

Using Oracle Recovery Manager and Dell/EMC Storage

Oracle® Recovery Manager (RMAN) can be used to create backups and to restore and recover an Oracle database. With Dell/EMC storage, RMAN can provide a foundation for enterprise-class data protection and recovery.

BY TESFAMARIAM MICHAEL, MAHMOUD AHMADIAN, AND BOB NG

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Many IT departments have implemented user-managed backups for database as well as enterprise infrastructure software and data. During the user-managed backup process, database administrators (DBAs) use raw data backup tools to directly back up the disk content holding Oracle data. The disk content is first conditioned by putting the Oracle database (or tablespace files) into hot backup. Putting the database into hot backup causes the Oracle server to perform checkpoints on different tablespaces as part of the disk data conditioning. These checkpoints can affect the production performance level. Use of fast, storage-based, point-in-time logical replication helps to minimize the time required to copy the conditioned Oracle disk data. Integrating this type of replication into the user-managed backup process can help to minimize the duration of the backup and its impact on applications service.

Oracle® Database 10g includes Recovery Manager (RMAN), a utility for creating backups and for restoring and recovering an Oracle database. RMAN works directly through the database management system's engine to secure the appropriate data for use in its backup process. As such, RMAN does not require the preconditioning of the Oracle data stored on disk through mechanisms such as hot backup. However, RMAN competes for system resources with production user activities, which can

impact production performance for the entire duration that RMAN needs to complete the backup task.

The combination of the two approaches, user-managed backup and RMAN, offers an option that can help minimize the service-level impact as well as the duration of the disruption. Starting with user-managed backup of the Oracle database that is facilitated by storage-based, logical, near-instantaneous replication, DBAs can minimize the length of time during which the production service level is disturbed. The captured disk copy can then be mounted onto a separate set of resources, such as backup servers, where the RMAN task can be run in the background. This technique enables DBAs to benefit from an RMAN backup with no further impact on the production service level. It can be an effective way to leverage additional hardware and software resources to enhance the overall quality of service of the production environment.

Offering enhanced functionality

Given the importance of backup, Oracle has recently enhanced RMAN in Oracle Database 10g. By design, RMAN works intimately with the database server processes. As a result, RMAN enables many features that may not be present in user-managed backup alternatives. These features include block-level detection of data corruption during backup and restore; optimized backup using

process parallelism; reduced space consumption using compression and block change tracking; a common user interface across all supported operating systems; a catalog containing detailed information of backup history; compatibility with most of the leading backup software applications through RMAN's Media Management Library application programming interface (API); incremental backup; and image copy backup.

Comparing online and RMAN backups

Online backups, also referred to as hot backups, are performed while the database is mounted and open. Hot backups do not require database downtime and allow higher availability than offline, or cold, backups. Oracle best practices recommend using RMAN for all Oracle database backup and recovery operations.

For hot backups, redo logs must be archived regardless of whether RMAN is used. Recovering a database from a hot backup without archived redo logs is not possible. Oracle requires a minimum of two redo log files. However, the best practice is to configure several redo logs. Redo logs also may be multiplexed to enhance redundancy. These files switch roles from online redo log to offline redo log. While the online redo log is being updated by Oracle log writer, the offline redo log is archived by the log archive process. The role switch happens when the online redo log is full, after verifying that the offline redo log is archived.

If RMAN is not used, the database must be put in hot-backup mode. The System Change Number in the data file headers ceases to increment with checkpoints, and the full image of the changed database blocks are written to redo logs. This results in "extra work" if extensive changes are made to the database during a hot backup. Once the backup is complete, the database is taken out of hot-backup mode and reverts to normal logging.

Advantages of RMAN backups. The advantage of RMAN backups is that the database does not need to be put into hot-backup mode because the backup will be performed by Oracle processes that employ the read-consistency mechanism used by SQL statements. Another advantage is ease of backup management. When using RMAN to perform backups, RMAN can be directed to perform validation of backup data created. RMAN also maintains information about the created backup set in a catalog. This catalog information can greatly facilitate the ability to perform subsequent database restores using the most optimal backup data set alternatives.

However, running an RMAN backup directly against the production database can have drawbacks. Because the RMAN session runs concurrently with other production user requests, it competes for service from the database engine against those user processes.

Using storage-based replication to support Oracle backups

To leverage storage and database features for better performance, DBAs can use the storage software's fast replication features to create

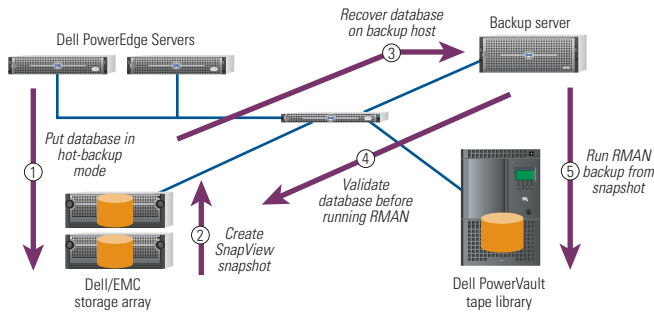


Figure 1. Using SnapView snapshots to offload RMAN backups

a logical or physical copy of the database. Rather than running RMAN on the production database, in this scenario the DBA puts the Oracle database into hot-backup mode. The storage system's near-instantaneous replication technology provides the ability to create a second copy of the database. The production database is therefore required to be kept in the hot-backup state just long enough to allow the storage replica to be made, which typically takes just a few seconds. Once the copy is available and accessible, it is mounted onto a separate server dedicated to the task of performing the RMAN backup. The logical copy, with the archived logs, is restored and the database is recovered onto the backup server node using RMAN. The recovered database can now be used as the target for RMAN to create the final backup to a Dell PowerVault™ tape library. The actual process of creating the RMAN backup may take substantially longer (minutes or hours), but that activity occurs without affecting the service of the production database for the entire backup duration.

Dell/EMC CX series storage arrays are available with the optional EMC® SnapView™ point-in-time copy software, which DBAs can use to create physical or logical copies of an Oracle database.

Physical point-in-time clones. Using SnapView clones for backups alleviates the overhead associated with database backups from the production volume. A clone is an actual copy of a logical unit (LUN) or volume, and it is created by mirroring (copying) the changes from the source (production volume) to the clone—a process referred to as cloned mirror write (CMW). As of the 3Q05 Dell/EMC CX series array release, up to eight clones can be assigned to one production volume.

DBAs can use the Oracle database residing on the clone as the target for RMAN. In this case, the database is switched to hot-backup mode so that the database will be in a consistent state when the clone is fractured. Once the clone is fractured, the database is returned to normal operation mode. The fractured clone is then used by RMAN to create a backup of the database onto backup media. This method offloads all the backup reads from the production volume, assuming that the SnapView clone is placed on spindles other than the ones they mirror, which is the recommended practice. Additionally, the load of CMW ceases as soon as the clone is fractured for backup. The same methodology applies

even if the Oracle database resides on multiple LUNs. As long as the Oracle database stays in the hot-backup state, while all the clones associated with each of the production database LUNs are being fractured, the clone set is a validated database LUN set that can be used to run the RMAN backup task.

The advantage of this method is that the source volume is not touched by the backup processes because the point-in-time copy of the source resides in the clone. However, with this technique the fractured clone(s) must be resynchronized with the production volume once the backup is complete. Because up to eight clones can be supported, users who need an up-to-date clone can be accommodated by keeping at least one of the clones in the group synchronized with the production volume.

Virtual point-in-time snapshots. Another method is to use SnapView snapshots to make a virtual point-in-time copy of the LUN, which is designed to complete in a matter of seconds. First the database is put in hot-backup mode. Then the SnapView software is used to create a snapshot of the LUN. The database is set back to normal mode and the snapshot is backed up. The advantage of this method is that the LUN is not fractured and no resynchronization to the production volume is required. However, because the snapshot is the point-in-time logical replica of the source LUN, the backup processing will affect the source LUN write I/O performance while the snapshot is used to drive the RMAN backup (see Figure 1).

Providing effective support for Oracle backups

The Dell/EMC CX300, CX500, and CX700 storage arrays are designed to provide reliable and scalable storage for Oracle databases. Storage instance replication features of these arrays, such as EMC SnapView software, can be valuable resources for Oracle DBAs. Leveraging the array-based software to support Oracle backups can help to optimize the service levels of the production environment during backup operations. Both SnapView clones and snapshots are options on the CX arrays that can enable DBAs to back up an Oracle database, incurring low performance impact during the backup process. Using RMAN in conjunction with SnapView can provide an effective method of storage and server offloading for Oracle backups. [▶](#)

Tesfamariam Michael is a software engineer in the Dell Database and Application Engineering Department of the Dell Product Group. Tesfamariam has an M.S. in Computer Science and a B.S. in Mathematics from Clark Atlanta University, and a B.S. in Electrical Engineering from Georgia Institute of Technology.

Mahmoud Ahmadian is an engineering consultant in the Database and Applications team of the Dell Product Group. Mahmoud has an M.S. in Computer Science from The University of Houston, Clear Lake.

Bob Ng is an engineering consultant in the EMC® CLARiiON® Application Solution Integration team at EMC. Bob has an M.S. in Electrical Engineering and Computer Science from the University of California, Berkeley.