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Prepared by:
Industry Standard Server Division

Compaq Computer Corporation

Contents

Compaq TaskSmart N-Series Cluster System Backup

Abstract: The document guides the user in understanding the backup and restore solution that is best suited to the Compaq TaskSmart N-Series Cluster and the business environment.

Introduction

Note: This paper includes the terms fibre and fiber. Fibre is the international spelling that refers to the Fibre Channel standards which include optical and copper media. Fiber refers to the optical media used to implement Fibre Channel.

Computer environments have information infrastructures that are spiraling out of control. Data management and information deployment are more complex today, due to the pressure of handling more online information while retaining an easy-to-access format. Even more pressing is the need for a complete data-protection strategy, which provides the security that your business requires and protects the most valuable asset of any company—information.

Compaq provides leading-edge solutions for both direct connect and SAN customers. With the introduction of the Compaq *TaskSmart*™ N-Series Cluster, Compaq also provides increased storage flexibility and fault tolerance for network attached storage.

Network attached storage (NAS) refers to storage elements that connect to a network and provide file access services to computer systems. The TaskSmart N-Series Cluster consists of two TaskSmart N2400 servers, two Compaq *StorageWorks*™ enclosures, one StorageWorks enclosure model 2200, two Fibre Channel SAN Switches, two SAN Element Manager HSG80 controllers for the Model 2200 enclosure, and two Fibre host bus adapters per node.

The Compaq TaskSmart N-Series Cluster is designed as a complete engineered storage solution for a network. The TaskSmart N-Series Cluster uses advanced technology architecture, an optimized and reliable operating system, and integrated software components in a fully certified and tested solution. The TaskSmart N-Series Cluster enables companies to realize the benefits of storage consolidation in a highly fault-tolerant configuration.

Protecting your information and ensuring efficient backup and reliable restore capabilities is crucial to any environment. With many factors to consider and many products to choose from in the backup and restore marketplace, Compaq has provided this information-based document to help ease the task of choosing a data-protection strategy.

Defining a Solution

There are key decisions that must be addressed when defining the appropriate backup and restore solution. Issues surrounding backup and restore performance, media reliability, tape rotation schemes, and offsite storage of data are addressed in this document. Core issues when deploying your backup solution are:

- Hardware
- Software (backup software vendor)
- Sizing

In enterprise environments, multiple servers commonly share a large tape library device through the existing communications network. This provides the benefit of an automated solution for reduced human error without impacting network performance during the backup and restore process. With the addition of a Modular Data Router (MDR), a tape library can be attached into the fibre infrastructure of the TaskSmart N-Series Cluster.

Hardware

Selecting the correct tape device and connection type ensures a reliable backup of data that is well-suited to the particular computing environment.

Tape Device Type

Because of their common use in the industry and excellent performance and capacity, Compaq recommends the following tape solutions for use with the TaskSmart N-Series Cluster.

- Compaq Standalone DLT 35/70
- Compaq Standalone DLT 40/80
- Compaq DLT Tape Array
- Compaq TL891 DLT Mini-Library
- Compaq TL895 DLT Library
- Compaq ESL9326 DLT Library
- Compaq SSL2020TL AIT Library
- Compaq TL891DLX DLT Library

For a full list of qualified tape solutions, refer to:

www.compaq.com/TaskSmart

Before purchasing a tape device, ensure that the backup software supports the preferred device. Most backup software supports a wide range of backup devices, and Compaq has done extensive testing and certification on select ISV software (VERITAS and Legato). The administrator should confirm your specific choice by consulting the software vendor's website. Vendors usually post a hardware compatibility guide for each version of the backup software application.

The TaskSmart N-Series Cluster configuration consists of two SAN Switches and four Fibre Channel host bus adapters with two per node. The supported switches and HBAs for the TaskSmart N-Series Cluster are:

- Fibre Channel SAN Switch 8
- Fibre Channel SAN Switch 16
- KGPSA PCI to FC HBA

Fibre Channel Environments

The supported backup configuration for the TaskSmart N-Series Cluster consists of a Fibre Channel environment. This configuration requires the use of a Modular Data Router which provides a SCSI-to-Fiber bridge. A Fibre loop environment is not supported by the TaskSmart N-Series Cluster. This section will provide a brief overview of how a Fibre Channel environment is used in the TaskSmart N-Series Cluster.

Switched Fabric Fibre Channel

Fibre Channel environments use a host bus adapter (HBA) to connect a cluster node to a fiber switch. The TaskSmart N-Series Cluster requires two HBAs per cluster node and two Fibre SAN switches. This configuration creates a multi-path fault-tolerant infrastructure. Switched fabric environments are scalable in performance and capacity because the architecture provides a dedicated data path between two devices in a switch. Switched fabric environments also provide good performance because they contain many dedicated 100-MB-per-second data paths without sharing bandwidth.

The TaskSmart N-Series Cluster Fibre Channel Switched Environment will consist of:

- One or more TaskSmart N-Series Clusters
- Two Fibre Channel 8- or 16-port SAN Switches
- Multiple Fibre Channel-to-SCSI bridges for library connectivity (Modular Data Router)
- Compaq TL891 Mini-Library, TL895 DLT Library, or ESL 9326D Library (shown in Figure 1)

The Enterprise Backup Solution for Switched Fabric Fibre Channel environments with the TL895 Library is illustrated in Figure 1.

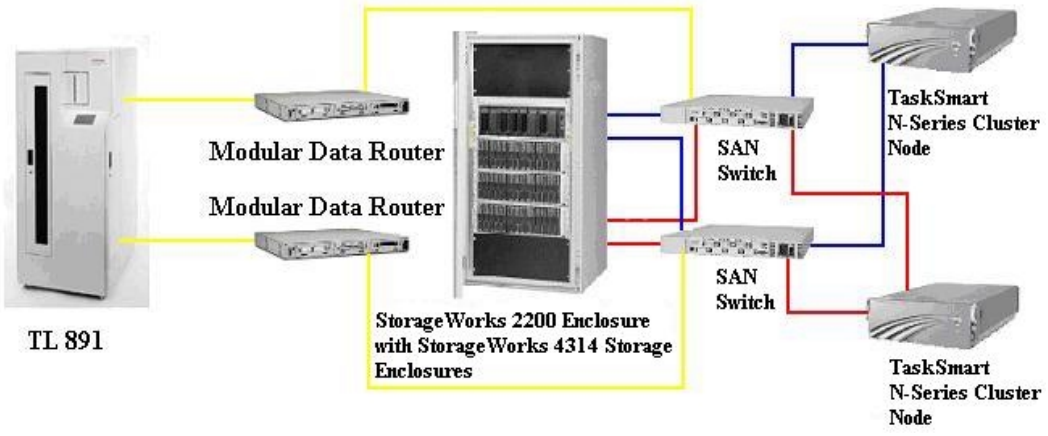

Figure 1: Compaq TaskSmart N-Series Cluster environment

Modular Data Router

The Modular Data Router allows the TaskSmart N-Series Cluster to connect to the SCSI backup devices. The MDR has the following features:

- UltraSCSI device

- Highly modular
- Multi-purpose storage controller
- Ability for Fibre Channel hosts to connect to SCSI targets

The Modular Data Router is a main component of the Switched Fabric Fibre Channel environment.

Figure 2: Modular Data Router component identification

Table 1. Modular Data Router components

	Component	Description
1	Power switch (not shown, on front panel)	Controls power to the Data Router.
2	AC power inlet	Standard IEC320 power inlet.
3	Management module	Master control module of the Data Router.
4	Power-On Self-Test LEDs	The LEDs on the Management module displays a series of patterns while the unit initializes. The unit is ready for use when the Management module LEDs show a pattern of a single LED moving back and forth.
5	RJ-45, 10/100, TX, Ethernet management port	This connector is provided for management through simple network management protocol (SNMP).
6	Dual SCSI-2 Module	Provides two, independent HVD **or** LVD SCSI ports.
7	Single Fibre Channel module	Provides Fibre Channel connectivity.
8	Short-wave GBIC	Provides optical-to-electrical conversion, facilitating Fibre Channel connection.
9	DB-9 RS232 serial port	This connector is provided for advanced configuration and management.
10	Power LED	Indicates active AC power.
11	Slot for fourth module (not shown, on front panel)	This slot is empty in three-module configurations.

Cabling the Modular Data Router

Figure 3 shows the cabling perspective for the TaskSmart N-Series Cluster.

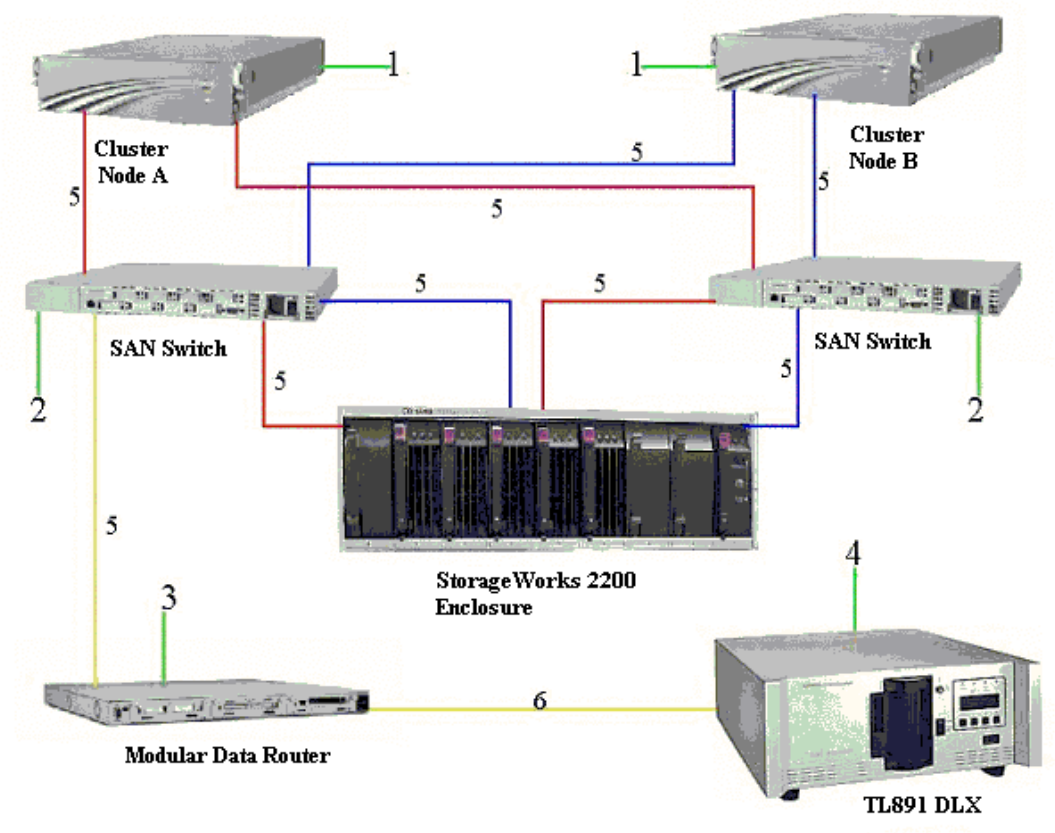

Figure 3: Cabling the Modular Data Router

Table 2. Cable routing identification for the Modular Data Router

1	Cluster node
2	Compaq Fibre Channel SAN Switch 8
3	Compaq Modular Data Router
4	Differential SCSI tape library (DLT Tape Library 35/70, TL895, SSL2020)
5	Multi-mode Fibre Channel cable
6	External VHDCI SCSI cable

VERITAS

Backup Exec

VERITAS Backup Exec is a storage-management software package that focuses on data backup and restore. The goal of backup and restore can be accomplished with many different tape devices in various configurations, and by using a transport method such as the corporate communication network, a server SCSI bus, or a Fibre Channel infrastructure.

Compaq has partnered with VERITAS to provide the Enterprise Backup Solution using the speed and scalability of Fibre Channel technology. Compaq supports the backup and restore of homogeneous/heterogeneous operating systems using VERITAS Backup Exec software. The EBS with VERITAS Backup Exec uses a SAN that provides dedicated bandwidth, independent of the local area network. This independence allows single or multiple backup or restore jobs to run, without the network traffic that is caused by traditional backup schemes.

The shared storage option (SSO) allows both nodes in the cluster to share a common set of tape devices.

VERITAS Backup Exec uses a database to arbitrate all device and media requests and to prevent accidental media overwrites. The database also provides for central device and media tracking and reporting.

Additionally, because of the manner in which the application addresses the devices, tape libraries are always presented to the application in a consistent order. This device persistency eliminates the need to reconfigure the application in case of a tape drive or library failure.

For more information about the installation, operation, troubleshooting, and upgrades of VERITAS, refer to the online document Enterprise Backup Solution with *VERITAS Backup Exec User Guide*, located at

www.compaq.com/products/storageworks/ebs/ebslibrary.html

NetBackup

The VERITAS NetBackup feature provides complete data protection for the TaskSmart N-Series Cluster. With NetBackup, organizations can manage all aspects of backup and recovery from intuitive graphical user interfaces (GUIs). Consistent backup policies can be set across the enterprise.

The NetBackup media management capability enables organizations to perform all aspects of media management, including library sharing. The NetBackup Java interface provides complete real-time and historical analysis of all backup and recovery operations.

VERITAS NetBackup SSO is the industry's first heterogeneous SAN solution that allows individual tape drives (stand-alone or in a robotic tape library) to be shared dynamically between multiple VERITAS NetBackup servers. The drives are connected to each host by enabling Fibre Channel hardware, such as switches and Fibre Channel tape controllers. SSO allows enterprises to leverage their peripheral investments more thoroughly through drive sharing because individual drives can be used by both cluster nodes. SSO utilizes hardware resources more efficiently.

NetBackup is easy to install and implement. The Windows server version provides a wizard-driven installation and configuration program. Administrators define backup schedules by using the graphical scheduling interface. Full and incremental backups can be on an hourly, daily, weekly, or monthly basis. A backup window can be defined to ensure that backups are run at times that support the needs of the organization. Administrators can also assign backup classes descriptive, multiple-word names for tracking and reporting.

NetBackup can perform full or partial recovery from a primary backup and it can recover applications or complete servers in offsite locations. NetBackup can automatically create copies of the primary backups. These secondary tapes can then be sent offsite for storage. NetBackup also de-multiplexes tapes so that data is located on more than one tape. This feature allows business-critical applications to come up first, followed by secondary and tertiary applications.

The process of performing a selective restore is much faster if the data is located on duplicate tapes. Organizations rarely restore a complete server at a hot-site location. The backup copies that NetBackup creates are TAR-compatible (UNIX Tape Archive). Although NetBackup uses its own method for moving data and writing data to tape to ensure reliability, it provides the capability for these tapes to be read by basic UNIX utilities.

For complete disaster recovery automation, NetBackup provides an option for complete vault management. This option includes functions such as ejection of the backup copies to the I/O bin in a tape library and the ability to access and retrieve reports written in a variety of formats including Iron Mountain (Arcus) and DataSafe.

Legato NetWorker

Dramatically increased performance and scalability in backup and recovery operations are achieved in NetWorker software with an advanced indexing architecture. NetWorker software features Open File Connection and support for the TaskSmart N-Series Cluster.

NetWorker software can provide Comprehensive Data Protection for the TaskSmart N-Series Cluster because it protects all data, including security information, user profiles, access control lists, and Windows registries and event logs. NetWorker software also provides the ability to share a tape library between Legato NetWorker server and cluster nodes.

Legato NetWorker software helps organizations easily protect vast amounts of critical distributed data by offering automated media handling, interoperable tape format, data stream parallelism, remote tape management, and automatic integration with the popular storage management frameworks in the network environment.

Legato NetWorker software is based on the client/server architecture and consists of three distinct components: Client, Storage Node, and Server. This three-tier architecture provides the flexibility and performance required to protect and manage data on the most complex networks. The data protection process is encompassed in a data zone, which is a collection of clients, storage nodes, and data protected by a single Legato NetWorker server. A Legato NetWorker data zone can be collectively administered with a single set of data protection policies and procedures. Legato NetWorker serves as a data zone manager, delivering both centralized and distributed storage management.

Software Trial Versions

All Compaq tape devices are shipped with trial versions of popular third-party backup solution software, some of which are supported on the TaskSmart N-Series Cluster. Use of the existing software organization reduces the complexity and setup time of the backup solution. It is important to understand that the software may require upgrades because the system is moving to a new data-protection architecture, such as Fibre Channel. Additionally, the administrator must check with independent software vendors to ensure which additional components or upgrades are required.

The TaskSmart N-Series Cluster also contains an integrated backup solution that can be used for basic backup functionality. This solution will not have all the functionality and features offered by third-party solutions. Compaq recommends the selection and purchase of a third-party backup solution that meets user needs.

Some important capabilities include the following:

- Autochanger support for the chosen device
- Tape media management database
- File history database with extensive search capabilities
- Ability to define backup groups and schedules
- Ability to take advantage of multiple tape devices concurrently to reduce the backup window
- Capabilities to analyze, summarize, and report status automatically
- Options to enable backup of open and locked files
- Options to back up system state and system databases
- Options to interact with software from a remote console application
- Options for quick disaster recovery
- Options for sharing tape devices, if you intend to use a shared library

Sizing Considerations

Sizing considerations guide an administrator in selecting or scaling the solution to fit specific business requirements. Factors to consider when sizing include:

- Speed of backup and restoration
  - How much data must be backed up?
  - How long will it take to complete a backup?
  - Is a full backup needed or will a partial backup suffice?
- Cost
  - What equipment will be required to implement this backup?
  - What software vendor will best meet organizational needs?
- Safety of data
  - How often is this information backed up?

For more information about which hardware and software products are certified by Compaq, access the Compaq StorageWorks Enterprise Backup Solution Hardware/Software Compatibility Matrix at

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

Sizing Tools

To help understand the factors that affect performance and purchasing decisions, Compaq has developed a performance sizing tool. This tool addresses the factors involved in selecting a backup solution for a particular environment. Among these are performance, capacity, reliability, automation, and cost. If a backup solution has not already been selected, Compaq provides some useful tools that make the selection process easier.

The award-winning sizer is a Windows-based tool that helps maximize business benefits by optimizing the solution.

This sizing tool displays:

- Product information
- A complete backup schedule for your environment
- Tape library solutions supporting performance and business requirements.

The sizing guide can be accessed from the Compaq Storage website by accessing the following:

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

Information about backup products is available on the Compaq website at www.compaq.com

For more information about Enterprise Backup Solutions backup sizing, access the following:

www.compaq.com/products/storageworks/ebs/ebswhitepaper.html

Backup Best Practices

After a backup solution is installed, establish procedures that will enhance the reliability and effectiveness of the backups. The following sections describe general recommendations for performing a backup. Keep company-specific needs and environment in mind when implementing these suggestions.

The Case for Backups

The TaskSmart N-Series Cluster has a range of high-availability features, including:

- RAID 1 (mirroring) for the operating system drives
- Snapshots
- Redundant power supplies and fans
- Redundant host bus adapters for multiple paths through the switches and controllers

The Model 2200 enclosure has the following high-availability features:

- Redundant controllers

- RAID 1/RAID 5 for the data drives
- Redundant power supplies and redundant batteries
- Support for spare sets, which provide online spares for disksets

In addition to these features, regularly scheduled backups to removable media are crucial in safeguarding your data against accidental loss, intentional tampering, or hardware failures.

If the data drives are configured in RAID 5 arrays, it is highly unlikely that data loss will occur due to drive failure. Two drives in the same array set must fail for data loss to occur. However, data loss is always possible. Backups will prevent an inconvenience from becoming a disaster.

Snapshots are a convenient but temporary online copy of the data. Snapshots should never be used as, or considered a replacement for, tape backup. If something were to happen to the disks, the snapshot could be affected along with the data. Additionally, the TaskSmart N-Series Cluster automatically deletes the oldest snapshot to recover space when disk space is low. Compaq does not recommend dependency on snapshots for data protection. The use of tape backup and restore solutions in conjunction with snapshot functionality is a convenient and cost-effective method of protecting corporate information.

Backup Schedules

An automatic, periodic backup is much more reliable than occasional backups that occur only when someone remembers to execute them. The specific needs of the organization will determine what type of schedule to implement.

A weekly or biweekly full backup is the basis of any good backup schedule. Add to that baseline daily incremental or differential backups to capture any daily changes that occur between full backups. Depending on the rate of data change, and the capacity and performance of the backup devices, adjust the backup schedule to fit the environment of the organization. Incremental backups capture changes to the data that have occurred since the last backup. Differential backups capture all the changes that have occurred since the last full backup.

If the backup devices do not have sufficient capacity for a full backup, distribute the backups so they occur throughout the backup cycle. This strategy can meet the backup needs of the organization until a larger tape backup device or library can be installed. For example, instead of doing a full backup of disks C:, X:, Y:, and Z: on Friday, back up C: on Monday, X: on Tuesday, Y: on Wednesday, and Z: on Thursday. Schedule incremental or differential backups on the same distributed schedule.

Archiving Server Setup

After the administrator has established a regular backup schedule, it is necessary to document the setup attributes of your TaskSmart N-Series Cluster. There is always the possibility of the complete loss of the server in cases of fire, flood, or weather disasters. To maximize the ability to recover from server disasters and to minimize the time required for recovery, keep current copies of the following information in a safe location:

- Server names
- Quorum Disk backup and system state backup
- IP addresses
- Gateways

- DNS servers
- HSG80 controller configuration
  - Units
  - RAIDsets
  - Mirrorsets
  - Connections
- Cluster Administrator configuration:
  - IP address resources
  - Network name resources
  - File share resources
- Virtual Replicator configuration:
  - Pool names
  - Sizes
  - Member logical drives
  - Virtual disk names and sizes
  - Snapshot names

This information helps to quickly and accurately recover from catastrophic failures caused by events such as fires, weather disasters, theft, and complete hardware failure. Further information on disaster recovery can be found in the *TaskSmart N-Series Cluster Disaster Recovery White Paper* and the *TaskSmart N-Series Cluster Planning White Paper*.

Multiple Backup Devices

To take advantage of multiple backup devices, the server must be configured correctly. Generally, backing up multiple disks requires multiple tape drives. If the TaskSmart N-Series Cluster has 500 GB of disk space and is arranged as a single virtual disk, it is more difficult to take advantage of multiple tape drives. If possible, make multiple smaller virtual disks. This procedure lets the administrator back up the multiple devices in parallel, sending the data from one or two disks to each tape in parallel. This type of configuration greatly reduces the time required for backup and makes the most efficient use of the tape backup device.

If it is necessary to use a single, large virtual disk, the administrator configures several backup groups to contain the various directory trees at the root of the virtual disk, so that more than one tape device can work in parallel.

Also, note how your virtual disks are constructed when setting up backup jobs. To increase the performance of the backups, schedule the back up of virtual disks so disks that share a common set of physical drives are scheduled at different times. The underlying physical disks can devote more time to each of the backup jobs, rather than having two backup jobs competing for disk I/O.

Media Rotation

Backup software solutions are equipped to label and track media usage accurately. Take advantage of these capabilities to maintain different media pools for full backups, incremental/differential backups, and archive media. The retention time for the data on each of these types of backups is different. For example, using differential backups on the same tape for full backups causes the tape space to be wasted after the retention time for the differential data has passed. Keep separate media pools to avoid this problem.

Offsite Storage

Set up a regular process for moving important long-term media, such as backups and archives, offsite for safekeeping. This ensures that the administrator can recover the data in the event of a complete facility destruction where the TaskSmart N-Series appliance resides. As an alternative to a commercial offsite storage facility, if the company has multiple buildings, you can store the offsite media in another building. This alternative will provide some protection in the event of a building fire where your TaskSmart N-Series Cluster is located.

When employing offsite storage, strike a balance between safety and convenience by deciding how long to keep the media onsite. After the media has been moved offsite, restores will take much longer because the media is not readily available.

A periodic audit of the offsite facility ensures that the media is being stored in secure, environmentally acceptable conditions, and that it can be located and returned to the facility in a timely manner.

Readiness Testing

Completing regular backups is important, but it is only the first step in the backup process. To verify the integrity of those backups, the administrator must conduct periodic testing to confirm the ability to recover files and directories. Regularly testing the recoverability of random files or directories ensures that the backup solution is working as planned.

Snapshots

Snapshots enable the instant creation of virtual replicas of production data without the requirement of a physical copy. Snapshots function identically to ordinary physical disks with both read and write capability.

IMPORTANT: Snapshots should be considered an additional convenience for restores, not a replacement for tape backup. In the event of disk failures, snapshots can be lost with the original virtual disk data. Snapshots will be automatically deleted without warning by *SANworks*™ Virtual Replicator (SWVR) to regain space when disk space is low.

When a quick copy of production data is needed, snapshots can be used with minimal disruption to running applications. For example, the snapshot can be the source for backup using standard backup tools. Snapshots can remain online for restore operations, testing, and data mining.

Quick Online Restores

The SANworks Virtual Replicator is a utility used to combine logical disks into "pools of space" from which virtual disks are created. SWVR also enables the "snapshot" capability for the TaskSmart N-Series Cluster. Snapshots are temporary, online copies of the virtual disks. When a snapshot is made, an identical copy of the original source disk is created without any additional disk space being utilized. Snapshots can be completed in a few seconds, because disk space is used only when the original files change.

Though snapshots should never be considered a replacement for regular data backup to removable media, they can be a highly convenient feature for immediate, tapeless recoveries. If a file is accidentally deleted or corrupted, it can be recovered quickly by accessing the snapshot, selecting the file or directory, and copying it back to its original location on the virtual disk.

To use the snapshot capability for a quick online restore, take a snapshot on a regular basis or before the source disk is altered. This ensures a backup of all the original files, applications, and configurations.

Backups

Snapshots can also be used as the source of data for a backup. There are some applications that must be stopped before backups are made. A backup requires that the file system is recorded in a consistent state, where no changes occur during the backup. Because snapshots are created in a matter of seconds and maintain a consistent view of the file system from that point on, snapshots can drastically reduce the amount of time applications must be paused or shut down during backup operations.

The TaskSmart N-Series Cluster facilities automatically creating snapshots at any given time, and can even be set up to create a snapshot, execute a backup, and delete the snapshot upon successful completion of the backup job.

Optional Backup Features

Many backup vendors have optional modules for additional backup features that can be valuable in some computing environments. These modules are usually sold separately.

Open File Backup

Open file backup provides the capability to back up a file that is open and possibly locked by a client system. Open file backup is usually not provided in the backup application itself and is an added option that can be purchased separately. This capability enhances the effectiveness of backup operations by capturing those files that are open while backup operations are occurring.

Disaster Recovery Options

Like the open file backup feature, automated disaster recovery is usually a separately purchased option. This option speeds the recovery from fire, theft, and other catastrophes by creating bootable media that is used to quickly get the server up to begin recovering data. The TaskSmart N-Series Cluster can be recovered from various types of disasters resulting in loss of all or just part of the cluster configuration. For more information on disaster recovery, see the disaster recovery guide for the TaskSmart N-Series Cluster.

Tape Libraries for Automation

Tape libraries improve performance, capacity, and reliability of tape backup operations and should be used whenever they are practical. Libraries must be enabled by additional licensing, installation of library control modules, and configuration steps. Some of the benefits of tape libraries include:

- Enhanced performance by the automated, instantaneous handling of tapes, requiring no lag time for an administrator to arrive and manually change the tape
- Improved capacity because tape libraries include storage slots for additional tape cartridges. Enough media can be loaded so that operations can continue overnight, over the weekend, or even all week, without intervention or tape changes
- Increased reliability because tapes are handled less and the human element of forgetfulness in changing tapes is eliminated

Supported Configurations

Compaq offers and supports the official software versions listed in Table 3. Ensure that the correct version of each program for the best support is installed.

Table 3. Applicable connection methods and backup solutions vendors

Connection Method	VERTIAS Backup Exec version 8.0 and 8.5	VERITAS NetBackup version 3.4	Legato Networker version 6.0
FC-AL	Q 20012	N/A	N/A
FC-Switched	Supported	Supported	Supported

Contact Us

For comprehensive online support, refer to:

www.compaq.com/

For international information, refer to:

www.compaq.com/corporate/overview/world_offices.html

For a list of Compaq products, refer to:

www.compaq.com/showroom/

For a list of Compaq storage products and solutions, refer to:

www.compaq.com/storage/index.html

For a list of Enterprise Backup Solutions, refer to:

www.compaq.com/products/storageworks/ebs

For more information about the TaskSmart N-Series Cluster and TaskSmart N2400 appliance, refer to:

www.compaq.com/TaskSmart

Table 4. Departments and telephone numbers for the United States and Canada

Department	Telephone Number
Compaq DirectPlus	1-800-888-5858 (U.S.)
Compaq Partner Direct	1-800-888-5874
Compaq Reseller Locator	1-800-345-1518 (Option 3)
Compaq Canada Reseller Locator and Product Literature	1-800-567-1616
Compaq Product Information	1-800-345-1518 (U.S.) 1-800-567-1616 (Canada)
Compaq Technical Support	1-800-OK-COMPAQ (U.S. and Canada) 1-800-652-6672