

# Backup Strategies for Database Environments

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## White Paper



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## MANAGEMENT OVERVIEW

Most mission-critical business applications depend on the capabilities of industry-standard relational database management systems—predominantly Oracle, Sybase, and Informix. Such applications are often deployed on top of distributed multi-terabyte databases and support thousands of business-focused end users. Managing each of these database management systems consists of assuring availability, integrity, performance, security, reliability, and backup of the database. However, assuring a reliable and quick local or remote recovery is the job of a complementary enterprise-scale storage management system. The right end-to-end storage management system includes high-volume remote backup, archive and recovery management of all database and file subsystems. The **objective is simple—high availability to critical end users and their applications, 24 hours a day, 7 days a week.**

The right backup and recovery solution must:

- Allow integrated coverage of all major database management systems, conventional file systems, local or networked backup, high-speed recovery, mainframe-strength volume and media management, and cost-effective central management of both departmental and enterprise-wide systems with thousands of nodes.
- Cover all the hardware being used for integrated modern applications, especially the key database servers on UNIX and NT, as well as other hardware with environment systems such as Windows, Novell and Macintosh.
- Have the capability to deal with an individual file, a whole disk, databases and related files for an application, all the way up to catering for disaster recovery.
- Allow administrators to automatically set storage policies that enforce backups at certain frequencies, check whether tapes can still be read, and take appropriate actions when predetermined exceptions or events occur during backup or recovery.
- Complement facilities from the database vendors and conform to industry standards.
- Be both highly available and secure.
- Integrate with Hierarchical Storage Management (HSM) systems, which may be required to manage the vast volumes of multimedia and other files often needed in modern applications.
- Reduce costs of computing resources, with a minimum number of administrators for large distributed-computing configurations.
- Provide the ability to select from the industry's widest selection of high-performance, high-capacity, off-line storage devices.

This level of sophistication is important to both small and large companies to fulfill one primary purpose – to assure that when a failure does occur, a corporation's mission-critical systems can be fully operational very quickly, following a fast and reliable recovery of their data.

VERITAS NetBackup is the leading enterprise-level product that assures both databases and conventional file systems are always recoverable—with backups being taken on the fly in the minimum time possible, exploiting the latest, high-speed, robotically controlled media storage devices. NetBackup carries out hot database backups fully integrated with the Oracle Parallel Backup and Restore facility, Informix On-Bar capability, Sybase Backup Server or DataTools SQL-BackTrack product.

## INTRODUCTION

For businesses, meeting goals includes the accurate and timely deployment of physical, human and financial resources to support critical business processes. Leading companies also deploy appropriate computing and other technologies in a focused manner, and have learned the importance of timely data management.

More than ever before this critical data is kept in relational databases. Industry analysts estimate that between 30 and 50 percent of all corporate data is in databases, and that percentage is expected to grow significantly over the next few years. The result is that mission-critical databases are growing at a phenomenal rate – often 40 to 50 percent annually.

The lack of comprehensive database backup and storage management solutions has put much of this mission-critical data at risk. At best, companies with very large databases have had to resort to extremely time consuming and costly custom solutions in an attempt to improve the safety of their most critical data.

One solution has been to shut down the database and back up the underlying disks to tape. But this process may not be acceptable if there isn't a sufficient time window available to complete the backup, or if the application must be up and running 24 hours a day. In addition, database and storage administrators' needs may vary greatly, depending upon the size and criticality of the applications, which database systems are being deployed, and the price/performance balance that the company must have.

The need, therefore, is to allow the database administrators a wide range of choices, and to provide the complete flexibility necessary for automatic, scheduled, on-the-fly database backup that meets the data availability requirements of large businesses with mission-critical databases from multiple vendors. Also, the database administrators would like to be confident that behind the scenes is an industry-strength volume management solution monitoring off-line tapes and automatically managing robots and other devices.

In response to this need, storage management solutions for very large, mission-critical databases are becoming available in the marketplace. Database vendors such as Oracle, Informix and Sybase are delivering database backup interfaces; and these interfaces can be used by complementary sophisticated storage management products from vendors such as VERITAS. The challenges include:

- Developing database management solutions and strategies that offer companies a choice of alternative approaches.
- Catering for the different database versions that may still be in operation.
- Providing different price/performance options.
- Guaranteeing database integrity while keeping the database available to those users who depend on it to make critical business decisions.

## Background

Database technology has significantly evolved in the last twenty years. Many companies have operational systems that encompass some of the earlier technology along with the new. What started out as combinations of simple flat files evolved into highly specialized, hierarchical databases that required custom, handcrafted management schemes extremely costly to develop, manage, and maintain. Relational database technologies then appeared on the scene, enabling businesses to structure their data in compliance with their business processes, rather than vice versa, revolutionizing database usage. This transformation has made advanced, database storage management techniques such as hot backup, database archive, and management of replicated databases critical business requirements.

What is put into databases has also changed. The Codd and Date original notion of simple 'normalized' tables and columns has been complemented by the ability to capture and manipulate large blocks of text, sound, multimedia, structured documents, and even n-dimensional arrays of data for spatial or temporal data manipulation. These are giving rise to relational systems that are orders of magnitude larger than a few years ago. Some applications exploit large-scale data warehouses using inter-related data held in both databases and more conventional files. And formal structured objects will soon be viable in these same industry-strength database management systems. For businesses, these systems must be managed efficiently and effectively, often as a single unified corporate asset, catering for the huge volume and the integrity of backup and recovery of data/information across these subsystems. Solutions that may be required include very high performance backup and recovery, no limits on the size of objects being managed, the possible deployment of integrated HSM (Hierarchical Storage Management), and both project and database archive.

Database management system vendors have realized that dealing with the hundreds of new robotics and media devices on the market and providing the volume management, media management, disaster recovery, and management interfaces that large corporations require is not their core competency. But providing basic, reliable backup and journalized recovery is. So the first point of integration was the need to take database dumps and manage them off-line, or to provide fast file or raw partition backups of quiescent databases (i.e. databases that are not being updated). The second thing the vendors did was to provide application program interfaces whereby leading storage management suppliers could take on-the-fly backups of the database, and then subsequent recovery would be integrated with a 'roll forward' of transactions taken during and after the backup. Most recently vendors such as Oracle, Informix and Sybase have also provided high-performance hot or parallel backup capabilities where multiple streams of data can be given to the storage management systems for equally fast and reliable off-line management and recovery. However, database vendors only support certain versions of their database systems with these new facilities. To support operational databases using older versions, to give database and storage administrators choice, and to enable different price/performance options to be taken, support of each of these capabilities and to cater for third-party alternatives is important. These third-party alternatives, such as SQL-BackTrack, offer an alternative approach and cross-platform coverage of database vendors and versions.

Management of this complex, database-centric, distributed, open-systems environment with sophisticated storage management facilities that are integrated, fast, safe, reliable, and provide operational alternatives for the modern business process is a necessity.

## Key Business Needs

An integrated storage management solution, for companies relying on database technology, must provide:

- Support of each widely used database management system, including all recent versions, very high-performance on-the-fly backup, and safe fast parallel recovery.
- Administrators with a choice of options for price, performance, and facilities.
- Industry-strength features, including support of reliability, cost-effective use of resources, handling scale, standards, security, etc., so that it can be deployed on both a departmental and enterprise scale.
- The convergence of two world-class technologies – leading database and storage management technologies – integrated to support a mixed database and conventional file, high-scale, mission-critical, operational deployment.
- Reliability, quality, usability, 7x24 support, automatic operation, automatic error correction, high availability, and security of operation.
- The widest choice of database storage management approaches and off-line media and robotics devices possible to fit in with the devices they may already have (or are contemplating acquiring), so that the best balance can be gained for price and performance when looked at from a boardroom business level.

## THE VERITAS APPROACH

VERITAS provides the best storage management tools in the industry as an integrated solution for high-scale, distributed, open-systems computing. Several technologies and mature products have been converged to provide backup, file archive, recovery, database archive, database defragmentation, hierarchical storage management, and off-line volume management. In addition, other VERITAS technologies and products continue to be integrated to enhance automatic autonomous operation, scheduling, security, performance monitoring, and high availability, such that the enterprise-level storage management is as secure, reliable and highly available as possible.

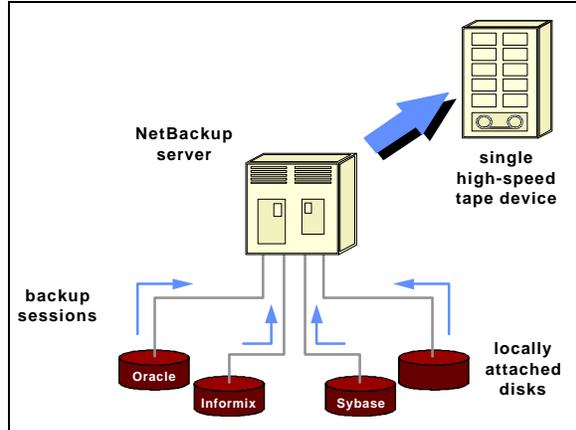
### Availability of Critical Data

Timely access to critical data is often the difference between success and failure of a business. In today's global economy, critical files and databases must often be available 24 hours per day. If access to a critical system is interrupted for any reason, alternative systems must be able to take over the load automatically and transparently. Disaster recovery capabilities must be available so that if the worst happens and a complete site is disabled, critical data must be restored and available on line in a few minutes or, at most, a few hours.

From a database storage management perspective, availability to data translates to minimizing or totally removing the backup window, and ensuring the availability of data and systems in the event of a service interruption or disaster.

### Maximizing Performance

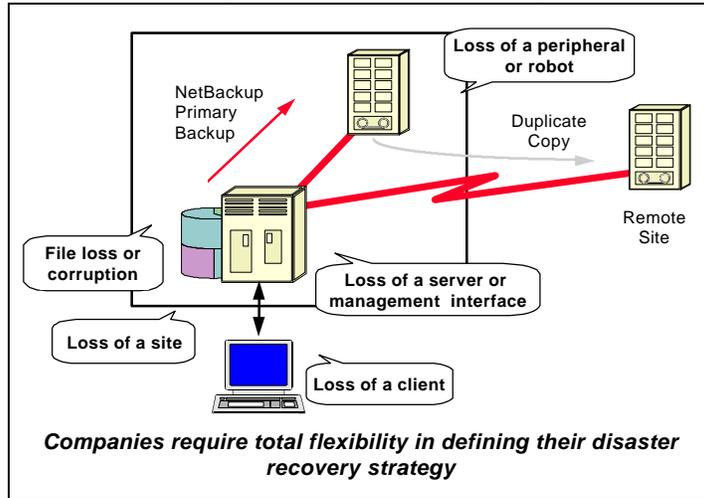
Performance is critical to data availability, even in on-line database backup configurations. NetBackup enables agents to gather files or databases and then pump parallel data streams to a storage engine or server on the local machine or across the network. On systems where backup-media transfer rates far exceed disk or network transfer rates, data streams from multiple disks and clients can be combined into a single stream to drive the off-line media at its peak rates – this facility to cause the tapes to stream is called multiplexing. Performance scales in a nearly linear manner as additional peripheral devices and backup servers are added incrementally.



Ultra-fast raw partition backups are also essential to provide very fast recovery of whole disks or sites in the event of major failings, and to cater for database management systems which themselves handle the bits and bytes on the disk below the file level. A raw partition backup occurs when the back up product simply copies the underlying disk, which is as fast as it is possible to take data off a disk as the head only does a single uninterrupted pass. When the site has to backup multiple terabytes of data this is a favored solution for full backups during, for example, a weekend, where finishing the backup before the users arrive back to work on the Monday is vital.

## Disaster Recovery

As their reliance on computers and computer information increases, large global corporations are concerned as never before about accessibility to their data in the event of a natural disaster or act of terrorism. A full disaster recovery program may include identifying key processes, systems, applications, physical resources, etc., that need to be replicated to a pre-prepared remote site, or that can be rapidly reconstructed, to enable the core and critical business processes to be back in operation within a predefined timescale. Typically, different policies apply, dependent upon the threat to the company's ability to support the particular business process. The disaster recovery process is normally very well documented, and would include details about moving employees to prepared sites, responsibilities and authority during and after the enactment of the disaster program, handling security, etc. The data and storage management is just a part of a much bigger picture, but it is often considered to be a vital one. Often, replication of the data on a disabled site must occur in a maximum of a few hours or even minutes rather than days, which was the norm just a few years ago.



The disaster recovery options required by geographically dispersed organizations mean that the storage management applications must offer a continuum of solutions. Some companies require only that their critical databases and files are backed up and duplicated off site. Other companies want alternative sites to have the ability to take over and provide access to critical data without user interruption. In short, companies want total price/performance flexibility and choice in determining what disaster recovery policy works best for their environment and defined business policies.

NetBackup ensures that a second remote site is continuously updated with complete copies of off-line data to be used in the event of a disaster. This is a mandatory component for disaster recovery, as it is essential to have a single, trusted medium to maintain the copies at the remote site of all databases, conventional files, executables, and every other bit of data required to replicate the service and manage it.

## Choice

While some companies use a single database technology for all their data, most run applications that use a mix of database management systems and conventional files. Typically, where an operational system is working reliably on a particular version of a DBMS, there is reluctance to move to a different version – thus most companies are running several versions of the software for each of their database management systems. The design, therefore, has to cater for all such circumstances simultaneously.

From a backup perspective, for example, some businesses require high-performance, hot database backups across multiple DBMS vendors. Others require sophisticated support for older versions of databases that are not addressed by the latest hot-backup utilities from their database vendors. For others, off-line database backup techniques work just fine. It all comes down to an issue of cost performance and data availability.

To this end, VERITAS provides database backup of databases that exploit raw disk partitions directly and databases that use the operating system file subsystem. It also supports a range of off-line, read-enabled, and completely on-line database backup options for multiple versions of Oracle, Informix and Sybase databases via the backup application programming interfaces of the database vendors and an alternative backup option using DataTool's SQL-BackTrack product. This enables companies to customize their database storage management strategy with an off-the-shelf product that allows a wide choice of cost, technology and feature options.

## Handling Scale

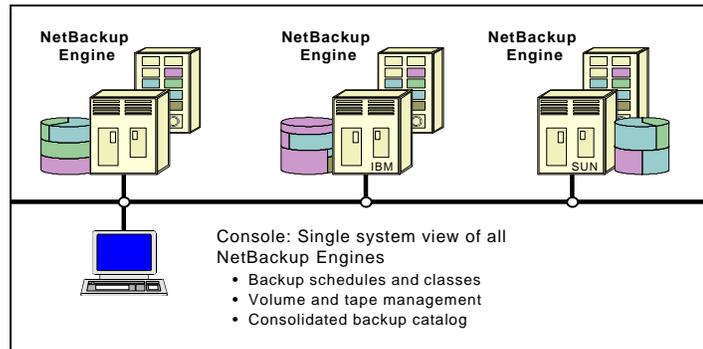
The next aspect is handling scale in every sense – administrative effort, performance, and organizational flexibility.

## Architecture

The product is designed in a client/server manner, which lends itself to handling scale. Agents on each node copy the required files or raw partition data and provide it as a stream to a backup engine on what is often called a storage server. This engine technology manages many local and remote agents and also controls the robots and other off-line media devices on the server. A management interface can control several management engines, either locally or across the network.

## Centralized Management

A central management interface that can control thousands of agents and storage engines in a secure manner across a distributed operational environment is critical to scalability from an administrative perspective. To reduce costs and administrative effort, all backups of clients, file and database backup policies, and device and robotics management are administered from a single screen on a single management interface. The backup catalogs for all of the backup engines across the entire site are consolidated on the management interface as well, to enable a central point for all restores, enforcing the high level of safety and security required by large organizations.



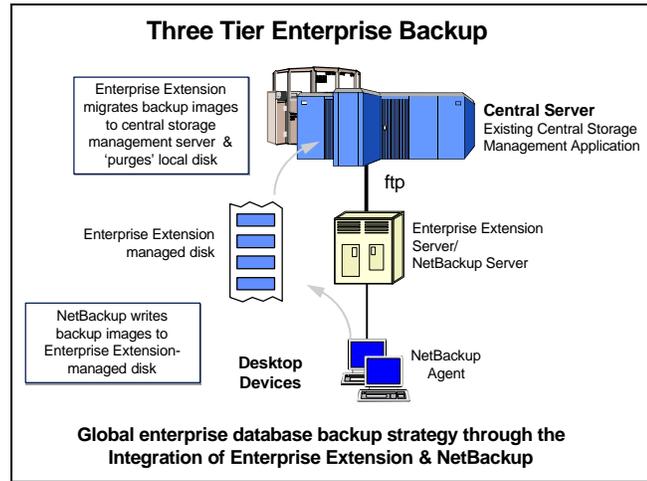
## Scalable Performance

NetBackup enables backup agents to gather files or databases and then pump parallel data streams to a storage engine or server on the local machine or across the network. When increased performance is required or additional clients and/or data must be managed, an additional backup engine can simply be added, thereby improving throughput. Because of NetBackup's central management capabilities the administrative impact is minimal, and the product architecture enables performance to scale in a nearly linear manner as additional peripheral devices, agents and backup servers are added incrementally.

## Organizational Flexibility

An emerging trend in large companies is the 'recentralization' of data to large servers in the department or data center. Increasingly, distributed data located at the desktop and on departmental file and database servers is being backed up to a central location where it can be stored and managed cost-effectively. A traditional client/server storage management product typically is not flexible enough to cope with a three-tiered environment.

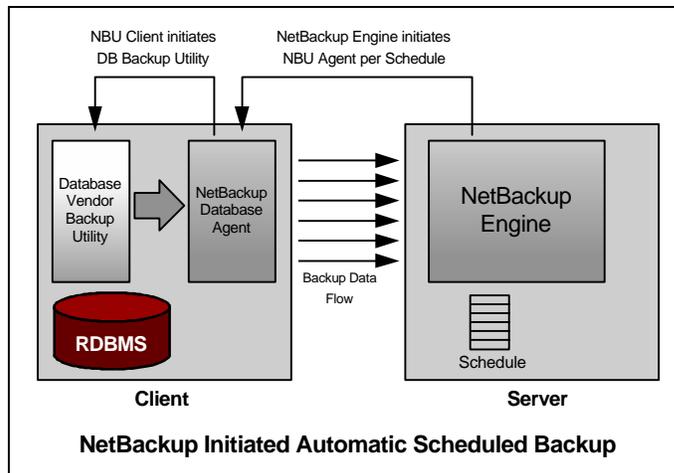
VERITAS' approach to three-tier 'desktop-to-data-center' storage management is to combine NetBackup with VERITAS Enterprise Extension, a disk-to-remote-disk migration product. NetBackup writes backup images to disk on a departmental server, and Enterprise Extension migrates those images to the central server disk over the network, where it is then managed by a storage management application resident on the remote mainframe or other central server. Many companies have found this of great value, as their mainframe had spare capacity and already had advanced off-line storage management silos and other services.



## Automation

A critical component of cost-effective storage management for large companies is automatic and scheduled operations. Once a database or systems administrator has set up the storage management policies for a particular database cluster, the actual operation should occur automatically and transparently, involving the administrator only if there are errors or exceptions.

Yet many of the latest on-line database backup capabilities available in the marketplace today do not address the issue of scheduling and automation adequately. Database backup utilities often have to be initiated manually by the administrator or, for example, scheduled on UNIX via the highly unusable and unreliable 'cron' utility. This approach requires excessive maintenance and is poorly integrated with the system backup schedules. A better approach is to tightly integrate the backup and the database backup schedules.



With NetBackup, the backup server initiates the on-line database backup session, which in turn initiates the database vendor backup utility on the agent. The database backups are now an integral part of the overall file and database backup strategy, which can be managed from the NetBackup central management interface in an integrated manner. This is particularly important for applications that use a database and associated conventional files.

## Industry Standard Data Format

Some of the basics in the VERITAS storage management approach start with the ability to back up in industry-standard format to assure the data can be recovered across hardware types and provide a long-term, safe format for companies that must retain backups and archives for many years. In recent years such facilities have been upgraded to cater for the enormous single files that exist to hold multimedia, electronic mail, and databases themselves.

It is also important to note that UNIX, NT and other systems provide a wide variety of different types of operating system file systems, such as VERITAS, FAT, NTFS, NFS, and HPFS. The agent storage technology is designed to work with this wide range, including remotely mounted files.

## Volume and Media Management

Sophisticated volume management is essential to deal with the otherwise overwhelming numbers of tapes required in a large installation. The ability to support the widest set possible of robotics, tape and other devices may be critical to fitting in with existing systems and deployment of the huge data warehouses of today. To that end, a storage laboratory has been set up with a wide range of devices and servers from different vendors to certify new and old devices on the target platforms used by VERITAS customers.

Other aspects of media management are just as critical. Large corporations require a sophisticated level of volume and media management to share expensive robotic resources, manage on-site as well as off-site media pools, and take care automatically of mundane but critical tasks such as automatic drive cleaning, tape rotation, tape pool management, tape image consolidation, scratch tapes, labeling, compression, volume expiration, etc.

## DATABASE BACKUP SPECIFICS

VERITAS offers a wide range of choices so that database administrators can choose the particular database backup strategy that best meets their company's availability requirements and cost-performance goals.

### Raw Disk Partition Backups

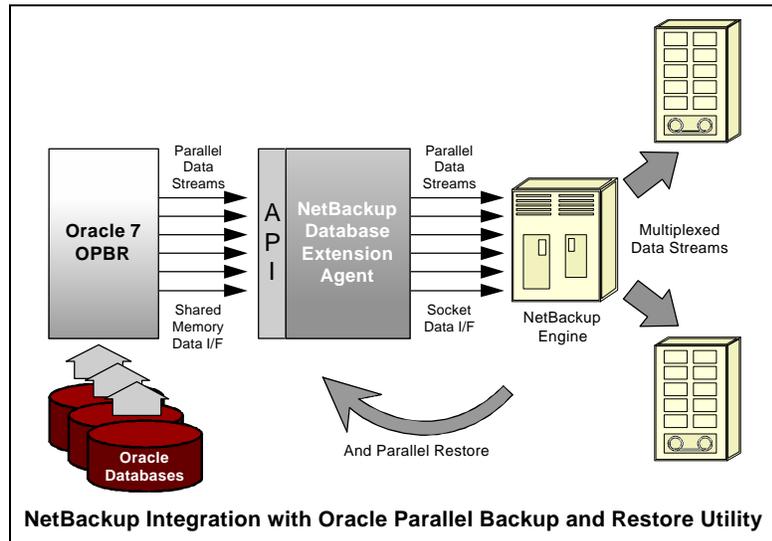
For companies with a sufficiently large backup window, off-line, raw partition backups of databases can be the least complex and most cost-effective solution. With this simple option, the whole database must be brought down or quiesced for the duration of the backup operation. Through NetBackup's raw partition backup capability, the entire disk partition is backed up to media. Raw partition backups are typically the fastest performing backups possible in terms of disk-to-media transfer speeds, but the database is often unavailable to users during the backup operation.

NetBackup also supports a generic 'warm' backup option. With this option the database can be used while the backup is being taken. Pre- and post-processing scripts are used to coordinate with the database management system – to put the database into, and later out of, 'hot' backup mode. This assures that when a subsequent restore of the database is done the relevant database roll-forward utilities can be used to complete the recovery of the database to a consistent state. This option does not provide the same level of performance as using the parallel facilities mentioned below, but is often used for older versions of a DBMS where performance is perfectly adequate.

### Oracle Parallel Backup and Restore Facility

The combination of the Oracle Enterprise Backup Utility (OEBU), which comes with version 7.3 of the database, or the Oracle Backup/Recovery Manager (RMAN) and VERITAS NetBackup offers a completely on-line, highly reliable backup solution for Oracle databases of virtually any size. VERITAS has implemented Oracle's backup API in NetBackup's Oracle Database Extension option.

The Oracle utilities back up Oracle 7 and 8 databases and control files and passes that data to the NetBackup database agent to perform complete database backups. Oracle communicates with the NetBackup database client via the OEBU/RMAN utility API, enabling DBAs to take full advantage of all NetBackup's features while utilizing full data-path parallelism to maximize backup performance.



In the event of database failure, the NetBackup-OEBU/RMAN system can restore either the entire database, or just the damaged portion. Database files can be restored from the last backup or from an earlier point in time. Oracle's standard recovery procedures can then complete recovery of the database to a consistent state.

## Key Benefits

The integration of VERITAS NetBackup and the Oracle Parallel Backup and Restore utility offers the following benefits:

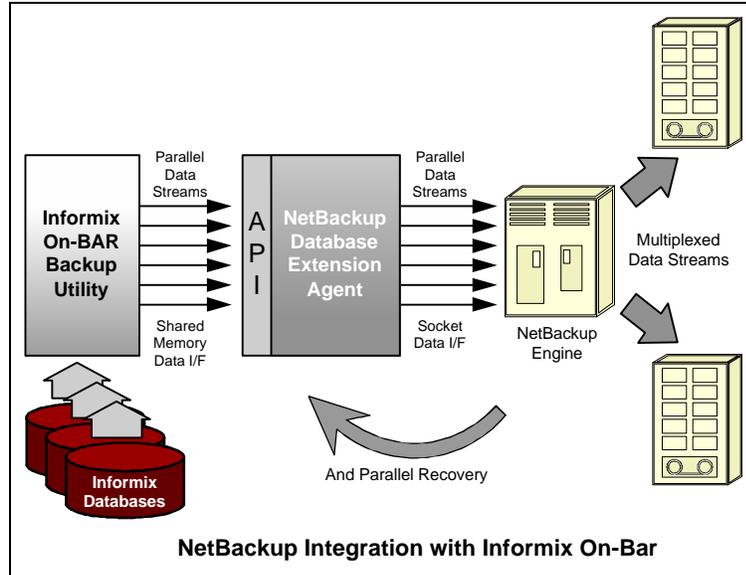
- ▼ High Performance Backup – multiple Oracle databases or tablespaces can be streamed in parallel between the target database and the backup media. NetBackup can multiplex multiple images into a single data stream to write to high-speed devices to sustain their peak rates.
- ▼ High Performance Recovery – in a similar manner NetBackup can stream data back from off-line media at peak transfer rates to feed a parallel recovery operation by OEBU/RMAN – thereby getting the applications and users of the database operational in the shortest time possible.
- ▼ Maximized Data Availability – the combination of extremely fast backup performance and on-line, database backup capabilities makes reliable storage management of 7x24 Oracle databases possible.
- ▼ Single Management Interface – NetBackup's single management interface ensures that all database backup configuration, policy, media management, and device management are administered from a single point, regardless of how many NetBackup servers or Oracle databases there are in the configuration. This significantly reduces the administrative costs, especially for remote operations.
- ▼ Sophisticated Media Management – media management capabilities such as volume pools, off-site media tracking, device cleaning, and media-image consolidation are available to the Oracle database administrator from an easy-to-use graphical user interface.
- ▼ Lights-out Operations – NetBackup's lights-out operational capabilities have been extended to Oracle's Parallel OEBU/RMAN utilities. NetBackup, based on predefined backup schedules can initiate completely automated and scheduled database backups. Database administrators, and even users with the appropriate privileges, can request on-line database backups and restores without backup administrator or operator involvement.
- ▼ Raw Device and File System Support – large companies require a wide range of options for database and file backups. With a combined VERITAS and Oracle solution, databases in raw partitions or mounted file systems can be backed up on-line, as well as standard files.

## Informix On-Bar

Informix On-Bar combined with VERITAS NetBackup offers a completely on-line, highly reliable backup solution for Informix databases. VERITAS has implemented the Informix On-Bar API technology in NetBackup's Informix Database option.

The Informix On-Bar utility backs up database and control files and passes that data to the NetBackup database agent to perform complete on-line Informix database backups. The On-Bar utility communicates with the NetBackup database agent through a high-speed, shared-memory interface. On-Bar backs up data from on-line Informix databases or tablespaces, using parallelism to maximize backup performance.

In the event of database failure, the NetBackup-On-Bar system can restore either the entire database, or just the damaged portion. Database files can be restored from the last backup or from an earlier point in time. Informix standard recovery procedures can then complete recovery of the database to a consistent state.



Informix On-Bar is available with Informix versions 7.2, 7.3 and 8.x.

## Key Benefits

The integration of VERITAS NetBackup and the Informix On-Bar backup utility offers the following benefits:

- ▼ **High Performance Backup** – multiple Informix databases or tablespaces can be streamed in parallel between the target database and the backup media. NetBackup can multiplex multiple images into a single data stream to write to high-speed devices to sustain their peak rates.
 

High Performance Recovery – in a similar manner NetBackup can stream data back from off-line media at peak transfer rates to feed a parallel recovery operation by Informix On-Bar – thereby getting the applications and users of the database operational in the shortest time possible.
- ▼ **Maximized Data Availability** – the combination of extremely fast backup performance and on-line, database backup capabilities makes reliable storage management of 7x24 Informix databases possible.
- ▼ **Single Management Interface** – NetBackup's single management interface ensures that all Informix database backup configuration, policy, media management, and device management are administered from a single point, regardless of how many NetBackup servers and Informix databases there are in the configuration. This significantly reduces the administrative costs, especially for remote operations.

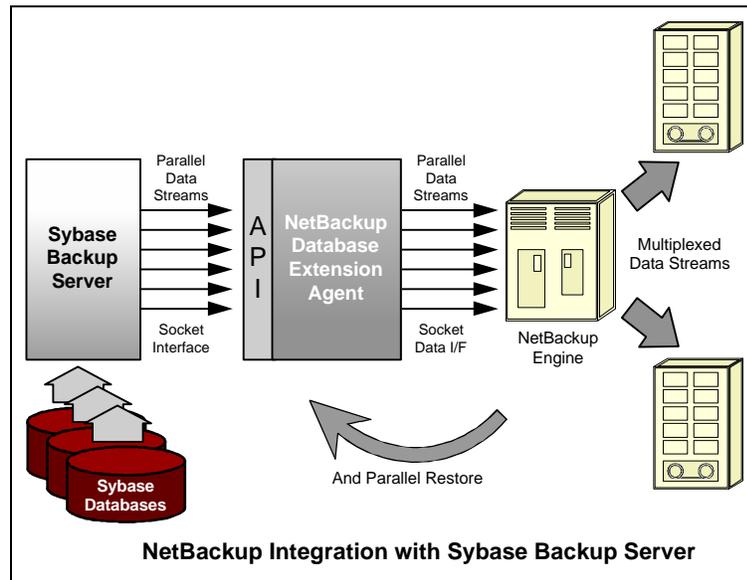
- ▼ Sophisticated Media Management – media management capabilities such as volume pools, off-site media tracking, device cleaning, and media-image consolidation are available to the Informix database administrator from an easy-to-use graphical user interface.
- ▼ Lights-out Operations – NetBackup's lights-out operational capabilities have been extended to the Informix On-Bar utility. NetBackup, based on predefined backup schedules can initiate completely automated and scheduled database backups. Database administrators, and even users with the appropriate privileges, can request on-line database backups and restores without backup administrator or operator involvement.
- ▼ Raw Device and File System Support – large companies require a wide range of options for database and file backups. With a combined VERITAS and Informix solution, databases in raw partitions or mounted file systems can be backed up on-line, as well as standard files.

## Sybase Backup Server

With Sybase Release 11, Sybase provided the Sybase Backup Server API, a standard interface for on-line database backups of Sybase 11 databases. The combination of the Sybase Backup Server API and VERITAS NetBackup offers a completely on-line, highly reliable backup solution for Sybase databases from an easy-to-use GUI interface. VERITAS has implemented the Sybase Backup Server API in NetBackup's Sybase Database option.

The Sybase Backup Server utilizes high-performance parallel data streams to back up a local or distributed Sybase database to the NetBackup database agent to perform completely automated database backups. The Sybase Backup Server communicates with the NetBackup database client via the Backup Server API, enabling DBAs to take full advantage of all NetBackup's features while utilizing full data-path parallelism to maximize backup performance.

In the event of database failure, the NetBackup-Backup Server system can restore either the entire database, or just the damaged portion.



## Key Benefits

The integration of VERITAS NetBackup and the Sybase 11 Backup Server offers the following benefits:

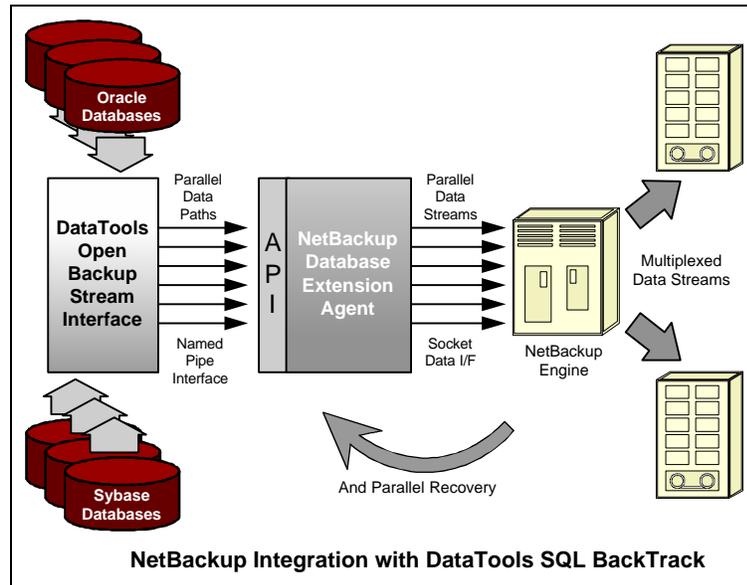
- ▼ Support for Sybase 11 Databases – Sybase Backup Server supports hot database backups of Sybase version 11 databases across multiple hardware-vendor platforms.
- ▼ High Performance Backup – multiple Sybase databases or tablespaces can be streamed in parallel between the target database and the backup media. NetBackup can multiplex multiple images into a single data stream to write to high-speed devices to sustain their peak rates.
- ▼ High Performance Recovery – in a similar manner NetBackup can stream data back from off-line media at peak transfer rates to feed a parallel recovery operation by Sybase Backup Server – thereby getting the applications and users of the database operational in the shortest time possible.
- ▼ Maximized Data Availability – the combination of extremely fast backup performance and on-line, database backup capabilities makes reliable storage management of 7x24 Sybase databases possible.
- ▼ Single Management Interface – NetBackup's single management interface ensures that all database backup configuration, policy, media management, and device management are administered from a single point, regardless of how many NetBackup servers and Sybase databases there are in the configuration. This significantly reduces the administrative costs, especially for remote operations.

- ▼ Sophisticated Media Management – media management capabilities such as volume pools, off-site media tracking, device cleaning, and media-image consolidation are available to the Sybase database administrator from an easy-to-use graphical user interface.
- ▼ Lights-out Operations – NetBackup's lights-out operational capabilities have been extended to Sybase databases. NetBackup based on predefined backup schedules can initiate completely automated and scheduled database backups. Database administrators, and even users with the appropriate privileges, can request on-line database backups and restores without backup administrator or operator involvement.
- ▼ Raw Device and File System Support – large companies require a wide range of options for database and file backups. With a combined VERITAS and Sybase solution, databases in raw partitions or mounted file systems can be backed up on-line, as well as standard files.

## DataTools SQL-BackTrack

DataTools was first to market with an on-line database backup capability with their SQL-BackTrack product. SQL-BackTrack provides reliable, parallel, on-line backup of both Sybase (4.x, 10.x and 11) and Oracle (6.x and 7.x) databases. NetBackup's DataTools Database agent integrates to BackTrack through the DataTools Open Backup Stream Interface (OBSI).

The DataTools OBSI interface communicates with the NetBackup agent through parallel named pipes, which provide a high-performance, scalable data path. The DataTools OBSI can backup multiple Sybase or Oracle databases or tablespaces in parallel. NetBackup extends that data-path parallelism all the way to the peripheral. For high-speed peripherals, NetBackup can multiplex multiple images into a single data stream to write to high-speed devices at their peak rates.



In case of a database failure, the combination of NetBackup and SQL-BackTrack can recover full, incremental, and transaction-log backups in the appropriate order automatically. Since SQL-BackTrack supports multiple versions of Sybase and Oracle, it can be used to migrate data between servers that are running different versions of Oracle or Sybase.

### Key Benefits

The integration of VERITAS NetBackup and the DataTools SQL-BackTrack product offers the following benefits:

- ▼ Support for both Sybase & Oracle Databases – SQL-BackTrack currently supports hot database backups of Sybase versions 4.x and 10.x and Oracle 6.x and 7.x databases across multiple hardware-vendor platforms.
- ▼ High Performance Backup – multiple Sybase and Oracle databases or tablespaces can be streamed in parallel between the target database and the backup media. NetBackup can multiplex multiple images into a single data stream to write to high-speed devices to sustain their peak rates.
- ▼ High Performance Recovery – in a similar manner NetBackup can stream data back from off-line media at peak transfer rates to feed a parallel recovery operation by SQL-BackTrack – thereby getting the applications and users of the database operational in the shortest time possible.
- ▼ Maximized Data Availability – the combination of extremely fast backup performance and on-line database backup capabilities makes reliable storage management of 7x24 databases possible.

- ▼ Single Management Interface – NetBackup's single management interface ensures that all database backup configuration, policy, media management, and device management are administered from a single point, regardless of how many NetBackup servers and databases there are in the configuration. This significantly reduces the administrative costs, especially for remote operations.
- ▼ Sophisticated Media Management – NetBackup media management capabilities such as volume pools, off-site media tracking, device cleaning, and media-image consolidation are all available to the Sybase or Oracle database administrator from an easy-to-use graphical user interface.
- ▼ Lights-out Operations – NetBackup's lights-out operational capabilities have been extended to the SQL-BackTrack utility. Completely automated and scheduled Oracle and Sybase database backups can be initiated by NetBackup, based on predefined backup schedules. Database administrators, and even users with the appropriate privileges, can request on-line database backups and restores without backup administrator or operator involvement.
- ▼ Raw Device and File System Support – large companies require a wide range of options for database and file backups. With a combined VERITAS and DataTools solution, databases in raw partitions or mounted file systems can be backed up on-line, as well as standard files.

## Heterogeneous Database Environments

Many large companies have Oracle, Sybase, Informix and conventional file databases to meet their different needs. The VERITAS NetBackup and VERITAS Hierarchical Storage Management products may be used with any mix of the Oracle Parallel Backup and Restore utility, the Informix On-Bar utility, Sybase Backup Server, and DataTools SQL-BackTrack product – all managed from a single console.

<b>VERITAS NetBackup with:</b>	<b>Versions of Database Supported</b>
Oracle Parallel Backup	Oracle 7.3, 8.x
Informix On-Bar	Informix 7.2, 7.3 and 8.x
Sybase Backup Server	Sybase 11
SQL-BackTrack	Oracle 6.x, 7.x, Sybase 4.x, 10.x and 11
Direct File and Raw Partition Support	All

Matrix correct at time of writing

## ADDED VALUE

### Event-driven Backup

In addition to storage management in its own right, other VERITAS technologies can be used to provide additional functionality and added value.

The VERITAS Event Manager technology may be used with the storage technology to monitor and take automatic autonomous action to keep systems going or to trigger backups or recoveries. For example, the Event Manager could detect that it is later than 9 p.m. **and** that all users are logged off and therefore trigger a backup; or it could trigger backups on conclusion of a monthly consolidation of a financials package. It can also be used for more sophisticated purposes such as monitoring that a tablespace is nearly full and preemptively recommending that a backup and tablespace extension process be carried out.

The backup product itself may be monitored from the view of status, progress, possible problems, and performance.

The Event Manager may also be used as a product in its own right to monitor and take automatic corrective action on problems with Oracle, Informix, Sybase, the underlying operating system, the application, and other essential system components.

### Highly Available Database and Database Backup

High availability is critical when one considers enormous data warehouses consisting of conventional files, multimedia, and relational databases. In one sense, high availability can be considered as the automatic restart of failed databases and applications (e.g. using the Event Manager) or the use of a high-availability product to fail over database, application, and system software transparently to a second server. VERITAS' high availability product, VERITAS FirstWatch, supports all the leading database and file subsystems, application, operating system, and other software failovers.

When combined with VERITAS FirstWatch, VERITAS' storage backup and HSM management applications uniquely can automatically fail over between remote sites with little or no interruption in service for the user. When integrated with the database replication server capabilities provided by several database vendors, the result is that uninterruptable access to critical data can be maintained even when site disasters occur. This ensures that if a failure of the database does occur on the secondary site one can still guarantee that the storage management software is always available to provide the data stream for full or partial database restore. The objective is to get the users' systems back on line as fast as possible.

The optimum solution is that the entire system, comprising applications, databases, systems, operating system, and storage management system, is all monitored and automatically operated by the event manager and also made highly available to a remote site.

## SUMMARY

VERITAS' technology is the most scalable solution on the market, with many customers managing the storage needs of databases and conventional files over thousands of nodes. It provides a cost-effective central management capability, minimizing administrative costs. It supports a wide range of robotics, tape and other devices. It also provides unique facilities for event-driven backup and highly available storage servers that are important where continuous operation or disaster recovery is the goal.

VERITAS NetBackup is the leading departmental and enterprise-level product that assures that both databases and conventional file systems are always recoverable – with backups being taken on the fly in the minimum time possible, exploiting the latest, high-speed, robotically controlled, media storage devices.

The combination of VERITAS NetBackup, VERITAS HSM and the other facilities mentioned in this paper come together to meet the simple objective – **to get the business applications and their databases going again with minimal loss of availability to critical users, on a 24 hour a day basis.**