to the Replication Agent instance directory, enter the following:
   - On Windows:
     ```
     cd %SYBASE%\RAX-15_1\inst_name
     ```
     where:
     - *%SYBASE%* is the path to the Replication Agent installation directory.
     - *inst_name* is the name of the Replication Agent instance.
   - On UNIX:
     ```
     cd $SYBASE/RAX-15_1/inst_name
     ```
     where:
     - *$SYBASE* is the path to the Replication Agent installation directory.
     - *inst_name* is the name of the Replication Agent instance.
3. In the Replication Agent instance directory, invoke the *RUN* script to start the Replication Agent instance:
   ```
   RUN_inst_name
   ```
   Here, *inst_name* is the server name of the Replication Agent instance.

For example, to start the Replication Agent instance named “my_ra,” enter:

```
RUN_my_ra
```

Note Because this *RUN* script is generated at the time that the instance is created, the UNIX version does not have the *.sh* extension.

After you start the Replication Agent instance, you must open another operating system command window to log in to its administration port.

Using the Replication Agent administration port

When you create a Replication Agent instance, you specify a client socket port number for its administration port. Client applications use this port to connect to the Replication Agent.

The administration port allows Open Client (or Open Client-compatible) applications to log in and execute Replication Agent commands. You can use any Sybase Open Client interface utility (such as isql or SQL Advantage®) to connect to the Replication Agent administration port.

Note Client applications are *not* provided with the Replication Agent software. The isql utility is provided with the Replication Server software, and both isql and SQL Advantage are provided with the Adaptive Server software.

Creating an entry in the interfaces file

In general, Open Client applications (such as isql) require an interfaces file to identify available servers, host machines, and client ports. On Windows, the interfaces file is named *sql.ini*; on UNIX, the interfaces file is named *interfaces*.

If you want Open Client applications to be able to connect to the Replication Agent administration port as they would to any other Open Server application, you must create a server entry for the Replication Agent in the interfaces file on the Open Client application host machine.

A server entry for a Replication Agent administration port in an interfaces file appears as follows:

```
[inst_name]
 query=protocol,host_name,port_num
```

where:

- *inst_name* is the name of the Replication Agent instance.
- *protocol* is the network protocol used for the connection.
- *host_name* is the name of the Replication Agent host machine.
- *port_num* is the client socket port number of the administration port.

For example, to specify an interfaces file entry for a Replication Agent instance named “my_ra,” using the Windows socket protocol, on a host named “my_host,” with client socket port number 10002, you would add the following lines to the interfaces file:

```
[my_ra]
query=NLWNSCK,my_host,10002
```

Some systems require the interfaces file to be in the TLI form. If your system does, you must use a utility (such as sybtli or dsedit) that edits the interfaces file and saves the result in a form compatible with TLI.

After you create an entry for the Replication Agent instance in the interfaces file, you can connect to the administration port using any Open Client application that uses that interfaces file.

Logging in to the Replication Agent using *isql*

This section describes how to use the isql interactive SQL utility to log in to the Replication Agent administration port.

Before you can log in to the Replication Agent administration port with an Open Client application (such as isql), first create a server entry for the Replication Agent instance in the interfaces file. See “Creating an entry in the interfaces file” on page 43 for more information.

Note The first time you log in to a newly created Replication Agent instance, use the default administrator login “sa” with no password.

❖ **To log in to a Replication Agent instance**

1. Open an operating system command window.
2. At the operating system prompt, enter the following command:

   ```
   isql -Uusername -Ppassword -Sinst_name
   ```

   where:

   - *username* is the Replication Agent administrator login.
   - *password* is the corresponding password.
   - *inst_name* is the name of the Replication Agent instance.

   For example, to log in to a new Replication Agent instance named "my_ra," enter:

   ```
   isql -Usa -P -Smy_ra
   ```

Once you have successfully logged in to the administration port, you can use Replication Agent commands to administer the Replication Agent instance.

Creating the Replication Agent administrator login

Each Replication Agent instance has only one administrator login. The default administrator login (`sa`, with no password) is created when the Replication Agent instance is created.

Note Sybase recommends that you create a new administrator login and password to replace the default "sa" login and secure access to the administration port immediately after you create a Replication Agent instance. See "Creating the Replication Agent administrator login" on page 45 for more information.

You can use ra_set_login to create (or change) the administrator login for a Replication Agent instance.

❖ **To create or change the Replication Agent administrator login**

1. Log in to the Replication Agent instance with the administrator login.

   When you log in to the Replication Agent instance for the first time, use the default administrator login.

2. After you log in, enter the following command:

```
ra_set_login admin_user,admin_pw
```

where:

- *admin_user* is the new administrator login name you want to use for this Replication Agent instance.
- *admin_pw* is the password for the new administrator login.

Note Use the values from section 1 of the “Installation and Setup Worksheet” in the Replication Agent *Installation Guide* to specify the Replication Agent administrator login name and password.

The new login name replaces the current administrator login. The next time you log in to the Replication Agent instance, you must use the new administrator login name and password.

Setting up Replication Agent connectivity

You must set up connectivity between the Replication Agent instance and the following replication system components:

- Primary data server
- Replication Server
- RSSD

Primary databases require you to perform specific setup tasks *before* you can set up connectivity between the Replication Agent and a primary database. See the Replication Agent *Primary Database Guide* to verify that the required setup tasks have been performed for your primary database.

Note The term “RSSD” in this document refers to both RSSD and ERSSD; any difference is noted.

Setting up connectivity for the Replication Agent requires:

- Creating a user login name, with the appropriate authority in the primary data server and the primary database, for the Replication Agent
- Creating a user login name, with connect source and create object permission in the Replication Server, for the Replication Agent

- Creating a user login name, with the appropriate authority in the RSSD data server and the RSSD, for the Replication Agent
- Setting values for the Replication Agent connection configuration parameters

To record the values of connection configuration parameters for each Replication Agent instance, use the “Installation and Setup Worksheet” in the Replication Agent *Installation Guide*.

Creating the primary database user login name

Replication Agent requires client access to the primary database to:

- Get information about the database schema
- Create, manage, and read Replication Agent objects in the primary database
- Get information about database log devices (Replication Agent for Oracle and Replication Agent for Microsoft SQL Server)

Use the following procedure to set up a user login name in the primary data server and the primary database for the Replication Agent instance.

Note You must have a System Administrator user role in the primary data server to perform this procedure.

❖ **To create a primary database user login for Replication Agent**

1. Log in to the primary data server with a System Administrator user role.
2. Add the Replication Agent login name to the primary data server, and if necessary, to the primary database.
    - Refer to the Replication Agent *Primary Database Guide* for information about the permissions and authorities required in each type of primary data server and primary database.
    - Refer to the documentation provided by your primary data server vendor for information about the specific commands you need to execute to create the Replication Agent login name in the primary data server (and, if necessary, in the primary database).

After you set up the Replication Agent user login in the primary data server, verify that the new user login name is valid (it can log in to the primary data server and access the primary database).

Creating the Replication Server user login name

Replication Agent requires client access to the primary Replication Server to send replicated transactions. Use the following procedure to set up a Replication Server user login name for the Replication Agent instance.

Note You must have "sa" permission in the Replication Server to perform this procedure.

❖ To create a Replication Server user login for Replication Agent

1. Log in to the Replication Server with a login that has "sa" permission.
2. Create the Replication Agent user login name in the Replication Server:

   ```
   create user ra_rs_user set password ra_rs_pwd
   ```

   where:

   - *ra_rs_user* is the Replication Agent user login name.
   - *ra_rs_pwd* is the password for the user login name.
3. Grant connect source permission to the Replication Agent login name:

   ```
   grant connect source to ra_rs_user
   ```

   Here, *ra_rs_user* is the Replication Agent user login name.

After you set up the Replication Agent user login in the primary Replication Server, verify that the new user login name is valid (it can log in to the Replication Server).

Creating the RSSD user login name

Replication Agent requires client access to the ERSSD or RSSD to obtain information about replication definitions.

The following sections describe procedures for:

- Setting up the ERSSD user login for Replication Agent

- Setting up the RSSD user login for Replication Agent

Refer to the appropriate procedure for your Replication Server configuration.

Setting up the ERSSD user login for Replication Agent

Use the following procedure to set up a user login name for the Replication Agent instance in an ERSSD managed by Adaptive Server Anywhere.

You must have the primary user role in the ERSSD (“sa” permission in the Replication Server) to perform this procedure.

Note For more information, see “Setting up the RSSD user login for Replication Agent” on page 50.

❖ To set up the ERSSD user login for Replication Agent

1. Log in to the ERSSD as the primary user.
2. Add the Replication Agent login name to the ERSSD:

   ```
   grant connect to ra_rssd_user
   identified by ra_rssd_pwd
   ```

   where:

   - *ra_rssd_user* is the Replication Agent user login name.
   - *ra_rssd_pwd* is the password for the user login name.
3. Give the Replication Agent user permission to read the Replication Server system tables:

   ```
   grant membership in group rs_systabgroup
   to ra_rssd_user
   ```

   Here, *ra_rssd_user* is the Replication Agent user login name.

After you set up the Replication Agent user login in the ERSSD, verify that the new user login name is valid (it can log in to the ERSSD and access the Replication Server system tables).

Setting up the RSSD user login for Replication Agent

Use the following procedure to set up a user login name for the Replication Agent instance in an RSSD managed by Adaptive Server.

Note You can configure Replication Server to use an external Adaptive Server Enterprise (ASE) database to host the RSSD information. By default, the Replication Server uses an embedded RSSD. If your environment requires that an ASE must be used to host the RSSD, these instructions apply.

You must have a System Administrator user role in the Adaptive Server that manages the RSSD to perform this procedure.

Note See "Setting up the ERSSD user login for Replication Agent" on page 49 for more information.

❖ **To set up the RSSD user login for Replication Agent**

- Log in to the Adaptive Server that manages the RSSD with a System Administrator user role.

After you set up the Replication Agent user login in the RSSD, verify that the new user login name is valid (it can log in to the RSSD data server and access the RSSD).

Setting up the connection configuration parameters

When Replication Agent connects to another replication system component, it uses values stored in its configuration parameters to define the following minimal set of connection properties:

- Server host name
- Port number
- User login name
- User login password

Note The complete set of connection parameters is different for each database. For the complete set of connection parameters that each database requires, see the Replication Agent *Primary Database Guide*.

For its connection to the Replication Server, Replication Agent relies on the values of two additional configuration parameters (rs_source_db and rs_source_ds) to identify the Replication Server primary database connection in the LTL connect source command.

The Replication Agent instance must be in *Admin* state to set up connection parameters. In *Admin* state, the instance has no connections established to other replication system components, but it is available to execute administrative commands. For more information, see “Understanding Replication Agent states” on page 68.

Note The values of the rs_source_db and rs_source_ds parameters must *exactly match* the database and data server names specified in the create connection command for the Replication Server primary database connection. The values are case sensitive.

See the Replication Agent *Reference Manual* for more information about the rs_source_db and rs_source_ds parameters.

To record the values of connection configuration parameters for each Replication Agent instance, use the “Installation and Setup Worksheet” in the Replication Agent *Installation Guide*.

Note The Replication Agent instance must be running before you can set its connection configuration parameter values. See “Starting the Replication Agent” on page 35 for more information.

❖ **To set up connection parameters for the primary database**

In the *Admin* state, the Replication Agent instance has no connections established to other replication system components, but it is available to execute administrative commands. The Replication Agent instance must be in *Admin* state to set up connection parameters.

1 Log in to the Replication Agent administration port, and verify that the Replication Agent instance is in *Admin* state:

   a Issue the following command to verify that the Replication Agent instance is in *Admin* state:

   ```
   ra_status
   ```

   b If the instance is not in *Admin* state, use the following command to change it to *Admin* state:

```
        suspend
```

2 For Oracle, specify the primary data server host name:

```
ra_config pds_hostname, pds_host
```

Here, *pds_host* is the network name of the primary data server host machine.

3 For IBM DB2 Universal Database, specify the data source name or database alias of the primary database:

```
ra_config pds_datasource_name, name
```

Here, *name* is the data source name or database alias of the primary database.

4 For Microsoft SQL Server, specify the primary data server name:

```
ra_config pds_server_name, server
```

Here, *server* is the name of the primary data server.

5 For Oracle or Microsoft SQL Server, specify the primary data server port number:

```
ra_config pds_port_number, NNN
```

Here, *NNN* is the number of the network port where the primary data server listens for connections.

6 Specify the primary database name:

```
ra_config pds_database_name, pdb
```

Here, *pdb* is the database name of the primary database.

7 Specify the primary data server user login name for the Replication Agent instance:

```
ra_config pds_username, ra_pds_user
```

Here, *ra_pds_user* is the user login name that the Replication Agent uses to log in to the primary data server.

8 Specify the password for the Replication Agent user login:

```
ra_config pds_password, ra_pds_pwd
```

Here, *ra_pds_pwd* is the password for the user login name that the Replication Agent uses to log in to the primary data server.

After you set up connection configuration parameters for the primary database, you can use the Replication Agent test_connection PDS command to test connectivity between the Replication Agent and the primary database. See "Testing network connectivity" on page 55 for more information.

❖ **To set up connection parameters for the Replication Server**

1 Log in to the Replication Agent administration port, and verify that the Replication Agent instance is in *Admin* state:

   a Issue the following command:

   ```
   ra_status
   ```

   b If the instance is not in *Admin* state, issue the following command to change it to *Admin* state:

   ```
   suspend
   ```

2 Specify the Replication Server host name:

   ```
   ra_config rs_hostname, rs_host
   ```

   Here, *rs_host* is the network name of the Replication Server host machine.

3 Specify the Replication Server port number:

   ```
   ra_config rs_port_number, NNN
   ```

   Here, *NNN* is the number of the network port where Replication Server listens for connections.

4 Specify the Replication Server character set:

   ```
   ra_config rs_charset, charset
   ```

   Here, *charset* matches the RS_charset value in the Replication Server *configuration* (*.cfg*) file. The location of the Replication Server configuration file is *$SYBASE/REP-15_0/install/<instance>.cfg*, where *<instance>* is the Replication Server instance.

5 Specify the Replication Server user login name for the Replication Agent instance:

   ```
   ra_config rs_username, ra_rs_user
   ```

   Here, *ra_rs_user* is the user login name that the Replication Agent uses to log in to the primary Replication Server.

6 Specify the user login password for the Replication Agent instance:

   ```
   ra_config rs_password, ra_rs_pwd
   ```

Here, *ra_rs_pwd* is the password for the user login name that the Replication Agent uses to log in to the primary Replication Server.

7 Specify the primary data server name for the Replication Server primary database connection:

```
ra_config rs_source_ds, pds
```

Here, *pds* is the primary data server name that the Replication Agent uses in the LTL connect source command.

8 Specify the primary database name for the Replication Server primary database connection:

```
ra_config rs_source_db, pdb
```

Here, *pdb* is the primary database name that the Replication Agent uses in the LTL connect source command.

❖ To set up connection parameters for the ERSSD (or RSSD)

1 Log in to the Replication Agent administration port, and verify that the Replication Agent instance is in *Admin* state:

a Use the following command:

```
ra_status
```

b If the instance is not in *Admin* state, issue the following command to put it in *Admin* state:

```
suspend
```

2 Specify the ERSSD host name:

```
ra_config rssd_hostname, rssd_host
```

Here, *rssd_host* is the network name of the ERSSD host machine.

3 Specify the ERSSD port number:

```
ra_config rssd_port_number, NNN
```

Here, *NNN* is the number of the network port where the ERSSD server listens for connections.

4 Specify the ERSSD database name:

```
ra_config rssd_database_name, rssd_db
```

Here, *rssd_db* is the database name of the ERSSD.

5 Specify the ERSSD user login name for the Replication Agent instance:

```
ra_config rssd_username, ra_rssd_user
```

Here, *ra_rssd_user* is the user login name that the Replication Agent uses to log in to the ERSSD.

6 Specify the user login password for the Replication Agent instance:

```
ra_config rssd_password, ra_rssd_pwd
```

Here, *ra_rssd_pwd* is the password for the user login name that the Replication Agent uses to log in to the RSSD.

After you set up connection configuration parameters for the primary Replication Server and RSSD, you can use the Replication Agent test_connection RS command to test connectivity between the Replication Agent and the Replication Server and RSSD.

Testing network connectivity

Replication Agent provides a simple means of testing network connections. The test_connection command sends a connection request and confirms the network connection to the following servers:

- Primary data server
- Primary Replication Server
- RSSD server (if so configured)

Note If the value of the use_rssd configuration parameter is true, the test_connection command tests Replication Agent connectivity to the RSSD when it tests connectivity to the Replication Server. If the value of the use_rssd configuration parameter is false, the test_connection command does *not* test Replication Agent connectivity to the RSSD.

The test_connection command returns a failure message if:

- The connection specifications (server name, port number, user login, and so forth) recorded in the Replication Agent configuration parameters are not correct.
- The Replication Agent cannot establish a connection to a server because of a network failure.
- The Replication Agent cannot establish a connection to a server because the server is down.

The test_connection command does *not* validate Replication Agent user login permissions in the primary database. It verifies only that the user login and password specified in the pds_username and pds_password parameters can log in to the primary data server.

The test_connection command does verify that the Replication Agent user login (specified in the rs_username and rs_password parameters) has connect source permission in the primary Replication Server.

For more information, see “Setting up Replication Agent connectivity” on page 46.

Note You must be in *Admin* state to test network connectivity.

❖ **To verify Replication Agent connections**

1 Log in to the Replication Agent instance with the administrator login.

2 Test Replication Agent network connections:

```
test_connection
```

This command tests all of the connections from the Replication Agent instance you logged in to.

Note You can test a specific connection (either the primary data server or the primary Replication Server) by specifying the connection you want to test.

If the test_connection command returns a failure, check the Replication Agent system log to determine the cause of the failure. You may also need to check the system log of the server associated with the connection to determine the cause of the failure.

See the Replication Agent *Reference Manual* for more information about the test_connection command.

Initializing Replication Agent

Replication Agent uses the native transaction log maintained by the primary database to obtain transactions. To support replication, Replication Agent creates some objects in the primary database.

Note Before you initialize a Replication Agent that has an RASD, the primary database must be quiesced. Only Replication Agent for Oracle and Replication Agent for Microsoft SQL Server use an RASD. The following procedure includes that quiesce.

Specifying the object name prefix

Before you create the Replication Agent objects, you can specify the object name prefix string to be used to name the objects. You can set this prefix string to avoid conflicts with the names of existing database objects in your primary database.

The value of the pdb_xlog_prefix parameter is the prefix string used in all Replication Agent object names. Use the ra_config command to change the value of the pdb_xlog_prefix parameter.

Note Replication Agent uses the value of pdb_xlog_prefix to find its objects in the primary database. If you change the value of pdb_xlog_prefix after you initialize Replication Agent, Replication Agent is unable to find the objects that use the old prefix.

Note Replication Agent requires you to perform specific setup tasks at the primary database before you can initialize Replication Agent. See the Replication Agent *Primary Database Guide* to verify that the required setup tasks have been performed for your primary database.

❖ **To initialize a Replication Agent**

1 Log in to the Replication Agent administration port.

2 To define a prefix that uniquely identifies the Replication Agent transaction log you are creating, use the following command:

```
ra_config pdb_xlog_prefix, string
```

Here, *string* is a character string of one to three characters that is used as a prefix for all names of the Replication Agent objects created in the primary database.

Note The default value of the pdb_xlog_prefix parameter is ra_. Unless this string poses a conflict with existing database object names in your primary database, you should use the default value.

---

3 To initialize the Replication Agent, use the following command:

```
pdb_xlog init
```

Note Replication Agent versions earlier than 12.6 use the pxb_xlog command with the create keyword to initialize the Replication Agent. This keyword has been retained for backward compatibility, but the init keyword is the correct and preferred syntax to be used with the pdb_xlog command.

When you invoke the pdb_xlog command with the init option, Replication Agent does the following:

- Checks the primary database for compatible settings.
- Generates a SQL script that is run in the primary database. This script creates the Replication Agent objects in the primary database.

For Replication Agents that use an RASD, the RASD is initialized with information from the primary database.

Note Replication Agent must be initialized before any objects can be marked for replication in the primary database.

---

4 To verify that the Replication Agent was initialized and that its objects were created in the primary database, use the following command:

```
pdb_xlog
```

When you invoke the pdb_xlog command with no options, Replication Agent returns a list of the objects in the primary database, if initialization completed successfully. If no information is returned, Replication Agent has not been initialized, and none of its objects exist in the primary database.

When the Replication Agent is initialized and both primary database and Replication Server connections are defined correctly, you can put the Replication Agent instance in *Replicating* state. See “Starting the Replication Agent” on page 35 for more information about putting the Replication Agent in *Replicating* state.

Marking objects in the primary database

Individual tables to be replicated must be marked. Tables can be marked explicitly with the pdb_setreptable command or automatically during pdb_xlog init processing when the pdb_automark_tables configuration parameter is set to true.

Note The pdb_automark_tables parameter is not available for Replication Agent for UDB.

Tables, stored procedures, and sequences (Oracle only) must be marked for replication and have replication enabled for the object (table, stored procedure, or sequence). LOB columns must have replication enabled, and the table that contains the LOB column must be marked for replication and have replication enabled for that table.

There are four types of objects that can be marked for replication in a primary database:

- Tables
- Stored procedures

  Note Procedure replication is not available for IBM DB2 Universal Database.

- Large-object (LOB) columns
- DDL (Oracle and Microsoft SQL Server only)

  Note DDL replication is not available for IBM DB2 Universal Database.

- Sequences (Oracle only)

Marking tables in the primary database

For transactions against a table to be replicated, the primary table in the primary database must be marked for replication, and replication must be enabled for that table.

Note The setting of the pdb_convert_datetime parameter affects the format of date values sent to Replication Server. The pdb_convert_datetime parameter should be set appropriately before any tables are marked for replication. For a detailed description of the pdb_convert_datetime configuration parameter, see Chapter 2, “Configuration Parameters,” in the Replication Agent *Reference Manual*.

❖ **To mark a table in the primary database**

1 Log in to the Replication Agent administration port.

2 Use the pdb_setreptable command to determine if the table you want to mark is already marked in the primary database:

```
pdb_setreptable pdb_table
```

Here, *pdb_table* is the name of the table in the primary database that you want to mark for replication.

- If the pdb_setreptable command returns information that the specified table is marked and replication is enabled, you need not continue this procedure.
- If the pdb_setreptable command returns information that the specified table is marked but replication is disabled, skip step 3 and go to step 4 to enable replication for the table.
- If the pdb_setreptable command returns information that the specified table is not marked, continue this procedure to mark the table for replication.

3 Use the pdb_setreptable command to mark the table for replication and specify the name to use for replication:

- Use the following command to mark the table for replication using a replication definition with the same table name:

  ```
  pdb_setreptable pdb_table, mark
  ```

  Here, *pdb_table* is the name of the table in the primary database that you want to mark for replication.

- Use the following command to mark the table for replication using a replication definition with a different table name:

  ```
  pdb_setreptable pdb_table, rep_table, mark
  ```

  where:

  - *pdb_table* is the name of the table in the primary database that you want to mark for replication.
  - *rep_table* is the name of the table in the with primary table named rep_table clause in the replication definition for this table.

- When you mark a table for replication, if the Replication Server replication definition for the table is to be owner qualified, you must specify that the log transfer language (LTL) sent by Replication Agent should also be owner qualified to match the replication definition. To do this, use the owner keyword after the mark keyword:

  ```
  pdb_setreptable pdb_table, mark, owner
  ```

  Here, *pdb_table* is the name of the table in the primary database that you want to mark for replication.

If the pdb_dflt_object_repl parameter is set to true (the default), the table marked for replication with the pdb_setreptable command is ready for replication after you invoke the pdb_setreptable command successfully, and you can skip step 4 in this procedure.

If the pdb_dflt_object_repl parameter is set to false, you must enable replication for the table before replication can take place.

4. Use the pdb_setreptable command to enable replication for the marked table:

   ```
   pdb_setreptable pdb_table, enable
   ```

   Here, *pdb_table* is the name of the marked table in the primary database for which you want to enable replication.

5. Use the pdb_setreptable command with the all keyword to mark or enable all user tables at once:

   ```
   pdb_setreptable all, {mark|enable}
   ```

Here, mark or enable are the keywords identifying the action that should be taken against all user tables in the database.

Note The ability to mark all tables is not available for IBM DB2 Universal Database.

After the table is marked and replication is enabled for the table, you can begin replicating transactions that affect data in that table.

Marking stored procedures in the primary database

To replicate invocations of a stored procedure in the primary database, the stored procedure must be marked for replication, and replication must be enabled for that stored procedure.

For Oracle, DDL replication must be disabled before marking (or unmarking) a stored procedure.

Note Procedure replication is not available for IBM DB2 Universal Database.

❖ **To mark a stored procedure in the primary database**

1. Log in to the Replication Agent administration port.
2. Use the pdb_setrepproc command to determine if the stored procedure you want to mark is already marked in the primary database:

   ```
   pdb_setrepproc pdb_proc
   ```

   Here, *pdb_proc* is the name of the stored procedure in the primary database that you want to mark for replication.

   - If the pdb_setrepproc command returns information that the specified stored procedure is marked and replication is enabled, you need not continue this procedure.
   - If the pdb_setrepproc command returns information that the specified stored procedure is marked but replication is disabled, skip step 3 and continue this procedure from step 4 to enable replication for the stored procedure.
   - If the pdb_setrepproc command returns information that the specified stored procedure is not marked, continue this procedure to mark the stored procedure for replication.

3 Use the pdb_setrepproc command to mark the stored procedure for replication and specify the name to use for replication:

- Use the following command to mark the stored procedure for replication using a function replication definition with the same procedure name:

  ```
  pdb_setrepproc pdb_proc, mark
  ```

  Here, *pdb_proc* is the name of the stored procedure in the primary database that you want to mark for replication.

- Use the following command to mark the stored procedure for replication using a function replication definition with a different procedure name:

  ```
  pdb_setrepproc pdb_proc, rep_proc, mark
  ```

  where:

  - *pdb_proc* is the name of the stored procedure in the primary database that you want to mark for replication.
  - *rep_proc* is the name of the stored procedure in the with all procedures named rep_proc clause in the function replication definition for this stored procedure.

If the pdb_dflt_object_repl parameter is set to true (the default), the stored procedure marked for replication with the pdb_setrepproc command is ready for replication after you invoke the pdb_setrepproc command successfully, and you can skip step 4 in this procedure.

If the pdb_dflt_object_repl parameter is set to false, you must enable replication for the stored procedure so replication can take place.

4 Use the pdb_setrepproc command to enable replication for the marked stored procedure:

```
pdb_setrepproc pdb_proc, enable
```

Here, *pdb_proc* is the name of the marked stored procedure in the primary database for which you want to enable replication.

After the stored procedure is marked and replication is enabled for the stored procedure, you can begin replicating invocations of that stored procedure.

Enabling replication for LOB columns

For transactions that affect a LOB column to be replicated, the table that contains the LOB column must be marked for replication and have replication enabled.

If the value of the pdb_dflt_column_repl parameter is set to true, all LOB columns in a table have replication enabled automatically when you mark the table (by invoking the pdb_setreptable command). If the value of the pdb_dflt_column_repl parameter is set to false, you must enable replication separately for each LOB column before replication can take place.

Note The default value of the pdb_dflt_column_repl parameter is false.

❖ **To enable replication for a LOB column in the primary database**

1 Log in to the Replication Agent administration port.

2 Use the pdb_setrepcol command to determine if replication is already enabled for the LOB column you want to enable replication for in the primary database:

```
pdb_setrepcol tablename, pdb_col
```

where:

- *tablename* is the name of the table that contains the LOB column.
- *pdb_col* is the name of the LOB column in the primary database.

Note For Replication Agent for UDB, if pdb_setrepcol is invoked with a table containing a "DATE" column, the primary key in the primary table must *not* include the "DATE" column.

If the pdb_setrepcol command returns information that replication is enabled for the specified column, you need not continue this procedure.

If the pdb_setrepcol command returns information that replication is not enabled for the specified column, continue this procedure to enable replication for the column.

3 Use the pdb_setrepcol command to enable replication for the LOB column:

```
pdb_setrepcol tablename, pdb_col, enable
```

where:

- *tablename* is the name of the table that contains the LOB column.
- *pdb_col* is the name of the LOB column in the primary database for which you want to enable replication.

After replication is enabled for the LOB column, you can begin replicating transactions that affect data in that column.

Enabling replication for DDL

Note DDL replication is not available for IBM DB2 Universal Database.

For DDL to be replicated, the pdb_setrepddl command must be set to enable. If pdb_setrepddl is set to enable, all DDL in your primary database is replicated. Also, you must set the ddl_username and the ddl_password.

Note To replicate DDL:

- Replication Agent requires a unique user name to be supplied that has authority to execute all DDL commands at the standby database.
- Replication Server must have a database-level replication definition with replicate DDL set in the definition.

For details about configuration property ddl_username and for database-level replication definition, refer to the Replication Agent *Reference Manual*.

❖ To enable replication for DDL in the primary database

1 Log in to the Replication Agent administration port.

2 Use the pdb_setrepddl command without an argument to determine if replication is already enabled for DDL in the primary database:

```
pdb_setrepddl
```

If the pdb_setrepddl command returns information that replication is enabled, you do not need to continue this procedure.

If the pdb_setrepddl command returns information that replication is not enabled for DDL, continue this procedure to enable replication for DDL.

3 Use the pdb_setrepddl command to enable replication for DDL:

```
pdb_setrepddl enable
```

After replication is enabled for the DDL, you can begin replicating your primary database.

For more information, see the Replication Agent *Primary Database Guide*.

Starting replication

Note Before you attempt to replicate transactions from the primary database, you must complete all of the procedures in "Setting up Replication Agent connectivity" on page 46.

❖ **To start replication in the Replication Agent instance**

1 Log in to the Replication Agent administration port, and use the following command to verify that the Replication Agent instance is in *Admin* state:

```
ra_status
```

2 Start replication by invoking the following command:

```
resume
```

3 Use the ra_status command to verify that the Replication Agent instance is in *Replicating* state.

Note The Replication Agent instance goes to the Replicating state only if a connection for the primary database has been created in the primary Replication Server. For more information on creating the primary database connection in Replication Server, see the Replication Agent *Primary Database Guide*.

When the Replication Agent instance is in *Replicating* state, it is scanning the transaction log for transactions to be replicated and sending LTL to the primary Replication Server.

If the Replication Agent instance is not in Replicating state after you invoke the resume command, see Chapter 4, "Troubleshooting Replication Agent" for more information.

CHAPTER 3 Administering Replication Agent

This chapter describes administrative tasks and procedures for the Replication Agent.

For information about installing the Replication Agent software, see the Replication Agent *Installation Guide*.

For information about setting up the Replication Agent, see Chapter 2, “Setting Up and Configuring Replication Agent.”

Note Although example procedures in this chapter show isql as the Open Client application used to log in to the Replication Agent administration port, you can use any Open Client (or Open Client-compatible) application to do so.

Determining current Replication Agent status

The Replication Agent status consists of the current state and activity of the Replication Agent instance.

❖ **To determine the status of a Replication Agent instance**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the following command to get current status for the Replication Agent instance:

```
ra_status
```

This command returns the current state of the Replication Agent instance and any current activity, as shown in the following example:

```
State  Action
------ ---------------------------
ADMIN  Waiting for operator command
(1 row affected)
```

Understanding Replication Agent states

When a Replication Agent instance is running, it can be in one of two discrete states:

- *Admin* – the instance has no connections established to other replication system components, but it is available to execute administrative commands, such as changing configuration parameters and maintaining the transaction log or the RASD. No replication processing occurs when the Replication Agent instance is in *Admin* state.
- *Replicating* – the instance is performing its normal replication processing: scanning the transaction log, processing log records and change-set data, and sending LTL commands to the primary Replication Server. In *Replicating* state, some administrative commands are not allowed.

The default start-up state is *Admin*. The Replication Agent instance goes to *Admin* state automatically when no start-up state is specified.

The state of a Replication Agent instance can be changed by either:

- An external event that occurs while the Replication Agent is processing replicated transactions (for example, a network error on the Replication Server connection), or
- Operator intervention (for example, invoking a command that changes the Replication Agent state).

From the moment a state-changing event occurs until the Replication Agent instance is actually in the new state, the instance is said to be “in transition.” During state transition, some administrative commands are ignored.

Admin state

A Replication Agent instance goes to *Admin* state when:

- The instance is started in its default state.

- The instance is started with the ra utility -admin option.
- The Replication Agent quiesce or suspend command is invoked when Replication Agent is in *Replicating* state.
- An unrecoverable error occurs when the instance is in *Replicating* state.

In *Admin* state, the Replication Agent instance is running, but it has no connection established to the primary Replication Server (or RSSD, if so configured) or the primary database.

You can perform most administrative tasks while the Replication Agent instance is in *Admin* state, including changing the value of any Replication Agent configuration parameter.

Note In *Admin* state, the instance can open a connection to the primary database, if necessary, to process a command that requests results from the primary database.

A Replication Agent instance may go to *Admin* state from *Replicating* state when a network failure or communication error causes its connection to the primary database or the primary Replication Server to be dropped.

When Replication Agent drops a connection, before it goes to *Admin* state, it first attempts to re-establish the connection using the values recorded in its configuration parameters for that connection. If it cannot reconnect, the Replication Agent instance goes to *Admin* state.

Replicating state

A Replication Agent instance goes to *Replicating* state when:

- The instance is started with the ra utility -replicate option.
- The Replication Agent resume command is invoked when Replication Agent is in *Admin* state.

Note The Replication Agent instance goes to the *Replicating* state only if a connection for the primary database has been created in the primary Replication Server. For more information on creating the primary database connection in Replication Server, see the Replication Agent *Primary Database Guide*.

In *Replicating* state, the Replication Agent instance maintains a connection to the primary database and to the primary Replication Server (and RSSD, if so configured), and its Log Reader component scans the transaction log for transactions to replicate.

If the Replication Agent instance has finished processing all of the records in the transaction log, its state continues to appear as *Replicating*. When the Replication Agent instance reaches the end of the log:

- The Log Reader component log-scanning process "sleeps" according to the values of the scan_sleep_increment and scan_sleep_max configuration parameters.
- After the Log Transfer Interface (LTI) component finishes processing all of the change sets it received from the Log Reader and sending all of the LTL to the Replication Server, no replication throughput occurs until new replicated transactions appear in the log and the Log Reader scans them.
- The Replication Agent instance remains in *Replicating* state, unless some other event causes it to go to *Admin* state.

Changing the Replication Agent state

The state of a Replication Agent instance indicates its current operational condition, and determines which administrative tasks you can perform.

Generally, there are only two reasons to change the state of a Replication Agent instance:

- To perform certain administrative or maintenance procedures (change the state from *Replicating* to *Admin*)
- To restore normal replication processing (change the state from *Admin* to *Replicating*), either after an administrative or maintenance procedure, or after recovery from an error

Changing from *Replicating* state to *Admin* state

To change the state of the Replication Agent instance from *Replicating* to *Admin*, you can use either the quiesce or suspend command. For more information, see "Stopping replication in the Replication Agent" on page 75.

See the Replication Agent *Reference Manual* for more detailed information about the quiesce and suspend commands.

Changing from *Admin* state to *Replicating* state

To change the state of the Replication Agent instance from *Admin* to *Replicating*, you can use the resume command. For more information, see "Starting replication in the Replication Agent" on page 74.

See the Replication Agent *Reference Manual* for more detailed information about the resume command.

Getting Replication Agent statistics

The Replication Agent records information about the performance of its internal components whenever it is in *Replicating* state. You can use this information to tune Replication Agent performance or troubleshoot problems.

To get information about Replication Agent performance, use the ra_statistics command. You can also use ra_statistics to reset the statistics counters.

Note Each time the Replication Agent instance goes to *Replicating* state, statistics counters are reset automatically.

For more information about the ra_statistics command and Replication Agent performance statistics, see the Replication Agent *Reference Manual*.

Shutting down the Replication Agent instance

Each Replication Agent instance can be started and shut down independently of all other components in a replication system, and independently of other Replication Agent instances.

For information about how to start a instance, see “Starting the Replication Agent” on page 35.

Shutting down the Replication Agent instance terminates its process on the host machine.

Note You can stop all replication processing in the Replication Agent without shutting down the instance. For more information, see “Stopping replication in the Replication Agent” on page 75.

To shut down a Replication Agent instance, you must log in to the administration port and invoke the shutdown command. The shutdown command gives you two options:

- Normal shutdown – first quiesces the Replication Agent instance, and then shuts down the instance, terminating its process.

- Immediate shutdown – shuts down the Replication Agent instance and terminates its process immediately, without first quiescing. To use this method, use the immediate keyword when you invoke the shutdown command.

Note If the Replication Agent instance is in state transition, it ignores the shutdown command with no option (normal shutdown). It does *not* ignore shutdown immediate when it is in any state, including transition from one state to another.

When a Replication Agent instance is shut down normally, it does the following:

- Stops reading the transaction log
- Drops its connection to the primary database
- Finishes processing any transactions it already has in its internal queues
- Drops its connection to the Replication Server after successfully sending LTL for any transactions in its internal queues
- Terminates its process

❖ To shut down a Replication Agent instance

1. Log in to the Replication Agent instance with the administrator login.
2. Invoke the shutdown command as follows:
   - Use the following command to shut down the Replication Agent instance normally:

     ```
     shutdown
     ```

   - Use the following command to force an immediate shutdown, regardless of the state of the Replication Agent instance:

     ```
     shutdown immediate
     ```

     This command shuts down and terminates the Replication Agent instance immediately, without first quiescing.

For more detailed information about the shutdown command, see the Replication Agent *Reference Manual*.

Replication Agent configuration requirements

This section describes the configuration requirements for each component.

Primary database

Configure the primary database as follows:

- Add the Replication Agent user login name to the primary database, and grant the user appropriate permission to be able to perform tasks necessary to support replication.
- Add the Maintenance User login name (as specified in the Replication Server create connection command) to the primary database.
- *For Oracle*: Enable supplemental logging, and disable the recycle bin.
- *For Microsoft SQL Server*: Initialize the data server. Also, configure the database to allow a remote TCP/IP connection and to allow a remote DAC connection.

Replication Agent

Configure the Replication Agent instance as follows:

- Make sure that the connection configuration is set correctly for network communications with the primary database, Replication Server, and RSSD.
- Use the pdb_xlog init command to initialize Replication Agent. This command validates that the primary database is prepared for replication, sets up Replication Agent system objects in the primary database, and initializes the RASD (Oracle and Microsoft SQL Server only).

Replication Server

Configure the Replication Server as follows:

- Use the Replication Agent user login name, with connect source and create object permission granted.
- Identify or create the Replication Agent user login name for the RSSD.
- Define the database Replication Definition and Subscription for the primary and standby database.
- Apply the Heterogeneous Datatype Support Scripts at the RSSD.
- *For Oracle*: If Replication Server is version 15.0 or earlier, apply the scripts distributed with Replication Agent to correctly define the Oracle error class. See “RSSD” for details.

RSSD

Replication Server requires changes to the RSSD to support Oracle datatypes. To implement these changes, execute the following Replication Server scripts against the RSSD database.

Note In each script, you must set the `RSSD` statement to point to the correct RSSD for your Replication Server.

$SYBASE/REP-15_0/scripts/hds_oracle_udds.sql
$SYBASE/REP-15_0/scripts/hds_oracle_funcstrings.sql
$SYBASE/REP-15_0/scripts/hds_clt_ase_to_oracle.sql
$SYBASE/REP-15_0/scripts/hds_clt_oracle_to_ase.sql

Also, if your Replication Server is version 15.0 or earlier, execute the following Replication Agent script against the RSSD:

$SYBASE/RAX-15_1/scripts/hds_oracle_new_udds.sql

To correctly define the Oracle error class in both Replication Server and the RSSD, do the following:

- At Replication Server, execute the *$SYBASE/RAX-15_1/scripts/oracle/oracle_create_error_class_1_rs.sql* script.
- At the RSSD database, execute the *$SYBASE/RAX-15_1/scripts/oracle/oracle_create_error_class_2_rssd.sql* script.
- At Replication Server, execute the *$SYBASE/RAX-15_1/scripts/oracle/oracle_create_error_class_3_rs.sql* script.

Starting replication in the Replication Agent

When the Replication Agent instance is in *Replicating* state, it maintains connections to the primary database and the primary Replication Server (and RSSD, if so configured), and its Log Reader component scans the transaction log for transactions to replicate.

The Replication Agent instance must be running before you can start replication. For more information, see “Starting the Replication Agent” on page 35.

❖ **To start replication in the Replication Agent**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the following command to start replication:

   ```
   resume
   ```

   After you invoke the resume command, the Replication Agent instance should go from *Admin* state to *Replicating* state.
3. Use the following command to verify that the Replication Agent instance is in *Replicating* state:

   ```
   ra_status
   ```

If the Replication Agent instance does not go to *Replicating* state after you invoke the resume command, see Chapter 4, “Troubleshooting Replication Agent,” for more information.

See the Replication Agent Replication Agent *Reference Manual* for more detailed information about the resume command and how Replication Agent starts replication processing.

Stopping replication in the Replication Agent

When you stop replication in the Replication Agent:

- The internal Log Reader and Log Transfer Interface components stop their normal replication processing.
- Any open connections to the primary database are released, and the connection to the Replication Server is dropped.
- The Replication Agent instance goes from *Replicating* state to *Admin* state.

When the Replication Agent instance is in *Admin* state, it is running and available to execute administrative commands, but it does not maintain connections to the primary database and the primary Replication Server (and RSSD, if so configured), and it does not process replicated transactions.

Some administrative tasks require the Replication Agent instance to be in *Admin* state. In a normally operating replication system, you must stop replication in the Replication Agent to perform those tasks.

There are two ways to stop replication in the Replication Agent:

- Quiesce the Replication Agent instance to stop replication gracefully. For more information, see “Quiescing the Replication Agent” on page 76.
- Suspend the Replication Agent instance to stop replication immediately. For more information, see “Suspending the Replication Agent instance” on page 77.

Quiescing the Replication Agent

Quiescing the Replication Agent instance stops its replication processing gracefully, ensuring that all transactions from the log have been read and sent to the Replication Server:

- *For Oracle and Microsoft SQL Server*: The Log Reader component continues reading operations from the transaction log until there are no operations left; that is, until the Log Reader reaches the end of the log. The Log Reader continues to send change-set data to the Log Transfer Interface component until it finishes processing the last operation it scanned from the log.
- *For IBM DB2 Universal Database*: The Log Reader component stops reading operations from the transaction log when the current scan is complete. It continues to send change-set data to the Log Transfer Interface component until it finishes processing the last operation it scanned from the log.
- The Log Transfer Interface component stops sending LTL commands to the Replication Server as soon as it finishes processing the last change set it received from the Log Reader.
- When the Log Transfer Interface component is finished processing its input queue and sending the resulting LTL, the Replication Agent instance releases all of its connections to the primary database (if any are open), and drops its connection to the Replication Server (and RSSD, if connected).
- The Replication Agent instance goes from *Replicating* state to *Admin* state.

❖ To quiesce a Replication Agent instance

1. Log in to the Replication Agent instance with the administrator login.
2. Use the following command to quiesce the Replication Agent:

   ```
   quiesce
   ```

After you invoke the quiesce command, the Replication Agent instance should go from *Replicating* state to *Admin* state.

3 Use the following command to verify that the Replication Agent instance is in *Admin* state:

```
ra_status
```

Note If the internal queues are full and the primary database is still recording new activity to the log files when you invoke the quiesce command, the quiesce processing may take a while to complete, and there may be a delay before the Replication Agent instance completes the transition to *Admin* state.

For more detailed information about the quiesce command and its processing, see the Replication Agent *Reference Manual*.

Suspending the Replication Agent instance

Suspending the Replication Agent instance stops its replication processing immediately:

- The Log Reader component stops scanning the transaction log immediately, and the Log Transfer Interface component stops sending LTL commands to the Replication Server immediately.
- All data in the Replication Agent internal queues (input and output queues of the Log Reader and Log Transfer Interface components) is flushed without further processing.
- The Replication Agent instance releases all of its connections to the primary database (if any are open), and drops its connection to the Replication Server (and RSSD, if connected).
- The Replication Agent instance goes from *Replicating* state to *Admin* state.

❖ To suspend a Replication Agent instance

1 Log in to the Replication Agent instance with the administrator login.

2 Use the following command to suspend the Replication Agent:

```
suspend
```

After you invoke suspend, the Replication Agent instance should go from *Replicating* state to *Admin* state.

3 Use the following command to verify that the Replication Agent instance is in *Admin* state:

```
ra_status
```

For more detailed information about the suspend command, see the Replication Agent *Reference Manual*.

Managing Replication Agent

This section describes administration and maintenance procedures for the following Replication Agent variants:

- Replication Agent for Microsoft SQL Server
- Replication Agent for IBM DB2 Universal Database (UDB)
- Replication Agent for Oracle

Replication Agent for Microsoft SQL Server

The Replication Agent for Microsoft SQL Server uses the native Microsoft SQL Server log to capture replicated transactions. The objects it creates in the primary database facilitate replication. These database objects require no routine maintenance.

See the Replication Agent *Primary Database Guide* for information on how to automatically truncate the primary database transaction log.

Replication Agent for UDB

The Replication Agent for UDB uses the native DB2 log to capture replicated transactions. The Replication Agent for UDB creates objects in the primary database to store its system data, but those database objects require no routine maintenance.

Depending on the configuration, Replication Agent may process only online transaction logs (default) or may also access archived transactions logs. For information about online transaction log files, archive transaction log files, and log truncation, see the Replication Agent *Primary Database Guide*.

Replication for Oracle

The Replication Agent for Oracle uses the native Oracle log to capture replicated transactions. The objects it creates in the primary database facilitate stored procedure replication. These database objects require no routine maintenance.

Depending on the configuration, Replication Agent may also access archived transactions logs (default) or may process only online transaction logs. For information on redo log and archive log files, see the Replication Agent *Primary Database Guide*.

Administration tasks

The following sections describe each Replication Agent administration and maintenance task in detail:

- Initializing Replication Agent
- Deinitializing Replication Agent
- Forcing Replication Agent deinitialization
- Truncating the transaction log
- Backing up Replication Agent objects in the primary database

Initializing Replication Agent

Before you can initialize a Replication Agent instance, the Replication Agent instance must be running, and connectivity to the primary database must be established. See “Starting the Replication Agent” on page 35 and “Setting up Replication Agent connectivity” on page 46 for more information.

Note Before you initialize a Replication Agent that has an RASD, the primary database must be quiesced. Only Replication Agent for Oracle and Replication Agent for Microsoft SQL Server use an RASD. The following procedure includes quiescing.

❖ **To initialize a Replication Agent transaction log in the primary database**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the following command to determine if objects associated with this Replication Agent instance already exists in the primary database:

```
pdb_xlog
```

If no Replication Agent objects exist, the pdb_xlog command returns no information. Continue this procedure to initialize Replication Agent. This procedure also creates objects in the primary database that support replication.

Note The pdb_xlog command looks for Replication Agent objects based on the value of the pdb_xlog_prefix configuration parameter. If the value of the pdb_xlog_prefix parameter changed *after* a transaction log was created, the pdb_xlog command cannot find the previously created objects.

If Replication Agent objects exist in the primary database, the pdb_xlog command returns a list of objects.

If objects exist for the Replication Agent instance, you do not need to complete this procedure.

3 If you want to use a particular string for the database object name prefix of the transaction log components, use the ra_config command to set the value of the pdb_xlog_prefix parameter:

```
ra_config pdb_xlog_prefix, XXX
```

Here, *XXX* is a one- to three-character string that is to be the new value of the pdb_xlog_prefix parameter, and the prefix string used in the database object names when the objects are created. The default value of the pdb_xlog_prefix parameter is ra_.

Note The value of the pdb_xlog_prefix_chars parameter specifies the non-alphabetic characters that are allowed in the prefix string (the value of the pdb_xlog_prefix parameter). The primary data server may restrict the characters that can be used in database object names. See the Replication Agent *Primary Database Guide* for information about which characters are available for which database.

You can also use ra_config to determine the current value of the pdb_xlog_prefix parameter:

```
ra_config pdb_xlog_prefix
```

When you invoke ra_config and specify a configuration parameter with no value, it returns the current value of that parameter.

4 If your Replication Agent has an RASD, you must quiesce the primary database, or otherwise prevent any DDL operations that can change the database objects or schema.

Only the Replication Agent for Oracle and the Replication Agent for Microsoft SQL Server use an RASD.

Log in to the primary data server with a user login that has appropriate permissions or authority, and quiesce the primary database (or execute the commands necessary to prevent any DDL operations that change the database objects or schema).

5 Use the pdb_xlog command to initialize the Replication Agent transaction log:

```
pdb_xlog init
```

Note When you invoke pdb_xlog with the init keyword, the command returns an error message if the Replication Agent objects (using the prefix string currently specified in the pdb_xlog_prefix parameter) already exist in the primary database.

When you invoke the pdb_xlog command with the init option, the Replication Agent does the following:

- Checks the primary database for compatible settings.
- Generates a SQL script that is run in the primary database. This script creates the Replication Agent objects.

For Replication Agents that use an RASD, the RASD is initialized with information from the primary database.

Note You can configure the Replication Agent to generate the script—but not execute it—by setting the value of the pdb_auto_run_scripts parameter to false *before* you invoke the pdb_xlog command. To complete the transaction log creation, you must set pdb_auto_run_scripts to true and rerun the pdb_xlog init command.

If the log-creation script executes successfully, the script is stored in a file named *partinit.sql* in the *scripts/xlog/installed* directory.

If the log-creation script does *not* execute successfully, the primary database is not changed, and the script is stored in a file named *partinit.sql* in the *scripts/xlog* directory.

Check the primary database error log to determine why the log-creation script did not execute successfully. To get the log-creation script to execute successfully, you may need to edit the script file. See Chapter 4, “Troubleshooting Replication Agent,” for more information.

Deinitializing Replication Agent

The Replication Agent instance must be running in *Admin* state to remove its objects from the primary database and to deinitialize Replication Agent. See "Starting the Replication Agent" on page 35 for more information.

❖ **To remove Replication Agent objects from the primary database**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the pdb_xlog command to verify that the Replication Agent objects exist in the primary database:

   ```
   pdb_xlog
   ```

   If the Replication Agent objects do not exist in the primary database, the pdb_xlog command returns no information about any objects. If no objects exist, you do not need to complete this procedure.

   Note The pdb_xlog command looks for Replication Agent objects based on the current value of the pdb_xlog_prefix configuration parameter. If the value of the pdb_xlog_prefix parameter changed after the Replication Agent instance was initialized, the pdb_xlog command cannot find the Replication Agent objects that were previously created.

   If objects exist for this Replication Agent instance, the pdb_xlog command returns a list of the names of the objects. Continue this procedure to remove the objects from the primary database.
3. Use the pdb_setreptable command to disable replication for all marked tables in the primary database:

   ```
   pdb_setreptable all, disable
   ```

   When you invoke the pdb_setreptable command with the all and disable keywords, Replication Agent disables replication for all marked tables in the primary database.
4. Use the pdb_setrepproc command to disable replication for all marked procedures in the primary database:

   ```
   pdb_setrepproc all, disable
   ```
5. Use the pdb_setreptable command to unmark all marked tables in the primary database:

   ```
   pdb_setreptable all, unmark
   ```

When you invoke the pdb_setreptable command with the all and unmark keywords, Replication Agent removes replication marking from all marked tables in the primary database.

6. Use the pdb_setrepproc command to unmark all marked procedures in the primary database:

   ```
   pdb_setrepproc all, unmark
   ```

   When you invoke the pdb_setrepproc command with the all and unmark keywords, Replication Agent removes replication marking from all marked procedures in the primary database.

   Note Normally, if any objects in the primary database are marked for replication, you cannot remove the Replication Agent transaction log.

   ---

7. Use the pdb_xlog command to remove Replication Agent objects:

   ```
   pdb_xlog remove
   ```

   Note When you invoke the pdb_xlog command with the remove keyword, the command returns an error message if no Replication Agent objects exist in the primary database.

   After you invoke the pdb_xlog command with the remove keyword, Replication Agent generates a script that removes the objects from the primary database and deinitializes Replication Agent.

   Note You can configure Replication Agent to simply build the script, but not execute it, by setting the value of the pdb_auto_run_scripts parameter to false before invoking the pdb_xlog command. To complete the removal of the Replication Agent objects, you must set pdb_auto_run_scripts to true and rerun the pdb_xlog init command.

If the log removal script executes successfully, the script is stored in a file named *partdeinit.sql* file in the *RAX-15_1\inst_name\scripts\xlog\installed* directory.

If the log removal script does not execute successfully, the script is stored in a file named *partdeinit.sql* in the *RAX-15_1\inst_name\scripts\xlog* directory.

Forcing Replication Agent deinitialization

When you invoke the pdb_xlog command with the remove keyword, Replication Agent creates the *partdeinit.sql* script. When Replication Agent executes this script successfully, all Replication Agent objects are removed from the primary database.

In the event that the *partdeinit.sql* script fails for some reason, some Replication Agent objects may be removed from the primary database and some Replication Agent objects may remain.

Note If errors cause a script execution failure, refer to your primary database error logs and the Replication Agent system log to evaluate the errors and determine if any corrective action is necessary.

To finish removing Replication Agent objects after a script execution failure, invoke the pdb_xlog command with the remove keyword, followed by the force keyword:

```
pdb_xlog remove, force
```

When you use the force keyword, Replication Agent continues executing the *partdeinit.sql* script, even when errors are encountered, until the script is finished.

Truncating the transaction log

The Replication Agents for Microsoft SQL Server, Oracle, and UDB support both automatic and manual transaction log truncation.

You can enable or disable automatic log truncation at any time, and you can truncate the Replication Agent transaction log manually at any time, with automatic log truncation either enabled or disabled.

Note Depending on the type of database and the Replication Agent configuration, Replication Agent truncates either the database online logs or archive logs. Sybase recommends that you configure Replication Agent to truncate the database archive logs. See the Replication Agent *Primary Database Guide* for details.

When the Replication Agent truncates its transaction log, either automatically or on command (manually), the truncation point is determined by the most recent LTM Locator received from the primary Replication Server.

Automatic truncation

You have two options for automatic transaction log truncation:

- Automatic truncation each time the Replication Agent receives a new LTM Locator value from the primary Replication Server
- Periodic truncation on a time interval you specify

Replication Agent truncates the transaction log based on the most recent truncation point received from the primary Replication Server. The truncation point is part of the information contained in the LTM Locator.

❖ To enable automatic log truncation

1. Log in to the Replication Agent instance with the administrator login.
2. Use the ra_config command to enable automatic log truncation and specify the type of automatic truncation:
   - Use the following commands to enable automatic log truncation at a specified time interval:

     ```
     ra_config truncation_type, interval
     ra_config truncation_interval, N
     ```

     Here, *N* is the number of minutes between automatic truncations.

     Note The maximum truncation_interval value is 720.

   - Use the following command to enable automatic log truncation whenever the Replication Agent receives a new LTM Locator value from the primary Replication Server:

     ```
     ra_config truncation_type, locator_update
     ```

See the Replication Agent *Reference Manual* for more information about the truncation_interval and truncation_type configuration parameters.

❖ To disable automatic log truncation

1. Log in to the Replication Agent instance with the administrator login.
2. Use the ra_config command to disable automatic log truncation:

```
ra_config truncation_type, command
```

Note If the value of the truncation_type parameter is interval, and the value of the truncation_interval parameter is 0 (zero), automatic log truncation is effectively disabled.

Manual truncation

If automatic log truncation is disabled, you must periodically truncate the Replication Agent transaction log manually.

❖ **To truncate the Replication Agent transaction log manually**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the following command to truncate the Replication Agent transaction log:

   ```
   pdb_truncate_xlog
   ```

   The pdb_truncate_xlog command is asynchronous; it does not return success or failure, unless an immediate error occurs.

See the Replication Agent *Reference Manual* for more information about the pdb_truncate_xlog command.

Note As an alternative to the Replication Agent automatic log truncation feature, use a scheduler utility to execute the pdb_truncate_xlog command in a script.

Backing up Replication Agent objects in the primary database

The Replication Agent does not support automatically backing up and restoring Replication Agent objects in the primary database.

Sybase recommends that you use the database backup utilities provided by your primary database vendor to periodically back up the Replication Agent transaction log objects in the primary database.

Managing the Replication Agent System Database

Replication Agent for Oracle and Replication Agent for Microsoft SQL Server use an embedded database, managed by SQL Anywhere, for the RASD.

You can perform four tasks to maintain the RASD:

- Updating the RASD
- Backing up the RASD
- Restoring the RASD
- Truncating the RASD

RASD overview

Note DDL replication is not available in Replication Agent for UDB.

Each instance of Replication Agent for Oracle or Replication Agent for Microsoft SQL Server depends on the information in its RASD to recognize database structure or schema objects in the transaction log.

When you create a Replication Agent instance, the RASD is created automatically, but it contains no information until you *initialize* the Replication Agent instance using the `pdb_xlog init` command. When you initialize a Replication Agent instance, it does the following:

- Queries the primary database to get information about the database structure or schema
- Stores information about the database schema in its RASD

Note Initializing Replication Agent is one of the tasks required to set up the replication system, and it has several prerequisites. For more information about these tasks and how to initialize the Replication Agent, see “Create the Replication Agent instance” on page 9.

After the RASD is initially populated, its contents are synchronized with the primary database automatically during normal replication (without intervention).

If replication does not occur, the contents of the RASD become stale (not synchronized with the primary database), and you should rebuild them before use.

DDL commands

Most of the common data definition language (DDL) commands and system procedures executed in the primary database are recorded in the transaction log, and they are replicated to the replicate database. When it processes those DDL transactions for replication, the Replication Agent updates the RASD automatically.

If a DDL command or system procedure produces a change in the primary database schema and the Replication Agent cannot recognize that command or procedure and update its RASD automatically, a replication failure occurs if a subsequent transaction changes data in an object that is not recorded in the RASD. In that event, you must quiesce the primary database and reinitialize Replication Agent to force it to update the RASD. For more information, see "Updating the RASD" on page 89.

Each time it processes a DDL transaction that affects an existing database object, the Replication Agent creates a new *version* of the object metadata in its RASD. The version of each object is identified by the LTM Locator value of the DDL transaction that changed it.

Previous versions of objects must be kept in the RASD long enough to allow system recovery. For example, replaying a transaction that involved an object before it was changed by DDL could produce an error (or data inconsistency) with the current version of the object.

Note The Replication Agent does not support replaying transactions from a restored transaction log.

Object versions and LTM Locator values

The Replication Agent determines which version of each object to use by comparing the current object version string with the current LTM Locator value. If the current LTM Locator value is greater than or equal to the value of the object version, the current object metadata is used. If the current LTM Locator value is less than the value of the object version, a previous version of the object metadata must be used.

Without periodic truncation, the size of the RASD can grow indefinitely, as more and more versions of object metadata are added. For more information, see "Truncating the RASD" on page 94.

Updating the RASD

Note The RASD is usually updated automatically during normal replication activity. The following procedure to force an update of the RASD should only be used with the recommendation of Sybase Technical Support when the RASD is suspected of being corrupt.

❖ To update the RASD

1. Log in to the Replication Agent instance with the administrator login.
2. Use the following command to determine the state of the Replication Agent instance:

   ```
   ra_status
   ```

3. If the Replication Agent is in *Admin* state, skip this step and go to step 4.

   If the Replication Agent is in *Replicating* state:

   a. Use the following command to suspend replication by the Replication Agent instance:

      ```
      suspend
      ```

   b. Use the following command to verify that the Replication Agent is in *Admin* state:

      ```
      ra_status
      ```

4. Use the following command to re-initialize the Replication Agent and force it to update the RASD:

   ```
   pdb_xlog init, force
   ```

   Note The pdb_xlog init, force command does *not* overwrite any marking information or configurations. Also, it does *not* overwrite any existing path information to the log devices in the RASD, if all of the following log information in the RASD matches that returned by the primary data server.

   For each transaction log or device identified in the RASD, if any information does not match the information returned by the primary data server, pdb_xlog init, force overwrites the RASD record for that transaction log or device with the information returned by the primary data server.

5. Resume replication in the Replication Agent:

   ```
   resume
   ```

6 Verify that the Replication Agent is in *Replicating* state:

```
ra_status
```

If the Replication Agent does not return to *Replicating* state, see Chapter 4, "Troubleshooting Replication Agent," for more information.

Updating the log device repository

Replication Agent stores information about primary log devices in its RASD when you initialize the Replication Agent instance. Log device information in the RASD is referred to as the *log device repository*.

Unlike other information in the RASD, you can update the log device repository at any time using the ra_updatedevices command.

Note If any log device is added, dropped, extended, or moved at the primary database, the Replication Agent log device repository must be updated. If Oracle ASM is being used to manage redo logs and a disk is added to or dropped from an ASM disk group, the device repository should be updated. Sybase recommends that you coordinate all log device changes at the primary database with updating the Replication Agent log device repository.

When you update the log device repository, Replication Agent does the following:

- Queries the primary database for information about all of its log devices.
- Compares the information returned by the primary database with the information recorded in the log device repository.
- Updates the log device repository with the new information returned by the primary database, if:
  - It finds information for existing log devices in the log device repository that does not match the information returned by the primary database, or
  - It finds information about new log devices in the information returned by the primary database.

If the path for a log device at the primary site is different from the path for the corresponding log device at the standby site, you must use ra_devicepath to specify the path to the log device recorded in the RASD.

Note The primary database need not be quiesced when you update the Replication Agent log device repository.

❖ **To update the log device repository**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the following command to determine the state of the Replication Agent instance:

```
ra_status
```

3 If the Replication Agent is in *Admin* state, skip this step and go to step 4.

   If the Replication Agent is in *Replicating* state:

   a Suspend replication by the Replication Agent instance:

   ```
   suspend
   ```

   b Verify that the Replication Agent is in *Admin* state:

   ```
   ra_status
   ```

4 If you coordinate log device changes at the primary database with updating the Replication Agent log device repository, make the log device changes at the primary database after the Replication Agent is in *Admin* state.

5 After you verify that the Replication Agent is in *Admin* state, update the log device repository in the RASD:

```
ra_updatedevices
```

6 If you need to specify the path for a log device, use ra_devicepath:

```
ra_devicepath device, dev_path
```

   where:

   - *device* is the device ID (for Oracle, this is the group ID).

- *dev_path* is the alternate path (optional) that Replication Agent should use to access the log device.

Note You must invoke ra_devicepath once for each log device whose path you need to specify.

---

7 Start replication in the Replication Agent instance:

```
resume
```

You can update the log device repository as often as necessary to accommodate log device changes at the primary database.

Backing up the RASD

Like any database, you should periodically back up the RASD to prevent data loss in the event of a device failure.

Note Sybase recommends that you always back up the RASD before you truncate the RASD. RASD backups should also be synchronized with primary database backups so that, in the event of a primary database restore, the RASD is restored to the same relative point.

The Replication Agent places RASD backup files in the directory identified by the rasd_backup_dir configuration parameter. You can back up the RASD at any time, when the Replication Agent instance is in any state.

❖ To back up the RASD

1 Log in to the Replication Agent instance with the administrator login.

2 Back up the RASD:

```
rasd_backup
```

After the backup completes successfully, the Replication Agent returns a confirmation message.

If the Replication Agent could not find the directory identified in the rasd_backup_dir parameter, or if it could not write the RASD backup files in that directory (for example, because of a permission problem), it returns an error. You must correct the cause of the error before you can successfully back up the RASD.

Restoring the RASD

If the RASD becomes corrupt (for example, because of a device failure), you can restore the database from the most recent backup files.

The Replication Agent retrieves the RASD backup files from the directory identified by the rasd_backup_dir configuration parameter. See the Replication Agent *Reference Manual* for more information about the rasd_backup_dir parameter.

Note To restore the RASD, the Replication Agent instance must be in *Admin* state.

❖ **To restore the RASD**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the following command to determine the state of the Replication Agent instance:

   ```
   ra_status
   ```

3. If the Replication Agent is in *Admin* state, skip this step and go to step 4.

   If the Replication Agent is in *Replicating* state:

   a. Use the following command to suspend replication by the Replication Agent instance:

      ```
      suspend
      ```

   b. Use the following command to verify that the Replication Agent is in *Admin* state:

      ```
      ra_status
      ```

4. After you verify that the Replication Agent is in *Admin* state, use the following command to restore the RASD:

   ```
   rasd_restore
   ```

   After the restore operation completes successfully, the Replication Agent returns a message to confirm that the RASD restore was successful.

   If the Replication Agent cannot find the directory identified in the rasd_backup_dir parameter, or if it cannot read the RASD backup files in that directory (for example, because of a permission problem), it returns an error. You must correct the cause of the error to restore the RASD.

5 After the RASD is successfully restored from the most recent backup, use the following command to resume replication in the Replication Agent instance:

```
resume
```

If the Replication Agent does not return to *Replicating* state, see Chapter 4, “Troubleshooting Replication Agent,” for more information.

Truncating the RASD

To keep the RASD from growing indefinitely, you can periodically truncate older versions of its primary database object metadata.

Note Back up the RASD using rasd_backup *before* you truncate it. For more information, see “Backing up the RASD” on page 92.

The RASD stores definitions for two types of database objects:

- Articles – tables and stored procedures that are marked for replication
- Users – database users who apply transactions in the primary database

Use the ra_truncatearticles and ra_truncateusers commands to manage the size of the RASD.

Note You can truncate the RASD at any time, when the Replication Agent instance is in any state.

❖ To truncate older versions of articles in the RASD

1 Log in to the Replication Agent instance with the administrator login.

2 Use the following command to truncate articles in the RASD:

```
ra_truncatearticles NNN
```

Here, *NNN* is an LTM Locator value that identifies the oldest non-current version of any article to be kept.

All non-current versions of all articles that are *less than* the LTM Locator value you specify are truncated from the RASD. If the current (most recent) version of an article is older than the version identified by the LTM Locator value, it is *not* truncated.

❖ **To truncate older versions of users in the RASD**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the following command to truncate users in the RASD:

   ```
   ra_truncateusers NNN
   ```

   Here, *NNN* is an LTM Locator value that identifies the oldest non-current version of any user to be kept.

All non-current versions of all users that are *less than* the LTM Locator value you specify are truncated from the RASD. If the current (most recent) version of a user is older than the version identified by the LTM Locator value, it is *not* truncated.

Identifying replicated transactions and procedures

In a Sybase transaction replication system, the Replication Agent and Replication Server components both provide features that allow you to identify (or select) the transactions that you want to replicate. You do not need to replicate all transactions, or all data-changing operations, in the primary database.

The ability to select transactions for replication is particularly useful when you need to implement a replication system to support an application that uses some of the tables in a database, but not all of them.

By marking tables, you identify the specific tables in the primary database for which transactions are replicated. Transactions that affect the data in marked tables are referred to as *replicated transactions*.

Note If a transaction affects data in both marked and unmarked tables, only the operations that affect data in marked tables are replicated.

By marking stored procedures, you identify (or select) the specific procedures in the primary database that are to be replicated as *applied functions*. When a marked procedure is invoked in the primary database, its invocation is replicated, along with its input parameter values, to the replicate database.

The ability to select procedures for replication is particularly useful when you need to implement a replication system to support an application that uses stored procedures, or when replicating a single procedure invocation is more efficient than replicating numerous, individual data-changing operations that are produced by a single procedure invocation.

Replication Agent provides the following features to allow you to select replicated transactions and procedures:

- Marking and unmarking tables
- Enabling and disabling replication for marked tables
- Enabling and disabling replication for LOB columns
- Marking and unmarking stored procedures (Replication Agent for Oracle and Replication Agent for Microsoft SQL Server)
- Enabling and disabling replication for stored procedures (Replication Agent for Oracle and Replication Agent for Microsoft SQL Server)
- Enabling and disabling replication for DDL (Replication Agent for Oracle and Replication Agent for Microsoft SQL Server)

Preparing to mark tables or stored procedures

Before you can mark tables or stored procedures for replication, you must create the Replication Agent transaction log objects.

See the following for more information:

- Chapter 2, “Setting Up and Configuring Replication Agent”
- “Managing the Replication Agent System Database”

Marking and unmarking tables

Individual tables to be replicated must be marked. You can mark tables explicitly using the pdb_setreptable command or automatically during pdb_xlog init processing when the pdb_automark_tables configuration parameter is set to true.

Note The pdb_automark_tables configuration parameter is not supported for UDB.

To replicate transactions that affect the data in a table in the primary database, that table must be marked for replication, and replication must be enabled for the marked table.

Marking a table can be separate from enabling replication for that table. If the value of the pdb_dflt_object_repl parameter is true, replication is enabled automatically at the time a table is marked. For more information, see “Enabling and disabling replication for marked tables” on page 104.

Table marking with Replication Agent for UDB

When a table is marked for replication with the Replication Agent for UDB (DB2), the Replication Agent does the following:

- Logs in to the primary database and sets the value of the table DATA CAPTURE option to DATA CAPTURE CHANGES.
- Adds a row to the Replication Agent marked objects table in the primary database. Each row in the marked objects table lists attributes of a table marked for replication in the primary database.

If you need to change the schema of a marked table, you must:

1. Lock the table so that new operations cannot change any data in the table.
2. Wait for the Replication Agent to complete its processing of any logged transactions in the table.
3. Quiesce the Replication Agent instance.
4. Change the table schema without changing the DATA CAPTURE option.
5. Unlock the table to allow normal user or client access.
6. Use the Replication Agent resume command to restart replication.

Note If you change the schema of a primary table, you may need to rematerialize the replicate table.

Table unmarking with Replication Agent for UDB

When you unmark a table marked for replication with the log-based Replication Agent for UDB, the Replication Agent does the following:

- Logs in to the primary database and restores the value of the table DATA CAPTURE option to the value it had before the table was marked.
- Deletes the table row in the Replication Agent marked objects table.

When a table is unmarked, any subsequent operations that affect the data in that table are ignored (not replicated).

Note In the event that the Replication Agent for UDB must re-scan the transaction log (such as when recovering from a replication error), transactions recorded prior to unmarking a table are not replicated.

Table marking with Replication Agent for Oracle

When a table is marked for replication with the log-based Replication Agent for Oracle, the Replication Agent does the following:

- Connects to the RASD
- Records the mark status for the table in the RASD Article for that table.

When a table is marked, any subsequent operations that affect the data in that table are replicated.

Table marking and unmarking with Replication Agent for Microsoft SQL Server

When a table is marked for replication with the log-based Replication Agent for Microsoft SQL Server, Replication Agent logs in to the primary database and executes commands to turn on logging of changes in the Microsoft SQL Server transaction log.

When a table marked for replication is unmarked with the log-based Replication Agent for Microsoft SQL Server, Replication Agent logs in to the primary database and executes commands to turn off logging of changes in the Microsoft SQL Server transaction log.

Marking a table for replication

Use the following procedure to mark tables for replication with any Replication Agent.

❖ **To mark a table in the primary database for replication**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the pdb_setreptable command to determine if the table is already marked:

```
pdb_setreptable pdb_table
```

Here, *pdb_table* is the name of the table that you want to mark for replication.

If the pdb_setreptable command returns information that the specified table is marked for replication, you do not need to continue this procedure.

If the pdb_setreptable command returns information that the specified table is not marked, continue this procedure to mark the table for replication.

3 If there is no table replication definition, only a database replication definition, and no table replication definition is to be added before replication, do one of the following:

   a When the table in the replicate database has the *same* name as the table in the primary database, use the following command to mark a table for replication:

   ```
   pdb_setreptable pdb_table, mark
   ```

   Here, *pdb_table* is the name of the table in the primary database that you want to mark for replication.

   b When the table in the replicate database has a *different* name from the table in the primary database, use the following command to mark a table for replication:

   ```
   pdb_setreptable pdb_table, rep_table, mark
   ```

   Here, *pdb_table* is the name of the table in the primary database that you want to mark for replication, and *rep_table* is the name of the table in the replicate database.

4 If there is a table replication definition or one is to be added before replication, do one of the following regardless of whether or not there is also a database replication definition:

   a When the primary table in the table replication definition has the *same* name as the table in the primary database, use the following command to mark a table for replication:

   ```
   pdb_setreptable pdb_table, mark
   ```

   Here, *pdb_table* is the name of the table in the primary database that you want to mark for replication.

   Note If the table in the replicate database has the *same* name as the primary table in the table replication definition, you can use the with all tables named clause in the replication definition in the primary Replication Server. For example,

   ```
   create replication definition my_table_repdef
   with primary at data_server.database
   ```

```
with all tables named pdb_table ...
```

If the table in the replicate database has a *different* name from the primary table in the table replication definition, the table replication definition must map to the table in the replicate database. For example,

```
create replication definition my_table_repdef
with primary at data_server.database
with primary table named pdb_table
with replicate table named rep_table ...
```

---

b When the primary table in the table replication definition has a *different* name from the table in the primary database, use the following command to mark a table for replication:

```
pdb_setreptable pdb_table, rdpri_table, mark
```

Here, *pdb_table* is the name of the table in the primary database that you want to mark for replication, and *rdpri_table* is the name of the primary table in the table replication definition. The table replication definition must map to the table in the replicate database.

Note If the table in the replicate database has the *same* name as the primary table in the table replication definition, you can use the with all tables named clause in the replication definition in the primary Replication Server. For example,

```
create replication definition my_table_repdef
with primary at data_server.database
with all tables named rdpri_table ...
```

If the table in the replicate database has a *different* name from the primary table in the table replication definition, the table replication definition must map to the table in the replicate database. For example,

```
create replication definition my_table_repdef
with primary at data_server.database
with primary table named rdpri_table
with replicate table named rep_table ...
```

---

5 When you mark a table for replication, optionally specify that the table owner must be included when matching to an owner-qualified replication definition.

- If the owner mode is set, then the owner name is used when matching the replication definition in Replication Agent.
- If the owner mode is not set, then the owner name is not used by Replication Agent for replication definition name matching.

To specify that the table owner must be included when matching to an owner-qualified replication definition, use the owner keyword after the mark keyword:

```
pdb_setreptable pdb_table, mark, owner
```

Here, *pdb_table* is the name of the table that you want to mark for replication.

Note The table owner name returned from the primary database must be the same as the owner name specified in the replication definition for the table.

---

6 Consider the following:

- If the value of the pdb_dflt_object_repl parameter is true, the table you marked for replication is ready for replication immediately after the pdb_setreptable command returns successfully.
- The default value of the pdb_dflt_object_repl parameter is true.
- If the value of the pdb_dflt_object_repl parameter is true, you can skip the following step for using pdb_setreptable to enable replication for a marked table.
- If the value of the pdb_dflt_object_repl parameter is false, you must enable replication for the table, as described in the following step.

7 Use the pdb_setreptable command to enable replication for a marked table:

```
pdb_setreptable pdb_table, enable
```

Here, *pdb_table* is the name of the marked table.

After replication is enabled for the table, the Replication Agent can begin replicating transactions that affect data in that table.

Unmarking a table

For IBM DB2 Universal Database only, Replication Agent must be in *Admin* state when unmarking.

❖ **To unmark a table in the primary database**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the pdb_setreptable command to confirm that the table is marked in the primary database:

   ```
   pdb_setreptable pdb_table
   ```

   Here, *pdb_table* is the name of the table in the primary database that you want to unmark.

   If the pdb_setreptable command returns information that the specified table is marked, continue this procedure to unmark the table.

   If the pdb_setreptable command does not return information that the specified table is marked, you need not continue this procedure.
3. Use the pdb_setreptable command to disable replication from the table:

   ```
   pdb_setreptable pdb_table, disable
   ```

   Here, *pdb_table* is the name of the table in the primary database that you want to disable.
4. Use the pdb_setreptable command to remove the replication marking from the table:

   ```
   pdb_setreptable pdb_table, unmark
   ```

   Here, *pdb_table* is the name of the table in the primary database that you want to unmark.

   If you need to force the unmark, you can use the following command:

   ```
   pdb_setreptable pdb_table, unmark, force
   ```
5. Use the pdb_setreptable command to confirm that the table is no longer marked for replication:

   ```
   pdb_setreptable pdb_table
   ```

   Here, *pdb_table* is the name of the table in the primary database that you unmarked.

Note You can unmark all marked objects in the primary database by invoking the pdb_setreptable command with the all keyword.

Enabling and disabling replication for DDL

Note DDL replication is available only for Oracle and Microsoft SQL Server. See the Replication Agent *Primary Database Guide* for more information on the DDL commands that are not replicated.

Before you enable DDL replication, you must set the ddl_username and ddl_password configuration parameters to the user name that Replication Server uses at the replicate database when executing the DDL commands. This user name must be different from the maintenance user that was configured in the Replication Server replicate connection. For details, see the Replication Agent *Reference Manual*.

If you need to temporarily suspend replication of DDL, you can use the pdb_setrepddl command to disable replication of DDL. When you are ready to resume replication of DDL, you can use the pdb_setrepddl command to enable replication.

When you set the value of pdb_setrepddl to enable, DDL in your primary database is replicated, with exceptions as described in the Replication Agent *Primary Database Guide*.

Note To replicate DDL, Replication Server must have a database-level replication definition with replicate DDL set in the definition. For details on creating a database-level replication definition, see the Replication Agent *Reference Manual*.

Enabling replication for DDL

❖ **To enable replication for DDL in the primary database**

1 Log in to the Replication Agent administration port.

2 Use the pdb_setrepddl command without an argument to determine if replication is already enabled for DDL in the primary database:

```
pdb_setrepddl
```

If the pdb_setrepddl command returns information that replication is enabled, you do not need to continue this procedure.

If the pdb_setrepddl command returns information that replication is not enabled for DDL, continue this procedure to enable replication for DDL.

3. Use the pdb_setrepddl command to enable replication for DDL:

   ```
   pdb_setrepddl enable
   ```

   After replication is enabled for the DDL, you can resume replicating your primary database.

For enabling DDL replication details specific to your primary database, see the Replication Agent *Primary Database Guide*.

Disabling replication for DDL

❖ **To disable replication for DDL in the primary database**

1. Log in to the Replication Agent administration port.
2. Use the pdb_setrepddl command without an argument to determine if replication is already disabled for DDL in the primary database:

   ```
   pdb_setrepddl
   ```

   If the pdb_setrepddl command returns information that replication is disabled, you do not need to continue this procedure.

   If the pdb_setrepddl command returns information that replication is enabled for DDL, continue this procedure to disable replication for DDL.
3. Use the pdb_setrepddl command to disable replication for DDL:

   ```
   pdb_setrepddl disable
   ```

   After replication is disabled for the DDL, you can resume replicating your primary database.

   See the Replication Agent *Primary Database Guide* for details specific to your primary database.

Enabling and disabling replication for marked tables

If you need to temporarily stop replication for a marked table (for example, when maintenance operations are performed in the primary database), you can disable replication for a marked table without affecting replication for other tables in the primary database. Then, when you are ready to resume replication from that table, you can enable replication for that table without affecting other tables in the database.

To replicate transactions that affect the data in a table, that table must be marked for replication, and replication must be enabled for the marked table. For more information, see “Marking and unmarking tables” on page 96.

Replication Agent for UDB has a marked objects table that contains an entry for each marked table in the primary database. Each marked table row contains a flag indicating whether replication is enabled or disabled for the marked table. Replication Agent for Oracle and Replication Agent for Microsoft SQL Server have *articles* in the RASD. An article is an object that has a one-to-one relationship to the table and has a marked indicator.

When replication is disabled for a marked object, the marking infrastructure remains in place, but no transactions for that object are sent to Replication Server.

Note For Replication Agent for UDB, if you need to change the schema of a marked table in the primary database, you must first unmark the table to remove the transaction log objects that Replication Agent creates for the primary table.

This is not required for Replication Agent for Oracle or Replication Agent for Microsoft SQL Server because DDL commands are captured and the RASD is updated automatically.

See “Marking and unmarking tables” on page 96 for more information.

Enabling replication for marked tables

❖ **To enable replication for a marked table**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the pdb_setreptable command to verify that replication is disabled for the table:

```
pdb_setreptable pdb_table
```

Here, *pdb_table* is the name of the marked table you want to enable replication for.

If the pdb_setreptable command returns information that the table is marked and has replication disabled, continue this procedure to enable replication for the table.

Note A table must be marked for replication before replication can be enabled or disabled for the table.

3 Use the pdb_setreptable command to enable replication for the table:

```
pdb_setreptable pdb_table, enable
```

Here, *pdb_table* is the name of the marked table in the primary database for which you want to enable replication.

After replication is enabled for the table, any transaction that affects the data in that table is captured for replication.

4 You can use the pdb_setreptable command again to verify that replication is now enabled for the table:

```
pdb_setreptable pdb_table
```

Here, *pdb_table* is the name of the marked table for which you want to verify that replication is enabled.

Disabling replication for marked tables

❖ **To disable replication for a marked table**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the pdb_setreptable command to verify that replication is enabled for the table:

```
pdb_setreptable pdb_table
```

Here, *pdb_table* is the name of the marked table for which you want to disable replication.

If the pdb_setreptable command returns information that the table is marked and has replication enabled, continue this procedure to disable replication for the table.

Note A table must be marked for replication before replication can be enabled or disabled for the table.

3 Use the pdb_setreptable command to disable replication for the table:

```
pdb_setreptable pdb_table, disable
```

Here, *pdb_table* is the name of the marked table in the primary database for which you want to disable replication.

After replication is disabled for the table, transactions that affect the data in that table are not captured for replication until replication is enabled again.

4 You can use the pdb_setreptable command again to verify that replication is now disabled for the table:

```
pdb_setreptable pdb_table
```

Here, *pdb_table* is the name of the marked table for which you want to verify that replication is disabled.

Enabling and disabling replication for LOB columns

In this document, all columns that contain large object (LOB) datatypes are referred to as LOB columns, regardless of the actual datatype name used by the primary database vendor. To replicate transactions that affect a LOB column, replication must be enabled for that column.

You must enable replication for each LOB column you want to replicate, in addition to marking and enabling replication for the table that contains the LOB column.

- If the value of the pdb_dflt_column_repl parameter is true, replication is enabled automatically for all LOB columns in a table at the time the table is marked.
- If the value of the pdb_dflt_column_repl parameter is false, replication is not enabled automatically for any LOB columns in a table at the time the table is marked.

For more information on marking a table for replication see “Marking and unmarking tables” on page 96.

When a table is marked for replication and replication is enabled for that table but not for a LOB column in that table, any part of a transaction that affects the LOB column is not replicated. The portion of a transaction that affects all other non-LOB columns is replicated if the table is marked for replication and replication is enabled for the table.

Replication Agent for UDB

When replication is enabled for a LOB column, Replication Agent makes an entry in the prefixBLOB_COLUMNS_ table to support replication for that column.

When Replication Agent processes a transaction that affects a LOB column, the LOB data is not stored in the transaction log because of its possible size. Instead, the Replication Agent Log Reader component reads the LOB data directly from the primary database at the time it processes the transaction.

Compromising transaction integrity

Because of the way Replication Agent processes the LOB column data when replicating transactions, it is possible to compromise transaction integrity. For example, if two transactions change the data in a LOB column and the Log Reader does not process the first transaction until after the second transaction has been committed, when the LOB data is read from the primary database, the value of that data is the result of the second transaction. In this event, the value of the LOB data in the first transaction is never sent to the replicate database. After the second transaction is processed by the Log Reader, the primary and replicate databases are synchronized again, but for a period of time between processing the first and second transactions, the replicate database contains data that does not match the originating transaction.

This problem occurs only when a LOB column is changed more than once by a sequence of transactions. The period of time over which the problem exists could be significant if the replication system throughput is slow or if a replication system component fails. As soon as the last transaction that changes the LOB column is processed at the replicate site, the problem is corrected.

Replication Agent for Oracle

In contrast to the IBM DB2 Universal Database, Oracle logs all LOB data (except for *BFILE* datatypes) in the Oracle redo log. This allows the Replication Agent to apply each individual LOB change. However, for *BFILE* data, the same technique is used as for Replication Agent for UDB, and the same limitation exists—*BFILE* data is not logged but read from the database at the time the rest of the transaction is processed. If two consecutive transactions modify the same *bfile*, the same inconsistency described previously can occur.

Replication Agent for Microsoft SQL Server

Microsoft SQL Server logs all LOB data in the database transaction log. This allows Replication Agent to apply each individual LOB change.

For more information on LOB handling for Microsoft SQL Server, see the Replication Agent *Primary Database Guide*.

Enabling replication for LOB columns

❖ **To enable replication for a LOB column in a marked table**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the pdb_setrepcol command to verify that replication is disabled for the LOB column:

   ```
   pdb_setrepcol pdb_table, pdb_col
   ```

   where:

   - *pdb_table* is the name of the marked table that contains the LOB column.
   - *pdb_col* is the name of the LOB column.

   If the pdb_setrepcol command returns information that the LOB column has replication disabled, continue this procedure to enable replication for the column.

   Note The table that contains the LOB column must be marked for replication before replication can be enabled or disabled for a LOB column.

3. Use the pdb_setrepcol command to enable replication for the LOB column:

   ```
   pdb_setrepcol pdb_table, pdb_col, enable
   ```

   where:

   - *pdb_table* is the name of the marked table that contains the LOB column.
   - *pdb_col* is the name of the LOB column for which you want to enable replication.

   After replication is enabled for the LOB column (and if replication is enabled for the table that contains the column), any transaction that affects the data in that column is replicated.

4. You can use the pdb_setrepcol command again to verify that replication is now enabled for the LOB column:

```
pdb_setrepcol pdb_table, pdb_col
```

where:

- *pdb_table* is the name of the marked table that contains the LOB column.
- *pdb_col* is the name of the LOB column for which you want to verify that replication is enabled.

Disabling replication for LOB columns

❖ **To disable replication for a LOB column in a marked table**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the pdb_setrepcol command to verify that replication is enabled for the LOB column:

   ```
   pdb_setrepcol pdb_table, pdb_col
   ```

   where:

   - *pdb_table* is the name of the marked table that contains the LOB column.
   - *pdb_col* is the name of the LOB column you want to disable replication for.

   If the pdb_setrepcol command returns information that the LOB column has replication enabled, continue this procedure to disable replication for the column.

   Note The table that contains the LOB column must be marked for replication before replication can be enabled or disabled for a LOB column.

3. Use the pdb_setrepcol command to disable replication for the LOB column:

   ```
   pdb_setrepcol pdb_table, pdb_col, disable
   ```

   where:

   - *pdb_table* is the name of the marked table that contains the LOB column.
   - *pdb_col* is the name of the LOB column for which you want to disable replication.

After replication is disabled for the LOB column, transactions that affect the data in that column are not replicated unless replication is enabled for that column again.

4 You can use the pdb_setrepcol command again to verify that replication is now disabled for the LOB column:

```
pdb_setrepcol pdb_table, pdb_col
```

where:

- *pdb_table* is the name of the marked table that contains the LOB column.
- *pdb_col* is the name of the LOB column for which you want to verify that replication is disabled.

Marking and unmarking stored procedures

Note Stored procedure replication is not supported for IBM DB2 Universal Database.

Replication Agent supports Replication Server function replication by replicating the invocation of stored procedures in the primary database.

Note In this document, the terms *function* and *stored procedure* are synonyms.

Replication Agent can replicate both *applied functions* and *request functions*:

- Applied functions are stored procedures that are executed in the primary database and generate transactions that affect data in the primary database.
- Request functions are stored procedures that are invoked in one database (for example, a replicate database), then executed in another database (for example, a primary database).

Replication Agent does not distinguish between these two function types, except to supply a specific user and password for use with request functions. If you are using request functions, the configuration parameters function_username and function_password must be supplied.

For more information about applied and request functions, see the Managing Replicated Functions chapter of the Replication Server *Administration Guide*.

For more information about the function_username and function_password configuration parameters, see the Replication Agent *Reference Manual*.

In order to replicate a stored procedure invoked in a primary database, the stored procedure must be marked for replication, and replication must be enabled for that stored procedure. (This is analogous to marking and enabling replication for tables.)

Note Marking a stored procedure for replication is separate from enabling replication for the stored procedure. If the value of the pdb_dflt_object_repl parameter is true, replication is enabled automatically at the time a stored procedure is marked. For more information, see "Enabling and disabling replication for stored procedures" on page 117.

If a marked stored procedure performs operations that affect a marked table, the operations that affect the marked table are not captured for replication; only the invocation of the marked stored procedure is replicated.

When you mark a stored procedure for replication, Replication Agent creates a shadow-row procedure for that stored procedure. Replication Agent for Oracle and Replication Agent for UDB also modify the marked stored procedure as follows:

- Inserts a new first step to execute the associated shadow-row procedure
- Inserts a new last step to again execute the shadow-row procedure with different parameters.

If you need to temporarily suspend replication of a marked stored procedure (for example, when database maintenance operations are performed in the primary database), you can disable replication for the stored procedure. For more information, see "Enabling and disabling replication for stored procedures" on page 117.

When you unmark an object that has been marked for replication, the transaction log objects that were created to facilitate the replication for that object are removed from the primary database.

For more information on the Replication Server function replication feature, see the Replication Server *Administration Guide*.

Marking a stored procedure for replication

Note For Oracle, DDL replication must be disabled during the marking of stored procedures. Because marking of a stored procedure modifies that stored procedure, you must first disable DDL replication to prevent the marking modifications from replicating to the replicate site. See "Disabling replication for DDL" on page 104.

❖ To mark a stored procedure for replication

1. Log in to the Replication Agent instance with the administrator login.
2. Use the pdb_setrepproc command to determine if the stored procedure is already marked in the primary database:

   ```
   pdb_setrepproc pdb_proc
   ```

   Here, *pdb_proc* is the name of the stored procedure in the primary database that you want to mark for replication.

   - If the pdb_setrepproc command returns information that the specified stored procedure is marked, you do not need to continue this procedure
   - If the pdb_setrepproc command returns information that the specified stored procedure is not marked, continue this procedure to mark the stored procedure for replication.
3. If there is no function replication definition, only a database replication definition, and no function replication definition is to be added before replication, do one of the following:

   a. When the procedure in the replicate database has the *same* name as the procedure in the primary database, use the following command to mark a procedure for replication:

   ```
   pdb_setrepproc pdb_proc, mark
   ```

   Here, *pdb_proc* is the name of the procedure in the primary database that you want to mark for replication.

   b. When the procedure in the replicate database has a *different* name from the procedure in the primary database, use the following command to mark a procedure for replication:

   ```
   pdb_setrepproc pdb_proc, rep_proc, mark
   ```

Here, *pdb_proc* is the name of the procedure in the primary database that you want to mark for replication, and *rep_proc* is the name of the procedure in the replicate database.

4 If there is a function replication definition or one is to be added before replication, do one of the following regardless of whether or not there is also a database replication definition:

a When the function replication definition has the *same* name as the procedure in the primary database, use the following command to mark a procedure for replication:

```
pdb_setrepproc pdb_proc, mark
```

Here, *pdb_proc* is the name of the procedure in the primary database that you want to mark for replication.

Note If the procedure in the replicate database has the *same* name as the function replication definition, there is no need to use the deliver as clause. For example,

```
create function replication definition pdb_proc
with primary at data_server.database ...
```

If the procedure in the replicate database has a *different* name from the name of the function replication definition, the function replication definition must map to the procedure in the replicate database. For example,

```
create function replication definition pdb_proc
with primary at data_server.database
deliver as 'rep_proc' ...
```

---

b When the name of the function replication definition is *different* from the procedure in the primary database, use the following command to mark a procedure for replication:

```
pdb_setrepproc pdb_proc, rdpri_proc, mark
```

Here, *pdb_proc* is the name of the procedure in the primary database that you want to mark for replication, and *rdpri_proc* is the name of the function replication definition. The function replication definition must map to the procedure in the replicate database.

Note If the procedure in the replicate database has the *same* name as the function replication definition, there is no need to use the deliver as clause. For example,

```
create function replication definition rdpri_proc
with primary at data_server.database ...
```

If the procedure in the replicate database has a *different* name from the function replication definition, the function replication definition must map to the procedure in the replicate database. For example,

```
create function replication definition rdpri_proc
with primary at data_server.database
deliver as 'rep_proc' ...
```

5 Use the pdb_setrepproc command to enable replication for the marked stored procedure:

```
pdb_setrepproc pdb_proc, enable
```

Here, *pdb_proc* is the name of the marked stored procedure for which you want to enable replication.

After replication is enabled for the stored procedure, you can begin replicating invocations of that stored procedure in the primary database.

Note If your stored procedure is in Oracle and you disabled DDL replication during stored procedure marking, remember to re-enable DDL replication. Because marking a stored procedure modifies it, you must first disable DDL replication to prevent the marking modifications from replicating to the standby site. See "Enabling replication for DDL" on page 103.

Unmarking a stored procedure

When you unmark a stored procedure, Replication Agent removes the transaction log objects that were created when the stored procedure was marked.

Note For Oracle, DDL replication must be disabled during the unmarking of stored procedures. See "Disabling replication for DDL" on page 104.

❖ **To unmark a stored procedure**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the pdb_setrepproc command to confirm that the stored procedure is marked in the primary database:

```
pdb_setrepproc pdb_proc
```

Here, *pdb_proc* is the name of the stored procedure that you want to unmark.

- If the pdb_setrepproc command returns information that the specified stored procedure is marked, continue this procedure to unmark the stored procedure.
- If the pdb_setrepproc command does not return information that the specified stored procedure is marked, you do not need to continue this procedure.

3 Use the pdb_setrepproc command to disable replication of the stored procedure:

```
pdb_setrepproc pdb_proc, disable
```

Here, *pdb_proc* is the name of the stored procedure that you want to unmark.

4 Use the pdb_setrepproc command to remove the replication marking from the stored procedure:

```
pdb_setrepproc pdb_proc, unmark
```

Here, *pdb_proc* is the name of the stored procedure that you want to unmark.

If you need to force the unmark, you can use the following command:

```
pdb_setrepproc pdb_proc, unmark, force
```

5 Use the pdb_setrepproc command to confirm that the stored procedure is no longer marked for replication:

```
pdb_setrepproc pdb_proc
```

Here, *pdb_proc* is the name of the stored procedure in the primary database that you unmarked.

You can unmark all marked stored procedures in the primary database by invoking the pdb_setrepproc command with the all keyword.

Note If your stored procedure is in Oracle and you disabled DDL replication during stored procedure unmarking, remember to re-enable DDL replication. See “Enabling replication for DDL” on page 103.

Enabling and disabling replication for stored procedures

Note Procedure replication is not supported for IBM DB2 Universal Database.

If you need to temporarily suspend replication of a stored procedure, use the pdb_setrepproc command to disable replication for the marked stored procedure. When you are ready to resume replication of the marked stored procedure, use the pdb_setrepproc command to enable replication.

To replicate invocations of a stored procedure in the primary database, the stored procedure must be marked for replication, and replication must be enabled for that stored procedure; no procedures are marked by default for replication.

Marking a stored procedure for replication is separate from enabling replication for the stored procedure. For more information, see “Marking and unmarking stored procedures” on page 111.

Enabling replication for stored procedures

❖ **To enable replication for a marked stored procedure**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the pdb_setrepproc command to verify that replication is disabled for the stored procedure:

```
pdb_setrepproc pdb_proc
```

Here, *pdb_proc* is the name of the marked stored procedure you want to enable replication for.

If the pdb_setrepproc command returns information that the stored procedure is marked and has replication disabled, continue this procedure to enable replication for the stored procedure.

Note A stored procedure must be marked for replication before replication can be enabled or disabled for the stored procedure.

3 Use the pdb_setrepproc command to enable replication for the stored procedure:

```
pdb_setrepproc pdb_proc, enable
```

Here, *pdb_proc* is the name of the marked stored procedure for which you want to enable replication.

After replication is enabled for the stored procedure, any invocation of that stored procedure is replicated.

4 You can use the pdb_setrepproc command again to verify that replication is now enabled for the stored procedure:

```
pdb_setrepproc pdb_proc
```

Here, *pdb_proc* is the name of the marked stored procedure for which you want to verify that replication is enabled.

Disabling replication for stored procedures

❖ **To disable replication for a marked stored procedure**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the pdb_setrepproc command to verify that replication is enabled for the stored procedure:

```
pdb_setrepproc pdb_proc
```

Here, *pdb_proc* is the name of the marked stored procedure you want to disable replication for.

If the pdb_setrepproc command returns information that the stored procedure is marked and has replication enabled, continue this procedure to disable replication for the stored procedure.

Note A stored procedure must be marked for replication *before* replication can be enabled or disabled for that stored procedure.

3 Use the pdb_setrepproc command to disable replication for the stored procedure:

```
pdb_setrepproc pdb_proc, disable
```

Here, *pdb_proc* is the name of the marked stored procedure for which you want to disable replication.

After replication is disabled for the stored procedure, any invocation of that stored procedure is not captured for replication until replication is enabled again.

4 You can use the pdb_setrepproc command again to verify that replication is now disabled for the stored procedure:

```
pdb_setrepproc pdb_proc
```

Here, *pdb_proc* is the name of the marked stored procedure for which you want to verify that replication is disabled.

Marking and unmarking Oracle sequences

Note Sequence replication is supported only for Oracle.

Replication Agent supports replication of sequences in the primary database. In order to replicate a sequence invoked in a primary database, the sequence must be marked for replication and replication must be for all of that sequence. (This is analogous to marking and enabling replication for tables.)

Note Marking a sequence for replication is separate from enabling replication for the sequence. If the value of the pdb_dflt_object_repl parameter is true, replication is enabled automatically at the time a sequence is marked. For more information, see “Enabling and disabling replication for sequences” on page 123.

Oracle does not log information every time a sequence is incremented. Sequence replication occurs when the Replication Agent captures the system table updates that occur when the sequence's cache is refreshed. Therefore, the sequence value replicated when a sequence is marked for replication is the “next” sequence value to be used when the current cache expires. The result is that not every individual increment of a sequence is replicated, but the standby site always has a value greater than the available cached values at the primary site.

If you need to temporarily suspend replication of a marked sequence you can disable replication for the sequence. For more information see “Unmarking a sequence” on page 121.

Marking a sequence for replication

❖ **To mark a sequence for replication**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the pdb_setrepseq command to determine if the sequence is already marked in the primary database:

```
pdb_setrepseq pdb_seq
```

Here, *pdb_seq* is the name of the sequence in the primary database that you want to mark for replication.

- If the pdb_setrepseq command returns information that the specified sequence is marked, you do not need to continue this procedure.
- If the pdb_setrepseq command returns information that the specified sequence is not marked, continue this procedure to mark the sequence for replication.

❖ **To mark a sequence for replication**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the pdb_setrepseq command to determine if the sequence is already marked in the primary database:

   ```
   pdb_setrepseq pdb_seq
   ```

   Here, *pdb_seq* is the name of the sequence in the primary database that you want to mark for replication.

   Consider the following:

   - If the pdb_setrepseq command returns information that the specified sequence is marked, you do not need to continue this procedure.
   - If the pdb_setrepseq command returns information that the specified sequence is not marked, continue this procedure to mark the sequence for replication.
3. Use the pdb_setrepseq command to mark the sequence for replication.

   The pdb_setrepseq command allows you to mark the primary sequence to be replicated and specify a different sequence name to use in the replicate database.

   - Use the following command to mark the sequence for replication when the sequence name you wish to increment at the standby site has a different name:

     ```
     pdb_setrepseq pdb_seq, mark
     ```

     Here, *pdb_seq* is the name of the sequence in the primary database that you want to mark for replication.

     Note Replicating a sequence with a different name than the provided name is consistent with other marking commands but is not a typical configuration.

- Use the following command to mark the sequence for replication using a different sequence name:

  ```
  pdb_setrepseq pdb_seq, rep_seq, mark
  ```

  where:

  - *pdb_seq* is the name of the sequence in the primary database that you want to mark for replication.
  - *rep_seq* is the name of the sequence in the standby database that you wish to increment.

  Note Replicating sequence values to a sequence with a different name at the replicate database assumes that the replicate database sequence has the same attributes and starting value as the primary site's sequence.

  Consider the following:

  - If the value of the pdb_dflt_object_repl parameter is true, the sequence marked for replication with the pdb_setrepseq command is ready for replication after you invoke the pdb_setrepseq command successfully.
  - If the value of the pdb_dflt_object_repl parameter is true (the default value), you can skip step 4 in this procedure.
  - If the value of the pdb_dflt_object_repl parameter is false, you must enable replication for the sequence before replication can take place.

4. Use the pdb_setrepseq command to enable replication for the marked sequence:

   ```
   pdb_setrepseq pdb_seq, enable
   ```

   Here, *pdb_seq* is the name of the marked sequence for which you want to enable replication.

After replication is enabled for the sequence, you can begin replicating invocations of that sequence in the primary database.

Unmarking a sequence

❖ **To unmark a sequence**

1. Log in to the Replication Agent instance with the administrator login.

2 Use the pdb_setrepseq command to confirm that the sequence is marked in the primary database:

```
pdb_setrepseq pdb_seq
```

Here, *pdb_seq* is the name of the sequence that you want to unmark.

Consider the following:

- If the pdb_setrepseq command returns information that the specified sequence is marked, continue this procedure to unmark the sequence.
- If the pdb_setrepseq command does not return information that the specified sequence is marked, you do not need to continue this procedure.

3 Use the pdb_setrepseq command to disable replication of the sequence:

```
pdb_setrepseq pdb_seq, disable
```

Here, *pdb_proc* is the name of the sequence that you want to unmark.

4 Use the pdb_setrepseq command to remove the replication marking from the sequence:

```
pdb_setrepseq pdb_seq, unmark
```

Here, *pdb_seq* is the name of the sequence that you want to unmark.

If you need to force the unmark, you can use the following command:

```
pdb_setrepseq pdb_seq, unmark, force
```

5 Use the pdb_setrepseq command to confirm that the sequence is no longer marked for replication:

```
pdb_setrepseq pdb_seq
```

Here, *pdb_seq* is the name of the sequence in the primary database that you unmarked.

Enabling and disabling replication for sequences

If you need to temporarily suspend replication of a sequence, you can use the pdb_setrepseq command to disable replication for the marked sequence. When you are ready to resume replication of the marked sequence, you can use the pdb_setrepseq command to enable replication.

Note No sequences are marked by default for replication.

To replicate updates of a sequence in the primary database, the sequence must be marked for replication and replication must be enabled for that sequence.

Marking a sequence for replication is separate from enabling replication for the sequence. For more information, see "Marking a sequence for replication" on page 119.

Enabling replication for sequences

❖ **To enable replication for a marked sequence**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the pdb_setrepseq command to verify that replication is disabled for the sequence:

```
pdb_setrepseq pdb_seq
```

Here, *pdb_seq* is the name of the marked sequence you want to enable replication for.

If the pdb_setrepseq command returns information that the sequence is marked and has replication disabled, continue this procedure to enable replication for the sequence.

Note A sequence must be marked for replication before replication can be enabled or disabled for the sequence.

3 Use the pdb_setrepseq command to enable replication for the sequence:

```
pdb_setrepseq pdb_seq, enable
```

Here, *pdb_seq* is the name of the marked sequence for which you want to enable replication.

After replication is enabled for the sequence, any invocation of that sequence is replicated.

4. You can use the pdb_setrepseq command again to verify that replication is now enabled for the sequence:

   ```
   pdb_setrepseq pdb_seq
   ```

   Here, *pdb_seq* is the name of the marked sequence for which you want to verify that replication is enabled.

Disabling replication for marked sequence

❖ **To disable replication for a marked sequence**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the pdb_setrepseq command to verify that replication is enabled for the sequence:

   ```
   pdb_setrepseq pdb_seq
   ```

   Here, *pdb_seq* is the name of the marked sequence you want to disable replication for.

   If the pdb_setrepseq command returns information that the sequence is marked and has replication enabled, continue this procedure to disable replication for the sequence.

   Note A sequence must be marked for replication before replication can be enabled or disabled for that sequence.

3. Use the pdb_setrepseq command to disable replication for the sequence:

   ```
   pdb_setrepseq pdb_seq, disable
   ```

   Here, *pdb_seq* is the name of the marked sequence for which you want to disable replication.

   After replication is disabled for the sequence, any invocation of that sequence is not captured for replication until replication is enabled again.
4. You can use the pdb_setrepseq command again to verify that replication is now disabled for the sequence:

   ```
   pdb_setrepseq pdb_seq
   ```

   Here, *pdb_seq* is the name of the marked sequence for which you want to verify that replication is disabled.

Configuring and tuning the Replication Agent

The performance of Replication Agent can be tuned or optimized by adjusting some of the Replication Agent configuration parameters.

You can set or change a Replication Agent configuration parameter with the ra_config command.

Because the Replication Agent overwrites its entire configuration file whenever ra_config or ra_set_login is invoked, Sybase recommends that you *do not* edit the configuration file. Also, each Replication Agent instance reads its configuration file only at start-up. You must use the ra_config command if you want a new configuration parameter value to take effect before the instance is shut down and restarted.

Note Some configuration parameter changes are recorded in the configuration file when you invoke ra_config, but they do not take effect until the Replication Agent instance is shut down and restarted.

All Replication Agent configuration parameters can be changed when the Replication Agent instance is in *Admin* state. Some configuration parameters *cannot* be changed when the instance is in *Replicating* state.

For more information about the ra_config command and Replication Agent configuration parameters, see the Replication Agent *Reference Manual*.

Configuring Replication Agent

To set or change a Replication Agent configuration parameter, use the ra_config command.

Because the Replication Agent overwrites its entire configuration file whenever ra_config or ra_set_login is invoked, Sybase recommends that you *do not* edit the configuration file. Also, Replication Agent reads the configuration file only at start-up. You must use the ra_config command if you want a new configuration parameter value to take effect before the Replication Agent is shut down and restarted.

Note Some configuration parameter changes are recorded in the configuration file when you invoke ra_config, but do not take effect until the Replication Agent is shut down and restarted.

Customizing tuning

Generally, the Replication Agent default configuration values provide optimal performance. However, there may be certain situations where the configuration should be changed to suit or optimize your particular environment.

Adjusting the size and volume of the Replication Agent system logs

By default, the system logs produced by the Replication Agent are a pre-set size. They roll over occasionally to prevent continual disk consumption.

You can adjust the size of a log and adjust the number of backup files:

- By increasing these sizes, you can save log data for a longer period of time.
- By decreasing them, you can increase the unused space in your environment.

❖ **To adjust the size and volume of log files**

1 Log in to the running Replication Agent instance using the administrator login.

2 Verify that the Replication Agent instance is in *Admin* state:

```
ra_status
```

3 Use the ra_config command to set the values of the following Replication Agent configuration parameters for the primary database. Increase the following values if you want to increase the size and number of backup files. Decrease the following values if you want to make more space available in your environment:

```
ra_config log_backup_files, n
```

```
ra_config log_wrap, m
```

Preventing continual spinning at the end of a log scan

Replication Agent uses the configuration parameters scan_sleep_increment and scan_sleep_max to “pause” scanning when the end of the log is reached. This prevents Replication Agent from continually “spinning” on the end of the log. The downside is that Replication Agent may pause up to 60 seconds (by default) before a new transaction appears because it was sleeping. When you need the maximum possible latency for a transaction to be less than the 60-second default, you can reduce the scan parameters. This results in additional CPU usage when the end of the log is reached.

Conversely, if CPU maximization is a greater concern than latency, you can increase these parameters to allow Replication Agent to use less CPU on an inactive log, at the cost of having the latency of the “next” transaction increased.

Note These parameters have effect *only* when the end of the log has been reached and there is no additional activity to be replicated. By default, Replication Agent immediately re-scans (without pause) when the end of the log has not been reached.

CHAPTER 4

Troubleshooting Replication Agent

This chapter describes basic troubleshooting procedures for Replication Agent and the replication system.

Diagnosing command errors and replication errors

Two types of failures can occur in your replication system: command and replication. Command failures occur when you are in setting up your replication system. They return specific error messages that help you troubleshoot the problem. Replication failures occur after the replication system has been set up and replicated transactions do not appear in the replicate database.

Often, problems that prevent replication from occurring do not result in an error message from any replication system component. For example, a component may not recognize a problem in its own configuration that prevents replication from starting.

In a functioning Replication Agent system—one that has previously replicated transactions successfully—most system problems result in an error message from one or more of the system components. However, some problems that interrupt replication might not be interpreted as errors by the system components. In that case, replication fails but no error message is returned.

Use the diagnostic and troubleshooting tips in the following sections to identify and correct the cause of a replication system problem:

- Troubleshooting specific command errors
- Examining the Replication Agent if a failure occurs
- Checking the Replication Server

Troubleshooting specific command errors

This section describes troubleshooting for specific errors you may encounter in a Replication Agent. These error messages can be returned from a command or appear in the log file.

Connection refused

Error message

```
Could not connect to <jdbc:sybase:Tds:localHost:5001/emb>:
JZ006: Caught IOException: java.net.ConnectException:
Connection refused: connectJZ006:
```

Explanation

The Replication Agent attempted to connect to a Sybase server on a host called *localHost* and port 5001. The error indicates that no server was found.

Action

This is a usually a configuration error: Either the server that Replication Agent is attempting to connect to is not running, or the host and port information configured in Replication Agent is incorrect.

- Verify that your server is running.
- Verify that your Replication Agent is configured with the correct host and port information. See “Setting up the connection configuration parameters” on page 50 for more information.
- Test your connection after you have verified them. For more information, see “Testing network connectivity” on page 55.

Examining the Replication Agent if a failure occurs

When no transactions appear to be replicated to the replicate database, and you receive specific error messages, see "Troubleshooting specific command errors" on page 130. When no errors are returned by any replication system components, check the following:

- Verify primary database objects marked for replication
- Examine the Replication Agent logs
- Check the Replication Agent status
- Use the ra_statistics command to troubleshoot

Verify primary database objects marked for replication

In a Sybase transaction replication system, both the Replication Agent and Replication Server components provide features that allow you to select the objects that you want to replicate. You do not need to replicate all objects or all data-changing operations in the primary database.

If a primary database object (such as a table or stored procedure) is not replicating, verify the object that you intended to replicate is marked.

❖ **To verify that a primary database object is marked for replication**

1. Log in to the Replication Agent instance with the administrator login.
2. Use the appropriate command to determine if the object is already marked:
   - For a table:

     ```
     pdb_setreptable pdb_table
     ```

     Here, *pdb_table* is the name of the table that you want to verify is marked for replication.
   - For a LOB column:

     ```
     pdb_setrepcol pdb_table, pdb_col
     ```

     where:
     - *pdb_table* is the name of the marked table that contains the LOB column.
     - *pdb_col* is the name of the LOB column.
   - For a stored procedure:

```
pdb_setrepproc pdb_proc
```

Here, *pdb_proc* is the name of the stored procedure in the primary database that you want to verify is marked for replication.

- For DDL:

```
pdb_setrepddl
```

- For sequences:

```
pdb_setrepseq pdb_seq
```

Here, *pdb_seq* is the name of the sequence you want to verify is marked for replication.

After you verify that the primary database objects are marked, see the following table:

If...	**Then...**
The primary database object is not marked.	Mark the object: • Table – see "Marking a table for replication" on page 98. • LOB column – see "Enabling replication for LOB columns" on page 109. • Stored procedure – see "Marking and unmarking stored procedures" on page 111. • DDL – see "Enabling and disabling replication for DDL" on page 103. • Sequence - see "Marking and unmarking Oracle sequences" on page 119.
The primary database object is marked.	See "Check the Replication Agent status" on page 132.

Check the Replication Agent status

The status of the Replication Agent instance indicates whether it is in *Replicating* state or in *Admin* state.

No replication takes place when the Replication Agent instance is in *Admin* state. For more information, see "Understanding Replication Agent states" on page 68.

❖ **To check the current Replication Agent status**

1 Log in to the Replication Agent instance with the administrator login.

2 Use the following command to check the current status of the Replication Agent:

```
ra_status
```

This command returns the current state of the Replication Agent instance, as shown in the following example:

```
State  Action
------ ----------------------------
ADMIN  Waiting for operator command
(1 row affected)
```

See the Replication Agent *Reference Manual* for more information about the ra_status command.

When the Replication Agent instance is in one of the following states, take the suggested actions.

If...	Then...
The Replication Agent instance is in *Replicating (Waiting at end of log)* state.	Examine the statistics output to check the progress of the replication process. See “Use the ra_statistics command to troubleshoot” on page 136 for more information.
The Replication Agent instance is *Replicating* state. **Note** When the Replication Agent instance is in the *Replicating* state, all data may *not* have yet been replicated. You can only be sure that the Replication Agent instance is finished replicating when the state is *Replicating (Waiting at end of log)*.	The instance is operating normally, but it has not reached the end of the transaction log. Wait until Replication Agent instance is in *Replicating (Waiting at end of log)* state. Then repeat the procedure on page 133.

If...	Then...
The Replication Agent instance is in *Admin* state.	Start replication and put the Replication Agent instance in *Replicating* state by executing the Replication Agent resume command. See "Starting replication in the Replication Agent" on page 74 for more information. If the Replication Agent instance returns to *Admin* state after you invoke the resume command, there is at least one unresolved problem that prevents the instance from going to *Replicating* state. See "Examine the Replication Agent logs" on page 134 for more information.

Examine the Replication Agent logs

The Replication Agent system log files contain warning and error messages, as well as information about the Replication Agent connections to the primary database and the primary Replication Server. Look for the most recent command you executed at the bottom of the log file to find the most recent message. The logs are located in the *$SYBASE/RAX-15_1/inst_name/log* directory, where *inst_name* is the name of the Replication Agent instance.

The following is sample output from an Oracle instance log file:

```
W.     2007/04/26 11:33:23.075  OracleLogScanne
com.sybase.ds.oracle.log.OracleLogScanner    scanForward 23      The change
vector list for log record <00001610.000002d2.0170> is empty.

W.     2007/04/26 11:33:43.313  OracleLogScanne
com.sybase.ds.oracle.log.OracleLogScanner    scanForward 23      The change
vector list for log record <00001610.00000483.011c> is empty.

W.     2007/04/26 11:33:47.879  OracleLogScanne
com.sybase.ds.oracle.log.OracleLogScanner    scanForward 23      The change
vector list for log record <00001610.000004f7.012c> is empty.

T.     2007/04/26 11:35:28.867  OracleLogScanne
com.sybase.ds.oracle.log.OracleLogScanner    scanForward 23      Moving to log
<5649>.

E.     2007/04/26 11:35:30.359  ERROR
com.sybase.ds.oracle.log.record.RecordFactoryparseLogRecord 23
com.sybase.ds.oracle.record.UnknownRecordException: Unkown CVxE_4 inner op
type: <63>.
```

```
E.     2007/04/26 11:35:30.359  ERROR
com.sybase.ds.oracle.log.record.RecordFactoryparseLogRecord 23
java.lang.RuntimeException:
com.sybase.ds.oracle.record.UnknownRecordException: Unkown CVxE_4 inner op
type: <63>.

E.     2007/04/26 11:35:30.359  ERROR
com.sybase.ds.oracle.log.record.RecordFactoryparseLogRecord 23
com.sybase.ds.oracle.log.record.RecordFactory.createChangeVector(RecordFactor
y.java:430)
```

where:

- The first column displays a single character indicating the type of message:
  - I = information
  - W = warning
  - E = error
  - T = trace
  - S = severe
- The second column is a time stamp indicating when the message was written.
- The third column is a description.
- The fourth column identifies the Java class that produced the error.

  Note The following two columns appear only when configuration property log_trace_verbose is set to true.

- The fifth column includes the method.
- The sixth column includes the line number.
- The final column is a text description of the message.

Note In some cases, the information in a specific column is not consistent with these descriptions. In these cases, other information is generated that Technical Support uses to determine from where the message was generated.

Use the *ra_statistics* command to troubleshoot

The ra_statistics command returns activity-related statistics that you can use to evaluate Replication Agent operations and performance. By comparing the statistics returned when you first run the command to the statistics returned after you have successfully replicated something that you know works, you can analyze the differences in the statistics and troubleshoot where the problem lies. The statistics help you determine if the instance is:

- Scanning the transaction log
- Processing replicated transactions
- Sending LTL to the Replication Server

❖ To check Replication Agent operations

1. Log in to the Replication Agent instance with the administrator login.
2. Verify that you are in *Replicating* state. If you are not, change the state to *Admin*. For more information, see “Check the Replication Agent status” on page 132.
3. Use the following command to return statistics for all of the Replication Agent components and the Java VM:

   ```
   ra_statistics
   ```

4. Save the statistics returned to use as a baseline for comparison.
5. Perform activity against the object that is not being replicated.
   For example, update a table that is not being replicated.
6. Repeat step 2.

   Note Be sure to allow enough time for the Replication Agent to process the transaction.

7. Compare the newly-returned statistics activity with the baseline.
   Check for differences and see the following table.

If...	Then...
The value returned for `Total Maintenance User operations filtered` increases	You are executing the transaction as the Replication Server maintenance user for this Replication Server connection. By default, these transactions are not sent to Replication Server. You must either connect to the primary database as a different user, or you can set the configuration value of filter_maint_userid to false. See "Setting up the connection configuration parameters" on page 50.

For more information about the ra_statistics command, see the Replication Agent *Reference Manual*.

Check available memory

If you are running out of memory, you see the following error message:

```
java.lang.OutOfMemoryError
```

When you are running out of memory, either the Replication Agent drops out of *Replicating* state or the entire Replication Agent server stops executing.

To support adjusting the amount of memory available to the JRE, all of the executable scripts (or batch files) in the Replication Agent *bin* directory refer to an environment variable named RA_JAVA_MAX_MEM. All Replication Agent instance *RUN* scripts also reference the RA_JAVA_MAX_MEM environment variable.

To adjust the amount of memory available to the JRE, do one of the following:

- Set the value of a system variable named RA_JAVA_MAX_MEM in your environment and use the ra utility to start the Replication Agent instance, or
- Set the value of the RA_JAVA_MAX_MEM variable in the Replication Agent instance *RUN* script and use the *RUN* script to start the Replication Agent instance.

If you start a Replication Agent instance by invoking the ra utility, you can set the value of the RA_JAVA_MAX_MEM system variable in your environment to specify the amount of memory available to the JRE. Before it sets the RA_JAVA_MAX_MEM variable to a default value, the ra and ra_admin utilities check to see if it is already set.

If you start a Replication Agent instance by invoking the instance *RUN* script (or batch file), you can edit the instance *RUN* script to change the default value of RA_JAVA_MAX_MEM and specify the amount of memory available to the JRE.

Note When a Replication Agent instance is started with the instance *RUN* script, the value of the RA_JAVA_MAX_MEM variable specified in the *RUN* script overrides the value set elsewhere. Therefore, you can edit the *RUN* script to adjust the memory available to the JRE uniquely for each instance.

Debugging LTL

LTL (Log Transfer Language) is the syntax used to communicate or distribute replication data to Replication Server. It is the principle output from a Replication Agent. For more details about LTL syntax, see the Replication Server *Design Guide*.

❖ **To debug LTL**

1 Log in to the running Replication Agent instance using the administrator login.

2 Verify that the Replication Agent instance is in *Admin* state:

```
ra_status
```

3 Set the values of the following Replication Agent configuration parameters for the primary database:

```
ra_config LITTRACELTL, true
```

4 Change the Replication Agent state to *Replicating*:

```
resume
```

5 When new replication activity is generated, check the *LTITRACELTL.log* file in the log directory to debug your problem.

Uncompressing LTL for debugging a problem

By default, the LTL generated by the Replication Agent is compressed to reduce the amount of data sent to Replication Server, reducing network bandwidth. In cases where you require more verbose output to help debug a problem, change the following configuration parameters to produce more verbose LTL.

❖ **To produce more verbose LTL**

1. Log in to the running Replication Agent instance using the administrator login.
2. Verify that the Replication Agent instance is in *Admin* state:

   ```
   ra_status
   ```

3. Set the values of the following Replication Agent configuration parameters for the primary database:

   ```
   ra_config column_compression, false
   ra_config compress_ltl_syntax, false
   ra_config structured_tokens, false
   ```

4. When new replication activity is generated, check the *LTITRACELTL.log* file in the log directory to debug your problem.

Checking the Replication Server

This section describes how to use Replication Server commands to check for the most common replication problems. For more detailed information about diagnosing and solving Replication Server problems, see the Replication Server *Troubleshooting Guide*.

Check replication definitions and subscriptions

Verify that you created replication definitions with the appropriate information.

Verify that you defined and activated subscriptions for all of the replication definitions.

Check status and operation

Replication Server provides several admin commands that you can use to check on its status and operation.

❖ **To check the status and operation of the Replication Server**

1. Log in to the Replication Server with a user login that has “sa” permission.

2 Use the following command to check the current status of the Replication Server:

```
admin health
```

This command returns the current status of the Replication Server, as shown in the following example:

```
Mode            Quiesce      Status
-------          -------      ------
NORMAL           FALSE       HEALTHY
```

If the Replication Server status is `SUSPECT`, use the admin who_is_down command to check for Replication Server threads that may be down or attempting to connect to other servers.

3 Use the following command to check the current status of the Replication Server primary database connection (the connection from the Replication Agent to the primary Replication Server):

```
admin show_connections
```

You can also use the admin who, dsi command to get more information about the Replication Agent connection in the primary Replication Server.

Note Use the admin show_connections or admin who, dsi command output to verify that the primary data server and primary database names are correct for the Replication Agent connection in the primary Replication Server.

See the Replication Server *Reference Manual* for more information about the admin show_connections and admin who commands.

Replication Agent login in Replication Server

The Replication Server connect source lti command accomplishes the following:

- Verifies that the Replication Server database connection used by the Replication Agent exists in the primary Replication Server
- Verifies that the login name specified in the Replication Agent rs_username parameter has permission to connect to the primary Replication Server as a data source

- Returns a version string that shows the highest numbered version of LTL that the primary Replication Server supports

❖ **To verify that the *rs_username* login has appropriate permissions**

1. Log in to the primary Replication Server with the Replication Agent user login name specified in the rs_username configuration parameter.

   Refer to the “Installation and Setup Worksheet” in the Replication Agent *Installation Guide* for this login name.

2. Execute the connect source lti command:

   ```
   connect source lti pds.pdb version
   ```

   where:

   - *pds* is the value specified for the Replication Agent rs_source_ds configuration parameter.
   - *pdb* is the value specified for the Replication Agent rs_source_db configuration parameter.
   - *version* is the proposed LTL version number.

   Refer to the “Installation and Setup Worksheet” in the Replication Agent *Installation Guide* for the values of the rs_source_ds and rs_source_db parameters.

   Enter 999 for the value of the LTL version number. Replication Server returns the highest numbered version of LTL that it supports.

3. Disconnect from the primary Replication Server as rs_username, and then log in to the Replication Agent instance with the administrator login and invoke the resume command.

For more information about the connect source lti command, see the Replication Server *Design Guide* and Replication Agent *Reference Manual*.

Verify stable queues

Check the Replication Server stable queues to determine which transactions are being processed or ignored, and to determine whether transactions are open (not committed).

❖ **To display information about SQM and SQT threads**

1. Log in to the primary Replication Server and execute the admin who, sqm command.

2 View the results to determine the number of duplicate messages being detected and ignored, and the number of blocks being written in the Replication Server stable queues.

3 In the primary Replication Server, execute the admin who, sql command.

4 View the results to find open transactions.

See the Replication Server *Reference Manual* for more information about the admin who command.

Monitor performance

You can monitor the performance of Replication Server using the rs_ticket and rs_ticket_report Replication Server stored procedures, which respectively reside at the primary and replicate databases. Replication Agent provides support for these stored procedures through the Replication Agent rs_ticket command.

For detailed information about the rs_ticket and rs_ticket_report Replication Server stored procedures, see the Replication Server *Reference Manual*. For information about the rs_ticket Replication Agent command, see the Replication Agent *Reference Manual*.

APPENDIX A

Materializing Subscriptions to Primary Data

This appendix introduces the concept of bulk materialization and how to use it to set up replication from primary tables in a primary database. It also describes the process of materializing subscriptions to primary tables in a non-Sybase database.

Understanding materialization

Materialization is a process of creating and activating subscriptions and copying data from the primary database to the replicate database, thereby initializing the replicate database. Before you can replicate data from a primary database, you must set up and populate each replicate database so that it is in a state consistent with that of the primary database.

There are two types of subscription materialization supported by the Sybase Replication Server:

- *Bulk materialization* – the process of manually creating and activating a subscription and populating a replicate database using data unload and load utilities outside the control of the replication system.

- *Atomic materialization* – the process of creating a subscription and populating a replicate database using Replication Server commands.

Note Replication Agent does not support atomic materialization.

See the Replication Server *Administration Guide* for more information on subscription materialization methods.

Bulk materialization overview

Sybase recommends that you use bulk materialization to materialize subscriptions to primary data in a non-Sybase database. When you use bulk materialization, you must coordinate and manually perform the following materialization activities:

- Define, activate, and validate the subscription (or create the subscription without materialization)
- Unload the subscription data at the primary site
- Move the unloaded data to the replicate database
- Load data into the replicate tables
- Resume the database connection from the replicate Replication Server to the replicate database so that the replicate database can receive replicated transactions
- Resume replication at the Replication Agent instance

There are two bulk materialization options for subscriptions to primary data in a non-Sybase database:

- Atomic bulk materialization
- Nonatomic bulk materialization

Unloading data from a primary database

Part of the subscription materialization process is unloading the subscription data from the primary table so it can be loaded into the replicate table. Subscription data is the data in the primary table that is requested by the subscription.

Data-unloading utilities are usually provided with the primary data server software. You can use one of the OEM-supplied unloading utilities or a database unload utility of your choice.

Loading data into replicate databases

Part of the subscription materialization process is loading the subscription data from the primary table into the replicate table.

If you are using Sybase Adaptive Server Enterprise as the data server for your replicate database, you can use the Sybase bcp utility to load subscription data into the replicate database.

If you are using a non-Sybase data server as the data server for your replicate database, you can use the load utility of your choice to load subscription data into the replicate database.

See also

- *Sybase Adaptive Server Enterprise Utility Programs* for more information about using the bcp utility to load subscription data into a replicate database in Sybase Adaptive Server 12.5 or later.

Using atomic bulk materialization

Atomic bulk materialization assumes that all applications updating the primary table can be suspended while a copy of the table is made. This copy is loaded at the replicate site.

You can use this method to retrieve data from the primary database if you can suspend updates to the primary data.

Prepare for atomic bulk materialization

Before you start an atomic bulk materialization procedure, verify the following:

- The primary table exists and contains data.
- You have a user ID with ownership or select privilege on the primary table (or a column to be replicated in the primary table).
- The replicate table exists and contains the appropriate columns.
- You successfully configured every Replication Server in your replication system.
- You created the replication definition correctly at the primary Replication Server.
- You successfully created the Replication Agent transaction log in the primary database.
- You marked and enabled replication for the primary table in the primary database.
- You started the Replication Agent instance and put it in the *Replicating* state.

Use the atomic bulk materialization procedure

❖ **To perform atomic bulk materialization**

1. Log in to the replicate Replication Server as the System Administrator (sa) using isql:

   ```
   isql -Usa -Psa_password -SRRS_servername
   ```

   where:

   - *sa* is the System Administrator user ID.
   - *sa_password* is the password for the System Administrator user ID.
   - *RRS_servername* is the name of the replicate Replication Server.

2. Define the subscription at the replicate Replication Server using the following syntax:

   ```
   1> define subscription subscription_name
   2> for replication_definition
   3> with replicate at dataserver.database
   ```

```
4> [where search_conditions]
5> go
```

The dataserver.database name must match the name you used for your replicate database.

3 Check the subscription at both the primary and replicate Replication Servers. Use the following command to verify that the subscription status is DEFINED:

```
1> check subscription subscription_name
2> for replication_definition
3> with replicate at dataserver.database
4> go
```

4 Lock the primary table to prevent primary transaction activity. This prevents updates to the primary table during materialization.

5 Unload the subscription data at the primary site using your preferred database unload method to select or dump the data from the primary table.

Note When unloading subscription data from the primary table, make sure you select only the columns specified in the replication definition and the rows specified in the subscription.

6 Activate the subscription using the with suspension option at the replicate Replication Server by using the following syntax:

```
1> activate subscription subscription_name
2> for replication_definition
3> with replicate at dataserver.database
4> with suspension
5> go
```

7 Wait for the subscription to become active at both the primary and replicate Replication Servers. Execute the check subscription command at both the primary and replicate Replication Servers to verify that the subscription status is ACTIVE.

When the subscription status is ACTIVE at the replicate Replication Server, the database connection for the replicate database is suspended.

8 Restore the primary table to read-write access (unlock).

9 Load the subscription data into the replicate database using the bcp utility or the preferred database load utility for your site.

Note Before loading the subscription data into the replicate table, make sure that any data manipulation to be performed by Replication Agent (such as datetime conversion) or by Replication Server function strings is applied to the unload file.

---

10 From the replicate Replication Server, resume the database connection for the replicate database:

```
1> resume connection
2> to dataserver.database
3> go
```

11 Validate the subscription at the replicate Replication Server:

```
1> validate subscription subscription_name
2> for replication_definition
3> with replicate at dataserver.database
4> go
```

12 Wait for the subscription to become valid at both the primary and replicate Replication Servers, then execute the check subscription command at both the primary and replicate Replication Servers to verify that the status is VALID.

When you complete this procedure, the subscription is created, the replicate data is consistent with the primary data, and replication is in progress.

If replication is not in progress when you complete this procedure, see Chapter 4, “Troubleshooting Replication Agent.”

Using nonatomic bulk materialization

Nonatomic bulk materialization assumes applications updating the primary table cannot be suspended while a copy of the table is made. Therefore, a nonatomic materialization requires the use of the Replication Server auto-correction feature to get the replicate database synchronized with the primary database.

Note You cannot use nonatomic materialization if the replicate minimal columns feature is set for the replication definition for the primary table.

Prepare for nonatomic bulk materialization

Before you start a nonatomic bulk materialization procedure, verify the following:

- The primary table exists and contains data.
- You have a user ID with ownership or select privilege on the primary table (or a column to be replicated in the primary table).
- The replicate table exists and contains the appropriate columns.
- You successfully configured every Replication Server in your replication system.
- You created the replication definition correctly at the primary Replication Server.
- You successfully created the Replication Agent transaction log in the primary database.
- You marked and enabled replication for the primary table in the primary database.
- You started the Replication Agent instance and put it in the *Replicating* state.

Use the nonatomic bulk materialization procedure

❖ **To perform nonatomic bulk materialization**

1. Log in to the replicate Replication Server as the System Administrator (sa) using isql:

   ```
   isql -Usa -Psa_password -SRRS_servername
   ```

   where:

   - *sa* is the System Administrator user ID.
   - *sa_password* is the password for the System Administrator user ID.
   - *RRS_servername* is the name of the replicate Replication Server.

2. Turn on the auto-correction feature at the replicate Replication Server:

   ```
   1> set autocorrection on
   2> for replication_definition
   3> with replicate at dataserver.database
   4> go
   ```

3. Define the subscription at the replicate Replication Server:

   ```
   1> define subscription subscription_name
   2> for replication_definition
   3> with replicate at dataserver.database
   4> with suspension
   5> go
   ```

   The dataserver.database name must match the name you used for your replicate database.

4. In the primary database, invoke the rs_marker stored procedure to activate the subscription.

5. Check the subscription at both the primary and replicate Replication Servers. Use the following command to verify that the subscription status is ACTIVE:

   ```
   1> check subscription subscription_name
   2> for replication_definition
   3> with replicate at dataserver.database
   4> go
   ```

   When the subscription status is ACTIVE at the replicate Replication Server, the database connection for the replicate database is suspended.

6 Unload the subscription data at the primary site using the preferred database unload method for your site to select or dump the data from the primary tables.

Note When unloading subscription data from the primary table, make sure you select only the columns specified in the replication definition and the rows specified in the subscription.

---

7 In the primary database, invoke the rs_marker stored procedure to validate the subscription.

8 Wait for the subscription to become valid at both the primary and replicate Replication Servers, then execute the check subscription command at both the primary and replicate Replication Servers to verify that the status is VALID.

9 Load the subscription data into the replicate database using the bcp utility or the preferred database load utility for your site.

Note Before loading the subscription data into the replicate table, make sure that any data manipulation that is to be performed by Replication Agent (such as datetime conversion) or by Replication Server function strings is applied to the unload file.

---

10 From the replicate Replication Server, resume the database connection for the replicate database:

```
1> resume connection
2> to dataserver.database
3> go
```

11 Wait for the subscription to become valid at both the primary and replicate Replication Servers, then execute the check subscription command at both the primary and replicate Replication Servers to verify that the status is VALID.

When the subscription status is VALID at the replicate Replication Server, the replicate database is synchronized with the primary database and you can turn off auto-correction.

12 Turn off the auto-correction feature at the replicate Replication Server using the following syntax:

```
1> set autocorrection off
2> for replication_definition
3> with replicate at dataserver.database
```

```
4> go
```

When you complete this procedure, the subscription is created, the replicate data is consistent with the primary data, and replication is in progress.

If replication is not in progress when you complete this procedure, see Chapter 4, “Troubleshooting Replication Agent.”

See also

- *Replication Server Commands Reference* for information on Replication Command Language (RCL) commands.
- *Replication Server Administration Guide* for information on configuring Replication Servers and materialization methods.

Glossary

This glossary describes Replication Server and Replication Agent terms used in this book.

Adaptive Server

The brand name for Sybase relational database management system (RDBMS) software products.

- *Adaptive Server Enterprise* manages multiple, large relational databases for high-volume online transaction processing (OLTP) systems and client applications.
- *Adaptive Server IQ* manages multiple, large relational databases with special indexing algorithms to support high-speed, high-volume business intelligence, decision support, and reporting client applications.
- *Adaptive Server Anywhere* manages relational databases with a small RDBMS footprint, which is ideal for embedded applications and mobile device applications.

See also **database** and **RDBMS**.

atomic materialization

A materialization method that copies subscription data from a primary database to a replicate database in a single, atomic operation. No changes to primary data are allowed until the subscription data is captured at the primary database. See also **bulk materialization** and **nonatomic materialization**.

BCP utility

A bulk copy transfer utility that provides the ability to load multiple rows of data into a table in a target database. See also **bulk copy**.

bulk copy

An Open Client interface for the high-speed transfer of data between a database table and program variables. It provides an alternative to using SQL insert and select commands to transfer data. See also **BCP utility** and **materialization**.

bulk materialization	A materialization method whereby subscription data in a replicate database is initialized outside of the replication system. You can use bulk materialization for subscriptions to table replication definitions or function replication definitions. See also **atomic materialization**, **materialization**, and **nonatomic materialization**.
client	In client/server systems, the part of the system that sends requests to servers and processes the results of those requests. See also **client application**.
client application	Software that is responsible for the user interface, including menus, data entry screens, and report formats. See also **client**.
commit	An instruction to the DBMS to make permanent the changes requested in a transaction. Contrast with **rollback**. See also **DBMS** and **transaction**.
data client	A client application that provides access to data by connecting to a data server. See also **client**, **client application**, and **data server**.
data distribution	A method of locating (or placing) discrete parts of a single set of data in multiple systems or at multiple sites. Data distribution is distinct from data replication, although a data replication system can be used to implement or support data distribution. Contrast with **data replication**.
data replication	The process of copying data to remote locations, and then keeping the replicated data synchronized with the primary data. Data replication is distinct from data distribution. Replicated data is stored copies of data at one or more remote sites throughout a system, and it is not necessarily distributed data. Contrast with **data distribution**. See also **transaction replication**.
data server	A server that provides the functionality necessary to maintain the physical representation of a table in a database. Data servers are usually database servers, but they can be any data repository with the interface and functionality a data client requires. See also **client**, **client application**, and **data client**.
database	A collection of data with a specific structure (or schema) for accepting, storing, and providing data for users. See also **data server** and **relational database**.
database connection	A connection that allows Replication Server to manage the database and distribute transactions to the database. Each database in a replication system can have only one database connection defined in Replication Server. See also **Replication Server** and **route**.
datatype	A keyword that identifies the characteristics of stored information on a computer. Some common datatypes are: char, int, smallint, date, time, numeric, and float. Different data servers support different datatypes.

DBMS	An abbreviation for *database management system*, a computer-based system for defining, creating, manipulating, controlling, managing, and using databases. The DBMS can include the user interface for using the database, or it can be a stand-alone data server system. Compare with **RDBMS**. See also **database**.
ERSSD	An abbreviation for embedded *Replication Server System Database*, which manages replication system information for a Replication Server.
function	A Replication Server object that represents a data server operation, such as insert, delete, or begin transaction. Replication Server distributes operations to replicate databases as functions. See also **function string**.
function string	A string that Replication Server uses to map a function and its parameters to a data server API. Function strings allow Replication Server to support replication between (homogeneous) non-Sybase data servers, and heterogeneous replication, in which the primary and replicate databases are different types, with different SQL extensions and different command features. See also **function**.
gateway	Connectivity software that allows two or more computer systems with different network architectures to communicate.
inbound queue	A stable queue managed by Replication Server to spool messages received from a Replication Agent. See also **outbound queue** and **stable queue**.
interfaces file	A file containing information that Sybase Open Client and Open Server applications need to establish connections to other Open Client and Open Server applications. See also **Open Client** and **Open Server**.
isql	An interactive SQL client application that can connect and communicate with any Sybase Open Server application, including Adaptive Server, Replication Agent, and Replication Server. See also **Open Client** and **Open Server**.
Java	An object-oriented, platform-independent, “write once, run anywhere” programming language developed by Sun Microsystems. The Replication Agent is a Java application.
Java VM	The Java Virtual Machine (JVM), which is the part of the Java Runtime Environment (JRE) that interprets Java byte codes. See also **Java** and **JRE**.
JDBC	An abbreviation for *Java Database Connectivity*, the standard communication protocol for connectivity between Java clients and data servers. See also **client**, **data server**, and **Java**.

jConnect	The Sybase JDBC driver that Replication Agent uses to connect to Replication Server and the RSSD.
JRE	An abbreviation for *Java Runtime Environment*, which consists of the Java Virtual Machine (Java VM or JVM), the Java Core Classes, and supporting files. To run a Java application, such as the Replication Agent, a JRE must be installed on the machine. See also **Java** and **Java VM**.
LAN	An abbreviation for “local area network,” a computer network located on the user premises and covering a limited geographical area (usually a single site). Communication within a local area network is not subject to external regulations; however, communication across the LAN boundary can be subject to some form of regulation. Contrast with **WAN**.
latency	In transaction replication, the time it takes to replicate a transaction from a primary database to a replicate database. Specifically, latency is the time elapsed between committing an original transaction in the primary database and committing the replicated transaction in the replicate database. See also **transaction replication**.
LOB	An abbreviation for *large object*, a type of data element (or datatype) associated with a column that contains extremely large quantities of data.
Log Reader	An internal component of the Replication Agent that interacts with the primary database to capture transactions for replication. See also **Log Transfer Interface** and **Log Transfer Manager**.
Log Transfer Interface	An internal component of the Replication Agent that interacts with Replication Server to forward transactions for distribution to a replicate database. See also **Log Reader** and **Log Transfer Manager**.
Log Transfer Interface	An internal component of the Replication Agent that interacts with Replication Server to forward transactions for distribution to a replicate database. See also **Log Reader** and **Log Transfer Manager**.
Log Transfer Language	The proprietary protocol used between Replication Agent and Replication Server to replicate data from the primary database to Replication Server. See also **Log Reader** and **Log Transfer Interface**.
Maintenance User	A special user login name in the replicate database that Replication Server uses to apply replicated transactions to the database. See also **replicate database** and **Replication Server**.

materialization	The process of copying the data from a primary database to a replicate database, initializing the replicate database so that the replication system can begin replicating transactions. See also **atomic materialization**, **bulk materialization**, and **non-atomic materialization**.
nonatomic materialization	A materialization method that copies subscription data without a lock on the primary database. Changes to primary data are allowed during data transfer, which may cause temporary inconsistencies between the primary and replicate databases. Contrast with **atomic materialization**. See also **bulk materialization**.
ODBC	An abbreviation for *Open Database Connectivity*, an industry standard communication protocol for clients connecting to data servers. See also **client**, **data server**, and **JDBC**.
Open Client	A Sybase product that provides customer applications, third-party products, and other Sybase products with the interfaces needed to communicate with Open Server applications. See also **Open Server**.
Open Client application	An application that uses Sybase Open Client libraries to implement Open Client communication protocols. See also **Open Client** and **Open Server**.
Open Server	A Sybase product that provides the tools and interfaces required to create a custom server. See also **Open Client**.
Open Server application	A server application that uses Sybase Open Server libraries to implement Open Server communication protocols. See also **Open Client** and **Open Server**.
outbound queue	A stable queue managed by Replication Server to spool messages to a replicate database. See also **inbound queue**, **replicate database**, and **stable queue**.
primary data	The version of a set of data that is the source used for replication. Primary data is stored and managed by the primary database. See also **primary database**.
primary database	The database that contains the data to be replicated to another database (the replicate database) through a replication system. The primary database is the source of replicated transactions and data in a replication system. Sometimes called the *active database*. Contrast with **replicate database**. See also **primary data** and **replicated transaction**.
primary key	The column or columns whose data uniquely identify each row in a table.
primary table	A table used as a source for replication. Primary tables are defined in the primary database schema. See also **primary data** and **primary database**.

primary transaction	A transaction that is committed in the primary database and recorded in the primary database transaction log. See also **primary database** and **transaction log**.
quiesce	To cause a system to go into a state in which further data changes are not allowed. See also **quiescent**.
quiescent	In a replication system, a state in which all data-changing operations have been propagated to their destinations. Some Replication Server commands require that you quiesce the replication system. In a database, a state in which all data-changing operations are suspended so that transactions cannot change any data. This term is interchangeable with *quiesced* and *in quiesce*. See also **quiesce**.
RASD	An abbreviation for *Replication Agent System Database*, information in which the primary database uses to recognize database structure or schema objects in the transaction log.
RCL	An abbreviation for *Replication Command Language*, the command language used to manage Replication Server. See also **Replication Server**.
RDBMS	An abbreviation for *relational database management system*, which is an application that manages and controls relational databases. Compare with **DBMS**. See also **relational database**.
relational database	A collection of data in which data is viewed as being stored in tables, which consist of columns (data items) and rows (units of information). Relational databases can be accessed by SQL requests. Compare with **database**. See also **SQL**.
replicate data	The data managed by a replicate database, which is the destination (or target) of a replication system. Contrast with **primary data**. See also **replicate database** and **replication system**.
replicate database	A database that contains data replicated from another database (the primary database) through a replication system. The replicate database is the database that receives replicated transactions and/or data in a replication system. Sometimes called the *standby database*. Contrast with **primary database**. See also **replicate data**, **replicated transaction**, and **replication system**.
replicated data	A set of data that is replicated from a primary database to a replicate database by a replication system. See also **primary database**, **replication system**, and **replicate database**.

replicated transaction	A primary transaction that is replicated from a primary database to a replicate database by a transaction replication system. See also **primary database**, **primary transaction**, **replicate database**, and **transaction replication**.
Replication Agent	An application that reads a primary database transaction log to acquire information about data-changing transactions in the primary database, processes the log information, and then sends it to a Replication Server for distribution to a replicate database. See also **primary database**, **replicate database**, and **Replication Server**.
replication definition	A description of a table or stored procedure in a primary database, for which subscriptions can be created. The replication definition, maintained by Replication Server, includes information about the columns to be replicated and the location of the primary table or stored procedure. See also **Replication Server** and **subscription**.
Replication Server	The Sybase software product that provides the infrastructure for a robust transaction replication system. See also **Replication Agent**.
RSSD	An abbreviation for *Replication Server System Database*, which manages replication system information for a Replication Server. See also **Replication Server**.
replication system	A data processing system that replicates data from one location to another. Data can be replicated between separate systems at a single site, or from one or more local systems to one or more remote systems. See also **data replication** and **transaction replication**.
rollback	An instruction to a database to reverse the data changes requested in a unit of work (a transaction). Contrast with **commit**. See also **transaction**.
route	A one-way message stream from a primary Replication Server to a replicate Replication Server. Routes carry data-changing commands (including those for RSSDs) and replicated functions (database procedures) between separate Replication Servers. See also **Replication Server**.
SQL	An abbreviation for *Structured Query Language*, a non-procedural programming language used to process data in a relational database. ANSI SQL is an industry standard. See also **transaction**.

stable queue	A disk device-based, store-and-forward queue managed by Replication Server. Messages written into the stable queue remain there until they can be delivered to the appropriate process or replicate database. Replication Server provides a stable queue for both incoming messages (the inbound queue) and outgoing messages (the outbound queue). See also **database connection**, **Replication Server**, and **route**.
subscription	A request for Replication Server to maintain a replicated copy of a table, or a set of rows from a table, in a replicate database at a specified location. See also **replicate database**, **replication definition**, and **Replication Server**.
table	In a relational database, a two-dimensional array of data, or a named data object that contains a specific number of unordered rows composed of a group of columns that are specific to the table. See also **database** and **relational database**.
transaction	A unit of work in a database that can include zero, one, or many operations (including insert, update, and delete operations), and that is either applied or rejected as a whole. Each SQL statement that modifies data can be treated as a separate transaction, if the database is so configured. See also **replicated transaction** and **SQL**.
transaction log	Generally, the log of transactions that affect the data managed by a database or a data server. Replication Agent reads the transaction log to identify and acquire the transactions to be replicated from the primary database. See also **primary database**, **Replication Agent**, and **transaction**.
transaction replication	A data replication method that copies data-changing operations from a primary database to a replicate database. See also **data replication**, **primary database**, and **replicate database**.
transactional consistency	A condition in which all transactions in the primary database are applied in the replicate database, and in the same order that they were applied in the primary database. See also **primary database**, **replicate database**, and **transaction**.
WAN	An abbreviation for “wide area network,” a system of local-area networks (LANs) connected together with data communication lines. Contrast with **LAN**.

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