

CHAPTER 1

Introduction

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Architecture

The Avamar® Plug-in for Oracle works with Oracle and Oracle Recovery Manager (RMAN) to back up Oracle databases, tablespaces, or datafiles to an Avamar server or a Data Domain® system. The Avamar Plug-in for Oracle serves as a backup module and the Avamar server or Data Domain system as a storage device. You can perform backups and restores from Avamar Administrator or from the RMAN command line interface.

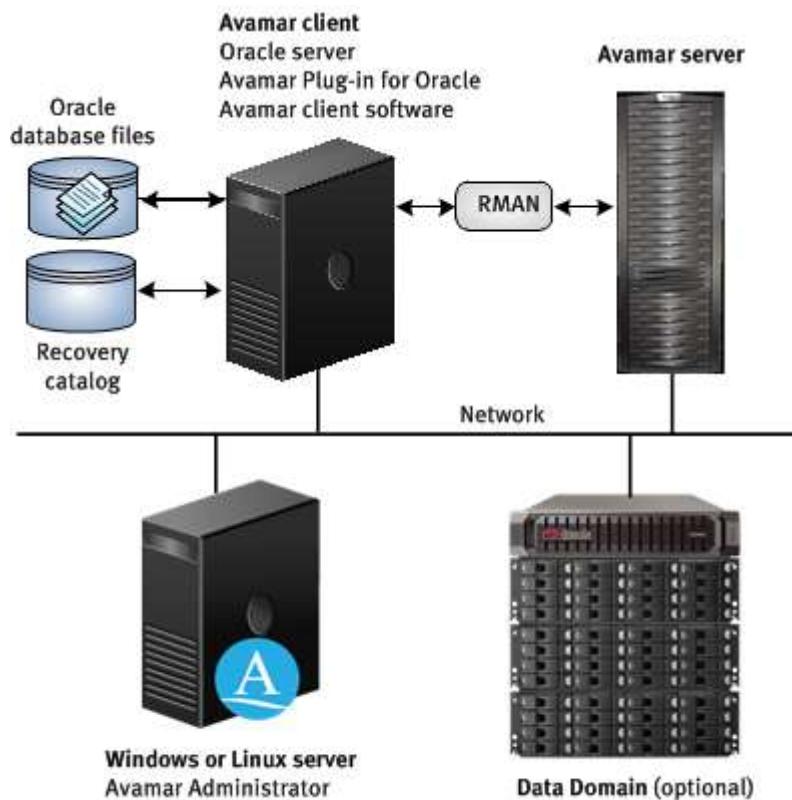
From the RMAN command line interface, RMAN uses the Avamar Plug-in for Oracle as a data mover to perform backup and recovery. From Avamar Administrator, the Avamar Plug-in for Oracle creates an RMAN script to perform the backup or restore operation and spawns an RMAN process to run the script. RMAN then uses the Avamar Plug-in for Oracle as a data mover to perform a backup or a restore operation.

Stand-alone configuration

You can deploy the Avamar Plug-in for Oracle in stand-alone configurations for all supported platforms.

The following figure shows a stand-alone configuration that uses the Avamar Plug-in for Oracle to back up or restore Oracle data to or from an Avamar server or a Data Domain system.

Figure 1 Avamar Plug-in for Oracle in a stand-alone configuration



The *Avamar Compatibility and Interoperability Matrix* provides more information about supported platforms.

High-availability configuration

You can also deploy the Avamar Plug-in for Oracle in high-availability (HA) configurations such as Microsoft Cluster Server (MSCS), Solaris Cluster Server (VCS), and Oracle Real Application Clusters (RAC).

MSCS configurations

The Avamar Plug-in for Oracle supports two-node MSCS configuration. You can use the Avamar Plug-in for Oracle to back up Oracle database files from Windows Server 2008 and MSCS for both 32-bit and 64-bit platforms.

VCS configurations

The Avamar Plug-in for Oracle supports both two-node active/active and two-node active/passive VCS configurations. You can use the Avamar Plug-in for Oracle to back up Oracle database files from Solaris platforms that run VCS.

In an active/active cluster configuration, each node runs an instance of the Avamar Plug-in for Oracle as an application in separate service groups. This functionality provides application redundancy. When a failure occurs on one active node, the other active node hosts both service groups.

In an active/passive cluster configuration, the service group is online on the active node until a failover occurs. Then the service group comes online on the passive node.

You can run backups and restores from both nodes.

RAC configurations

RAC is an option for an Oracle database that enables multiple nodes to have shared access to a single database. The Avamar Plug-in for Oracle supports backups of RAC configuration on HP-UX, IBM AIX, Linux, Solaris, or Windows platforms, and requires that Oracle RAC installation is in the English language.

The Avamar Plug-in for Oracle installation packages for the HP-UX, IBM AIX, Linux, and Solaris platforms include three configuration scripts for Oracle RAC:

- `rac_config`—Configures the Avamar Plug-in for Oracle to back up and restore RAC databases.
- `rac_deconfig`—Deletes the RAC configuration from the Avamar Plug-in for Oracle.
- `rac_stop`—Removes the Avamar agent (`EMCagent`) from the Oracle Clusterware resource list.

The Avamar Plug-in for Oracle installation package for Microsoft Windows includes `AvamarRACConfiguration.exe`.

Use Avamar Administrator to back up and restore Oracle RAC databases just as you would for non-RAC databases. In an Oracle RAC configuration, each cluster node runs a local instance of the Oracle database and maintains a local copy of online logs. The instance name differs from the database unique name.

To back up an Oracle RAC database, the Avamar Plug-in for Oracle connects to the instance of the database that is running on the current active node. To restore an Oracle RAC database, you must first shut down all database instances, and then start the instance on the registered node in a “no mount” state.

When one cluster node fails or is taken offline, the other cluster nodes continue operating. The Oracle RAC database remains available to users without interruption.

The Avamar Plug-in for Oracle backs up and restores Oracle RAC databases by connecting to the instance that runs on the cluster node. This node is the one registered with the Avamar server.

Because each node runs an instance of the Oracle database in a RAC configuration, when a failover occurs, users access the database on the failover node. The failover process is transparent to the users.

Data Domain system support

The Avamar Plug-in for Oracle supports backups to and restore from Data Domain systems. You can back up Oracle data to a Data Domain system by using Avamar Administrator or by using RMAN backup scripts. The Avamar Plug-in for Oracle stores the metadata for the backup on the Avamar server.

Before you can store backups on a Data Domain system, you must add the Data Domain system to the Avamar configuration by using Avamar Administrator. After you configure the Data Domain system, you can back up Oracle database files to the Data Domain system by performing the following actions:

- Selecting the appropriate plug-in option from Avamar Administrator.
- Specifying the Data Domain system as the target system for RMAN backup scripts.

You can also specify a Data Domain system when you create a dataset for a scheduled backup.

You must store the full backup for a client and all subsequent incremental backups on either the Avamar server or a single Data Domain system. The Avamar Plug-in for Oracle does not support backups that are stored partly on Avamar and partly on a Data Domain system. For example, the Avamar Plug-in for Oracle does not support the following types of backups:

- Full backup on a Data Domain system and incremental backups on the Avamar server
- Full backup on the Avamar server and incremental backups on a Data Domain system
- Full backup on one Data Domain system and incremental backups on another Data Domain system

If you change the device on which backups for a client are stored, you must then perform a full backup before you perform any further incremental backups.

The steps to restore backups are the same whether you restore backups from the Avamar server or from a Data Domain system. The restore process determines the location of the backup.

The *Avamar and Data Domain System Integration Guide* provides more information about configuring Data Domain systems for use with Avamar systems.

Log files

The Avamar Plug-in for Oracle creates log files during backup and restore operations. The log files are for debugging purposes. Backup and restore operations from Avamar Administrator create the `avoracle.log` file in the `install-directory/var/clientlogs` directory.

Backup and restore operations

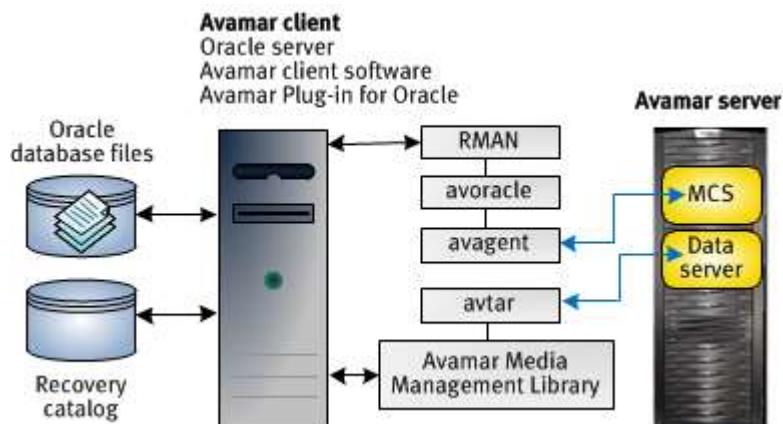
You can perform backup and restores by using Avamar Administrator or by running RMAN scripts from the command line.

Backups and restores in Avamar Administrator

During backups or restores in Avamar Administrator, the Avamar Plug-in for Oracle generates an RMAN script that performs the backup or restore of the specified database. The Avamar client agent runs RMAN with this script. The script directs Oracle to open a connection with an Avamar Media Management library, which invokes an `avtar` session to connect to the Avamar server.

The following figure shows the process flow between the Avamar client and Avamar server.

Figure 2 Avamar client and Avamar server process flow diagram



The Oracle backup process generates an RMAN script similar to the following script:

```

configure controlfile autobackup on;
run {
allocate channel cl type sbt;
send 'connect information for avtar to connect to the Avamar
server';
backup database;
}

```

During the backup or restore operation, RMAN creates a log file that you can view from Avamar Administrator:

```

Recovery Manager: Release 11.1.0.7.0 - Production
Copyright (c) 1995, 2004, Oracle. All rights reserved.
connected to target database: ORACLE (DBID=1420649215) using target
database controlfile instead of recovery catalog
RMAN> configure controlfile autobackup on;
2> run {
3> allocate channel cl type sbt;
4> send '... ';
6> backup database;
7> }
8>

```

```

old RMAN configuration parameters:
CONFIGURE CONTROLFILE AUTOBACKUP OFF;
new RMAN configuration parameters:
CONFIGURE CONTROLFILE AUTOBACKUP OFF;
new RMAN configuration parameters are successfully stored
allocated channel: c1
channel c1: sid=142 devtype=SBT_TAPE
channel c1: AVTAR/Avamar backup
sent command to channel: c1

Starting backup at 23-NOV-12
channel c1: starting full datafile backupset
channel c1: specifying datafile(s) in backupset
input datafile fno=00001 name=D:\ORACLE\PRODUCT\10.1.0\ORADATA
\ORACLE\ORACLE\SYSTEM01.DBF
input datafile fno=00003 name=D:\ORACLE\PRODUCT\10.1.0\ORADATA
\ORACLE\ORACLE\SYSAUX01.DBF
input datafile fno=00002 name=D:\ORACLE\PRODUCT\10.1.0\ORADATA
\ORACLE\ORACLE\UNDOTBS01.DBF
input datafile fno=00004 name=D:\ORACLE\PRODUCT\10.1.0\ORADATA
\ORACLE\ORACLE\USERS01.DBF
channel c1: starting piece 1 at 23-NOV-12
channel c1: finished piece 1 at 23-NOV-12
piece handle=15gfs32k_1_1 comment=API Version 2.0,MMS Version
2.2.0.108 channel c1: backup set complete, elapsed time: 00:00:45
channel c1: starting full datafile backupset channel c1: specifying
datafile(s) in backupset including current controlfile in backupset
including current SPFILE in backupset channel c1: starting piece 1
at 23-NOV-12 channel c1: finished piece 1 at 23-NOV-12 piece
handle=16gfs341_1_1 comment=API Version 2.0,MMS Version 2.2.0.108
channel c1: backup set complete, elapsed time: 00:00:17 Finished
backup at 21-MAR-11 released channel: c1

Recovery Manager complete.

```

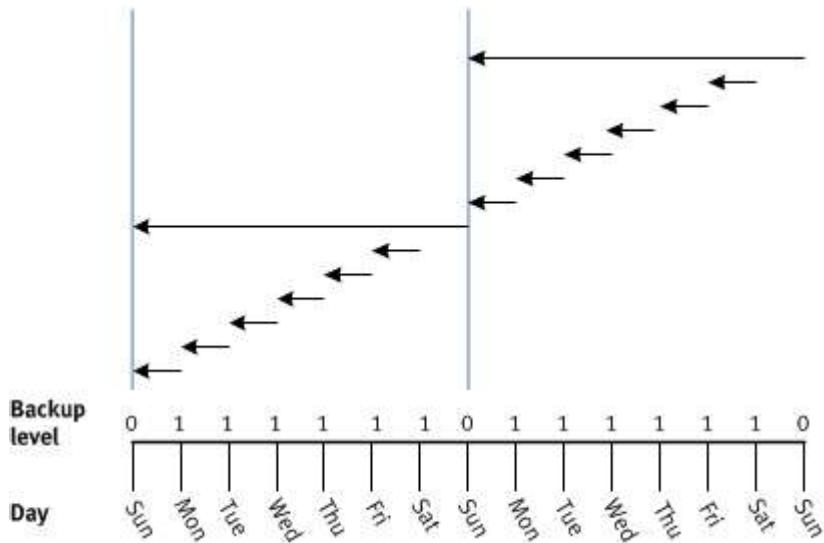
Backup

The Avamar Plug-in for Oracle enables you to back up Oracle database files and archive logs by using Avamar Administrator or RMAN backup scripts. When you use an RMAN script, you can back up an Oracle database, a tablespace, or a single datafile.

Backup types

The Avamar Plug-in for Oracle supports the following types of backups:

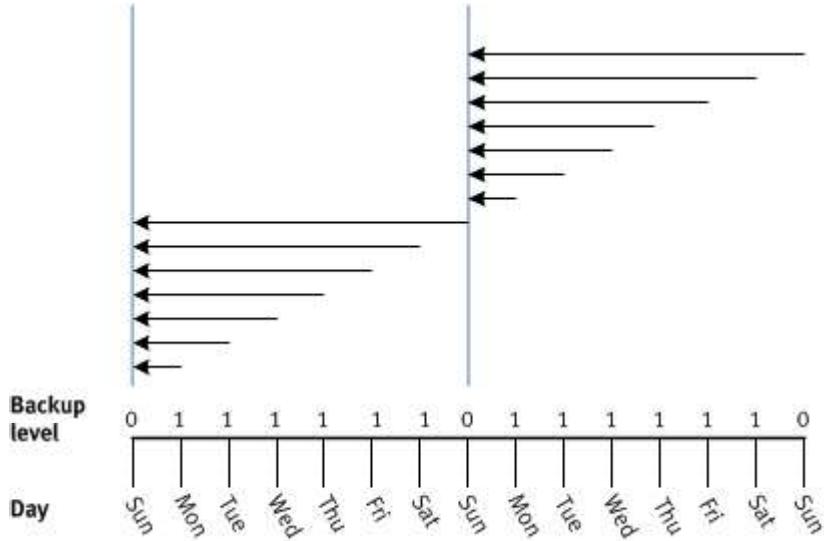
- Backups of Oracle database files and archive logs.
- Cold (offline) backups of the Oracle file system.
- Four backup levels:
 - Full—Backs up all data files. You can optionally choose to backup the archive logs during a Level 0 (incremental) backup or at a later time. Level full, the default backup level, is not part of the incremental backup strategy.
 - Level 0 (incremental)—Backs up all data files. You must run a Level 0 backup before you run a Level 1 backup.
 - Differential (incremental)—Backs up all database blocks that have changed since the most recent incremental (differential or cumulative) or level 0 backup. The following figure shows daily level 1 differential backups during a two-week period.

Figure 3 Level 1 differential backups

- Cumulative (incremental)—Backs up all database blocks that have changed since the most recent level 0 backup.

Restoring a backup from a cumulative backup is faster than restoring a backup from a differential backup. Cumulative backups, however, require more disk space and take longer to complete than differential backups.

Perform cumulative level backups when recovery time is more important than disk space. The following figure shows daily level 1 cumulative backups during a two-week period.

Figure 4 Level 1 cumulative backups

- On-demand or scheduled backups—You can perform on-demand backups or schedule backups to run automatically.

Archive log backups

The **Backup Command Line Options** dialog box includes the following backup options: **Back up database**, **Back up archive logs**, and **Delete archive log after backup**.

You must select at least one of the backup options, otherwise the backup fails. The Avamar Plug-in for Oracle does not validate these options. When you select the **Back up archive logs** option, the Avamar Plug-in for Oracle ignores the incremental backup options and performs a full backup.

Avamar Administrator does not support restores of only archive logs. To restore only archive logs, you must use an RMAN script.

Automatic Storage Management and raw file structure support

The Avamar Plug-in for Oracle supports backups of databases that use Automated Storage Management (ASM) for storage management and raw file structure.

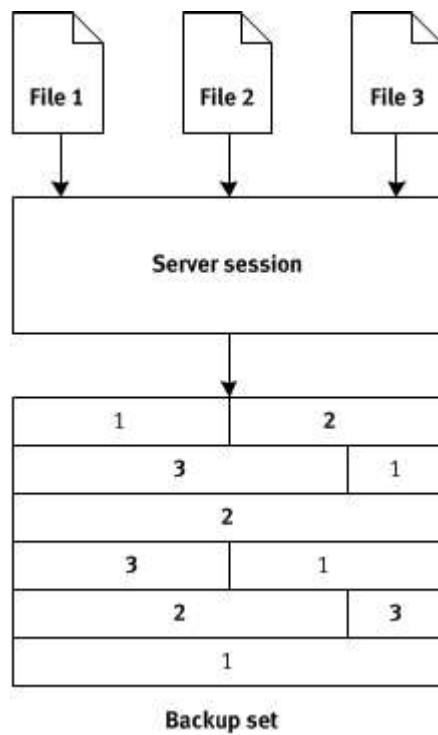
Oracle offline backup

The Avamar Plug-in for Oracle supports Oracle's offline backup feature, which enables you to back up a database that is in a mount state. This type of backup is equivalent to a hot backup of a database. A restore of an offline backup uses the same procedure that a restore of a hot backup uses.

RMAN tuning options

Backups that you perform with the Avamar Plug-in for Oracle in Avamar Administrator use RMAN. RMAN reads the individual data files, bundles the files into backup sets, and then sends the backup set to `avtar`.

To create the backup set, RMAN simultaneously reads multiple files from the disk, and then writes the blocks of file data into the same backup set. The combination of blocks from multiple files is called backup multiplexing. The following figure shows the multiplexing of three files into a backup piece.

Figure 5 RMAN multiplexing

In [Figure 5](#) on page 25, RMAN simultaneously reads three files and writes them to the backup set intermingled. The RMAN multiplexing feature intermingles the backup files, and does not provide the data stream in a similar format for subsequent reads.

Because of how the RMAN multiplexing feature intermingles files, backups by the Avamar Plug-in for Oracle to the Avamar server can contain the duplicate data even if no changes were made to the database since the last backup. The RMAN multiplexing feature can negatively affect the data deduplication ratio of the Avamar Plug-in for Oracle.

The Avamar Plug-in for Oracle improves data deduplication performance by enabling you to use the **Filesperset** option in Avamar Administrator.

The **Filesperset** option specifies the number of files to include in each backup set. The default value of the **Filesperset** option is 1. When you specify a value for the **Filesperset** option, RMAN uses the value as a limit for the number of files RMAN includes in a backup set.

RMAN backup optimization

The Avamar Plug-in for Oracle supports the RMAN backup optimization feature through the RMAN CLI only. By enabling the backup optimization feature, the RMAN backup command skips the backup of a file if an identical file is already backed up to the allocated device type.

Enable backup optimization with the `configure backup optimization` on RMAN command.

Enabling backup optimization reduces backup time. The Oracle documentation provides more information about backup optimization.

[Enabling RMAN backup optimization](#) on page 111 provides more information about performing backups that use the backup optimization feature.

RMAN multisection backups

The Avamar Plug-in for Oracle supports the Oracle multisection backup feature through the RMAN CLI only. To use this feature, perform backups with the `SECTION SIZE` parameter to divide data files into subsections. Each subsection is then backed up in parallel across multiple channels. The Oracle documentation provides more information about the multisection backup feature.

Restore and recovery

The Avamar Plug-in for Oracle supports the restore of a database backup from one system to another system or to a directory on the same system. During a restore you can recover corrupt blocks or recover data blocks from the flash recovery area (FRA).

Corrupt block recovery

The Avamar Plug-in for Oracle includes the **Corrupt blocks** option, which enables you to recover corrupt data blocks only and not the entire database. The **Corrupt blocks** option is an advanced option in the **Restore Command Line Options** dialog box.

To use the **Corrupt blocks** option, you must first configure the database to use checksums to verify data blocks. To enable this feature, set the initialization parameter, `DB_BLOCK_CHECKSUM`, to `TYPICAL` for the Oracle database. This setting enables RMAN to detect both physical and logical corruption:

- Physical corruption can occur because of defective memory boards, defective controllers, or broken sectors on a hard disk.
- Logical corruption can occur if the contents of a data block are logically inconsistent. Examples of logical corruption include corruption of a row piece or an index entry.

You can use the **Corrupt blocks** option while the database is open.

Flashback Database recovery

The Avamar Plug-in for Oracle supports Oracle Flashback Database recovery. The Flashback Database feature enables you to rewind the database to a target time, system change numbers (SCN), or a log sequence number. The Avamar Plug-in for Oracle provides a new option in the **Restore Command Line Options** dialog box that enables you to perform a recovery from Flashback Database logs.

[Plug-in Options](#) on page 131 provides more information about Flashback Recovery options.

Roll forward recovery

The Avamar Plug-in for Oracle supports roll-forward recovery by providing the **Open the database with resetlogs after recovery** advanced option in Avamar Administrator. The installation of the Avamar Plug-in for Oracle enables this advanced option by default.

The **Open the database with resetlogs after recovery** option instructs the restore operation to open the database with resetlogs after the restore completes. The opening of the database with resetlogs initializes the logs, resets the log sequence number, truncates the available changes in the redo logs, and starts a new incarnation of the database.

To roll forward a database after a restore operation completes, you must clear the **Open the database with resetlogs after recovery** option in the **Restore Command Line Options** dialog box. When you clear this option, the restore operation does not open the database with resetlogs. You can apply archive logs to recover the database to the most current point-in-time that is available.

Concurrent backups and restores

The Avamar Plug-in for Oracle supports concurrent backups, restore, or both types of operations from Avamar Administrator. You can select multiple databases for a backup or restore operation and the Avamar Plug-in for Oracle runs the backup or restore operations concurrently.

When the operation completes, the Avamar Plug-in for Oracle creates a snapview with all of the files that are backed up or restored. For differential, cumulative, and archive log only backups, the snapview also contains the backup files from the previous backups.

You can perform concurrent backups on Oracle 10g and later. You cannot run concurrent backups of the same database from Avamar Administrator and the RMAN CLI simultaneously.

Avamar Plug-in for Oracle backups from Avamar Administrator use the same page cache files per database. Concurrent backups to a Data Domain system do not use cache files.

Multiple databases

The Avamar Plug-in for Oracle supports the selection of multiple databases for both backup and restore operations.

When multiple databases are backed up on the same workorder, they are logically grouped so that Avamar Administrator can present a hierarchical view of the databases during subsequent restore operations. This grouping is accomplished by prefixing a path that comprises the ORACLE-INSTANCE and ORACLE-SID to each database within the backup. For example, an Oracle 11g database with ORACLE-SID set to orcl is prefixed with /11g/orcl/.

Multi-streaming

Multi-streaming is a feature that enables a backup or a restore to use multiple RMAN channels to the Avamar server or the Data Domain system. A backup or restore that uses multiple RMAN channels runs multiple instances of `avtar` in parallel.

RMAN might not use all the RMAN channels that you specify. For example, if you specify 4 RMAN channels for a backup, RMAN might use only 2 channels. The backup ignores the other 2 channels. The default number of RMAN channels is 1 and the maximum is 10.

Allocating multiple RMAN channels for backups and restores can improve performance. Performance improvements for backups and restores, however, depend on the Oracle server configuration.

You can specify multiple RMAN channels for backups and restores by using the **Number of RMAN Channels** option in Avamar Administrator or by specifying `allocate channel` commands in an RMAN script.

Oracle Exadata

Oracle Exadata is a product that combines hardware and software to run Oracle. The Avamar Plug-in for Oracle supports Oracle Exadata for Oracle Database Machine and Exadata Storage Server (attached to an external database server) configurations.

The Avamar Plug-in for Oracle supports the same environment for Oracle Exadata (including the Oracle database versions, operating system versions, and Avamar versions) as the environment that the Avamar Plug-in for Oracle supports for Oracle RAC. The *Avamar Compatibility and Interoperability Matrix* provides more information about supported environments for the Avamar Plug-in for Oracle.

Install and configure the Avamar Plug-in for Oracle on the Exadata database server the same way you install and configure the Avamar Plug-in for Oracle in Oracle RAC configurations. Use Avamar Administrator to back up and restore the Exadata database server just as you would for non-Exadata database servers. [Backup](#) on page 75 and [Restore and Recovery](#) on page 89 provide more information.

Oracle recovery catalog

The Avamar Plug-in for Oracle supports the Oracle recovery catalog feature during backups and restores.

When you select the **Use recovery catalog** option for a backup, the backup updates the recovery catalog. All backups include the database control file so that future restore operations do not depend on the recovery catalog.

When Avamar Administrator cannot use the recovery catalog for a restore, the restore must use the database control file. You can, however, restore a database from an Avamar backup by using the recovery catalog from RMAN. [Using the catalog for backup and restores](#) on page 123 provides more information.

Preprocessing and postprocessing backup and restore scripts

The Avamar Plug-in for Oracle supports preprocessing and postprocessing scripts for both backup and restore operations that you perform in Avamar Administrator.

Preprocessing and postprocessing scripts are user-written shell scripts (`.sh`) on Linux or UNIX. On Windows, scripts are batch scripts (`.bat`), vb Scripts (`.vbs`), and JSscripts (`.js`). The Avamar Plug-in for Oracle runs preprocessing and postprocessing scripts as root on Linux or UNIX, and as an administrator on Windows.

You can use preprocessing and postprocessing scripts for various tasks, such as the following tasks:

- Copying logs from the `var` directory to different directory before a backup.
- Preparing the databases for a backup or restore.
- Running SQL queries to get database information.
- Setting environment parameters.

All preprocessing and postprocessing scripts must be in the `/avamar/etc/scripts` directory on the client. The preprocessing and postprocessing feature is an advanced option in Avamar Administrator. [Preprocessing and postprocessing scripts and attributes](#) on page 141 provides more information.

In addition to using preprocessing and postprocessing scripts, the Avamar Plug-in for Oracle supports the use of preprocessing and postprocessing attributes. Specify preprocessing and postprocessing attributes and attribute values in the **Enter Attribute** and **Enter Attribute Value** fields.