

Designing Data Protection Strategies for Oracle Databases

VERITAS Backup Exec™ 10 *for Windows Servers*

Agent for Oracle on Windows Servers

TABLE OF CONTENTS

Executive Summary	3
Oracle Backup Basics	4
Limitations of Manual Backup Methods	4
Cold Backups	4
Hot Backups (online).....	4
Data Restoration	5
Database Recovery.....	5
Requirements for Oracle Backup and Recovery.....	6
Backup and Recovery With Backup Exec Agent for Oracle	7
Local vs. Remote Backup and Recovery	7
Solution Outline.....	7
Why not use VERITAS Backup Exec Advanced Open File Option (AOFO)?.....	9
VERITAS Backup Exec Agent for Oracle Architecture	9
Storage Area Networks	9
Dedicated Backup LAN.....	9
Restoring Databases	10
Restoring an Online Oracle Database	10
Restoring Individual Tablespaces	10
Restoring the Archived Logfiles Data.....	10
Restoring the Database's Tablespaces	10
Restoring a Closed Oracle Database	11
Agent for Oracle Disaster Recovery Prerequisites	12
Disaster Recovery Using the Oracle Agent	12
Summary	13

EXECUTIVE SUMMARY

Oracle database backup and recovery is an inherently challenging process that becomes more difficult as databases grow in size and as increasing demands on database availability limit the time available to perform backups. Many organizations use custom-made scripts and manual backup methods to protect their Oracle data. However, these methods do not provide the reliability required by corporate environments, and do little to improve the ongoing availability of critical systems.

Eliminating backup overhead on production Oracle databases is also a requirement for many of today's online 7x24xforever, critical business applications. Oracle is the foundation for most business applications, so even the slightest performance impact or shortest downtime to an Oracle database can result in significant business loss. A backup and recovery solution must eliminate down time and provide both efficiency and speed to support these environments.

VERITAS Backup Exec agent for Oracle on Windows Servers integrates non-disruptive data protection for business-critical Oracle 10g, 9i, 8i, and 8.x databases. Use advanced features such as the granular protection of individual table spaces or a complete application/database backup and the protection of archived redo logs and control files, without ever taking them offline.

This paper discusses the essentials that every Oracle database administrator (DBA) should be equipped with and follows when creating their Oracle backup, restore and recovery strategy. This paper will also touch on the future direction of Oracle database backup and recovery.

KEY BENEFITS

- Supports Oracle 10g, 9i, 8i, and 8.x databases
- Offers full disaster recovery capability in the event of catastrophic database failure
- To backup and restore online Oracle databases allowing database users to continue to run their backup operations without interruption.

ORACLE BACKUP BASICS

If you run critical applications with Oracle databases, you probably have already invested in an Oracle backup and recovery solution. For many organizations, this solution is an assortment of scripts and manual processes managed and maintained by in-house database administrators (DBAs). For various reasons, many organizations continue to use backup schemes that no longer efficiently back up their data.

Oracle Backups	
COLD BACKUPS	Taken when the database is shut down, creating a consistent backup image (the database is in a consistent state).
HOT BACKUPS (ONLINE)	Taken while the database is online. These may be either full or incremental backups. For very large databases, for example, it may be necessary to back up one tablespace one day, another one the next, etc. In addition, hot backups are not inherently consistent; they must be managed in conjunction with archived and online redo logs to bring the database to a consistent state. There is also the situation where restores may be performed in parallel with backups (e.g., a user drops a tablespace, so it must be recovered while a database backup is in progress). Performing hot backups requires putting the Oracle database into a special backup mode, generating some additional redo and rollback information during the backup.

Often, a problem is not discovered until a recovery fails, resulting in a costly database outage or loss of data. A backup solution that once worked well for smaller databases does not address the needs of a larger Oracle database, or a large database with increasing availability requirements. Symptoms of an inadequate backup/recovery solution include:

- Excessive DBA time spent maintaining and managing backups, without scheduled automated backups
- Infrequent backups, leading to lengthier recoveries
- Prolonged outages due to data restoration errors or problems finding the right files
- Operator support required for changing tapes

It is not enough to have Oracle database experts in-house — you also need storage management capabilities for handling and managing high-volume backups for optimal performance and manageability. VERITAS Backup Exec combines data protection and storage management capabilities with Oracle-specific database functionality to provide a highly scalable backup and recovery solution for protecting Oracle database data.

LIMITATIONS OF MANUAL BACKUP METHODS

Oracle provides a rich variety of backup and recovery options, which are described in greater detail in the Oracle Administration Guide and in a number of third-party books on Oracle database administration. This paper presents a basic description of these options to highlight the inherent challenges of manual methods.

Oracle backups can be divided into two categories:

These two methods can be used in combination, with full cold backups once a week and tablespace-level hot backups on a daily basis. In addition, Oracle is continuously adding information to redo logs, which contain the

transaction-by-transaction history of the database and are used to bring the database to a consistent state during a restore/recovery. The database backup process must manage all the files comprising the database, including data files, control files, parameter files and archived redo logs.

Recovering from a failure is a more complex operation, requiring exact steps to be followed depending on the kind of failure experienced. Generally, database recovery includes two phases:

Oracle Recovery	
DATA RESTORATION	Identifying and restoring the appropriate data files, archived redo logs, control files, and parameter files from secondary media to their appropriate location on primary disk.
DATABASE RECOVERY	Taking the appropriate steps in Oracle to recover the database, either to a specific point in time or, if recovering from a database failure, to the most recent point before the failure.

Determining which files to restore is challenging, particularly if you have been performing a series of hot backups over a long period of time during which you haven't performed a cold backup. A point-in-time recovery requires different steps than an up-to-the-minute recovery.

Restoring the wrong files (for example, restoring the control file when it is not necessary to do so) will cause more problems than the original outage. Determining which archive logs are required also delays recovery.

In many Oracle environments, it is the duty of the DBA to create and run backup scripts to manage their regularly scheduled Oracle backups. These scripts can perform either cold or hot backups, and automate backups to some degree. However, deploying user-created scripts is still primarily a manual approach to Oracle backups because:

- Maintaining the scripts is a manual, ongoing process. For example, as new tablespaces and data files are added to the database, the scripts must be updated.
- The scripts typically lack the robust error management and reusability of commercial software, and as such require ongoing maintenance.
- Although scripts automate backups, recovery is a manual process that requires the presence and guidance of an experienced DBA.
- Operators still need to be available to change tapes manually during backups.

Manual methods are adequate for some installations. For example, if the database is small, and if an adequate backup window is available, then a DBA has the luxury of simply shutting down the database and performing a consistent "cold" backup. Likewise, if the database does not undergo significant daily changes, backups do not need to occur as often.

However, as databases grow in size, manual methods become more difficult to manage. A large database may have hundreds of data files; tracking and storing the backup files on secondary media requires time-consuming organization. Very large backups may need tape changes during the backup, making automation even more necessary.

Most importantly, manual backups still leave organizations vulnerable to errors and delays in the recovery process.

Organizations must carefully evaluate whether their backup and recovery solutions protect not only their data but also the availability of their critical systems.

REQUIREMENTS FOR ORACLE BACKUP AND RECOVERY

An effective Oracle backup and recovery solution must meet the following requirements:

- **High availability of current systems** — If you have a small backup window, or no backup window at all, you need a high-performance solution that supports hot backups and minimizes the impact of backups on the production Oracle database.
- **Reliable results** — Oracle recovery can be complex; the backup solution must be reliable and provide the functionality to recover from a wide variety of Oracle database failures.
- **Manageability** — A backup and recovery solution should completely automate the backup processes, so unattended backups can take place at any time. The solution should allow the DBA to schedule and prioritize backups so that the most critical Oracle data is backed up first in case something goes wrong during the backup to prevent all of the data from being backed up successfully. And the solution must provide end-to-end backup management, from tracking and restoring the right files to expiring old backups.
- **Flexibility** — An Oracle backup and recovery solution should let you recover a single tablespace, perform online recoveries where possible, or recover to a point in time. To enable these capabilities, the backup solution must be closely integrated with the Oracle database.

Delivering all of these capabilities in a corporate environment, with critical data at stake, requires a solution that encompasses both database-specific functionality and storage management capabilities.

BACKUP AND RECOVERY WITH BACKUP EXEC AGENT FOR ORACLE

LOCAL VS. REMOTE BACKUP AND RECOVERY

One has to consider two ways of setting up the backup of an Oracle database. Most often, the Oracle database does not reside on the backup server. In that case, a client access license (CAL) must be installed on the remote Oracle Server/Backup Exec client. The client agent uses VERITAS' patented agent accelerator technology to greatly reduce the amount of bandwidth and time required to properly protect the Oracle database. To ease the licensing, this CAL is fully integrated with the Oracle Agent. In the rare instance where the Backup Exec server and the Oracle database server are installed on the same hardware, the CAL included with the Oracle Agent can be used to protect another remote server.

SOLUTION OUTLINE

The components required to effectively protect Oracle databases are:

- VERITAS Backup Exec 10.0 *for Windows Servers*
- Backup Exec Agent for Oracle w/CAL

The Backup Exec Agent for Oracle provides a complete solution for backing up and restoring database servers running single or multiple Oracle databases. The agent is capable of protecting database data using any of the three methods outlined below.

When performing your normal file system backups using the standard Backup Exec software, make sure that the Oracle database control and data files are excluded from the backup set. Failure to do so will result in unnecessary entries in the Job History, showing the database files as skipped files as they are both locked and unreadable when the database is open.

For the last two methods, Backup Exec Agent for Oracle takes advantage of the Oracle Database Server's ability to create a copy of a database's control file while the database is online.

Backup Exec Data Protection Methods

<p>Closed Database</p>	<p>This type of backup takes place while a database is shut down, so all data files and control files comprising the database are available for backup by a file system backup operation. This type of backup is recommended whenever you make structural changes to the database. An alternative to shutting down the database is to select only the directories and files that make up the database.</p>
<p>Benefit: This type of backup should always be run once to ensure a solid baseline for disaster recovery purposes.</p>	
<p>Entire Online Database</p>	<p>This includes automatically protecting the database's tablespace data files and the database control file. It also includes all of the Oracle archived redo logs. If new tablespaces have been added to the Oracle database since the last backup operation was performed, these new tablespaces are automatically detected and backed up during the next full backup operation of the Oracle database.</p>
<p>Benefit: The primary benefit of backing up the entire online database is that it allows database users to continue to run their database operations without interruption. In addition, restores require fewer steps to bring a failed database back online</p>	
<p>Individual Online Tablespaces</p>	<p>Use this option to protect individual, online tablespaces within the Oracle database. When an online tablespace is backed up, the tablespace is placed in Backup Mode and its associated data files are backed up. After backup, the individual tablespace is placed back online if it was previously online. When all selected tablespaces have been backed up, the archive redo logfiles are backed up to the same backup set.</p>
<p>Benefit: The primary benefit of this feature is that it allows you to schedule the frequency of Individual tablespace backups. This is useful in environments where your Oracle database has a tablespace that rarely changes — you can schedule its backup to occur less frequently than it would for another tablespace that constantly changes. This feature allows you to perform backups of critical tablespace, and it reduces the amount of time it takes for a backup to complete</p>	

WHY NOT USE VERITAS BACKUP EXEC ADVANCED OPEN FILE OPTION (AOFO)?

The AOFO utility is designed to adequately protect all file system data. The Open File Option does not offer the ability to intelligently protect all the necessary database files or to set the database into Backup Mode. In addition, a number of specialized database capabilities, such as selectively protecting only specific tablespaces and bringing those tablespaces back online after successful backup, are not supported by the Open File Option.

VERITAS BACKUP EXEC AGENT FOR ORACLE ARCHITECTURE

Each Oracle database agent contains a list of one or more database instances. Each database instance contains its own Archived Logfiles directory and Database Control File directory. Although no files appear in either of these directories, Backup Exec backs up the hidden files necessary to fully protect your Oracle databases. Tablespace data appears as subdirectories within the list database instances. Data files that comprise the tablespace appear as files within the appropriate tablespace directory entry.

STORAGE AREA NETWORKS

With VERITAS Backup Exec Shared Storage Option™, you can share storage devices (such as high-speed, high-capacity tape changers) dynamically in a heterogeneous Oracle database server environment. For example, you can allocate two drives in a robotic device for a specific Oracle database backup; Backup Exec dynamically releases those drives once the backup is complete. This feature works in a SAN or a SCSI switched environment. This capability lets organizations use storage hardware more effectively and efficiently with their Oracle database servers.

DEDICATED BACKUP LAN

Backup Exec offers you the ability to select a specific Backup Network. This feature allows you to direct primary backup traffic, generated by Backup Exec, to a specific local network. Directing backup jobs to a specified local network isolates the backup data so that other connected networks are not affected when backup operations are performed.

Additionally, a dedicated backup network can be leveraged to restore data. The feature is enabled on the media server and allows you to protect all the remote computers that reside on the specified local network. When the feature is enabled and a backup job is submitted, Backup Exec verifies that the media server and the remote computer are located on the specified local network. If both the media server and the remote computer are on the backup network, then the backup operation is performed. If the media server or the remote computer is not on the specified local network, the job fails. However, you can set up Backup Exec to use any available network to back up remote computers that are not connected to the backup network.

RESTORING DATABASES

If they become corrupted or are accidentally deleted, you can restore full databases, individual tablespaces, and the database control file. If you need to restore full databases, they can be either online or closed. When creating Oracle database restore jobs, you must always select the option to restore over existing files.

RESTORING AN ONLINE ORACLE DATABASE

A basic assumption with this procedure is that the Oracle Database Server is operational, and that database administration can be performed. It also assumes that all the tablespaces you want to restore have been defined, and that the Oracle Agent has been started on the database server.

The following procedure is used when the database is operational, but you want to restore the entire database to a prior state for which you have an online backup.

Restoring an online database requires you to run two separate restore jobs.

- First, restore the database's Archived Logfiles directory.
- Second, restore each of the database's tablespaces, which completes the database recovery.

After each tablespace is restored, the Agent for Oracle automatically attempts to perform media recovery for the tablespace. If the media recovery is unsuccessful, the agent creates an application event log entry with the specific Oracle error code. Be aware that a database's system tablespace cannot be restored while the database is online. The system tablespace can only be restored to a closed database.

RESTORING INDIVIDUAL TABLESPACES

If one or more tablespace data files become corrupted or deleted, a single tablespace can be recovered easily with the Oracle Agent. Do not restore individual tablespaces if an entire database becomes corrupted. Instead restore the entire database, along with the pertinent transaction logs.

RESTORING THE ARCHIVED LOGFILES DATA

In order to restore Archived Logfiles data, you must select which of the previously backed up systems you want to restore. Then expand the view to reveal backups sets that contain either tablespaces and/or logfiles. Select the Archived Logfiles directory from the appropriate backup set. Submit the restore job.

RESTORING THE DATABASE'S TABLESPACES

After restoring the Archived Logfiles directory follow the same steps and now select the backup set from which you restored the Archived Logfiles directory. Select each tablespace taking care NOT to select the Archived Logfiles directory since these were previously restored in step 1. Submit the restore job to restore the tablespaces. After each tablespace is restored, the Oracle Agent automatically attempts to perform media recovery for the tablespace. If the media recovery is unsuccessful, the agent creates an application event log entry with the specific Oracle error code.

RESTORING A CLOSED ORACLE DATABASE

Close the database by typing the following command: shutdown

If you cannot close the database using the normal shutdown command, you can close the database using the Oracle Enterprise Manager Shutdown Abort mode of the Shutdown Database dialog box, or the SHUTDOWN command with the ABORT option.

Determine which system you want to restore and expand the view to reveal backup sets that contain either tablespaces and/or logfiles. Clicking a backup set in the restore selections pane reveals the set's contents in the results pane.

Determine which backup set contains the entire Oracle database you want to restore.
Submit the restore job to restore the entire Oracle database.

AGENT FOR ORACLE DISASTER RECOVERY PREREQUISITES

The following items are required to fully recover your Oracle database server in the event of a disaster.

- Make a full Oracle database server file system backup using Backup Exec.

When making this backup, include both the Oracle database directory and the Windows system directory. However, do not include the Oracle database tablespace data files in this backup.

- Using the Oracle Agent, make a second backup containing the Oracle database tablespace data files.

After creating these backups, you will now have the necessary components to recover your Oracle database server in the event a disaster should occur.

DISASTER RECOVERY USING THE ORACLE AGENT

Developing the ability to recover your Oracle databases after a catastrophic failure requires that you implement a plan of protection before a failure happens. When developing a pre-disaster plan, you should use the following recommended backup strategies:

- Have a minimum of one closed database backup of your database.
- Have at least one backup of the Windows directory on the Oracle database server, making sure that you also include the Windows Registry.
- Perform a full, closed, database backup every time the structure of the database is altered.

For example, if you create a new tablespace or drop an old one, a complete closed database backup is recommended.

- Schedule regular full online backups of your Oracle database server.
- Schedule frequent tablespace backups to supplement regular full backups for tablespaces that change frequently.

SUMMARY

VERITAS is committed to providing quality Oracle database backup and recovery solutions to meet the needs of your corporation, whether your company is a startup with a small Oracle database or a large distributed organization using multiple remote Oracle databases with many gigabytes or terabytes of data. The Backup Exec solution offers a number of benefits:

- The ability to offer full disaster recovery capability in the event of catastrophic database failure by using a combination of a closed baseline backup with subsequent full and/or tablespace backups.
- The ability to backup and restore online Oracle databases allowing database users to continue to run their backup operations without interruption.
- The ability to backup and restore only specific tablespaces, allowing you to rapidly backup and restore frequently changing data.

All of these benefits are available in both local and remote servers, and in LAN, SAN or dedicated backup LAN topologies. Below is a list of VERITAS Backup Exec software solutions available to protect your mission-critical Oracle databases:

- Backup Exec Agent for Oracle on Windows Servers
- Backup Exec SAN Shared Storage Option for use with Oracle databases

VERITAS Software is committed to delivering quality solutions for your Oracle databases, now and in the future.

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