7

Diagnosing and Resolving Problems

Oracle Database includes an advanced fault diagnosability infrastructure for collecting and managing diagnostic data, so as to diagnose and resolve database problems. **Diagnostic data** includes the trace files, dumps, and core files that are also present in previous releases, plus new types of diagnostic data that enable customers and Oracle Support to identify, investigate, track, and resolve problems quickly and effectively.

- About the Oracle Database Fault Diagnosability Infrastructure
  Oracle Database includes a fault diagnosability infrastructure for preventing, detecting, diagnosing, and resolving database problems.
- About Investigating, Reporting, and Resolving a Problem
  You can use the Enterprise Manager Support Workbench (Support Workbench) to investigate and report a problem (critical error), and in some cases, resolve the problem. You can use a "roadmap" that summarizes the typical set of tasks that you must perform.
- Diagnosing Problems
  This section describes various methods to diagnose problems in an Oracle database.
- Reporting Problems
  Using the Enterprise Manager Support Workbench (Support Workbench), you can create, edit, and upload custom incident packages. With custom incident packages, you have fine control over the diagnostic data that you send to Oracle Support.
- Resolving Problems
  This section describes how to resolve database problems using advisor tools, such as SQL Repair Advisor and Data Recovery Advisor, and the resource management tools, such as the Resource Manager and related APIs.
- Diagnosis and Tracing in a PDB Using Package DBMS_USERDIAG
  This section describes how to use the PL/SQL package DBMS_USERDIAG for diagnosis and allows you to set up a trace within a PDB.

7.1 About the Oracle Database Fault Diagnosability Infrastructure

Oracle Database includes a fault diagnosability infrastructure for preventing, detecting, diagnosing, and resolving database problems.

- Fault Diagnosability Infrastructure Overview
  The fault diagnosability infrastructure aids in preventing, detecting, diagnosing, and resolving problems. The problems that are targeted in particular are critical errors such as those caused by code bugs, metadata corruption, and customer data corruption.
- Incidents and Problems
  A **problem** is a critical error in a database instance, Oracle Automatic Storage Management (Oracle ASM) instance, or other Oracle product or component. An **incident** is a single occurrence of a problem.
- Fault Diagnosability Infrastructure Components
  The fault diagnosability infrastructure consists of several components, including the Automatic Diagnostic Repository (ADR), various logs, trace files, the Enterprise Manager Support Workbench, and the ADRCI Command-Line Utility.

- Structure, Contents, and Location of the Automatic Diagnostic Repository
  The Automatic Diagnostic Repository (ADR) is a directory structure that is stored outside of the database. It is therefore available for problem diagnosis when the database is down.

7.1.1 Fault Diagnosability Infrastructure Overview

The fault diagnosability infrastructure aids in preventing, detecting, diagnosing, and resolving problems. The problems that are targeted in particular are critical errors such as those caused by code bugs, metadata corruption, and customer data corruption.

When a critical error occurs, it is assigned an incident number, and diagnostic data for the error (such as trace files) are immediately captured and tagged with this number. The data is then stored in the Automatic Diagnostic Repository (ADR)—a file-based repository outside the database—where it can later be retrieved by incident number and analyzed.

The goals of the fault diagnosability infrastructure are the following:

- First-failure diagnosis
- Problem prevention
- Limiting damage and interruptions after a problem is detected
- Reducing problem diagnostic time
- Reducing problem resolution time
- Simplifying customer interaction with Oracle Support

The keys to achieving these goals are the following technologies:

- **Automatic capture of diagnostic data upon first failure**—For critical errors, the ability to capture error information at first-failure greatly increases the chance of a quick problem resolution and reduced downtime. An always-on memory-based tracing system proactively collects diagnostic data from many database components, and can help isolate root causes of problems. Such proactive diagnostic data is similar to the data collected by airplane "black box" flight recorders. When a problem is detected, alerts are generated and the fault diagnosability infrastructure is activated to capture and store diagnostic data. The data is stored in a repository that is outside the database (and therefore available when the database is down), and is easily accessible with command line utilities and Oracle Enterprise Manager Cloud Control (Cloud Control).
- **Standardized trace formats**—Standardizing trace formats across all database components enables DBAs and Oracle Support personnel to use a single set of tools for problem analysis. Problems are more easily diagnosed, and downtime is reduced.
- **Health checks**—Upon detecting a critical error, the fault diagnosability infrastructure can run one or more health checks to perform deeper analysis of a critical error. Health check results are then added to the other diagnostic data collected for the error. Individual health checks look for data block corruptions, undo and redo corruption, data dictionary corruption, and more. As a DBA, you can manually invoke these health checks, either on a regular basis or as required.
- **Incident packaging service (IPS) and incident packages**—The IPS enables you to automatically and easily gather the diagnostic data—traces, dumps, health check reports, and more—pertaining to a critical error and package the data into a zip file for transmission to Oracle Support. Because all diagnostic data relating to a critical error are tagged with that error's incident number, you do not have to search through trace files and other files to determine the files that are required for analysis; the incident packaging service identifies the required files automatically and adds them to the zip file. Before creating the zip file, the IPS first collects diagnostic data into an intermediate logical structure called an incident

package (package). Packages are stored in the Automatic Diagnostic Repository. If you choose to, you can access this intermediate logical structure, view and modify its contents, add or remove additional diagnostic data at any time, and when you are ready, create the zip file from the package. After these steps are completed, the zip file is ready to be uploaded to Oracle Support.

- **Data Recovery Advisor**—The Data Recovery Advisor integrates with database health checks and RMAN to display data corruption problems, assess the extent of each problem (critical, high priority, low priority), describe the impact of a problem, recommend repair options, conduct a feasibility check of the customer-chosen option, and automate the repair process.
- **SQL Test Case Builder**—For many SQL-related problems, obtaining a reproducible test case is an important factor in problem resolution speed. The SQL Test Case Builder automates the sometimes difficult and time-consuming process of gathering as much information as possible about the problem and the environment in which it occurred. After quickly gathering this information, you can upload it to Oracle Support to enable support personnel to easily and accurately reproduce the problem.

7.1.2 Incidents and Problems

A **problem** is a critical error in a database instance, Oracle Automatic Storage Management (Oracle ASM) instance, or other Oracle product or component. An **incident** is a single occurrence of a problem.

- About Incidents and Problems
  To facilitate diagnosis and resolution of critical errors, the fault diagnosability infrastructure introduces two concepts for Oracle Database: problems and incidents.
- Incident Flood Control
  It is conceivable that a problem could generate dozens or perhaps hundreds of incidents in a short period of time. This would generate too much diagnostic data, which would consume too much space in the ADR and could possibly slow down your efforts to diagnose and resolve the problem. For these reasons, the fault diagnosability infrastructure applies *flood control* to incident generation after certain thresholds are reached.
- Related Problems Across the Topology
  For any problem identified in a database instance, the diagnosability framework can identify related problems across the topology of your Oracle Database installation.

7.1.2.1 About Incidents and Problems

To facilitate diagnosis and resolution of critical errors, the fault diagnosability infrastructure introduces two concepts for Oracle Database: problems and incidents.

A **problem** is a critical error in a database instance, Oracle Automatic Storage Management (Oracle ASM) instance, or other Oracle product or component. Critical errors manifest as internal errors, such as `ORA-00600`, or other severe errors, such as `ORA-07445` (operating system exception) or `ORA-04031` (out of memory in the shared pool). Problems are tracked in the ADR. Each problem has a *problem key*, which is a text string that describes the problem. It includes an error code (such as `ORA 600`) and in some cases, one or more error parameters.

An **incident** is a single occurrence of a problem. When a problem (critical error) occurs multiple times, an incident is created for each occurrence. Incidents are timestamped and tracked in the Automatic Diagnostic Repository (ADR). Each incident is identified by a numeric incident ID, which is unique within the ADR. When an incident occurs, the database:

- Makes an entry in the alert log.

- Sends an *incident alert* to Cloud Control.
- Gathers first-failure diagnostic data about the incident in the form of dump files (incident dumps).
- Tags the incident dumps with the incident ID.
- Stores the incident dumps in an ADR subdirectory created for that incident.

Diagnosis and resolution of a critical error usually starts with an incident alert. Incident alerts are displayed on the Cloud Control Database Home page or Oracle Automatic Storage Management Home page. The Database Home page also displays in its Related Alerts section any critical alerts in the Oracle ASM instance or other Oracle products or components. After viewing an alert, you can then view the problem and its associated incidents with Cloud Control or with the ADRCI command-line utility.

See Also:

- "Viewing Problems with the Support Workbench"
- "About Investigating, Reporting, and Resolving a Problem"
- "ADRCI Command-Line Utility"

7.1.2.2 Incident Flood Control

It is conceivable that a problem could generate dozens or perhaps hundreds of incidents in a short period of time. This would generate too much diagnostic data, which would consume too much space in the ADR and could possibly slow down your efforts to diagnose and resolve the problem. For these reasons, the fault diagnosability infrastructure applies *flood control* to incident generation after certain thresholds are reached.

A **flood-controlled incident** is an incident that generates an alert log entry, is recorded in the ADR, but does not generate incident dumps. Flood-controlled incidents provide a way of informing you that a critical error is ongoing, without overloading the system with diagnostic data. You can choose to view or hide flood-controlled incidents when viewing incidents with Cloud Control or the ADRCI command-line utility.

Threshold levels for incident flood control are predetermined and cannot be changed. They are defined as follows:

- After five incidents occur for the same problem key in one hour, subsequent incidents for this problem key are flood-controlled. Normal (non-flood-controlled) recording of incidents for that problem key begins again in the next hour.
- After 25 incidents occur for the same problem key in one day, subsequent incidents for this problem key are flood-controlled. Normal recording of incidents for that problem key begins again on the next day.

In addition, after 50 incidents for the same problem key occur in one hour, or 250 incidents for the same problem key occur in one day, subsequent incidents for this problem key are not recorded at all in the ADR. In these cases, the database writes a message to the alert log indicating that no further incidents will be recorded. As long as incidents continue to be generated for this problem key, this message is added to the alert log every ten minutes until the hour or the day expires. Upon expiration of the hour or day, normal recording of incidents for that problem key begins again.

7.1.2.3 Related Problems Across the Topology

For any problem identified in a database instance, the diagnosability framework can identify related problems across the topology of your Oracle Database installation.

In a single instance environment, a related problem could be identified in the local Oracle ASM instance. In an Oracle RAC environment, a related problem could be identified in any database instance or Oracle ASM instance on any other node. When investigating problems, you are able to view and gather information on any related problems.

A problem is related to the original problem if it occurs within a designated time period or shares the same execution context identifier. An **execution context identifier (ECID)** is a globally unique identifier used to tag and track a single call through the Oracle software stack, for example, a call to Oracle Fusion Middleware that then calls into Oracle Database to retrieve data. The ECID is typically generated in the middle tier and is passed to the database as an Oracle Call Interface (OCI) attribute. When a single call has failures on multiple tiers of the Oracle software stack, problems that are generated are tagged with the same ECID so that they can be correlated. You can then determine the tier on which the originating problem occurred.

7.1.3 Fault Diagnosability Infrastructure Components

The fault diagnosability infrastructure consists of several components, including the Automatic Diagnostic Repository (ADR), various logs, trace files, the Enterprise Manager Support Workbench, and the ADRCI Command-Line Utility.

- Automatic Diagnostic Repository (ADR)
  The ADR is a file-based repository for database diagnostic data such as traces, dumps, the alert log, health monitor reports, and more. It has a unified directory structure across multiple instances and multiple products.
- Alert Log
  The alert log is an XML file that is a chronological log of messages and errors.
- Attention Log
  The attention log is a structured, externally modifiable file that contains information about critical and highly visible database events. Use the attention log to quickly access information about critical events that need action.
- Trace Files, Dumps, and Core Files
  Trace files, dumps, and core files contain diagnostic data that are used to investigate problems. They are stored in the ADR.
- DDL Log
  The data definition language (DDL) log is a file that has the same format and basic behavior as the alert log, but it only contains the DDL statements issued by the database.
- Debug Log
  An Oracle Database component can detect conditions, states, or events that are unusual, but which do not inhibit correct operation of the detecting component. The component can issue a warning about these conditions, states, or events. The debug log is a file that records these warnings.
- Other ADR Contents
  In addition to files mentioned in the previous sections, the ADR contains health monitor reports, data repair records, SQL test cases, incident packages, and more. These components are described later in the chapter.

- Enterprise Manager Support Workbench
  The Enterprise Manager Support Workbench (Support Workbench) is a facility that enables you to investigate, report, and in some cases, repair problems (critical errors), all with an easy-to-use graphical interface.
- ADRCI Command-Line Utility
  The ADR Command Interpreter (ADRCI) is a utility that enables you to investigate problems, view health check reports, and package first-failure diagnostic data, all within a command-line environment.

7.1.3.1 Automatic Diagnostic Repository (ADR)

The ADR is a file-based repository for database diagnostic data such as traces, dumps, the alert log, health monitor reports, and more. It has a unified directory structure across multiple instances and multiple products.

The database, Oracle Automatic Storage Management (Oracle ASM), the listener, Oracle Clusterware, and other Oracle products or components store all diagnostic data in the ADR. Each instance of each product stores diagnostic data underneath its own home directory within the ADR. For example, in an Oracle Real Application Clusters environment with shared storage and Oracle ASM, each database instance and each Oracle ASM instance has an ADR home directory. ADR's unified directory structure, consistent diagnostic data formats across products and instances, and a unified set of tools enable customers and Oracle Support to correlate and analyze diagnostic data across multiple instances. With Oracle Clusterware, each host node in the cluster has an ADR home directory.

Starting with Oracle Database 23ai, several improvements have been made to make problem diagnosis better. These improvements include:

- **Attention Log** - entries are more verbose and provide more detail for the database administrator. Entries now include attributes such as urgency, target user, a verbose description of the event, a detailed solution to the event, and more.
- **Debug Log** - all log entries that are **not** database administrator or customer focused are now recorded in the debug log instead of the alert log.
- **Trace Content Classification** - every trace entry is now categorized with a label that denotes the type of content written. There are 10 categories denoting highest to lowest security categorization. You may filter the data by security categorization to be selected and packaged for analysis by Oracle for further diagnosis.
- **Trace File Limits and Segmentation** - trace files created by the database will no longer default to unlimited size. Segmentation and rotation of the files has been enabled. There is now an upper limit of 1GB per foreground process and 10GB per background process, equally divided into 5 segments resulting in 200MB per segment for foreground processes and 2GB per background process. Any further traces generated will create new segments and delete the older segments. The first segment is preserved, and only last four segments are rotated.

  Trace files are limited to 32MB each for the Oracle Database Free Edition.

  The initialization parameter `MAX_DUMP_FILE_SIZE`, which controls the trace file size, defaults to 1GB per foreground process and 10GB per background process for Oracle Database Enterprise Edition and other editions, except the Free Edition, which default to 32MB.
- **Trace Content Suppression** - repetitive or excessive content is no longer written to the traces.

> **Note:**
>
> Because all diagnostic data, including the alert log, are stored in the ADR, the initialization parameters `BACKGROUND_DUMP_DEST` and `USER_DUMP_DEST` are deprecated. They are replaced by the initialization parameter `DIAGNOSTIC_DEST`, which identifies the location of the ADR.

Related Topics

- Structure, Contents, and Location of the Automatic Diagnostic Repository
  The Automatic Diagnostic Repository (ADR) is a directory structure that is stored outside of the database. It is therefore available for problem diagnosis when the database is down.

7.1.3.2 Alert Log

The alert log is an XML file that is a chronological log of messages and errors.

There is one alert log in each ADR home. Each alert log is specific to its component type, such as database, Oracle ASM, listener, and Oracle Clusterware.

For the database, the alert log includes messages about the following:

- Critical errors (incidents)
- Administrative operations, such as starting up or shutting down the database, recovering the database, creating or dropping a tablespace, and others.
- Errors during automatic refresh of a materialized view
- Other database events

You can view the alert log in text format (with the XML tags stripped) with Cloud Control and with the ADRCI utility. There is also a text-formatted version of the alert log stored in the ADR for backward compatibility. However, Oracle recommends that any parsing of the alert log contents be done with the XML-formatted version, because the text format is unstructured and may change from release to release.

> **See Also:**
>
> - "ADRCI Command-Line Utility"
> - "Viewing the Alert Log"

7.1.3.3 Attention Log

The attention log is a structured, externally modifiable file that contains information about critical and highly visible database events. Use the attention log to quickly access information about critical events that need action.

There is one attention log for each database instance. The attention log contains a pre-determined, translatable series of messages, with one message for each event. Some important attributes of a message are as follows:

- Attention ID: A unique identifier for the message.

- Attention type: The type of attention message. Possible values are Error, Warning, Notification, or Additional information. The attention type can be modified dynamically.
- Message text
- Urgency: Possible values are Immediate, Soon, Deferrable, or Information.
- Scope: Possible values are Session, Process, PDB Instance, CDB Instance, CDB Cluster, PDB (for issues in persistent storage that a database restart will not fix), or CDB (for issues in persistent storage that a database restart will not fix).
- Target user: The user who must act on this attention log message. Possible values are Clusterware Admin, CDB admin, or PDB admin.
- Cause
- Action

Contents of the Attention Log

The following is an example of an attention log message that needs immediate action.

```
{
IMMEDIATE : "PMON (ospid: 3565): terminating the instance due to ORA error
822"
CAUSE: "PMON detected fatal background process death"
ACTION: "Termination of fatal background is not recommended, Investigate
cause of process termination"
CLASS : CDB-INSTANCE / CDB_ADMIN / ERROR / DBAL-35782660
TIME : 2020-03-28T14:15:16.159-07:00
INFO : "Some additional data on error PMON error"
}
```

Related Topics

- Viewing Attention Log Information
  Access information stored in the attention log either by opening the file with any text editor or by querying the `V$DIAG_ATTENTION` view.

7.1.3.4 Trace Files, Dumps, and Core Files

Trace files, dumps, and core files contain diagnostic data that are used to investigate problems. They are stored in the ADR.

- Trace Files
  Each server and background process can write to an associated trace file. Trace files are updated periodically over the life of the process and can contain information on the process environment, status, activities, and errors. In addition, when a process detects a critical error, it writes information about the error to its trace file.
- Dumps
  A dump is a specific type of trace file. A dump is typically a one-time output of diagnostic data in response to an event (such as an incident), whereas a trace tends to be continuous output of diagnostic data.
- Core Files
  A core file contains a memory dump, in an all-binary, port-specific format.

7.1.3.4.1 Trace Files

Each server and background process can write to an associated trace file. Trace files are updated periodically over the life of the process and can contain information on the process environment, status, activities, and errors. In addition, when a process detects a critical error, it writes information about the error to its trace file.

The SQL trace facility also creates trace files, which provide performance information on individual SQL statements. You can enable SQL tracing for a session or an instance.

Trace file names are platform-dependent. Typically, database background process trace file names contain the Oracle SID, the background process name, and the operating system process number, while server process trace file names contain the Oracle SID, the string "ora", and the operating system process number. The file extension is `.trc`. An example of a server process trace file name is orcl_ora_344.trc. Trace files are sometimes accompanied by corresponding trace metadata (`.trm`) files, which contain structural information about trace files and are used for searching and navigation.

Starting with Oracle Database 21c, all trace file records contain a prefix that is used to classify records. The prefix indicates the level of sensitivity of each trace record. This helps in enhancing security.

Oracle Database includes tools that help you analyze trace files. For more information on application tracing, SQL tracing, and tracing tools, see *Oracle Database SQL Tuning Guide*.

Related Topics

- Finding Trace Files
  Trace files are stored in the Automatic Diagnostic Repository (ADR), in the `trace` directory under each ADR home. To help you locate individual trace files within this directory, you can use data dictionary views. For example, you can find the path to your current session's trace file or to the trace file for each Oracle Database process.

7.1.3.4.2 Dumps

A dump is a specific type of trace file. A dump is typically a one-time output of diagnostic data in response to an event (such as an incident), whereas a trace tends to be continuous output of diagnostic data.

When an incident occurs, the database writes one or more dumps to the incident directory created for the incident. Incident dumps also contain the incident number in the file name.

7.1.3.4.3 Core Files

A core file contains a memory dump, in an all-binary, port-specific format.

Core file names include the string "core" and the operating system process ID. Core files are useful to Oracle Support engineers only. Core files are not found on all platforms.

7.1.3.5 DDL Log

The data definition language (DDL) log is a file that has the same format and basic behavior as the alert log, but it only contains the DDL statements issued by the database.

The DDL log is created only for the RDBMS component and only if the `ENABLE_DDL_LOGGING` initialization parameter is set to `TRUE`. When this parameter is set to `FALSE`, DDL statements are not included in any log.

The DDL log contains one log record for each DDL statement issued by the database. The DDL log is included in IPS incident packages.

There are two DDL logs that contain the same information. One is an XML file, and the other is a text file. The DDL log is stored in the log/ddl subdirectory of the ADR home.

> **See Also:**
>
> *Oracle Database Reference* for more information about the `ENABLE_DDL_LOGGING` initialization parameter

7.1.3.6 Debug Log

An Oracle Database component can detect conditions, states, or events that are unusual, but which do not inhibit correct operation of the detecting component. The component can issue a warning about these conditions, states, or events. The debug log is a file that records these warnings.

These warnings recorded in the debug log are not serious enough to warrant an incident or a write to the alert log. They do warrant a record in a log file because they might be needed to diagnose a future problem.

The debug log has the same format and basic behavior as the alert log, but it only contains information about possible problems that might need to be corrected.

The debug log reduces the amount of information in the alert log and trace files. It also improves the visibility of debug information.

The debug log is included in IPS incident packages. The debug log's contents are intended for Oracle Support. Database administrators should not use the debug log directly.

> **Note:**
>
> Because there is a separate debug log starting with Oracle Database 12*c*, the alert log and the trace files are streamlined. They now contain fewer warnings of the type that are recorded in the debug log.

7.1.3.7 Other ADR Contents

In addition to files mentioned in the previous sections, the ADR contains health monitor reports, data repair records, SQL test cases, incident packages, and more. These components are described later in the chapter.

7.1.3.8 Enterprise Manager Support Workbench

The Enterprise Manager Support Workbench (Support Workbench) is a facility that enables you to investigate, report, and in some cases, repair problems (critical errors), all with an easy-to-use graphical interface.

The Support Workbench provides a self-service means for you to gather first-failure diagnostic data, obtain a support request number, and upload diagnostic data to Oracle Support with a

minimum of effort and in a very short time, thereby reducing time-to-resolution for problems. The Support Workbench also recommends and provides easy access to Oracle advisors that help you repair SQL-related problems, data corruption problems, and more.

7.1.3.9 ADRCI Command-Line Utility

The ADR Command Interpreter (ADRCI) is a utility that enables you to investigate problems, view health check reports, and package first-failure diagnostic data, all within a command-line environment.

You can then upload the package to Oracle Support. ADRCI also enables you to view the names of the trace files in the ADR, and to view the alert log with XML tags stripped, with and without content filtering.

For more information on ADRCI, see *Oracle Database Utilities*.

7.1.4 Structure, Contents, and Location of the Automatic Diagnostic Repository

The Automatic Diagnostic Repository (ADR) is a directory structure that is stored outside of the database. It is therefore available for problem diagnosis when the database is down.

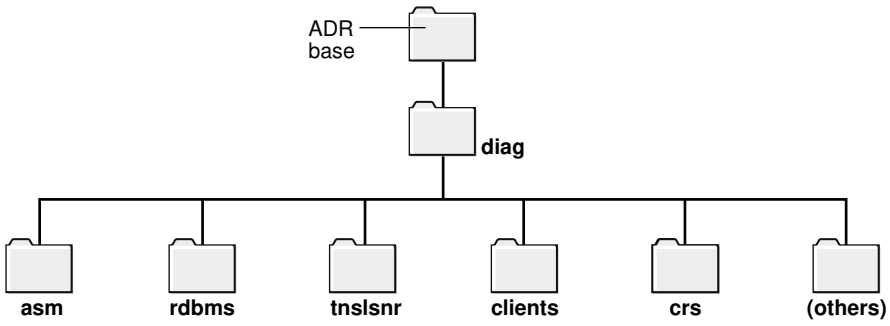
The ADR root directory is known as **ADR base**. Its location is set by the `DIAGNOSTIC_DEST` initialization parameter. If this parameter is omitted or left null, the database sets `DIAGNOSTIC_DEST` upon startup as follows:

- If environment variable `ORACLE_BASE` is set, `DIAGNOSTIC_DEST` is set to the directory designated by `ORACLE_BASE`.
- If environment variable `ORACLE_BASE` is not set, `DIAGNOSTIC_DEST` is set to *ORACLE_HOME*/log.

Within ADR base, there can be multiple ADR homes, where each ADR home is the root directory for all diagnostic data—traces, dumps, the alert log, and so on—for a particular instance of a particular Oracle product or component. For example, in an Oracle Real Application Clusters environment with Oracle ASM, each database instance, Oracle ASM instance, and listener has an ADR home.

ADR homes reside in ADR base subdirectories that are named according to the product or component type. Figure 7-1 illustrates these top-level subdirectories.

Figure 7-1 Product/Component Type Subdirectories in the ADR



> **Note:**
>
> Additional subdirectories might be created in the ADR depending on your configuration. Some products automatically purge expired diagnostic data from ADR. For other products, you can use the ADRCI utility `PURGE` command at regular intervals to purge expired diagnostic data.

The location of each ADR home is given by the following path, which starts at the ADR base directory:

`diag/product_type/product_id/instance_id`

As an example, Table 7-1 lists the values of the various path components for an Oracle Database instance.

Table 7-1 ADR Home Path Components for Oracle Database

Path Component	Value for Oracle Database
product_type	rdbms
product_id	*DB_UNIQUE_NAME*
instance_id	*SID*

For example, for a database with a SID and database unique name both equal to `orclbi`, the ADR home would be in the following location:

ADR_base`/diag/rdbms/orclbi/orclbi/`

Similarly, the ADR home path for the Oracle ASM instance in a single-instance environment would be:

ADR_base`/diag/asm/+asm/+asm/`

ADR Home Subdirectories

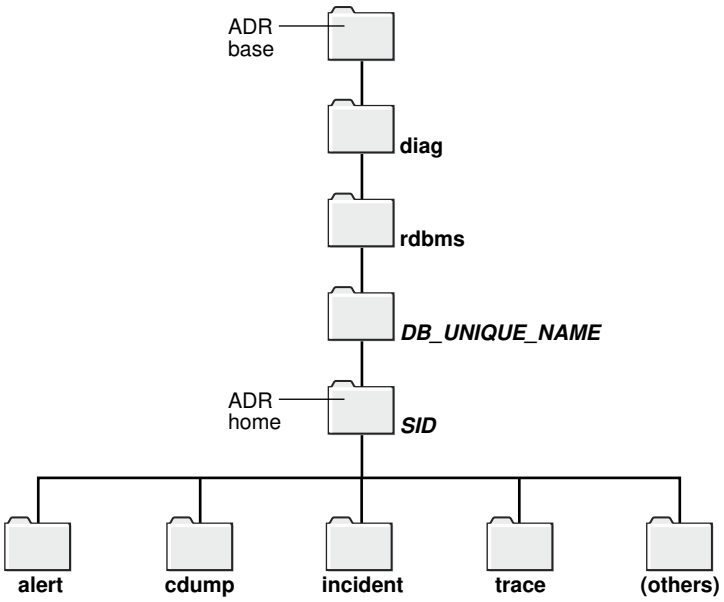
Within each ADR home directory are subdirectories that contain the diagnostic data. Table 7-2 lists some of these subdirectories and their contents.

Table 7-2 ADR Home Subdirectories

Subdirectory Name	Contents
alert	The XML-formatted alert log
cdump	Core files
incident	Multiple subdirectories, where each subdirectory is named for a particular incident, and where each contains dumps pertaining only to that incident
trace	Background and server process trace files, SQL trace files, and the text-formatted alert log
(others)	Other subdirectories of ADR home, which store incident packages, health monitor reports, logs other than the alert log (such as the DDL log and the debug log), and other information

Figure 7-2 illustrates the complete directory hierarchy of the ADR for a database instance.

Figure 7-2 ADR Directory Structure for a Database Instance



ADR in an Oracle Clusterware Environment

Oracle Clusterware uses ADR and has its own Oracle home and Oracle base. The ADR directory structure for Oracle Clusterware is different from that of a database instance. There is only one instance of Oracle Clusterware on a system, so Clusterware ADR homes use only a system's host name as a differentiator.

When Oracle Clusterware is configured, the ADR home uses `crs` for both the product type and the instance ID, and the system host name is used for the product ID. Thus, on a host named `dbprod01`, the CRS ADR home would be:

ADR_base`/diag/crs/dbprod01/crs/`

> **See Also:**
>
> *Oracle Clusterware Administration and Deployment Guide*

ADR in an Oracle Real Application Clusters Environment

In an Oracle Real Application Clusters (Oracle RAC) environment, each node can have ADR base on its own local storage, or ADR base can be set to a location on shared storage. You can use ADRCI to view aggregated diagnostic data from all instances on a single report.

ADR in Oracle Client

Each installation of Oracle Client includes an ADR for diagnostic data associated with critical failures in any of the Oracle Client components. The ADRCI utility is installed with Oracle Client so that you can examine diagnostic data and package it to enable it for upload to Oracle Support.

Viewing ADR Locations with the V$DIAG_INFO View

The `V$DIAG_INFO` view lists all important ADR locations for the current Oracle Database instance.

```
SELECT * FROM V$DIAG_INFO;

INST_ID NAME                 VALUE
------- -------------------- ----------------------------------------------------------
      1 Diag Enabled         TRUE
      1 ADR Base             /u01/oracle
      1 ADR Home             /u01/oracle/diag/rdbms/orclbi/orclbi
      1 Diag Trace           /u01/oracle/diag/rdbms/orclbi/orclbi/trace
      1 Diag Alert           /u01/oracle/diag/rdbms/orclbi/orclbi/alert
      1 Diag Incident        /u01/oracle/diag/rdbms/orclbi/orclbi/incident
      1 Diag Cdump           /u01/oracle/diag/rdbms/orclbi/orclbi/cdump
      1 Health Monitor       /u01/oracle/diag/rdbms/orclbi/orclbi/hm
      1 Default Trace File   /u01/oracle/diag/rdbms/orclbi/orclbi/trace/orcl_ora_22769.trc
      1 Active Problem Count 8
      1 Active Incident Count 20
```

The following table describes some of the information displayed by this view.

Table 7-3 Data in the V$DIAG_INFO View

Name	Description
ADR Base	Path of ADR base
ADR Home	Path of ADR home for the current database instance
Diag Trace	Location of background process trace files, server process trace files, SQL trace files, and the text-formatted version of the alert log
Diag Alert	Location of the XML-formatted version of the alert log
Default Trace File	Path to the trace file for the current session

Viewing Critical Errors with the V$DIAG_CRITICAL_ERROR View

The `V$DIAG_CRITICAL_ERROR` view lists all of the non-internal errors designated as critical errors for the current Oracle Database release. The view does not list internal errors because internal errors are always designated as critical errors.

The following example shows the output for the `V$DIAG_CRITICAL_ERROR` view:

```
SELECT * FROM V$DIAG_CRITICAL_ERROR;

FACILITY   ERROR
---------- ----------------------------------------------------------------
ORA        7445
ORA        4030
ORA        4031
ORA        29740
ORA        255
ORA        355
ORA        356
ORA        239
ORA        240
ORA        494
ORA        3137
ORA        227
```

```
ORA         353
ORA         1578
ORA         32701
ORA         32703
ORA         29770
ORA         29771
ORA         445
ORA         25319
OCI         3106
OCI         3113
OCI         3135
```

The following table describes the information displayed by this view.

Table 7-4 Data in the V$DIAG_CRITICAL_ERROR View

Column	Description
FACILITY	The facility that can report the error, such as Oracle Database (ORA) or Oracle Call Interface (OCI)
ERROR	The error number

> **See Also:**
>
> "About Incidents and Problems" for more information about internal errors

7.2 About Investigating, Reporting, and Resolving a Problem

You can use the Enterprise Manager Support Workbench (Support Workbench) to investigate and report a problem (critical error), and in some cases, resolve the problem. You can use a "roadmap" that summarizes the typical set of tasks that you must perform.

> **Note:**
>
> The tasks described in this section are all Cloud Control–based. You can also accomplish all of these tasks (or their equivalents) with the ADRCI command-line utility, with PL/SQL packages such as DBMS_HM and DBMS_SQLDIAG, and with other software tools. See *Oracle Database Utilities* for more information on the ADRCI utility, and see *Oracle Database PL/SQL Packages and Types Reference* for information on PL/SQL packages.

- Roadmap — Investigating, Reporting, and Resolving a Problem
  You can begin investigating a problem by starting from the Support Workbench home page in Cloud Control. However, the more typical workflow begins with a critical error alert on the Database Home page.
- Task 1: View Critical Error Alerts in Cloud Control
  You begin the process of investigating problems (critical errors) by reviewing critical error alerts on the Database Home page or Oracle Automatic Storage Management Home page.

- Task 2: View Problem Details
  You continue your investigation from the Incident Manager Problem Details page.
- Task 3: (Optional) Gather Additional Diagnostic Information
  You can perform the following activities to gather additional diagnostic information for a problem. This additional information is then automatically included in the diagnostic data uploaded to Oracle Support. If you are unsure about performing these activities, then check with your Oracle Support representative.
- Task 4: (Optional) Create a Service Request
  At this point, you can create an Oracle Support service request and record the service request number with the problem information.
- Task 5: Package and Upload Diagnostic Data to Oracle Support
  For this task, you use the quick packaging process of the Support Workbench to package and upload the diagnostic information for the problem to Oracle Support.
- Task 6: Track the Service Request and Implement Any Repairs
  After uploading diagnostic information to Oracle Support, you might perform various activities to track the service request, to collect additional diagnostic information, and to implement repairs.

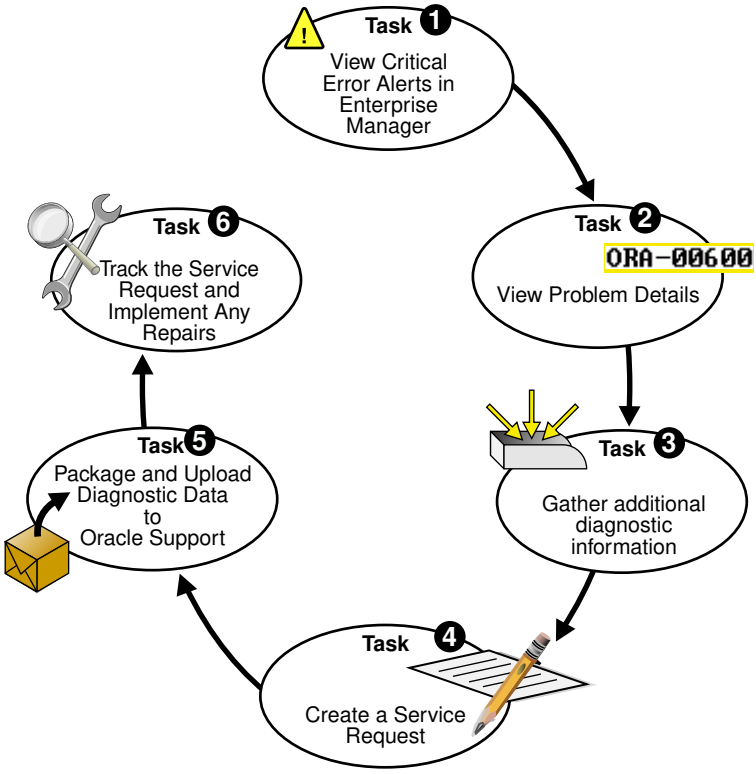
> **See Also:**
>
> "About the Oracle Database Fault Diagnosability Infrastructure" for more information on problems and their diagnostic data

7.2.1 Roadmap — Investigating, Reporting, and Resolving a Problem

You can begin investigating a problem by starting from the Support Workbench home page in Cloud Control. However, the more typical workflow begins with a critical error alert on the Database Home page.

Figure 7-3 illustrates the tasks that you complete to investigate, report, and in some cases, resolve a problem.

Figure 7-3 Workflow for Investigating, Reporting, and Resolving a Problem



The following are task descriptions. Subsequent sections provide details for each task.

- **Task 1: View Critical Error Alerts in Cloud Control**

  Start by accessing the Database Home page in Cloud Control and reviewing critical error alerts. Select an alert for which to view details, and then go to the Problem Details page.

- **Task 2: View Problem Details**

  Examine the problem details and view a list of all incidents that were recorded for the problem. Display findings from any health checks that were automatically run.

- **Task 3: (Optional) Gather Additional Diagnostic Information**

  Optionally run additional health checks or other diagnostics. For SQL-related errors, optionally invoke the SQL Test Case Builder, which gathers all required data related to a SQL problem and packages the information in a way that enables the problem to be reproduced at Oracle Support.

- **Task 4: (Optional) Create a Service Request**

  Optionally create a service request with My Oracle Support and record the service request number with the problem information. If you skip this step, you can create a service request later, or the Support Workbench can create one for you.

- **Task 5: Package and Upload Diagnostic Data to Oracle Support**

  Invoke a guided workflow (a *wizard*) that automatically packages the gathered diagnostic data for a problem and uploads the data to Oracle Support.

- **Task 6: Track the Service Request and Implement Any Repairs**

Optionally maintain an activity log for the service request in the Support Workbench. Run Oracle advisors to help repair SQL failures or corrupted data.

> **See Also:**
>
> "Viewing Problems with the Support Workbench"

7.2.2 Task 1: View Critical Error Alerts in Cloud Control

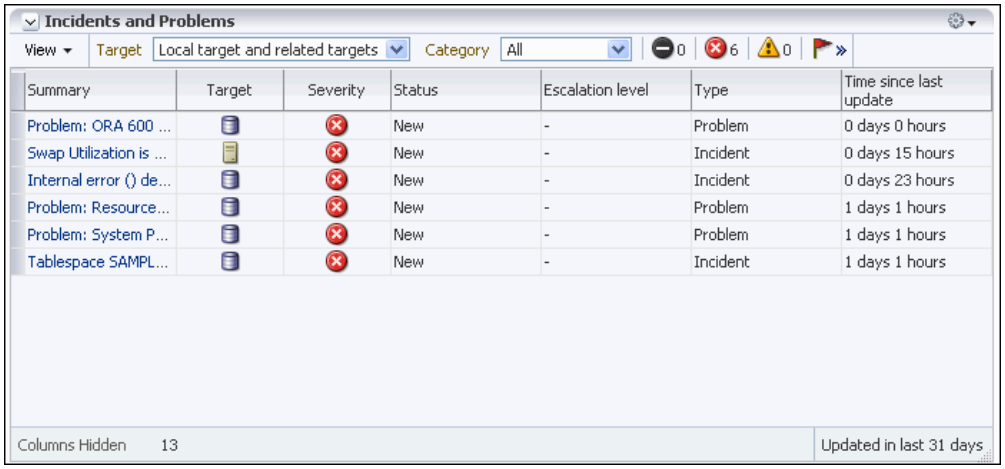
You begin the process of investigating problems (critical errors) by reviewing critical error alerts on the Database Home page or Oracle Automatic Storage Management Home page.

To view critical error alerts:

1. Access the Database Home page in Cloud Control.
2. View the alerts in the Incidents and Problems section.

   If necessary, click the hide/show icon next to the Alerts heading to display the alerts.

   Also, in the Category list, you can select a particular category to view alerts for only that category.



3. In the Summary column, click the message of the critical error alert that you want to investigate.

   The General subpage of the Incident Manager Problem Details page appears. This page includes:

   - Problem details
   - Controls that allow you to acknowledge, clear, or record a comment about the alert in the Tracking section
   - Links that enable you to diagnose the problem using Support Workbench and package the diagnostics in the Guided Resolution section.

   Other sections might appear depending on the type of problem you are investigating.

   To view more information about the problem, click the following subpages on the Incident Manager Problem Details page:

- The Incidents subpage contains information about individual incidents for the problem.
- The My Oracle Support Knowledge subpage provides access to My Oracle Support for more information about the problem.
- The Updates subpage shows any updates entered about the problem.
- The Related Problems subpage shows other open problems with the same problem key as the current problem.

4. Perform one of the following actions:
   - To view the details of the problem associated with the critical error alert that you are investigating, proceed with "Task 2: View Problem Details".
   - If there are several related problems and you want to view more information about them, then complete these steps:
     – View problems and incidents as described in "Viewing Problems with the Support Workbench".
     – Select a single problem and view problem details, as described in "Viewing Problems with the Support Workbench".
     – Continue with "Task 3: (Optional) Gather Additional Diagnostic Information".

7.2.3 Task 2: View Problem Details

You continue your investigation from the Incident Manager Problem Details page.

To view problem details:

1. On the General subpage of the Incident Manager Problem Details page, click **Support Workbench: Problem Details** in the Diagnostics subsection.

   The Support Workbench Problem Details page appears.

2. (Optional) Complete one or more of the following actions:
   - In the Investigate and Resolve section, under Diagnose, click Related Problems Across Topology.

     A page appears showing any related problems in the local Oracle Automatic Storage Management (Oracle ASM) instance, or in the database or Oracle ASM instances on other nodes in an Oracle Real Application Clusters environment. This step is recommended if any critical alerts appear in the Related Alerts section on the Cloud Control Database Home page.

     See "Related Problems Across the Topology" for more information.
   - To view incident details, in the Incidents subpage, select an incident, and then click **View**.

     The Incident Details page appears, showing the Dump Files subpage.
   - On the Incident Details page, select **Checker Findings** to view the Checker Findings subpage.

     This page displays findings from any health checks that were automatically run when the critical error was detected.

7.2.4 Task 3: (Optional) Gather Additional Diagnostic Information

You can perform the following activities to gather additional diagnostic information for a problem. This additional information is then automatically included in the diagnostic data

uploaded to Oracle Support. If you are unsure about performing these activities, then check with your Oracle Support representative.

- Manually invoke additional health checks.

  See "Identifying Problems Proactively with Health Monitor".

- Invoke the SQL Test Case Builder.

  See "Creating Test Cases with SQL Test Case Builder".

7.2.5 Task 4: (Optional) Create a Service Request

At this point, you can create an Oracle Support service request and record the service request number with the problem information.

If you choose to skip this task, then the Support Workbench will automatically create a draft service request for you in "Task 5: Package and Upload Diagnostic Data to Oracle Support".

To create a service request:

1. From the Enterprise menu, select **My Oracle Support**, then **Service Requests**.

   The My Oracle Support Login and Registration page appears.

2. Log in to My Oracle Support and create a service request in the usual manner.

   (Optional) Remember the service request number (SR#) for the next step.

3. (Optional) Return to the Problem Details page, and then do the following:

   a. In the Summary section, click the **Edit** button that is adjacent to the SR# label.

   b. Enter the SR#, and then click **OK**.

   The SR# is recorded in the Problem Details page. This is for your reference only. See "Viewing Problems with the Support Workbench" for information about returning to the Problem Details page.

7.2.6 Task 5: Package and Upload Diagnostic Data to Oracle Support

For this task, you use the quick packaging process of the Support Workbench to package and upload the diagnostic information for the problem to Oracle Support.

Quick packaging has a minimum of steps, organized in a guided workflow (a wizard). The wizard assists you with creating an incident package (package) for a single problem, creating a zip file from the package, and uploading the file. With quick packaging, you are not able to edit or otherwise customize the diagnostic information that is uploaded. However, quick packaging is the more direct, straightforward method to package and upload diagnostic data.

To edit or remove sensitive data from the diagnostic information, enclose additional user files (such as application configuration files or scripts), or perform other customizations before uploading, you must use the custom packaging process, which is a more manual process and has more steps. See "Reporting Problems" for instructions. If you choose to follow those instructions instead of the instructions here in Task 5, do so now and then continue with Task 6: Track the Service Request and Implement Any Repairs when you are finished.

To package and upload diagnostic data to Oracle Support:

1. On the Support Workbench Problem Details page, in the Investigate and Resolve section, click **Quick Package**.

   The Create New Package page of the Quick Packaging wizard appears.

> **Note:**
>
> See "Viewing Problems with the Support Workbench" for instructions for returning to the Problem Details page if you are not already there.

2. (Optional) Enter a package name and description.
3. Fill in any remaining fields on the page. If you have created a service request for this problem, then select the **No** option button for Create new Service Request (SR).

   If you select the **Yes** option button for Create new Service Request (SR), then the Quick Packaging wizard creates a draft service request on your behalf. You must later log in to My Oracle Support and fill in the details of the service request.

   Click **Next**.

   The Quick Packaging wizard displays a page indicating that it is processing the command to create a new package. When it finished, the Quick Packaging: View Contents page is displayed.
4. Review the contents on the View Contents page, making a note of the size of the created package, then click **Next**.

   The Quick Packaging: View Manifest page appears.
5. Review the information on this page, making a note of the location of the manifest (listed next to the heading Path). After you have reviewed the information, click **Next**.

   The Quick Packaging: Schedule page appears.
6. Choose either **Immediately**, or **Later**. If you select **Later**, then you provide additional information about the time the package should be submitted to My Oracle Support. After you have made your choice and provided any necessary information, click **Submit**.

   The Processing: Packaging and Sending the Package progress page appears.

When the Quick Packaging wizard is complete, if a new draft service request was created, then the confirmation message contains a link to the draft service request in My Oracle Support in Cloud Control. You can review and edit the service request by clicking the link.

The package created by the Quick Packaging wizard remains available in the Support Workbench. You can then modify it with custom packaging operations (such as adding new incidents) and upload again at a later time. See "Viewing and Modifying Incident Packages".

7.2.7 Task 6: Track the Service Request and Implement Any Repairs

After uploading diagnostic information to Oracle Support, you might perform various activities to track the service request, to collect additional diagnostic information, and to implement repairs.

Among these activities are the following:

- Adding an Oracle bug number to the problem information.

  To do so, on the Problem Details page, click the **Edit** button that is adjacent to the Bug# label. This is for your reference only.
- Adding comments to the problem activity log.

  You may want to do this to share problem status or history information with other DBAs in your organization. For example, you could record the results of your conversations with Oracle Support. To add comments, complete the following steps:

1. Access the Problem Details page for the problem, as described in "Viewing Problems with the Support Workbench".
2. Click **Activity Log** to display the Activity Log subpage.
3. In the Comment field, enter a comment, and then click **Add Comment**.

   Your comment is recorded in the activity log.

- As new incidents occur, adding them to the package and reuploading.

  For this activity, you must use the custom packaging method described in "Reporting Problems".
- Running health checks.

  See "Identifying Problems Proactively with Health Monitor".
- Running a suggested Oracle advisor to implement repairs.

  Access the suggested advisor in one of the following ways:
  - **Problem Details page**—In the Self-Service tab of the Investigate and Resolve section
  - **Support Workbench home page**—on the Checker Findings subpage
  - **Incident Details page**—on the Checker Findings subpage

  Table 7-5 lists the advisors that help repair critical errors.

Table 7-5 Oracle Advisors that Help Repair Critical Errors

Advisor	Critical Errors Addressed	See
Data Recovery Advisor	Corrupted blocks, corrupted or missing files, and other data failures	"Repairing Data Corruptions with the Data Recovery Advisor"
SQL Repair Advisor	SQL statement failures	"Repairing SQL Failures with the SQL Repair Advisor"

> **See Also:**
>
> "Viewing Problems with the Support Workbench" for instructions for viewing the Checker Findings subpage of the Incident Details page

7.3 Diagnosing Problems

This section describes various methods to diagnose problems in an Oracle database.

- Identifying Problems Reactively
  This section describes how to identify Oracle database problems reactively.
- Identifying Problems Proactively with Health Monitor
  You can run diagnostic checks on a database with Health Monitor.
- Gathering Additional Diagnostic Data
  This section describes how to gather additional diagnostic data using alert log and trace files.

- Creating Test Cases with SQL Test Case Builder
  SQL Test Case Builder is a tool that automatically gathers information needed to reproduce the problem in a different database instance.

7.3.1 Identifying Problems Reactively

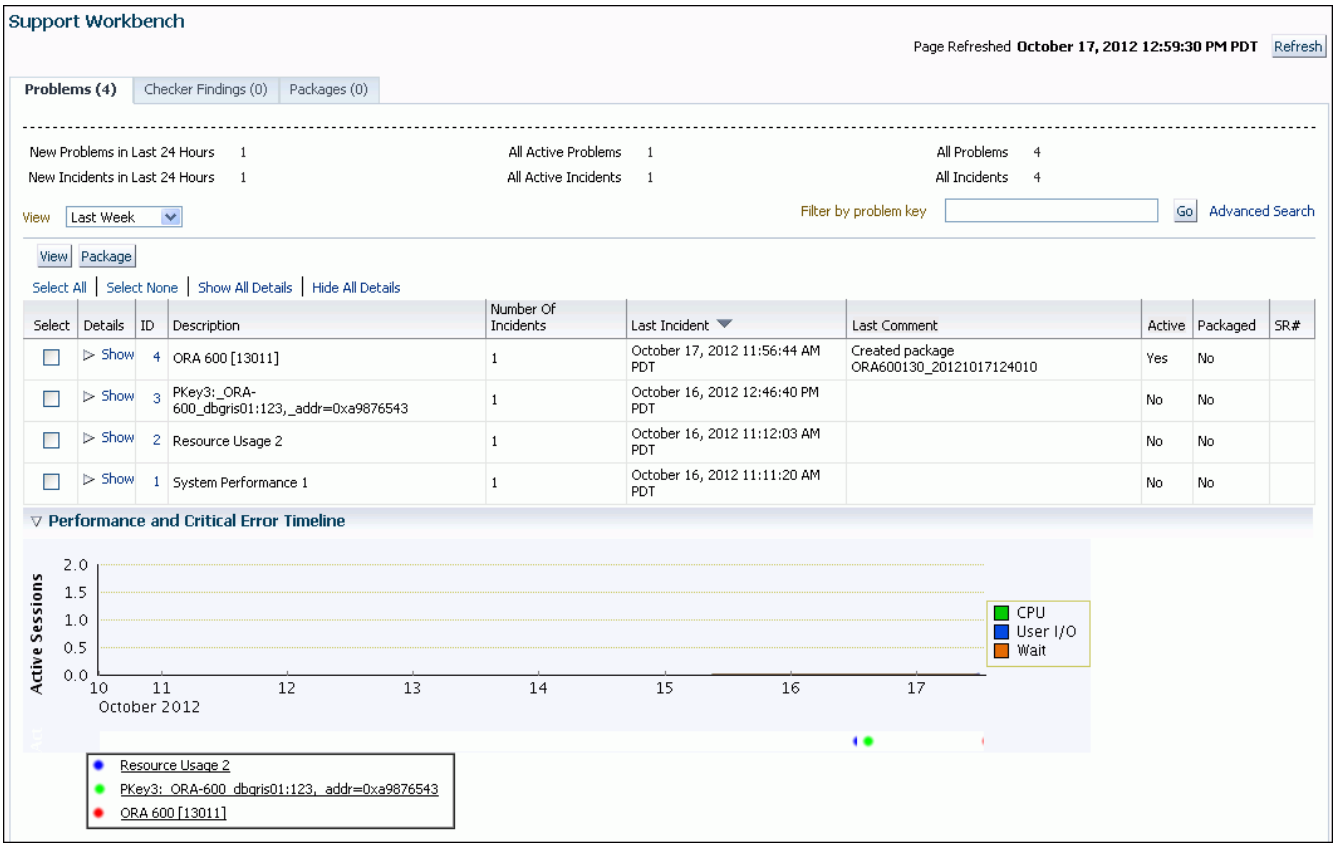
This section describes how to identify Oracle database problems reactively.

- Viewing Problems with the Support Workbench
  You can use the Support Workbench home page in Cloud Control to view all the problems or the problems in a specific time period.
- Adding Problems Manually to the Automatic Diagnostic Repository
  You can use Support Workbench in Cloud Control to manually add a problem to the ADR.
- Creating Incidents Manually
  You can create incidents manually by using the Automatic Diagnostic Repository Command Interpreter (ADRCI) utility.
- Using DBMS_HCHECK to Identify Data Dictionary Inconsistencies
  DBMS_HCHECK is a read-only and lightweight PL/SQL package procedure that helps you identify database dictionary inconsistencies.

7.3.1.1 Viewing Problems with the Support Workbench

You can use the Support Workbench home page in Cloud Control to view all the problems or the problems in a specific time period.

Figure 7-4 Support Workbench Home Page in Cloud Control



To access the Support Workbench home page (database or Oracle ASM):

1. Access the Database Home page in Cloud Control.
2. From the Oracle Database menu, select **Diagnostics**, then **Support Workbench**.

   The Support Workbench home page for the database instance appears, showing the Problems subpage. By default the problems from the last 24 hours are displayed.
3. To view the Support Workbench home page for the Oracle ASM instance, click the link **Support Workbench (+ASM_*hostname*)** in the Related Links section.

To view problems and incidents:

1. On the Support Workbench home page, select the desired time period from the View list. To view all problems, select **All**.
2. (Optional) If the Performance and Critical Error Timeline section is hidden, click the **Show/Hide** icon adjacent to the section heading to show the section.

   This section enables you to view any correlation between performance changes and incident occurrences.
3. (Optional) Under the Details column, click **Show** to display a list of all incidents for a problem, and then click an incident ID to display the Incident Details page.

To view details for a particular problem:

1. On the Support Workbench home page, select the problem, and then click **View**.

   The Problem Details page appears, showing the Incidents subpage. The incidents subpage shows all incidents that are open and that generated dumps—that is, that were not flood-controlled.
2. (Optional) To view both normal and flood-controlled incidents, select **All** in the Data Dumped list.
3. (Optional) To view details for an incident, select the incident, and then click **View**.

   The Incident Details page appears.
4. (Optional) On the Incident Details page, to view checker findings for the incident, click **Checker Findings**.
5. (Optional) On the Incident Details page, to view the user actions that are available to you for the incident, click **Additional Diagnostics**. Each user action provides a way for you to gather additional diagnostics for the incident or its problem.

> **See Also:**
>
> "Incident Flood Control"

7.3.1.2 Adding Problems Manually to the Automatic Diagnostic Repository

You can use Support Workbench in Cloud Control to manually add a problem to the ADR.

System-generated problems, such as critical errors generated internally to the database are automatically added to the Automatic Diagnostic Repository (ADR) and tracked in the Support Workbench.

From the Support Workbench, you can gather additional diagnostic data on these problems, upload diagnostic data to Oracle Support, and in some cases, resolve the problems, all with the easy-to-use workflow that is explained in "About Investigating, Reporting, and Resolving a Problem".

There may be a situation in which you want to manually add a problem that you noticed to the ADR, so that you can put that problem through that same workflow. An example of such a situation might be a global database performance problem that was not diagnosed by Automatic Diagnostic Database Monitor (ADDM). The Support Workbench includes a mechanism for you to create and work with such a user-reported problem.

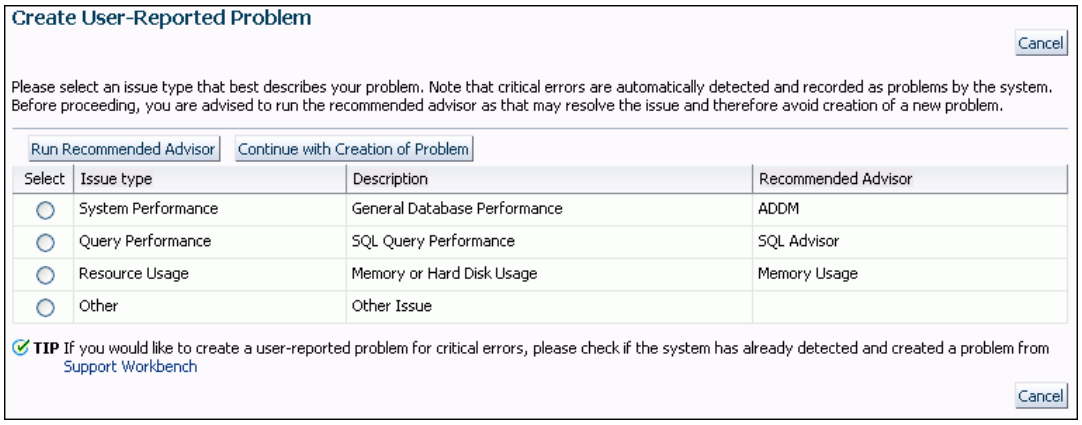
To create a user-reported problem:

1. Access the Support Workbench home page.

   See "Viewing Problems with the Support Workbench" for instructions.

2. Under Related Links, click **Create User-Reported Problem**.

   The Create User-Reported Problem page appears.



3. If your problem matches one of the listed issue types, select the issue type, and then click **Run Recommended Advisor** to attempt to solve the problem with an Oracle advisor.
4. If the recommended advisor did not solve the problem, or if you did not run an advisor, do one of the following:
   - If your problem matches one of the listed issue types, select the issue type, and then click **Continue with Creation of Problem**.
   - If your problem does not match one of the listed issue types, select the issue type **Other** and then click **Continue with Creation of Problem**.

   The Problem Details page appears.
5. Follow the instructions on the Problem Details page.

   See "About Investigating, Reporting, and Resolving a Problem" for more information.

> **See Also:**
>
> "About the Oracle Database Fault Diagnosability Infrastructure" for more information on problems and the ADR

7.3.1.3 Creating Incidents Manually

You can create incidents manually by using the Automatic Diagnostic Repository Command Interpreter (ADRCI) utility.

To create an incident manually by using the ADRCI utility:

1. Ensure that the `ORACLE_HOME` and `PATH` environment variables are set properly. The `PATH` environment variable must include *`ORACLE_HOME`*`/bin` directory.
2. Start the ADRCI utility by running the following command at the operating system command prompt:

   ```
   ADRCI
   ```

   The ADRCI utility starts and displays the following prompt:

   ```
   adrci>
   ```

3. Run the ADRCI command having the following syntax to create an incident manually:

   ```
   adrci> dde create incident type incident_type
   ```

   Specify *incident_type* value for the type of incident that you want to create.

> **See Also:**
>
> - *Oracle Database Utilities* for more information about the ADRCI utility

7.3.1.4 Using DBMS_HCHECK to Identify Data Dictionary Inconsistencies

DBMS_HCHECK is a read-only and lightweight PL/SQL package procedure that helps you identify database dictionary inconsistencies.

`DBMS_HCHECK` is a read-only and lightweight PL/SQL package procedure that helps you identify database dictionary inconsistencies that are manifested in unexpected entries in the RDBMS dictionary tables or invalid references between dictionary tables. Database dictionary inconsistencies can cause process failures and, in some cases, instance crash. Such inconsistencies may be exposed to internal `ORA-00600` errors. `DBMS_HCHECK` assists you in identifying such inconsistencies and in some cases provides guided remediation to resolve the problem and avoid such database failures.

Unexpected entries in the dictionary tables or invalid references between dictionary tables, for example, include the following:

- A lob segment not in `OBJ$`
- An entry in `SOURCE$` not in `OBJ$`
- Invalid data between `OBJ$-PARTOBJ$` and `TABPART$`
- A segment with no owner

- A table with no segment
- A segment with no object entry
- A recycle bin object not in the `recyclebin$`
- Check if `Control Seq` is near the limit

To run all the checks or only the critical checks defined by `dbms_hcheck`, connect to the SYS schema, and then run the following commands as SYS user:

Full check

```
SQL> set serveroutput on size unlimited
SQL> execute dbms_hcheck.full
```

Critical check

```
SQL> set serveroutput on size unlimited
SQL> execute dbms_hcheck.critical
```

Optionally, turn on the spool to redirect the output to a server-side flat file. By default, when you query the SYS schema, the `DBMS_HCHECK` package creates a trace file named, `HCHECK.trc`.

For example: `/<path>/diag/rdbms/<db_name>/<oracle_sid>/trace/<oracle_sid>_<ora>_<pid>_HCHECK.trc`.

The execution reports the result as:

- **CRITICAL**: Requires an immediate fix.
- **FAIL**: Requires resolution on priority.
- **WARN**: Good to resolve.
- **PASS**: No issues.

> **Note:**
>
> In all cases, any output reporting "problems" must be triaged by Oracle Support to confirm if any action is required.

Example 7-1 Full check run

```
SQL> set serveroutput on size unlimited
SQL> execute dbms_hcheck.full
dbms_hcheck on 07-MAR-2023 03:17:48
-----------------------------------------------
Catalog Version 21.0.0.0.0 (2300000000)
db_name: ORCL
Is CDB?: NO
Trace File: /oracle/log/diag/rdbms/orcl/orcl/trace/orcl_ora_2574906_HCHECK.trc

                                  Catalog       Fixed
Procedure Name                    Version    Vs Release    Timestamp
Result
```

```
------------------------------ ... ---------- -- ---------- --------------
------
.- OIDOnObjCol                 ... 2300000000 <=  *All Rel* 03/07 03:17:48
PASS
.- LobNotInObj                 ... 2300000000 <=  *All Rel* 03/07 03:17:48
PASS
.- SourceNotInObj              ... 2300000000 <=  *All Rel* 03/07 03:17:48
PASS
.- OversizedFiles              ... 2300000000 <=  *All Rel* 03/07 03:17:48
PASS
.- PoorDefaultStorage          ... 2300000000 <=  *All Rel* 03/07 03:17:48
PASS
.- PoorStorage                 ... 2300000000 <=  *All Rel* 03/07 03:17:48
PASS
.- TabPartCountMismatch        ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- TabComPartObj               ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- Mview                       ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- ValidDir                    ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- DuplicateDataobj            ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- ObjSyn                      ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- ObjSeq                      ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- UndoSeg                     ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- IndexSeg                    ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- IndexPartitionSeg           ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- IndexSubPartitionSeg        ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- TableSeg                    ... 2300000000 <=  *All Rel* 03/07 03:17:49
FAIL

HCKE-0019: Orphaned TAB$ (no SEG$) (Doc ID 1360889.1)
ORPHAN TAB$: OBJ#=83241 DOBJ#=83241 TS=5 RFILE/BLOCK=5/11 TABLE=SYS.ORPHANSEG
BOBJ#=

.- TablePartitionSeg           ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- TableSubPartitionSeg        ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- PartCol                     ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- ValidSeg                    ... 2300000000 <=  *All Rel* 03/07 03:17:49
FAIL

HCKE-0023: Orphaned SEG$ Entry (Doc ID 1360934.1)
ORPHAN SEG$: SegType=LOB TS=5 RFILE/BLOCK=5/26

.- IndPartObj                  ... 2300000000 <=  *All Rel* 03/07 03:17:49
```

```
PASS
.- DuplicateBlockUse           ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- FetUet                      ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- Uet0Check                   ... 2300000000 <=  *All Rel* 03/07 03:17:49
PASS
.- SeglessUET                  ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ValidInd                    ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ValidTab                    ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- IcolDepCnt                  ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ObjIndDobj                  ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- TrgAfterUpgrade             ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ObjType0                    ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ValidOwner                  ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- StmtAuditOnCommit           ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- PublicObjects               ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- SegFreelist                 ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ValidDepends                ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- CheckDual                   ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ObjectNames                 ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ChkIotTs                    ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- NoSegmentIndex              ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- NextObject                  ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- DroppedROTS                 ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- FilBlkZero                  ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- DbmsSchemaCopy              ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- IdnseqObj                   ... 2300000000 >  1201000000 03/07 03:17:50
PASS
.- IdnseqSeq                   ... 2300000000 >  1201000000 03/07 03:17:50
PASS
.- ObjError                    ... 2300000000 >  1102000000 03/07 03:17:50
PASS
.- ObjNotLob                   ... 2300000000 <=  *All Rel* 03/07 03:17:50
FAIL
```

```
HCKE-0049: OBJ$ LOB entry has no LOB$ or LOBFRAG$ entry (Doc ID 2125104.1)
OBJ$ LOB has no LOB$ entry: Obj=83243 Owner: SYS LOB Name: LOBC1

.- MaxControlfSeq              ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- SegNotInDeferredStg         ... 2300000000 >  1102000000 03/07 03:17:50
PASS
.- SystemNotRfile1             ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- DictOwnNonDefaultSYSTEM     ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ValidateTrigger             ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- ObjNotTrigger               ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
.- InvalidTSMaxSCN             ... 2300000000 >  1202000000 03/07 03:17:50
CRITICAL

HCKE-0054: TS$ has Tablespace with invalid Maximum SCN (Doc ID 1360208.1)
TS$ has Tablespace with invalid Maximum SCN: TS#=5 Tablespace=HCHECK Online$=1

.- OBJRecycleBin               ... 2300000000 <=  *All Rel* 03/07 03:17:50
PASS
---------------------------------------
07-MAR-2023 03:17:50  Elapsed: 2 secs
---------------------------------------
Found 4 potential problem(s) and 0 warning(s)
Found 1 CRITICAL problem(s) needing attention
Contact Oracle Support with the output and trace file
to check if the above needs attention or not
BEGIN dbms_hcheck.full; END;

*
ERROR at line 1:
ORA-20000: dbms_hcheck found 1 critical issue(s).  Trace file:
/oracle/log/diag/rdbms/orcl/orcl/trace/orcl_ora_2574906_HCHECK.trc

SQL>
```

Example 7-2 Critical check run

```
SQL> set serveroutput on size unlimited
SQL> execute dbms_hcheck.critical
dbms_hcheck on 07-MAR-2023 03:12:23
---------------------------------------------
Catalog Version 21.0.0.0.0 (2100000000)
db_name: ORCL
Is CDB?: NO
Trace File: /oracle/log/diag/rdbms/orcl/orcl/trace/orcl_ora_2574058_HCHECK.trc

                                  Catalog       Fixed
Procedure Name                    Version    Vs Release    Timestamp
Result
------------------------------ ... ---------- -- ---------- --------------
------
```

```
.- UndoSeg                      ... 2300000000 <=  *All Rel* 03/07 03:12:23
PASS
.- MaxControlfSeq               ... 2300000000 <=  *All Rel* 03/07 03:12:23
PASS
.- InvalidTSMaxSCN              ... 2300000000 >  1202000000 03/07 03:12:23
CRITICAL

HCKE-0054: TS$ has Tablespace with invalid Maximum SCN (Doc ID 1360208.1)
TS$ has Tablespace with invalid Maximum SCN: TS#=5 Tablespace=HCHECK Online$=1

---------------------------------------
07-MAR-2023 03:12:23  Elapsed: 0 secs
---------------------------------------
Found 1 potential problem(s) and 0 warning(s)
Found 1 CRITICAL problem(s) needing attention
Contact Oracle Support with the output and trace file
to check if the above needs attention or not
BEGIN dbms_hcheck.critical; END;

*
ERROR at line 1:
ORA-20000: dbms_hcheck found 1 critical issue(s).  Trace file:
/ade/b/959592990/oracle/log/diag/rdbms/orcl/orcl/trace/
orcl_ora_2574058_HCHECK.trc

SQL>
```

Related Topics

- Summary of DBMS_HCHECK Subprograms

7.3.2 Identifying Problems Proactively with Health Monitor

You can run diagnostic checks on a database with Health Monitor.

- About Health Monitor
  Oracle Database includes a framework called Health Monitor for running diagnostic checks on the database.
- Running Health Checks Manually
  Health Monitor can run health checks manually either by using the `DBMS_HM` PL/SQL package or by using the Cloud Control interface, found on the Checkers subpage of the Advisor Central page.
- Viewing Checker Reports
  After a checker has run, you can view a report of its execution. The report contains findings, recommendations, and other information. You can view reports using Cloud Control, the ADRCI utility, or the `DBMS_HM` PL/SQL package. The following table indicates the report formats available with each viewing method.
- Health Monitor Views
  Instead of requesting a checker report, you can view the results of a specific checker run by directly querying the ADR data from which reports are created.
- Health Check Parameters Reference
  Some health checks require parameters. Parameters with a default value of `(none)` are mandatory.

7.3.2.1 About Health Monitor

Oracle Database includes a framework called Health Monitor for running diagnostic checks on the database.

- About Health Monitor Checks
  Health Monitor checks (also known as checkers, health checks, or checks) examine various layers and components of the database.
- Types of Health Checks
  Health monitor runs several different types of checks.

7.3.2.1.1 About Health Monitor Checks

Health Monitor checks (also known as checkers, health checks, or checks) examine various layers and components of the database.

Health checks detect file corruptions, physical and logical block corruptions, undo and redo corruptions, data dictionary corruptions, and more. The health checks generate reports of their findings and, in many cases, recommendations for resolving problems. Health checks can be run in two ways:

- **Reactive**—The fault diagnosability infrastructure can run health checks automatically in response to a critical error.
- **Manual**—As a DBA, you can manually run health checks using either the `DBMS_HM` PL/SQL package or the Cloud Control interface. You can run checkers on a regular basis if desired, or Oracle Support may ask you to run a checker while working with you on a service request.

Health Monitor checks store findings, recommendations, and other information in the Automatic Diagnostic Repository (ADR).

Health checks can run in two modes:

- **DB-online** mode means the check can be run while the database is open (that is, in `OPEN` mode or `MOUNT` mode).
- **DB-offline** mode means the check can be run when the instance is available but the database itself is closed (that is, in `NOMOUNT` mode).

All the health checks can be run in DB-online mode. Only the Redo Integrity Check and the DB Structure Integrity Check can be used in DB-offline mode.

> **Note:**
>
> "Automatic Diagnostic Repository (ADR)"

7.3.2.1.2 Types of Health Checks

Health monitor runs several different types of checks.

Health monitor runs the following checks:

- **DB Structure Integrity Check**—This check verifies the integrity of database files and reports failures if these files are inaccessible, corrupt or inconsistent. If the database is in

mount or open mode, this check examines the log files and data files listed in the control file. If the database is in NOMOUNT mode, only the control file is checked.

- **Data Block Integrity Check**—This check detects disk image block corruptions such as checksum failures, head/tail mismatch, and logical inconsistencies within the block. Most corruptions can be repaired using Block Media Recovery. Corrupted block information is also captured in the V$DATABASE_BLOCK_CORRUPTION view. This check does not detect inter-block or inter-segment corruption.
- **Redo Integrity Check**—This check scans the contents of the redo log for accessibility and corruption, as well as the archive logs, if available. The Redo Integrity Check reports failures such as archive log or redo corruption.
- **Undo Segment Integrity Check**—This check finds logical undo corruptions. After locating an undo corruption, this check uses PMON and SMON to try to recover the corrupted transaction. If this recovery fails, then Health Monitor stores information about the corruption in V$CORRUPT_XID_LIST. Most undo corruptions can be resolved by forcing a commit.
- **Transaction Integrity Check**—This check is identical to the Undo Segment Integrity Check except that it checks only one specific transaction.
- **Dictionary Integrity Check**—This check examines the integrity of core dictionary objects, such as tab$ and col$. It performs the following operations:
  - Verifies the contents of dictionary entries for each dictionary object.
  - Performs a cross-row level check, which verifies that logical constraints on rows in the dictionary are enforced.
  - Performs an object relationship check, which verifies that parent-child relationships between dictionary objects are enforced.

  The Dictionary Integrity Check operates on the following dictionary objects:

  tab$, clu$, fet$, uet$, seg$, undo$, ts$, file$, obj$, ind$, icol$, col$, user$, con$, cdef$, ccol$, bootstrap$, objauth$, ugroup$, tsq$, syn$, view$, typed_view$, superobj$, seq$, lob$, coltype$, subcoltype$, ntab$, refcon$, opqtype$, dependency$, access$, viewcon$, icoldep$, dual$, sysauth$, objpriv$, defrole$, and ecol$.

7.3.2.2 Running Health Checks Manually

Health Monitor can run health checks manually either by using the DBMS_HM PL/SQL package or by using the Cloud Control interface, found on the Checkers subpage of the Advisor Central page.

- Running Health Checks Using the DBMS_HM PL/SQL Package
  The DBMS_HM procedure for running a health check is called RUN_CHECK.
- Running Health Checks Using Cloud Control
  Cloud Control provides an interface for running Health Monitor checkers.

7.3.2.2.1 Running Health Checks Using the DBMS_HM PL/SQL Package

The DBMS_HM procedure for running a health check is called RUN_CHECK.

1. To call RUN_CHECK, supply the name of the check and a name for the run, as follows:

```
BEGIN
  DBMS_HM.RUN_CHECK('Dictionary Integrity Check', 'my_run');
END;
/
```

2. To obtain a list of health check names, run the following query:

```
SELECT name FROM v$hm_check WHERE internal_check='N';
```

Your output is similar to the following:

```
NAME
----------------------------------------------------------------
DB Structure Integrity Check
Data Block Integrity Check
Redo Integrity Check
Transaction Integrity Check
Undo Segment Integrity Check
Dictionary Integrity Check
```

Most health checks accept input parameters. You can view parameter names and descriptions with the `V$HM_CHECK_PARAM` view. Some parameters are mandatory while others are optional. If optional parameters are omitted, defaults are used. The following query displays parameter information for all health checks:

```
SELECT c.name check_name, p.name parameter_name, p.type,
p.default_value, p.description
FROM v$hm_check_param p, v$hm_check c
WHERE p.check_id = c.id and c.internal_check = 'N'
ORDER BY c.name;
```

Input parameters are passed in the `input_params` argument as name/value pairs separated by semicolons (;). The following example illustrates how to pass the transaction ID as a parameter to the Transaction Integrity Check:

```
BEGIN
  DBMS_HM.RUN_CHECK (
   check_name   => 'Transaction Integrity Check',
   run_name     => 'my_run',
   input_params => 'TXN_ID=7.33.2');
END;
/
```

See Also:

- "Health Check Parameters Reference"
- *Oracle Database PL/SQL Packages and Types Reference* for more examples of using `DBMS_HM`.

7.3.2.2.2 Running Health Checks Using Cloud Control

Cloud Control provides an interface for running Health Monitor checkers.

To run a Health Monitor Checker using Cloud Control:

1. Access the Database Home page.
2. From the Performance menu, select **Advisors Home**.
3. Click **Checkers** to view the Checkers subpage.
4. In the Checkers section, click the checker you want to run.

5. Enter values for input parameters or, for optional parameters, leave them blank to accept the defaults.
6. Click **OK**, confirm your parameters, and click **OK** again.

7.3.2.3 Viewing Checker Reports

After a checker has run, you can view a report of its execution. The report contains findings, recommendations, and other information. You can view reports using Cloud Control, the ADRCI utility, or the `DBMS_HM` PL/SQL package. The following table indicates the report formats available with each viewing method.

- About Viewing Checker Reports
  Results of checker runs (findings, recommendations, and other information) are stored in the ADR, but reports are not generated immediately.
- Viewing Reports Using Cloud Control
  You can also view Health Monitor reports and findings for a given checker run using Cloud Control.
- Viewing Reports Using DBMS_HM
  You can view Health Monitor checker reports with the `DBMS_HM` package function `GET_RUN_REPORT`.
- Viewing Reports Using the ADRCI Utility
  You can create and view Health Monitor checker reports using the ADRCI utility.

7.3.2.3.1 About Viewing Checker Reports

Results of checker runs (findings, recommendations, and other information) are stored in the ADR, but reports are not generated immediately.

Report Viewing Method	Report Formats Available
Cloud Control	HTML
`DBMS_HM` PL/SQL package	HTML, XML, and text
ADRCI utility	XML

When you request a report with the `DBMS_HM` PL/SQL package or with Cloud Control, if the report does not yet exist, it is first generated from the checker run data in the ADR, stored as a report file in XML format in the HM subdirectory of the ADR home for the current instance, and then displayed. If the report file already exists, it is just displayed. When using the ADRCI utility, you must first run a command to generate the report file if it does not exist, and then run another command to display its contents.

The preferred method to view checker reports is with Cloud Control.

> **Note:**
>
> "Automatic Diagnostic Repository (ADR)"

7.3.2.3.2 Viewing Reports Using Cloud Control

You can also view Health Monitor reports and findings for a given checker run using Cloud Control.

To view run findings using Cloud Control:

1. Access the Database Home page.
2. From the Performance menu, select **Advisors Home**.
3. Click **Checkers** to view the Checkers subpage.
4. Click the run name for the checker run that you want to view.

   The Run Detail page appears, showing the Findings subpage for that checker run.
5. Click **Runs** to display the Runs subpage.

   Cloud Control displays more information about the checker run.
6. Click **View Report** to view the report for the checker run.

   The report is displayed in a new browser window.

7.3.2.3.3 Viewing Reports Using DBMS_HM

You can view Health Monitor checker reports with the `DBMS_HM` package function `GET_RUN_REPORT`.

This function enables you to request HTML, XML, or text formatting. The default format is text, as shown in the following SQL*Plus example:

```
SET LONG 100000
SET LONGCHUNKSIZE 1000
SET PAGESIZE 1000
SET LINESIZE 512
SELECT DBMS_HM.GET_RUN_REPORT('HM_RUN_1061') FROM DUAL;

DBMS_HM.GET_RUN_REPORT('HM_RUN_1061')
------------------------------------------------------------------------------

 Run Name                      : HM_RUN_1061
 Run Id                        : 1061
 Check Name                    : Data Block Integrity Check
 Mode                          : REACTIVE
 Status                        : COMPLETED
 Start Time                    : 2007-05-12 22:11:02.032292 -07:00
 End Time                      : 2007-05-12 22:11:20.835135 -07:00
 Error Encountered             : 0
 Source Incident Id            : 7418
 Number of Incidents Created   : 0

Input Parameters for the Run
 BLC_DF_NUM=1
 BLC_BL_NUM=64349

Run Findings And Recommendations
 Finding
 Finding Name  : Media Block Corruption
 Finding ID    : 1065
 Type          : FAILURE
 Status        : OPEN
```

```
Priority      : HIGH
Message       : Block 64349 in datafile 1:
                '/u01/app/oracle/dbs/t_db1.f' is media corrupt
Message       : Object BMRTEST1 owned by SYS might be unavailable
Finding
Finding Name  : Media Block Corruption
Finding ID    : 1071
Type          : FAILURE
Status        : OPEN
Priority      : HIGH
Message       : Block 64351 in datafile 1:
                '/u01/app/oracle/dbs/t_db1.f' is media corrupt
Message       : Object BMRTEST2 owned by SYS might be unavailable
```

> **See Also:**
>
> *Oracle Database PL/SQL Packages and Types Reference* for details on the `DBMS_HM` package.

7.3.2.3.4 Viewing Reports Using the ADRCI Utility

You can create and view Health Monitor checker reports using the ADRCI utility.

To create and view a checker report using ADRCI:

1. Ensure that the `ORACLE_HOME` and `PATH` environment variables are set properly, and then start the ADRCI utility by running the following command at the operating system command prompt:

   ```
   ADRCI
   ```

   The ADRCI utility starts and displays the following prompt:

   ```
   adrci>
   ```

   Optionally, you can change the current ADR home. Use the `SHOW HOMES` command to list all ADR homes, and the `SET HOMEPATH` command to change the current ADR home. See *Oracle Database Utilities* for more information.

2. Enter the following command:

   ```
   show hm_run
   ```

   This command lists all the checker runs (stored in `V$HM_RUN`) registered in the ADR.

3. Locate the checker run for which you want to create a report and note the checker run name. The `REPORT_FILE` field contains a file name if a report already exists for this checker run. Otherwise, generate the report with the following command:

   ```
   create report hm_run run_name
   ```

4. To view the report, enter the following command:

   ```
   show report hm_run run_name
   ```

> **Note:**
>
> "Automatic Diagnostic Repository (ADR)"

7.3.2.4 Health Monitor Views

Instead of requesting a checker report, you can view the results of a specific checker run by directly querying the ADR data from which reports are created.

This data is available through the views `V$HM_RUN`, `V$HM_FINDING`, and `V$HM_RECOMMENDATION`.

The following example queries the `V$HM_RUN` view to determine a history of checker runs:

```
SELECT run_id, name, check_name, run_mode, src_incident FROM v$hm_run;

    RUN_ID NAME         CHECK_NAME                        RUN_MODE SRC_INCIDENT
---------- ------------ --------------------------------- -------- ------------
         1 HM_RUN_1     DB Structure Integrity Check      REACTIVE            0
       101 HM_RUN_101   Transaction Integrity Check       REACTIVE         6073
       121 TXNCHK       Transaction Integrity Check       MANUAL              0
       181 HMR_tab$     Dictionary Integrity Check        MANUAL              0
           .
           .
           .
       981 Proct_ts$    Dictionary Integrity Check        MANUAL              0
      1041 HM_RUN_1041  DB Structure Integrity Check      REACTIVE            0
      1061 HM_RUN_1061  Data Block Integrity Check        REACTIVE         7418
```

The next example queries the `V$HM_FINDING` view to obtain finding details for the reactive data block check with `RUN_ID` 1061:

```
SELECT type, description FROM v$hm_finding WHERE run_id = 1061;

TYPE          DESCRIPTION
------------- ----------------------------------------
FAILURE       Block 64349 in datafile 1: '/u01/app/orac
              le/dbs/t_db1.f' is media corrupt

FAILURE       Block 64351 in datafile 1: '/u01/app/orac
              le/dbs/t_db1.f' is media corrupt
```

> **See Also:**
>
> - "Types of Health Checks"
> - *Oracle Database Reference* for more information on the `V$HM_*` views

7.3.2.5 Health Check Parameters Reference

Some health checks require parameters. Parameters with a default value of `(none)` are mandatory.

Table 7-6 Parameters for Data Block Integrity Check

Parameter Name	Type	Default Value	Description
BLC_DF_NUM	Number	(none)	Block data file number
BLC_BL_NUM	Number	(none)	Data block number

Table 7-7 Parameters for Redo Integrity Check

Parameter Name	Type	Default Value	Description
SCN_TEXT	Text	0	SCN of the latest good redo (if known)

Table 7-8 Parameters for Undo Segment Integrity Check

Parameter Name	Type	Default Value	Description
USN_NUMBER	Text	(none)	Undo segment number

Table 7-9 Parameters for Transaction Integrity Check

Parameter Name	Type	Default Value	Description
TXN_ID	Text	(none)	Transaction ID

Table 7-10 Parameters for Dictionary Integrity Check

Parameter Name	Type	Default Value	Description
CHECK_MASK	Text	ALL	Possible values are: • COLUMN_CHECKS—Run column checks only. Verify column-level constraints in the core tables. • ROW_CHECKS—Run row checks only. Verify row-level constraints in the core tables. • REFERENTIAL_CHECKS—Run referential checks only. Verify referential constraints in the core tables. • ALL—Run all checks.
TABLE_NAME	Text	ALL_CORE_TABLES	Name of a single core table to check. If omitted, all core tables are checked.

7.3.3 Gathering Additional Diagnostic Data

This section describes how to gather additional diagnostic data using alert log and trace files.

- Viewing the Alert Log
  You can view the alert log with a text editor, with Cloud Control, or with the ADRCI utility.

- Finding Trace Files
  Trace files are stored in the Automatic Diagnostic Repository (ADR), in the `trace` directory under each ADR home. To help you locate individual trace files within this directory, you can use data dictionary views. For example, you can find the path to your current session's trace file or to the trace file for each Oracle Database process.

7.3.3.1 Viewing the Alert Log

You can view the alert log with a text editor, with Cloud Control, or with the ADRCI utility.

To view the alert log with Cloud Control:

1. Access the Database Home page in Cloud Control.
2. From the Oracle Database menu, select **Diagnostics**, then **Support Workbench**.
3. Under Related Links, click **Alert Log Contents**.

   The View Alert Log Contents page appears.
4. Select the number of entries to view, and then click **Go**.

To view the alert log with a text editor:

1. Connect to the database with SQL*Plus or another query tool, such as SQL Developer.
2. Query the `V$DIAG_INFO` view as shown in "Viewing ADR Locations with the V$DIAG_INFO View".
3. To view the text-only alert log, without the XML tags, complete these steps:
   a. In the `V$DIAG_INFO` query results, note the path that corresponds to the `Diag Trace` entry, and change directory to that path.
   b. Open file alert_*SID*.log with a text editor.
4. To view the XML-formatted alert log, complete these steps:
   a. In the `V$DIAG_INFO` query results, note the path that corresponds to the `Diag Alert` entry, and change directory to that path.
   b. Open the file log.xml with a text editor.

> **See Also:**
>
> *Oracle Database Utilities* for information about using the ADRCI utility to view a text version of the alert log (with XML tags stripped) and to run queries against the alert log

7.3.3.2 Finding Trace Files

Trace files are stored in the Automatic Diagnostic Repository (ADR), in the `trace` directory under each ADR home. To help you locate individual trace files within this directory, you can use data dictionary views. For example, you can find the path to your current session's trace file or to the trace file for each Oracle Database process.

To find the trace file for your current session:

- Submit the following query:

```
SELECT VALUE FROM V$DIAG_INFO WHERE NAME = 'Default Trace File';
```

  The full path to the trace file is returned.

To find all trace files for the current instance:

- Submit the following query:

```
SELECT VALUE FROM V$DIAG_INFO WHERE NAME = 'Diag Trace';
```

  The path to the ADR trace directory for the current instance is returned.

To determine the trace file for each Oracle Database process:

- Submit the following query:

```
SELECT PID, PROGRAM, TRACEFILE FROM V$PROCESS;
```

> **See Also:**
>
> - "Structure, Contents, and Location of the Automatic Diagnostic Repository"
> - The ADRCI `SHOW TRACEFILE` command in *Oracle Database Utilities*

7.3.4 Creating Test Cases with SQL Test Case Builder

SQL Test Case Builder is a tool that automatically gathers information needed to reproduce the problem in a different database instance.

A **SQL test case** is a set of information that enables a developer to reproduce the execution plan for a specific SQL statement that has encountered a performance problem.

This section contains the following topics:

- Purpose of SQL Test Case Builder
  SQL Test Case Builder automates the process of gathering and reproducing information about a problem and the environment in which it occurred.
- Concepts for SQL Test Case Builder
  Key concepts for SQL Test Case Builder include SQL incidents, types of information recorded, and the form of the output.
- User Interfaces for SQL Test Case Builder
  You can access SQL Test Case Builder either through Cloud Control or using PL/SQL on the command line.
- Running SQL Test Case Builder
  You can run SQL Test Case Builder using Cloud Control.

7.3.4.1 Purpose of SQL Test Case Builder

SQL Test Case Builder automates the process of gathering and reproducing information about a problem and the environment in which it occurred.

For most SQL components, obtaining a reproducible test case is the most important factor in bug resolution speed. It is also the longest and most painful step for users. The goal of SQL Test Case Builder is to gather as much as information related to an SQL incident as possible, and then package it in a way that enables Oracle staff to reproduce the problem on a different system.

The output of SQL Test Case Builder is a set of scripts in a predefined directory. These scripts contain the commands required to re-create all the necessary objects and the environment on another database instance. After the test case is ready, you can create a zip file of the directory and move it to another database, or upload the file to Oracle Support.

7.3.4.2 Concepts for SQL Test Case Builder

Key concepts for SQL Test Case Builder include SQL incidents, types of information recorded, and the form of the output.

This section contains the following topics:

- SQL Incidents
  In the fault diagnosability infrastructure of Oracle Database, an **incident** is a single occurrence of a problem.
- What SQL Test Case Builder Captures
  SQL Test Case Builder captures permanent information about a SQL query and its environment.
- Output of SQL Test Case Builder
  The output of SQL Test Case Builder is a set of files that contains commands required to re-create the environment and all necessary objects.

7.3.4.2.1 SQL Incidents

In the fault diagnosability infrastructure of Oracle Database, an **incident** is a single occurrence of a problem.

A SQL incident is a SQL-related problem. When a problem (critical error) occurs multiple times, the database creates an incident for each occurrence. Incidents are timestamped and tracked in the Automatic Diagnostic Repository (ADR). Each incident has a numeric incident ID, which is unique within the ADR.

SQL Test Case Builder is accessible any time on the command line. In Oracle Enterprise Manager Cloud Control (Cloud Control), the SQL Test Case pages are only available after a SQL incident is found.

7.3.4.2.2 What SQL Test Case Builder Captures

SQL Test Case Builder captures permanent information about a SQL query and its environment.

The information includes the query being executed, table and index definitions (but not the actual data), PL/SQL packages and program units, optimizer statistics, SQL plan baselines, and initialization parameter settings. Starting with Oracle Database 12c, SQL Test Case

Builder also captures and replays transient information, including information only available as part of statement execution.

SQL Test Case Builder supports the following:

- Adaptive plans

  SQL Test Case Builder captures inputs to the decisions made regarding adaptive plans, and replays them at each decision point. For adaptive plans, the final statistics value at each buffering statistics collector is sufficient to decide on the final plan.

- Automatic memory management

  The database automatically handles the memory requested for each SQL operation. Actions such as sorting can affect performance significantly. SQL Test Case Builder keeps track of the memory activities, for example, where the database allocated memory and how much it allocated.

- Dynamic statistics

  Dynamic statistics is an optimization technique in which the database executes a recursive SQL statement to scan a small random sample of a table's blocks to estimate predicate selectivities. Regathering dynamic statistics on a different database does not always generate the same results, for example, when data is missing. To reproduce the problem, SQL Test Case Builder exports the dynamic statistics result from the source database. In the testing database, SQL Test Case Builder reuses the same values captured from the source database instead of regathering dynamic statistics.

- Multiple execution support

  SQL Test Case Builder can capture dynamic information accumulated during multiple executions of the query. This capability is important for automatic reoptimization.

- Compilation environment and bind values replay

  The compilation environment setting is an important part of the query optimization context. SQL Test Case Builder captures nondefault settings altered by the user when running the problem query in the source database. If any nondefault parameter values are used, SQL Test Case Builder re-establishes the same values before running the query.

- Object statistics history

  The statistics history for objects is helpful to determine whether a plan change was caused by a change in statistics values. `DBMS_STATS` stores the history in the data dictionary. SQL Test Case Builder stores this statistics data into a staging table during export. During import, SQL Test Case Builder automatically reloads the statistics history data into the target database from the staging table.

- Statement history

  The statement history is important for diagnosing problems related to adaptive cursor sharing, statistics feedback, and cursor sharing bugs. The history includes execution plans and compilation and execution statistics.

> **See Also:**
>
> - *Oracle Database SQL Tuning Guide* for more information about adaptive query plans, supplemental dynamic statistics, automatic reoptimization, and SQL plan baselines
> - *Oracle Database PL/SQL Packages and Types Reference* to learn about the `DBMS_STATS` package

7.3.4.2.3 Output of SQL Test Case Builder

The output of SQL Test Case Builder is a set of files that contains commands required to re-create the environment and all necessary objects.

By default, SQL Test Case Builder stores the files in the following directory, where *incnum* refers to the incident number and *runnum* refers to the run number:

```
$ADR_HOME/incident/incdir_incnum/SQLTCB_runnum
```

For example, a valid output file name could be as follows:

```
$ORACLE_HOME/log/diag/rdbms/dbsa/dbsa/incident/incdir_2657/SQLTCB_1
```

You can also specify a particular directory for storing the SQL Test Case Builder files by creating a directory object with the name `SQL_TCB_DIR` and running the procedure `DBMS_SQLDIAG.EXPORT_SQL_TESTCASE` as shown in the following example:

```
CREATE OR REPLACE DIRECTORY SQL_TCB_DIR '/tmp';

DECLARE
tc CLOB;
BEGIN
  DBMS_SQLDIAG.EXPORT_SQL_TESTCASE (
    directory => 'SQL_TCB_DIR',
    sql_text  => 'select * from hr_table',
    testcase  => tc);
END;
```

> **Note:**
>
> The database administrator must have read and write access permissions to the operating system directory specified in the directory object `SQL_TCB_DIR`.

You can also specify a name for a test case using the `testcase_name` parameter of the `DBMS_SQLDIAG.EXPORT_SQL_TESTCASE` procedure. A test case name is used as a prefix for all the files generated by SQL Test Case Builder.

If you do not specify a test case name, then a default test case name having the following format is used by SQL Test Case Builder:

```
oratcb_connectionId_sqlId_sequenceNumber_sessionId
```

Here, *connectionId* is the database connection ID, *sqlId* is the SQL statement ID, *sequenceNumber* is the internal sequence number, and *sessionId* is the database session ID.

You can also specify any additional information to include in the output of SQL Test Case Builder using the `ctrlOptions` parameter of the `DBMS_SQLDIAG.EXPORT_SQL_TESTCASE` procedure. The following are some of the options that you can specify in the `ctrlOptions` parameter:

- `compress`: This option is used to compress the SQL Test Case Builder output files into a zip file.
- `diag_event`: This option is used to specify the level of trace information to include in the SQL Test Case Builder output.
- `problem_type`: This option is used to assign an issue type for a SQL Test Case Builder test case. For example, if a test case is related to performance regression issue, then you can assign the value of `PERFORMANCE` to the `problem_type` option.

You can view the information about all the test cases generated by SQL Test Case Builder by querying the `V$SQL_TESTCASES` view as shown in the following example:

```
select testcase_name, sql_text from v$sql_testcases;

TESTCASE_NAME                          SQL_TEXT
-------------------------------------  ---------------------
oratcb_0_am8q8kudm02v9_1_00244CC50001  select * from hr_table
```

> **Note:**
>
> The `V$SQL_TESTCASES` view requires the existence of a SQL Test Case Builder root directory object named `SQL_TCB_DIR`. In Oracle Autonomous Database environments, this directory object is created automatically on each POD during provisioning. For on-premises databases, you must explicitly create the SQL Test Case Builder root directory object `SQL_TCB_DIR`, otherwise the `V$SQL_TESTCASES` view will not display any information. The database administrator must have read and write access permissions to the operating system directory specified in the directory object `SQL_TCB_DIR`.

> **See Also:**
>
> - *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_SQLDIAG.EXPORT_SQL_TESTCASE` procedure
> - *Oracle Database Reference* for more information about the `V$SQL_TESTCASES` view

7.3.4.3 User Interfaces for SQL Test Case Builder

You can access SQL Test Case Builder either through Cloud Control or using PL/SQL on the command line.

This section contains the following topics:

- Graphical Interface for SQL Test Case Builder
  Within Cloud Control, you can access SQL Test Case Builder from the Incident Manager page or the Support Workbench page.
- Command-Line Interface for SQL Test Case Builder
  The `DBMS_SQLDIAG` package performs tasks relating to SQL Test Case Builder.

7.3.4.3.1 Graphical Interface for SQL Test Case Builder

Within Cloud Control, you can access SQL Test Case Builder from the Incident Manager page or the Support Workbench page.

This section contains the following topics:

- Accessing the Incident Manager
  From the Incidents and Problems section on the Database Home page, you can navigate to the Incident Manager.
- Accessing the Support Workbench
  From the Oracle Database menu, you can navigate to the Support Workbench.

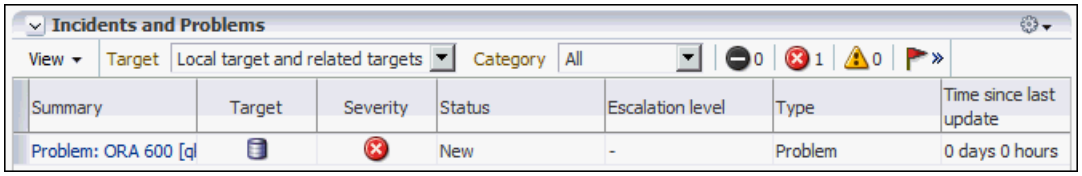
7.3.4.3.1.1 Accessing the Incident Manager

From the Incidents and Problems section on the Database Home page, you can navigate to the Incident Manager.

To access the Incident Manager:

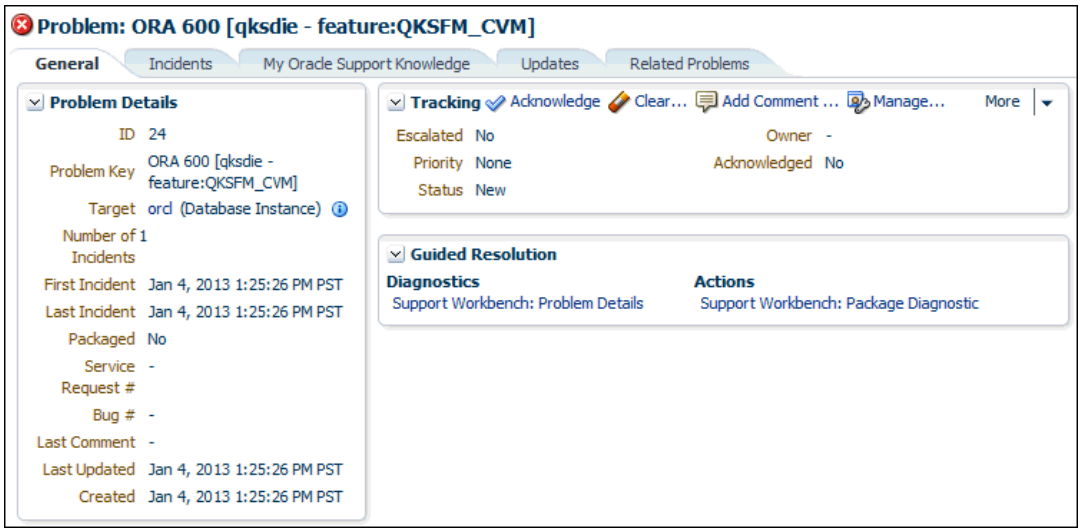
1. Log in to Cloud Control with the appropriate credentials.
2. Under the **Targets** menu, select **Databases**.
3. In the list of database targets, select the target for the Oracle Database instance that you want to administer.
4. If prompted for database credentials, then enter the minimum credentials necessary for the tasks you intend to perform.
5. In the Incidents and Problems section, locate the SQL incident to be investigated.

   In the following example, the `ORA 600` error is a SQL incident.



6. Click the summary of the incident.

   The Problem Details page of the Incident Manager appears.



   The Support Workbench page appears, with the incidents listed in a table.

7.3.4.3.1.2 Accessing the Support Workbench

From the Oracle Database menu, you can navigate to the Support Workbench.

To access the Support Workbench:

1. Log in to Cloud Control with the appropriate credentials.
2. Under the **Targets** menu, select **Databases**.
3. In the list of database targets, select the target for the Oracle Database instance that you want to administer.
4. If prompted for database credentials, then enter the minimum credentials necessary for the tasks you intend to perform.
5. From the **Oracle Database** menu, select **Diagnostics**, then **Support Workbench**.

   The Support Workbench page appears, with the incidents listed in a table.

7.3.4.3.2 Command-Line Interface for SQL Test Case Builder

The `DBMS_SQLDIAG` package performs tasks relating to SQL Test Case Builder.

This package consists of various subprograms for the SQL Test Case Builder, some of which are listed in the following table.

Table 7-11 SQL Test Case Functions in the DBMS_SQLDIAG Package

Procedure	Description
EXPORT_SQL_TESTCASE	Exports a SQL test case to a user-specified directory
EXPORT_SQL_TESTCASE_DIR_BY_INC	Exports a SQL test case corresponding to the incident ID passed as an argument
EXPORT_SQL_TESTCASE_DIR_BY_TXT	Exports a SQL test case corresponding to the SQL text passed as an argument
IMPORT_SQL_TESTCASE	Imports a SQL test case into a schema
REPLAY_SQL_TESTCASE	Automates reproduction of a SQL test case
EXPLAIN_SQL_TESTCASE	Explains a SQL test case

See Also:

Oracle Database PL/SQL Packages and Types Reference to learn more about the DBMS_SQLDIAG package

7.3.4.4 Running SQL Test Case Builder

You can run SQL Test Case Builder using Cloud Control.

Assumptions

This tutorial assumes the following:

- You ran the following EXPLAIN PLAN statement as user sh, which causes an internal error:

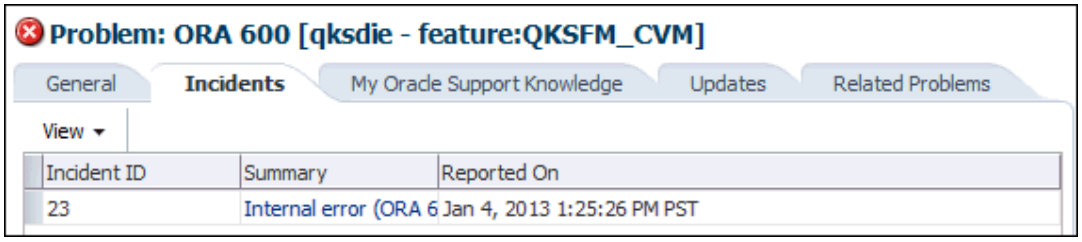
```
EXPLAIN PLAN FOR
  SELECT unit_cost, sold
  FROM   costs c,
         ( SELECT /*+ merge */ p.prod_id, SUM(quantity_sold) AS sold
           FROM   products p, sales s
           WHERE  p.prod_id = s.prod_id
           GROUP BY p.prod_id ) v
  WHERE  c.prod_id = v.prod_id;
```

- In the Incidents and Problems section on the Database Home page, a SQL incident generated by the internal error appears.
- You access the Incident Details page, as explained in "Accessing the Incident Manager".

To run SQL Test Case Builder:

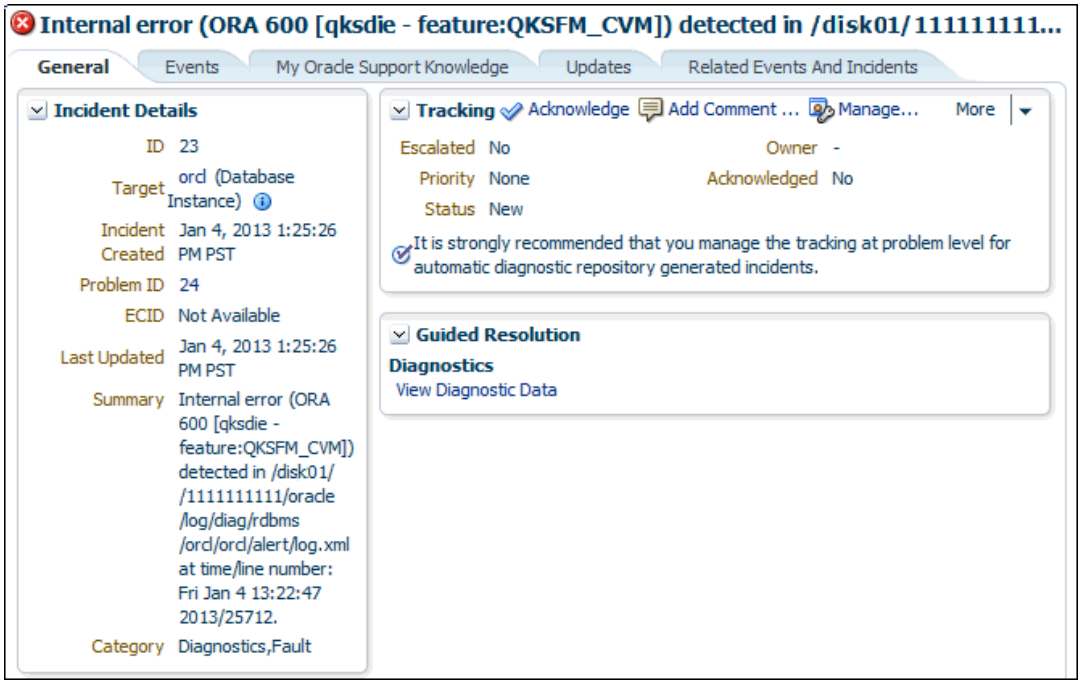
1. Click the Incidents tab.

   The Problem Details page appears.



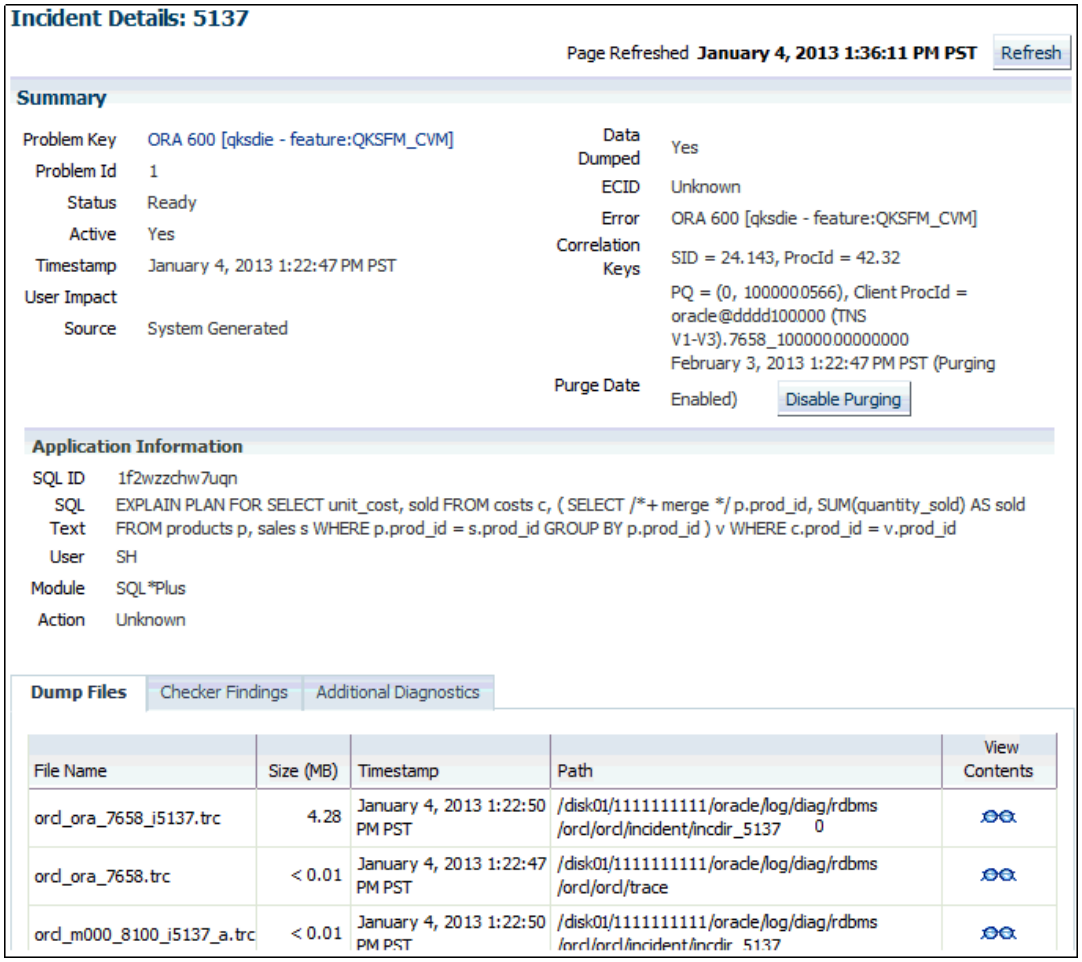
2. Click the summary for the incident.

   The Incident Details page appears.



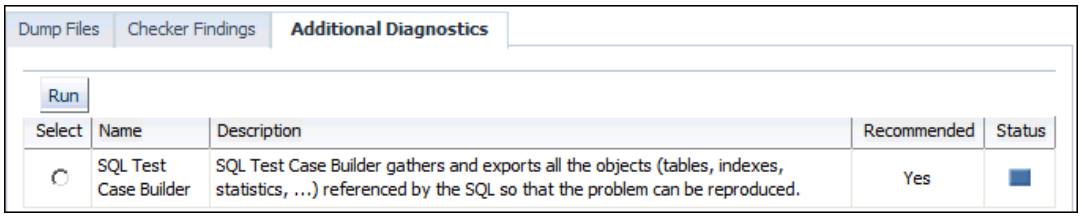
3. In Guided Resolution, click **View Diagnostic Data**.

   The Incident Details: *incident_number* page appears.



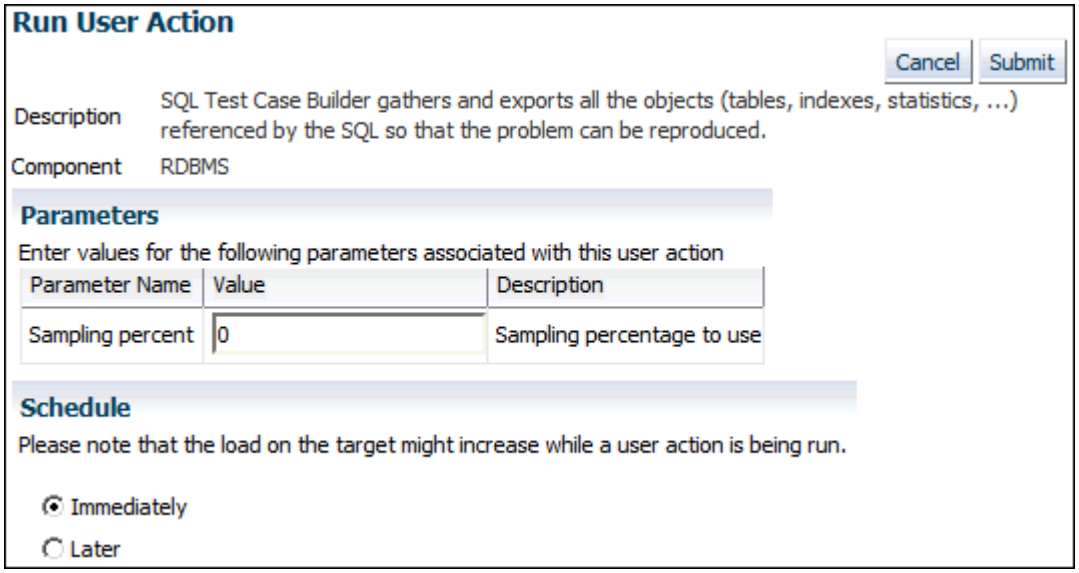
4. In the Application Information section, click **Additional Diagnostics**.

   The Additional Diagnostics subpage appears.



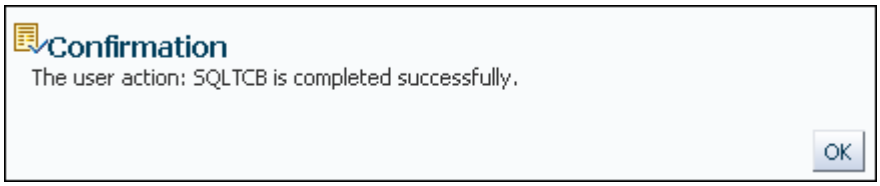
5. Select **SQL Test Case Builder**, and then click **Run**.

   The Run User Action page appears.



6. Select a sampling percentage (optional), and then click **Submit**.

   After processing completes, the Confirmation page appears.



7. Access the SQL Test Case files in the location described in "Output of SQL Test Case Builder".

7.4 Reporting Problems

Using the Enterprise Manager Support Workbench (Support Workbench), you can create, edit, and upload custom incident packages. With custom incident packages, you have fine control over the diagnostic data that you send to Oracle Support.

- Incident Packages
  You can collect diagnostic data into an intermediate logical structure called an incident package (package).
- Packaging and Uploading Problems with Custom Packaging
  You use Support Workbench (Support Workbench) to create and upload custom incident packages (packages). Before uploading, you can manually add, edit, and remove diagnostic data files from the package.
- Viewing and Modifying Incident Packages
  After creating an incident package with the custom packaging method, you can view or modify the contents of the package before uploading the package to Oracle Support.
- Creating, Editing, and Uploading Correlated Packages
  After you upload a package to Oracle Support, you can create and upload one or more correlated packages.
- Deleting Correlated Packages
  You delete a correlated package with the Support Workbench for the target for which you created the package.

- Setting Incident Packaging Preferences
  You can set incident packaging preferences. Examples of incident packaging preferences include the number of days to retain incident information, and the number of leading and trailing incidents to include in a package for each problem.

> **See Also:**
>
> "About the Oracle Database Fault Diagnosability Infrastructure"

7.4.1 Incident Packages

You can collect diagnostic data into an intermediate logical structure called an incident package (package).

- About Incident Packages
  For the customized approach to uploading diagnostic data to Oracle Support, you first collect the data into an intermediate logical structure called an incident package (package).
- About Correlated Diagnostic Data in Incident Packages
  To diagnose problem, it is sometimes necessary to examine not only diagnostic data that is directly related to the problem, but also diagnostic data that is *correlated* with the directly related data.
- About Quick Packaging and Custom Packaging
  The Support Workbench provides two methods for creating and uploading an incident package: the quick packaging method and the custom packaging method.
- About Correlated Packages
  Correlated packages provide a means of packaging and uploading diagnostic data for related problems.

7.4.1.1 About Incident Packages

For the customized approach to uploading diagnostic data to Oracle Support, you first collect the data into an intermediate logical structure called an incident package (package).

A **package** is a collection of metadata that is stored in the Automatic Diagnostic Repository (ADR) and that points to diagnostic data files and other files both in and out of the ADR. When you create a package, you select one or more problems to add to the package. The Support Workbench then automatically adds to the package the problem information, incident information, and diagnostic data (such as trace files and dumps) associated with the selected problems. Because a problem can have many incidents (many occurrences of the same problem), by default only the first three and last three incidents for each problem are added to the package, excluding any incidents that are over 90 days old. You can change these default numbers on the Incident Packaging Configuration page of the Support Workbench.

After the package is created, you can add any type of external file to the package, remove selected files from the package, or edit selected files in the package to remove sensitive data. As you add and remove package contents, only the package metadata is modified.

When you are ready to upload the diagnostic data to Oracle Support, you first create a zip file that contains all the files referenced by the package metadata. You then upload the zip file through My Oracle Support.

Related Topics

- Packaging and Uploading Problems with Custom Packaging
  You use Support Workbench (Support Workbench) to create and upload custom incident packages (packages). Before uploading, you can manually add, edit, and remove diagnostic data files from the package.
- Viewing and Modifying Incident Packages
  After creating an incident package with the custom packaging method, you can view or modify the contents of the package before uploading the package to Oracle Support.

7.4.1.2 About Correlated Diagnostic Data in Incident Packages

To diagnose problem, it is sometimes necessary to examine not only diagnostic data that is directly related to the problem, but also diagnostic data that is *correlated* with the directly related data.

Diagnostic data can be correlated by time, by process ID, or by other criteria. For example, when examining an incident, it may be helpful to also examine an incident that occurred five minutes after the original incident. Similarly, while it is clear that the diagnostic data for an incident should include the trace file for the Oracle Database process that was running when the incident occurred, it might be helpful to also include trace files for other processes that are related to the original process.

Thus, when problems and their associated incidents are added to a package, any correlated incidents are added at the same time, with their associated trace files.

During the process of creating the physical file for a package, the Support Workbench calls upon the Incident Packaging Service to finalize the package. **Finalizing** means adding to the package any additional trace files that are correlated by time to incidents in the package, and adding other diagnostic information such as the alert log, health checker reports, SQL test cases, configuration information, and so on. Therefore, the number of files in the zip file may be greater than the number of files that the Support Workbench had previously displayed as the package contents.

The Incident Packaging Service follows a set of rules to determine the trace files in the ADR that are correlated to existing package data. You can modify some of those rules in the Incident Packaging Configuration page in Cloud Control.

Because both initial package data and added correlated data may contain sensitive information, it is important to have an opportunity to remove or edit files that contain this information before uploading to Oracle Support. For this reason, the Support Workbench enables you to run a command that finalizes the package as a separate operation. After manually finalizing a package, you can examine the package contents, remove or edit files, and then generate and upload a zip file.

> **Note:**
>
> Finalizing a package does not mean closing it to further modifications. You can continue to add diagnostic data to a finalized package. You can also finalize the same package multiple times. Each time that you finalize, any new correlated data is added.

Related Topics

- Setting Incident Packaging Preferences
  You can set incident packaging preferences. Examples of incident packaging preferences include the number of days to retain incident information, and the number of leading and trailing incidents to include in a package for each problem.

7.4.1.3 About Quick Packaging and Custom Packaging

The Support Workbench provides two methods for creating and uploading an incident package: the quick packaging method and the custom packaging method.

Quick Packaging—This is the more automated method with a minimum of steps, organized in a guided workflow (a wizard). You select a single problem, provide a package name and description, and then schedule upload of the package contents, either immediately or at a specified date and time. The Support Workbench automatically places diagnostic data related to the problem into the package, finalizes the package, creates the zip file, and then uploads the file. With this method, you do not have the opportunity to add, edit, or remove package files or add other diagnostic data such as SQL test cases. However, it is the simplest and quickest way to get first-failure diagnostic data to Oracle Support. Quick packaging is the method used in the workflow described in "About Investigating, Reporting, and Resolving a Problem".

When quick packaging is complete, the package that was created by the wizard remains. You can then modify the package with custom packaging operations at a later time and manually reupload.

Custom Packaging—This is the more manual method, with more steps. It is intended for expert Support Workbench users who want more control over the packaging process. With custom packaging, you can create a new package with one or more problems, or you can add one or more problems to an existing package. You can then perform a variety of operations on the new or updated package, including:

- Adding or removing problems or incidents
- Adding, editing, or removing trace files in the package
- Adding or removing external files of any type
- Adding other diagnostic data such as SQL test cases
- Manually finalizing the package and then viewing package contents to determine if you must edit or remove sensitive data or remove files to reduce package size.

You might conduct these operations over several days, before deciding that you have enough diagnostic information to send to Oracle Support.

With custom packaging, you create the zip file and request the upload to Oracle Support as two separate steps. Each of these steps can be performed immediately or scheduled for a future date and time.

Related Topics

- About Investigating, Reporting, and Resolving a Problem
  You can use the Enterprise Manager Support Workbench (Support Workbench) to investigate and report a problem (critical error), and in some cases, resolve the problem. You can use a "roadmap" that summarizes the typical set of tasks that you must perform.
- Task 5: Package and Upload Diagnostic Data to Oracle Support
  For this task, you use the quick packaging process of the Support Workbench to package and upload the diagnostic information for the problem to Oracle Support.

7.4.1.4 About Correlated Packages

Correlated packages provide a means of packaging and uploading diagnostic data for related problems.

A database instance problem can have related problems in other database instances or in Oracle Automatic Storage Management instances. After you create and upload a package for one or more database instance problems (the "main package"), you can create and upload one or more correlated packages, each with one or more related problems. You can accomplish this only with the custom packaging workflow in Support Workbench.

Related Topics

- Related Problems Across the Topology
  For any problem identified in a database instance, the diagnosability framework can identify related problems across the topology of your Oracle Database installation.
- Creating, Editing, and Uploading Correlated Packages
  After you upload a package to Oracle Support, you can create and upload one or more correlated packages.

7.4.2 Packaging and Uploading Problems with Custom Packaging

You use Support Workbench (Support Workbench) to create and upload custom incident packages (packages). Before uploading, you can manually add, edit, and remove diagnostic data files from the package.

To package and upload problems with custom packaging:

1. Access the Support Workbench home page.

   See "Viewing Problems with the Support Workbench" for instructions.

2. (Optional) For each problem that you want to include in the package, indicate the service request number (SR#) associated with the problem, if any. To do so, complete the following steps for each problem:

   a. In the Problems subpage at the bottom of the Support Workbench home page, select the problem, and then click **View**.

   > **Note:**
   >
   > If you do not see the desired problem in the list of problems, or if there are too many problems to scroll through, select a time period from the View list and click **Go**. You can then select the desired problem and click **View**.

   The Problem Details page appears.

   b. Next to the SR# label, click **Edit**, enter a service request number, and then click **OK**.

   The service request number is displayed on the Problem Details page.

   c. Return to the Support Workbench home page by clicking **Support Workbench** in the locator links at the top of the page.

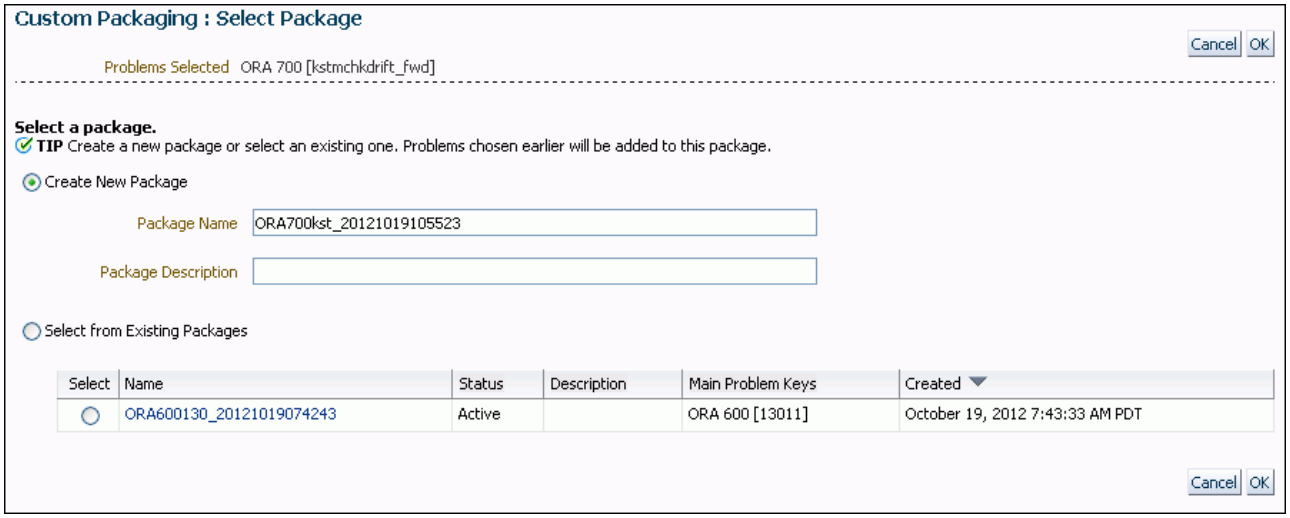
3. On the Support Workbench home page, select the problems that you want to package, and then click **Package**.

   The Select Packaging Mode page appears.

> **Note:**
>
> The packaging process may automatically select additional correlated problems to add to the package. An example of a correlated problem is one that occurs within a few minutes of the selected problem. See "About Correlated Diagnostic Data in Incident Packages" for more information.

4. Select the **Custom packaging** option, and then click **Continue**.

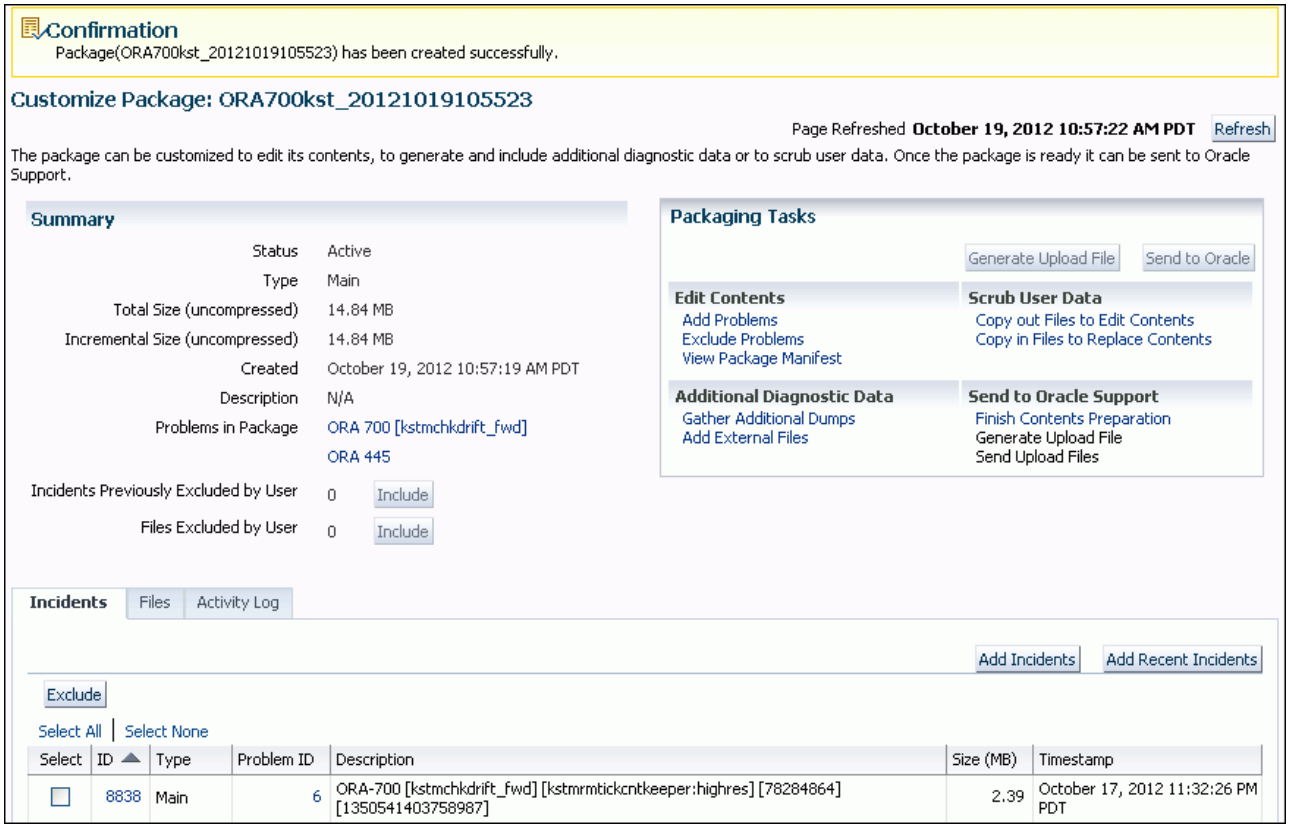
   The Select Package page appears.



5. Do one of the following:

   - To create a new package, select the **Create new package** option, enter a package name and description, and then click **OK**.
   - To add the selected problems to an existing package, select the **Select from existing packages** option, select the package to update, and then click **OK**.

   The Customize Package page appears. It displays the problems and incidents that are contained in the package, plus a selection of packaging tasks to choose from. You run these tasks against the new package or the updated existing package.



6. (Optional) In the Packaging Tasks section, click links to perform one or more packaging tasks. Or, use other controls on the Customize Package page and its subpages to manipulate the package. Return to the Customize Package page when you are finished.

   See "Viewing and Modifying Incident Packages" for instructions for some of the most common packaging tasks.

7. In the Packaging Tasks section of the Customize Package page, under the heading Send to Oracle Support, click **Finish Contents Preparation** to finalize the package.

   A list (or partial list) of files included in the package is displayed. (This may take a while.) The list includes files that were determined to contain correlated diagnostic information and added by the finalization process.

   See "About Correlated Diagnostic Data in Incident Packages" for a definition of package finalization.

8. Click **Files** to view all the files in the package. Examine the list to see if there are any files that might contain sensitive data that you do not want to expose. If you find such files, then exclude (remove) or edit them.

   See "Editing Incident Package Files (Copying Out and In)" and "Removing Incident Package Files" for instructions for editing and removing files.

   To view the contents of a file, click the eyeglasses icon in the rightmost column in the table of files. Enter host credentials, if prompted.

> **Note:**
>
> Trace files are generally for Oracle internal use only.

9. Click **Generate Upload File**.

   The Generate Upload File page appears.

10. Select the **Full** or **Incremental** option to generate a full package zip file or an incremental package zip file.

    For a full package zip file, all the contents of the package (original contents and all correlated data) are always added to the zip file.

    For an incremental package zip file, only the diagnostic information that is new or modified since the last time that you created a zip file for the same package is added to the zip file. For example, if trace information was appended to a trace file since that file was last included in the generated physical file for a package, the trace file is added to the incremental package zip file. Conversely, if no changes were made to a trace file since it was last uploaded for a package, that trace file is not included in the incremental package zip file.

    > **Note:**
    >
    > The Incremental option is dimmed (unavailable) if an upload file was never created for the package.

11. Schedule file creation either immediately or at a future date and time (select **Immediately** or **Later**), and then click **Submit**.

    File creation can use significant system resources, so it may be advisable to schedule it for a period of low system usage.

    A Processing page appears, and creation of the zip file proceeds. A confirmation page appears when processing is complete.

    > **Note:**
    >
    > The package is automatically finalized when the zip file is created.

12. Click **OK**.

    The Customize Package page returns.

13. Click **Send to Oracle**.

    The View/Send Upload Files page appears.

14. (Optional) Click the **Send Correlated Packages** link to create correlated packages and send them to Oracle.

    See "Creating, Editing, and Uploading Correlated Packages". When you are finished working with correlated packages, return to the View/Send Upload Files page by clicking the **Package Details** link at the top of the page, clicking **Customize Package**, and then clicking **Send to Oracle** again.

15. Select the zip files to upload, and then click **Send to Oracle**.

    The Send to Oracle page appears. The selected zip files are listed in a table.

16. Fill in the requested My Oracle Support information. Next to Create new Service Request (SR), select **Yes** or **No**. If you select Yes, a draft service request is created for you. You

must later log in to My Oracle Support and fill in the service request details. If you select No, enter an existing service request number.

17. Schedule the upload to take place immediately or at a future date and time, and then click **Submit**.

    A Processing page appears. If the upload is completed successfully, a confirmation page appears. If the upload could not complete, an error page appears. The error page may include a message that requests that you upload the zip file to Oracle manually. If so, contact your Oracle Support representative for instructions.

18. Click **OK**.

    The View/Send Upload Files page returns. Under the Time Sent column, check the status of the files that you attempted to upload.

19. (Optional) Create and upload correlated packages.

    See "Creating, Editing, and Uploading Correlated Packages" for instructions.

> **See Also:**
>
> - "About Incidents and Problems"
> - "About Incident Packages"
> - "About Quick Packaging and Custom Packaging"

7.4.3 Viewing and Modifying Incident Packages

After creating an incident package with the custom packaging method, you can view or modify the contents of the package before uploading the package to Oracle Support.

In addition, after using the quick packaging method to package and upload diagnostic data, you can view or modify the contents of the package that the Support Workbench created, and then reupload the package. To modify a package, you choose from among a selection of *packaging tasks*, most of which are available from the Customize Package page.

- Viewing Package Details
  The Package Details page contains information about the incidents, trace files, and other files in a package, and enables you to view and add to the package activity log.
- Accessing the Customize Package Page
  The Customize Package page is used to perform various packaging tasks, such as adding and removing problems; adding, removing, and scrubbing (editing) package files; and generating and uploading the package zip file.
- Editing Incident Package Files (Copying Out and In)
  The Support Workbench enables you to edit one or more files in an incident package.
- Adding an External File to an Incident Package
  You can add any type of external file to an incident package.
- Removing Incident Package Files
  You can remove one or more files of any type from the incident package.
- Viewing and Updating the Incident Package Activity Log
  The Support Workbench maintains an activity log for each incident package.

> **See Also:**
>
> - "About Incident Packages"
> - "Packaging and Uploading Problems with Custom Packaging"

7.4.3.1 Viewing Package Details

The Package Details page contains information about the incidents, trace files, and other files in a package, and enables you to view and add to the package activity log.

To view package details:

1. Access the Support Workbench home page.

   See "Viewing Problems with the Support Workbench" for instructions.

2. Click **Packages** to view the Packages subpage.

   A list of packages that are currently in the Automatic Diagnostic Repository (ADR) is displayed.

3. (Optional) To reduce the number of packages displayed, enter text into the **Search** field above the list, and then click **Go**.

   All packages that contain the search text anywhere in the package name are displayed. To view the full list of packages, remove the text from the **Search** field and click **Go** again.

4. Under the Package Name column, click the link for the desired package.

   The Package Details page appears.

7.4.3.2 Accessing the Customize Package Page

The Customize Package page is used to perform various packaging tasks, such as adding and removing problems; adding, removing, and scrubbing (editing) package files; and generating and uploading the package zip file.

To access the Customize Package page:

1. Access the Package Details page for the desired package, as described in "Viewing Package Details".

2. Click **Customize Package**.

   The Customize Package page appears.

7.4.3.3 Editing Incident Package Files (Copying Out and In)

The Support Workbench enables you to edit one or more files in an incident package.

You may want to do this to delete or overwrite sensitive data in the files. To edit package files, you must first copy the files out of the package into a designated directory, edit the files with a text editor or other utility, and then copy the files back into the package, overwriting the original package files.

The following procedure assumes that the package is already created and contains diagnostic data.

To edit incident package files:

1. Access the Customize Package page for the desired incident package.

   See "Accessing the Customize Package Page" for instructions.

2. In the Packaging Tasks section, under the Scrub User Data heading, click **Copy out Files to Edit contents**.

   If prompted for host credentials, enter credentials and then click **OK**.

   The Copy Out Files page appears. It displays the name of the host to which you can copy files.

3. Do one of the following to specify a destination directory for the files:

   - Enter a directory path in the **Destination Folder** field.
   - Click the magnifying glass icon next to the **Destination Folder** field, and then complete the following steps:

     a. If prompted for host credentials, enter credentials for the host to which you want to copy out the files, and then click **OK**. (Select **Save as Preferred Credential** to avoid the prompt for credentials next time.)

        The Browse and Select: File or Directory window appears.

     b. Select the desired destination directory, and then click **Select**.

        The Browse and Select: File or Directory window closes, and the path to the selected directory appears in the Destination Folder field of the Copy Out Files page.

4. Under Files to Copy Out, select the desired files, and then click **OK**.

   > **Note:**
   >
   > If you do not see the desired files, then they may be on another page. Click the **Next** link to view the next page. Continue clicking **Next**, or select from the list of file numbers (to the left of the Next link) until you see the desired files. You can then select the files and click **OK**.

   The Customize Package page returns, displaying a confirmation message that lists the files that were copied out.

5. Using a text editor or other utility, edit the files.

6. On the Customize Package page, in the Packaging Tasks section, under the Scrub User Data heading, click **Copy in Files to Replace Contents**.

   The Copy In Files page appears. It displays the files that you copied out.

7. Select the files to copy in, and then click **OK**.

   The files are copied into the package, overwriting the existing files. The Customize Package page returns, displaying a confirmation message that lists the files that were copied in.

7.4.3.4 Adding an External File to an Incident Package

You can add any type of external file to an incident package.

To add an external file to an incident package:

1. Access the Customize Package page for the desired incident package.

   See "Accessing the Customize Package Page" for instructions.

2. Click the **Files** link to view the Files subpage.

   From this page, you can add and remove files to and from the package.

3. Click **Add external files**.

   The Add External File page appears. It displays the host name from which you may select a file.

4. Do one of the following to specify a file to add:

   - Enter the full path to the file in the **File Name** field.
   - Click the magnifying glass icon next to the **File Name** field, and then complete the following steps:

     a. If prompted for host credentials, enter credentials for the host on which the external file resides, and then click **OK**. (Select **Save as Preferred Credential** to avoid the prompt for credentials next time.)

     b. In the Browse and Select: File or Directory window, select the desired file and then click **Select**.

        The Browse and Select window closes, and the path to the selected file appears in the File Name field of the Add External File page.

5. Click **OK**.

   The Customize Package page returns, displaying the Files subpage. The selected file is now shown in the list of files.

7.4.3.5 Removing Incident Package Files

You can remove one or more files of any type from the incident package.

To remove incident package files:

1. Access the Customize Package page for the desired incident package.

   See "Accessing the Customize Package Page" for instructions.

2. Click the **Files** link to view the Files subpage.

   A list of files in the package is displayed.

   If you have not yet generated a physical file for this package, all package files are displayed in the list. If you have already generated a physical file, then a View list appears above the files list. It enables you to choose between viewing only incremental package contents or the full package contents. The default selection is incremental package contents. This default selection displays only those package files that were created or modified since the last time that a physical file was generated for the package. Select **Full package contents** from the View list to view all package files.

3. Select the files to remove, and then click **Exclude**.

> **Note:**
>
> If you do not see the desired files, then they may be on another page. Click the **Next** link to view the next page. Continue clicking **Next**, or select from the list of file numbers (to the left of the Next link) until you see the desired files. You can then select the files and click **Remove**.

7.4.3.6 Viewing and Updating the Incident Package Activity Log

The Support Workbench maintains an activity log for each incident package.

Most activities that you perform on a package, such as adding or removing files or creating a package zip file, are recorded in the log. You can also add your own notes to the log. This is especially useful if multiple database administrators are working with packages.

To view and update the incident package activity log:

1. Access the Package Details page for the desired incident package.

   See "Viewing Package Details" for instructions.

2. Click the **Activity Log** link to view the Activity Log subpage.

   The activity log is displayed.

3. To add your own comment to the activity log, enter text into the **Comment** field, and then click **Add Comment**.

   Your comment is appended to the list.

7.4.4 Creating, Editing, and Uploading Correlated Packages

After you upload a package to Oracle Support, you can create and upload one or more correlated packages.

This is recommended if critical alerts appeared in the Related Alerts section of the Database Home page. The correlated packages are associated with the original package, also known as the **main package**. The main package contains problems that occurred in a database instance. Correlated packages contain problems that occurred on other instances (Oracle ASM instances or other database instances) and that are related problems for the problems in the main package. There can be only one correlated package for each related instance.

To create, edit, and upload a correlated package:

1. View the Package Details page for the main package.

   See "Viewing Package Details" for instructions.

2. On the Package Details page, click **Customize Package**.

3. On the Customize Package page, in the Packaging Tasks section, under Additional Diagnostic Data, click **Create/Update Correlated Packages**.

4. On the Correlated Packages page, under Correlated Packages, select one or more instances that have incidents and click **Create**.

   A confirmation message appears, and the package IDs of the newly created correlated packages appear in the ID column.

5. Select the instance on which you created the correlated package, and click **Finish Contents Preparation**.

A confirmation message appears.

6. (Optional) View and edit a correlated package by completing these steps:
   a. Click the package ID to view the package.

      If prompted for credentials, enter them and click **Login**.
   b. On the Package Details page, click **Files** to view the files in the package.
   c. Click **Customize Package** and perform any desired customization tasks, as described in "Viewing and Modifying Incident Packages".
7. For each correlated package to upload, click **Generate Upload File**.
8. For each correlated package to send to Oracle, select the package and click **Send to Oracle**.

> **Note:**
>
> If **Send to Oracle** is unavailable (dimmed), then there were no correlated incidents for the instance.

> **See Also:**
>
> - "About Correlated Packages"
> - "Related Problems Across the Topology"

7.4.5 Deleting Correlated Packages

You delete a correlated package with the Support Workbench for the target for which you created the package.

For example, if you created a correlated package for an Oracle ASM instance target, access the Support Workbench for that Oracle ASM instance.

To delete a correlated package:

1. Access the Support Workbench for the target on which you created the correlated package.

> **Tip:**
>
> See the Related Links section at the bottom of any Support Workbench page. Or, see "Viewing Problems with the Support Workbench"

2. Click **Packages** to view the Packages subpage.
3. Locate the correlated package in the list. Verify that it is a correlated package by viewing the package description.
4. Select the package and click **Delete**.
5. On the confirmation page, click **Yes**.

See Also:

- "About Correlated Packages"
- "Related Problems Across the Topology"

7.4.6 Setting Incident Packaging Preferences

You can set incident packaging preferences. Examples of incident packaging preferences include the number of days to retain incident information, and the number of leading and trailing incidents to include in a package for each problem.

By default, if a problem has many incidents, only the first three and last three incidents are packaged. You can change these and other incident packaging preferences with Cloud Control or with the ADRCI utility.

To set incident packaging preferences with Cloud Control:

1. Access the Support Workbench home page.

   See "Viewing Problems with the Support Workbench" for instructions.
2. In the Related Links section at the bottom of the page, click **Incident Packaging Configuration**.

   The View Incident Packaging Configuration page appears. Click **Help** to view descriptions of the settings on this page.
3. Click **Edit**.

   The Edit Incident Packaging Configuration page appears.
4. Edit settings, and then click **OK** to apply changes.

See Also:

- "About Incident Packages"
- "About Incidents and Problems"
- "Task 5: Package and Upload Diagnostic Data to Oracle Support"
- *Oracle Database Utilities* for information on ADRCI

7.5 Resolving Problems

This section describes how to resolve database problems using advisor tools, such as SQL Repair Advisor and Data Recovery Advisor, and the resource management tools, such as the Resource Manager and related APIs.

- About Automatic Error Mitigation
  The database attempts automatic error mitigation for SQL statements that fail with an ORA-00600 error during SQL compilation.

- Repairing SQL Failures with the SQL Repair Advisor
  In the rare case that a SQL statement fails with a critical error, you can run the SQL Repair Advisor to try to repair the failed statement.
- Repairing Data Corruptions with the Data Recovery Advisor
  You use the Data Recovery Advisor to repair data block corruptions, undo corruptions, data dictionary corruptions, and more.
- Quarantine for Execution Plans for SQL Statements Consuming Excessive System Resources
  Starting with Oracle Database 19c, you can use the SQL Quarantine infrastructure (SQL Quarantine) to quarantine execution plans for SQL statements that are terminated by the Resource Manager for consuming excessive system resources in an Oracle database. An individual SQL statement may have multiple execution plans, and if it attempts to use the execution plan that is quarantined, then that SQL statement is not allowed to run, thus preventing database performance degradation.
- Viewing Attention Log Information
  Access information stored in the attention log either by opening the file with any text editor or by querying the `V$DIAG_ATTENTION` view.

7.5.1 About Automatic Error Mitigation

The database attempts automatic error mitigation for SQL statements that fail with an ORA-00600 error during SQL compilation.

An ORA-00600 is a severe error. It indicates that a process has encountered a low-level, unexpected condition. When a SQL statement fails with this error during the parse phase, automatic error mitigation traps it and attempts to resolve the condition. If a resolution is found, the database generates a SQL patch in order to adjust the SQL execution plan. If this patch enables the parse to complete successfully, then the ORA-00600 error is not raised and no exception is seen by the application.

How Automatic Error Mitigation Works

These series of examples show how automatic error mitigation can transparently fix ORA-00600 errors.

1. Consider the following error condition. The query has failed and raised a fatal exception.

```
SQL> SELECT count(*)
  2  FROM emp1 e1
  3  WHERE ename = (select max(ename) from emp2 e2 where e2.empno =
e1.empno)
  4    AND empno = (select max(empno) from emp2 e2 where e2.empno =
e1.empno)
  5    AND job = (select max(job) from emp2 e2 where e2.empno = e1.empno);

ERROR at line 3:
ORA-00600: internal error code, arguments: [kkqctcqincf0], [0], [], [],
[], [], [], [], [], [], [], []
```

2. Automatic error mitigation is then turned on in the session.

```
SQL> alter session set sql_error_mitigation = 'on';

Session altered.
```

3. If automatic error mitigation is enabled and it successfully resolves the error, the ORA-00600 message in Step 1 is not displayed, because no exception is returned to the application. The query has been executed successfully.

```
SQL> SELECT count(*)
  2  FROM emp1 e1
  3  WHERE ename = (select max(ename) from emp2 e2 where e2.empno =
e1.empno)
  4    AND empno = (select max(empno) from emp2 e2 where e2.empno =
e1.empno)
  5    AND job = (select max(job) from emp2 e2 where e2.empno = e1.empno);

COUNT(*)

----------


999
```

4. If you now look at the explain plan for this query, you can see in the **Note** section at the bottom that a SQL patch has been created to repair the query.

```
SQL> SELECT * FROM
table(dbms_xplan.display_cursor(sql_id=>'5426r24y45gz0',cursor_child_no=>1,
format=>'basic +note'));

PLAN_TABLE_OUTPUT

--------------------------------------------------------------------------------
-----
EXPLAINED SQL
STATEMENT:
------------------------

SELECT count(*) FROM emp1 e1 where ename = (select max(ename) FROM emp2 e2
WHERE e2.empno = e1.empno) AND empno = (select max(empno) FROM
emp2 e2 WHERE e2.empno = e1.empno) AND job = (select max(job) FROM emp2 e2
WHERE e2.empno = e1.empno);


Plan hash value:
1226419153

-------------------------------------------

| Id  | Operation               | Name
|
-------------------------------------------

|   0 | SELECT STATEMENT        |
|
|   1 |  SORT AGGREGATE         |
|
|   2 |   HASH JOIN             |
|
|   3 |    HASH JOIN            |
```

```
|
|   4 |     HASH JOIN           |
|
|   5 |      TABLE ACCESS FULL  | EMP1
|
|   6 |      VIEW               | VW_SQ_3
|
|   7 |       SORT GROUP BY     |
|
|   8 |        TABLE ACCESS FULL| EMP2
|
|   9 |     VIEW                | VW_SQ_2
|
|  10 |      SORT GROUP BY      |
|
|  11 |       TABLE ACCESS FULL | EMP2
|
|  12 |    VIEW                 | VW_SQ_1
|
|  13 |     SORT GROUP BY       |
|
|  14 |      TABLE ACCESS FULL  | EMP2
|
----------------------------------------


Note

-----

   - cpu costing is off (consider enabling
it)
   - SQL patch "SYS_SQLPTCH_AUTO_dq7z4ydz3b2ug" used for this statement
```

Tip:

You can get more information about the origin and type of a patched SQL problem by querying `DBA_SQL_PATCHES` and `DBA_SQL_ERROR_MITIGATIONS`.

```
SQL> SELECT name,signature,origin FROM dba_sql_patches
  2  /

    NAME                             SIGNATURE             ORIGIN

--------------------------------------------------------------------------
------
    SYS_SQLPTCH_AUTO_dq7z4ydz3b2ug  15789590553029872463  AUTO-
FOREGROUND-REPAIR

SQL> SELECT m.sql_id, m.signature, m.problem_key, m.problem_type 2
FROM dba_sql_error_mitigations m;

    SQL_ID             SIGNATURE
PROBLEM_KEY             PROBLEM_TYPE

--------------------------------------------------------------------------
--------------
    5426r24y45gz0      15789590553029872463    ORA 600
[kkqctcqincf0]  COMPILATION ERROR
```

See Also:

Although automatic error mitigation repairs ORA-00600 are transparent to your application, there are views you can inspect to get more information about the process.

The Database Error Message Reference defines ORA-00600, which is the internal error number for Oracle program exceptions.

The *Oracle Database Reference Manual* provides three views related to automatic error mitigation.

- SQL_ERROR_MITIGATION describes the properties of the `SQL_ERROR_MITIGATION` initialization parameter.
- DBA_SQL_ERROR_MITIGATIONS shows the actions performed by automatic error mitigation. It describes each successful error mitigation, based on SQL ID. The `MITIGATION_DETAILS` column provides information on SQL patches created by automatic error mitigation.
- DBA_SQL_PATCHES shows details of SQL patches that have been generated (including but not limited to patches created by automatic error mitigation). The `ORIGIN` column value for patches created by automatic error mitigation is `AUTO-FOREGROUND-REPAIR`.

The *Application Packaging and Types Reference* documents the `SQL_ERROR_MITIGATION` initialization parameter.

7.5.2 Repairing SQL Failures with the SQL Repair Advisor

In the rare case that a SQL statement fails with a critical error, you can run the SQL Repair Advisor to try to repair the failed statement.

- About the SQL Repair Advisor
  You run the SQL Repair Advisor after a SQL statement fails with a critical error.
- Running the SQL Repair Advisor Using Cloud Control
  You can run the SQL Repair Advisor from the Problem Details page of the Support Workbench of Cloud Control.
- Running the SQL Repair Advisor Using the DBMS_SQLDIAG Package Subprograms
  You can run the SQL Repair Advisor using the `DBMS_SQLDIAG` package subprograms.
- Viewing, Disabling, or Removing a SQL Patch Using Cloud Control
  After you apply a SQL patch with the SQL Repair Advisor, you can view it to confirm its presence, disable it, or remove it using Cloud Control. One reason to disable or remove a patch is if you install a later release of Oracle Database that fixes the bug that caused the failure in the patched SQL statement.
- Disabling or Removing a SQL Patch Using DBMS_SQLDIAG Package Subprograms
  After you apply a SQL patch with the SQL Repair Advisor, you can disable or remove it using the `DBMS_SQLDIAG` package subprograms. One reason to disable or remove a patch is if you install a later release of Oracle Database that fixes the bug that caused the failure in the patched SQL statement.
- Exporting and Importing a Patch Using DBMS_SQLDIAG Package Subprograms
  A patch created using the SQL Repair Advisor can be exported out of one system and imported into another system using `DBMS_SQLDIAG` package subprograms.

7.5.2.1 About the SQL Repair Advisor

You run the SQL Repair Advisor after a SQL statement fails with a critical error.

The advisor analyzes the statement and in many cases recommends a patch to repair the statement. If you implement the recommendation, the applied SQL patch circumvents the failure by causing the query optimizer to choose an alternate execution plan for future executions.

You can run the SQL Repair Advisor using either Cloud Control or `DBMS_SQLDIAG` package subprograms.

7.5.2.2 Running the SQL Repair Advisor Using Cloud Control

You can run the SQL Repair Advisor from the Problem Details page of the Support Workbench of Cloud Control.

Typically, you do so when you were already notified of a critical error caused by your SQL statement and that you followed the workflow described in "About Investigating, Reporting, and Resolving a Problem".

To run the SQL Repair Advisor using Cloud Control:

1. Access the Problem Details page for the problem that pertains to the failed SQL statement.

   See "Viewing Problems with the Support Workbench" for instructions.

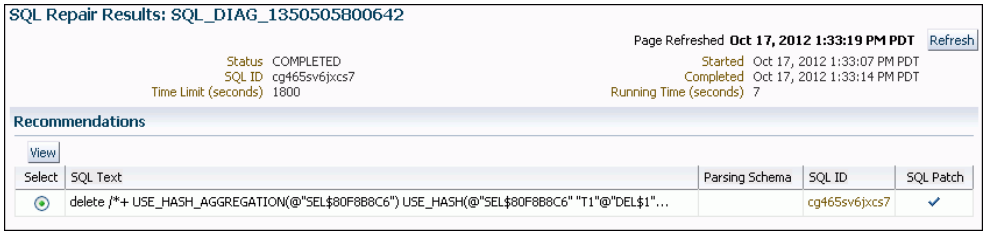
2. In the Investigate and Resolve section, under the Resolve heading, click **SQL Repair Advisor**.

3. On the SQL Repair Advisor page, complete these steps:

   a. Modify the preset task name if desired, optionally enter a task description, modify or clear the optional time limit for the advisor task, and adjust settings to schedule the advisor to run either immediately or at a future date and time.

   b. Click **Submit**.

   A "Processing" page appears. After a short delay, the SQL Repair Results page appears.



A check mark in the SQL Patch column indicates that a recommendation is present. The absence of a check mark in this column means that the SQL Repair Advisor was unable to devise a patch for the SQL statement.

> **Note:**
>
> If the SQL Repair Results page fails to appear, then complete these steps to display it:
>
> a. Go to the Database Home page.
>
> b. From the Performance menu, select **Advisors Home**.
>
> c. On the Advisor Central page, in the Results list, locate the most recent entry for the SQL Repair Advisor.
>
> d. Select the entry and click **View Result**.

4. If a recommendation is present (there is a check mark in the SQL Patch column), then click **View** to view the recommendation.

   The Repair Recommendations page appears, showing the recommended patch for the statement.

5. Click **Implement**.

   The SQL Repair Results page returns, showing a confirmation message.

6. (Optional) Click **Verify using SQL Worksheet** to run the statement in the SQL worksheet and verify that the patch successfully repaired the statement.

7.5.2.3 Running the SQL Repair Advisor Using the DBMS_SQLDIAG Package Subprograms

You can run the SQL Repair Advisor using the `DBMS_SQLDIAG` package subprograms.

Typically, you do so when you are notified of a critical error caused by your SQL statement and that you followed the workflow described in "About Investigating, Reporting, and Resolving a Problem".

You run the SQL Repair Advisor by creating and executing a diagnostic task using the `DBMS_SQLDIAG` package subprograms `CREATE_DIAGNOSIS_TASK` and `EXECUTE_DIAGNOSIS_TASK` respectively. The SQL Repair Advisor first reproduces the critical error and then tries to produce a workaround in the form of a SQL patch, which you can apply using the `ACCEPT_SQL_PATCH` subprogram.

> **Note:**
>
> Starting with Oracle Database 19c, you can also use a single subprogram `SQL_DIAGNOSE_AND_REPAIR` to create a diagnostic task, execute it, and accept SQL patch recommendation for a given SQL statement. Thus, the `SQL_DIAGNOSE_AND_REPAIR` subprogram achieves the functionality of all the following subprograms – `CREATE_DIAGNOSIS_TASK`, `EXECUTE_DIAGNOSIS_TASK`, and `ACCEPT_SQL_PATCH`.

To run the SQL Repair Advisor using the DBMS_SQLDIAG package subprograms:

1. **Identify the problematic SQL statement**

   Consider the SQL statement that gives a critical error:

   ```
   DELETE FROM t t1
   WHERE t1.a = 'a' AND
         ROWID <> (SELECT MAX(ROWID)
                   FROM t t2
                   WHERE t1.a = t2.a AND
                         t1.b = t2.b AND
                         t1.d = t2.d)
   ```

   You use the SQL Repair Advisor to repair this critical error.

2. **Create a diagnosis task**

   Run `DBMS_SQLDIAG.CREATE_DIAGNOSIS_TASK`. You can specify an optional task name, an optional time limit for the advisor task, and problem type. In the example below, we specify the SQL text, the task name as '`error_task`' and a problem type as '`DBMS_SQLDIAG.PROBLEM_TYPE_COMPILATION_ERROR`'.

   ```
   DECLARE
     rep_out   CLOB;
     t_id      VARCHAR2(50);
   BEGIN
     t_id := DBMS_SQLDIAG.CREATE_DIAGNOSIS_TASK (
             sql_text => 'DELETE FROM t t1
                          WHERE t1.a = ''a'' AND
                                ROWID <> (SELECT MAX(ROWID)
                                          FROM t t2
                                          WHERE t1.a = t2.a AND
                                                t1.b = t2.b AND
                                                t1.d = t2.d)',
             task_name => 'error_task',
             problem_type => DBMS_SQLDIAG.PROBLEM_TYPE_COMPILATION_ERROR);
   ```

3. **Execute the diagnosis task**

   To execute the workaround generation and analysis phase of the SQL Repair Advisor, you run `DBMS_SQLDIAG.EXECUTE_DIAGNOSIS_TASK` with the task ID returned by the `CREATE_DIAGNOSIS_TASK`. After a short delay, the SQL Repair Advisor returns. As part of its execution, the SQL Repair Advisor keeps a record of its findings which can be accessed through the reporting facilities of SQL Repair Advisor.

   ```
   DBMS_SQLDIAG.EXECUTE_DIAGNOSIS_TASK (t_id);
   ```

4. **Generate a report for the diagnosis task**

The analysis of the diagnosis task is accessed using `DBMS_SQLDIAG.REPORT_DIAGNOSIS_TASK`. If the SQL Repair Advisor was able to find a workaround, it recommends a SQL Patch. A SQL Patch is similar to a SQL profile, but unlike the SQL Profile, it is used to workaround compilation or execution errors.

```
rep_out := DBMS_SQLDIAG.REPORT_DIAGNOSIS_TASK (t_id, DBMS_SQLDIAG.TYPE_TEXT);
DBMS_OUTPUT.PUT_LINE ('Report : ' ||  rep_out);
END;
/
```

5. **Apply the patch**

   If a patch recommendation is present in the report, you can run `DBMS_SQLDIAG.ACCEPT_SQL_PATCH` to accept the patch. This procedure takes task name as an argument.

   ```
   EXECUTE DBMS_SQLDIAG.ACCEPT_SQL_PATCH(task_name => 'error_task', task_owner =>
   'SYS', replace => TRUE);
   ```

6. **Test the patch**

   Now that you have accepted the patch, you can rerun the SQL statement. This time, it will not give you the critical error. If you run *explain plan* for this statement, you will see that a SQL patch was used to generate the plan.

   ```
   DELETE FROM t t1
   WHERE t1.a = 'a' AND
         ROWID <> (SELECT max(rowid)
                   FROM t t2
                   WHERE t1.a = t2.a AND
                         t1.b = t2.b AND
                         t1.d = t2.d);
   ```

> **See Also:**
>
> *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_SQLDIAG` package subprograms

7.5.2.4 Viewing, Disabling, or Removing a SQL Patch Using Cloud Control

After you apply a SQL patch with the SQL Repair Advisor, you can view it to confirm its presence, disable it, or remove it using Cloud Control. One reason to disable or remove a patch is if you install a later release of Oracle Database that fixes the bug that caused the failure in the patched SQL statement.

To view, disable, or remove a SQL patch using Cloud Control:

1. Access the Database Home page in Cloud Control.
2. From the Performance menu, select **SQL**, then **SQL Plan Control**.

   The SQL Plan Control page appears.
3. Click **SQL Patch** to display the SQL Patch subpage.

   The SQL Patch subpage displays all SQL patches in the database.
4. Locate the desired patch by examining the associated SQL text.

Click the SQL text to view the complete text of the statement. After viewing the SQL text, click **Return**.

5. To disable the patch on the SQL Patch subpage, select it, and then click **Disable**.

   A confirmation message appears, and the patch status changes to `DISABLED`. You can later reenable the patch by selecting it and clicking **Enable**.

6. To remove the patch, select it, and then click **Drop**.

   A confirmation message appears.

> **See Also:**
>
> "About the SQL Repair Advisor"

7.5.2.5 Disabling or Removing a SQL Patch Using DBMS_SQLDIAG Package Subprograms

After you apply a SQL patch with the SQL Repair Advisor, you can disable or remove it using the `DBMS_SQLDIAG` package subprograms. One reason to disable or remove a patch is if you install a later release of Oracle Database that fixes the bug that caused the failure in the patched SQL statement.

To disable a SQL patch using DBMS_SQLDIAG package subprogram:

Run the procedure `DBMS_SQLDIAG.ALTER_SQL_PATCH` by specifying the patch name to disable with the status value of `DISABLED`.

The following example disables the SQL patch `sql_patch_12345`.

```
EXEC DBMS_SQLDIAG.ALTER_SQL_PATCH('sql_patch_12345', 'STATUS', 'DISABLED');
```

To remove a SQL patch using DBMS_SQLDIAG package subprogram:

Run the procedure `DBMS_SQLDIAG.DROP_SQL_PATCH` by specifying the patch name to remove. The patch name can be obtained from the explain plan section or by querying the view `DBA_SQL_PATCHES`.

The following example removes the SQL patch `sql_patch_12345`.

```
EXEC DBMS_SQLDIAG.DROP_SQL_PATCH('sql_patch_12345');
```

> **See Also:**
>
> - "About the SQL Repair Advisor"
> - *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_SQLDIAG` package subprograms

7.5.2.6 Exporting and Importing a Patch Using DBMS_SQLDIAG Package Subprograms

A patch created using the SQL Repair Advisor can be exported out of one system and imported into another system using `DBMS_SQLDIAG` package subprograms.

Patches can be exported out of one system and imported into another by using a staging table. Like with SQL diagnosis sets, the operation of inserting into the staging table is called as "pack", and the operation of creating patches from staging table data is called as "unpack".

To export and import a patch using the DBMS_SQLDIAG package subprograms:

1. Create a staging table owned by user '`SH`' by calling `DBMS_SQLDIAG.CREATE_STGTAB_SQLPATCH`:

   ```
   EXEC DBMS_SQLDIAG.CREATE_STGTAB_SQLPATCH(
       table_name          =>  'STAGING_TABLE',
       schema_name         =>  'SH');
   ```

2. Call `DBMS_SQLDIAG.PACK_STGTAB_SQLPATCH` one or more times to write SQL patch data into the staging table. In this case, copy data for all SQL patches in the `DEFAULT` category into a staging table owned by the current schema owner:

   ```
   EXEC DBMS_SQLDIAG.PACK_STGTAB_SQLPATCH(
       staging_table_name  =>  'STAGING_TABLE');
   ```

3. In this case, only a single SQL patch `SP_FIND_EMPLOYEE` is copied into a staging table owned by the current schema owner:

   ```
   EXEC DBMS_SQLDIAG.PACK_STGTAB_SQLPATCH(
       patch_name          =>  'SP_FIND_EMPLOYEE',
       staging_table_name  =>  'STAGING_TABLE');
   ```

   The staging table can then be moved to another system using either data pump, import/export commands or using a database link.

4. Call `DBMS_SQLDIAG.UNPACK_STGTAB_SQLPATCH` to create SQL patches on the new system from the patch data in the staging table. In this case, change the name in the data for the `SP_FIND_EMPLOYEE` patch stored in the staging table to '`SP_FIND_EMP_PROD`':

   ```
   exec dbms_sqldiag.remap_stgtab_sqlpatch(
      old_patch_name      =>  'SP_FIND_EMPLOYEE',
      new_patch_name      =>  'SP_FIND_EMP_PROD',
   ```

> **See Also:**
>
> *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_SQLDIAG` package subprograms

7.5.3 Repairing Data Corruptions with the Data Recovery Advisor

You use the Data Recovery Advisor to repair data block corruptions, undo corruptions, data dictionary corruptions, and more.

The Data Recovery Advisor integrates with the Enterprise Manager Support Workbench (Support Workbench), with the Health Monitor, and with the RMAN utility to display data corruption problems, assess the extent of each problem (critical, high priority, low priority), describe the impact of a problem, recommend repair options, conduct a feasibility check of the customer-chosen option, and automate the repair process.

The Cloud Control online help provides details on how to use the Data Recovery Advisor. This section describes how to access the advisor from the Support Workbench.

The Data Recovery Advisor is automatically recommended by and accessible from the Support Workbench when you are viewing health checker findings that are related to a data corruption or other data failure. The Data Recovery Advisor is also available from the Advisor Central page.

To access the Data Recovery Advisor in Cloud Control:

1. Access the Database Home page in Cloud Control.

   The Data Recovery Advisor is available only when you are connected as `SYSDBA`.

2. From the Oracle Database menu, select **Diagnostics**, then **Support Workbench**.
3. Click **Checker Findings**.

   The Checker Findings subpage appears.

4. Select one or more data corruption findings and then click **Launch Recovery Advisor**.

> **See Also:**
>
> *Oracle Database Backup and Recovery User's Guide* for more information about the Data Recovery Advisor

7.5.4 Quarantine for Execution Plans for SQL Statements Consuming Excessive System Resources

Starting with Oracle Database 19c, you can use the SQL Quarantine infrastructure (SQL Quarantine) to quarantine execution plans for SQL statements that are terminated by the Resource Manager for consuming excessive system resources in an Oracle database. An individual SQL statement may have multiple execution plans, and if it attempts to use the execution plan that is quarantined, then that SQL statement is not allowed to run, thus preventing database performance degradation.

- About Quarantine for Execution Plans for SQL Statements
  You can use the SQL Quarantine infrastructure (SQL Quarantine) to quarantine execution plans for SQL statements that are terminated by the Resource Manager for consuming excessive system resources in an Oracle database. The quarantined execution plans for such SQL statements are not allowed to run again, thus preventing database performance degradation.
- Creating a Quarantine Configuration for an Execution Plan of a SQL Statement
  You can create a quarantine configuration for an execution plan of a SQL statement using any of these `DBMS_SQLQ` package functions – `CREATE_QUARANTINE_BY_SQL_ID` or `CREATE_QUARANTINE_BY_SQL_TEXT`.
- Specifying Quarantine Thresholds in a Quarantine Configuration
  After creating a quarantine configuration for an execution plan for a SQL statement, you can specify quarantine thresholds for it using the `DBMS_SQLQ.ALTER_QUARANTINE` procedure. When any of the Resource Manager thresholds is equal to or less than a quarantine threshold specified in a SQL statement's quarantine configuration, then the SQL statement is not allowed to run, if it uses the execution plan specified in its quarantine configuration.
- Enabling and Disabling a Quarantine Configuration
  You can enable or disable a quarantine configuration using the `DBMS_SQLQ.ALTER_QUARANTINE` procedure. A quarantine configuration is enabled by default when it is created.
- Viewing the Details of a Quarantine Configuration
  You can query the `DBA_SQL_QUARANTINE` view to get details of all the quarantine configurations.
- Deleting a Quarantine Configuration
  The unused quarantine configurations are automatically purged or deleted after 53 weeks. You can also delete a quarantine configuration using the `DBMS_SQLQ.DROP_QUARANTINE` procedure. You can disable automatic deletion of a quarantine configuration using the `DBMS_SQLQ.ALTER_QUARANTINE` procedure.
- Viewing the Details of Quarantined Execution Plans of SQL Statements
  You can query the `V$SQL` and `GV$SQL` views to get details about the quarantined execution plans of SQL statements.

- Transferring Quarantine Configurations from One Database to Another Database
  You can transfer quarantine configurations from one database to another database using the `DBMS_SQLQ` package subprograms – `CREATE_STGTAB_QUARANTINE`, `PACK_STGTAB_QUARANTINE`, and `UNPACK_STGTAB_QUARANTINE`.
- Example: Quarantine for an Execution Plan of a SQL Statement Consuming Excessive System Resources
  This example shows how an execution plan of a SQL statement is quarantined when it exceeds a resource consumption limit configured using the Resource Manager.

7.5.4.1 About Quarantine for Execution Plans for SQL Statements

You can use the SQL Quarantine infrastructure (SQL Quarantine) to quarantine execution plans for SQL statements that are terminated by the Resource Manager for consuming excessive system resources in an Oracle database. The quarantined execution plans for such SQL statements are not allowed to run again, thus preventing database performance degradation.

Using the Resource Manager, you can configure limits for SQL statements for consuming system resources (*Resource Manager thresholds*). The Resource Manager terminates SQL statements that exceed the Resource Manager thresholds. In the earlier Oracle Database releases, if a SQL statement that is terminated by the Resource Manager runs again, the Resource Manager allows it to run again and terminates it again when it exceeds the Resource Manager thresholds. Thus, it is a waste of system resources to allow such SQL statements to run again.

Starting with Oracle Database 19c, you can use SQL Quarantine to automatically quarantine execution plans of SQL statements terminated by the Resource Manager, so that they are not allowed to run again. SQL Quarantine information is periodically persisted to the data dictionary. When resource manager terminates a SQL statement, it may be several minutes before the statement is quarantined.

> **Note:**
>
> *Oracle Database Licensing Information User Manual* for details on which features are supported for different editions and services

Additionally, SQL Quarantine can also be used to create *quarantine configurations* for execution plans of SQL statements by specifying thresholds for consuming various system resources (similar to the Resource Manager thresholds) using the `DBMS_SQLQ` package subprograms. These thresholds are known as *quarantine thresholds*. If any of the Resource Manager thresholds is equal to or less than a quarantine threshold specified in a SQL statement's quarantine configuration, then the SQL statement is not allowed to run, if it uses the execution plan specified in its quarantine configuration.

The following are the steps to manually set quarantine thresholds for an execution plan for a SQL statement using the `DBMS_SQLQ` package subprograms:

1. Create a quarantine configuration for an execution plan for a SQL statement
2. Specify quarantine thresholds in the quarantine configuration

You can also perform the following operations related to quarantine configurations using the `DBMS_SQLQ` package subprograms:

- Enable or disable a quarantine configuration

- Delete a quarantine configuration
- Transfer quarantine configurations from one database to another

> **Note:**
>
> - A quarantine configuration is specific to an execution plan for a SQL statement. If two different SQL statements use the same execution plan, they do not share the same quarantine configuration.
> - An execution plan is quarantined specific to a SQL statement that is terminated by the Resource Manager. Thus, an execution plan that is quarantined for a SQL statement will not be quarantined for a different SQL statement that is not yet terminated by the Resource Manager.
> - If there is no quarantine configuration created for an execution plan for a SQL statement, or if no quarantine thresholds are specified in its quarantine configuration, the execution plan for a SQL statement still gets automatically quarantined, if the Resource Manager terminates it for exceeding any of the Resource Manager thresholds.

For example, consider a resource plan of the Resource Manager that limits execution time for SQL statements to be 10 seconds (Resource Manager threshold). Consider a SQL statement Q1 for which this resource plan is application. When Q1 exceeds execution time of 10 seconds, it gets terminated by the Resource Manager. SQL Quarantine then creates a quarantine configuration for Q1 specific to that execution plan and stores this execution time of 10 seconds as a quarantine threshold in the quarantine configuration.

If Q1 is executed again with the same execution plan and the Resource Manager threshold is still 10 seconds, then SQL Quarantine does not allow Q1 to execute, because it refers to the quarantine threshold of 10 seconds to determine that Q1 will be eventually terminated by the Resource Manager as Q1 takes at least 10 seconds to execute.

If the Resource Manager threshold is changed to 5 seconds and Q1 is executed again with the same execution plan, then SQL Quarantine does not allow Q1 to execute, because it refers to the quarantine threshold of 10 seconds to determine that Q1 will be eventually terminated by the Resource Manager as Q1 takes at least 10 seconds to execute.

If the Resource Manager threshold is changed to 15 seconds and Q1 is executed again with the same execution plan, then SQL quarantine allows Q1 to execute, because it refers to the quarantine threshold of 10 seconds to determine that Q1 takes at least 10 seconds to execute, but there is a possibility that Q1 may complete its execution within 15 seconds.

> **Note:**
>
> A quarantine threshold is specific to an execution plan for a SQL statement, and it is automatically set by SQL Quarantine based on the Resource Manager threshold that is exceeded by the SQL statement and its execution plan. You can also manually set a quarantine threshold for a specific execution plan for a SQL statement by using the `DBMS_SQLQ` package subprograms.

See Also:

- "Creating a Quarantine Configuration for an Execution Plan of a SQL Statement"
- "Specifying Quarantine Thresholds in a Quarantine Configuration"
- "Enabling and Disabling a Quarantine Configuration"
- "Viewing the Details of a Quarantine Configuration"
- "Deleting a Quarantine Configuration"
- "Specifying Automatic Switching by Setting Resource Limits" for information about how to configure resource consumption limits for SQL statements using the Resource Manager

7.5.4.2 Creating a Quarantine Configuration for an Execution Plan of a SQL Statement

You can create a quarantine configuration for an execution plan of a SQL statement using any of these `DBMS_SQLQ` package functions – `CREATE_QUARANTINE_BY_SQL_ID` or `CREATE_QUARANTINE_BY_SQL_TEXT`.

The following example creates a quarantine configuration for an execution plan having the hash value of `3488063716` for a SQL statement having the SQL ID of `8vu7s907prbgr`:

```
DECLARE
    quarantine_config VARCHAR2(30);
BEGIN
    quarantine_config := DBMS_SQLQ.CREATE_QUARANTINE_BY_SQL_ID(
                             SQL_ID => '8vu7s907prbgr',
                             PLAN_HASH_VALUE => '3488063716');
END;
/
```

If you do not specify an execution plan or specify it as `NULL`, then the quarantine configuration is applied to all the execution plans of a SQL statement, except for those execution plans for which the execution plan-specific quarantine configurations are already created.

The following example creates a quarantine configuration for all the execution plans for a SQL statement having the SQL ID of `152sukb473gsk`:

```
DECLARE
    quarantine_config VARCHAR2(30);
BEGIN
    quarantine_config := DBMS_SQLQ.CREATE_QUARANTINE_BY_SQL_ID(
                             SQL_ID => '152sukb473gsk');
END;
/
```

The following example creates a quarantine configuration for all the execution plans for a SQL statement `'select count(*) from emp'`:

```
DECLARE
    quarantine_config VARCHAR2(30);
BEGIN
    quarantine_config := DBMS_SQLQ.CREATE_QUARANTINE_BY_SQL_TEXT(
                             SQL_TEXT => to_clob('select count(*) from emp'));
END;
/
```

The `CREATE_QUARANTINE_BY_SQL_ID` and `CREATE_QUARANTINE_BY_SQL_TEXT` functions return the name for the quarantine configuration, which can be used for specifying *quarantine thresholds* for an execution plan for a SQL statement using the `DBMS_SQLQ.ALTER_QUARANTINE` procedure.

> **See Also:**
>
> - "Specifying Quarantine Thresholds in a Quarantine Configuration"
> - *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_SQLQ` package subprograms

7.5.4.3 Specifying Quarantine Thresholds in a Quarantine Configuration

After creating a quarantine configuration for an execution plan for a SQL statement, you can specify quarantine thresholds for it using the `DBMS_SQLQ.ALTER_QUARANTINE` procedure. When any of the Resource Manager thresholds is equal to or less than a quarantine threshold specified in a SQL statement's quarantine configuration, then the SQL statement is not allowed to run, if it uses the execution plan specified in its quarantine configuration.

You can specify quarantine thresholds for the following resources in a quarantine configuration using the `DBMS_SQLQ.ALTER_QUARANTINE` procedure:

- CPU time
- Elapsed time
- I/O in megabytes
- Number of physical I/O requests
- Number of logical I/O requests

In the following example, the quarantine threshold specified for CPU time is 5 seconds and elapsed time is 10 seconds for the quarantine configuration `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`.

```
BEGIN
    DBMS_SQLQ.ALTER_QUARANTINE(
       QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
       PARAMETER_NAME  => 'CPU_TIME',
       PARAMETER_VALUE => '5');

    DBMS_SQLQ.ALTER_QUARANTINE(
       QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
```

```
       PARAMETER_NAME  => 'ELAPSED_TIME',
       PARAMETER_VALUE => '10');
END;
/
```

When the SQL statement is executed using the execution plan specified in this quarantine configuration, and if the Resource Manager threshold for CPU time is 5 seconds or less, or elapsed time is 10 seconds or less, then the SQL statement is not allowed to run.

> **Note:**
>
> If any of the Resource Manager thresholds is equal to or less than a quarantine threshold specified in a SQL statement's quarantine configuration, then that SQL statement is not allowed to run, if it uses the execution plan specified in its quarantine configuration.

Querying quarantine thresholds for a quarantine configuration

You can query a quarantine threshold for a quarantine configuration using the `DBMS_SQLQ.GET_PARAM_VALUE_QUARANTINE` function. The following example returns the quarantine threshold for CPU time consumption for the quarantine configuration `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`:

```
DECLARE
    quarantine_config_setting_value VARCHAR2(30);
BEGIN
    quarantine_config_setting_value :=
        DBMS_SQLQ.GET_PARAM_VALUE_QUARANTINE(
              QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
              PARAMETER_NAME  => 'CPU_TIME');
END;
/
```

Deleting quarantine thresholds from a quarantine configuration

You can delete a quarantine threshold from a quarantine configuration by specifying `DBMS_SQLQ.DROP_THRESHOLD` as the value for `PARAMETER_VALUE`. The following example deletes the quarantine threshold for CPU time consumption from the quarantine configuration `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`:

```
BEGIN
    DBMS_SQLQ.ALTER_QUARANTINE(
       QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
       PARAMETER_NAME  => 'CPU_TIME',
       PARAMETER_VALUE => DBMS_SQLQ.DROP_THRESHOLD);
END;
/
```

> **See Also:**
>
> *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_SQLQ.ALTER_QUARANTINE` procedure

7.5.4.4 Enabling and Disabling a Quarantine Configuration

You can enable or disable a quarantine configuration using the `DBMS_SQLQ.ALTER_QUARANTINE` procedure. A quarantine configuration is enabled by default when it is created.

The following example disables the quarantine configuration having the name `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`:

```
BEGIN
    DBMS_SQLQ.ALTER_QUARANTINE(
       QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
       PARAMETER_NAME  => 'ENABLED',
       PARAMETER_VALUE => 'NO');
END;
/
```

The following example enables the quarantine configuration having the name `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`:

```
BEGIN
    DBMS_SQLQ.ALTER_QUARANTINE(
       QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
       PARAMETER_NAME  => 'ENABLED',
       PARAMETER_VALUE => 'YES');
END;
/
```

> **See Also:**
>
> *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_SQLQ.ALTER_QUARANTINE` procedure

7.5.4.5 Viewing the Details of a Quarantine Configuration

You can query the `DBA_SQL_QUARANTINE` view to get details of all the quarantine configurations.

The `DBA_SQL_QUARANTINE` view contains the following information about each quarantine configuration:

- Quarantine configuration name
- SQL statement for which the quarantine configuration is applicable
- Hash value of the execution plan for which the quarantine configuration is applicable

- Status of the quarantine configuration (enabled or disabled)
- Status of automatic purging of the quarantine configuration (yes or no)
- Quarantine thresholds specified for the quarantine configuration:
  - CPU time
  - Elapsed time
  - I/O in megabytes
  - Number of physical I/O requests
  - Number of logical I/O requests
- Date and time when the quarantine configuration was created
- Date and time when the quarantine configuration was last executed

> **See Also:**
>
> *Oracle Database Reference* for details of the `DBA_SQL_QUARANTINE` view

7.5.4.6 Deleting a Quarantine Configuration

The unused quarantine configurations are automatically purged or deleted after 53 weeks. You can also delete a quarantine configuration using the `DBMS_SQLQ.DROP_QUARANTINE` procedure. You can disable automatic deletion of a quarantine configuration using the `DBMS_SQLQ.ALTER_QUARANTINE` procedure.

The following example disables automatic deletion of the quarantine configuration `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`:

```
BEGIN
    DBMS_SQLQ.ALTER_QUARANTINE(
       QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
       PARAMETER_NAME  => 'AUTOPURGE',
       PARAMETER_VALUE => 'NO');
END;
/
```

The following example enables automatic deletion of the quarantine configuration `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`:

```
BEGIN
    DBMS_SQLQ.ALTER_QUARANTINE(
       QUARANTINE_NAME => 'SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4',
       PARAMETER_NAME  => 'AUTOPURGE',
       PARAMETER_VALUE => 'YES');
END;
/
```

The following example deletes the quarantine configuration `SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4`:

```
BEGIN
    DBMS_SQLQ.DROP_QUARANTINE('SQL_QUARANTINE_3z0mwuq3aqsm8cfe7a0e4');
END;
/
```

> **See Also:**
>
> *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_SQLQ` package subprograms

7.5.4.7 Viewing the Details of Quarantined Execution Plans of SQL Statements

You can query the `V$SQL` and `GV$SQL` views to get details about the quarantined execution plans of SQL statements.

The following columns of the `V$SQL` and `GV$SQL` views show the quarantine information of execution plans of SQL statements:

- `SQL_QUARANTINE`: This column shows the name of the quarantine configuration for an execution plan of a SQL statement.
- `AVOIDED_EXECUTIONS`: This column shows the number of times an execution plan of a SQL statement was prevented from running after it was quarantined.

> **See Also:**
>
> *Oracle Database Reference* for details of the `V$SQL` and `GV$SQL` views

7.5.4.8 Transferring Quarantine Configurations from One Database to Another Database

You can transfer quarantine configurations from one database to another database using the `DBMS_SQLQ` package subprograms – `CREATE_STGTAB_QUARANTINE`, `PACK_STGTAB_QUARANTINE`, and `UNPACK_STGTAB_QUARANTINE`.

For example, you may have tested the quarantine configurations on a *test* database and confirmed that they have performed well. You may then want to load these quarantine configurations into a *production* database.

The following example describes the steps to transfer quarantine configurations from one database *(source database)* to another database *(destination database)* using the `DBMS_SQLQ` package subprograms:

1. Using SQL*Plus, connect to the source database as a user with the administrative privileges, and create a staging table using the `DBMS_SQLQ.CREATE_STGTAB_QUARANTINE` procedure.

The following example creates a staging table named `TBL_STG_QUARANTINE`:

```
BEGIN
  DBMS_SQLQ.CREATE_STGTAB_QUARANTINE (
    staging_table_name => 'TBL_STG_QUARANTINE');
END;
/
```

2. Add the quarantine configurations into the staging table, which you want to transfer to the destination database.

   The following example adds all the quarantine configurations starting with the name `QUARANTINE_CONFIG_` into the staging table `TBL_STG_QUARANTINE`:

```
DECLARE
  quarantine_configs NUMBER;
BEGIN
  quarantine_configs := DBMS_SQLQ.PACK_STGTAB_QUARANTINE(
                            staging_table_name => 'TBL_STG_QUARANTINE',
                            name => 'QUARANTINE_CONFIG_%');
END;
/
```

   The `DBMS_SQLQ.PACK_STGTAB_QUARANTINE` function returns the number of quarantine configurations added to the staging table.

3. Export the staging table `TBL_STG_QUARANTINE` to a dump file using the Oracle Data Pump Export utility.
4. Transfer the dump file from the source database system to the destination database system.
5. On the destination database system, import the staging table `TBL_STG_QUARANTINE` from the dump file into the destination database using the Oracle Data Pump Import utility.
6. Using SQL*Plus, connect to the destination database as a user with the administrative privileges, and create the quarantine configurations from the imported staging table.

   The following example creates the quarantine configurations on the destination database based on all the quarantine configurations stored in the imported staging table `TBL_STG_QUARANTINE`:

```
DECLARE
  quarantine_configs NUMBER;
BEGIN
  quarantine_configs := DBMS_SQLQ.UNPACK_STGTAB_QUARANTINE(
                            staging_table_name => 'TBL_STG_QUARANTINE');
END;
/
```

   The `DBMS_SQLQ.UNPACK_STGTAB_QUARANTINE` function returns the number of quarantine configurations created in the destination database.

> **See Also:**
>
> *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_SQLQ` package subprograms

7.5.4.9 Example: Quarantine for an Execution Plan of a SQL Statement Consuming Excessive System Resources

This example shows how an execution plan of a SQL statement is quarantined when it exceeds a resource consumption limit configured using the Resource Manager.

1. Using the Resource Manager, specify the execution time limit of 3 seconds for SQL statements executed by the user `HR`.

   The following code performs these operations by creating a complex resource plan using the `DBMS_RESOURCE_MANAGER` package subprograms:

   - creates a consumer group `TEST_RUNAWAY_GROUP`.
   - assigns the user `HR` to the `TEST_RUNAWAY_GROUP` consumer group.
   - creates a resource plan `LIMIT_RESOURCE` that terminates SQL statements when they exceed the execution time of 3 seconds.
   - assigns the `LIMIT_RESOURCE` resource plan to the `TEST_RUNAWAY_GROUP` consumer group.

```
connect / as sysdba

begin

  -- Create a pending area
  dbms_resource_manager.create_pending_area();

  -- Create a consumer group 'TEST_RUNAWAY_GROUP'
  dbms_resource_manager.create_consumer_group (
    consumer_group => 'TEST_RUNAWAY_GROUP',
    comment        => 'This consumer group limits execution time for SQL statements'
  );

  -- Map the sessions of the user 'HR' to the consumer group 'TEST_RUNAWAY_GROUP'
  dbms_resource_manager.set_consumer_group_mapping(
    attribute      => DBMS_RESOURCE_MANAGER.ORACLE_USER,
    value          => 'HR',
    consumer_group => 'TEST_RUNAWAY_GROUP'
  );

  -- Create a resource plan 'LIMIT_RESOURCE'
  dbms_resource_manager.create_plan(
    plan    => 'LIMIT_RESOURCE',
    comment => 'Terminate SQL statements after exceeding total execution time'
  );

  -- Create a resource plan directive by assigning the 'LIMIT_RESOURCE' plan to
  -- the 'TEST_RUNAWAY_GROUP' consumer group
  -- Specify the execution time limit of 3 seconds for SQL statements belonging to
  -- the 'TEST_RUNAWAY_GROUP' group
  dbms_resource_manager.create_plan_directive(
    plan             => 'LIMIT_RESOURCE',
    group_or_subplan => 'TEST_RUNAWAY_GROUP',
    comment          => 'Terminate SQL statements when they exceed the' ||
                        'execution time of 3 seconds',
```

```
    switch_group     => 'CANCEL_SQL',
    switch_time      => 3,
    switch_estimate  => false
  );

  -- Allocate resources to the sessions not covered by the currently active plan
  -- according to the OTHER_GROUPS directive
  dbms_resource_Manager.create_plan_directive(
    plan              => 'LIMIT_RESOURCE',
    group_or_subplan  => 'OTHER_GROUPS',
    comment           => 'Ignore'
  );

  -- Validate and submit the pending area
  dbms_resource_manager.validate_pending_area();
  dbms_resource_manager.submit_pending_area();

  -- Grant switch privilege to the 'HR' user to switch to the 'TEST_RUNAWAY_GROUP'
  -- consumer group
  dbms_resource_manager_privs.grant_switch_consumer_group('HR',
                                                          'TEST_RUNAWAY_GROUP',
                                                          false);

  -- Set the initial consumer group of the 'HR' user to 'TEST_RUNAWAY_GROUP'
  dbms_resource_manager.set_initial_consumer_group('HR',
                                                   'TEST_RUNAWAY_GROUP');

end;
/

-- Set the 'LIMIT_RESOURCE' plan as the top plan for the Resource Manager
alter system set RESOURCE_MANAGER_PLAN = 'LIMIT_RESOURCE' scope = memory;

-- Unlock the HR user and assign it the DBA role
alter user hr identified by hr_user_password account unlock;
grant dba to hr;

-- Flush the shared pool
alter system flush shared_pool;
```

2. Connect to the Oracle database as the `HR` user and run the SQL statement that exceeds the execution time limit of 3 seconds:

```
select count(*)
from employees emp1, employees emp2,
     employees emp3, employees emp4,
     employees emp5, employees emp6,
     employees emp7, employees emp8,
     employees emp9, employees emp10
where rownum <= 100000000;
```

   The SQL statement is terminated by the Resource Manager as it exceeds the execution time limit of 3 seconds and the following error message is displayed:

```
ORA-00040: active time limit exceeded - call aborted
```

   The execution plan for the SQL statement is now added to the quarantine list, so that it is not allowed to run again.

3. Run the SQL statement again.

   Now the SQL statement should terminate immediately with the following error message, because its execution plan is quarantined:

```
ORA-56955: quarantined plan used
```

4. View the details of the quarantined execution plan of the SQL statement by querying the `v$sql` and `dba_sql_quarantine` views.

   - Query the `v$sql` view. The `v$sql` view contains information about various statistics of the SQL statements including the quarantine statistics.

     ```
     select sql_text, plan_hash_value, avoided_executions, sql_quarantine
     from v$sql
     where sql_quarantine is not null;
     ```

     The output of this query is similar to the following:

     ```
     SQL_TEXT                            PLAN_HASH_VALUE   AVOIDED_EXECUTIONS   SQL_QUARANTINE
     ----------------------------------  ---------------   ------------------   ----------------------------------
     select count(*)                     3719017987        1                    SQL_QUARANTINE_3uuhv1u5day0yf6ed7f0c
     from employees emp1, employees emp2,
          employees emp3, employees emp4,
          employees emp5, employees emp6,
          employees emp7, employees emp8,
          employees emp9, employees emp10
     where rownum <= 100000000;
     ```

     The `sql_quarantine` column shows the auto-generated name for the quarantine configuration for the execution plan of the SQL statement.

   - Query the `dba_sql_quarantine` view. The `dba_sql_quarantine` view contains information about the quarantine configurations of execution plans of the SQL statements.

     ```
     select sql_text, name, plan_hash_value, last_executed, enabled
     from dba_sql_quarantine;
     ```

     The output of this query is similar to the following:

     ```
     SQL_TEXT                            NAME                                PLAN_HASH_VALUE
     LAST_EXECUTED                 ENABLED
     ----------------------------------  ----------------------------------  ---------------
     ----------------------------  -------
     select count(*)                     SQL_QUARANTINE_3uuhv1u5day0yf6ed7f0c  3719017987       14-JAN-19 02.19.01.000000
     AM   YES
     from employees emp1, employees emp2,
          employees emp3, employees emp4,
          employees emp5, employees emp6,
          employees emp7, employees emp8,
          employees emp9, employees emp10
     where rownum <= 100000000;
     ```

     The `name` column shows the auto-generated name for the quarantine configuration for the execution plan of the SQL statement.

5. Clean up the example environment.

   The following code deletes all the database objects created for this example:

   ```
   connect / as sysdba

   begin
     for quarantineObj in (select name from dba_sql_quarantine) loop
       sys.dbms_sqlq.drop_quarantine(quarantineObj.name);
     end loop;
   end;
   /

   alter system set RESOURCE_MANAGER_PLAN = '' scope = memory;
   ```

```
execute dbms_resource_manager.clear_pending_area();
execute dbms_resource_manager.create_pending_area();
execute dbms_resource_manager.delete_plan('LIMIT_RESOURCE');
execute dbms_resource_manager.delete_consumer_group('TEST_RUNAWAY_GROUP');
execute dbms_resource_manager.validate_pending_area();
execute dbms_resource_manager.submit_pending_area();
```

See Also:

- "Creating a Complex Resource Plan" for more information about creating a complex resource plan using the `DBMS_RESOURCE_MANAGER` package subprograms
- *Oracle Database PL/SQL Packages and Types Reference* for more information about the `DBMS_RESOURCE_MANAGER` package subprograms
- *Oracle Database Reference* for more information about the `V$SQL` view

7.5.5 Viewing Attention Log Information

Access information stored in the attention log either by opening the file with any text editor or by querying the `V$DIAG_ATTENTION` view.

To view the attention log by using a text editor:

1. Navigate to the *$ORACLE_HOME*`/diag/rdbms/`*database_name*`/`*instance_id*`/trace` directory.
2. Open the `attention.log` file.

To view attention log information stored in the data dictionary:

1. Connect to the database with SQL*Plus or a query tool such as SQL Developer.
2. Query the `V$DIAG_ATTENTION` view using the required filters.

   For example, the following query displays attention messages for which urgent action must be taken. A `message_level` of 1 corresponds to critical errors that need immediate action.

```
SELECT container_name, message_id, message_type, message_text, cause_text,
       action_text, version, host_id, component_id
FROM   v$diag_attention
WHERE  message_level = 1;
```

7.6 Diagnosis and Tracing in a PDB Using Package DBMS_USERDIAG

This section describes how to use the PL/SQL package DBMS_USERDIAG for diagnosis and allows you to set up a trace within a PDB.

- About DBMS_USERDIAG
  The `DBMS_USERDIAG` package provides a narrow set of functionality provided through `DBMS_SYSTEM` , which restricts arbitrary event settings.
- Examples of Using DBMS_USERDIAG
  This section shows examples of using the `DBMS_USERDIAG` package.

7.6.1 About DBMS_USERDIAG

The `DBMS_USERDIAG` package provides a narrow set of functionality provided through `DBMS_SYSTEM` , which restricts arbitrary event settings.

For a given PDB, the `DBMS_USERDIAG` package allows you:

- to enable the SQL trace at a given level.
- to disable the SQL trace.
- to check the SQL trace.

Most of the regular diagnostic mechanisms have been restricted outside of a given PDB using lockdown profiles, so that arbitrary events cannot be enabled from user sessions in a shared tenancy in CBD deployments in cloud instances. In particular, the `alter session set events` statement is blocked in cloud deployments because it can be misused to set events and actions which may change code-path execution or simulate errors.

7.6.2 Examples of Using DBMS_USERDIAG

This section shows examples of using the `DBMS_USERDIAG` package.

The example below shows setting a trace event for SQL ID `g3yc1js3g2689`.

```
exec dbms_userdiag.enable_sql_trace_event(sql_id=>'g3yc1js3g2689', binds=>1,
                                          waits=>1,
plan_stat=>'all_executions');
```

The example below shows writing a message to the trace file:

```
exec dbms_userdiag.trace('DBMS_USERDIAG-TRACE:This is a message, written
default to trace file');
```

This example shows writing to the default trace file. A non-zero value for ALERT writes to the alert log:

```
exec dbms_userdiag.trace('DBMS_USERDIAG-TRACE:This is an alert log message',
alert=>1);
```

This example shows enabling excpetions to the thrown if there are internal errors, if any:

```
exec dbms_userdiag.SET_EXCEPTION_MODE(TRUE);
```

Related Topics

- PL/SQL Packages and Types Reference