Oracle Transparent Gateway®

Ingres II on Sun SPARC Solaris Administrator's Guide

Release 8.1.6

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Oracle Transparent Gateway for Ingres II on Sun SPARC Solaris Administrator's Guide, Release 8.1.6

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Primary Authors: Stuart Cornfield, Orit Curiel, Julian Weiss

Contributors: Esti Adan, Jacco Draaijer, Pavana Jain, Cynthia Kibbe, Kishan Peyetti

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Preface

Oracle Transparent Gateway for Ingres II allows Oracle client applications to access Ingres II data through Structured Query Language (SQL). The gateway, with the Oracle database server, creates the appearance that all data resides on a local Oracle database server, even though the data can be widely distributed.

This Preface contains the following sections:

Audience

Read this guide if you are responsible for the following tasks:

- Installing and configuring Oracle Transparent Gateway for Ingres II
- Diagnosing gateway errors
- Using the gateway to access Ingres II data

> **Note:** You should understand the fundamentals of transparent gateways and the Sun SPARC Solaris operating system before using this guide to install or administer the gateway.

Related Publications

In addition to this guide, the following publications are related to Oracle Transparent Gateway for Ingres II:

- *Getting to Know Oracle8i*
- *Oracle Call Interface Programmer's Guide*
- *Oracle Enterprise Manager Administrator's Guide*
- *Oracle8i Administrator's Guide*
- *Oracle8i Application Developer's Guide*
- *Oracle8i Concepts*
- *Oracle8i Designing and Tuning for Performance*
- *Oracle8i Distributed Database Systems*
- *Oracle8i Error Messages*
- *Oracle8i National Language Support Guide*
- *Oracle8i Reference*
- *Oracle8i SQL Reference*
- *Net8 Administrator's Guide*
- *SQL*Plus User's Guide and Reference*

Note: Collateral gateway information and other related material, such as white papers, are posted on `http://www.oracle.com/gateways`.

Notational Conventions

The following conventions are used in this guide:

Italic Font	Italic characters indicate that the parameter, variable, or expression in the command syntax must be replaced by a value that you provide.
`Monospace Font`	Monospace font indicates something the computer displays.
Punctuation	Punctuation in syntax examples, other than square brackets and vertical bars, must be entered as shown.
[ ]	Square brackets enclose optional items. Do not enter the brackets.
( )	Parentheses enclose all Net8 Keyword-Value pairs in connect descriptors. They must be entered as part of the connect descriptor, as in `(KEYWORD=`*`value`*`)`.
|	A vertical bar represents a choice of two or more options. You must enter one of the options separated by the vertical bar. Do not enter the vertical bar.
UPPERCASE	Uppercase characters within the text represent parameters.

Your Comments are Welcome

We value and appreciate your comment as an Oracle user and reader of our manuals. As we write, revise, and evaluate our documentation, your opinions are the most important feedback we receive.

You can send comments and suggestions about this reference to the Gateway Development department at the following e-mail address:

infodev@us.oracle.com

If you prefer, you can send letters or faxes containing your comments to:

Information Development Documentation Manager
Oracle Corporation
500 Oracle Parkway, 4op7
Redwood Shores, CA 94065
Fax: (650) 506-7228. Attn: Information Development

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Release Information

This chapter contains information specific to this release of the Oracle Transparent Gateway for Ingres II, and contains the following sections:

Product Set

This table lists the versions of the components included on the distribution CD-ROM. All components are at production level.

Product	Version Number
Net8 Server	8.1.6.0.0
Net8 Client	8.1.6.0.0
Net8 Assistant	8.1.6.0.0
Net8 Configuration Assistant	8.1.6.0.0
Oracle Universal Installer	1.7.0.18.0A
Oracle Transparent Gateway for Ingres II	8.1.6.0.0

System Requirements

This section describes the following:

- Hardware Requirements
- Software Requirements

Note: The gateway components can be located on one platform or distributed over several platforms. You should determine the gateway configuration before you determine the hardware and software requirements of the system.

As Oracle continues to support new releases and changes of the Oracle database server and Ingres II, the supported configuration will be updated. For current supported configuration information, refer to `http://www.oracle.com/gateways`.

See Also: "Gateway Process Flow" on page 2-5.

Hardware Requirements

The following table summarizes the hardware requirements for the Oracle Transparent Gateway for Ingres II.

Hardware Requirements	
Processor	A Sun SPARC Solaris workstation running the required version of Sun SPARC Solaris
Memory	2.6MB of real memory is recommended for the first user to support the gateway. Each concurrent use of the gateway requires 0.2MB. The total real memory requirement for the concurrent use of the gateway also depends on these factors: ■ The SQL statement issued by the user ■ The number of cursors currently opened against Ingres II ■ The number of columns in the table being accessed
CD-ROM Drive	An internal or external CD-ROM drive
Disk Space	200MB of free disk space

Software Requirements

The system software configuration described in this section is supported by Oracle Corporation as long as the underlying system software products are supported by their respective vendors. Verify the latest support status with your system software vendors.

The following table summarizes the software requirements for the Oracle Transparent Gateway for Ingres II.

Software Requirements	
Operating System	Sun SPARC Solaris Version 2.6 or 2.7
Oracle database server	Oracle8*i* Enterprise Edition Server Version 8.1.6 Oracle database server can reside on any supported platform

Software Requirements	
Oracle Networking	On gateway machine: ■ Net8 Server Version 8.1.6 ■ Oracle Adapter for Named Pipes, SPX, or TCP/IP, SPX On the Oracle database server machine: ■ Oracle Net8 Client 8.1.6 ■ Oracle Adapter for Named Pipes, SPX, or TCP/IP The Net8 products are included on the distribution CD-ROM. Net8 or Net8 Client and the Oracle Adapter must be installed on the machine where the Oracle database server is installed. Net8 Server and the Oracle Adapter must be installed on the machine where the gateway is installed.
Ingres II	Ingres II Version 2.0

Tested Configurations

The following table provides the tested configurations at Oracle, at the time of this document release. Oracle continues to provide support for the most recent releases of Oracle and non-Oracle systems in a timely manner. For current supported configuration information, please contact Oracle Support Services or visit `http://www.oracle.com/gateways`.

Gateway Configurations for the Oracle database server release 8.1.6	
Database	**Gateway and Operating System**
Ingres II Version 2.0	tg4ingr release 8.1.6 running on Sun SPARC Solaris Versions 2.6 and 2.7

Database Compatibility Issues for Ingres II

Ingres II and Oracle databases function differently in some areas, causing compatibility problems. The following compatibility issues are described in this section:

- Naming Rules
- Data Types
- Queries
- Locking

Naming Rules

Naming rule issues include the following:

- Rules for Naming Objects
- Object Names
- Case Sensitivity

Rules for Naming Objects

Oracle and Ingres II use different database object naming rules. For example, the maximum number of characters allowed for each object name can be different. Also, the use of quotation marks, case sensitivity, and the use of alphanumeric characters can all be different.

See Also: *Oracle8i Reference* and Ingres II documentation.

Object Names

Names of Ingres II database objects are limited to a maximum of 32 characters. An object name can be composed of these characters:

- Numbers 0 to 9
- Lowercase letters a to z
- Uppercase letters A to Z
- Underscore character (_)
- Special characters "#". "@", and "$"

Case Sensitivity

Ingres II handles letter case differently from Oracle. Ingres II uses the following rules:

- Table owner names default to uppercase letters, unless the name is surrounded by double quote characters.
- Column names, table names, view names, and so on, are always treated as lowercase letters.

The Oracle database server defaults to uppercase unless you surround identifiers with double quote characters. For example, to refer to a Ingres II table called emp, enter the name with double quote characters as follows:

```
SQL> SELECT * FROM "emp"@INGR;
```

However, to refer to a Ingres II table called emp owned by Scott from an Oracle application, enter the following:

```
SQL> SELECT * FROM "Scott"."emp"@INGR;
```

If the Ingres II table called emp is owned by SCOTT, a table owner name in uppercase letters, you can enter the owner name without double quote characters as follows:

```
SQL> SELECT * FROM SCOTT."emp"@INGR;
```

or

```
SQL> SELECT * FROM scott."emp"@INGR;
```

Oracle Corporation recommends that you surround all Ingres II object names with double quote characters and use the exact letter case for the object names as they appear in the Ingres II data dictionary. This convention is not required when referring to the supported Oracle data dictionary tables or views listed in Appendix B, "Data Dictionary".

If existing applications cannot be changed according to these conventions, create views in Oracle to associate Ingres II names to the correct letter case. For example, to refer to the Ingres II table emp from an existing Oracle application by using only uppercase names, define the following view:

```
SQL> CREATE VIEW EMP (EMPNO, ENAME, SAL, HIREDATE)
      AS SELECT "empno", "ename", "sal", "hiredate"
      FROM "emp"@INGR;
```

With this view, the application can issue statements such as the following:

```
SQL> SELECT EMPNO, ENAME FROM EMP;
```

Using views is a workaround solution that duplicates data dictionary information originating in the Ingres II data dictionary. You must be prepared to update the Oracle view definitions whenever the data definitions for the corresponding tables are changed in the Ingres II database.

Data Types

Data type issues include the following:

- Ingres II Date Limit

Ingres II Date Limit

The Oracle database server supports dates through December 31, 4712. Ingres II supports dates in the range of January 1, 1582 through December 31, 2382. If a date beyond the range of Ingres II is passed to the Ingres II database, an error is returned.

Default Date Values

When only a time value is given for a DATE datatype field, Ingres II adds the current date to the time value, while the Oracle database server adds the date of the first day.

Data Type Conversion

Ingres II does not support implicit conversions between character data types and numeric data types. Such conversions must be explicit.

See Also: "Data Type Conversion" on page 5-4 for more information about restrictions on data types.

Queries

Query issues include the following:

Empty Strings

The gateway passes the empty string to the Ingres II database without any conversion.

The gateway returns an empty string to the Oracle database server as a NULL value. This applies only to columns defined with a VARCHAR data type.

Empty Bind Variables

The gateway passes empty bind variables to the Ingres II database as a NULL value. This applies only to columns defined with a VARCHAR data type.

Locking

The locking model for a Ingres II database differs significantly from the Oracle model. The gateway depends on the underlying Ingres II behavior, so Oracle applications that access Ingres II through the gateway can be affected by the following possible scenarios:

- Read access might block write access
- Write access might block read access
- Statement-level read consistency is not guaranteed

> **See Also:** Ingres II documentation for information about the Ingres II locking model.

Known Restrictions

This section describes the following known restrictions and includes suggestions for dealing with them when possible:

- Transactional Integrity
- Transaction Capability
- COMMIT or ROLLBACK in Cursor Loops Closes Open Cursors
- Pass-Through Feature
- LONG BYTE and LONG VARCHAR Data Types
- SQL Syntax
- SQL*Plus
- Database Links
- National Language Support
- Stored Procedures

The following restriction also applies:

- When negative numbers are used in a SUBSTR function, incorrect results are returned. This is due to way the gateway compnsates for the lackof a SUBSTR function in Ingres II.

Transactional Integrity

The gateway cannot guarantee transactional integrity in the following cases:

- When a statement that is processed by the gateway causes an implicit commit in the target database
- When the target database is configured to work in autocommit mode

---

Note: Oracle corporation strongly recommends the following:

- If you know that executing a particular statement causes an implicit commit in the target database, then ensure that this statement is executed in its own transaction.
- Do not configure the target database to work in autocommit mode.

Transaction Capability

The gateway does not support savepoints. If a distributed update transaction is under way involving the gateway and a user attempts to create a savepoint, the following error occurs:

```
ORA-02070: database dblink does not support savepoint in this context
```

By default, the gateway is configured as COMMIT_CONFIRM and it is always the commit point site when the Ingres II database is updated by the transaction.

> **See Also:** *Oracle8i Distributed Database Systems* for more information and restrictions of the COMMIT_CONFIRM mode.

COMMIT or ROLLBACK in Cursor Loops Closes Open Cursors

Any COMMIT or ROLLBACK issued in a PL/SQL cursor loop closes all open cursors, which can result in the following error:

```
ORA-1002:  fetch out of sequence
```

To prevent this error, move the COMMIT or ROLLBACK statement outside the cursor loop.

Pass-Through Feature

Oracle Corporation recommends that you place a DDL statement in its own transaction when executing such a statement with the pass-through feature. An explicit COMMIT must be issued after the DDL statement.

If the SQL statements being passed through the gateway result in an implicit commit at the Ingres II database, the Oracle transaction manager is unaware of the commit and an Oracle ROLLBACK command cannot be used to roll back the transaction.

LONG BYTE and LONG VARCHAR Data Types

The gateway supports only INSERT and UPDATE of LONG BYTE and LONG VARCHAR data up to 31,900 bytes and 61,900 bytes, respectively, when using bind variables.

An unsupported SQL function cannot be used in an SQL statement which accesses a column defined as Ingres II data type LONG BYTE or LONG VARCHAR. See Appendix A, "Supported SQL Syntax and Functions" for more information.

You cannot use SQL*Plus to select data from a column defined as Ingres II data type LONG BYTE or LONG VARCHAR when the data is greater than 80 characters in length. Oracle Corporation recommends using Pro*C or Oracle Call Interface to access such data in a Ingres II database.

The gateway does not support the PL/SQL function COLUMN_VALUE_LONG of the DBMS_SQL package.

SQL Syntax

This section lists restrictions on the following SQL syntax:

- WHERE CURRENT OF Clause Is Not Supported
- CONNECT BY Clause
- FOR UPDATE OF Clause
- Subqueries in UPDATE Statement
- ROWID

> **See Also:** Appendix A, "Supported SQL Syntax and Functions" for more information about restrictions on SQL syntax.

WHERE CURRENT OF Clause Is Not Supported

UPDATE and DELETE statements with the WHERE CURRENT OF clause are not supported by the gateway because they rely on the Oracle ROWID implementation. To update or delete a row through the gateway, a condition style WHERE clause must be used.

CONNECT BY Clause

The CONNECT BY clause in a SELECT statement is not supported.

FOR UPDATE OF Clause

A SELECT statement of this syntax:

```
SQL> SELECT ... FROM table_list FOR UPDATE LIST column_list
```

is supported only when *column_list* refers to columns of the first table in *table_list*.

Subqueries in UPDATE Statement

Subqueries in the SET clause of an UPDATE statement are not supported.

Whenever the use of a condition is allowed in an UPDATE statement, the gateway allows the condition to contain a subquery. Each subquery, however, must reference an Ingres II table. For example, using the table GTW_DEPT, the following statement results in a 10% salary increase for all employees working in the RESEARCH department:

```
SQL> UPDATE "gtw_emp"@INGR SET "sal"="sal" * 1.1
  2   WHERE "deptno"=(SELECT "deptno" FROM "gtw_dept"@INGR
  3       WHERE "dname"='RESEARCH');
```

If "gtw_dept"@INGR is replaced by "dept" in the subquery, where dept is the same table but located in the Oracle database, the following error results after the statement is issued:

```
ORA-02025: All tables in the SQL statement must be at the remote database.
```

ROWID

The Oracle ROWID implementation is not supported.

SQL*Plus

In SQL*Plus, the gateway does not support using a SELECT statement to retrieve data from an Ingres II column defined as data type BYTE.

The gateway does not support the SQL*Plus COPY command for lowercase table names.

Database Links

The gateway is not multithreaded and cannot support shared database links. Each gateway session spawns a separate gateway process and connections cannot be shared.

National Language Support

The gateway supports all single byte ASCII character sets and the following multibyte character sets:

- JA16EBCDIC930
- JA16EUC
- JA16EUCYEN
- JA16SJIS
- JA16SJISYEN
- JA16VMS

> **See Also:** *Oracle8i Distributed Database Systems* and *Oracle8i National Language Support Guide* for more information.

Stored Procedures

The gateway does not support the procedure feature that allows the execution of stored procedures in a non-Oracle database.

Known Problems

This section describes known problems and includes suggestions for correcting them when possible. If you have any questions or concerns about the problems, contact Oracle Support Services. A current list of problems is available online. Contact your local Oracle Corporation office for information about accessing the list.

The following known problems are described in this section:

Encrypted Format Login

The Oracle database server supports an Oracle initialization parameter, DBLINK_ENCRYPT_LOGIN. When this parameter is set to TRUE, the password for the login user ID is not sent over the network.

If this parameter is set to TRUE in the initialization parameter file used by the Oracle database server, you must change the setting to FALSE to allow Oracle to communicate with the gateway.

Aggregate Function with CREATE TABLE or CREATE VIEW Statement

The Oracle database server does not send the gateway a SELECT statement containing an aggregate function that is part of a CREATE TABLE or CREATE VIEW statement. For example, it does not send the following statement:

```
CREATE TABLE sum_calls_table AS
   SELECT SUM(calls_abandoned), SUM(calls_completed),
   SUM(calls_failed) FROM monthly_calls@INGR;
```

Instead, Oracle interprets what the SQL statement requests and sends the gateway a statement or statements to retrieve the data required for the request. After the data is retrieved, Oracle performs the aggregate function originally requested and passes the results to the application.

A solution to this problem is to use a different series of SQL statements. For example, instead of using the CREATE TABLE statement in the above example, use the following statements:

```
DROP TABLE sum_calls_table;
CREATE TABLE sum_calls_table (x1sum NUMBER, x2sum NUMBER,
   x3sum NUMBER);
DECLARE
   x1 NUMBER;
   x2 NUMBER;
   x3 NUMBER;
BEGIN
   SELECT SUM(calls_abandoned), SUM(calls_completed),
   SUM(calls_failed) INTO x1, x2, x3 FROM monthly_calls@INGR;
   INSERT INTO sum_calls_table VALUES (x1, x2, x3);
END;
/
```

Date Arithmetic

The following SQL expressions do not function correctly with the gateway:

date + *number*
number + *date*
date - *number*
date1 - *date2*

Statements with the above expressions are sent to the Ingres II database without any translation. Since Ingres II does not support these date arithmetic functions, the statements return an error.

Ingres II MONEY Data Type

Incorrect negative values might be returned from a SELECT statement that retrieves data from columns defined as MONEY that contain negative values near the precision limit.

String Functions

If you concatenate numeric literals using the "||" or CONCAT operator when using the gateway to query an Ingres II database, the result is an arithmetic addition. For example, the result of the following statement is 18:

```
SQL> SELECT 9 || 9 FROM "dual"@INGR;
```

The result is 99 when using Oracle to query an Oracle database.

2

Introduction

Oracle Transparent Gateway for Ingres II allows Oracle client applications to access Ingres II data through Structured Query Language (SQL). The gateway, with the Oracle database server, creates the appearance that all data resides on a local Oracle database server, even though data might be widely distributed. If data is moved from the Ingres II database to an Oracle database, no changes in client application design or function are needed, because the gateway handles all differences in data types or SQL functions between the application and database.

This chapter contains the following sections:

Oracle Heterogeneous Services

The generic core of the Oracle Transparent Gateway for Ingres II is incorporated into the database as the Heterogeneous Services facility. Heterogeneous Services (HS) extend the Oracle SQL engine to recognize the SQL and procedural capabilities of the remote non-Oracle system and the mappings required to obtain necessary data dictionary information. Additionally, since Heterogeneous Services is integrated with the Oracle database server, the transaction coordination of the server maintains the transaction coordination between Oracle and the remote non-Oracle system. For example, Heterogeneous Services provide the two-phase commit protocol to ensure distributed transaction integrity, even for non-Oracle systems that do not natively support two-phase commit.

Oracle Transparent Gateway for Ingres II, together with the Heterogeneous Services component that is integrated in the Oracle8i server, provide information for and connectivity to Ingres II.

See Also: *Oracle8i Distributed Database Systems.*

Oracle Transparent Gateway for Ingres II

Using Oracle SQL, Oracle client applications can access Ingres II data as if the data were stored in an Oracle table. Data residing in Oracle and Ingres II databases can be accessed by a single SQL statement, performing heterogeneous joins and subselects. This means you can develop one set of portable applications to use against Oracle and Ingres II databases. You can continue to develop new information systems without losing your investment in existing data and applications.

Transactions updating Oracle and Ingres II databases are automatically protected by the Oracle two-phase commit feature. Use of synonyms is another Oracle feature. By setting up synonyms in the Oracle database server that point to database links to Ingres II tables, the physical location of the data is transparent to the client application. This allows future migration of data from Ingres II to Oracle to be transparent to the client applications.

The gateway requires only the Oracle database server and Net8. All other Oracle products are optional. However, using other Oracle products with the gateway can greatly extend the gateway's capabilities.

Gateway Architecture

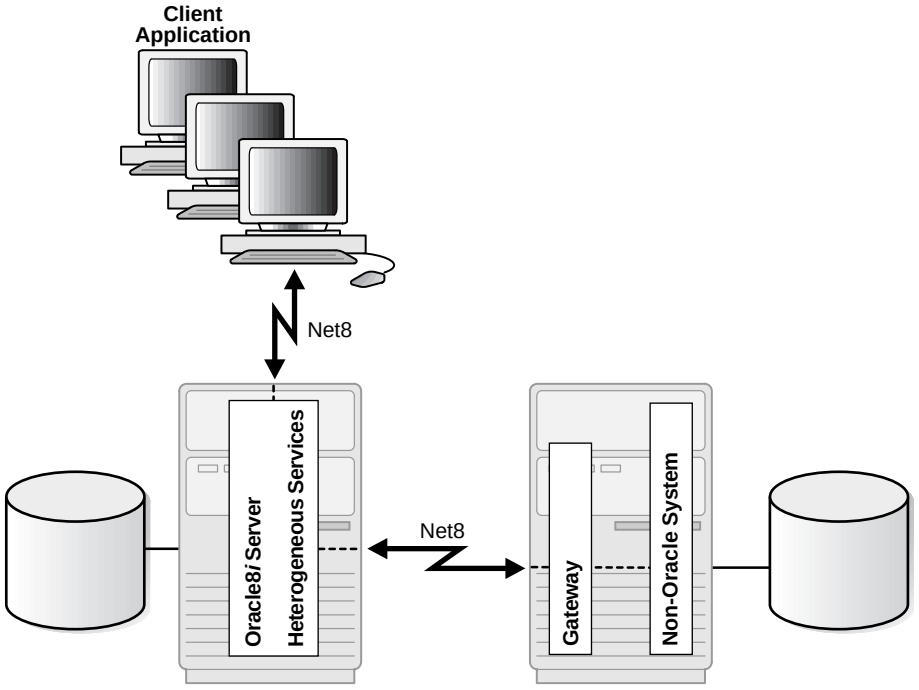
The gateway is invoked by the listener. The gateway is not multi-threaded and cannot support shared database links. Each gateway session spawns a separate gateway process, and connections cannot be shared.

The gateway resides on the Sun SPARC Solaris machine with the Ingres II database or Ingres II client (in which case the Ingres II database can reside on a separate machine). The Oracle database server can reside on the same machine as the gateway or on another machine.

Note: The non-Oracle system shown in Figure 2–1 and Figure 2–2 represents Ingres II.

The gateway interacts with the Oracle database server to interface between client applications and Ingres II, as shown in Figure 2–1 on page 2-4.

Figure 2–1 Gateway Processing



- Client applications, such as Developer, connect to the Oracle database server by using Net8.
- The Oracle database server, which includes Heterogeneous Services and the database itself, resides on a single system. This Oracle database server also stores definitions of database links for Ingres II.
- The gateway to Ingres II and the Ingres II database server itself, which includes the Ingres II database, reside on a second system. The Oracle database server on the first system uses Net8 to connect directly to the Ingres II gateway on the second system.
- On the second system, the Ingres II gateway accesses the Ingres II database server by using whatever networking software the target supports.

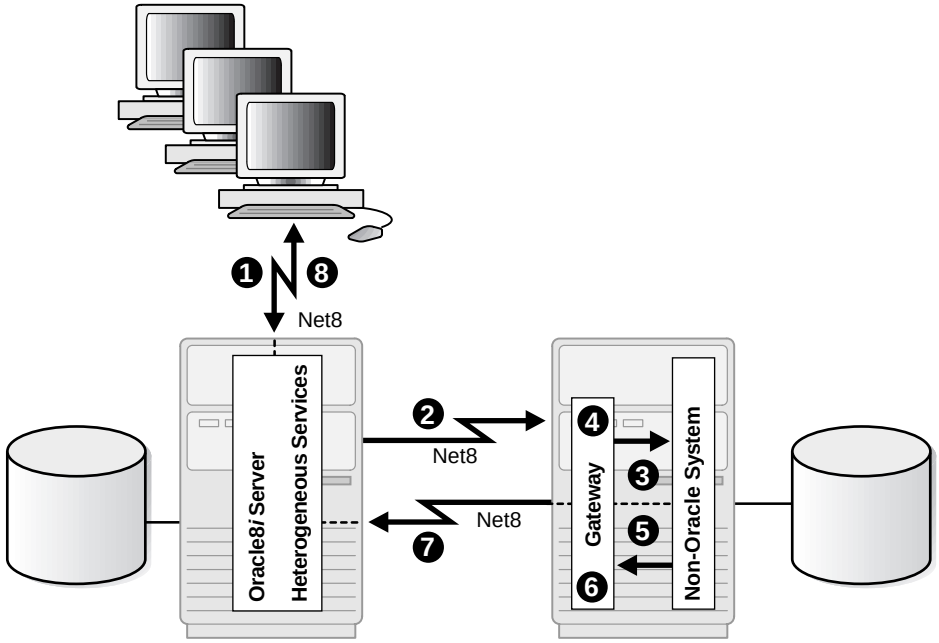
The Oracle database server and the gateway work together to present the appearance of a single Oracle database to the client. All data accessed by the client

appears to reside in a single Oracle database. The client application sends a request to the Oracle database server, and the Oracle database server sends the request to the gateway. For the first transaction in a session, the gateway logs into Ingres II using a username and password that is valid in the Ingres II database. The gateway converts the SQL statement to a native Ingres II statement, and Ingres II performs the request. The gateway converts the retrieved data to a format compatible with the Oracle database server and returns the results to the Oracle database server, which returns the results to the client application.

Gateway Process Flow

Figure 2–2 shows a typical gateway process flow. The steps explain the sequence of events that occurs when a client application queries the Ingres II database through the gateway.

Figure 2–2 Gateway Process Flow



1. The client application sends a query over Net8 to the Oracle database server.

2. The Oracle database server sends the query over to the gateway, again using Net8.
3. For the first transaction in a session, the gateway logs into Ingres II using a username and password that is valid in the Ingres II database.
4. The gateway converts the Oracle SQL statement into an SQL statement understood by Ingres II.
5. The gateway retrieves data using Ingres II SQL statements.
6. The gateway converts retrieved data into a format compatible with the Oracle database server.
7. The gateway returns query results to the Oracle database server, again using Net8.
8. The Oracle database server passes the query results to the client application by using Net8. The database link remains open until the gateway session is finished or the database link is explicitly closed.

Additional Features

This section describes the following additional features provided by the Oracle Transparent Gateway for Ingres II:

- Remote Data Access
- Elimination of Unnecessary Data Duplication
- Heterogeneous Database Integration
- Application Development and End User Tools
- Two-Phase Commit and Multi-Site Transactions
- Query Optimization
- Error Mapping and Logging
- Pass-Through Feature

Remote Data Access

Applications can take advantage of Oracle client-server capability to connect to a remote server using Net8. The server can then connect to the gateway using a database link. You have more flexibility in locating your data because the Oracle architecture enables network connections between each of the components.

With remote access, you can move application development onto cost-efficient workstations or microcomputers. Without remote access, you are limited to the data available in the local environment. With remote access, your data sources are virtually unlimited. Remote access also enables you to choose the best environment for your users. For example, data might be located on a platform that supports only character-mode interfaces, but users can access the data from desktop platforms that support graphical user interfaces.

Elimination of Unnecessary Data Duplication

The gateway gives applications direct access to Ingres II data, so the need for uploading and downloading large quantities of data to other locations is eliminated. You instead access the data where it is, when you want it, without having to move the data between machines and risk unsynchronized and inconsistent data. Avoiding data duplication reduces the disk storage requirements over all your systems.

Heterogeneous Database Integration

The Oracle database server can accept a SQL statement that queries data stored in several different databases. The Oracle database server with heterogeneous services processes the SQL statement and passes the appropriate SQL directly to other Oracle databases and through gateways to non-Oracle databases. The Oracle database server then combines the results and returns them to the client. This enables a query to be processed that spans Ingres II, other databases, and local and remote Oracle data.

Application Development and End User Tools

Through the gateway, Oracle Corporation extends the range of application development and user tools you can use to access the databases. These tools increase application development and user productivity by reducing prototype, development, and maintenance time. Current Oracle users do not have to learn a new set of tools to access data stored in Ingres II databases. Instead, they can access Oracle and Ingres II data with one set of tools. These tools can run on remote machines connected through Net8 to the Oracle database server.

Two-Phase Commit and Multi-Site Transactions

In a distributed database system, the network might fail during a distributed transaction. The Oracle transaction model uses a two-phase commit protocol to protect the databases during the period of committing data at sites participating in a distributed transaction. This feature ensures that all database servers participating in the transaction commit or roll back the transaction statements. The gateway supports this two-phase commit protocol. Only one Ingres II database is allowed for each update transaction.

Query Optimization

Whenever possible, the Oracle database server passes the entire query to the non-Oracle system to utilize the indexes and statistics of the non-Oracle system tables.

When a query that involves multiple databases is processed, the Oracle database server passes optimized statements to the remote servers and gateways involved in the query to minimize the amount of data returned across the network.

> **See Also:** *Oracle8i Designing and Tuning for Performance* and *Oracle8i Distributed Database Systems* for information about collocated inline views and joins.

Error Mapping and Logging

The gateway provides error mapping. It maps the Ingres II error to an Oracle database server error message and adds all of the relevant error messages generated by Ingres II. You can route messages to the client application, an operator console, an error log, or any combination of these destinations as needed. Error mapping provides database transparency for applications.

Pass-Through Feature

Commands and statements specific to the Ingres II database can be passed through the gateway for execution by Ingres II.

> **See Also:** Using the Pass-Through Feature on page 5-5.

3

Installing the Gateway

This chapter explains how to install the gateway software from the distribution CD-ROM. This chapter includes the following sections:

- Before You Begin
- Installing the Gateway from the CD-ROM
- De-installing the Gateway

Before You Begin

Confirm that you have met all of the hardware and software requirements described in Chapter 1. You should also determine the configuration of the gateway components on the system, identify the machines on which the Oracle database server, the gateway, and the Ingres II database reside, and verify the administration roles. Refer to the following sections:

- Determine the Configuration of the Gateway Components
- Installation Worksheet

Determine the Configuration of the Gateway Components

Figure 3–1, "Gateway Component Configuration", is a system diagram that gives an example of one possible system configuration. To sketch your own system, first draw a box. This represents a single system. Next, for each component you wish to install on the system, draw a box inside the box representing your system. Label these boxes with their respective component names. Follow the same procedure to represent a second system.

Draw a line with an arrow on both ends between the two systems to represent communication between them. Draw a box or boxes to represent client applications, and draw a line between them and the Oracle database server to represent communications between the client applications and the Oracle database server. Label the machines on which the Oracle database server, the gateway, and the non-Oracle database reside.

Identify the machines on which Ingres II and the Oracle database server reside and where the gateway will be installed. Write this information on the Installation Worksheet. After you determine the configuration and identify the machines, verify that the machines and the software meet the hardware and software requirements described in Chapter 1. The supported versions of Sun SPARC Solaris, Ingres II database and communication software, and the Oracle database server must all be installed.

Important: Verify that you have Oracle database administration access and privileges on the machines on which the gateway and the Oracle database server are to be installed.

Figure 3–1 Gateway Component Configuration

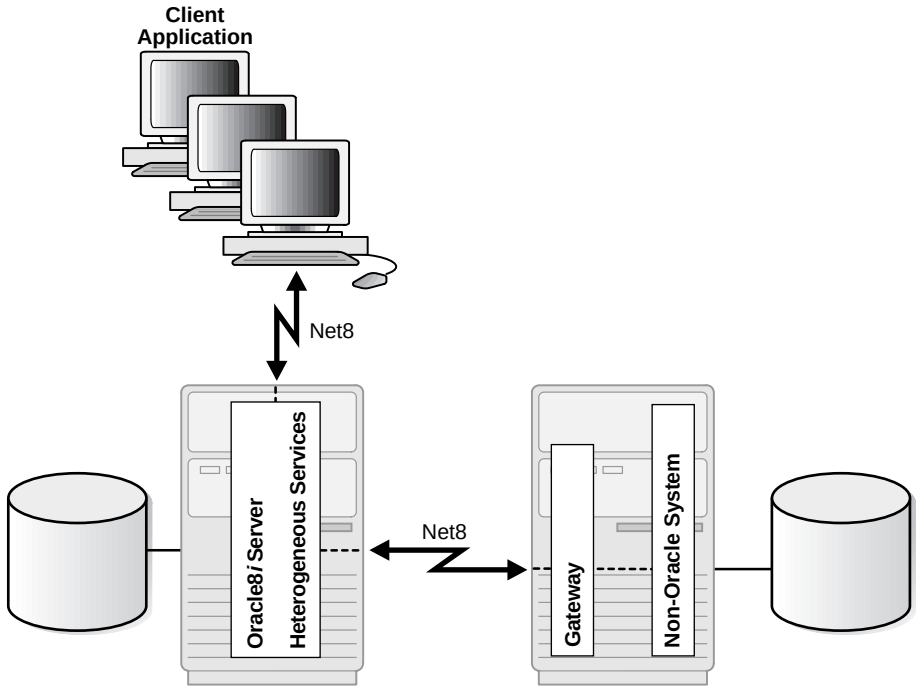


Figure 3–1, "Gateway Component Configuration", is a system diagram that gives an example of one possible system configuration. In this diagram, the Oracle8*i* database server, which includes Heterogeneous Services and the database files, resides on a single machine. Client applications access the server over Net8. The gateway and its respective non-Oracle system and database reside on a second machine. The two systems communicate over Net8 so that the Oracle database server accesses the non-Oracle system through the gateway.

Installation Worksheet

Fill in the values on the following Installation Worksheet, so you can refer to it during the configuration process.

Table 3–1 Installation Worksheet

Description	Value
Oracle database server machine name	
Oracle database server platform (OS and its version number)	
$ORACLE_HOME of Oracle database server (full path name)	
Gateway machine name	
Gateway machine platform (OS and its version number)	
$ORACLE_HOME of the gateway (full path name)	
Ingres II net / server installed location (full path name)	
Version of the Ingres II Server to which the gateway will connect	
Name of the Ingres II database to which the gateway will connect	
Name of the Ingres II virtual node which will be used to access a remote, networked Ingres server	

Installing the Gateway from the CD-ROM

Install the Gateway software from the CD-ROM as follows:

1. Log on to Sun SPARC Solaris as the Oracle Database Administrator (DBA) user.

   If you are not currently a DBA user, contact the system administrator to create a database administrator login user ID.

See Also: The Preinstallation chapter of the *Oracle8i Installation Guide Release 2 (Oracle v8.1.6) for Sun SPARC Solaris*.

2. Create the $ORACLE_HOME directory.

   Create the $ORACLE_HOME directory where the gateway will be installed and write the value on the Installation Worksheet. The gateway installation should be under a new $ORACLE_HOME. Do not install under an existing $ORACLE_HOME that already has either the Oracle database server or one or more other Oracle products installed.

   When you create the directory, use the version number as part of the path name to allow different versions of the gateway to be installed under one Oracle directory tree. For example:

   ```
   $ mkdir /oracle
   $ mkdir /oracle/gateway
   $ mkdir /oracle/gateway/8.1.6
   $ chown oracle /oracle/gateway/8.1.6
   $ chgrp dba /oracle/gateway/8.1.6
   $ chmod 755 /oracle/gateway/8.1.6
   ```

3. Set the environment variables path.

   Set the $ORACLE_HOME environment variable path to point to the directory you created in step 2 above. The command you use to set this variable depends upon which UNIX shell you are using. For example, if you are using either the Bourne Shell or Korn Shell, enter the following:

   ```
   $ ORACLE_HOME=/oracle/gateway/8.1.6; export ORACLE_HOME
   ```

   If you are using the C Shell, enter the following:

   ```
   $ setenv ORACLE_HOME /oracle/gateway/8.1.6
   ```

   Set the ORACLE_TERM environment variable to point to the terminal type. This command depends on which UNIX shell you are using. For example, if you are using either the Bourne Shell or Korn Shell, enter the following:

   ```
   $ ORACLE_TERM=vt100; export ORACLE_TERM
   ```

   If you are using the C Shell, enter the following:

   ```
   $ setenv ORACLE_TERM vt100
   ```

4. Set up and start the Oracle Universal Installer.

Insert the CD-ROM into the CD-ROM drive, change directories to this drive, and start the Oracle Universal Installer. Enter the following commands:

```
$ cd /cdrom/cdrom0
$ ./runInstaller
```

> **See Also:** *Oracle 8i Installation Guide Release 2 (8.1.6) for Sun SPARC Solaris* for general information about installing Oracle products and using the Oracle Universal Installer.

5. Run the Oracle Universal Installer and install the gateway.

   The Oracle Universal Installer screens and the sequence in which they appear depend on the platform. Default values are selected for you and should be used unless you have reason to change them. Refer to Table 3–2, " Installation Prompts and Responses", as a guide to the installation. Follow the instructions in the Response column for each entry in the Screen column.

Table 3–2 Installation Prompts and Responses

Screen	Response
Full path of the products.jar file which contains the product or products you want to install.	The Oracle Universal Installer extracts and displays this value from its configuration file. Do not change the text in the Source field.
Full path of the gateway $ORACLE_HOME	Enter the $ORACLE_HOME directory path in which the gateway will be installed. You can set the default location of the $ORACLE_HOME environment variable before you start the Oracle Universal Installer.
Installation Types	Custom – If you selected this installation type, then you can optionally install the Oracle Universal Installer on your machine in addition to the Ingres II gateway. Also, you can select the languages in which the Ingres II gateway runs. Typical – If you selected this installation type, both the Ingres II gateway and the Oracle Universal Installer are installed on your machine. The default language selected during install is English.
Ingres II installation adheres to the ANSI/ISO SQL-92 database standard.	Yes – Ingres II adheres to the ANSI/ISO SQL-92 database standard. No – Ingres II installation does not adhere to the ANSI/ISO SQL-92 database standard.

Table 3–2 (Cont.) Installation Prompts and Responses

Screen	Response
The name of the virtual node if Ingres / Net is used to connect to the remote networked Ingres II database server.	Enter the name of the virtual node to which the gateway will connect.
The name of the Ingres II database to which the gateway will connect.	Enter the name of the database to which the gateway will connect.
Net8 Configuration Assistant	Check the box "Perform typical configuration."

6. Verify whether the software was successfully installed.

   You can verify that the installation was successful after the Oracle Universal Installer confirms that the installation has been completed. Check the contents of the installation log file located in the following file, where `orainventory_location` is the directory in which `OraInventory` is located:

   ```
   orainventory_location/logs/installActions.log
   ```

De-installing the Gateway

De-install the gateway as follows:

1. Start the Oracle Universal Installer: see Step 4, "Set up and start the Oracle Universal Installer."
2. Click the [De-install Products] button on the Welcome dialog box or the [Installed Products ...] button available on any Oracle Universal Installer window. The Inventory dialog box appears and displays a list of installed products.
3. Click to select the gateway product in the Inventory dialog box, and click the Remove button.

   Only the files that were copied into the $ORACLE_HOME directory during the gateway installation are removed when the gateway is de-installed. You must manually remove all other related files.

4

Configuring the Gateway

After installing the gateway, perform the following tasks to configure the gateway for Ingres II:

- Configuring the Gateway
- Configuring Net8 Listener for the Gateway
- Configuring the Oracle Database Server for Gateway Access
- Performing Optional Configuration Tasks
- Creating Database Links
- Configuring the Gateway for Multiple Ingres II Databases

Configuring the Gateway

Perform the following tasks to configure the Oracle Transparent Gateway for Ingres II.

Task 1: Choose a System ID for the Gateway

The gateway system identifier (SID) is an alphanumeric character string that identifies a gateway instance. You need one gateway instance, and therefore one gateway SID, for each Ingres II database you are accessing. The SID is used as part of the file name for the initialization parameter file. The default SID is tg4ingr.

You can define a gateway SID, but using the default of tg4ingr is easier because you do not need to change the initialization parameter file name. However, if you want to access two Ingres II databases, you need two gateway SIDs, one for each instance of the gateway. If you have one Ingres II database and want to access it sometimes with one set of gateway parameter settings, and other times with different gateway parameter settings, you can do that by having multiple gateway SIDs for the single Ingres II database.

Task 2: Customize the Initialization Parameter File

The initialization parameter file must be available when the gateway is started. During installation, the following default initialization parameter file is created:

```
$ORACLE_HOME/tg4ingr/admin/inittg4ingr.ora
```

where $ORACLE_HOME is the directory under which the gateway is installed.

If you are not using tg4ingr as the gateway SID, you must rename the initialization parameter file using the SID you chose in Task 1. This default initialization parameter file is sufficient for starting the gateway, verifying a successful installation, and running the demonstration scripts.

In the initialization parameter file, specify the Ingres II connection as follows:

```
HS_FDS_CONNECT_INFO=vnode::database_name
```

where *vnode* is the virtual node which will be used by the Ingres II client to access a remote networked Ingres II server. If you specify only *database_name*, omitting *vnode*, the gateway binds to the specified local database.

The entry for *database_name* is case-sensitive. You can specify an environment variable instead of the database name if your logical database is distributed among several physical databases. The Oracle Transparent Gateway for Ingres II translates

the logical name before binding. For example, a logical name (ALL_SITES) can be defined to use as the *database_name* for a logical database distributed among two physical databases (BOSTON_DB and PARIS_DB), as follows in the UNIX C shell:

```
$ setenv ALL_SITES BOSTON_DB,PARIS_DB
```

Additionally, set the Ingres II environment variable, as follows:

```
SET II_SYSTEM=ingres_parent_dir
```

A number of initialization parameters can be used to modify gateway behavior. You might want to change the initialization parameter file later to meet system requirements.

> **See Also:** Appendix C, "Heterogeneous Services Initialization Parameters" and the *Oracle8i Distributed Database Systems* for more information about customizing the initialization parameter file.

Configuring Net8 Listener for the Gateway

The gateway requires Net8 to provide transparent data access. After configuring the gateway, configure Net8 to work with the gateway.

Task 1: Configure Net8 TNS Listener for the Gateway

Net8 uses the TNS listener to receive incoming connections from a Net8 client. The TNS listener and the gateway must reside on the same machine.

The TNS listener listens for incoming requests from the Oracle database server. For the TNS listener to listen for the gateway, information about the gateway must be added to the TNS listener configuration file, `listener.ora`. This file is located in `$ORACLE_HOME/network/admin`, where $ORACLE_HOME is the $ORACLE_HOME directory under which the TNS listener is installed. This is the same $ORACLE_HOME directory under which the gateway is installed.

Note: If Net8 is reinstalled, the original `listener.ora` file is renamed and a new `listener.ora` file is put into the `$ORACLE_HOME/network/admin` directory.

The following entries must be added to the `listener.ora` file:

- A list of Net8 addresses on which the TNS listener listens
- The gateway that the TNS listener starts in response to incoming connection requests

Example of Address to Listen On in listener.ora File

The Oracle database server accesses the gateway using Net8 and the TCP/IP protocol adapter. The following is the syntax of the connect descriptor entry in the `listener.ora` file:

```
LISTENER=
        (ADDRESS=
          (PROTOCOL=TCP)
          (HOST=host_name)
          (PORT=port_number))
```

where:

host_name	is the name of the machine on which the gateway is installed.
port_number	specifies the port number used by the TNS listener. If you have other listeners running on *host_name*, the value of *port_number* must be different from the other listeners' port numbers.

Example of Gateway to Start in listener.ora File

To direct the TNS listener to start the gateway in response to incoming connection requests, add an entry to the `listener.ora` file with the following syntax:

```
SID_LIST_LISTENER=
   (SID_LIST=
      (SID_DESC=
         (SID_NAME=gateway_sid)
         (ORACLE_HOME=oracle_home_directory)
         (PROGRAM=tg4ingr)
      )
   )
```

where:

gateway_sid	specifies the SID of the gateway and matches the gateway SID specified in the connect descriptor entry in the tnsnames.ora file.
oracle_home_directory	specifies the Oracle home directory where the gateway resides.
tg4ingr	specifies the Oracle Transparent Gateway for Ingres II.

If you are already running a TNS listener that listens on multiple database SIDs, add only the following syntax to SID_LIST in the existing `listener.ora` file:

```
SID_LIST_LISTENER=
(SID_LIST=
   (SID_DESC=.
     .
   )
   (SID_DESC=.
     .
   )
   (SID_DESC=
      (SID_NAME=gateway_sid)
      (ORACLE_HOME=oracle_home_directory)
      (PROGRAM=tg4ingr)
   )
)
```

> **See Also:** *Net8 Administrator's Guide* for information about changing the `listener.ora` file.

Task 2: Stop and Start the TNS Listener for the Gateway

The TNS listener must be started to initiate the new settings, as follows:

1. Set the PATH environment variable to access the commands in the directory $ORACLE_HOME/`bin` where the gateway is installed. If you have the Bourne or Korn Shell, enter the following:

   ```
   $ PATH=$ORACLE_HOME/bin:$PATH;export PATH
   ```

   If you have the C Shell, enter the following:

   ```
   $ setenv PATH $ORACLE_HOME/bin:$PATH
   ```

2. Set the LD_LIBRARY_PATH to include the Ingres II libraries. If you have the Bourne or Korn Shell, enter the following:

```
$ set LD_LIBRARY_PATH=$II_SYSTEM/lib:$ORACLE_HOME/lib:$LD_LIBRARY_
PATH;export LD_LIBRARY_PATH
```

   If you have the C Shell, enter the following:

```
$ setenv LD_LIBRARY_PATH $II_SYSTEM/lib:$ORACLE_HOME/lib:$LD_LIBRARY_PATH
```

   Note: II_SYSTEM is an Ingres II environment variable. See your Ingres II documentation for information about setting the environment variables to access the Ingres II database.

3. If the listener is already running, use the lsnrctl command to stop the listener and then start it with the new settings, as follows:

```
$ lsnrctl stop
$ lsnrctl start
```

4. Check the status of the listener with the new settings, as follows:

```
$ lsnrctl status
```

   The following is an example of output from a lsnrctl status check:

```
Connecting to (ADDRESS=(PROTOCOL=TCP)(HOST=204.179.99.15)(PORT=1551))
STATUS of the LISTENER
----------------------
Alias                     LISTENER
Version                   TNSLSNR for Solaris: Version 8.1.6.0.0 - Production
Start Date                05-DEC-1999 14:07:29
Uptime                    0 days 21 hr. 9 min. 25 sec
Trace Level               off
Security                  OFF
SNMP                      OFF
Listener Parameter File   /parla/test40/ingr/network/admin/listener.ora
Listener Log File         /parla/test40/ingr/network/log/listener.log
Services Summary...
  tg4ingr            has 1 service handler(s)
The command completed successfully
```

   In this example, tg4ingr is the default SID value assigned during installation. You can use any valid ID for the SID, or keep the default.

Note: You must use the same SID value in the `tnsnames.ora` file, the `listener.ora` file.

Configuring the Oracle Database Server for Gateway Access

Any Oracle client connected to the Oracle database server can access Ingres II data through the gateway. The Oracle client and the Oracle database server can reside on different machines. The gateway accepts connections only from the Oracle database server.

Before you use the gateway to access Ingres II data you must configure the Oracle database server to enable communication with the gateway over Net8.

Configuring Oracle Net8 for the Oracle Database Server

To configure the server you add connect descriptors to the `tnsnames.ora` file. You cannot use the Net8 Assistant or the Net8 Easy Config tools to configure the `tnsnames.ora` file. You must edit the file manually.

See Also: *Oracle8i Administrator's Guide* for information about editing the `tnsnames.ora` file.

For the Oracle database server to access the gateway, it needs a service name entry or a connect descriptor name entry in the tnsnames.ora file to tell the Oracle database server where to make connections. By default, this file is in `$ORACLE_HOME/network/admin`, where $ORACLE_HOME is the directory in which the Oracle database server is installed. The `tnsnames.ora` file is required by the Oracle database server accessing the gateway, but not by the gateway.

Configuring tnsnames.ora

Edit the `tnsnames.ora` file to add a connect descriptor for the gateway. The following is an example of the Net8 entries using TCP/IP protocol needed for the Oracle database server to access the gateway:

```
connect_descriptor=
   (DESCRIPTION=
      (ADDRESS=
         (PROTOCOL=TCP)
         (HOST=host_name)
         (PORT=port_number)
      )
```

```
(CONNECT_DATA=
   (SID=gateway_sid))
(HS=OK))
```

where:

connect_descriptor	is the description of the object to connect to as specified when creating the database link, such as tg4ingr. Check the sqlnet.ora file in the Oracle database server's $ORACLE_HOME for the following lines: ■ names.directory_path = (TNSNAMES, HOSTNAME) ■ names.default_domain = world ■ name.default_zone = world **Note**: If the Oracle database server is on Sun SPARC Solaris, the file is `$ORACLE_HOME/network/admin/sqlnet.ora`. If the `sqlnet.ora` file has these lines, *connect_descriptor* must end with the extension .world.
TCP	is the TCP protocol used for TCP/IP connections.
host_name	specifies the machine where the gateway is running.
port_number	matches the port number used by the Net8 TNS listener that is listening for the gateway. The TNS listener's port number can be found in the `listener.ora` file used by the TNS listener. See "Example of Address to Listen On in listener.ora File" on page 4-4.
gateway_sid	specifies the SID of the gateway and matches the SID specified in the `listener.ora` file of the TNS listener that is listening for the gateway. See "Task 1: Configure Net8 TNS Listener for the Gateway" on page 4-3 for more information.
(HS=OK)	specifies that this connect descriptor uses the Oracle Heterogeneous Services option.

Performing Optional Configuration Tasks

You can perform the following configuration tasks:

- Configuring for Two-Phase Commit

Configuring for Two-Phase Commit

The gateway supports the following transaction capabilities:

- COMMIT_CONFIRM
- READ_ONLY
- SINGLE_SITE

By default, the gateway runs in COMMIT_CONFIRM transaction mode. When the Ingres II database is updated by a transaction, the gateway becomes the commit point site. The Oracle database server commits the unit of work in the Ingres II database after verifying that all Oracle databases in the transaction have successfully prepared the transaction. Only one gateway can participate in an Oracle two-phase commit transaction as the commit point site.

> **See Also:** *Oracle8i Distributed Database Systems* for information about the two-phase commit process.

To enable the COMMIT_CONFIRM transaction mode, create a recovery account and password and create a log table. The log table, called HS_TRANSACTION_LOG, is where two-phase commit transactions are recorded.

Task 1: Create a Recovery Account and Password

For the gateway to recover distributed transactions, a recovery account and password must be set up in the Ingres II database. By default, both the user name of the account and the password are RECOVER. The name of the account can be changed with the gateway initialization parameter HS_FDS_RECOVERY_ACCOUNT. The account password can be changed with the gateway initialization parameter HS_FDS_RECOVERY_PWD.

Note: Oracle Corporation recommends that you use the default value RECOVER for the user name and password.

1. Set up a user account in the Ingres II database. Both the user name and password must be a valid Ingres II user name and password.
2. In the initialization parameter file, set the following gateway initialization parameters:
   - HS_FDS_RECOVERY_ACCOUNT to the user name of the Ingres II user account you set up for recovery.
   - HS_FDS_RECOVERY_PWD to the password of the Ingres II user account you set up for recovery.

See Also: For information about editing the initialization parameter file, see “Task 2: Customize the Initialization Parameter File” on page 4-2. For information about HS_FDS_RECOVERY_ACCOUNT and HS_FDS_RECOVERY_PWD, see Appendix C, "Heterogeneous Services Initialization Parameters".

Task 2: Create the Transaction Log Table

When configuring the gateway for two-phase commit, a table must be created in the Ingres II database for logging transactions. The gateway uses the transaction log table to check the status of failed transactions that were started at the Ingres II database by the gateway and registered in the table. Updates to the transaction log table cannot be part of an Oracle distributed transaction.

Note: The information in the transaction log table is required by the recovery process and must not be altered. The table must be used, accessed, or updated only by the gateway.

The table consists of two columns, GLOBAL_TRAN_ID, data type CHAR(64) NOT NULL and TRAN_COMMENT, data type CHAR(255).

Create a transaction log table in the user account you created in "Task 1: Create a Recovery Account and Password". Because the transaction log table is used to record the status of a gateway transaction, the table must reside at the database

where the Ingres II update takes place. Also, the transaction log table must be created under the owner of the recovery account.

> **Note:** To utilize the transaction log table, users of the gateway must be granted privileges on the table.

To create a transaction log table use the `tg4ingr_tx.sql` script, located in the directory `$ORACLE_HOME/tg4ingr/admin` where $ORACLE_HOME is the directory under which the gateway is installed. Use isql to execute the script, as follows:

```
$ isql -Urecovery_account -Precovery_account [-Sserver] -itg4ingr_tx.sql
```

Creating Database Links

Any Oracle client connected to the Oracle database server can access Ingres II data through the gateway. The Oracle client and the Oracle database server can reside on different machines. The gateway accepts connections only from the Oracle database server.

A connection to the gateway is established through a database link when it is first used in an Oracle session. In this context, a connection refers to the connection between the Oracle database server and the gateway. The connection remains established until the Oracle session ends. Another session or user can access the same database link and get a distinct connection to the gateway and Ingres II database.

Database links are active for the duration of a gateway session. If you want to close a database link during a session, you can do so with the ALTER SESSION statement. The database and application administrators of a distributed database system are responsible for managing the necessary database links that define paths to the Ingres II database.

> **See Also:** *Oracle8i Administrator's Guide* and *Oracle8i Distributed Database Systems* for more information about using database links.

Configuring the Gateway for Multiple Ingres II Databases

The tasks for configuring the gateway to access multiple Ingres II databases are similar to the tasks for configuring the gateway for a single database. The configuration example assumes the following:

- The gateway is installed and configured with the default SID of tg4ingr
- The ORACLE_HOME environment variable is set to the directory where the gateway is installed
- The gateway is configured for one Ingres II database named db1
- Two Ingres II databases named db2 and db3 on a server named ingr2_sun are being added

Configuring the gateway for additional Ingres II databases is similar to configuring it for one database, and involves the following:

- Configuring the gateway
- Configuring the Ingres II environment
- Configuring Net8 for the gateway and the Oracle database server

Multiple Databases Example: Configuring the Gateway

Choose Two System IDs for Each Ingres II Database

A separate instance of the gateway accesses the different Ingres II databases. Each instance needs its own gateway System ID (SID). For this example, the gateway SIDs are chosen for the instances that access the Ingres II databases:

- tg4ingr2 for the gateway accessing database db2
- tg4ingr3 for the gateway accessing database db3

Create Two Initialization Parameter Files

Create an initialization parameter file for each instance of the gateway by copying the original initialization parameter file, `$ORACLE_HOME/tg4ingr/admin/inittg4ingr.ora`, twice, naming one with the gateway SID for db2 and the other with the gateway SID for db3:

```
$ cd $ORACLE_HOME/tg4ingr/admin
$ cp inittg4ingr.ora inittg4ingr2.ora
$ cp inittg4ingr.ora inittg4ingr3.ora
```

Change the value of the HS_FDS_CONNECT_INFO parameter in the new files.

For `inittg4ingr2.ora`, enter the following:

```
HS_FDS_CONNECT_INFO=db2
```

For `inittg4ingr3.ora`, enter the following:

```
HS_FDS_CONNECT_INFO=db3
```

> **Note:** If you have multiple gateway SIDs for the same Ingres II database because you want to use different gateway parameter settings at different times, follow the same procedure. You create several initialization parameter files, each with different SIDs and different parameter settings.

Multiple Databases Example: Configuring the Ingres II Environment

Set the Ingres II environment variables in both of the new initialization parameter files, as follows:

For `inittg4ingr2.ora`, enter the following:

```
SET II_SYSTEM=ingres_parent_dir
```

For `inittg4ingr3.ora`, enter the following:

```
SET II_SYSTEM=ingres_parent_dir
```

Multiple Databases Example: Configuring Oracle Net8 Listener

Add Entries to listener.ora

Add two new entries to the TNS listener configuration file, `listener.ora`. You must have an entry for each gateway instance, even when multiple gateway instances access the same database.

The following example shows the entry for the original installed gateway first, followed by the new entries:

```
SID_LIST_LISTENER=
(SID_LIST=
   (SID_DESC=
      (SID_NAME=tg4ingr)
      (ORACLE_HOME=oracle_home_directory)
```

```
      (PROGRAM=tg4ingr)
   )
   (SID_DESC=
      (SID_NAME=tg4ingr2)
      (ORACLE_HOME=oracle_home_directory)
      (PROGRAM=tg4ingr)
   )
   (SID_DESC=
      (SID_NAME=tg4ingr3)
      (ORACLE_HOME=oracle_home_directory)
      (PROGRAM=tg4ingr)
   )
)
```

Multiple Databases Example: Stopping and Starting the TNS Listener

The LD_LIBRARY_PATH environment variable must be set to include the Ingres II libraries and the TNS listener must be started to initiate the new settings.

If you have the Bourne or Korn Shell, to set the LD_LIBRARY_PATH enter the following:

```
$ set LD_LIBRARY_PATH=$II_SYSTEM/lib:ORACLE_HOME/lib:$LD_LIBRARY_PATH;export LD_
LIBRARY_PATH
```

If you have the C Shell, enter the following:

```
$ setenv LD_LIBRARY_PATH $II_SYSTEM/lib:ORACLE_HOME/lib:$LD_LIBRARY_PATH
```

Note: II_SYSTEM is an Ingres II environment variable. See your Ingres II documentation for information about setting the environment variables to access the Ingres II database.

If the listener is already running, use the lsnrctl command to stop the listener and then start it with the new settings, as follows:

```
$ lsnrctl stop
$ lsnrctl start
```

Multiple Databases Example: Configuring the Oracle Database Server for Gateway Access

Configuring Net8 on the Oracle Database Server for Multiple Gateway Instances

Add two connect descriptor entries to the `tnsnames.ora` file. You must have an entry for each gateway instance, even if the gateway instances access the same database.

The following Ingres II example shows the entry for the original installed gateway first, followed by the two entries for the new gateway instances:

```
old_db_link=(DESCRIPTION=
               (ADDRESS=
                 (PROTOCOL=TCP)
                 (PORT=1541)
                 (HOST=gtwhost))
                 (CONNECT_DATA=
                     (SID=tg4ingr))
                (HS=OK))
new_db2_link=(DESCRIPTION=
               (ADDRESS=
                 (PROTOCOL=TCP)
                 (PORT=1541)
                 (HOST=gtwhost))
                 (CONNECT_DATA=
                     (SID=tg4ingr2))
                 (HS=OK))
new_db3_link=(DESCRIPTION=
               (ADDRESS=
                 (PROTOCOL=TCP)
                 (PORT=1541)
                 (HOST=gtwhost))
                 (CONNECT_DATA=
                     (SID=tg4ingr3))
                 (HS=OK))
```

The value for PORT is the TCP/IP port number of the TNS listener that is listening for the gateway. The number can be found in the `listener.ora` file used by the TNS listener. The value for HOST is the name of the machine on which the gateway is running. The name also can be found in the `listener.ora` file used by the TNS listener.

Multiple Databases Example: Accessing Ingres II Data

Enter the following to create a database link for the tg4ingr2 gateway:

```
SQL> CREATE PUBLIC DATABASE LINK INGR2 CONNECT TO
  2  user2 IDENTIFIED BY password2 USING 'tg4ingr2';
```

Enter the following to create a database link for the tg4ingr3 gateway:

```
SQL> CREATE PUBLIC DATABASE LINK INGR3 CONNECT TO
  2  user3 IDENTIFIED BY password3 USING 'tg4ingr3';
```

After the database links are established you can query the new Ingres II databases, as in the following:

```
SQL> SELECT * FROM ALL_USERS@INGR2;
```

or

```
SQL> SELECT * FROM ALL_USERS@INGR3;
```

5

Using the Gateway

After the gateway is installed and configured, you can use the gateway to access Ingres II data, pass Ingres II commands from applications to the Ingres II database, perform distributed queries, and copy data.

This chapter contains the following sections:

Accessing Ingres II Data Through the Gateway

To access Ingres II data through the gateway, complete the following steps on the Oracle database server:

1. Log in to the Oracle database server.
2. Create a database link to the Ingres II database, as in the following:

```
SQL> CREATE DATABASE LINK INGR
  2   CONNECT TO user_id IDENTIFIED BY password
  3   USING 'tg4ingr'
```

where:

user_id is the user ID used to establish a session in the Ingres II. This user ID must be a valid Ingres II database user ID and be authorized to use any database object in the Ingres II database that is referenced in the SQL commands.

If *user_id* contains lowercase letters or non-alphanumeric characters, surround *user_id* with double quotation marks.

password is the password used to establish a session in the Ingres II database. This must be a valid Ingres II database password.

If *password* contains lowercase letters or non-alphanumeric characters, surround *password* with double quotation marks.

See Also: "Database Links" on page 1-12 and "Creating Database Links" on page 4-11 for more information.

3. Retrieve data from the Ingres II database using one of the following methods:
   - If the CONNECT TO clause of the database link specifies ORACLE as the user ID, the following example retrieves data from the EMP table in the Ingres II database using the name ORACLE as the Ingres II database user:

     ```
     SQL> SELECT * FROM "EMP"@INGR
     ```

   - The following SELECT statement retrieves the EMP table in the CORPDATA schema, using the name ORACLE as the Ingres II database user:

     ```
     SQL> SELECT * FROM "CORPDATA"."EMP"@INGR
     ```

The ORACLE user must have the appropriate Ingres II privileges to access the CORPDATA.EMP table.

4. Update data in the Ingres II database using the UPDATE statement, as in the following example:

```
SQL> UPDATE "EMP"@INGR SET "SAL"="SAL"*1.10
```

Oracle Database Server SQL Construct Processing

The gateway rewrites SQL statements when the statements need to be translated or post-processed.

For example, consider a program that requests the following from the Ingres II database:

```
SELECT "COL_A" FROM "test"@INGR
WHERE "COL_A" = INITCAP('jones');
```

The Ingres II database does not recognize INITCAP, so the Oracle database server does a table scan of test and filters the results locally. The gateway rewrites the SELECT statement as follows:

```
SELECT "COL_A" FROM "test"@INGR
```

The results of the query are sent to the gateway and are filtered by the Oracle database server.

Consider the following UPDATE request:

```
UPDATE "test"@INGR WHERE "COL_A" = INITCAP('jones');
```

In this case, the Oracle database server and the gateway cannot compensate for the lack of support at the Ingres II side, so an error is issued.

If you are performing operations on large amounts of data stored in the Ingres II database, keep in mind that some functions require data to be moved to the integrating Oracle database server before processing can occur.

Data Type Conversion

The gateway converts Ingres II data types to Oracle data types as follows:

Table 5–1 Data Type Conversions

Ingres II	Oracle	Comment
BYTE	RAW	
BYTE VARYING	RAW	
C, CHAR	CHAR	
DATE	DATE	DATE range is January 1, 1582 through December 31, 2382.
DECIMAL	NUMBER(p[,s])	If precision and scale are not specified, DECIMAL is converted to NUMBER(16)
FLOAT	FLOAT(49)	
FLOAT4	FLOAT(23)	
FLOAT8	FLOAT(49)	
INTEGER	NUMBER(10)	NUMBER range is -2,147,483,647 to 2,147,483,647
INTEGER1	NUMBER(3)	
INTEGER2	NUMBER(5)	NUMBER range is -32,767 to 32,767
INTEGER4	NUMBER(10)	NUMBER range is -2,147,483,647 to 2,147,483,647
LONG BYTE	LONG RAW	
LONG VARCHAR	LONG	
MONEY	FLOAT(49)	
OBJECT_KEY	CHAR(16)	
SMALLINT	NUMBER(5)	NUMBER range is -32,767 to 32,767
TABLE_KEY	CHAR(8)	
TEXT	VARCHAR2	The length of a TEXT data type ranges from 1 to 2000 characters
VARCHAR	VARCHAR2	The length of a VARCHAR data type ranges from 1 to 2000 characters

Using Synonyms

You can provide complete data location transparency and network transparency by using the synonym feature of the Oracle database server. When a synonym is defined, you do not have to know the underlying table or network protocol. A synonym can be public, which means that all Oracle users can refer to the synonym. A synonym can also be defined as private, which means every Oracle user must have a synonym defined to access the Ingres II table.

The following statement creates a system wide synonym for the EMP table in the schema of user ORACLE in the Ingres II database:

```
SQL> CREATE PUBLIC SYNONYM EMP FOR "ORACLE"."EMP"@INGR
```

> **See Also:** *Oracle8i Administrator's Guide* for information about synonyms.

Using the Pass-Through Feature

The gateway can pass Ingres II commands or statements from the application to the Ingres II database using the DBMS_HS_PASSTHROUGH package.

Use the DBMS_HS_PASSTHROUGH package in a PL/SQL block to specify the statement to be passed to the Ingres II database, as follows:

```
DECLARE
    num_rows INTEGER;
BEGIN
    num_rows := DBMS_HS_PASSTHROUGH.EXECUTE_IMMEDIATE@INGR('command');
END;
/
```

Where *command* cannot be one of the following:

- COMMIT
- ROLLBACK
- SAVEPOINT

The DBMS_HS_PASSTHROUGH package does support passing bind values and executing SELECT statements.

> **See Also:** *Oracle8i Distributed database Systems* for more information about the DBMS_HS_PASSTHROUGH package and the different functions supported by this package.

Performing Distributed Queries

Oracle Transparent Gateway technology enables the execution of distributed queries that join the Oracle database server and the Ingres II database, and any other data store for which Oracle Corporation provides a gateway. These complex operations can be invisible to the users requesting the data.

Example of a Distributed Query

The following example joins data between the Oracle database server, an IBM DB2 database, and the Ingres II database:

```
SQL> SELECT O.CUSTNAME, P.PROJNO, E.ENAME, SUM(E.RATE*P."HOURS")
         FROM ORDERS@DB2 O, EMP@ORACLE8 E, "PROJECTS"@INGR P
         WHERE O.PROJNO = P."PROJNO"
         AND P."EMPNO" = E.EMPNO
         GROUP BY O.CUSTNAME, P."PROJNO", E.ENAME
```

Through a combination of views and synonyms, using the following SQL statements, the process of distributed queries is transparent to the user:

```
SQL> CREATE SYNONYM ORDERS FOR ORDERS@DB2
SQL> CREATE SYNONYM PROJECTS FOR "PROJECTS"@INGR
SQL> CREATE VIEW DETAILS (CUSTNAME,PROJNO,ENAME,SPEND)
      AS
      SELECT O.CUSTNAME, P."PROJNO", E.ENAME, SUM(E.RATE*P."HOURS")
      SPEND
      FROM ORDERS O, EMP E, PROJECTS P
      WHERE O.PROJNO = P."PROJNO"
      AND P."EMPNO" = E.EMPNO
      GROUP BY O.CUSTNAME, P."PROJNO", E.ENAME
```

Use the following SQL statement to retrieve information from the data stores in one command:

```
SQL> SELECT * FROM DETAILS;
```

The command retrieves the following table:

```
CUSTNAME         PROJNO          ENAME          SPEND
--------         ------          -----          -----
ABC Co.             1            Jones            400
ABC Co.             1            Smith            180
XYZ Inc.            2            Jones            400
XYZ Inc.            2            Smith            180
```

Two-Phase Commit

When the gateway is configured as COMMIT_CONFIRM, it is always the commit point site when the Ingres II database is updated by the transaction, regardless of the HS_COMMIT_POINT_STRENGTH setting. The Oracle database server commits the unit of work in the Ingres II database after verifying that all Oracle databases in the transaction have successfully prepared the transaction.

> **See Also:** *Oracle8i Administrator's Guide* and *Oracle8i Distributed Database Systems* for more information about the two-phase commit process.

Only one gateway can participate in an Oracle two-phase commit transaction. Two-phase commit transactions are recorded in the HS_TRANSACTION_LOG table that is created when configuring the gateway.

> **See Also:** "Configuring for Two-Phase Commit" on page 4-9.

Distributed Ingres II Transactions

Because the HS_TRANSACTION_LOG table is used to record the status of a gateway transaction, the table must reside in the database where the Ingres II update takes place.

Updates to the HS_TRANSACTION_LOG table cannot be part of an Oracle distributed transaction.

> **See Also:** Chapter 4, "Configuring the Gateway" for more information.

Copying Data from the Oracle Database Server to Ingres II

Use the SQL*Plus COPY command to copy data from the local database to the Ingres II database. The syntax is as follows:

```
COPY FROM username/password@db_name
INSERT destination_table USING query
```

The following example selects all rows from the local Oracle EMP table, inserts them into the EMP table on the Ingres II database, and commits the transaction:

```
SQL> COPY FROM SCOTT/TIGER@ORACLE8 -
> INSERT SCOTT.EMP@INGR -
> USING SELECT * FROM EMP
```

The COPY command supports APPEND, CREATE, INSERT, and REPLACE options. However, INSERT is the only option supported when copying to Ingres II. The SQL*Plus COPY command does not support copying to tables with lowercase table names. Use the following PL/SQL syntax with lowercase table names:

```
DECLARE
    v1 oracle_table.column1%TYPE;
    v2 oracle_table.column2%TYPE;
    v3 oracle_table.column3%TYPE;
    .
    .
    .
    CURSOR cursor_name IS SELECT * FROM oracle_table;
BEGIN
    OPEN cursor_name;
    LOOP
       FETCH cursor_name INTO v1, v2, v3, ... ;
       EXIT WHEN cursor_name%NOTFOUND;
       INSERT INTO destination_table VALUES (v1, v2, v3, ...);
    END LOOP;

    CLOSE cursor_name;
END;
/
```

> **See Also:** *SQL*Plus User's Guide and Reference* for more information about the COPY command.

The following Oracle SQL INSERT statement is not supported for copying data from the Oracle database server to Ingres II:

```
INSERT INTO table_name  SELECT column_list FROM table_name
```

For example, consider the following statement:

```
SQL> INSERT INTO INGR_TABLE SELECT * FROM MY_LOCAL_TABLE
```

The statement returns the following error message:

```
ORA-2025:  All tables in the SQL statement must be at the remote database
```

Copying Data from Ingres II to the Oracle Database Server

The CREATE TABLE command lets you copy data from a Ingres II database to the Oracle database server. To create a table on the local database and insert rows from the Ingres II table, use the following syntax:

```
CREATE TABLE table_name AS query
```

The following example creates the table EMP in the local Oracle database and inserts the rows from the EMP table of the Ingres II database:

```
SQL> CREATE TABLE EMP AS SELECT * FROM SCOTT."EMP"@INGR
```

Alternatively, you can use the SQL*Plus COPY command to copy data from the Ingres II database to the Oracle database server.

> **See Also:** *SQL*Plus User's Guide and Reference* for more information about the COPY command.

Monitoring Gateway Sessions

The Distributed Access Manager is used for monitoring distributed sessions that involve non-Oracle systems. The tool is distributed and installed with Oracle Enterprise Manager and runs as a standalone application.

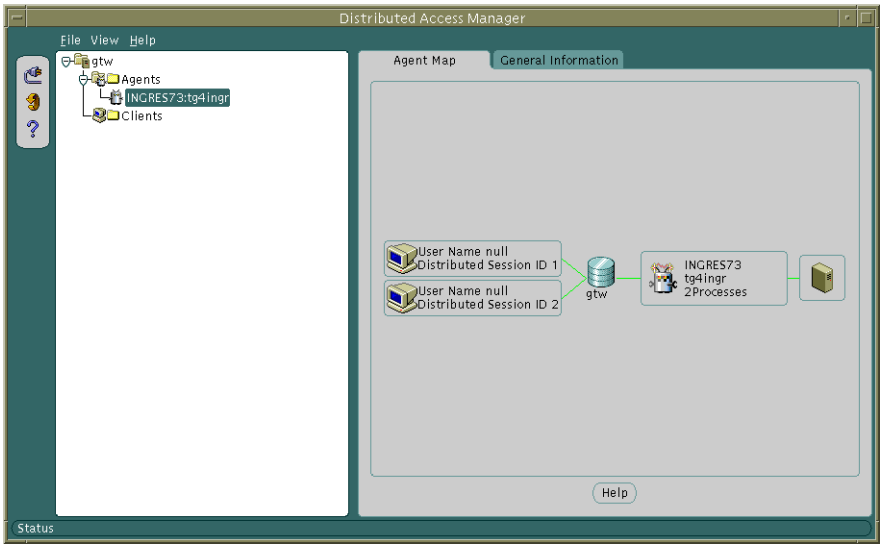
Start the Distributed Access Manager as follows:

```
oemapp damgr
```

Using Distributed Access Manager requires connecting to an instance of an Oracle database. Once connected, the tool displays all of the gateways currently registered with the server. For each active gateway, runtime information about the gateway is displayed. It contains the machine on which the gateway runs, its process ID, and the operating system user who started the gateway. The modules supported in the gateway are also listed.

In addition, data about the current sessions through this gateway are available. Sessions are tied to the gateway by the gateway's class and instance ID, which uniquely identify the gateway. The parent client session of the distributed session is described in terms of the client program, the user / schema that owns the session, the session ID, the status, and the terminal.

Figure 5–1 Distributed Access Manager View of a Session



Information about the database link that was used for establishing the distributed connection, the startup time, and the set of initialization parameters used for the session is also available.

All of the runtime information is derived from dynamically updated V$ tables. The Distributed Access Manager has a refresh capability available through the menu and toolbar that allows users to rerun queries if necessary and update the data. When the data is refreshed, the tool verifies that the set of registered agents remains the same. If it is not, the global view is updated.

> **See Also:** *Oracle Enterprise Manager Administrator's Guide* and online help for more information about the Distributed Access Manager.

6

Case Studies

The following case studies for Ingres II demonstrate some of the features of the Oracle Transparent Gateway. You can verify that the gateway is installed and operating correctly by using the demonstration files included on the distribution CD-ROM.

The demonstration files are automatically copied to disk when the gateway is installed.

This chapter contains the following sections:

Case Descriptions

The cases illustrate:

- A simple query (Case 1)
- A more complex query (Case 2)
- Joining Ingres II tables (Case 3)
- Write capabilities (Case 4)
- A data dictionary query (Case 5)
- The pass-through feature (Case 6)

CD-ROM Contents

The distribution CD-ROM contains the following:

- Demonstration files
- One SQL script file that creates the demonstration tables in the Ingres II database
- One SQL script file that drops the demonstration tables from the Ingres II database

Demonstration Files

After a successful gateway installation, use the demonstration files stored in the directory `$ORACLE_HOME/tg4ingr/demo` where $ORACLE_HOME is the $ORACLE_HOME directory under which the gateway is installed. The directory contains the following demonstration files:

bldingr.sql	case5.sql
case1.sql	case6a.sql
case2.sql	case6b.sql
case3.sql	demobldingr.sh
case4a.sql	dropingr.sql
case4b.sql	
case4c.sql	

Demonstration Requirements

The case studies assume these requirements have been met:

- The gateway demonstration tables are installed in the Ingres II database
- The Oracle server has an account named SCOTT with a password of TIGER
- The Oracle server has a database link called GTWLINK (set up as public or private to the user SCOTT) which connects the gateway to a Ingres II database as SCOTT with password TIGER2

  For example, you can create the database link as follows:

```
SQL> CREATE DATABASE LINK GTWLINK CONNECT TO SCOTT
  2    IDENTIFIED BY TIGER2 USING 'GTWSID';
```

- Net8 is configured correctly and running

Creating Demonstration Tables

The case studies are based on the GTW_EMP, GTW_DEPT, and GTW_SALGRADE tables. If the demonstration tables have not been created in the Ingres II database, use the demo`bldingr.sh` script to create them. Enter the following:

```
$ demobldingr.sh
```

The script creates the demonstration tables in the Ingres II database accordingly:

```
CREATE TABLE GTW_EMP (
EMPNO      INTEGER2 NOT NULL
ENAME      VARCHAR(10),
JOB        VARCHAR(9),
MGR        INTEGER2,
HIREDATE   DATE,
SAL        FLOAT4,
COMM       FLOAT8,
DEPTNO     SMALLINT);

CREATE TABLE GTW_DEPT (
DEPTNO     INTEGER1,
DNAME      VARCHAR(14),
LOC        VARCHAR(13));

CREATE TABLE GTW_SALGRADE (
GRADE      INTEGER1,
```

```
LOSAL      FLOAT4,
HISAL      FLOAT4);
```

Demonstration Table Definitions

The table definitions are listed below using information retrieved by the SQL SERVER MANAGER DESCRIBE command:

GTW_EMP

```
Name                           Null?    Type
------------------------------ -------- ----
EMPNO                          NOT NULL NUMBER(3)
ENAME                                   VARCHAR2(10)
JOB                                     VARCHAR2(9)
MGR                                     NUMBER(5)
HIREDATE                                DATE
SAL                                     NUMBER(7,2)
COMM                                    NUMBER(7,2)
DEPTNO                                  NUMBER(5)
```

GTW_DEPT

```
Name                           Null?    Type
------------------------------ -------- ----
DEPTNO                         NOT NULL NUMBER(3)
DNAME                                   VARCHAR2(14)
LOC                                     VARCHAR2(13)
```

GTW_SALGRADE

```
Name                           Null?    Type
------------------------------ -------- ----
GRADE                                   NUMBER(3)
LOSAL                                   NUMBER(9,4)
HISAL                                   NUMBER(9,4)
```

Demonstration Table Contents

The contents of the Ingres II tables are:

GTW_EMP

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	09-DEC-82	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	12-JAN-83	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

GTW_DEPT

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

GTW_SALGRADE

GRADE	LOSAL	HISAL
1	700	1200
2	1201	1400
3	1401	2000
4	2001	3000
5	3001	9999

Case 1: Simple Queries

Case 1 demonstrates the following:

- A simple query
- A simple query retrieving full date information

The first query retrieves all the data from GTW_DEPT and confirms that the gateway is working correctly. The second query retrieves all the data from GTW_EMP including the time portion of the hire date because the default date format was set to DD-MON-YY HH24:MM:SS for the session by an ALTER SESSION command.

To run Case 1, log on to SQL*Plus as SCOTT/TIGER and enter the following:

```
SQL> START CASE1
```

Case 1 executes two SQL statements. The first statement is as follows:

```
SELECT * FROM GTW_DEPT@GTWLINK;
```

which results in the following:

```
    DEPTNO DNAME          LOC
---------- -------------- -------------
        10 ACCOUNTING     NEW YORK
        20 RESEARCH       DALLAS
        30 SALES          CHICAGO
        40 OPERATIONS     BOSTON
```

The following command and SQL statement change the date format to DD-MON-YY HH24:MM:SS in Oracle and retrieve the employee name and hire date from the Ingres II database:

```
ALTER SESSION SET NLS_DATE_FORMAT = 'DD-MON-YY HH24:MM:SS';
SELECT ENAME, HIREDATE FROM GTW_EMP@GTWLINK;
```

which results in the following:

```
ENAME      HIREDATE
---------- ------------------
SMITH      17-Dec-80 00:00:00
ALLEN      20-Feb-81 00:00:00
WARD       22-Feb-81 00:00:00
JONES      02-Apr-81 00:00:00
MARTIN     28-Sep-81 00:00:00
BLAKE      01-May-81 00:00:00
CLARK      09-Jun-81 00:00:00
```

```
SCOTT      09-Dec-82 00:00:00
KING       17-Nov-81 00:00:00
TURNER     08-Sep-81 00:00:00
ADAMS      12-Jan-83 00:00:00
JAMES      03-Dec-81 00:00:00
FORD       03-Dec-81 00:00:00
MILLER     23-Jan-82 00:00:00

14 rows selected.
```

Case 2: A More Complex Query

Case 2 demonstrates the following:

- The functions SUM(*expression*) and NVL(*expr1*, *expr2*) in the SELECT list
- The GROUP BY and HAVING clauses

This query retrieves the departments from GTW_EMP whose total monthly expenses are higher than $10,000.

To run Case 2, log on to SQL*Plus as SCOTT/TIGER and enter the following:

```
SQL> START CASE2
```

which executes the following SQL statement:

```
SELECT SUM(SAL), SUM(COMM), SUM(SAL + NVL(COMM,0))
"TOTAL MONTHLY EXPENSES OF", DEPTNO "DEPARTMENT"
FROM GTW_EMP@GTWLINK GROUP BY DEPTNO
HAVING SUM(SAL + NVL(COMM,0)) > 10000;
```

which results in the following:

```
  SUM(SAL)  SUM(COMM) TOTAL MONTHLY EXPENSES OF DEPARTMENT
----------  --------- ------------------------ ----------
     10875                               10875         20
      9400       2200                    11600         30
```

Case 3: Joining Ingres II Tables

Case 3 demonstrates the following:

- Joins between Ingres II tables
- Subselects
- SQL tracing

The query retrieves information from three Ingres II tables and relates the employees to their department name and salary grade, but only for those employees earning more than the average salary.

To run Case 3, log on to SQL*Plus as SCOTT/TIGER and enter the following:

```
SQL> START CASE3
```

which executes the following SQL statement:

```
SELECT ENAME, DNAME, GRADE
FROM GTW_EMP@GTWLINK A, GTW_DEPT@GTWLINK B,
GTW_SALGRADE@GTWLINK C
WHERE A.DEPTNO = B.DEPTNO
AND SAL >= LOSAL AND SAL <= HISAL
AND SAL > (SELECT AVG(SAL) FROM GTW_EMP@GTWLINK);
```

which results in the following:

```
ENAME      DNAME               GRADE
---------- -------------- ----------
CLARK      ACCOUNTING              4
KING       ACCOUNTING              5
JONES      RESEARCH                4
SCOTT      RESEARCH                4
FORD       RESEARCH                4
BLAKE      SALES                   4

6 rows selected.
```

Case 4: Write Capabilities

Case 4 is split into three cases and demonstrates the following:

- DELETE Statement
- UPDATE Statement
- INSERT Statement

DELETE Statement

Case 4a demonstrates bind values and subselect. All employees in department 20 and one employee, WARD, in department 30 are deleted.

To run Case 4a, log on to SQL*Plus as SCOTT/TIGER and enter the following:

```
SQL> START CASE4A
```

which executes the following PL/SQL block:

```
DECLARE
   EID        SMALLINT;
   EMPLOYEE   VARCHAR(10);
   DEPARTMENT VARCHAR(14);
BEGIN
   EMPLOYEE := 'WARD';
   DEPARTMENT := 'RESEARCH';
   SELECT EMPNO INTO EID FROM GTW_EMP@GTWLINK
      WHERE ENAME = EMPLOYEE;
   DELETE FROM GTW_EMP@GTWLINK
      WHERE EMPNO = EID
         OR DEPTNO = (SELECT DEPTNO FROM GTW_DEPT@GTWLINK
             WHERE DNAME = DEPARTMENT);
END;
/
```

Note: For Ingres II, you must add the schema name before the dblink. For example, instead of `GTW_DEPT@GTWLINK`, you need `SCOTT.GTW_DEPT@GTWLINK`.

To ensure the outcome is correct, the script also issues:

```
SELECT ENAME, DEPTNO FROM GTW_EMP@GTWLINK;
ROLLBACK;
```

which results in the following:

```
ENAME          DEPTNO
---------- ----------
ALLEN              30
MARTIN             30
BLAKE              30
CLARK              10
KING               10
TURNER             30
JAMES              30
MILLER             10

8 rows selected.

Rollback complete.
```

WARD and all employees of the research department 20 were removed.

UPDATE Statement

Case 4b provides an example of a simple UPDATE statement. In this example, employees are given a $100 per month salary increase. To run Case 4b, log on to SQL*Plus as SCOTT/TIGER and enter the following:

```
SQL> START CASE4B
```

This script issues these statements:

```
UPDATE GTW_EMP@GTWLINK SET SAL = SAL + 100;
SELECT ENAME, SAL FROM GTW_EMP@GTWLINK;
ROLLBACK;
```

which results in the following:

```
ENAME              SAL
---------- ----------
SMITH              900
ALLEN             1700
WARD              1350
JONES             3075
MARTIN            1350
BLAKE             2950
CLARK             2550
SCOTT             3100
```

```
KING            5100
TURNER          1600
ADAMS           1200
JAMES           1050
FORD            3100
MILLER          1400

14 rows selected.

Rollback complete.
```

INSERT Statement

Case 4c is an example of a simple insert statement that does not provide information for all columns. To run Case 4c, log on to SQL*Plus as SCOTT/TIGER and enter the following:

```
SQL> START CASE4C
```

The script adds the department SHIPPING as department 50 to GTW_DEPT by issuing the following:

```
INSERT INTO GTW_DEPT@GTWLINK (DEPTNO, DNAME)
VALUES (50, 'SHIPPING');
SELECT * FROM GTW_DEPT@GTWLINK;
ROLLBACK;
```

which results in the following:

```
1 row created.

DEPTNO DNAME          LOC
------ -------------- -------------
    10 ACCOUNTING     NEW YORK
    20 RESEARCH       DALLAS
    30 SALES          CHICAGO
    40 OPERATIONS     BOSTON
    50 SHIPPING

Rollback complete.
```

Case 5: Data Dictionary Query

Case 5 demonstrates data dictionary mapping. It retrieves all the tables and views that exist in the Ingres II database that begin with "GTW". To run Case 5, log on to SQL*Plus as SCOTT/TIGER and enter the following:

```
SQL> START CASE5
```

The script issues the following statement:

```
SELECT * FROM ALL_TABLES@GTWLINK
   WHERE SUBSTR(TABLE_NAME,1,3) = 'GTW';
```

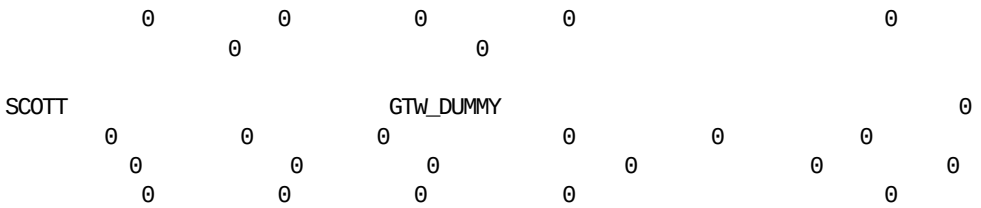
which results in the following:

```
OWNER                          TABLE_NAME                     T C I   PCT_FREE
------------------------------ ------------------------------ - - - ----------
 PCT_USED  INI_TRANS  MAX_TRANS INITIAL_EXTENT NEXT_EXTENT MIN_EXTENTS
---------- ---------- ---------- -------------- ----------- -----------
MAX_EXTENTS PCT_INCREASE  FREELISTS FREELIST_GROUPS L B   NUM_ROWS     BLOCKS
----------- ------------ ---------- --------------- - - ---------- ----------
EMPTY_BLOCKS  AVG_SPACE  CHAIN_CNT AVG_ROW_LEN AVG_SPACE_FREELIST_BLOCKS
------------ ---------- ---------- ----------- -------------------------
NUM_FREELIST_BLOCKS D I C T SAMPLE_SIZE L P I T S N B R G U D S M
------------------- - - - - ----------- - - - - - - - - - - - - -
SCOTT                          GTW_EMP                                      0
        0          0          0              0           0           0
          0            0          0              0           0           0
           0          0          0              0                       0
                  0                  0

SCOTT                          GTW_DEPT                                     0
        0          0          0              0           0           0
          0            0          0              0           0           0
           0          0          0              0                       0
                  0                  0

SCOTT                          GTW_SALGRADE                                 0
        0          0          0              0           0           0
          0            0          0              0           0           0
           0          0          0              0                       0
                  0                  0

SCOTT                          GTW_BONUS                                    0
        0          0          0              0           0           0
          0            0          0              0           0           0
```



Case 6: The Pass-Through Feature

Case 6 demonstrates the gateway pass-through feature which allows an application to send commands or statements to Ingres II.

This case demonstrates:

- A pass-through UPDATE statement using bind variables
- A pass-through SELECT statement

UPDATE Statement

Case 6a provides an example of a pass-through UPDATE statement with bind variables. In this example, the salary for EMPNO 7934 is set to 4000. To run Case 6a, log on to SQL*Plus as SCOTT/TIGER and enter the following:

```
SQL> START CASE6A
```

The script issues these statements:

```
SELECT * FROM GTW_EMP@GTWLINK WHERE EMPNO = 7934;

DECLARE
  crs binary_integer;
  ret integer;
BEGIN
  crs := DBMS_HS_PASSTHROUGH.OPEN_CURSOR@GTWLINK;
  DBMS_HS_PASSTHROUGH.PARSE@GTWLINK(crs,
   'UPDATE GTW_EMP SET SAL = ? WHERE EMPNO = ?');
  DBMS_HS_PASSTHROUGH.BIND_VARIABLE@GTWLINK(crs, 1, 4000);
  DBMS_HS_PASSTHROUGH.BIND_VARIABLE@GTWLINK(crs, 2, 7934);
  ret := DBMS_HS_PASSTHROUGH.EXECUTE_NON_QUERY@GTWLINK(crs);
  DBMS_HS_PASSTHROUGH.CLOSE_CURSOR@GTWLINK(crs);
END;
/
```

```
SELECT * FROM GTW_EMP@GTWLINK WHERE EMPNO = 7934;
```

The results are as follows:

```
     EMPNO ENAME      JOB              MGR HIREDATE         SAL       COMM
---------- ---------- --------- ---------- --------- ---------- ----------
    DEPTNO
----------
      7934 MILLER     CLERK            7782 23-JAN-82       1300
        10

PL/SQL procedure successfully completed.

     EMPNO ENAME      JOB              MGR HIREDATE         SAL       COMM
---------- ---------- --------- ---------- --------- ---------- ----------
    DEPTNO
----------
      7934 MILLER     CLERK            7782 23-JAN-82       4000
        10
```

SELECT Statement

Case 6b provides an example of a pass-through SELECT statement. The data that is returned from the SELECT statement is inserted into a local table at the Oracle database server. To run Case 6b, log on to SQL*Plus as SCOTT/TIGER and enter the following:

```
SQL> START CASE6B
```

The first two statements drop and recreate the LOCAL_PT_TABLE table in the Oracle database. The PL/SQL block uses the DBMS_HS_PASSTHROUGH package to execute a SELECT statement at Ingres II and inserts the data returned into LOCAL_PT_TABLE:

```
DROP TABLE LOCAL_PT_TABLE;
CREATE TABLE LOCAL_PT_TABLE (EMPNO NUMBER(5), ENAME VARCHAR2(10));

DECLARE
  crs binary_integer;
  ret binary_integer;
  ename varchar2(10);
  empno number;
```

```
BEGIN
  crs := DBMS_HS_PASSTHROUGH.OPEN_CURSOR@GTWLINK;
  DBMS_HS_PASSTHROUGH.PARSE@GTWLINK(crs,
   'SELECT EMPNO, ENAME FROM GTW_EMP');
  begin
    ret := 0;
    WHILE (true)
    LOOP
      ret := DBMS_HS_PASSTHROUGH.FETCH_ROW@GTWLINK(crs, false);
      DBMS_HS_PASSTHROUGH.GET_VALUE@GTWLINK(crs, 1, empno);
      DBMS_HS_PASSTHROUGH.GET_VALUE@GTWLINK(crs, 2, ename);
      insert into LOCAL_PT_TABLE values (empno, ename);
    END LOOP;
    EXCEPTION
     when NO_DATA_FOUND then
       BEGIN
        DBMS_OUTPUT.PUT_LINE('End of Fetch');
        DBMS_HS_PASSTHROUGH.CLOSE_CURSOR@GTWLINK(crs);
       END;
  END;
END;
/

SELECT * FROM LOCAL_PT_TABLE;
```

The results are as follows:

```
Table created.


PL/SQL procedure successfully completed.


     EMPNO ENAME
---------- ----------
      7369 SMITH
      7499 ALLEN
      7521 WARD
      7566 JONES
      7654 MARTIN
      7698 BLAKE
      7782 CLARK
      7788 SCOTT
      7839 KING
      7844 TURNER
```

```
      7876 ADAMS
      7900 JAMES
      7902 FORD
      7934 MILLER

14 rows selected.
```

7

Diagnosing Problems

This chapter provides information about diagnosing problems and understanding error messages. The following sections are included:

- Problem Identification
- Installation and Configuration Issues
- Net8 Configuration Problems
- Common Gateway Problems
- Analyzing Error Messages
- Tracing
- Oracle Support Services

Problem Identification

When you encounter a problem, you first should determine where the problem occurred. The following is a list of possible problem areas and references to more information about those areas.

- Installation and configuration

  See Also: "Installation and Configuration Issues" on page 7-3.

- Net8

  You might be experiencing problems in Net8 if you receive errors that appear as follows:

  `ORA-`*`nnnnn`*`: TNS: `*`error_text`*

  See Also: "Net8 Configuration Problems" on page 7-3.

- Oracle database server

  You might experience problems with the Oracle database server if the database link is not set up correctly or if the Oracle database server does not have the distributed option. Verify the installation of the Oracle database server, and check the case (upper or lower) of the letters in the user name and password used in the CREATE DATABASE LINK statement.

  See Also: "Tracing" on page 7-9.

- Ingres II or the gateway

  You might be experiencing problems with Ingres II or with the gateway if you receive errors that appear as:

  ```
  ORA-nnnnn: error_text
  [Transparent gateway for INGRES II]gateway_error_text
  ```

  where *nnnnn* ranges from 12300 to 12399 or *`error text`* involves the database link that calls the gateway.

  See Also: "Common Gateway Problems" on page 7-5, "Analyzing Error Messages" on page 7-6 and "Tracing" on page 7-9.

To see if the error originated with Ingres II, try the SQL statement with Ingres II native tools. Verify that the SQL executed correctly and has no syntax errors. Contact the Ingres II vendor for support.

Installation and Configuration Issues

The issues surrounding installation and configuration usually involve verifying if the installation process was successful, and wanting to know what to configure.

How do I verify that the installation succeeded?

Review the installation log file, which lists any problems encountered during installation. By default, the file has the following name:

`orainventory_location/logs/installActions.log`

where `orainventory_location` is the directory where the OraInventory is located.

Does the Oracle Installer configure everything?

No. The Oracle Installer simply installs the software. You must configure the software after its installation. Follow the tasks in Chapter 4, "Configuring the Gateway", to configure the gateway and its components.

Net8 Configuration Problems

If you receive errors that refer to TNS when accessing the gateway, the problem is probably with Net8 or the Net8 configuration. Following is a list of the most likely TNS errors and the actions you should take.

ORA-12154 "TNS:could not resolve service name"

Cause: The service name specified is not defined correctly in the `tnsnames.ora` file.

Action: Check the following items:

- Verify the `tnsnames.ora` file exists, is in the proper place, and is accessible.
- Verify the service name exists in one of the `tnsnames.ora` files. Add a service name if needed.

- Ensure there are no syntax errors in the `tnsnames.ora` file. Look for unmatched parentheses or stray characters. Any error in the `tnsnames.ora` file makes it unusable. If possible, regenerate the configuration files using the Oracle Network Manager.

  See Also: *Net8 Administrator's Guide.*

- Ensure the USING clause of the database link you created for the Ingres II database is pointing to the correct `tnsnames.ora` file.

  See Also: "Configuring the Gateway for Multiple Ingres II Databases" on page 4-12.

- If the `sqlnet.ora` file exists in the `$ORACLE_HOME/network/admin` directory, check to see if the file includes entries such as:

  ```
  names.directory_path=(TNSNAMES, HOSTNAME)
  names.default_domain=world
  names.default_zone=world
  ```

  If so, the service name might need the suffix .world.

ORA-12203 "TNS:unable to connect to destination"

Cause: An invalid TNS address was supplied or the destination is not listening. This error can also occur because of underlying network transport problems.

Action: For the Oracle database server:

- Ensure that the `tnsnames.ora` file is configured as described in "Configuring the Gateway for Multiple Ingres II Databases" on page 4-12.
- Ensure that the USING clause of the database link you created is pointing to the correct `tnsnames.ora` file.

For the gateway:

- Ensure that the `listener.ora` on the gateway machine is configured as described in "Configuring Net8 Listener for the Gateway" on page 4-3.
- Ensure that the Net8 listener is started.

If the Net8 configuration is correct but you still encounter errors, set up a loop-back link, which is a database link in the Oracle database server that

points back to itself. If Net8 is working properly you can access a table in the Oracle database server using a loop-back link. For example:

```
SELECT * FROM table@loop
```

If this link does not enable you to access a table in the Oracle database server, see the Net8 documentation for the platform for information about troubleshooting Net8.

> **See Also:** For more information about configuring the `listener.ora` and `tnsnames.ora` files, see "Configuring Net8 Listener for the Gateway" on page 4-3 and "Configuring the Gateway for Multiple Ingres II Databases" on page 4-12.

ORA-12500 "TNS:listener failed to start a dedicated server process"

Cause: The process of starting the Oracle database server failed. The Oracle database server executable could not be found or the environment is set up incorrectly.

Action: Check these items:

- Verify that the SID value specified in the `tnsnames.ora` file matches the gateway SID.

Common Gateway Problems

Many common gateway problems are caused by errors in the initialization parameter file, and are described in this section. For other errors, review the log files for more information. If no log file exists, the gateway might not have started. In that case, Net8 configuration might be the problem.

> **See Also:** "Oracle Support Services" on page 7-10.

ORA-02068: following severe error from *database_link_name*
ORA-01012: not logged *error_found_in_init_file*

Cause: One or more gateway initialization parameters might be configured incorrectly or there are syntax errors.

Action: Review the gateway log file for error messages that describe the problem. Correct the `inittg4ingr.ora` file as needed.

ORA-02068: following severe error from *database_link_name*

ORA-03113: end-of-file on communication channel

Cause: The HS_FDS_TRACE_LEVEL parameter is set to an invalid value in the initialization parameter file, or the target database is not set up correctly.

Action: Ensure the values are set correctly and the target database is set up correctly. Refer to the documentation for the target database.

ORA-02085: database link *database_link_name***. WORLD connects to** *database_link_name.domain_name*

Cause: The Oracle database server has GLOBAL_NAMES set to TRUE in its initialization parameter file. This error occurs because the value specified by HS_DB_DOMAIN in the initialization parameter file, displayed as *domain_name* in the error message, does not match a domain name of WORLD.

Action: Change the value of HS_DB_DOMAIN in the initialization parameter file to `WORLD`.

ORA-02085: database link *database_link_name1.domain_name* **connects to** *database_link_name2.domain_name*

Cause: The Oracle database server has GLOBAL_NAMES set to TRUE in its initialization parameter file. The value specified by HS_DB_NAME in the initialization parameter file (*database_link_name1*) must match the value of the database link used by the gateway (*database_link_name2*). The error occurs because the values do not match.

Action: Change the value of HS_DB_NAME in the initialization parameter file to match the database link name being used.

Analyzing Error Messages

This section describes the following topics:

- Message and Error Code Processing
- Oracle Database Server Error Codes
- Gateway Error Codes and Message Formats

Message and Error Code Processing

The gateway architecture includes a number of separate components. Any of these components can detect and report an error condition while processing an SQL statement that refers to one or more Ingres II database tables. An error condition can

be complex, involving error codes and supporting data from multiple components. In all cases, the application receives a single Oracle error code upon which to act.

Error conditions are represented in the following ways:

- An Oracle error code
- A gateway error code

  Gateway error conditions are reported to the application using one of the gateway error codes in the range of ORA-28500 through ORA-28561.

  See Also: "Gateway Error Codes and Message Formats" on page 7-8 for an explanation of the message format.

Oracle Database Server Error Codes

The Oracle database server messages and error codes are documented in *Oracle8i Server Messages*. Refer to that publication for information about interpreting the Oracle database server messages and for information about specific error codes.

If an error is detected by the Oracle database server, gateway message lines do not occur. For example, if the gateway cannot be accessed because of a Net8 or gateway installation problem, a gateway message line is not present in the generated error.

Another example of error messages without gateway message lines occurs when an INSERT statement attempts to insert data into a table, but does not include values for all of the columns in the table. The following SQL statement causes an error message:

```
SQL> insert into "EMP"@INGR values(9999);

ERROR at line 1:
ORA-00947: not enough values
```

The ORA-00947 message is not accompanied by gateway message lines because the error is detected by the Oracle database server. The Oracle database server obtains a description of the Ingres II table before sending the INSERT statement to the gateway for processing. This allows the Oracle database server to detect when the INSERT statement is invalid.

Gateway Error Codes and Message Formats

Error codes are generally accompanied by additional message text, beyond the text associated with the Oracle message number. The additional text includes details about the error.

Gateway messages have the following format:

```
ORA-nnnnn: error_text
[Transparent gateway for INGRES II]gateway_error_text

ORA-02063: preceding n lines from dblink
```

where:

nnnnn	is an Oracle error number where *nnnnn* ranges from 28500 to 28561.
error_text	is the text of the message associated with the error.
gateway_error_text	are additional messages generated by the gateway or by Ingres II. See "Oracle Database Server Error Codes" on page 7-7 for more information. The format of the *gateway_error_text* is: `[Transparent gateway for INGRES II]gateway_error_text`
n	is the total number of gateway message lines.
dblink	is the name of the database link used to access the gateway.

For example, if you get a message where *nnnnn* is between 28500 and 28561, it is a gateway message and that is where the error is occurring. A gateway message line such as the following means that the error originates in Ingres II or the gateway:

```
[Transparent gateway for INGRES II]
```

The ORA-28500 error code is returned for all errors for which a more specific error code does not exist. When the ORA-28500 error code is returned, the error might have been caused in the gateway by the Ingres II components of the target database.

Tracing

Use error tracing to pinpoint problem areas involving the gateway, the Oracle database server, and Ingres II.

You can enable error tracing to record by setting the HS_FDS_TRACE_LEVEL gateway initialization parameter.

> **See Also:** For information, see Appendix C, "Heterogeneous Services Initialization Parameters".

Use tracing only while testing and debugging the application. Do not enable tracing when the application is running in a production environment because tracing reduces gateway performance.

Trace Log Files

A log file is created with each SQL session to collect the following information:

- The SQL statement as it was sent to the gateway and then on to the target database
- User information such as user name, user program and terminal ID

Trace files are created in the `$ORACLE_HOME/TG4INGR/LOG` directory, where $ORACLE_HOME is the $ORACLE_HOME directory under which the gateway is installed. The trace file names have the format *agent_sid*_agt_*process_id*.trc where *agent_sid* is the sid for the gateway and *process_id* is the operating system process ID of the gateway session.

Reviewing the Trace Output

If you are having trouble accessing data from the Ingres II database, you might receive the following messages:

```
ORA-00942: table or view does not exist
[Transparent gateway for INGRES II]Object not found....
ORA-02063: preceding n lines from database_link_name
```

or the following message:

```
ORA-00904: invalid column name
```

To find the source of the problem, review the trace output from the gateway.

If you are certain that the identifier exists in the Ingres II database, the trace output might show, for example, that the table or column name in the SQL statement sent to the Ingres II database has the wrong case, or you forgot to enclose it in double quotation marks. The Oracle database server identifiers must be in uppercase unless you enclose them in double quotation marks. The case for identifiers for Ingres II depends on whether it is case-sensitive or not.

The outgoing parsed SQL statement listed in the trace output is the SQL statement passed to the gateway and on to the target database. If you think the SQL statement might have been generated incorrectly, test the SQL statement by executing it with Ingres II's native tools or using an ODBC application such as ODBC-Test. If you need help to execute the statement using these tools, contact the Ingres II vendor for support.

Oracle Support Services

If you determined that the problem does involve an Oracle component, but you have not been able to solve it, gather the information and fill out the worksheet before contacting Oracle Customer Support Services:

Note: Support for non-Oracle components is the responsibility of the vendor providing that component.

Table 7–1 Oracle Support Services Worksheet

Required Information	Site-specific Values
Name and full version numbers for:	
- the gateway	Oracle Transparent Gateway for Ingres II Version: _____
- the platform / OS on which the gateway resides	Sun SPARC Solaris_____ Version:_____ Machine Name:_____
Versions of Net8 Server used by the gateway	Net8 Version:_____
Net8 Adapter used by the gateway	Circle one: Named Pipes - SPX / IPX - TCP / IP Version:_____

Table 7–1 (Cont.) Oracle Support Services Worksheet

Required Information	Site-specific Values
Full pathname to directory in which gateway resides	Path:_____
Oracle database server and the platform / OS on which it resides	Oracle___ Server, Version:_____ OS:_____Version:_____ Machine Name:_____
Oracle SID of the Oracle database server	SID:_____
Full pathname to directory where the Oracle database server is installed	ORACLE_HOME:_____
Version of Net8 Client used by the Oracle database server	Version:_____
Net8 adapter used by the Oracle database server	Circle one: Named Pipes - SPX / IPX - TCP / IP Version:_____
The database and any patch information for it	Server Name:_____ Database Name:_____ Version:_____
Listing of spool log if using SQL*Plus, or the SQL statement and error message received	Check here: ❑
Relevant table and view definition (a full description of the tables involved in the SQL query)	Check here: ❑
Description of the problem (input, output, test cases, and so on)	Check here: ❑
Listings of key files:	Check here: ❑ `tg4ingr_agt_`*`pid`*`.trc` log file gathered with HS_FDS_TRACE_LEVEL ❑ Net8 configuration files, `tnsnames.ora` and `listener.ora` ❑ initialization parameter file

A

Supported SQL Syntax and Functions

This appendix contains the following sections:.

- Supported SQL Statements
- Oracle Functions

Supported SQL Statements

With a few exceptions, the gateway provides full support for Oracle DELETE, INSERT, SELECT, and UPDATE statements.

The gateway does not support Oracle Data Definition Language (DDL) statements. No form of the Oracle ALTER, CREATE, DROP, GRANT, or TRUNCATE statements can be used. Instead, use the pass-through feature of the gateway if you need to use DDL statements against the Ingres II database.

> **See Also:** "Using the Pass-Through Feature" on page 5-5 and *Oracle8i SQL Reference* for a detailed descriptions of keywords, parameters, and options.

DELETE

The DELETE statement is fully supported. However, only Oracle functions supported by Ingres II can be used.

> **See Also:** "Functions Supported by Ingres II" on page A-3 for a list of supported functions.

INSERT

The INSERT statement is fully supported. However, only Oracle functions supported by Ingres II can be used.

> **See Also:** "Functions Supported by Ingres II" on page A-3 for a list of supported functions.

SELECT

The SELECT statement is fully supported, with the following exceptions:

- CONNECT BY *condition*
- FOR UPDATE
- FOR UPDATE OF
- NOWAIT
- START WITH *condition*

UPDATE

The UPDATE statement is fully supported. However, only Oracle functions supported by Ingres II can be used. Column values can be set only to expressions; they cannot be set with subqueries.

See Also: "Functions Supported by Ingres II" on page A-3 for a list of supported functions.

Oracle Functions

All functions are evaluated by the Ingres II database after the gateway has converted them to Ingres II equivalents.

Functions Not Supported by Ingres II

Oracle SQL functions that have no equivalent function in OpenIngres are not supported in DELETE, INSERT, or UPDATE statements but are evaluated by the Oracle database server if the statement is a SELECT statement. That is, the Oracle database server performs post-processing of SELECT statements sent to the gateway.

If an unsupported function is used in a DELETE, INSERT, or UPDATE statement, the following Oracle error occurs:

```
ORA-02070: database db_link_name does not support function in this context
```

Note: The Oracle database server treats SELECT statements that contain a FOR UPDATE clause as UPDATE statements; it cannot perform post-processing of those statements.

Functions Supported by Ingres II

The gateway translates the following Oracle database server functions in SQL statements to their equivalent Ingres II functions:

- Arithmetic Operators
- Comparison Operators
- Group Functions
- String Functions

Arithmetic Operators

Oracle	OpenIngres
+	+
-	-
*	*
/	/

Comparison Operators

Oracle	OpenIngres
=	=
>	>
<	<
>=	>=
<=	<=
<>,!=,^=	<>, !=
BETWEEN X AND Y	BETWEEN X AND Y
IS NULL	IS NULL
IS NOT NULL	IS NOT NULL
NOT BETWEEN X AND Y	NOT BETWEEN X AND Y

Group Functions

Oracle	OpenIngres
AVG	AVG
COUNT	COUNT
MAX	MAX
MIN	MIN

Oracle	OpenIngres
SUM	SUM

String Functions

Oracle	OpenIngres
||	+
LENGTH	LENGTH
LOWER	LOWERCASE
SUBSTR (with 2 arguments – the arguments cannot be negative numbers)	shift('string', from)
SUBSTR (with 3 arguments – the arguments cannot be negative numbers)	left(shift('string', from), for)
UPPER	UPPERCASE

Pattern Matches

Oracle	OpenIngres
LIKE 'a%'	LIKE "a%", MATCHES "a*"
LIKE 'a_'	LIKE "a_", MATCHES "a?"
LIKE 'a\%' ESCAPE '\'	LIKE "a\%" ESCAPE "\"
NOT LIKE	NOT LIKE

Other Functions

Oracle	OpenIngres
ABS	ABS
COS	COS
EXP	EXP
LN	LOG
MOD	MOD
NVL	IFNULL
POSITION	LOCATION

Oracle	OpenIngres
RTRIM	TRIM
SIN	SIN
SQRT	SQRT

B

Data Dictionary

The Oracle Transparent Gateway for Ingres II translates a query that refers to an Oracle database server data dictionary table into a query that retrieves the data from a Ingres II data dictionary. You perform queries on data dictionary tables over the database link in the same way you query data dictionary tables in the Oracle database server. The gateway data dictionary is similar to the Oracle database server data dictionary in appearance and use.

This appendix contains the following sections:

Data Dictionary Support

Ingres II System Tables

Ingres II data dictionary information is stored in the Ingres II database as Ingres II system tables. All Ingres II system tables have names prefaced with “ii”. The Ingres II system tables define the structure of a database. When you change data definitions, Ingres II reads and modifies the Ingres II system tables to add information about the user tables.

Accessing the Gateway Data Dictionary

Accessing a gateway data dictionary table or view is identical to accessing a data dictionary in an Oracle database. You issue a SQL SELECT statement specifying a database link. The Oracle database server data dictionary view and column names are used to access the gateway data dictionary. Synonyms of supported views are also acceptable. For example, the following statement queries the data dictionary table ALL_TABLES to retrieve all table names in the Ingres II database:

```
SQL> SELECT * FROM ALL_TABLES@INGR;
```

When a data dictionary access query is issued, the gateway:

1. Maps the requested table, view, or synonym to one or more Ingres II system table names. The gateway translates all data dictionary column names to their corresponding Ingres II column names within the query. If the mapping involves one Ingres II system table, the gateway translates the requested table name to its corresponding Ingres II system table name within the query. If the mapping involves multiple Ingres II system tables, the gateway constructs a join in the query using the translated Ingres II system table names.
2. Sends the translated query to Ingres II.
3. Might convert the retrieved Ingres II data to give it the appearance of the Oracle database server data dictionary table.
4. Passes the data dictionary information from the translated Ingres II system table to the Oracle database server.

Note: The values returned when querying the gateway data dictionary might not be the same as the ones returned by the Oracle Enterprise Manager DESCRIBE command.

Direct Queries to Ingres II Tables

Queries issued directly to individual Ingres II system tables are allowed but they return different results because the Ingres II system table column names differ from those of the data dictionary view. Also, certain columns in an Ingres II system table cannot be used in data dictionary processing.

Supported Views and Tables

The gateway supports the following views and tables:

Table B–1 Gateway Supported Views and Tables

ALL_CATALOG	ALL_COL_COMMENTS
ALL_CONS_COLUMNS	ALL_CONSTRAINTS
ALL_INDEXES	ALL_OBJECTS
ALL_TAB_COLUMNS	ALL_TAB_COMMENTS
ALL_TABLES	ALL_USERS
ALL_VIEWS	DICT_COLUMNS
DICTIONARY	DUAL
TABLE_PRIVILEGES	USER_CATALOG
USER_COL_COMMENTS	USER_CONS_COLUMNS
USER_CONSTRAINTS	USER_INDEXES
USER_OBJECTS	USER_TAB_COLUMNS
USER_TAB_COMMENTS	USER_TABLES
USER_USERS	USER_VIEWS

No other Oracle database server data dictionary tables or views are supported. If you use a view not on the list, you receive the Oracle database server error code for no more rows available.

Data Dictionary Mapping

This table lists Oracle data dictionary view names and the equivalent Ingres II system table names. A plus sign (+) indicates that a join operation is involved.

Table B–2 Oracle Data Dictionary View Names and Ingres II Equivalents

View Name	Ingres II System Table Name
ALL_CATALOG	iitables
ALL_COL_COMMENTS	iicolumns+iitables
ALL_CONS_COLUMNS	iicolumns+iitables
ALL_CONSTRAINTS	iicolumns+iiintegrities+iitables
ALL_INDEXES	iiindexes
ALL_OBJECTS	iitables+iiprocedures
ALL_TAB_COLUMNS	iicolumns+iitables
ALL_TAB_COMMENTS	iitables
ALL_TABLES	iitables
ALL_USERS	iitables
ALL_VIEWS	iiviews
DICT_COLUMNS	iicolumns+iitables
DICTIONARY	iitables
DUAL	iitables
TABLE_PRIVILEGES	iitables+iipermits
USER_CATALOG	iitables
USER_COL_COMMENTS	iicolumns+iitables
USER_CONS_COLUMNS	iicolumns+iitables
USER_CONSTRAINTS	iicolumns+iiintegrities+iitables
USER_INDEXES	iiindexes
USER_OBJECTS	iitables+iiprocedures
USER_TAB_COLUMNS	iicolumns+iitables
USER_TAB_COMMENTS	iitables
USER_TABLES	iitables

Table B–2 (Cont.) Oracle Data Dictionary View Names and Ingres II Equivalents

View Name	Ingres II System Table Name
USER_USERS	iitables
USER_VIEWS	iiviews

Default Column Values

There is a minor difference between the gateway data dictionary and a typical Oracle database server data dictionary. The Oracle database server columns that are missing in a Ingres II data dictionary table are filled with zeros, spaces, null values, not-applicable values (N.A.), or default values, depending on the column type.

Gateway Data Dictionary Descriptions

The gateway data dictionary tables and views provide this information:

- Name, datatype, and width of each column
- The contents of columns with fixed values

They are described here with information retrieved by an Oracle Enterprise Manager DESCRIBE command. The values in the Null? column might differ from the Oracle database server data dictionary tables and views. Any default value is shown to the right of an item, but this is not information returned by DESCRIBE.

Table B–3 ALL_CATALOG

Name	Null?	Type	Value
OWNER	NOT NULL	VARCHAR2(255)	
TABLE_NAME	NOT NULL	VARCHAR2(255)	
TABLE_TYPE		VARCHAR2(5)	"TABLE" or "VIEW"

Table B–4 ALL_COL_COMMENTS

Name	Null?	Type	Value
OWNER	NOT NULL	VARCHAR2(255)	
TABLE_NAME	NOT NULL	VARCHAR2(255)	
COLUMN_NAME	NOT NULL	VARCHAR2(255)	

Table B–4 (Cont.) ALL_COL_COMMENTS

Name	Null?	Type	Value
COMMENTS	NOT NULL	CHAR(1)	

Table B–5 ALL_CONS_COLUMNS

Name	Null?	Type	Value
OWNER		VARCHAR2(30)	
CONSTRAINT_NAME		VARCHAR2(30)	
TABLE_NAME		VARCHAR2(30)	
COLUMN_NAME		VARCHAR2(4000)	
POSITION		NUMBER	

Table B–6 ALL_CONSTRAINTS

Name	Null?	Type	Value
OWNER		VARCHAR2(255)	
CONSTRAINT_NAME		VARCHAR2(255)	
CONSTRAINT_TYPE		VARCHAR2(1)	"R" or "P" or "U" or "C"
TABLE_NAME		VARCHAR2(255)	
SEARCH_CONDITION		VARCHAR2(1)	NULL
R_OWNER		VARCHAR2(255)	
R_CONSTRAINT_NAME		VARCHAR2(255)	
DELETE_RULE		VARCHAR2(1)	NULL
STATUS		VARCHAR2(1)	NULL
DEFERRABLE		VARCHAR2(1)	NULL
DEFERRED		VARCHAR2(1)	NULL
VALIDATED		VARCHAR2(1)	NULL
GENERATED		VARCHAR2(1)	NULL
BAD		VARCHAR2(1)	NULL
RELY		VARCHAR2(1)	NULL

Table B–6 (Cont.) ALL_CONSTRAINTS

Name	Null?	Type	Value
LAST_CHANGE		DATE	

Table B–7 ALL_INDEXES

Name	Null?	Type	Value
OWNER	NOT NULL	VARCHAR2(255)	
INDEX_NAME		VARCHAR2(255)	
INDEX_TYPE		VARCHAR2(1)	NULL
TABLE_OWNER	NOT NULL	VARCHAR2(255)	
TABLE_NAME	NOT NULL	VARCHAR2(255)	
TABLE_TYPE		VARCHAR(7)	"TABLE" or "CLUSTER"
UNIQUENESS		VARCHAR2(1)	NULL
COMPRESSION		VARCHAR2(1)	NULL
PREFIX_LENGTH		NUMBER	0
TABLESPACE_NAME		VARCHAR2(1)	NULL
INI_TRANS		NUMBER	0
MAX_TRANS		NUMBER	0
INITIAL_EXTENT		NUMBER	0
NEXT_EXTENT		NUMBER	0
MIN_EXTENTS		NUMBER	0
MAX_EXTENTS		NUMBER	0
PCT_INCREASE		NUMBER	0
PCT_THRESHOLD		NUMBER	0
INCLUDE_COLUMN		NUMBER	0
FREELISTS		NUMBER	0
FREELIST_GROUPS		NUMBER	0
PCT_FREE		NUMBER	0

Table B–7 (Cont.) ALL_INDEXES

Name	Null?	Type	Value
LOGGING		VARCHAR2(1)	NULL
BLEVEL		NUMBER	0
LEAF_BLOCKS		NUMBER	0
DISTINCT_KEYS		NUMBER	0
AVG_LEAF_BLOCKS_PER_KEY		NUMBER	0
AVG_DATA_BLOCKS_PER_KEY		NUMBER	0
CLUSTERING_FACTOR		NUMBER	0
STATUS		VARCHAR2(1)	NULL
NUM_ROWS		NUMBER	0
SAMPLE_SIZE		NUMBER	0
LAST_ANALYZED		VARCHAR2(0)	NULL
DEGREE		VARCHAR2(1)	NULL
INSTANCES		VARCHAR2(1)	NULL
PARTITIONED		VARCHAR2(1)	NULL
TEMPORARY		VARCHAR2(1)	NULL
GENERATED		VARCHAR2(1)	NULL
SECONDARY		VARCHAR2(1)	NULL
BUFFER_POOL		VARCHAR2(1)	NULL
USER_STATS		VARCHAR2(1)	NULL
DURATION		VARCHAR2(1)	NULL
PCT_DIRECT_ACCESS		NUMBER	0
ITYP_OWNER		VARCHAR2(1)	NULL
ITYP_NAME		VARCHAR2(1)	NULL
PARAMETERS		VARCHAR2(1)	NULL
GLOBAL_STATS		VARCHAR2(1)	NULL
DOMIDX_STATUS		VARCHAR2(1)	NULL
DOMIDX_OPSTATUS		VARCHAR2(1)	NULL

Table B–7 (Cont.) ALL_INDEXES

Name	Null?	Type	Value
FUNCIDX_STATUS		VARCHAR2(1)	NULL

Table B–8 ALL_OBJECTS

Name	Null?	Type	Value
OWNER		VARCHAR2(255)	
OBJECT_NAME		VARCHAR2(255)	
SUBOBJECT_NAME		VARCHAR2(1)	NULL
OBJECT_ID		NUMBER	
DATA_OBJECT_ID		NUMBER	0
OBJECT_TYPE		VARCHAR2(9)	"TABLE" or "VIEW" or "INDEX" or "PROCEDURE"
CREATED		DATE	
LAST_DDL_TIME		DATE	
TIMESTAMP		VARCHAR2(1)	NULL
STATUS		VARCHAR2(5)	“VALID”
TEMPORARY		VARCHAR2(1)	NULL
GENERATED		VARCHAR2(1)	NULL
SECONDARY		VARCHAR2(1)	NULL

Table B–9 ALL_TAB_COLUMNS

Name	Null?	Type	Value
OWNER		VARCHAR2(255)	
TABLE_NAME		VARCHAR2(255)	
COLUMN_NAME		VARCHAR2(255)	
DATA_TYPE		VARCHAR2(8)	
DATA_TYPE_MOD		VARCHAR2(1)	NULL

Table B–9 (Cont.) ALL_TAB_COLUMNS

Name	Null?	Type	Value
DATA_TYPE_OWNER		VARCHAR2(1)	NULL
DATA_LENGTH		NUMBER	
DATA_PRECISION		NUMBER	
DATA_SCALE		NUMBER	
NULLABLE		VARCHAR2(1)	"Y" or "N"
COLUMN_ID		NUMBER	
DEFAULT_LENGTH		NUMBER	0
DATA_DEFAULT		VARCHAR2(1)	NULL
NUM_DISTINCT		NUMBER	0
LOW_VALUE		NUMBER	0
HIGH_VALUE		NUMBER	0
DENSITY		NUMBER	0
NUM_NULLS		NUMBER	0
NUM_BUCKETS		NUMBER	0
LAST_ANALYZED		VARCHAR2(0)	NULL
SAMPLE_SIZE		NUMBER	0
CHARACTER_SET_NAME		VARCHAR2(1)	NULL
CHAR_COL_DEC_LENGTH		NUMBER	0
GLOBAL_STATS		VARCHAR2(1)	NULL
USER_STATS		VARCHAR2(1)	NULL
AVG_COL_LEN		NUMBER	0

Table B–10 ALL_TAB_COMMENTS

Name	Null?	Type	Value
OWNER	NOT NULL	VARCHAR2(255)	
TABLE_NAME	NOT NULL	VARCHAR2(255)	
TABLE_TYPE		VARCHAR2(5)	"TABLE" or "VIEW"

Table B–10 (Cont.) ALL_TAB_COMMENTS

Name	Null?	Type	Value
COMMENTS		VARCHAR2(1)	NULL

Table B–11 ALL_TABLES

Name	Null?	Type	Value
OWNER	NOT NULL	VARCHAR2(255)	
TABLE_NAME	NOT NULL	VARCHAR2(255)	
TABLESPACE_NAME		VARCHAR2(1)	NULL
CLUSTER_NAME		VARCHAR2(1)	NULL
IOT_NAME		VARCHAR2(1)	NULL
PCT_FREE		NUMBER	0
PCT_USED		NUMBER	0
INI_TRANS		NUMBER	0
MAX_TRANS		NUMBER	0
INITIAL_EXTENT		NUMBER	0
NEXT_EXTENT		NUMBER	0
MIN_EXTENTS		NUMBER	0
MAX_EXTENTS		NUMBER	0
PCT_INCREASE		NUMBER	0
FREELISTS		NUMBER	0
FREELIST_GROUPS		NUMBER	0
LOGGING		VARCHAR2(1)	NULL
BACKED_UP		VARCHAR2(1)	NULL
NUM_ROWS		NUMBER	0
BLOCKS		NUMBER	0
EMPTY_BLOCKS		NUMBER	0
AVG_SPACE		NUMBER	0
CHAIN_CNT		NUMBER	0

Table B–11 (Cont.) ALL_TABLES

Name	Null?	Type	Value
AVG_ROW_LEN		NUMBER	0
AVG_SPACE_FREELIST_BLOCKS		NUMBER	0
NUM_FREELIST_BLOCKS		NUMBER	0
DEGREE		VARCHAR2(1)	NULL
INSTANCES		VARCHAR2(1)	NULL
CACHE		VARCHAR2(1)	NULL
TABLE_LOCK		VARCHAR2(1)	NULL
SAMPLE_SIZE		NUMBER	0
LAST_ANALYZED		VARCHAR2(0)	NULL
PARTITIONED		VARCHAR2(1)	NULL
IOT_TYPE		VARCHAR2(1)	NULL
TEMPORARY		VARHCAR2(1)	NULL
SECONDARY		VARCHAR2(1)	NULL
NESTED		VARCHAR2(1)	NULL
BUFFER_POOL		VARCHAR2(1)	NULL
ROW_MOVEMENT		VARCHAR2(1)	NULL
GLOBAL_STATS		VARCHAR2(1)	NULL
USER_STATS		VARCHAR2(1)	NULL
DURATION		VARHCAR2(1)	NULL
SKIP_CORRUPT		VARCHAR2(1)	NULL
MONITORING		VARCHAR2(1)	NULL

Table B–12 ALL_USERS

Name	Null?	Type	Value
USERNAME	NOT NULL	VARCHAR2(255)	
USER_ID	NOT NULL	NUMBER(5)	
CREATED		VARCHAR2(0)	NULL

Table B–13 ALL_VIEWS

Name	Null?	Type	Value
OWNER	NOT NULL	VARCHAR2(30)	
VIEW_NAME	NOT NULL	VARCHAR2(30)	
TEXT_LENGTH	NOT NULL	NUMBER(10)	0
TEXT	NOT NULL	CHAR(1)	
TYPE_TEXT_LENGTH	NOT NULL	NUMBER(10)	0
TYPE_TEXT	NOT NULL	CHAR(1)	
OID_TEXT_LENGTH	NOT NULL	NUMBER(10)	0
OID_TEXT	NOT NULL	CHAR(1)	
VIEW_TYPE_OWNER	NOT NULL	CHAR(1)	
VIEW_TYPE	NOT NULL	CHAR(1)	

Table B–14 DICT_COLUMNS

Name	Null?	Type	Value
TABLE_NAME	NOT NULL	VARCHAR2(255)	
COLUMN_NAME	NOT NULL	VARCHAR2(255)	
COMMENTS	NOT NULL	CHAR2(1)	NULL

Table B–15 DICTIONARY

Name	Null?	Type	Value
TABLE_NAME	NOT NULL	VARCHAR2(255)	
COMMENTS	NOT NULL	CHAR(1)	

Table B–16 DUAL

Name	Null?	Type	Value
DUMMY	NOT NULL	CHAR(1)	"X"

Table B–17 TABLE_PRIVILEGES

Name	Null?	Type	Value
GRANTEE	NOT NULL	VARCHAR2(255)	
OWNER	NOT NULL	VARCHAR2(255)	
TABLE_NAME	NOT NULL	VARCHAR2(255)	
GRANTOR	NOT NULL	VARCHAR2(255)	
SELECT_PRIV		VARCHAR2(1)	"Y"
INSERT_PRIV		VARCHAR2(1)	"A"
DELETE_PRIV		VARCHAR2(1)	"Y"
UPDATE_PRIV		VARCHAR2(1)	"A"
REFERENCES_PRIV		VARCHAR2(1)	"A"
ALTER_PRIV		VARCHAR2(1)	"Y"
INDEX_PRIV		VARCHAR2(1)	"Y"
CREATED		VARCHAR2(0)	NULL

Table B–18 USER_CATALOG

Name	Null?	Type	Value
TABLE_NAME	NOT NULL	VARCHAR2(255)	
TABLE_TYPE		VARCHAR2(5)	"TABLE" or "VIEW"

Table B–19 USER_COL_COMMENTS

Name	Null?	Type	Value
TABLE_NAME	NOT NULL	VARCHAR2(255)	
COLUMN_NAME	NOT NULL	VARCHAR2(255)	
COMMENTS		VARCHAR2(1)	NULL

Table B–20 USER_CONS_COLUMNS

Name	Null?	Type	Value
OWNER		VARCHAR2(30)	
CONSTRAINT_NAME		VARCHAR2(30)	
TABLE_NAME		VARCHAR2(30)	
COLUMN_NAME		VARCHAR2(4000)	
POSITION		NUMBER	

Table B–21 USER_CONSTRAINTS

Name	Null?	Type	Value
OWNER		VARCHAR2(255)	
CONSTRAINT_NAME		VARCHAR2(255)	
CONSTRAINT_TYPE		VARCHAR2(1)	"R" or "P" or "U" or "C"
TABLE_NAME		VARCHAR2(255)	
SEARCH_CONDITION		VARCHAR2(1)	NULL
R_OWNER		VARCHAR2(255)	
R_CONSTRAINT_NAME		VARCHAR2(255)	
DELETE_RULE		VARCHAR2(1)	NULL
STATUS		VARCHAR2(1)	NULL
DEFERRABLE		VARCHAR2(1)	NULL
DEFERRED		VARCHAR2(1)	NULL
VALIDATED		VARCHAR2(1)	NULL
GENERATED		VARCHAR2(1)	NULL
BAD		VARCHAR2(1)	NULL
RELY		VARCHAR2(1)	NULL
LAST_CHANGE		DATE	NULL

Table B–22 USER_INDEXES

Name	Null?	Type	Value
INDEX_NAME		VARCHAR2(255)	
INDEX_TYPE		VARCHAR2(1)	NULL
TABLE_OWNER	NOT NULL	VARCHAR2(255)	
TABLE_NAME	NOT NULL	VARCHAR2(255)	
TABLE_TYPE		VARCHAR2(7)	"TABLE" or "CLUSTER"
UNIQUENESS		VARCHAR2(1)	NULL
COMPRESSION		VARCHAR2(1)	NULL
PREFIX_LENGTH		NUMBER	0
TABLESPACE_NAME		VARCHAR2(1)	NULL
INI_TRANS		NUMBER	0
MAX_TRANS		NUMBER	0
INITIAL_EXTENT		NUMBER	0
NEXT_EXTENT		NUMBER	0
MIN_EXTENTS		NUMBER	0
MAX_EXTENTS		NUMBER	0
PCT_INCREASE		NUMBER	0
PCT_THRESHOLD		NUMBER	0
INCLUDE_COLUMN		NUMBER	0
FREELISTS		NUMBER	0
FREELIST_GROUPS		NUMBER	0
PCT_FREE		NUMBER	0
LOGGING		VARCHAR2(1)	NULL
BLEVEL		NUMBER	0
LEAF_BLOCKS		NUMBER	0
DISTINCT_KEYS		NUMBER	0
AVG_LEAF_BLOCKS_PER_KEY		NUMBER	0

Table B–22 (Cont.) USER_INDEXES

Name	Null?	Type	Value
AVG_DATA_BLOCKS_PER_KEY		NUMBER	0
CLUSTERING_FACTOR		NUMBER	0
STATUS		VARCHAR2(1)	NULL
NUM_ROWS		NUMBER	0
SAMPLE_SIZE		NUMBER	0
LAST_ANALYZED		VARCHAR2(0)	NULL
DEGREE		VARCHAR2(1)	NULL
INSTANCES		VARCHAR2(1)	NULL
PARTITIONED		VARCHAR2(1)	NULL
TEMPORARY		VARCHAR2(1)	NULL
GENERATED		VARCHAR2(1)	NULL
SECONDARY		VARCHAR2(1)	NULL
BUFFER_POOL		VARCHAR2(1)	NULL
USER_STATS		VARCHAR2(1)	NULL
DURATION		VARHCAR2(1)	NULL
PCT_DIRECT_ACCESS		NUMBER	0
ITYP_OWNER		VARCHAR2(1)	NULL
ITYP_NAME		VARCHAR2(1)	NULL
PARAMETERS		VARCHAR2(1)	NULL
GLOBAL_STATS		VARCHAR2(1)	NULL
DOMIDX_STATUS		VARCHAR2(1)	NULL
DOMIDX_OPSTATUS		VARCHAR2(1)	NULL
FUNCIDX_STATUS		VARCHAR2(1)	NULL

Table B–23 USER_OBJECTS

Name	Null?	Type	Value
OBJECT_NAME		VARCHAR2(255)	

Table B–23 (Cont.) USER_OBJECTS

Name	Null?	Type	Value
SUBOBJECT_NAME		VARCHAR2(1)	NULL
OBJECT_ID		NUMBER	
DATA_OBJECT_ID		NUMBER	0
OBJECT_TYPE		VARCHAR2(9)	"TABLE" or "VIEW" or "INDEX" or "PROCEDURE"
CREATED		DATE	
LAST_DDL_TIME		DATE	
TIMESTAMP		VARCHAR2(1)	NULL
STATUS		VARCHAR2(5)	"VALID"
TEMPORARY		VARCHAR2(1)	NULL
GENERATED		VARCHAR2(1)	NULL
SECONDARY		VARCHAR2(1)	NULL

Table B–24 USER_TAB_COLUMNS

Name	Null?	Type	Value
TABLE_NAME		VARCHAR2(255)	
COLUMN_NAME		VARCHAR2(255)	
DATA_TYPE		VARCHAR2(8)	
DATA_TYPE_MOD		VARCHAR2(1)	NULL
DATA_TYPE_OWNER		VARCHAR2(1)	NULL
DATA_LENGTH		NUMBER	
DATA_PRECISION		NUMBER	
DATA_SCALE		NUMBER	
NULLABLE		VARCHAR2(1)	"Y" or "N"
COLUMN_ID		NUMBER	
DEFAULT_LENGTH		NUMBER	0

Table B–24 (Cont.) USER_TAB_COLUMNS

Name	Null?	Type	Value
DATA_DEFAULT		VARCHAR2(1)	NULL
NUM_DISTINCT		NUMBER	0
LOW_VALUE		NUMBER	0
HIGH_VALUE		NUMBER	0
DENSITY		NUMBER	0
NUM_NULLS		NUMBER	0
NUM_BUCKETS		NUMBER	0
LAST_ANALYZED		VARCHAR2(0)	NULL
SAMPLE_SIZE		NUMBER	0
CHARACTER_SET_NAME		VARCHAR2(1)	NULL
CHAR_COL_DECL_LENGTH		NUMBER	0
GLOBAL_STATS		VARCHAR2(1)	NULL
USER_STATS		VARCHAR2(1)	NULL
AVG_COL_LEN		NUMBER	0

Table B–25 USER_TAB_COMMENTS

Name	Null?	Type	Value
TABLE_NAME	NOT NULL	VARCHAR2(255)	
TABLE_TYPE		VARCHAR2(5)	"TABLE" or "VIEW"
COMMENTS		VARCHAR2(1)	NULL

Table B–26 USER_TABLES

Name	Null?	Type	Value
TABLE_NAME	NOT NULL	VARCHAR2(255)	
TABLESPACE_NAME		VARCHAR2(1)	NULL
CLUSTER_NAME		VARCHAR2(1)	NULL
IOT_NAME		VARCHAR2(1)	NULL

Table B–26 (Cont.) USER_TABLES

Name	Null?	Type	Value
PCT_FREE		NUMBER	0
PCT_USED		NUMBER	0
INI_TRANS		NUMBER	0
MAX_TRANS		NUMBER	0
INITIAL_EXTENT		NUMBER	0
NEXT_EXTENT		NUMBER	0
MIN_EXTENTS		NUMBER	0
MAX_EXTENTS		NUMBER	0
PCT_INCREASE		NUMBER	0
FREELISTS		NUMBER	0
FREELIST_GROUPS		NUMBER	0
LOGGING		VARCHAR2(1)	NULL
BACKED_UP		VARCHAR2(1)	NULL
NUM_ROWS		NUMBER	0
BLOCKS		NUMBER	0
EMPTY_BLOCKS		NUMBER	0
AVG_SPACE		NUMBER	0
CHAIN_CNT		NUMBER	0
AVG_ROW_LEN		NUMBER	0
AVG_SPACE_FREELIST_BLOCKS		NUMBER	0
NUM_FREELIST_BLOCKS		NUMBER	0
DEGREE		VARCHAR2(1)	NULL
INSTANCES		VARCHAR2(1)	NULL
CACHE		VARCHAR2(1)	NULL
TABLE_LOCK		VARCHAR2(1)	NULL
SAMPLE_SIZE		NUMBER	0
LAST_ANALYZED		VARCHAR2(0)	NULL

Table B–26 (Cont.) USER_TABLES

Name	Null?	Type	Value
PARTITIONED		VARCHAR2(1)	NULL
IOT_TYPE		VARCHAR2(1)	NULL
TEMPORARY		VARHCAR2(1)	NULL
SECONDARY		VARCHAR2(1)	NULL
NESTED		VARCHAR2(1)	NULL
BUFFER_POOL		VARCHAR2(1)	NULL
ROW_MOVEMENT		VARCHAR2(1)	NULL
GLOBAL_STATS		VARCHAR2(1)	NULL
USER_STATS		VARCHAR2(1)	NULL
DURATION		VARCHAR2(1)	NULL
SKIP_CORRUPT		VARCHAR2(1)	NULL
MONITORING		VARCHAR2(1)	NULL

Table B–27 USER_USERS

Name	Null?	Type	Value
USERNAME	NOT NULL	VARCHAR2(255)	
USER_ID	NOT NULL	NUMBER(5)	
ACCOUNT_STATUS		VARCHAR2(4)	"OPEN"
LOCK_DATE		VARCHAR2(0)	NULL
EXPIRY_DATE		VARCHAR2(0)	NULL
DEFAULT_TABLESPACE		VARCHAR2(1)	NULL
TEMPORARY_TABLESPACE		VARCHAR2(1)	NULL
CREATED		VARCHAR2(0)	NULL
INITIAL_RSRC_CONSUMER_GROUP		VARCHAR2(1)	NULL
EXTERNAL_NAME		VARCHAR2(1)	NULL

Table B–28 USER_VIEWS

Name	Null?	Type	Value
VIEW_NAME	NOT NULL	VARCHAR2(255)	
TEXT_LENGTH		NUMBER	0
TEXT	NOT NULL	VARCHAR2(255)	
TYPE_TEXT_LENGTH		NUMBER	0
TYPE_TEXT		VARCHAR2(1)	NULL
OID_TEXT_LENGTH		NUMBER	0
OID_TEXT		VARCHAR2(1)	NULL
VIEW_TYPE_OWNER		VARCHAR2(1)	NULL
VIEW_TYPE		VARCHAR2(1)	NULL

C

Heterogeneous Services Initialization Parameters

The Oracle database server init.ora parameters are distinct from heterogeneous services (HS) initialization parameters. Set Heterogeneous Services parameters in the initialization parameter file using an agent-specific mechanism, or set them in the Oracle data dictionary using the DBMS_HS package. All string values for Heterogeneous Services parameters must be lowercase.

This appendix contains information about the following Heterogeneous Services initialization parameters:

- HS_FDS_CONNECT_INFO
- HS_FDS_RECOVERY_ACCOUNT
- HS_FDS_RECOVERY_PWD
- HS_FDS_TIMEZONE
- HS_FDS_TRACE_LEVEL
- HS_FDS_TRANSACTION_MODEL

> **See Also:** *Oracle 8i Distributed Database Systems* for information on other available initialization parameters.

Initialization Parameter File Syntax

The syntax for the initialization parameter file is as follows:

1. The file is a sequence of commands.
2. Each command should start on a separate line.
3. End of line is considered a command terminator (unless escaped with a backslash).
4. Each command can have one of the following forms:
   a. `<param> = <value>`
   b. `set <param> = <value>`
   c. `private <param> = <value>`
   d. `set private <param> = <value>`

   where:

   <param> is an initialization parameter name.

   <value> is the initialization parameter value.

   'set' and 'private' are keywords.
5. 'set' and 'private' are reserved keywords. You cannot use either as an initialization parameter name. The 'set' keyword indicates that the initialization parameter should be set as an environment variable in the agent. The 'private' keyword indicates that the initialization parameter should be private to the agent and should not be uploaded to the server. Most initialization parameters should not be private. If, however, you are storing something sensitive like a password in the initialization parameter file, then you may not want it uploaded to the server because the initialization parameters and values are not encrypted when uploaded. Making these initialization parameters private prevents the upload from happening.
6. An initialization parameter name is a string of characters starting with a letter and consisting of letters, digits and underscores. Initialization parameter names are case sensitive.
7. An initialization parameter value is either:
   a. A string of characters that does not contain any backslashes, white space or double quotation marks (")

b. A quoted string beginning with a double quotation mark and ending with a double quotation mark. The following can be used inside a quoted string:

* backslash (\) is the escape character
* \n inserts a newline
* \t inserts a tab
* \" inserts a double quotation mark
* \ \inserts a backslash

A backslash at the end of the line continues the string on the next line. If a backslash precedes any other character then the backslash is ignored.

If there is a syntax error in an initialization parameter file, none of the settings take effect.

HS_FDS_CONNECT_INFO

Default value:	none
Range of values:	not applicable

Specifies the information needed to connect to the Ingres II database.

This is a required parameter, whose format is:

```
HS_FDS_CONNECT_INFO=vnode::database_name
```

where:

– *vnode* is the virtual node which will be used by the Ingres II client to access a remote networked Ingres II server. If you specify only *database_name*, omitting *vnode*, the gateway binds to the specified local database.

– *database_name* is the name of the database.

The entry for *database_name* is case-sensitive. You can specify an environment variable instead of the database name if your logical database is distributed among several physical databases. The Oracle Transparent Gateway for Ingres II translates the logical name before binding. For example, a logical name (ALL_SITES) can be defined to use as the database name for a logical database

distributed among two physical databases (BOSTON_DB and PARIS_DB), as follows in the UNIX shell:

```
setenv ALL_SITES BOSTON_DB,PARIS_DB
```

HS_FDS_RECOVERY_ACCOUNT

Default value:	RECOVER
Range of values:	any valid userid

Specifies the name of the recovery account used for the commit-confirm transaction model. An account with user name and password must be set up at Ingres II. For more information about the commit-confirm model, see the HS_FDS_ TRANSACTION_MODEL parameter.

HS_FDS_RECOVERY_PWD

Default value:	RECOVER
Range of values:	any valid password

Specifies the password of the recovery account used for the commit-confirm transaction model set up at Ingres II. For more information about the commit-confirm model, see the HS_FDS_TRANSACTION_MODEL parameter.

HS_FDS_TIMEZONE

Default value:	0
Range of values:	any value between -24 and +24

Sets the number of hours behind GMT. For example, `HS_FDS_TIMEZONE=4` is the United States East Coast time zone (which is four hours behind GMT). A negative number sets the number of hours ahead of GMT.

HS_FDS_TRACE_LEVEL

Default value:	off
Range of values:	off, on

Specifies whether error tracing is turned on or off for gateway connectivity.

The following values are valid:

- OFF disables the tracing of error messages.
- ON enables the tracing of error messages that occur when you encounter problems. The results are written to a gateway connectivity log file, in `$ORACLE_HOME/TG4INGR/LOG`.

HS_FDS_TRANSACTION_MODEL

Default value:	COMMIT_CONFIRM
Range of values:	COMMIT_CONFIRM, READ_ONLY, or SINGLE_SITE

Specifies the type of transaction model that is used when the Ingres II database is updated by a transaction.

The following values are possible:

- COMMIT_CONFIRM provides read and write access to the Ingres II database and allows the gateway to be part of a distributed update. To use the commit-confirm model, the following items must be created in the Ingres II database:
  - Transaction log table. The table name is HS_TRANSACTION_LOG. The transaction log table must be granted SELECT, DELETE, and INSERT privileges set to public.
  - Recovery account. The account name is assigned with the HS_FDS_RECOVERY_ACCOUNT parameter.
  - Recovery account password. The password is assigned with the HS_FDS_RECOVERY_PWD parameter.
- READ_ONLY provides read access to the Ingres II database.

- SINGLE_SITE provides read and write access to the Ingres II database. However, the gateway cannot participate in distributed updates.

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