Using VERITAS NetBackup™ to Protect Oracle9i Real Application Clusters on Linux

FLEXIBLE DATA MANAGEMENT INFRASTRUCTURE USING VERITAS AND LINUX
EXECUTIVE SUMMARY / BUSINESS CHALLENGE

The demands being placed on data centers are increasing. Shrinking staffs. Underutilized computing and storage hardware. Exploding costs and increased complexity. And these challenges are further compounded with flat budgets. Many businesses are faced with computing and storage infrastructures that are very complex, inherently heterogeneous, highly distributed, and costly to manage. In response to these harsh requirements, many companies have begun to look at how critical business applications and databases can be reliably deployed and protected on Linux systems.

And nowhere has the shift toward Linux been more visible than in support of critical line of business applications, especially when layered over Oracle9i Real Application Clusters (RAC). Oracle has been at the leading edge of data base technology for some time. Now they have extended past their core database product by offering Real Application Clusters for increased scalability and availability. However, to realize the full business benefits of these advanced technologies, data intensive applications need proven data storage management products to match the capabilities offered by clustered Linux servers and Oracle databases.

VERITAS NetBackup™ provides the data storage management support that Oracle9i RAC demands.

This paper examines today’s data management challenges and how VERITAS NetBackup can be used to protect Oracle9i Real Application Clusters layered over machines running the Linux operating system.
INTRODUCTION

Innovative storage systems and software, such as Oracle9i Real Application Clusters (RAC) and VERITAS NetBackup™, continue to reshape data storage management and protection. As storage capacity continues to grow, so do the demands for advanced, tightly integrated storage management solutions. Along with a growing amount of data and information, customers are seeking storage management solutions that possess a high level of availability, scalability, performance and protection, ideally without imposing any burden on production computing.

Information residing within Oracle databases requires frequent backups to protect against data loss or logical corruption, and to minimize recovery time. The more frequently backup operations are performed, the shorter the time period required to recover the user’s Oracle data. Unfortunately, this can often impose a significant impact on database performance and availability. Quite simply, databases and their related line of business applications cannot tolerate any downtime or lost performance when performing the necessary backup and recovery operations that are required to adequately protect their Oracle databases.

Until recently, two big concerns with Linux dulled corporate acceptance: reliability and scalability. Recently, important product and technology announcements have been aimed toward satisfying these key corporate requirements. Indeed, many CFOs are now asking their IT groups for their Linux strategy deployment plan. It’s clear that CFO and IT management have become comfortable with Linux, and that mainstream use of Linux in data centers has moved from bleeding-edge to early adopter status.

Oracle Corporation and VERITAS Software have both announced comprehensive product support for Linux systems. Since its introduction in 2001, Oracle has experienced continued adoption of Oracle9i database and Real Application Cluster technology on Linux. Oracle9i RAC is recognized as a cost-effective option for Oracle customers that are developing and deploying enterprise class applications on lower cost hardware systems such as Linux.

WHY ORACLE9i REAL APPLICATION CLUSTERS?

Oracle9i Real Application Clusters provides a highly available, scalable database clustering solution that offers businesses a reliable platform for deploying mission-critical applications. Oracle9i Real Application Clusters enables applications to be deployed having high availability, scalability and performance without modifying applications.

Applications using RAC components view a Real Application Clusters as a single logical system, and do not need to be modified or partitioned to achieve near linear scalability. This scalability allows customers to grow the size and complexity of the Oracle database to meet increased usage and demand.

Oracle Real Application Clusters provides the following key benefits for demanding enterprise applications:

- **Higher application availability**: The RAC architecture provides customers with near continuous access to data with minimal interruption caused by hardware and software failures. RAC deployments are resilient to multiple node failures and have the ability to scale well past the limitations of a single server, delivering fault tolerance and increased application availability to Oracle users.

- **Increased application scalability**: Application users can log onto a single virtual high performance cluster server. Adding nodes to the Oracle database is easy and manual intervention is not required. It is easy to partition Oracle data when processor nodes are added or when business requirements change.
THE COMPLEXITY OF PROTECTING ORACLE 9i RAC ENVIRONMENTS

An Oracle9i Real Application Clusters (RAC) database uses shared storage and clustering technology to establish a communication path and coordinated access to data for use by all member nodes in a RAC database environment. Oracle9i RAC coordinates the access to shared database instances across all cluster nodes. Oracle9i RAC cluster members share the workload. This provides improved application scalability without having to modify the application to support distributed processing.

The complexity of data protection in a RAC environment is increased over non-RAC Oracle database configurations, and includes the considerations for backup application and utility support for operating system dependent cluster-ware (OSD), as well understanding the clustered shared data access model used by RAC configurations.

By leveraging OSD, Oracle9i RAC monitors the management of the database resources needed to operate specific database instances. On the shared disk, to manage Oracle components such as data files, control files, redo logs, etc., Oracle requires the use of a network file sharing protocol such as CIFS or NFS. Oracle components can also be managed through the use of a clustered file system, for example Oracle CFS and VERITAS Database Edition Advanced Cluster.

Oracle’s Recovery Manager (RMAN) interface, and its integration with a supported Media Manager Layer (MML) like VERITAS NetBackup, has been fully tested to support Oracle9i RAC environments. Below is an example of a typical configuration of an Oracle9i environment.

An Oracle9i RAC configuration has these components:

![Figure 1: Two-Node Oracle9i RAC Environment Sharing The Same Storage](image)

1 Drawing source: Hewlett-Packard tutorial.
REQUIREMENTS FOR PROTECTING ORACLE 9i REAL APPLICATION CLUSTERS

Oracle database backup and recovery is an inherently challenging process that becomes even more difficult as databases grow in size and increased application availability demands limit the time available to protect Oracle data.

Eliminating the CPU and I/O impact placed on production Oracle databases is another vital requirement for today’s online, all-the-time availability required, critical business applications. Even the slightest impact on an Oracle database can result in significant business losses. A backup and recovery solution must provide both efficiency and speed to support these environments.

Oracle databases offer unique and specific challenges for backup and recovery. These include:

- **Managing large amounts of data** — Database backups tend to have very high data-volume operations, and managing these backups typically means managing tens to thousands of gigabytes of data, often located on SAN attached secondary storage.

- **Maintaining high availability** — As databases grow in size, the time spent creating a backup may exceed any “backup window.” Protecting Oracle9i RAC databases must be performed without losing application availability.

- **Handling complex recovery scenarios** — Recovering an Oracle database is much more complex than simply restoring a file from off-line media; it requires isolating the cause of the failure, identifying and restoring the correct set of files and table-spaces, restoring the appropriate archived redo logs, and logically recovering the database.

Archived Redo logs contain the history of transactions applied to the Oracle database. Protecting these logs is absolutely critical for complete Oracle9i protection. Oracle offers the option of running with or without archiving the redo logs. If you run in NOARCHIVELOG mode, you will only be able to perform cold, offline backups, requiring the database to be shutdown and unavailable for use. This form of logging is unacceptable for nearly all enterprise level applications.

By contrast, running with ARCHIVELOG enabled carries its own challenges. The log files must be configured carefully and monitored closely. An Oracle database will hang if your archive log destination fills up or becomes unavailable.

NetBackup provides several features that simplify Oracle archive log management and protection.

OPTIONS FOR PROTECTING ORACLE DATABASES

There are two broad options for protecting Oracle9i RAC databases using VERITAS NetBackup along with the NetBackup for Oracle agent and its integration with Oracle RMAN:

- **Cold backups** are taken when the database is shut down and unavailable, creating a consistent backup image as the database tables, control and parameter files and transaction log files are in a consistent state.

- **Hot backups** are performed while the database is online and available. These may be either full or incremental backups. Performing hot backups requires putting the Oracle database into a special backup mode, resulting in the creation of redo and rollback logs during the backup task.
Oracle continuously writes 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 database restore and logical recovery. Fully protecting databases requires that the backup process capture all of these components, including data files, control files, parameter files and archived redo logs.

VERITAS Software has worked closely with Oracle Corporation to develop a highly scalable and reliable online backup and recovery solution for Oracle9i databases.

**VERITAS NETBACKUP™ AND NETBACKUP™ FOR ORACLE**

VERITAS NetBackup is an enterprise backup and recovery solution that provides highly scalable support for a variety of servers and clients, together with extensive media management capabilities. NetBackup supports all leading tape vaults and optical disk libraries, and is excellent at managing distributed backups, securely and safely, for optimal performance.

NetBackup for Oracle is tightly integrated with Oracle’s Recovery Manager (RMAN), a key component of Oracle9i databases. These interfaces, created and supported by Oracle Corporation, manage basic backup and recovery operations.

VERITAS NetBackup manages backup policies and schedules, along with managing the media and communications with offline storage media. A single NetBackup server can manage multiple Oracle database backups, providing centralized storage management and leveraging high-speed and high-capacity storage devices. This combination of VERITAS storage management and Oracle database expertise improves the availability, manageability and reliability of Oracle9i databases and applications.

**IMPROVING THE AVAILABILITY OF ORACLE9i RAC DATABASES**

VERITAS NetBackup for Oracle is a flexible and scalable solution for enterprise database backups. Whether for a small, critical database or a number of large databases, NetBackup delivers the necessary data protection tools to protect both the data itself and the availability of the Oracle database.

NetBackup optimizes database availability in two important ways. Superior backup performance and hot backup support minimizes the impact of backups on production Oracle systems. Fast data restoration and simplified recovery brings databases back online faster after failures.

**HOT BACKUP SUPPORT**

VERITAS NetBackup for Oracle supports both cold and hot backups. Oracle database administrators can create backup schedules that best suit their needs and adjust those schedules as their databases grow in size or complexity.

Through its integration with Oracle RMAN, NetBackup for Oracle simplifies making and maintaining hot backups. It manages the processes of altering the database state for backups, backing up all of the appropriate files and archived redo logs, and tracking all of the backup information needed for a fast and reliable recovery.

**VERITAS NETBACKUP FOR ORACLE AND CHECKPOINT/RESTART**

VERITAS NetBackup for Oracle supports the Oracle9i Resumeable Backup and Restore feature, allowing for the restart a failed backup or a recovery task from the point of failure.

The benefit of this new feature is that NetBackup for Oracle backups and recoveries can be completed more efficiently and in a shorter period of time in the event of backup or recovery failure.
VERITAS NETBACKUP SUPPORT FOR ORACLE9i RAC

In joint testing at Oracle’s Redwood Shores, CA, headquarters, NetBackup for Oracle was installed on two Oracle9i servers in a RAC configuration. NetBackup was used to initiate backups on both Oracle9i servers. One of the Oracle9i servers was deliberately crashed, causing the backup task to fail. However, the surviving backup task running on the other remaining Oracle9i server continued processing, uninterrupted by the node failure, and completed successfully.

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# Figure 2: VERITAS NetBackup for Oracle Architecture

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BEST PRACTICES FOR PROTECTING ORACLE 9i RAC WITH NETBACKUP

Listed below are suggestions on how to use NetBackup to effectively protect your Oracle9i RAC environment:

1. The use of an Oracle database recovery catalog is strongly encouraged. An Oracle recovery catalog, itself a database with extensive backup and restore history, permits full, fine grained database recovery.
2. For Oracle9i RAC installations, distributed backup and recovery operations among RAC nodes is recommended. Data protection tasks for specific files (e.g. redo logs) can occur locally to a specific node. This will help optimize performance for large databases that typically run within RAC configurations.
3. Always place database transaction log files on separate physical disks and file systems than your table spaces, control and parameter files to ensure Oracle database recoverability should a shared disk device (e.g. shared between individual RAC nodes) fail.
4. A single virtual IP hostname for your entire RAC configuration is recommended as it permits you to specify a single client identity, allowing NetBackup to perform a restore to any physical node. If virtual hostnames are not used, restore operations can only be performed from the node associated to the client name used when the backup task was performed.
5. Avoid writing or multiplexing table spaces and archive transaction logs backups onto the same physical media, as this may result in longer restore times. Instead, periodically write archive and transaction logs onto separate media, ideally using NetBackup policies configured for exclusively preserving these critical files.
6. The NetBackup configuration for the backup of the nodes in the cluster should use the virtual or cluster name, so that the backup data cataloged can be easily accessible under a common name. This configuration will provide the greatest flexibility in the event of a node failure. NetBackup can be configured to not use cluster virtual node names. However, this approach may prove to be more complex, for example requiring the user to remember the alternative client recovery steps, which would decrease recovery performance when time is of the essence.
VERITAS OFFERS THE LEADING SOLUTION FOR PROTECTING ORACLE DATABASES

VERITAS is committed to providing quality Oracle database backup and recovery solutions to meet the needs of your enterprise, whether your company is a startup with a small Oracle database or a large Fortune 100 corporation with multiple Oracle databases and many terabytes or petabytes of data.

Currently available VERITAS products available for Linux include:

- **Data Protection** – VERITAS NetBackup DataCenter
- **Storage management** – VERITAS Foundation Suite, VERITAS Volume Manager, and VERITAS File System
- **High Availability** – VERITAS Cluster Server
- **Application Performance Management** – VERITAS Precise InDepth
- **Server Provisioning and Automation** – VERITAS OpForce
- **Management** – VERITAS Global Cluster Manager

Planned additional support for VERITAS products for Linux:

- Updates to the all existing Linux products listed above
- VERITAS support for SuSE Linux and UnitedLinux on the Itanium (IA-64) platform
- VERITAS Database Edition/Advanced Cluster for Oracle9i RAC
- VERITAS Volume Replicator
- VERITAS SANPoint Foundation Suite

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