COMPAQ

Solution Guide

Contents

Best Practices for the backup and restore of Oracle 9*i* using *SANworks* EVM 2.0 by Compaq

Abstract: The Best Practices for the backup and restore of Oracle 9*i* using *SANworks™* Enterprise Volume Manager v2.0 by Compaq provides insights and guidance to help database administrators achieve optimal results when managing the data protection of large Oracle 9*i* databases.

By using integrated technology components in a storage area network (SAN), *SANworks* EVM 2.0 helps protect Oracle 9*i* data while allowing applications to remain online with unimpeded performance. *SANworks* EVM 2.0 currently supports Windows 2000 and Windows NT.

This paper discusses performance testing conducted on an Oracle 9*i* database in a *SANworks* EVM 2.0 network configuration under simulated application load. It presents the findings from this testing, along with best practices for deploying and managing *SANworks* EVM 2.0 backup and restore jobs.

In addition, this paper provides pointers to additional information and resources that will maximize results when implementing *SANworks* EVM 2.0 by Compaq for Oracle 9*i*.

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Best Practices for Backup & Restore of Oracle 9*i* Using *SANworks* EVM 2.0 prepared by Storage Network Solutions Enterprise Storage Group

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Solution overview

SANworks™ Enterprise Volume Manager (EVM) v2.0 by Compaq, in conjunction with *StorageWorks™* RAID arrays by Compaq configured with HSG80 controllers in a storage area network (SAN), provides database administrators with a minimally disruptive solution for backup and restore of databases that are multiple terabytes in size and larger. The solution has been specifically tested in an Oracle 9*i* environment for backup and recovery of data from a Windows 2000-based application. In addition, tape backup was provided by the *StorageWorks* Enterprise Backup Solution (EBS). The results of testing this solution for Oracle 9*i* provide qualified evidence of its effectiveness in providing a reliable backup and restore infrastructure for end-to-end data protection of Oracle 9*i* data, with little-to-no associated application downtime.

SANworks EVM 2.0 is Web-based application software that addresses the need for business continuance and data protection by managing the creation of clones and snapshots across multiple controller-based storage subsystems in a heterogeneous computing environment. It provides the ability to create, run, and manage automated storage replication jobs and to link them with external jobs to achieve fully parallel processing operations.

StorageWorks EBS provides a consolidated backup infrastructure comprised of multiple servers connected over a high-speed, independent Fibre Channel SAN to centrally attached SCSI tape libraries. Though this approach, *StorageWorks* EBS is able to achieve flexible data protection that shrinks backup windows significantly.

This powerful combination of hardware and software provides enterprises with:

- A complete backup and restore infrastructure for Oracle 9*i* that has been tested to produce known results

- Data protection for databases reaching multiple terabytes in size

- Maximized application availability by off-loading the backup responsibility of the application server

- Increased profit potential by eliminating planned and unplanned downtime

- Simplified backup implementation and management by providing the tools and information needed to implement a proven, pre-tested, preconfigured solution, saving time and money

- Oracle 9*i* data integrity, providing assurance that an enterprise's most critical asset is protected by constantly checking the quality of the data as it is backed up and restored

- Investment protection, leveraging existing Compaq hardware and software, supporting multiple configurations, and providing interoperability with future products for planned and unplanned growth

Performance results for backup of Oracle 9*i* data

Because Oracle 9*i* databases are typically quite large, backup and restore operations can potentially be very disruptive to applications and users. By leveraging the capabilities of *SANworks* EVM 2.0 in a Fibre Channel SAN environment, very large Oracle 9*i* databases spanning multiple storage subsystems—even those separated geographically—can be backed up or restored quickly and with minimal disruption to production activities.

In laboratory testing with a Microsoft Windows 2000-based simulated banking application, Compaq was able to demonstrate significant application uptime benefits when using *SANworks* EVM 2.0 with *StorageWorks* EBS to replicate and backup an Oracle 9*i* database. Tests imposed heavy simulated workload on an Oracle database 23 GB in size, configured with RAID 1+0 storage arrays. Figures 1 and 2 below illustrates application availability results during data backup of these databases while the application continued to run.

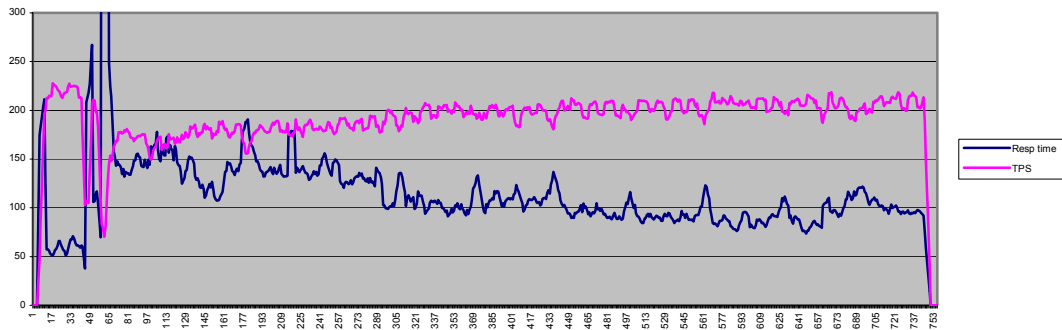### High load with SNAPbackup

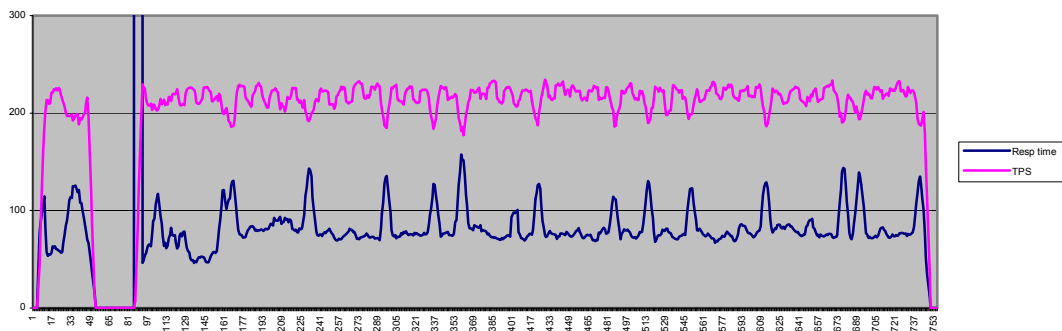Figure 1

High load with CLONEbackup

Figure 2

As shown in the charts above, the clone backup produced an average response time of approximately 82 ms (blue line)—an acceptable response times for users. These response times are nearly 30 percent faster than comparable response times when backup routines were conducted without using *SANworks* EVM 2.0.

In these tests, snapshots suffered from reduced performance in the beginning, when copy-on-write activity is heaviest. Over time, however, performance does improve. In contrast, clones showed better overall performance and offer greater data protection. In normal production, cloning is the recommended method of Oracle 9*i* data replication.

One of the key advantages of this solution is using *SANworks* EVM 2.0 to perform LAN-free backups. With this approach, backup data is moved across the SAN and kept isolated from the general-purpose LAN. As a result, network performance degradation is eliminated during backup.[1]

Test environment

Database server

The database server running Oracle was a Compaq *ProLiant* AS system running Windows 2000. To generate a load on this system, a widely used benchmark—TPC-B—was chosen, which provides a banking application environment with simulated write-intensive transactions.

A 23 GB Oracle database was created for this application and database files were placed on a RAID 1+0 storage set consisting of 8 x 9 GB 10000 rpm disks. Redo logs were placed on another RAID 1+0 storage set consisting of 4 x 4 GB 7200 rpm disks.

Load generator

Another Windows 2000-based ProLiant system was used for load generation, using a widely accepted software product. The load simulator allowed the number of users, wait times, and other parameters to be easily set to create a suitable load. The software also collects TPS and timing data during a simulation and stores these in a format that is easy to import into other applications.

Backup server

Backup of the Oracle database was performed by a separate Compaq *ProLiant* running Windows 2000 and Veritas NetBackup in a *StorageWorks* EBS configuration with a small DLT-based tape library connected to the SAN.

Note: The main purpose of these tests was to show the functionality of Enterprise Volume Manager v2.0 and demonstrate how it can be used in an Oracle environment. Therefore, no effort was spent on trying to achieve maximum absolute backup performance. Instead, a number of different scenarios were tested to show the relative performance of backing up Oracle databases in a variety of ways.

Enterprise Volume Manager

A standard SAN management appliance was used with *SANworks* EVM v2.0

Installation Notes

Oracle

Initial tests were performed using Oracle 8*i* for Windows. To validate the results, however, tests were re-run using Oracle 9*i*. Installation of Oracle is straightforward using the graphical utilities provided.

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[1] The Oracle 9i application remains online throughout the process, but experiences momentary disruption prior to backup, when EVM 2.0 creates a clone or snapshot.

Veritas NetBackup

The Oracle module for Veritas NetBackup was employed to enable NetBackup to operate smoothly with the Oracle Recovery Manager, RMAN, when conducting online backup tests without *SANworks* EVM.

HSG80 controllers

The latest version of HSG80 firmware, v8.6S-1, was obtained and installed.

Enterprise Volume Manager

When installing *SANworks* EVM 2.0, it is critical to have a thorough understanding of *SANworks* EVM operations. It s recommended to closely follow the guidelines provided in the *SANworks* Enterprise Volume Manager Version 2.0 (Multi-OS) Installation Guide (Part Number AA–RR0TA–TE).

Considerations using *SANworks* EVM V2.0

SANworks Enterprise Volume Manager V2.0 is a Web-enabled application that provides advanced, centralized storage management for Windows NT and Windows 2000. In the near future, support will also be provided for other operating systems, including Compaq *Tru64* UNIX, IBM AIX, Sun Solaris, and HP-UX.

SANworks EVM can be configured in a network of *SANworks* EVM-enabled computers, which can participate in automated storage unit replication jobs across as many as 25 *StorageWorks* subsystems equipped with HSG80 controllers, including *StorageWorks* Enterprise Storage Array (ESA) or Enterprise Modular Array (EMA) 12000 systems, as well as *StorageWorks* RAID Array (RA) or Modular Array (MA) 8000 Fibre Channel systems. Each *SANworks* EVM network and its associated *StorageWorks* subsystems can be remotely managed using a Web browser. Access control features are provided in the HTTP server included with *SANworks* EVM 2.0.

Note: Refer to the *SANworks Release Notes – Enterprise Volume Manager Version 2.0 (Multi-OS)* for descriptions of *SANworks* EVM 2.0 features and any known issues.

A *SANworks* EVM Server is installed on a management appliance from which it manages the *SANworks* EVM network and *SANworks* EVM jobs. *SANworks* EVM agents are installed on host computers and run the *SANworks* EVM jobs created for volume management. A typical EVM
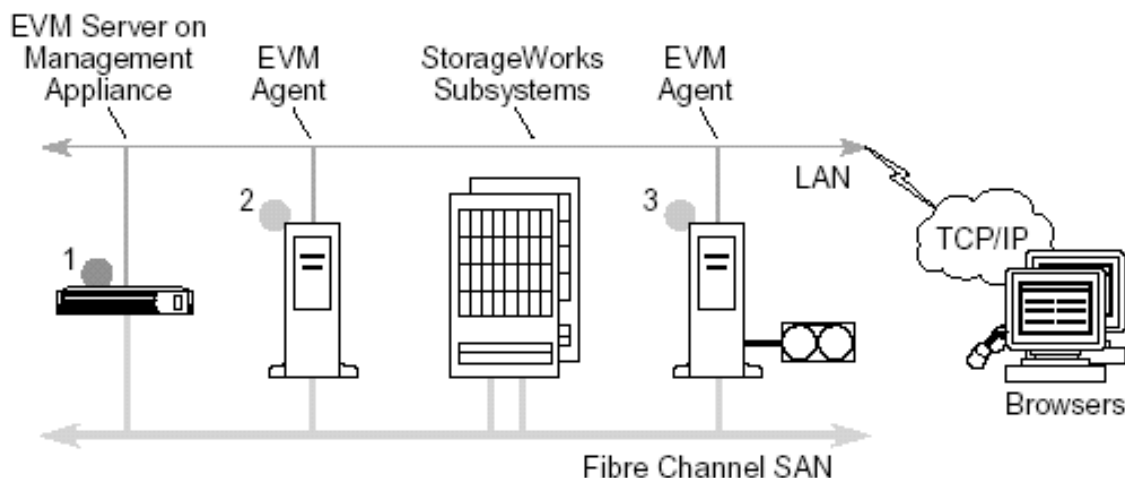

Figure 3

Using *SANworks* EVM, storage units on the *StorageWorks* subsystems can be replicated to create business continuance volumes (BCVs) using either the snapshot or clone capabilities of the *StorageWorks* HSG80 controller. By creating a BCV, *SANworks* EVM 2.0 provides an additional backup option for Oracle 9*i* data that is complementary to tape backup solutions, while also enabling very rapid restore of Oracle 9*i* data should recovery become necessary.

EVM job management

SANworks EVM 2.0 provides an intuitive Web browser interface, making it easy to create and manage storage unit replication jobs on a *StorageWorks* subsystem. *SANworks* EVM 2.0 incorporates a multi-threaded job engine that allows multiple jobs to be created and/or executed simultaneously.

Most jobs can be created with the EVM Create Job wizard as shown in Figure 4 below. Many jobs can be completed in just four simple steps, while more complex jobs may require six steps.
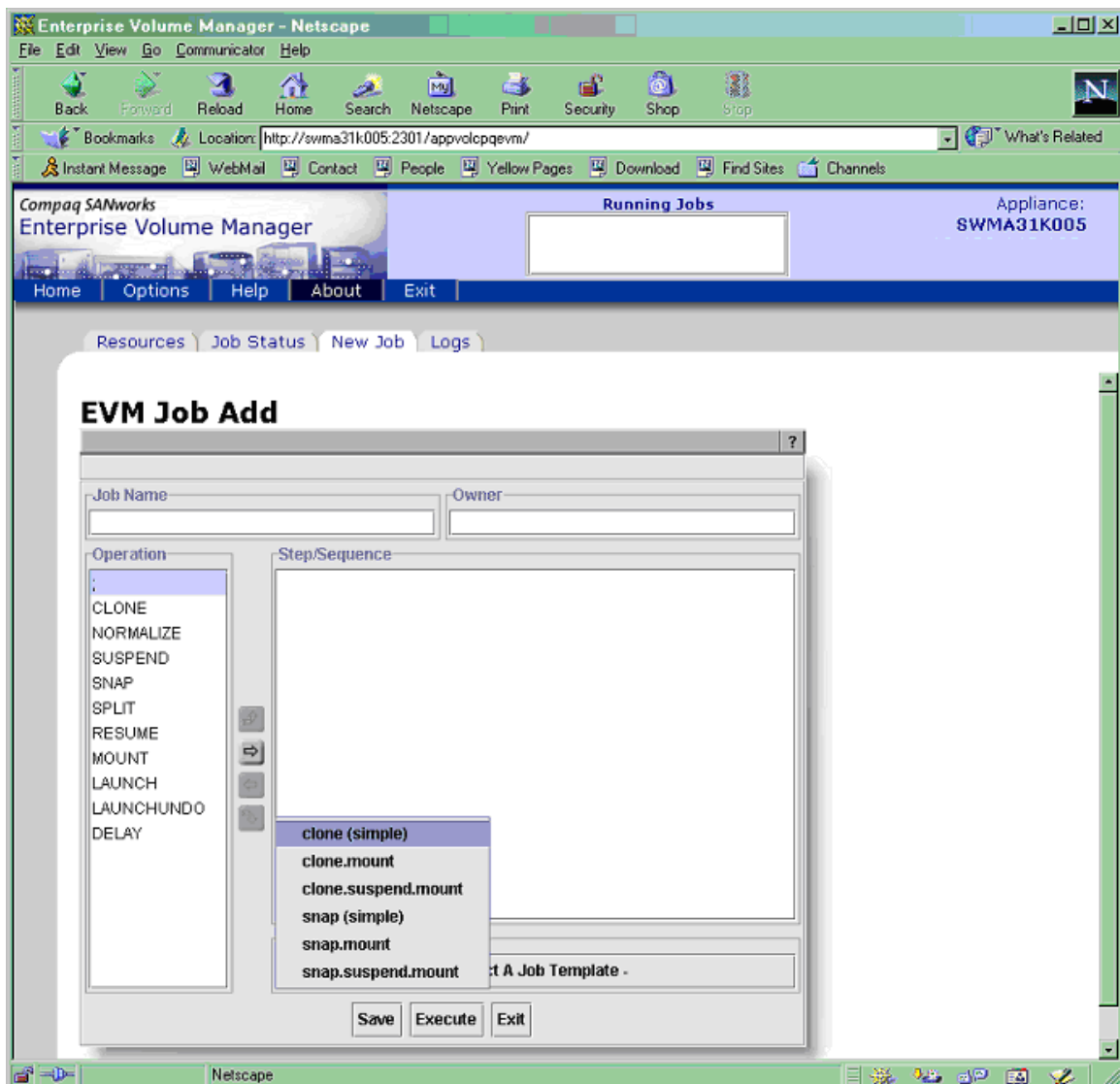

Figure 4

Through job pages, *SANworks* EVM also makes it easy to run, validate, monitor, review, and delete jobs. The *SANworks* EVM Network View and *SANworks* EVM Storage View features provide graphical displays of available resources on the *SANworks* EVM network, as shown in Figure 5 below.
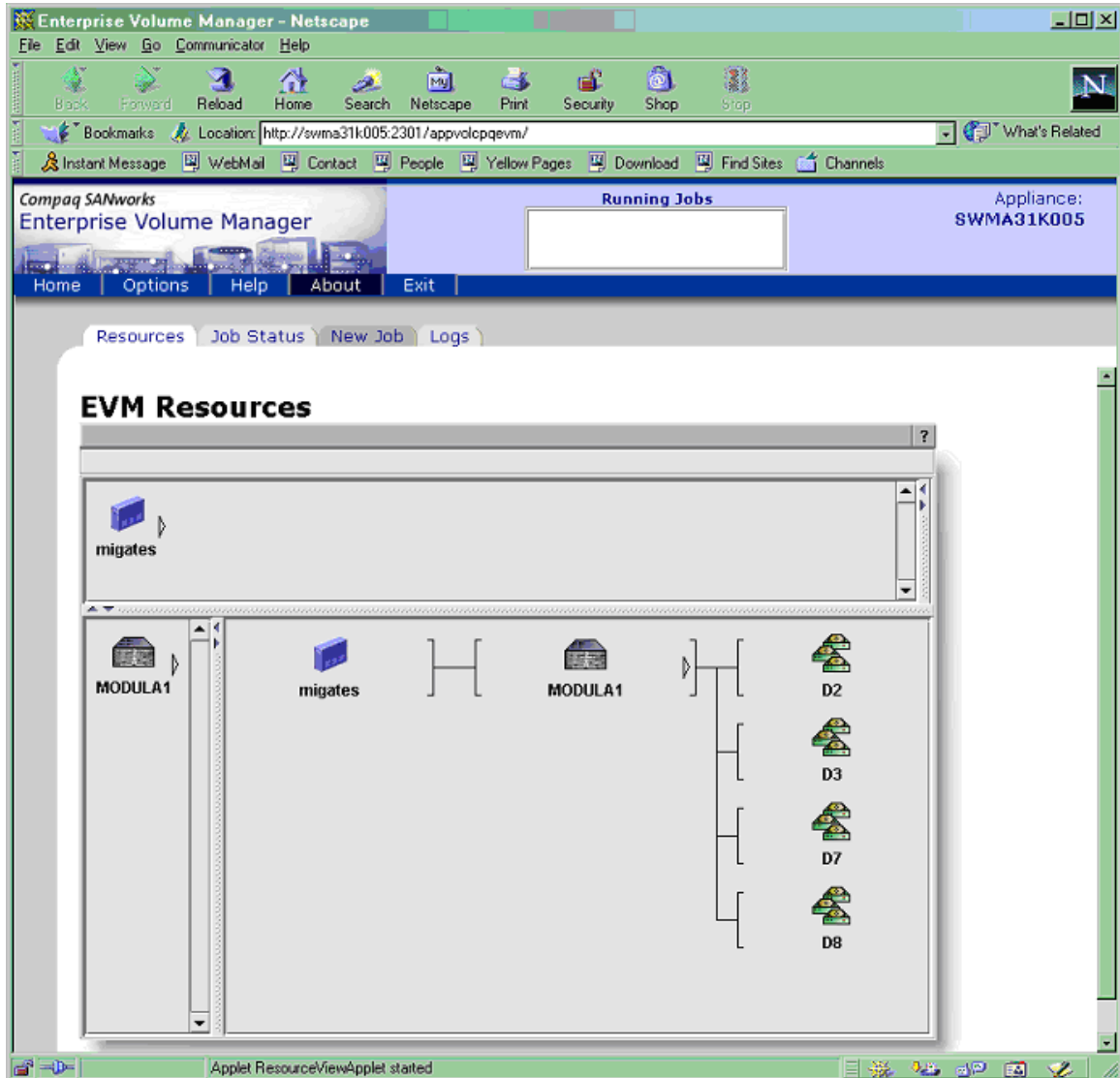

Figure 5

Storage units can be replicated using two controller-based methods: cloning and snapshots. Either method can be selected with a single click on the *SANworks* EVM web browser interface. All of the underlying *StorageWorks* CLI commands that are required to create clones or snapshots have been automated and incorporated into *SANworks* EVM. Figure 6 below illustrates a typical command set.
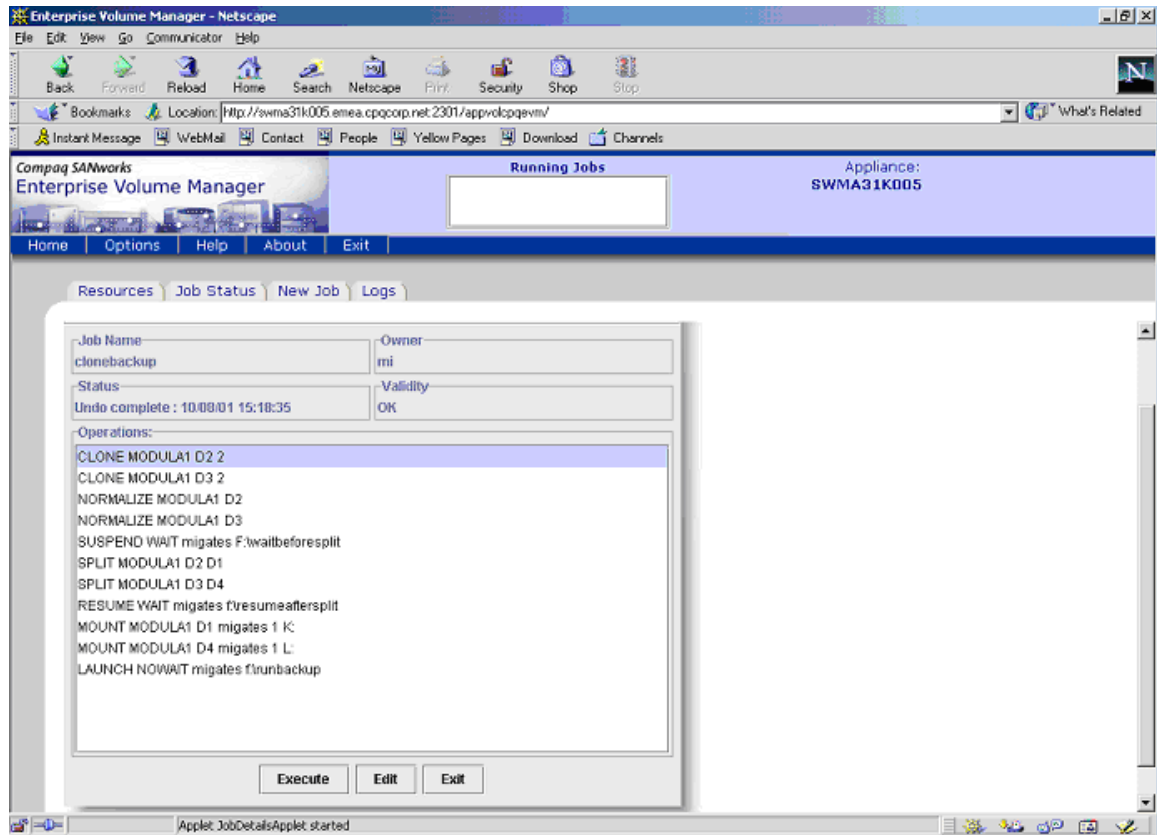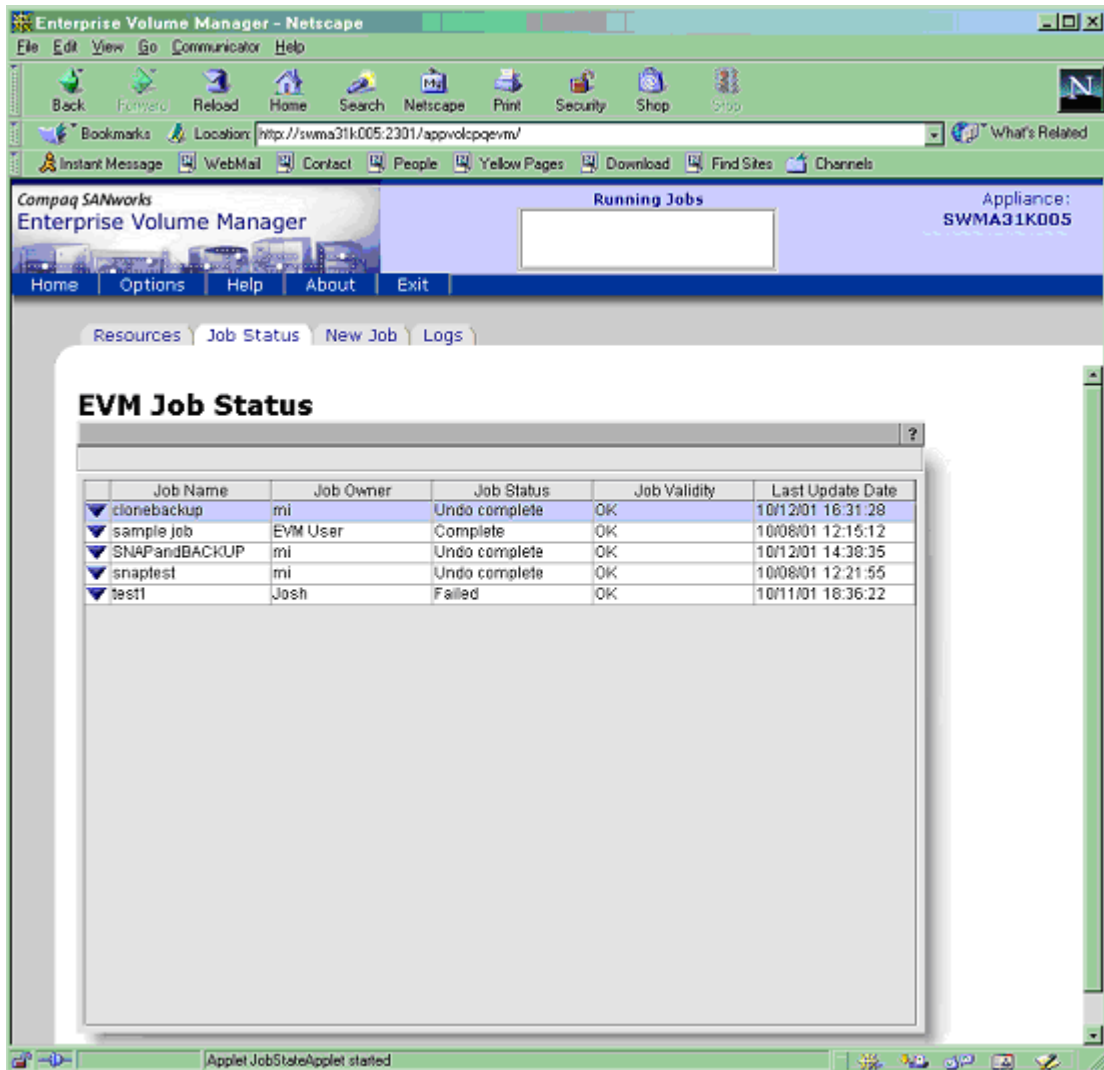

Figure 6

In the example above, the last argument of the SUSPEND and RESUME directives is simply a standard path\filename specification, which could be a batch file, a script, or an executable. In our example, the directives contain SQL scripts that are used to execute Oracle commands, but this is just one way of achieving the desired results. The SUSPEND script will checkpoint the database and place table spaces in online backup mode and the RESUME script will reverse these actions. In doing so, we can ensure that the backup will contain a valid backup of the database.

SANworks EVM also makes it easy to check the status of a job, again through an intuitive interface as shown in Figure 7 below.

Figure 7

Storage unit replication

SANworks EVM 2.0 supports storage unit replication using either cloning and snapshots. Table 1 below provides an overview of the features and applications for both replication methods.

Table 1. Cloning vs. snapshots

Feature	EVM clone	EVM snapshot
Storage unit replication	Creates physical copy of storage unit	Creates nearly instantaneous virtual copy of storage unit
Production impact	During creation and normalization, original unit remains online	During creation, original unit remains online and there is no interruption of operations
Units supported	JBOD, RAID 0, RAID 1, or RAID 0+1	JBOD, RAID 0, RAID 1, RAID 0+1 or RAID 3/5
Applications	Backups, data warehousing, testing, and system migrations	Near-line backup and rapid recovery

IMPORTANT: For the purposes of backup and restore of Oracle 9*i* databases, best practices recommend cloning as the method of storage unit replication.

Clone definition

Cloning is a method of making a physical, point-in-time copy of an Oracle 9*i* storage unit. *SANworks* EVM manages storage unit replication jobs, executing the correct commands automatically to create BCV clones, as well as mount them on a server with the specified drive letters. The BCV clones are then available for a variety of purposes, including backup or integrity checks. BCV clones can also remain unmounted for use as a near-line backup similar to snapshots.

Performance of clones

A clone can be built using one of two modes—Fast or Normal. Fast mode builds the clone at 20 MB per second (72 GB per hour), while Normal mode builds it at 7 MB per second (25 GB per hour). Because it runs at lower priority than host I/O, Normal mode is the default and recommended setting.

When replicating an Oracle 9*i* storage unit, the most important factors are the capacity and number of disks being normalized. Assuming a moderate I/O load on the *StorageWorks* HSG80 controller, and an adequate configuration of disks in the array, a replication rate of 60 GB per hour can be achieved.

Cloning an Oracle 9i storage unit using *SANworks* EVM

For each Oracle 9*i* storage unit to be cloned, *SANworks* EVM automatically checks the RAID level, determines the correct procedures, then searches the *StorageWorks* subsystems to select free disks for the BCV clone, which acts as an additional mirror. *SANworks* EVM then copies the Oracle data and normalizes the disks in the mirror set, including the BCV. When normalization is complete, all members of the mirror set have identical data and *SANworks* EVM splits the BCV from the mirror set.

Depending on the type of source unit, *SANworks* EVM applies slightly different replication procedures. It is important to consider the differences in procedures outlined below when planning *SANworks* EVM jobs and storage configurations.

Source unit is a three-member mirror set (RAID 1, RAID 0+1)

To achieve near-instantaneous cloning with *SANworks* EVM, a source unit should be configured as a three-member mirror set and be fully normalized. In this configuration, *SANworks* EVM instantly splits the third member to create the BCV clone. This approach to instant cloning also applies to mirror sets with four or more members. It also enables maximum hardware reliability, as well as best performance, due to the mirror set having more than two members.

Source unit is a two-member mirror set (RAID 1, RAID 0+1)

SANworks EVM automatically adds a third member to the mirror set and normalizes all the members. When the members are normalized, *SANworks* EVM splits the third member to create the new BCV clone.

Source unit is not mirrored (RAID 0 and JBOD)

SANworks EVM automatically creates a single-member mirror set and then adds a second member. When the members are normalized, *SANworks* EVM splits the second member to create the new BCV clone.

Source unit is RAID 3/5

RAID 3/5 units **cannot** be replicated by the clone method due to the presence of parity data. RAID 3/5 units, however, can be replicated using snapshots.

Source unit is a BCV clone

BCV clones **cannot** be further replicated. *SANworks* EVM tracks the BCV clones that it creates with each job and will not allow one to be selected as a source for another job.

EVM job interaction with Oracle 9*i* applications

SANworks EVM provides a simple, yet powerful set of features that allow storage unit replication jobs to be seamlessly combined with Oracle 9*i* applications. For example, it is easy to create:

- EVM-Oracle jobs that create near-line backup units of Oracle 9*i* databases on the *StorageWorks* subsystem

- EVM-Oracle-backup jobs that copy online Oracle 9*i* databases and mount them on backup servers for automated tape backup

- EVM-Oracle jobs that copy Oracle 9*i* databases and mount them on another server for data mining or testing

Creating high-availability solutions

By using batch files and scheduling applications, it is possible to create job sequences that can be run 24 hours a day, seven days a week.

Using clones during backup and restore

SANworks EVM 2.0 provides the ability to perform backup operations on a BCV clone that has been copied to a host other than the production server as long as that host resides on the same SAN. Through this non-disruptive method of backup, *SANworks* EVM eliminates device contention between the production workload and the backup operation, and off-loads significant CPU overhead associated with the backup process from the production server to a dedicated backup host.

The *SANworks* EVM network supports multiple controller pairs, assigning sequential numbering on the various controllers. For example, controller A may be assigned to storage units numbered 0 – 99, controller B to units 100 – 199, and controller C to units 200 – 299. In good practice, log files and databases should reside on separate controllers. When generating a BCV clone of a production Oracle 9*i* database, it is possible for the clone to reside at the controller level, or for the clone to be moved to a backup server, consistent with the administrator's policy.

If there are two existing members in a mirror set, then EVM's normalization process automatically builds a third mirror Fast-mode rate of 60 GB per hour when several disks are being normalized in parallel. Therefore, for an 18 GB disk drive, normalization requires approximately 18 minutes.

If the mirror set is originally established with three disks, then EVM's normalization process immediately breaks off the BCV (third mirror). Using this "quick clone" method, the EVM normalization process of an 18 GB disk drive takes less than 4 minutes.

In either case, with a three-member mirror set or a two-member mirror set, the EVM normalization process takes place in the background, having minimal impact on the Oracle 9*i* application.

If corruption occurs within a storage unit, a BCV clone can be used to restore the Oracle 9*i* data in minutes, as opposed to hours typically required when restoring a database from backup tapes.

Considerations using EBS

To analyze the performance of the *StorageWorks* Enterprise Backup Solution (EBS)—separate from the tests described above for Oracle 9*i*—Compaq designed a test suite to emulate real-world applications. As part of this test suite, Compaq generated formulas to accurately define backup windows by carefully analyzing the interrelationships between five components:

1. Feed source: Typically the hard disk (primary storage), the feed source can also be network-connected storage or a remote system. The type of controller that is used has a direct effect on the speed at which the server can send data to the tape device. Compaq tests show that, to achieve optimum backup rates, it is necessary to read from the primary storage device at a speed that is at least three times the backup rate (3:1) of each tape (AIT, DLT or SDLT) drive.

2. Storage connection: For *StorageWorks* EBS, the storage connection is the 100 MB per second Fibre Channel storage network that supports simultaneous transfer of many different data protocols, including SCSI, IP, and others. *StorageWorks* EBS has been tested to support 300 meter lengths of 62.5 micron multimode Fibre Channel and 500 meter lengths of 50 micron multimode Fibre Channel. *StorageWorks* EBS also supports long-wave 9 micron single mode cable up to 10 Kilometers on interswitch links.

3. File block size: With Fibre Channel Arbitrated Loop, the use of the largest block size will provide the fastest data transfers because the loop has to be arbitrated less frequently. For example, Windows 2000 supports up to 64 KB transfer block size.

4. File (data) compression ratio: The amount of compression has a direct impact on the rate at which a tape can read/write data. As the data compression ratio increases, tape storage capacity increases. For example, at 1:1 compression, an SDLT drive can store 110 GB of data; at 2:1 compression, it can store 220 GB of data.

5. Tape drive (secondary storage) system: For *StorageWorks* EBS, the tape drive system is comprised of *StorageWorks* tape libraries and a connection to the SAN. To connect a tape library to a SAN, a Modular Data Router or Compaq Fibre Channel Tape Controller-II provides a simple way to scale backup performance.

The above analysis spawned the creation of the *StorageWorks* Backup Sizing Tool, which is downloadable from www.compaq.com/ebs.

There are other considerations affecting performance in the overall storage solution. Trade-offs between performance, functionality, and cost are always factors. Moreover, objectives for future storage needs, such as scalability and flexibility, or current budget criteria, may determine the components of a storage solution, and have dramatic effects on the overall performance achieved.

SAN components, such as the interconnects, can also influence an implementation's performance. For example, when evaluating storage interconnects, there are several options:

- *Hubs* are ideally suited for a low-cost, entry-level SAN.

- *Fibre Channel Arbitrated Loop (FC-AL) switches* are recommended for easy-to-deploy, affordable, high-performance, x86-based SANs where there is a requirement for future connectivity into a fabric switch. FC-AL switches also provide a starting point for disk and tape consolidation.

- *Fabric (FC-SW) switches* are recommended for large, best-performing fabric-based SANs in an environment with heterogeneous operating systems where additional levels of business continuance, scalability, and functionality are desirable.

While all these interconnect devices have a port bandwidth of 100 MB per second, the aggregate bandwidth and throughput for each device varies. A fabric switch will be faster than a hub.

In evaluating trade-offs between performance, functionality and cost, it is critical to carefully consider the intended outcome for a specific implementation of the Non-Disruptive Backup & Restore Solution. Regardless of an enterprise's particular goals, an optimal set of SAN components can be selected to best achieve the intended outcome, whether it be more application uptime, better utilization of storage resources, or faster restores on business-critical data.

Supported configurations

Minimal configuration requirements

Each *SANworks* EVM 2.0 network requires the following:

- A Management Appliance with Open SAN Manager (OSM) software version 1.0B and Element Manager for *StorageWorks* HSG version 1.0B-Patch for HSG80 controllers installed

- *SANworks* EVM v2.0 Server software installed on the Management Appliance

- A Management Appliance and at least one *SANworks* EVM Agent node must be connected to at least one EVM-compatible *StorageWorks* subsystem (all containing *StorageWorks* HSG80 array controllers and using a *StorageWorks* Solution Software Kit 8.5C or 8.6)

- Access to a qualified Web browser (see "Supported Web Browsers")

Note: The StorageWorks Solution Software Kit 8.5C or 8.6 must be installed on the applicable *StorageWorks* subsystems. *SANworks* EVM V2.0 is not supported with any other ACS version.

IMPORTANT: The *SANworks* EVM Server software cannot be installed on a Management Appliance connected to *StorageWorks* HSV array controller subsystems. Only HSG array controller subsystems are supported at this time.

Required *SANworks* element manager

For *SANworks* EVM v2.0, the element manager provides access to *StorageWorks* HSG80 subsystem storage and is the interface to the HSG SAN network.

The required *SANworks* element manager for *SANworks* EVM V2.0 is called Element Manager for *StorageWorks* HSG version 1.0B-Patch. However, the element manager provided with the Management Appliance is Element Manager for *StorageWorks* HSG version 1.0A. An element manager update is required to upgrade from version 1.0A to 1.0B-Patch.

NOTE: *SANworks* EVM V2.0 cannot be installed if the *SANworks* HSV Element Manager software is installed on the Management Appliance. *SANworks* EVM V2.0 does not support this element manager version.

Refer to the *SANworks* EVM V2.0 Release Notes for more information related to the minimum required element manager version.

Supported Web Browsers

The *SANworks* EVM graphical user interface (GUI) must be accessed using a Web browser. Table 2 below identifies the supported browsers by the minimum browser and Java runtime environment (JRE) plug-in version numbers for each host operating system platform. Supported browser versions match the Management Appliance browser requirements.

NOTE: Refer to the *SANworks* EVM v2.0 Release Notes for the latest information on browsing to a *SANworks* EVM network by other supported operating system computers.

Each Web browser requires the JRE plug-in to properly display *SANworks* EVM data. See *SANworks* Enterprise Volume Manager Version 2.0 (Multi-OS) Network Administration Guide (Part Number AA–RR0VA–TE) for more information.

Table 2. Supported Web browsers

Host operating system	Web browser	Minimum browser version	Required JRE version
Windows 2000	Microsoft Internet Explorer	5.01	1.3.0_02
	Netscape Communicator	4.77	1.3.0_02
Windows NT	Microsoft Internet Explorer	5.5	1.3.0_02
	Netscape Communicator	4.77	1.3.0_02

EVM Agent Requirements

Agent requirements include required and optional attributes. Table 3 below describes these requirements for each host operating system platform.

Table 3. EVM agent requirements

Host operating system	Agent attributes
Windows 2000	Required:
	• Either Windows 2000 Server, Windows 2000 Advanced Server, or Windows 2000 Datacenter Server with Service Pack 2 or higher
	• Connection to a LAN (common with EVM Server and other EVM Agents)
	• Connection to the StorageWorks subsystem via an Emulex LP8000 or LP952 adapter, with a driver version provided by the StorageWorks Solution Software Kit 8.5C or 8.6
	Optional:
	SANworks Secure Path Version 3.1A (SP1) for Windows NT/2000, or higher
Windows NT	Required:
	• Either Windows NT Server 4.0 or Windows NT Server 4.0, Enterprise Edition 1.0 with Service Pack 5 or 6a
	• Connection to a LAN (common with EVM Server and other EVM Agents)
	• Connection to the StorageWorks subsystem via an Emulex LP8000 or LP952 adapter, with a driver version provided by the StorageWorks Solution Software Kit 8.5C or 8.6
	Optional:
	• Windows NT, MSCS Clustering enabled
	• *SANworks* Secure Path Version 3.1A for Windows NT/2000, or higher

Related information

Sizer tools

Backup sizer tool:
http://www.compaq.com/products/storageworks/ebs/ebstoolsbackupsizing.html

SANworks Enterprise Volume Manager (EVM)

EVM product overview

http://www.compaq.com/products/sanworks/evm/evmprod.html

StorageWorks Enterprise Backup Solution (EBS)

EBS product overview

http://www.compaq.com/ebs

EBS compatibility matrix

http://www.compaq.com/products/storageworks/ebs/EBScompatmatrix.html

EBS Installation and Startup Service

http://www.compaq.com/services/storage/st_enterprise.html

EBS sizer tool

http://www.compaq.com/products/storageworks/ebs/ebstoolsbackupsizing.html

StorageWorks

StorageWorks overview

http://www.compaq.com/storage/bridge.html

StorageWorks Command Console

http://www.compaq.com/products/storageworks/Storage-Management-Software/command_console.html

Choosing an Interconnect Device: Hubs, Fibre Channel Arbitrated Loop Switch, or Fabric Switch

http://www.compaq.com/products/storageworks/library/whitepapers/13DY-0900A-WWEN.html

Backup software

VERITAS: http://www.veritas.com

Services

Implementation Services – SAN Migration for Windows NT

http://www.compaq.com/services/storage/st_san.html

RAID StorageSet Installation, Startup & Configuration

http://www.compaq.com/services/storage/st_raid.html

Installation and Startup Service for Enterprise Backup Solution (EBS)

http://www.compaq.com/services/storage/st_enterprise.html